



EUROPEAN
COMMISSION

volume I: ANALYSIS

Monitoring industrial
research:

**the 2004 EU industrial
R&D investment
scoreboard**

Directorate General Joint Research Centre
Directorate General Research

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Scoreboard webpage and contact information

The *Scoreboard* webpage is: <http://EU-IRIScoreboard.jrc.es/> where the electronic version of the *2004 EU Industrial R&D Investment Scoreboard* (both Analysis – Volume I - and Company Data – Volume II -) is available.

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Seeking to make the EU “the most competitive knowledge-based economy by 2010,” the 2002 Barcelona European Council set a target for EU Research and Development (R&D) investment of 3 % of EU GDP, of which two thirds should be financed by the private sector. This has triggered an ambitious policy process. Its implementation is set out in the Commission’s 3 % Action Plan.¹ Among other things, the plan calls for “an **industrial research monitoring activity, including a score-board**, to analyse trends and facilitate benchmarking of research investment and research management practices between firms, building on experience in Member States”. This document is the first attempt to create such a scoreboard on industrial R&D investment.

The *2004 EU Industrial R&D Investment Scoreboard* has been produced as a pilot exercise to develop a closer understanding of company-level R&D in Europe by comparing European companies with those elsewhere. The *Scoreboard* lists the research investments of the top 500 corporate investors in R&D whose ultimate parent is located in the EU and of the top 500 companies whose ultimate parent is outside the EU. It provides corporate economic and financial data, R&D investment patterns by sectors, company rankings, and comparisons between EU, US and Japanese companies.

The *Scoreboard* presents a perspective on company R&D which is different to that offered by the official R&D statistics prepared by national statistical agencies and Eurostat. Official data look at R&D within particular territorial units. Here the focus is on the major R&D-investing companies, regardless of where their R&D is performed. This provides a complementary vantage point for the analysis, formulation, and promotion of new policy measures in support of the 3 % Action Plan. The *Scoreboard* enables users, such as companies, investors, and financial analysts, to compare research investment among EU companies and sectors, not only among themselves, but also with US and Japanese companies. For policymakers, it is a new tool for understanding the economic dimensions of corporate R&D, and makes an important contribution to the policy debate. The wealth of new data provided by the *Scoreboard* helps to enrich our understanding of this vital component of the Lisbon strategy.



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Acting Director General of the
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1 “Investing in research: an action plan for Europe”, COM(2003) 226 final/2.

Executive Summary

a. Introduction

The 2004 EU Industrial R&D Investment Scoreboard aims to provide a tool for companies and organisations to benchmark their industrial research, and to provide relevant information for policy-makers concerning research at the corporate level, particularly in the context of the Barcelona 3 % objective.

The Scoreboard provides a snapshot of the top 500 companies with registered offices in the EU, as well as the top 500 companies with registered offices outside the EU, ranked by the size of their R&D investments. These companies are responsible for a high proportion of global business-financed R&D.

NOTE: The term "R&D Investment" used in this report refers to corporate investment in R&D funded by companies themselves and their subsidiaries. It therefore excludes R&D financed by third parties such as governments or other companies. It also excludes a given company's share of any associated company or minority joint venture R&D investment. The definitions of "R&D" used by companies, following accepted international accounting standards, accord with definitions used in official statistics (as set out in the OECD's 'Frascati Manual').

To compile this first edition of the Scoreboard, data has been collected from the latest audited company reports and accounts that have been published up to 31 July 2004. It also encompasses data for the previous three reporting years.

Companies listed on official stock exchanges, private and state-owned companies are included, but companies that are subsidiaries of any other company are excluded to avoid double counting. Majority-owned subsidiaries are consolidated in the accounts of the parent, whereas joint ventures that are 50 % owned by each of two partners are included as stand alone companies.

The information used here is taken directly from company reports and accounts, and differs from official R&D statistics in significant ways. This is described in more detail in the first main section of the report. The principal strength of the data used here is that it provides a measure of global business-financed investments in R&D at the corporate level. The main limitations are the reliance on companies' disclosure of their R&D investments, and the absence of a territorial dimension to R&D performance.

b. Key findings

In the 2004 Scoreboard, the R&D investment of the top 500 EU companies totalled € 100.8 billion. The R&D investment of the top 500 non-EU companies listed in the Scoreboard is equivalent to € 195.6 billion. Over

the past four years R&D investment in EU *Scoreboard* companies has grown significantly slower than in non-EU companies – by 1.2 % per year, compared to 3.7 %.

NOTE: *The terms “EU company” and “non-EU company” are used throughout this report refer to a company whose registered head office is located in the EU or elsewhere in the world, respectively.*

Comparing trends in the EU and non-EU over time is complicated by changing price levels and exchange rates, by business-cycle differences, and by different patterns of global sales across companies. However the data suggests that, although the profitability of both EU and non-EU firms has been recovering from the recession years of 2001-2002, non-EU companies have been increasing their R&D investment at a faster rate than EU companies.

Scoreboard R&D investment is highly concentrated along three dimensions:

1. R&D is concentrated in large companies. For both EU and non-EU companies in the *Scoreboard*, a small group of firms is responsible for a high proportion of aggregate R&D investment. The top 20 EU companies account for more than 55 % of total R&D investment by the EU-500 companies. For the non-EU, the top 20 companies account for 37 %.
2. Just as R&D investment tends to be concentrated among the largest companies, the *Scoreboard* shows that it is also concentrated in a few of the 31 FTSE sectors. For the EU-500 as well as for the non-EU 500 companies, the four largest sectors in terms of aggregate R&D investment are automobiles & parts, pharmaceuticals & biotechnology, IT hardware, and electronics & electrical equipment. Together, these four sectors constitute 67 % of the global R&D investment by the *Scoreboard* companies (although they constitute only 37 % of total sales).

NOTE: *The term “sector” within the text of the report refers to the sector of economic activities according to the FTSE (Financial Times Stock Exchange index) classification, and corresponds to the sector in which a company declares its main activity.*

Looking at R&D investment by the two groups of EU and non-EU companies, the aggregate share of these four sectors is roughly the same (64 % compared to 68 %). However, there is a sharp difference between the two groups in the relative size of these sectors. The EU's largest R&D investment is in automobiles & parts, while the non-EU's largest share is in IT hardware.

3. R&D in Europe is also concentrated geographically. Companies with registered head offices located in three EU countries – Germany, France, and the UK – together account for 74 % of EU-500 R&D investment (whereas these countries account for only 54 % of EU25 GDP).

The table below summarises the EU and non-EU shares of R&D investment within the European top 10 R&D performing sectors, together with the respective R&D/Sales ratios for each sector.

NOTE: The term “R&D/Sales ratio” used here means the ratio of a company’s R&D investment to its net sales.

Table ES-1.

EU and non-EU R&D investments by sector

FTSE Sector	EU Top 500		Non-EU Top 500	
	Sector R&D Investment as % of all sectors	R&D/Sales ratio (%)	Sector R&D Investment as % of all sectors	R&D/Sales ratio (%)
Automobiles & Parts	23.8	4.6	15.7	4.1
Pharmaceuticals & Biotechnology	17.0	15.2	18.5	15.1
IT Hardware	12.4	15.6	22.9	8.6
Electronic & Electrical Equipment	10.3	6.5	10.9	5.7
Chemicals	7.2	4.2	4.2	3.8
Aerospace & Defence	6.8	8.0	2.1	2.7
Engineering & Machinery	4.6	2.5	2.5	2.8
Telecommunication Services	2.8	1.0	2.0	2.5
Software & Computer Services	2.6	12.8	7.8	10.0
Oil & Gas	1.9	0.3	1.2	0.5
Others (21 sectors)	10.6	1.5	12.2	2.1
Total (31 sectors)	100	3.2	100	4.5

The key point emerging from the table above is that in seven of the top ten R&D-performing sectors the EU companies have equivalent or higher R&D/Sales ratios than the non-EU companies. In particular, EU firms have higher R&D/Sales ratios in each of the EU's top five R&D performing sectors.

Even so, *overall* industrial R&D intensity (the average R&D/Sales ratio for the entire group of companies) is lower in the EU-500 than in the non-EU 500. The value for the EU is 3.2 %, significantly less than that for Japan at 4.2 % and for the US at 4.5%.

Why is the overall ratio lower, when the sectoral comparison is so favourable? The main reason is that the mix of industrial sectors in the EU differs from that of the non-EU world. The EU has a smaller proportion of output flowing from high R&D/Sales sectors. This is particularly noticeable in IT Hardware and Software & Computer Services. Together, IT Hardware and Software & Computer Services represent only 3.2 % of the sales of the EU firms in this *Scoreboard*, compared to 15.5 % for the non-EU firms.

Much of the difference in overall R&D/Sales ratios can be explained by the size difference in IT Hardware and Software & Computer Services between the EU and non-EU worlds. Because these two sectors together have a high R&D/Sales ratio relative to other sectors, their larger size in the non-EU raises the average R&D/Sales ratio for the whole group of non-EU companies. These structural differences raise important but complex issues that deserve attention in the future.

Content of the 2004 EU Industrial R&D Investment Scoreboard

The 2004 EU Industrial R&D Investment Scoreboard presents data on the top 500 R&D-investing companies in the European Union, ranked according to their total financial commitments to R&D. The ranking rests on worldwide R&D investments derived from the consolidated accounts of companies whose ultimate parent company is registered in one of the 25 Member States of the EU. The Scoreboard also includes separate R&D rankings of such companies located in each EU Member State. In addition, the Scoreboard collects R&D investment data for the top 500 R&D-investing companies whose ultimate parent is registered outside the EU25. All data are extracted from the audited annual reports & accounts of EU and non-EU companies, using rigorous financial reporting practice verification processes.

NOTE:

- The term "R&D Investment" is used in this report to refer to companies' cash investment in R&D conducted on their own behalf and funded by the companies themselves. It excludes R&D undertaken under contract for customers such as governments or other companies. It also excludes the companies' share of any associated company or joint-venture R&D investment. Where part or all of a company's R&D costs have been capitalised, the additions to the appropriate intangible assets are included to calculate the cash investment net of amortisation.
- The definition of "R&D" is that used by companies, following accepted international accounting standards (IAS 38), in accordance with the definitions used in official statistics (as defined in the OECD's 'Frascati Manual').
- The terms "EU-company, non-EU company or German-company, Finnish-company, US- company, Japanese- company, etc. " are used throughout this report to refer to a company whose ultimate parent has chosen to locate its registered office in that country or region.
- The term "R&D/Sales ratio" is used in this report to mean the ratio of company's R&D investment to its net sales.
- The "sectors" in which groups of companies are classified in this report are those sectors of economic activity as defined by the FTSE (Financial Times Stock Exchange index) sectorial classifications, and corresponds to the sector in which individual companies declare their main activity to be.
- When a year is mentioned in the analysis of company data, it refers to the company's published accounts for the given financial year. Companies from most countries have discretion in the choice of accounting period end and as a result the current year set can include accounts ending on a range of dates from the middle of one year to early next year.

The **company data** (in Annex 2 and in Volume II) presented in the 2004 EU Industrial R&D Investment Scoreboard for the last four available financial years (i.e. 2000/2001 to 2003/2004) are:

1. Company name.
2. Sector of main activity declared by the company, according to FTSE classification.

The 2004 EU Industrial R&D Investment Scoreboard presents data on the 500 companies in the European Union, with the greatest financial commitments to R&D. For comparison, the Scoreboard also shows R&D investment data for the top 500 R&D-active companies whose ultimate parent is registered outside the EU.

The analysis section of the Scoreboard aims to identify and discuss some of the main points and trends emerging from the data collected for the 500 EU and 500 non-EU companies.

3. Country of registration (country in which the ultimate parent company has chosen to locate its registered office).
4. Total R&D investment (in euro equivalent terms).
5. Net sales.
6. Operating profit (or loss).
7. Number of employees (the consolidated number of employees in the given year).
8. Market capitalisation.
9. Market breadth: net sales-percentage by destination broken down by location Europe, North America, Rest of the World.
10. Capital expenditure (CAPEX).

In addition, the 2004 *Scoreboard* includes the following information:

- a) R&D investment/net sales [as a percentage];
- b) Net sales per employee;
- c) (R&D investment + capital expenditure) / net sales [as a percentage];

The 2004 *Scoreboard* presents rankings of the companies according to the following criteria:

- Current R&D investments for EU companies.
- Current value of R&D investments for non-EU companies.
- Value of R&D investments for EU companies by Member State and for non-EU companies by country of head office registration.
- Value of R&D investments for all companies by industry sector (according to FTSE-classification).

The **analysis section** (Volume I) of the 2004 *EU Industrial R&D Investment Scoreboard* aims to identify and discuss some of the main points and trends emerging from the data collected for the 500 EU and 500 non-EU companies making the largest investments in R&D. There are three main levels of analysis described in the sections that follow:

- An overview of the whole set of largest R&D-investing companies both by world region (*Europe, N America, Asia Pacific*) and by major economy (*EU, Japan, US*). This overview rests on top-level measures such as total R&D investment, R&D investment as a percentage of sales (R&D/Sales ratio), and business performance (measured by sales growth, profitability etc.).
- The second level of analysis is concerned with sectors (within the limits of the sample size), and the way in which differences in sector size, sector mix and sector R&D/Sales ratio affect overall totals of R&D and the overall R&D/Sales ratio.
- Third, it is important to explore the apparent or possible strengths and weaknesses of the companies within the main R&D investing sectors. This is done by comparing major EU companies with those headquartered in other

economies, identifying the concentration of R&D by sector, and comparing company distributions of R&D/Sales ratios. The sectoral distributions highlight the importance of the overall investment intensity of a large sample of companies rather than just the small number of very large R&D-investing companies. This in-depth comparison of distributions can only be made for the EU vs. the US (for which a similar R&D Scoreboard is available) and is useful for comparing the large and medium-sized companies. Finally, there is a discussion of the links that exist between company input investments like R&D and capital expenditure, and company performance as output.

Key Features of the 2004 EU Industrial R&D Investment Scoreboard:

It relies exclusively on **R&D investment disclosed by companies in published annual reports and accounts** (it does not, therefore, include undeclared R&D investments). It refers to and lists only the **top R&D-investing companies**.

The Scoreboard does not provide figures for all R&D investment by all companies.

It refers to the **worldwide R&D investment of ultimate parent companies** ranked by R&D investment in two "top 500" lists, subdivided by the region (EU vs. non-EU) in which these **companies have chosen to locate their registered office**, and offers additional disaggregation by country.

The Scoreboard does not say where (i.e. the actual geographical location) companies perform their R&D.

It shows the **sectors of activities** (following the **FTSE classification**) which the **companies themselves state as being their main activity** in their published annual reports or when listed on an official stock exchange

The Scoreboard says nothing about the fields of research in which companies are doing R&D.

The Scoreboard does not say anything about how companies invest in R&D. In particular, it does not distinguish between intramural and extramural R&D. However, it does exclude R&D investment undertaken under contract for customers such as governments or other companies. It also excludes the companies' share of any associated company or joint venture R&D investment.

The *Scoreboard's* data therefore **complement information** collected from other sources, such as **national statistical offices, Eurostat or other organisations** (e.g. business enterprise expenditure on R&D). It can also complement any other information companies may choose to disclose or to gather and that may be relevant to R&D activity at a micro-economic level.

The Scoreboard does not aim to replace other sources of information with which to monitor private R&D.

It is a **direct input measure of industrial investment in R&D**.

Industrial R&D investment is not intended to be the only measure of innovation and business attractiveness. The Scoreboard does not report or analyse any types of investment in non-tangible assets or knowledge-related activities other than companies' R&D investments.



This first *European Union R&D Scoreboard* presents information on the R&D investments of each of the 500 largest EU companies in terms of their R&D investments.² It also lists the 500 largest non-EU R&D investing companies. The aim is to provide an in-depth assessment of future-oriented investments being made by European companies, in the form of R&D and capital expenditure (Capex), and to compare these with those of the larger R&D-active companies outside Europe. As well as R&D and capital expenditure, a range of financial performance data is included, such as sales, operating profits and market capitalisation. The *EU R&D Scoreboard* thus provides a detailed perspective on EU company-level R&D compared to the rest of the world in the same way that the existing UK and US Scoreboards do for these countries.³

The “Lisbon Strategy”, agreed by EU leaders at the Lisbon European Council in 2000, aims at making the EU “the most competitive knowledge-based economy in the world”. It recognises that this will require an increase in productivity, and that productivity is increased through activities such as R&D and skills development. In March 2002, the European Council in Barcelona set an overall goal of 3 % for R&D as a proportion of GDP, with two-thirds of this financed by the private sector. The most recent data (2002) show that R&D in the EU is about 2 % of GDP of which about 55 % is financed by industry. Overall R&D investment by industry in the EU will need to rise by about 10 % per annum between now and 2010 to meet the Barcelona target.

The *EU Scoreboard* is a particularly valuable tool with which to assess the progress being made by EU companies at the high end of the R&D investment spectrum and to compare their progress with that of their competitors based in other leading economies, particularly the US and Japan. However, while the *Scoreboard* enables changes in the worldwide R&D investments of larger companies to be monitored, it does not permit a direct assessment of progress of the contribution being made by EU companies to the Barcelona goal of increasing business R&D investment intensity in the EU. This is because it measures total EU company R&D investments worldwide rather than the amount of industrial R&D investment within the EU. The *Scoreboard* is nonetheless very instructive and relevant to the broader remit of the 3 % Action Plan as it provides a means of monitoring global R&D trends of companies on a sectoral, country-by-country, or world-region basis. This is complementary to, and does not replace, the “territorially specific” data collected by official statistical agencies.

The approach used for collecting the data for this *Scoreboard* is explained in detail in the next section. It uses the published and audited accounts of

Overall R&D investment by industry in the EU will need to rise by about 10% per annum between now and 2010 to meet the Barcelona target of 3% of GDP being devoted to R&D.

The EU Scoreboard is a means of assessing the progress being made by EU companies at the high end of the R&D investment spectrum and to compare their progress with that of their competitors based in other leading economies.

- 2 Companies are allocated to the country where their ultimate parent company has chosen to locate its registered office. The accounts used are the consolidated group accounts of the ultimate parent company. Companies which are subsidiaries of any other company are not ranked. This is the meaning given to the expressions “company headquarters” or “headquartered [in a given country]” which are used in the text of this report.
- 3 DTI 2003 R&D Scoreboard, UK Department of Trade & Industry, October 2004. Copies can be obtained by email from publications@dti.gsi.gov.uk. See also the website: www.innovation.gov.uk/finance. U.S. Industrial R&D Scoreboard 2003, Industrial Research Institute, December 2003.

The Scoreboard provides a means of monitoring global R&D trends on a sectoral, country-by-country, or world-region basis. It aims to complement, rather than replace, the “territorially specific” data collected by official statistical agencies.

each company's consolidated operations so that figures for R&D investment, sales, profits etc. used are those published for the company's worldwide activities. This approach enables inputs such as R&D and Capex to be related to outputs such as sales growth, market capitalisation, and value added for each company and its competitors. Of course, there are cases where companies concentrate R&D investment in one specific sector of their multi-sector portfolio of commercial operations. However, even in this case, such a sector-oriented type of R&D investment can benefit the overall economic performance of the company in question.

While the location of a company's R&D is important for the countries in which it chooses to locate (or not to locate) its R&D facilities, this factor does not affect the *Scoreboard* data, either overall or in terms of the R&D/Sales ratio (taken as a measure of company-level R&D intensity), except when changes in exchange rates affect the annual ranking, as exchange rate fluctuations can influence the R&D/ sales ratio if R&D investment is highly concentrated in the euro or dollar area while sales are more evenly distributed worldwide. The *Scoreboard* focuses instead on companies' consolidated operations so that all sales, manufacturing and R&D are included, wherever they occur in the world. This approach has its limitations, of course, particularly in the case of those few companies that have two or more divisions operating in different sectors, since the consolidated results represent averages of R&D, sales etc. across the sectors.

Although complementary, this approach is fundamentally different to that followed by EUROSTAT, the OECD and national statistics offices for Business Enterprise Expenditure on R&D (BERD) data published by country. More information about differences and complementarities between the *Scoreboard* and BERD data is offered in Box 1.

BOX 1

Scoreboard and BERD: differences and complementarities

There is an important difference between the data presented in the *EU R&D Scoreboard* and data on business enterprise expenditure on R&D (BERD) collected by national statistical agencies, and published by the OECD and Eurostat.

The R&D measure used in the *Scoreboard* refers to all R&D performed and financed by a particular company, regardless of where that R&D is performed. Where possible (that is, where the relevant information is available) the *Scoreboard* figure excludes R&D financed by governments or other companies, and also excludes the companies' share of any associated company or joint venture R&D investment.⁴ The *Scoreboard* therefore presents companies' global financial commitment to R&D.

The official concept, BERD, refers to all R&D performed by businesses within a particular sector and territory, regardless of the home location of the business, and regardless of the sources of finance (so BERD includes R&D performed by a company but financed by government,

⁴ Where some or all of a company's R&D costs have been capitalised, the additions to the appropriate intangible assets are included to calculate the cash investment net of amortisation.

research councils, non-profit foundations, or from overseas, by other companies and by itself). BERD includes R&D located in a given country and carried out by those parts of companies (including foreign-owned subsidiaries) that are located in the country.

From an analytical perspective, the *Scoreboard* is primarily relevant for those concerned with benchmarking company commitments and performance (such as companies, investors, business organisations, and policymakers). BERD data is primarily used by economists, governments and international organisations interested in the R&D performance of territorial units that are defined by political boundaries. However, both types of measure are useful to policy-makers seeking a complete picture of private R&D investment trends and patterns. The *Scoreboard* gives policymakers and others a vantage point on the relevant companies' global R&D investments and the economic outcomes which ultimately derive from business strategy decisions. In particular it shows how much companies are investing in R&D and in which industries the most R&D-active companies operate.

Further relevant differences are:

- The sampling processes are different. The *Scoreboard* collects all the relevant data published in its sample of the 500 largest companies, provided the company's R&D investment is above the *Scoreboard*'s minimum level. BERD typically takes on a stratified sample, covering all large companies and a representative sample of smaller companies.
- R&D intensities are defined differently. BERD measures R&D intensity for a sector, region or country in terms of R&D as a percentage of value added. The *Scoreboard* measures company-level R&D intensity in terms of the R&D/Sales ratio. The reason for this is that value added data are not available by company for US or Japanese companies because of the limitations of accounting practices, so European companies can only be compared with US or Japanese ones by using the R&D/Sales ratio.
- In terms of the sectoral classifications used, BERD information follows NACE (the European statistical classification of economic sectors), while the *Scoreboard* classifies companies' economic activities according to FTSE (Financial Times Stock Exchange index) classification.⁵

It is difficult to compare the *Scoreboard* figures and BERD data. Even if it were the case that both were fully comprehensive and accurately measured, the global measurements would still differ (a) because BERD includes non-company sources of R&D finance, and (b) because the measurements refer to different samples of firms. For example, the latest available figure of BERD for EU25 is € 122 billion (in current euros) in 2002⁶, while the total volume of global R&D investment by

5 NACE stands for "Nomenclature générale des Activités économiques dans les Communautés Européennes". In fact, companies themselves decide which FTSE sector is the most appropriate for their particular mix of business and consequently declare a main activity when listing on a stock market.

the top 500 EU companies in the financial year 2003/04 is of € 101 billion (in current euros).

Bearing in mind that the sector classifications in BERD and the *Scoreboard* are different, the *Scoreboard* can nevertheless provide useful complementary information because it refers to overall industrial R&D performed by companies whose registered offices are located in the EU. This gives rather a different perspective on the scale of European R&D investment compared to official statistics. For example, *Scoreboard* R&D expenditure by the three largest Swiss pharmaceutical companies Novartis, Roche, and Serono is significantly higher than total Swiss BERD. In 2000 these three firms alone invested € 5.7 billion in R&D world-wide, while overall Swiss Business Enterprise Expenditure on R&D reported by Eurostat for 2000, was approximately € 5.0 billion.

The Scoreboard is intended for four main audiences: Companies, investors, business organisations and government bodies. Its aim is to give a picture of companies' global R&D investments and economic outcomes.

How can this *Scoreboard* be of use to firms and policymakers? A company's R&D investment is a central contributor to innovation. R&D helps firms develop new products, processes and services and so maintain and enhance value added. In a world where more and more countries are industrialising, Europe needs to lead in R&D in those sectors where it is a key generator of added value. Successful European companies will compete by staying ahead with new products, processes and services which, when combined with marketing skills, operational excellence and sound strategic choices, will enable them to grow value added consistently and continue to provide skilled jobs. The *EU R&D Scoreboard* allows inputs to this process to be monitored by sector and by company for comparison with equivalent companies headquartered in the US and Japan. The *Scoreboard* offers policy-makers a picture of the relevant companies' global R&D investments and economic outcomes which ultimately derive from business strategy decisions, including how much, and in which industries, firms are performing R&D.

The *Scoreboard* is intended for four main audiences:

- **Companies:** To help them benchmark their own R&D investments and performance against international and European competitors in their sectors. Benchmarking, coupled with more effective investment and performance improvement programmes, is a way for companies to close performance gaps between them and their best international competitors. The data and analysis included in this *Scoreboard* provide opportunities for all interested EU companies to compare themselves with relevant benchmarks from the top 500 EU companies (registered in 16 countries and stating their main business to be in 31 different FTSE sectors) and top 500 non-EU R&D-investing companies.
- **Investors:** To help investors assess the prospects of companies which are in or might be added to, their portfolios. In particular, investors will want to ask about the size of each company's R&D investment relative to that of its competitors and the adequacy of its new product pipeline. Large investors can use the *Scoreboard* to provide a firm foundation for their discussions with companies on this issue.

6 OECD MSTI, May 2004; and Eurostat, European Commission, New Chronos, October 2004.

- **Business Organisations:** These include organisations representing businesses (or employees) in each country, and sectoral organisations. Some of these organise best practice programmes which help companies to learn from each other.
- **Government Organisations:** Governments – notably investment agencies - at regional and national levels, and policy-makers at the European level, need information on businesses as well as information on particular territories. Sectoral mixes, R&D/Sales ratios and the business environment for key sectors are examples of important policy concerns that arise from *Scoreboard*-based comparisons of one economy with another. The *R&D Scoreboard* provides the basis for evidence-based policy development in the areas of R&D investment and the business environment for R&D-active companies in the EU.



The data section of the *Scoreboard* contains three sets of company data ordered by FTSE sector, by country and by size of R&D investment. All data are taken directly from copies of the audited annual reports and accounts (*consolidated group accounts*) of the companies concerned. Since companies have different financial year ends, the *Scoreboard* is compiled by taking data from the latest audited company reports and accounts published on or before 31 July 2004. Time varying data such as market capitalisation is also taken at close of business on the same day. An end of July date is convenient since the many companies with a financial year-end at the end of December 2003 are included as are most companies with an end March 2004 year-end. Since the *Scoreboard* includes companies reporting in different currencies, all currencies have been converted to euros at the exchange rates prevailing on 31st December 2003. Company data are presented for the two principal groups of companies. These are:

- The top 500 EU companies, all of which have R&D investment of over € 8.5 million.
- The top 500 non-EU companies, all of which have an R&D investment of over € 51.4 million. There are 185 EU companies with an R&D investment of over € 51.6 million giving a world top 685 companies within which valid comparisons can be made between countries since the 685 companies are all in the same R&D investment size range (i.e. they have an R&D investment of over € 51m). A difference between the global 685 and the EU 315 (i.e. the 500 less the 185) is that the EU 315 contains companies with smaller sales that are either in an earlier stage of building their businesses, are competing in national rather than global markets, or also operate in international markets but simply invest less in R&D.

To ensure that the top 500 companies have been correctly identified in each case, data for many additional companies have been collected and analysed.

The scope and limitations of the data are discussed in more detail in the Annex. Briefly, however, the aim has been to achieve a list as complete as possible without double counting. There are two distinct categories of companies included in the EU list of this *Industrial R&D Scoreboard* – stock-exchange listed companies and private companies which have their headquarters (i.e. the registered office of the ultimate parent company) in one of the EU Member States. A third group of companies excluded from the EU list are the subsidiaries of non-EU companies that are located in the EU. These three types of companies are described below:

- **Listed companies.** These are the most visible and usually have the most extensive disclosure of financial data and R&D investment in their annual reports and published accounts. Knowledge of the R&D/Sales ratio of different sectors enables the search effort to be targeted by sector if required. For example, companies with small sales need to be examined in the biotechnology sector, since they may have large enough R&D investments to qualify them for inclusion in the top 500.

Company data are presented for two principal groups of companies: The top 500 EU companies (with an R&D investment of over €8.5 million); and the top 500 non-EU companies (all of which have an R&D investment of over €51.4 million).

The Scoreboard includes both listed and private companies. EU-based companies whose ultimate parent is registered outside the EU are not included. The aim has been to achieve as complete a list as possible, while avoiding double counting.

Large, publicly listed companies tend to dominate the total R&D investment figures. In the EU, the top 25 companies invested €61.2 billion in R&D in 2003 out of a total of €101 billion invested by the EU's top 500 companies.

- **Private companies (including government controlled companies).** The larger EU and international private companies such as Robert Bosch, ZF, JCB, Arla Foods and the BBC are almost as visible as listed companies, and the level of disclosure is usually similar. A similar search strategy is used to identify them. Smaller EU private companies, on the other hand, tend to be less visible, are less likely to be included in databases, and some may either not quote R&D in their annual reports and published accounts or, in a few cases, may not even be prepared to provide copies of their accounts. There are big variations between countries. For example, in the UK, the accounts of all private companies must be filed with Companies House and copies can be obtained for a small charge. In other countries, accounts may only need to be deposited with a local registrar and there may be no national (or even regional) service to provide copies at a reasonable charge.
- **EU companies owned by companies whose ultimate parent registered outside the EU are excluded.** These companies are not included in the *Scoreboard* for two reasons. The first is that, if they were included in the EU-500, there would be double counting when the larger companies from the EU-500 are compared with the non-EU 500. This is because many of the latter would already incorporate data for large EU subsidiaries in their consolidated accounts. Secondly, data on foreign-owned subsidiaries are difficult to obtain in some EU countries. Moreover, they may not contain R&D information and may be published long after the end of the financial year in question. There are, of course, no subsidiaries included in the list of companies in the non-EU 500. This is because it would be necessary to access sources of information on unlisted companies in all the countries concerned - this information is not even available in many EU countries.

Despite the concerns about the double counting of R&D investments, it would be valuable to have a separate list of R&D-active foreign subsidiaries in the EU given that information on the R&D investments of foreign-owned companies is of great interest to the countries concerned. This would permit monitoring of the propensity of foreign companies to set up R&D facilities in the EU and identifying which EU countries have been most successful in attracting inward investment of this type, remembering of course that the R&D strategy of a foreign-owned EU company is usually decided in the country where the head office of the parent company is located.

Given that, amongst the larger EU nations, the UK has a very successful track record of attracting inward investment, the UK R&D Scoreboard figure of over 20 % of total R&D carried out by foreign-owned companies is likely to be an upper limit for the larger EU countries⁷. Note that, in the UK, over 50 % of the R&D of foreign-owned companies is accounted for by just five companies. This is discussed in more detail in Section 5.

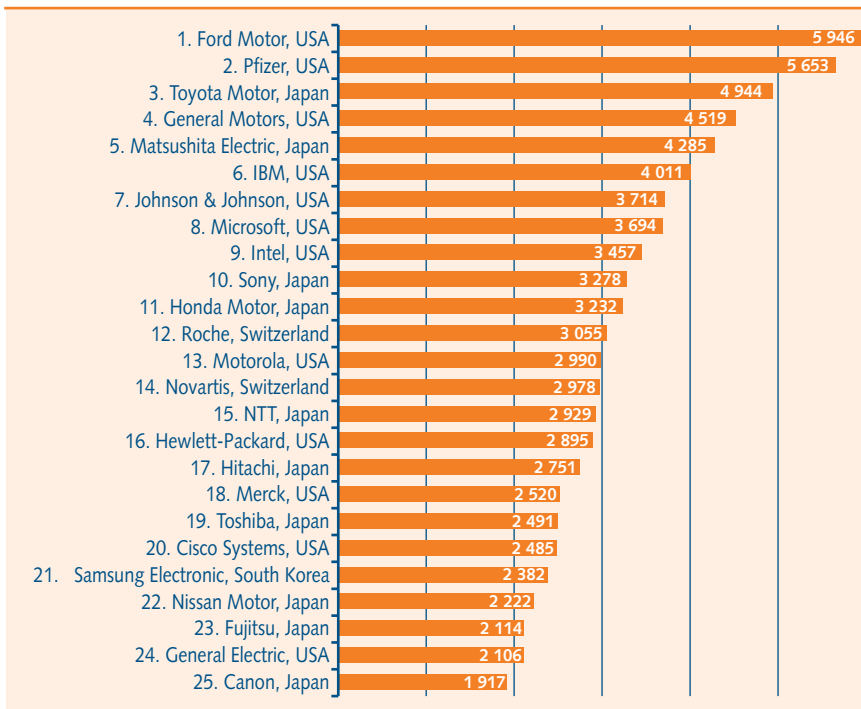
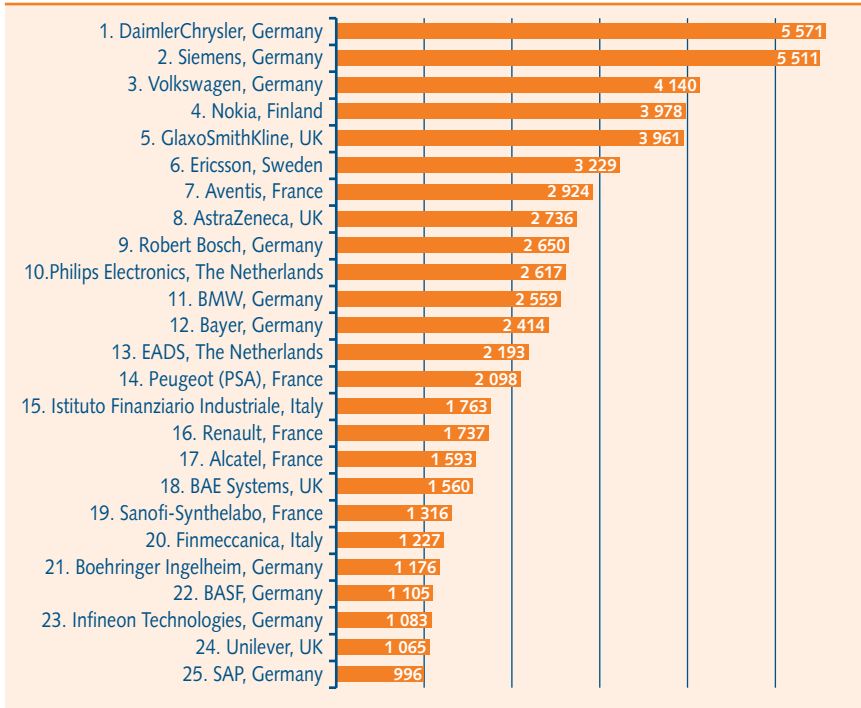
The more limited disclosure for smaller private companies has a relatively small effect on sector totals. This is because large companies dominate the totals and private companies in total contribute, in most countries (but not in all Member States), only a small fraction of the R&D investment of listed companies (*around 4.5 % in the UK, for example*) and because the data is difficult to obtain in some countries.

Figure 2.1 shows the top 25 companies located in the EU ranked by their worldwide R&D investment. Together these companies invested, € 61.2 billion in R&D in 2003 out of a total amount of € 101 billion for the EU's top 500 companies.

7 DTI 2003 R&D Scoreboard, UK Department of Trade & Industry, October 2003.

Figure 2.1.

Ranking of top EU and non-EU 25 companies and their location, by worldwide R&D investment (million €) in 2003.



Some 61% of EU-500 R&D is accounted for by the top 25 companies. In the case of the non-EU 500, this figure is 42%.

The top 3 sectors - automobiles & parts, IT hardware and pharmaceuticals & biotechnology - account for about 55% of R&D investment in both the EU-500 and the non-EU 500.

Companies with registered offices in just three EU countries - Germany, France, UK - together account for 74% of EU-500 R&D.

To illustrate the effects of the largest companies, sectors and countries, Table 2.1 shows the percentage of total R&D for the EU-500 and non-EU 500 contributed by the top 25 companies and the top three countries and sectors in each case. Some 61 % of EU-500 R&D is accounted for by the top 25 companies. In the case of the non-EU 500, this figure is 42 %.

All the top 25 EU companies, except one, have R&D investments of over € 1bn, while the top 25 non-EU companies, except one, have investments of over € 2bn. The difference can be understood in terms of the larger US plus Japanese economy having a shallower drop off in R&D with number of companies. The top 3 sectors - *automobiles & parts, IT hardware and pharmaceuticals & biotechnology* - account for about 55 % of R&D investment in both cases. Companies with registered offices in just three EU countries - *Germany, France, UK* - together account for 74 % of EU-500 R&D. The Netherlands, with just fewer than 7 %, is the fourth largest country in terms of the R&D invested by companies whose ultimate parents have their registered offices in the country.

Table 2.1.

Incidence of top companies, sectors and countries on the total R&D investment for the EU-500 and non-EU 500

Share of R&D investment to total contributed by	EU-500	Non-EU 500
Top 25 Companies	61%	42%
Top 3 Countries ⁸	74%	95%
Top 3 Sectors ⁹	53%	57%

Table 2.2 lists the numbers of companies in the EU-500 for the top 10 countries (all those with 10 or more companies in the *Scoreboard*). The other six countries represented in the *Scoreboard* have 20 companies between them, nine of these being from Spain. The average size of company by R&D investment is also shown in Table 2.2 and it is clear from this that Germany has the largest average size due to its six very large companies with R&D over € 2.4bn.

Table 2.2.

Number of Companies and Average R&D investment per Company for companies with registered office in Top 10 EU Member States

Country ¹⁰	Number of Companies in EU-500	Average R&D per Company
UK	149	€115m
Germany	100	€375m
France	66	€296m
Sweden	44	€146m
Finland	28	€176m
Denmark	28	€63m
Netherlands	22	€315m
Italy	17	€228m
Belgium	16	€77m
Austria	10	€26m

⁸ Largest countries by R&D investment from firms with headquarters in these countries

⁹ Largest sectors by R&D investment from firms operating in these sectors

¹⁰ Largest countries by R&D investment from firms with headquarters in these countries

The large proportion of total R&D contributed by the top 25 companies in each case does not mean that smaller companies are not important. The long-term success of any country or group of countries depends on the vigour of small companies and the proportion of them that grow their businesses to become medium-sized and eventually large companies. This is particularly important in the newer, more R&D-intensive sectors where growth rates are higher and a decade can see major changes in company size relative to established companies in more mature sectors. This vigour and ability to grow differ significantly between countries and a regularly published *Scoreboard* enables quantitative estimates to be made of such growth. The best results are obtained when the *Scoreboard* is large enough to capture companies with relatively small R&D and when a series of at least five annual *Scoreboards* are available. Examples of companies that have grown fast to reach the top 20 in the world by R&D include GlaxoSmithKline, Intel, Microsoft and Nokia. In the 1993 global R&D *Scoreboard* published in the UK, not one of these four companies was in the top 50 and two of the four (Microsoft and Nokia) were not even in the top 100. In a similar way, there will be companies today that are too small to reach the € 51 million minimum R&D investment for entry to the world top of R&D-investing companies which will be well up this ranking in ten years' time.

Whilst the overall total of R&D is only slightly affected by the differing levels of disclosure in different countries, the number of companies that each country has in the top 500 will be affected significantly. For example, some 75 companies have been identified (including 16 from Germany), which are thought to be R&D-active but which do not quote a figure for R&D in their accounts. Around 50 % of these may well have R&D over € 8m. There are also 9 companies that appear to have R&D over € 8m but their annual reports only quote R&D as percentage of sales rather than as a specific figure for R&D investment; they have not been included in the *Scoreboard* since no audited figure for R&D is given. In addition, there are companies that could well have significant R&D but which have not responded to a request for them to provide a copy of their accounts. In six cases (5 from Germany), companies declined to supply copies of accounts saying that they were private companies. It is hoped that publication of this *Scoreboard* will encourage more companies to disclose R&D in their accounts and be prepared to provide copies of those accounts. The incentive to do this is the increased visibility of R&D investment as a result of the publication of an *EU Scoreboard*. In fact, a company can enhance its attractiveness to investors or other providers of finance if it is both growing, and is seen to be investing in R&D to renew its range of products and services so that it has a good chance of being able to continue its profitable growth.

Since companies rarely report how much of their R&D is performed in each country, it is not possible to estimate the percentage being performed inside the EU or to see whether this is increasing or decreasing. Reasons why a company might change the EU/non-EU balance of its R&D include:

- The need to rebalance its overall R&D activity to take account of growth and market opportunities in particular regions. For example, a European company expanding its US sales will, at the very least, need more nearer-to-market R&D operations close to its US customers.
- The desire to reduce R&D costs by off-shoring certain types of R&D to lower cost countries such as India or China (e.g. software development to India).

The large proportion of total R&D contributed by the top 25 companies in each case does not mean that smaller companies are not important, particularly in R&D intensive sectors where the landscape can change radically in just a decade.

The overall R&D figure is only slightly affected by the differing levels of disclosure. However, the level of disclosure has a significant impact on the number of companies each country has in the top 500.

It is to be hoped that publication of this *Scoreboard* will encourage more companies to disclose R&D in their published accounts.

- The desire to place particular types of R&D in favourable environments. Examples might be the wider availability of certain scarce skills in one country or protection from disruption in another (e.g. the case of animal testing for pharmaceuticals).

These are important issues but are better explored by interviews with companies' CEOs (Chief Executive Officers) since there is likely to be inadequate information about them in company annual reports and accounts.

The Business Climate for R&D-Active companies

Section 3

The purpose of this section is to use the overall financial and R&D totals for the EU-500 and non-EU 500 *Scoreboards* to understand the average recent business performance of R&D-active companies in the major world economies of the EU, Japan and the US. This average business performance reflects the business climate experienced by R&D-active companies and the mix of companies operating in that climate. The business climate differs for these three major economies and also differs for different sectors although all are affected to some extent by the business cycle. The business cycles for sales in the EU and US may well have their peaks and troughs at different times, thus we will provide some additional information on the performance of these companies over the last three years.

3.a. Overall macroeconomic conditions and business performance of EU versus non-EU companies

The 2003 financial year saw the profitability of both EU and non-EU companies recovering from the recession of 2001-2002, although during the past four years non-EU companies have been increasing their net sales and R&D investment at faster rates than EU companies. The other important macroeconomic factor has been the shift in exchange rates, with the dollar depreciating against the euro (from \$0.94 by the end of December 2000 and \$0.89 in December 2001 to \$1.05 in December 2002 and \$1.26 in December 2003). This latter change has significantly reduced (by some 10 %) the number of US companies over the total number of companies, in any world-wide top ranking by R&D investment, for the previous years. The big effect that exchange rate changes can have on current values means that key dimensionless ratios such as R&D/Sales ratio (R&D investment as a percentage of net sales) or profitability (gross profit as a percentage of net sales) may become particularly valuable comparators of companies' performances. However, *Scoreboard* comparisons of the current year against a previous year use the current year exchange rates in the assessment of equivalent values for the previous year or years. To do otherwise would mean annual growth rates would be heavily affected by wide fluctuations in exchange rates against the euro, in the case of those companies with a large share of their financial operations in other currencies than the euro.

A series of headline figures for the EU-500, the non-EU 500 and the 185 top EU companies (which have a reported R&D investment in the same size range as the non-EU 500 companies) are given in Table 3.1. The differences between the EU-500 and EU-185 are small except in terms of size of company, in R&D/Sales ratio (where the EU-185 is higher) and in profitability (where it is lower).

When comparing EU to non-EU companies the big effects that exchange rates (and also some big acquisitions) can have over short periods need to be borne in mind. This implies less confidence can be placed in the interpretation of small changes in quantities such as changes in sector totals between different countries¹¹.

¹¹ Experience with Scoreboards that have been running over the latest decade (such as the UK-DTI R&D or Value Added Scoreboards) suggests that longer term, persistent trends are the most meaningful (see DTI 2003 R&D Scoreboard, UK Department of Trade & Industry, October 2003. Copies can be obtained by email from publications@dti.gsi.gov.uk. See also the website: www.innovation.gov.uk/finance)

In 2003, both EU and non-EU companies began recovering from the recession of 2001-2002, although during the past four years non-EU companies have been increasing their net sales and R&D investment at faster rates than EU companies.

Dimensionless ratios such as R&D/Sales ratio or profitability are a particularly useful way of eliminating exchange rate fluctuations from the comparisons.

Table 3.1.

Overall Business Performance of R&D Scoreboards Companies based on 2003 Financial Year Data

Factor	EU-500	EU-185	Non-EU 500
R&D Investment (€ bn)	100.8	93.9	195.6
R&D Investment /Company (€ bn)	0.20	0.51	0.39
Change in R&D Investment Over Previous Year (%)	-2.0	-1.9	3.9
R&D Investment CAGR for Last 3 Years (%)	1.2	1.1	3.7
Net Sales (€ bn)	3139.3	2614.7	4342.4
Change in Net Sales Over Previous Year (%)	-0.6	-0.7	6.8
Net Sales CAGR for Last 3 Years (%)	0.9	0.8	2.9
Employees (millions)	12.0	9.7	15.6
Change in Number of Employees Over Previous Year (%)	-3.4	-2.9	-1.0
Sales/Employee (€ k)	261.6	270.3	266.6
R&D Investment per Employee (€)	8394	9706	12094
R&D / Sales Ratio (%)	3.2	3.6	4.5
Operating Profit/Net Sales (%)	7.0	6.8	9.1

Note: The values are for the financial year 2003 (2003/2004 in certain cases); the growth rates are computed for the 2003 financial year compared with the 2002 financial year. For comparability reasons, the annual growth rates are adjusted according to the available sample of companies in each year (i.e. if there are no data for one company in one year, impeding the computation of growth rate, that particular company is excluded from the aggregate growth rate calculation)

The key features of Table 3.1 concern the comparison of the EU-185 and non-EU 500 groups of companies spanning the same size range. These are:

R&D investment by the top EU-185 companies decreased by 1.9% in 2003 with respect to the previous year whereas R&D investment by the non-EU 500 companies increased by 3.9%.

- The average EU-185 R&D investment per company is € 0.51bn, significantly larger than the € 0.39bn for the non-EU companies. This is due to the group of very large companies at the top of the EU-185.
- R&D investment by the EU-185 companies decreased by 1.9 % in 2003 with respect to the previous year whereas R&D investment by the non-EU 500 companies increased by 3.9 %. The change in sales was also very different in 2003, in the two cases, with the EU decreasing by 0.7 % but the non-EU increasing by 6.8 %. As already mentioned, this latter could partly be a result of the appreciation of the euro. The fact that net sales and R&D investment have moved in the same direction supports the view that R&D investment is positively correlated with company size, something which has already been found in many other studies.
- The average R&D/Sales ratio of the EU-185 companies is 3.6 % - only 80 % of the 4.5 % for the non-EU 500 companies. The R&D/Sales ratio for the total number of EU-500 companies is lower still at 3.2 %.
- Employee numbers have decreased by 2.9 % for the EU-185 and 3.4 % for the EU-500 companies, while remaining almost constant (-0.3 % over the previous year) for the non-EU 500 companies. Sales per employee show similar figures for companies from all the regions. As a consequence, the figures for R&D investment per employee are approximately 20 % smaller in the case of EU companies than in that of the non-EU companies.

- Profitability was lower for the EU-185 companies at 6.8 % or 73 % of the non-EU 500 figure of 9.1 %, and only slightly improved in the case of EU-500 companies (at 7.0 %).

The caveats associated with changes in *Scoreboard* parameters from year to year are that they can be affected by exchange rates, non-synchronisation of the business cycle between different economies and large acquisitions, which have in the past had a significant impact. Confidence in the importance of any particular trend grows if it persists in *Scoreboards* over several years and is seen in many different companies in a sector or economy.

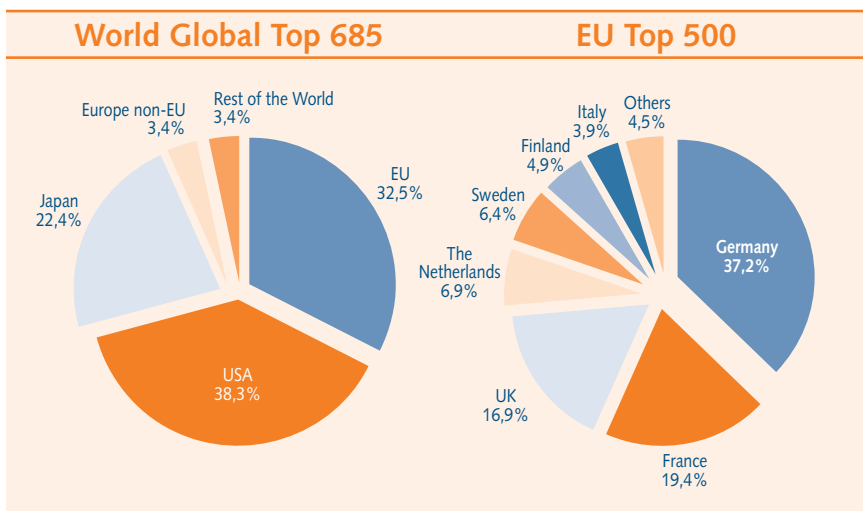
The average R&D/Sales ratio of the EU-185 companies is 3.6% - only 80% of the 4.5% for the non-EU 500 companies. The R&D/Sales ratio for the total number of EU-500 companies is lower still at 3.2%.

3.b. Business performance of R&D investing companies in each of the major regions

Given the differences in business conditions in the major economies of the world, the companies in the *Scoreboard* are grouped – according to the location of their registered offices – into five major regions, which are used for comparative purposes within this section: European Union, United States, Japan, the non-EU part of Europe (mostly Swiss companies) and the rest of the world (companies from Korea, Canada, China, Brazil, Australia, etc.). The breakdown of the R&D investment by the Top 685 companies, by location of the registered office of ultimate parent, is provided in Figure 3.1, together with the breakdown of the R&D investment of the EU-500 by EU Member State. Section 4c will address the regional breakdown in more detail. A comparison of the EU-185 companies with similar groups of companies whose registered offices are located in the US and Japan is shown in Table 3.2.

Figure 3.1.

The breakdown of R&D investment of major companies, by location of registered office, in 2003 (% of total)



US companies tend to lead the non-EU 500 companies on most measures.

For example, in 2003 the top R&D investing companies in the US increased R&D investment by 4.7% whereas R&D spending by their counterparts in the EU decreased by 1.9%.

A comparison of the US company data in Table 3.2 with the non-EU company data in Table 3.1 reveals that the US companies tend to lead the non-EU 500 companies on most measures. For example, the US companies had an average

R&D/Sales ratio of 4.9 % in 2003 vs. the non-EU 500 average at 4.5 % and US companies' profitability (ratio of operating profits to net sales) was also higher than that of the non-EU 500 company average during the same period.

By comparing the financial results of companies from the US-288 and Japan-153 samples¹² with the EU-185 companies' figures, one can see that the top R&D-spending companies in the US increased R&D investment by 4.7 % whereas their counterparts in the EU decreased R&D spending by 1.9 %. The US companies also show a substantially higher average aggregate profitability (ratio of gross profits to net sales) than those in the EU while registering a smaller drop in the number of employees. These comparisons point to a potential gap that needs to be closed between the R&D investment and the performance of the two economies. There is evidence that EU economies have experienced higher growth in the first half of 2004 and it will be interesting to see if the EU/US gap shows signs of closing in the 2005 *Scoreboard*. Smaller EU and US companies are compared in Section 8, revealing a similar gap in R&D investment. The origin of the big difference in the R&D/Sales ratio between US companies at 4.9 % and EU companies at 3.6 % is explained in Section 7.

Table 3.2.

Overall Comparison of Similar-Sized Companies from the R&D Scoreboards, by location of registered offices, in 2003

Factor	EU-185	US-288	Japan-153
R&D Investment (€ bn)	93.9	110.8	64.9
R&D Investment / Company (€ m)	508	385	424
Change of R&D Investment over previous year (%)	-1.9	4.7	2.8
Change of Net Sales over previous year (%)	-0.7	11.2	2.0
Change of Number Employees over previous year (%)	-2.9	-1.5	-0.4
R&D Investment CAGR for Last 3 years (%)	1.1	3.5	3.6
Net Sales CAGR for Last 3 years (%)	0.8	2.9	2.4
Capital expenditure / Sales (%)	4.7	6.4	6.3
R&D Investment / Employee (€)	9706	13814	12724
R&D / Sales ratio (%)	3.6	4.9	4.2
Operating Profit / Net Sales (%)	6.8	10.3	5.7

The key points from this table for the groups of large companies investing in R&D in each major economy (or at least for the companies with R&D investment over € 51.38m) are:

There were no substantial differences between EU and non-EU companies in the pattern of change in their R&D investment during the the last three years.

- US companies had, in 2003, the largest total R&D investment, the highest R&D/Sales ratio (4.9 %), the highest R&D investment growth rate and profitability of over 10 %.
- In 2003 Japanese companies had the smallest total R&D investment, the second highest R&D/Sales ratio of 4.2 %, an R&D investment growth rate the same as the US companies over the latest 3 years, but the lowest profitability (5.7 %).

¹² The number of companies with registered offices located in US and Japan, which are present in the non-EU 500 R&D groups on the Scoreboard is 288 and 153, respectively.

- Investment in R&D by EU companies in 2003 fell part way between that of Japanese and US companies. EU-based companies had the lowest R&D/Sales ratio (3.6 %) and the lowest R&D investment growth rate, but their profitability was above that of Japanese companies (6.8 %).

The trends in the R&D/Sales ratio can also be discerned from the separate trends in R&D investment and in net sales shown in Tables 3.1 and 3.2 and will be further detailed in Section 4.c. The R&D/Sales ratio for the EU-185 companies decreased in 2003 by some 1.2 % over the previous year, whereas for the Japanese companies it increased by almost 1 % and for the US companies it decreased by more than 6 %. However, the EU companies' figure is made up of an R&D investment which decreased last year by almost 2 % and a slightly smaller net sales decrease of less than 1 %. The US companies, on the other hand, increased R&D investment by 4.7 %, but this was overshadowed by a larger sales increase of 11.2 %. However, there is no clear trend in the evolution of R&D/Sales ratio of top companies investing in R&D during the latest 4 years, as will be illustrated in the following section.

There were no substantial differences between the EU and non-EU companies in terms of the changes in their R&D investment during the period of reference (Table 3.3). In both the EU and the non-EU, approximately 70 % of companies were steadily increasing their R&D investments during 2000-2003.

In both the EU and the non-EU, approximately 70 % of companies were steadily increasing their R&D investments during 2000-2003.

Table 3.3.

Distribution of *Scoreboard* companies by changes in their R&D investment in 2000-2003

	Changes in R&D Investment by Companies, 2003 over the previous year (% of total companies)		
	R&D Increase ≥ 5 %	R&D Increase 0-5 %	R&D Decrease
EU TOP 500	38	16	46
NON-EU TOP 500	47	16	37
	Changes in R&D Investment by Companies, 2000-2003 (% of total companies)		
	R&D Increase ≥ 5 % p.a.	R&D Increase 0-5 % p.a.	R&D Decrease p.a.
EU Top 500	51	18	31
Non-EU Top 500	52	19	29

However, more of the EU companies reduced R&D investment in 2003 than did non-EU ones. A detailed analysis needs to be based on data from more years so that growth rates can be compared over a longer period encompassing more than one business cycle.

Given the important contribution to total R&D investment made by the larger companies, it is interesting to compare the changes in R&D over one year for the top 25 EU and the top 25 US companies. Twelve of the top 25 EU companies reduced their R&D investment over the last year, four of them by double figure percentages. Only four of the top 25 US companies reduced R&D investment, and just one of these by a double figure percentage.

The changes over three years can be estimated from the CAGR (Compound Annual Growth Rate, which is the average growth per year extrapolated

The EU top-185 companies have a 3-year CAGR for R&D investment and net sales of 1.1% and 0.8% respectively in 2000-2003. The Japanese companies have a 3-year CAGR of 3.6% for R&D investment compared to 2.4% for net sales: an average increase in their R&D/Sales ratio of over 1% a year over the last three years.

from the growth over the three year period) figures reported in Table 3.2. In this case, all three large regional groupings of companies show increments in the R&D/Sales ratio, due to the fact that, on average, R&D investments grew faster than net sales over the three-year period. The companies in the EU Top-185 have a 3-year CAGR for R&D investment and net sales of 1.1 % and 0.8 % respectively, so there has been slight positive change in their average R&D/Sales ratio over the period 2000-2003. The Japanese companies, on the other hand, have a 3-year CAGR of 3.6 % for R&D investment compared to 2.4 % for net sales so their R&D/Sales ratio has increased by more than 1 % per year on average for the last three years. The performance of the US companies was somewhere in between, but they started out with a much higher R&D/Sales ratio. These changes have to be monitored in the medium to long term¹³ and need to be related to what has happened in the main sectors in the three large economies, given the different structures. However, the overall picture is one of a gap in R&D investment/Net sales ratio that could begin to close in 2004 if the EU's economic and investment growth are maintained.

13 For example, the DTI 2000 R&D Scoreboard showed US companies' R&D/Sales ratio over a period of more than 20 years and there was a very significant change between 1981 and 1990 when the US companies' R&D/Sales ratio doubled and remained at the higher value until 1996 when further increases occurred.

The purpose of this section is to extend the analysis of Section 3 with further details of the R&D performance of the EU-500 vs. non-EU 500 groups of companies active in the major economies of the EU and the rest of the world. There are three main features of R&D investment for an economy:

- The total amount of R&D investment compared to other economies and the way it is distributed across the different sectors.
- The R&D/Sales ratio of companies operating in the key sectors compared to the similar ratio found for companies in competitor economies.
- The distribution of the R&D investment between companies of different sizes. For example, two economies may both have two large companies in a major sector but one may also have many more smaller, fast growing companies in that sector which give it more 'strength in depth' and increased dynamism

The first two aspects are discussed in this section but the third is addressed in Section 8 where a large sample of EU companies (from the EU-500) is compared with a large sample of US companies from the US 1000 Scoreboard. The United States is the only other large economy for which a comprehensive Scoreboard is currently available for comparison (covering 1000 US companies).

As in the previous Section, most of the comparisons between EU companies non-EU companies on the *Scoreboard* are made by contrasting the EU-185 with the Japan 153, US-288 and with other groupings of companies in the non-EU 500. This ensures that companies of similar R&D size are being compared. It should be noted, however, that all these comparisons consider only companies with R&D spending of over € 51.38m. There may be big differences between the three economies in the case of smaller companies.

4.a. Total R&D for Regions and Economies

The total R&D investment by the companies in the five world regions considered in the analysis is shown in Table 4.1. Companies with their registered offices in Europe (the EU-185 plus the European section of the non-EU 500) spent a total of € 103.8bn on R&D. This was equal to 93.6 % of the US companies' R&D investment (which stood at € 110.8bn). On the other hand, European R&D spending was much larger than that of Japan, which was € 64.9bn. At almost € 94bn the EU-185 accounts for over 93 % of the EU-500, meaning that the last 315 companies contribute slightly more than 7 % of the R&D investment of the largest 185 (and below 7 % of overall R&D investment of the EU-500); this reflects the steep fall in the distribution of company R&D size against company rank. The fall in the value of the US dollar relative to the euro means that a table for the year before at the old exchange rates would show the US companies with a much larger R&D investment total than that reported in Table 4.1¹⁴.

¹⁴ This is particularly true for R&D activities, which are still performed largely within the country where the company's office is registered. BERD data for the year 2000 (STI Key Figures 2004) show that the flows of R&D investment by companies outside their region of registration do not exceed 10% of the total R&D expenditure (in PPS terms). In the case of the largest three economies of the world, the highest net outflow of business sector R&D funding (€ 5 billion) was reported for EU-15.

Most of the comparisons between EU non-EU companies on the Scoreboard are made by contrasting the top EU-185 with the Japan-153, US-288 and with other groupings of companies in the non-EU 500. This ensures that companies of similar R&D size are being compared.

The top EU-185 companies have an R&D/Sales ratio of 3.6%, which is lower than that of the comparable Japanese companies, at 4.2%, or US companies, at 4.9%.

The R&D/Sales ratios are also shown in Table 4.1. The Top 185 EU companies have an R&D/Sales ratio of 3.6 %, which is lower than that of the comparable Japanese companies, at 4.2 %, or US companies, at 4.9 %. The EU companies are also below the non-EU ones (at 4.8 %) because Swiss companies (which are the main contributors to research investment within this region) are characterised by a high R&D effort of 6.4 % (due to a large pharmaceuticals sector).

Table 4.1.

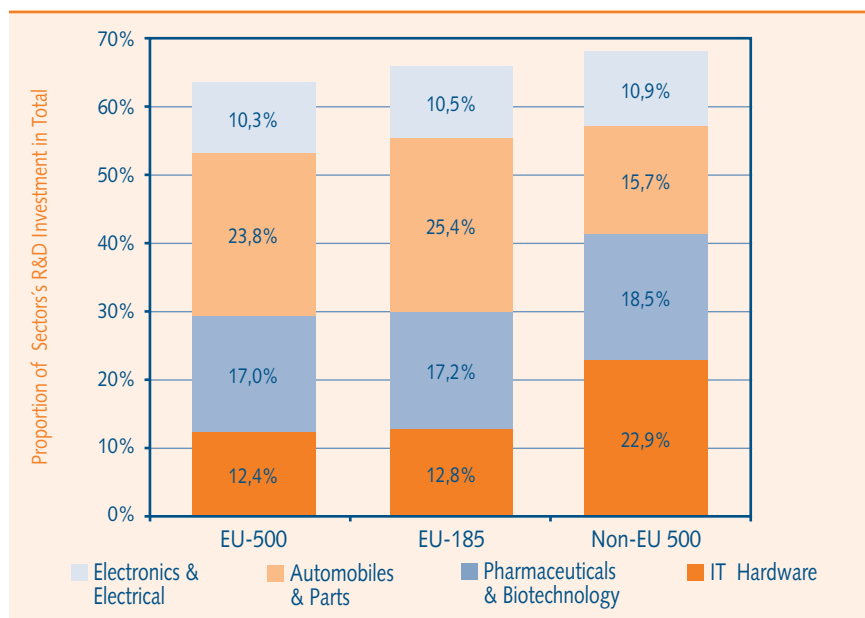
R&D Investment by Region in 2003

	EU-500	EU-185	Europe non-EU	US-288	Japan-153	Rest of the World	Non-EU 500
Total R&D investment (€ bn)	100.8	93.9	9.9	110.8	64.9	9.9	195.6
R&D / Sales ratio (%)	3.2	3.6	4.8	4.9	4.2	2.9	4.5

These differences are partly associated with differences in sector mix and partly with differences in performance between similar sectors. Figure 4.1 shows the big differences in the proportions of the four largest sectors between the R&D performance of major companies investing in research belonging to the EU-185 and non-EU 500 groups on the Scoreboard.

Figure 4.1.

R&D Investment by major sector of activity for companies in the EU-500, EU-185 and Non-EU 500, in 2003



The structure for the EU companies shows a proportionately much larger automobiles & parts sector but smaller IT hardware and slightly smaller pharmaceutical sectors (the latter two being sectors with a high intrinsic

R&D/Sales ratio). The very large EU companies (EU-185) also have a similar proportion of their R&D investment falling outside the four largest sectors – 34 % compared to 32 % for the non-EU 500 companies, but the aggregate share of sectors other than these four main sectors comes to 36.5 % in the case of the EU-500 companies.

It is these differences in the sector mix, particularly in sectors with high R&D/Sales ratios such as IT hardware, that account for much of the difference in the overall R&D/Sales ratio between the EU-185 and non-EU 500 shown in Table 4.1. It is important to bear in mind that two companies can dominate the *Scoreboard* sector figure by accounting for well over 50 % of the sector R&D investment represented in the overall sample. This is illustrated by Table 4.2 which shows sector concentrations for the EU-185, US and Japanese companies that are present in the *Scoreboard*. The concentration is defined here as the percentage of total sector R&D investment of all the companies listed in the *Scoreboard* accounted for by the top two companies. The two extreme examples are EU electronics & electrical equipment where Siemens and Philips account for 83 % of EU sector R&D investment and US automobiles & parts where Ford and General Motors account for 73 % of the sector's total R&D investment. It is only for IT hardware where the concentration falls below 30 % in the case of US companies. This is because the US companies are very strong in IT hardware and although the largest two companies by R&D (Intel and Motorola) account for over € 6bn, this is still only 22 % of the R&D investment by the top US-288 companies in the sector concerned.

Differences in the sector mix, particularly in sectors with high R&D/Sales ratios, account for much of the difference in the overall R&D/Sales ratio between the EU-185 and non-EU 500.

In some cases just two companies can dominate the sector figure by accounting for well over 50% of the sector's R&D investment.

Table 4.2.

R&D Investment Concentration by Sector and by Major Economies for Companies in 2004 Industrial R&D Investment Scoreboard, in 2003

Sector	Concentration of R&D Investment: Share of Sector R&D Investment contributed by top 2 Companies (%)		
	EU-185	US-288	Japan-153
IT Hardware	60	22	43
Pharmaceuticals & Biotechnology	43	38	30
Automobiles & Parts	41	73	52
Electronics & Electrical Equipment	83	55	49

4.b. Sector Specialisation

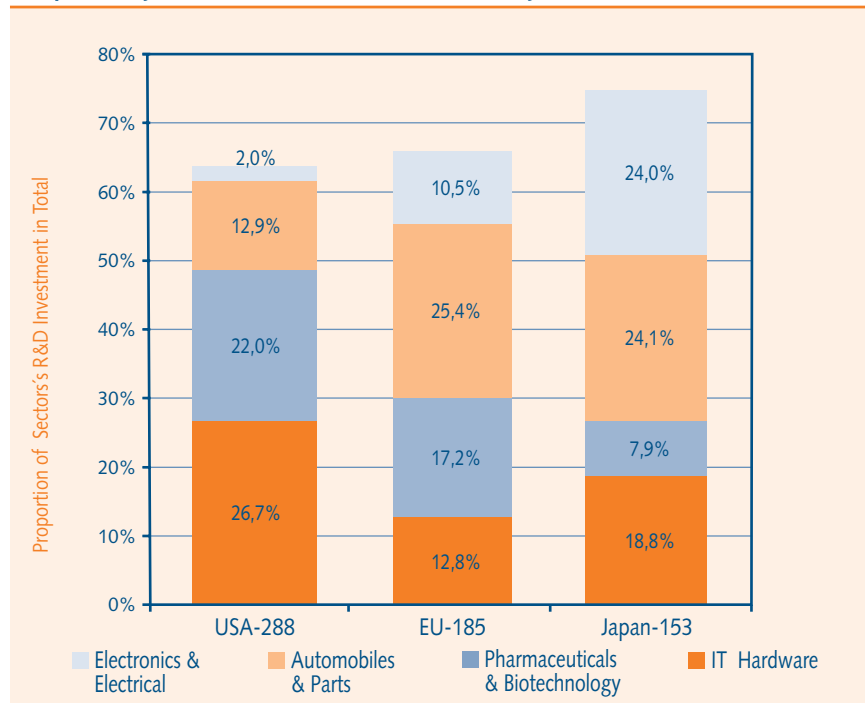
The analysis from the previous Section has begun to suggest the way in which different economies (or in any case the companies that have their registered offices located in the respective countries) have developed different specialisations. In Figure 4.2, the proportions of total R&D investment in the four major sectors are shown for the EU-185, Japan-153 and the US-288 sets of similar-sized companies. Around two-thirds of total R&D investment is accounted for by these four sectors for the EU and US companies but this rises to three-quarters for Japanese companies.

The Scoreboard's figures show Japanese companies to be strong in automobiles & parts and electronics & electrical equipment; US companies to be strong in IT hardware and in pharmaceuticals & biotechnology; and EU companies to be strong in automobiles & parts and pharmaceuticals & biotechnology.

The aggregate R&D investment of world's top 685 R&D-investing companies has decreased slightly over the last four years.

Figure 4.2.

The proportions of 4 major sector's R&D investment in total of similar-size companies by location of head office in the 3 major economies, in 2003



Japanese companies appear to be more specialised in automobiles & parts and electronics & electrical equipment but weaker in pharmaceuticals & biotechnology; US companies are strong in IT hardware and pharmaceuticals & biotechnology but weak in electronics & electrical equipment, while, at the aggregate sector level, the EU companies are clearly specialised in automobiles & parts and pharmaceuticals & biotechnology, but comparatively weak in IT hardware.

In policy terms, it is important to understand the differences outlined above, given the need to ensure the economy keeps its edge in those areas where it is strong, without overlooking weaker areas which may be important for the future and hence need to be encouraged, and of course bearing in mind the need for a degree of balance in the economy as whole. Issues of the quality of the local business environment and barriers to growth are very important when one economy wishes to close a perceived gap with another. There is a fuller discussion of the economies' sectoral specialisation and the effects this may have on the R&D/ Sales ratio in Section 7.

4.c. R&D indicators by location of companies' offices in major regions of the world

The evolution over the period 2000-2003 of the R&D investment worldwide by the top 685 (as of 2003) R&D-investing companies is presented in Table 4.3.

As the table shows, the proportion of the major R&D-investing EU companies that are included in the EU-185 group as of 2003 in the aggregate R&D

investment of world's top 685 R&D-investing companies has decreased slightly over the last four years, while US companies and the companies sited in the Rest of the World region (mainly Korea) increased their share in total *Scoreboard* companies' R&D investment.

Table 4.3.

The 2000-2003 evolution of the proportions of R&D investment of regional groups of R&D-investing top companies in aggregate R&D investment of the world's top 685 companies ranked as of 2003 (%)

REGIONAL GROUPS	2000	2001	2002	2003
EU (185)	33.7	34.2	33.7	32.5
US (288)	37.7	37.6	37.4	38.3
Japan (153)	22.3	21.5	22.2	22.4
Europe non-EU (23)	3.5	3.2	3.3	3.4
Rest of the World (36)	2.8	3.4	3.5	3.4
World Top 685 R&D investment (€ bn equivalent, at current prices)	256.8	278.8	283.0	289.7

Note: The proportions each year are computed for the same group of top companies as reported in the 2004 *Scoreboard*, based on the 2003 ranking. In first column, following the name of the region where the top companies are registered, the number of companies in each regional group is provided in brackets.

In each of the last four years, US companies were the biggest investors in industrial research among the top 685 companies (reaching a proportion over 38 % in total, in 2003), followed by EU companies (around one third of total) and Japanese companies (between 21.5 % and 22.4 %).

The overall deceleration in the world economy during 2001-2003 (which hit the major economies particularly hard) was probably the main contributor to the very low growth rate in R&D investment of the top 685 companies worldwide, registered in 2002 (0.5 %, not adjusted for inflation). As Figure 4.3A highlights, the outlook for the top 685 companies in the 2004 *Scoreboard* shows the signs of an incipient recovery in 2003.

The close correlation between the growth in net sales and that in R&D investment suggests there is a direct relationship between these two variables during the period studied.

Consequently, the ratio between the aggregate R&D investment and net sales for the top 685 companies listed in the *Scoreboard*¹⁵ did not change significantly during the period 2000-2003, as Figure 4.3B shows. The R&D/Sales ratio varied between 4.1 and 4.3¹⁶.

15 This indicator is a good equivalent for the company R&D intensity (the ratio between R&D spending and the value added of the given company in one period), often used to replace it due to the lack of data concerning value added in publicly available company reports.

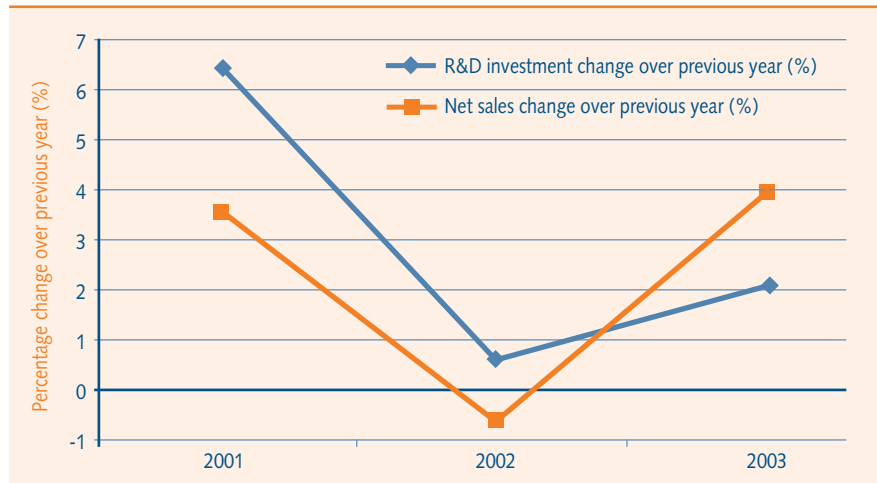
16 It means that the R&D intensity of the group of top R&D-investing companies – which usually is significantly higher than the R&D/Sales ratio, due to the fact that value added is smaller than the net sales - is quite high in comparison to the average R&D intensity in the overall economy (reported at 1.9% on average for the EU economy, for example). This implies that achieving the overall Barcelona target involves a far higher target for these companies than the average 3%.

In each of the last four years, the US companies among the world's top 685 were the biggest investors in industrial R&D.

The close correlation between the growth in net sales and that in R&D investment suggests there is a direct relationship between these two variables during the period studied

Figure 4.3A.

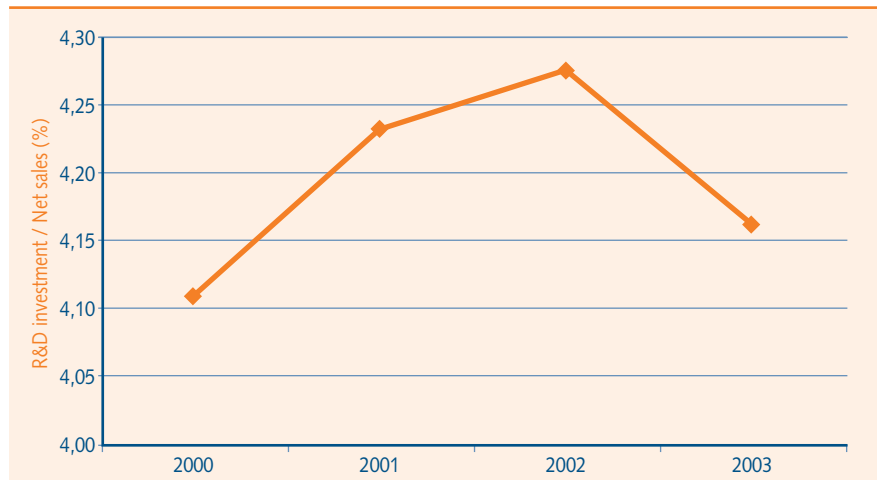
The change in annual growth rates of R&D investment and net sales from 2001-2003 for the world top 685 R&D-investing companies (percentage change on the previous year)



Note: For comparability reason, the annual growth rates have been adjusted depending on the sample of companies available in each year (if there are data missing for one company in one year, preventing the computation of growth rate, that particular company is excluded from the aggregate growth rate calculation).

Figure 4.3B.

The change in the R&D/ Sales ratio (%) during 2000-2003 for the world top 685 R&D-investing companies (grouped according to the 2003 *Scoreboard* ranking)



Another factor that drives companies' appetite to invest in research seems to be how their profitability changes over time (based on operating profit defined as a percentage of net sales). This is shown in Table 4.4:

Table 4.4.

Gross profits as a percentage of net sales for the Top 685 companies worldwide listed in the 2004 R&D Scoreboard

REGIONS	2000	2001	2002	2003
EU-185	8.2	3.1	1.9	6.8
US-288	14.0	4.4	2.6	10.3
Japan-153	4.5	4.1	3.6	5.7
Europe non-EU	16.4	12.1	7.8	12.4
Rest of the World	20.2	12.8	7.5	14.4
EU-500	8.4	3.0	1.8	7.0
non-EU 500	11.0	5.3	3.7	9.1

We may compare these data with the actual growth rates of R&D investment and net sales (reported for the main regions in which ultimate parent companies listed in the Scoreboard have chosen to site their registered office) in order to understand the motivations of multinationals and large companies for their research investment decisions, during recent years (Tables 4.5 and 4.6):

Table 4.5.

R&D investment growth rates (% over the previous year) for Top 685 companies investing in R&D worldwide, by location of registered offices in major regions

REGIONS	2001	2002	2003
EU-185	6.94	-1.47	-1.88
US-288	5.86	0.13	4.70
Japan-153	4.15	3.78	2.77
Europe non-EU	-0.59	2.74	7.84
Rest of the World	30.12	-4.95	-0.27
EU-500	7.15	-1.36	-2.03
non-EU 500	5.96	1.21	3.95

Table 4.6.

Net sales growth rates (% over the previous year) for Top 685 companies investing in R&D worldwide, by location of registered offices in major regions

REGIONS	2001	2002	2003
EU-185	4.39 %	-1.32 %	-0.66 %
US-288	0.03 %	-2.00 %	11.20 %
Japan-153	4.15 %	1.02 %	2.01 %
Europe non-EU	1.17 %	1.36 %	0.74 %
Rest of the World	14.54 %	3.40 %	5.38 %
EU-500	4.39 %	-1.03 %	-0.58 %
non-EU 500	2.47 %	-0.33 %	6.81 %

The following conclusions can be drawn from the tables presented above:

- Companies in all the regions suffered a decline in profits in 2001 compared to 2000, which worsened in 2002. They began to see a profits recover in 2003.

Companies in all the regions analysed suffered a decline in profits in 2001. Companies outside the EU began to see a recovery in profits in 2003.

- The data for the top R&D investing companies may indicate the presence of a phase gap of one year between the economic cycles of EU vs. US economy; the companies registered in United States were crossing a bad period earlier than EU companies, thus sales were performing worse in 2001 for US firms. The economic cycles affecting Japanese and EU companies seem to be more synchronised.
- Unlike the top 500 companies in the rest of the world, the EU-500 companies did not see a recovery in 2003. Rather, their decline in net sales and R&D investment accelerated. One of the reasons may lie in the negative impact on overseas net sales for the EU companies of the appreciation of the euro.
- R&D investment decisions seem to follow the economic results of companies – changes in net sales and profit rates - with a one year lag, on the average. This is the possible explanation of weak performances in R&D investment for EU and Japanese top R&D-investing companies in 2003, following the economic downturn registered in 2002.

The global picture of R&D/Sales ratio is presented in Table 4.7 and Figure 4.4:

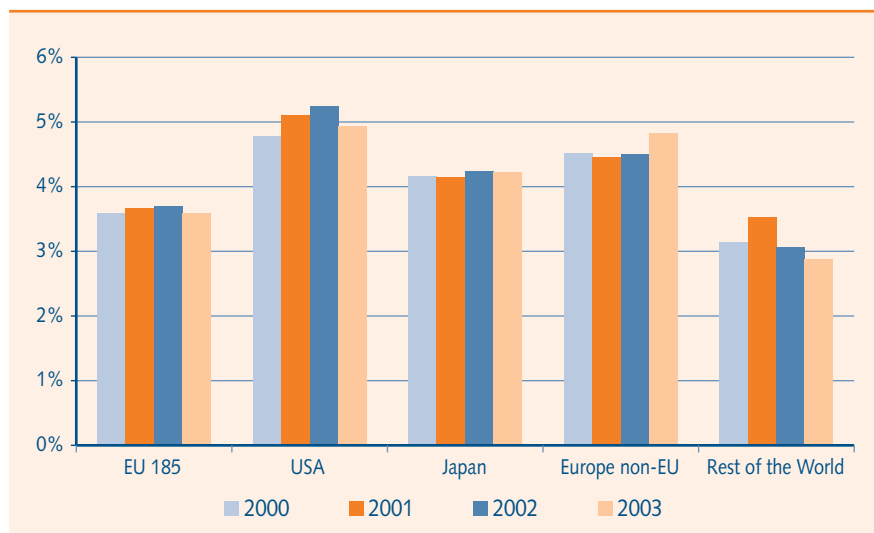
Table 4.7.

The R&D/Sales ratio for EU and non-EU 500 companies investing in R&D worldwide, by major regions, during 2000-2003

REGIONS	2000	2001	2002	2003
EU-500	3.21 %	3.37 %	3.31 %	3.21 %
non-EU 500	4.44 %	4.61 %	4.66 %	4.51 %

Figure 4.4.

The R&D/Sales ratio for *Scoreboard* Top 685 R&D-investing companies worldwide, by major regions, during 2000-2003



The findings from the above table are as follows:

- There was an overall drop in the R&D/Sales ratio in 2003, compared to 2002, for all the major R&D-active companies worldwide (except for companies in Switzerland, the main contributor in the region of Europe non-EU). This is due to the different patterns of growth in R&D investment and in net sales last year, with sales showing a strong recovery.
- The aggregate R&D/Sales ratio of the group of large US companies (4.9 %) and non-EU European companies (4.8 % overall and 6.5 % for Switzerland) was higher than that of the EU companies (3.6 %). Japanese companies had an aggregate R&D/Sales ratio somewhere in between. There are larger variations of this ratio for companies in US and the rest of the world and non-EU Europe, than for companies registered in EU or Japan. This fact may be influenced by changes in exchange rates, as the euro is taken as a base currency for this *Scoreboard*.

There was an overall drop in the R&D/Sales ratio between 2002 and 2003 for all the major R&D-active companies worldwide.

The aggregate R&D/Sales ratio of the group of large US companies and non-EU European companies was higher than that of the EU



Comparative Analysis of EU Top R&D Companies by Member State and by Sector

Section 5

5.a. The R&D investment by location of companies' registered office in EU Member States, 2000-2003

As discussed in the previous section, in 2003 the largest EU companies accounted for 32.5 % of the total R&D investment of the top 685 companies worldwide shown in our combined 2004 top 500 R&D companies on the *Scoreboard*. The time course of the total R&D investment over the period 2000-2003 is shown in table 5.1 (figures represent current prices in millions of euros¹⁷). The same table presents the proportions each Member State contributes to the overall R&D investment by the EU-500 companies, when ordered by the country chosen by the ultimate parent as the location of its registered office, during the same reference period.

Table 5.1.

Shares of groups of companies registered in selected EU Member States in total R&D expenditure of the top 500 EU-based companies investing in research, 2000-2003

EU COMPANIES REGISTERED BY MEMBER STATES IN Top 500	2000	2001	2002	2003
DE – Germany	35.7 %	35.4 %	37.5 %	37.2 %
FR – France	21.6 %	21.0 %	20.5 %	19.4 %
UK – United Kingdom	17.7 %	16.5 %	16.6 %	16.9 %
NL – The Netherlands	6.1 %	7.3 %	7.1 %	6.9 %
SE – Sweden	7.5 %	7.8 %	6.0 %	6.4 %
FI – Finland	4.2 %	4.3 %	4.4 %	4.9 %
IT – Italy	3.6 %	3.5 %	3.5 %	3.9 %
DK – Denmark	1.3 %	1.5 %	1.6 %	1.8 %
BE – Belgium	1.0 %	1.1 %	1.2 %	1.2 %
All other companies	1.2 %	1.7 %	1.7 %	1.5 %
R&D investment of Top 500 € m	100,790	102,207	101,883	91,900

The following conclusions may be drawn from the table above:

- The EU's top 500 R&D-investing companies are based in three of the four largest economies of the EU: Germany, France and United Kingdom. The proportion of German companies (37.2 % in 2003) in total EU R&D investment is approximately equal to the sum represented by both French companies (19.4 % in 2003) and UK companies (16.9 % in 2003) together. From 2000-2003, the proportion of French companies declined continuously, offset by an increase in the share of German companies. The big R&D investors from these three countries (315 companies out of the total 500 in the EU *Scoreboard*, or 63 %) account

The EU's top 500 R&D-investing companies are based in three of the four largest economies of the EU: Germany, France and United Kingdom.

The big R&D investors from these three countries account for 74% of the total R&D investment by the top 500 EU companies. This implies that R&D investment is highly concentrated among companies from these three countries.

¹⁷ Where currency conversion was needed, the end-year 2003 exchange rates against the euro were used for all years referred to in the *Scoreboard*.

Only 16 of today's 25 EU Member States are represented in the EU-500 Industrial R&D Investment Scoreboard.

An increasing number of EU companies at the bottom end of the EU-500 appear to have been increasing their R&D investment more rapidly than the EU's largest R&D investors over the period 2000-2003.

Three main sectors (automobiles & parts, pharmaceuticals & biotechnology and IT hardware) accounted for 53.2% of the total EU-500 R&D investment figure in 2003

for 74 % of the total R&D investment of top 500 EU companies, which implies that R&D investment is highly concentrated in companies from these three countries.

- A second group comprises countries whose companies account for a significant share of the total EU R&D investment by companies in the *Scoreboard's* EU-500: the Netherlands, Sweden, Finland and Italy. The proportions accounted for by the countries range between 6.9 % and 3.9 %. Their overall performance during 2000-2003 shows a mixed picture, with Italian and Finnish companies increasing their share.
- Only 16 of today's 25 EU Member States are represented in the EU-500 group on the *Scoreboard*¹⁸.

R&D investment in the European Union is highly concentrated. The top 20 companies account for more than 55 % of the total by EU-500 companies. However, this share can be seen to have declined over the period 2000-2003, dropping from 57.5 % in 2000 to 55.3 % in 2003. This suggests that an increasing number of EU companies at the bottom end of the EU-500 were increasing their R&D investment more rapidly than the very large EU R&D investors. It could also mean that the top 20 EU companies have started to outsource more of their R&D activities.

As mentioned in the previous section, four sectors account for most of R&D investment worldwide by the top R&D investing companies. Further details will be given in section 7, which discusses the ten sectors with highest shares among the top 685 companies investing in R&D worldwide. The contribution of each of those sectors to the total R&D investment by EU-500 companies investing in R&D and by the location of the offices of these companies is shown in Figure 5.1.

The following comments can be made:

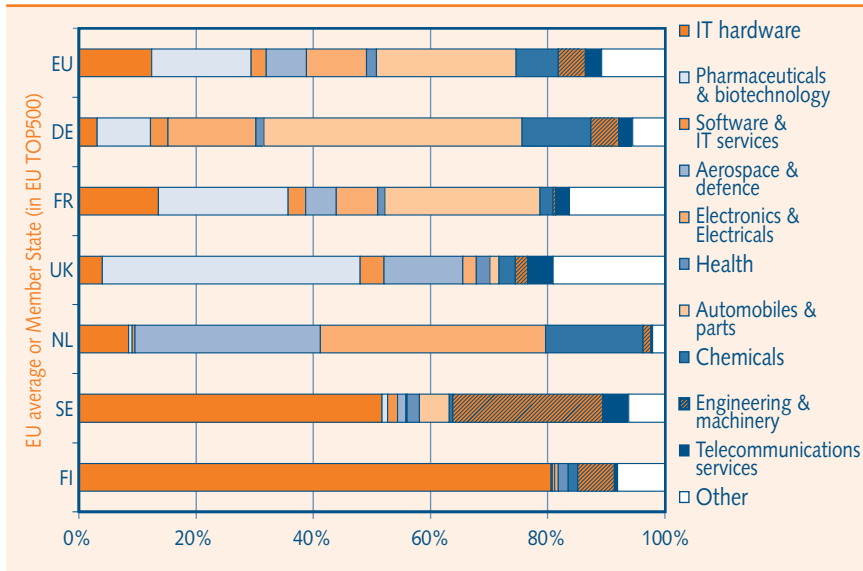
- As mentioned in section 4, three main sectors (automobiles & parts, pharmaceuticals & biotechnology and IT hardware, bearing in mind that companies are grouped according to their stated main business) in terms of their share in total R&D investment of EU-500 companies listed in the *Scoreboard* accounted for 53.2 % of the total R&D investment figure in 2003. Not all these sectors are characterised – worldwide or within the EU – by an intrinsically high R&D investment to net sales ratio.
- The share of the ten main sectors¹⁹ in the total R&D investment by the top 500 EU R&D-investing companies, again in 2003, was 89.3 %, with the remainder of the 21 FTSE sectors represented in the *Scoreboard* accounting for only 10.7 % of the total R&D investment figure.
- With one important exception (namely France), EU companies show at least one pronounced area specialisation in terms of R&D investment when compared to the average for EU companies in the R&D Top

¹⁸ This means that companies with registered offices in the rest of the EU Member States either do not disclose the information on their R&D investment, had R&D investments of less than €8.54million in 2003, or are affiliates or subsidiaries of ultimate parent companies located elsewhere.

¹⁹ Ranked by the weight of the R&D investment of companies who declared their main activity in the respective sector in total R&D investment of the top 685 *Scoreboard* companies.

Figure 5.1.

The shares (%) of major FTSE sectors in total R&D investment of the EU top 500 R&D-investing *Scoreboard* companies, by Member States (in which the companies' ultimate parents have located their registered offices), in 2003.



500 (a share more than twice the EU average). Germany shows a high degree of specialisation in automobiles & parts, which is one of Europe's most important sectors in terms of its R&D investment. Over 80 % of Finland's R&D investment is concentrated in IT hardware. Sweden shows R&D strength and specialisation in IT hardware and its traditional engineering & machinery sector. The Netherlands is an interesting case with three clear areas of specialisation: aerospace, chemicals and electronics & electrical equipment. The United Kingdom has specialised in the pharmaceuticals & biotechnology sector, but is also well above the EU average in aerospace & defence.

- No particular sectoral specialisation emerges in the case of France: The breakdown by sectors of R&D investments by French companies in the top EU-500 R&D investors in 2003 is close to the average pattern for the EU as a whole. However, in most of the ten sectors taken into account for the analysis, French companies are the second most important group of players in R&D investment among the EU-500 companies.

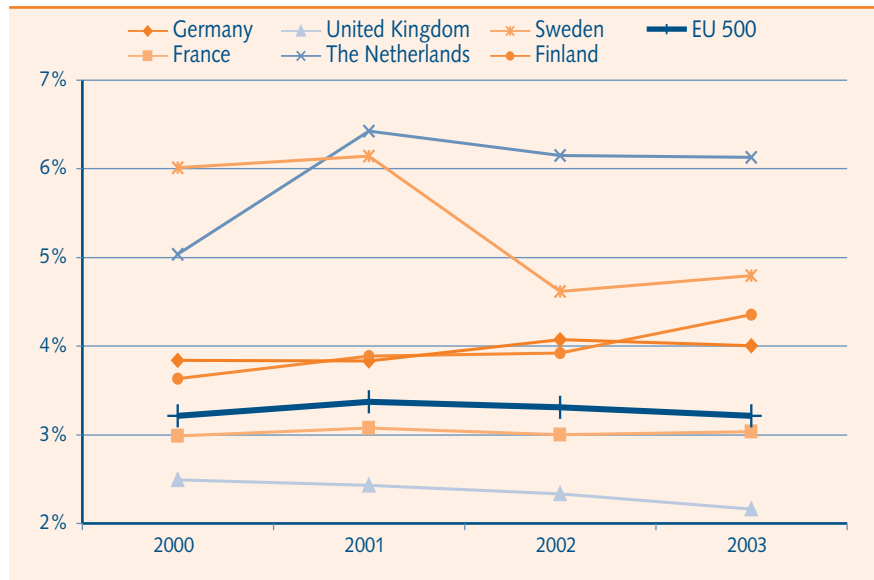
5.b. Analysis of R&D-related ratios²⁰ of EU companies by location of registered office in selected EU Member States

Figure 5.2 shows how the R&D/Sales ratio of the top EU R&D-investing companies (from the *Scoreboard*) whose ultimate parent company was located in the six Member States analysed progressed from 2000-2003. A number of points can be deduced from this figure, which also shows the average R&D/Sales ratio for all the EU companies as a whole:

²⁰ More information on R&D indicators is provided in Annex 1 of this document.

Figure 5.2.

Time course of R&D/Sales ratio for *Scoreboard* EU companies over the period 2000-2003, by country of registration



The aggregate R&D/Sales ratios of the groups of top EU R&D-investing companies by Member State did not change greatly between 2002 and 2003.

There was little difference between countries in terms of the impact of changes in profits on changes in R&D investment.

- Companies with offices registered in two of the EU Member States that are major players on the world markets, as well as on the EU research stage (France and United Kingdom), show overall R&D/Sales ratio below the EU-registered companies' average, with UK companies showing a marked declining trend, which began in 2000 from an already low position²¹. As with all the conclusions of this analysis, this finding is valid only for the available sample of companies included in the *EU 2004 R&D Industrial Scoreboard*, although it may characterise larger groups of EU companies as well.
- Only in the case of two countries from this group of six major EU players have the companies shown R&D investment to net sales ratios that are comparable or higher than those characterising the top US-288 companies reported in the 2004 non-EU R&D group on the *Scoreboard*: Sweden (4.8 % in 2003 and higher than 6 % until 2001 for Swedish companies on the *Scoreboard*) and the Netherlands (above 6 %).²²
- There has been little change in the aggregate R&D/Sales ratios of the groups of top EU R&D-investing companies by Member State in the last year analysed (2003 shows values close to those in 2002, except for UK and Finland).

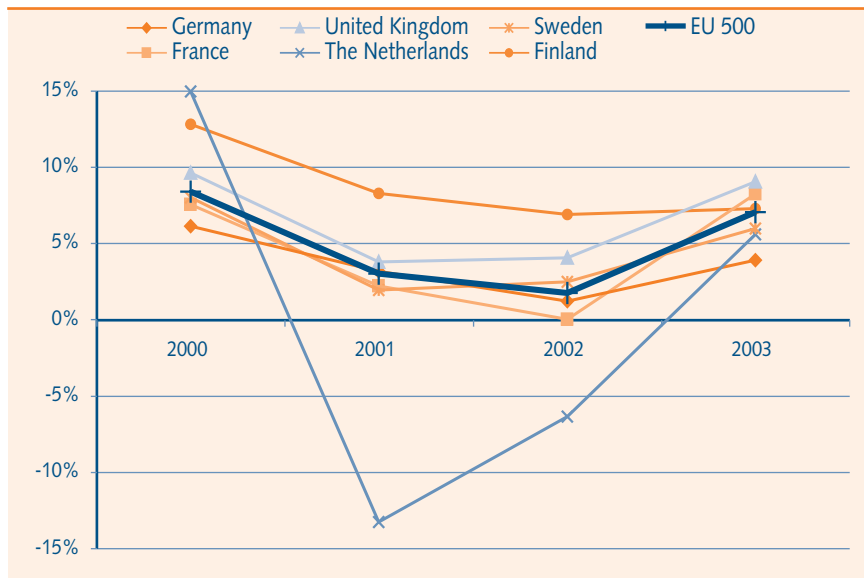
²¹ The UK case will be referred to in more detail in Section 7.

²² The overall picture may improve slightly for the UK and worsen for the Netherlands if we change the assignment of location of headquarter for joint companies such as Shell, a case in which the location of the main headquarters is ambiguous. Companies with high net sales figures operating in low R&D intensive sectors (such as oil & gas, for example) may change the average share of net sales their R&D investment represents quite significantly.

Figure 5.3 shows the evolution, during 2000-2003, of the average profitability (the ratio of gross profits to net sales) of all companies from a given Member States that are among the top 500 investors in R&D in the European Union (reported in the 2004 *Scoreboard*). The conclusions are presented below:

Figure 5.3.

Profitability of *Scoreboard* EU companies, by country in which head quarters are located, 2000-2003



- The change in profitability of the EU-500 companies and in their investment in research (according to the 2004 *Scoreboard*) shows a similar pattern and similar amplitudes for groups of companies registered in one country or another, with the exception of the Dutch-registered companies, whose amplitudes of annual variations are much larger. There has been a decrease in the rate during 2000-2002 and something of a recovery in 2003.
- The overall performance of the EU companies on the *Scoreboard* is dictated by the time course of profit rates among German and French companies, with French companies' profits appearing to be slightly more volatile than average. Finnish companies also show a similar pattern.
- The companies from the other three Member States already began to see a recovery in profits in 2002. This leads us to the conclusion that there is a cyclical phase-gap between EU countries, where the companies registered in more open economies, such as the Netherlands, Sweden or the UK, are influenced by the international economic outlook outside the EU more than companies registered in "core" EU Member States.
- Consequently, a correlation may be observed between changes in profitability and changes in R&D investment among the 2004 R&D *Scoreboard* companies in almost every major EU Member State. From the information available for 2000-2003, R&D investment of *Scoreboard* companies appears to have followed the pattern of growth in profits (Finnish and Dutch companies deviated from this assumption in 2003) with a one-year lag.

A correlation may be observed between changes in profitability and changes in R&D investment among the 2004 R&D *Scoreboard* companies in almost every major EU Member State.

There is no clear relationship between R&D investment and employment among the top EU companies investing in R&D during the period of analysis. In any event, after adjusting the data for the sample of companies and the available employment and R&D investment data, there has been a certain amount of synchronisation – in real, inflation-adjusted terms – of the value of R&D expenditure per employee spent by the main companies with the evolution of their R&D/Sales ratio. However, the annual variations in employment figures for EU companies as a whole are also highly dependent on the local (national) labour environment.

5.c. R&D by Foreign-Owned Companies in the UK

As explained in section 4, foreign-owned companies active in R&D in the EU are not included on the *Scoreboard*. There are two reasons for this: the data is much more difficult to obtain, and it is necessary to avoid double counting²³ when comparing EU with Non-EU economies. Nevertheless, it is of considerable interest to know which foreign-owned or foreign-registered companies carry out R&D (as well as sales and manufacturing) in EU Member States, and to what extent. The key issue for a country wishing to attract foreign-owned companies with significant R&D operations is the quality of the business environment. This includes a wide range of issues such as infrastructure, costs, regulations, skills, taxation, the health of various sectors in the country concerned including supplier networks and any barriers to the growth and operation of businesses.

In 2003, foreign-owned companies accounted for 21% of UK 700 R&D investment, and the largest foreign-owned companies made a major contribution to this total.

For this reason, this section includes a summary of the situation in the UK since for many years it has been a major destination for foreign direct investment in Europe. The data that follow are taken from the 2003 UK R&D Scoreboard of 700 companies. The 2004 data are just becoming available and are referred to where relevant.

In 2003, foreign-owned companies accounted for 21 % of UK 700 R&D investment, an increase on the 18 % recorded in the previous year. The largest foreign-owned companies made a major contribution to this total. For example, the top 5 foreign-owned companies in the UK account for 55 % of the foreign-owned total of R&D investment!

Three of the top five are pharmaceutical companies, a sector where the UK (and indeed Europe as a whole) is strong. However, despite this strong representation of foreign-owned companies in pharmaceuticals & biotechnology, the sectors where foreign-owned companies contribute the largest proportion of R&D tend to be those where the UK is relatively weak in that it has a lower proportion of sector R&D than is found internationally. This proportion would therefore be even lower were it not for the foreign-owned companies.

Preliminary 2004 data suggest that the foreign-owned company percentage of UK 700 R&D has risen a little above the 2003 level.

²³ This double counting would arise because, for example, if the R&D of a US subsidiary performing R&D in the EU were included in the EU figure, it would appear in both in the US total and in the EU total. In addition, it would not be valid to include foreign-owned EU companies in an EU listing which was then compared with US and Japanese companies' totals which do not include foreign-owned companies.

The Top R&D Scoreboard Companies

Section 6

As highlighted in Section 2, the top R&D-active companies account for a major proportion of the R&D investments registered on the *Scoreboard*. For example, the top 25 companies on the *2004 EU R&D Industrial Scoreboard* account for 61 % of total R&D investment and the top 25 companies in the non-EU 500 group on the same *Scoreboard* contribute 42 % of the total. The purpose of this section is to identify the top companies by R&D investment in the sample of EU-500 companies, as well as in the sample of non-EU 500 companies both of which are included on the *2004 Industrial R&D Scoreboard*. We will also address some issues concerning the top companies located in the three largest world economies, the top companies from the *Scoreboard* that are active in the four major sectors (from the R&D investment point of view) and also the top companies by R&D/Sales ratio. These lists not only show which companies have the greatest influence on R&D investment totals for different parts of the *Scoreboard* but also indicate the relative sectoral strengths of the different economies. Finally, some comments on the level of R&D investment concentration among R&D-active companies are offered, based on the *Scoreboard* data.

6.a. The Top Companies by R&D investment, by region and sector

Table 6.1 shows the top 12 companies by R&D investment in both the EU-500 and non-EU 500 Scoreboards, together with their own declared FTSE sector of main activity. The range of R&D investment from the first to the twelfth company in each list is similar (€ 5.6 to 2.4bn for the EU and € 5.9 to 3.1bn for the non-EU). Given that the non-EU 500 group of companies investing in R&D (reported in the *Scoreboard*) has almost twice the total R&D investment of the similar EU-500 group of companies, this similarity in the size of the top 12 companies reflects the very large size of the top European companies (*5 of the global top 12 by R&D investment have their registered office in the European Union*). Of the top 12 EU R&D-active companies, six have offices registered in Germany, two in the UK and one each in Finland, Sweden, France and The Netherlands. For the top 12 R&D-active companies registered in non-EU countries, the US provides seven, Japan four and Switzerland one.

For the purposes of comparison, Table 6.2 lists the top 10 US and top 10 Japanese companies ranked by their 2003 R&D investment. The table also shows, as in the case of Table 6.1 for the EU companies, the declared FTSE sector as being the company's main activity and the ranking the respective companies had in the similar 1994 UK R&D Scoreboard. The R&D range is similar in each economy but with the smaller Japanese economy having somewhat smaller companies in terms of R&D expenditure. The companies in these three lists all come from three groups of sectors, as shown in Table 6.3. The big difference between the three economies is the absence of pharmaceuticals & health companies from the Japanese top 10. The top Japanese companies are much stronger in electronics and IT Hardware but do not include any very large pharmaceutical companies among them. US companies' strength in software & computer services is apparent in the inclusion of IBM and Microsoft in the top 10 - there are no software companies in the EU or Japan top 10s. A European top 10 (including companies registered in non-EU countries of Europe) as opposed to an EU top 10 would include two Swiss pharmaceutical companies at positions 7 & 8; this would raise the number of

Although the non-EU 500 has almost twice the total R&D investment of the EU-500, the top 12 companies in each case are of similar size, highlighting the very large size of the top European companies.

A big difference between the three economies is the absence of pharmaceuticals & health companies from the Japanese top 10.

pharmaceutical companies to five out of a European top 10, emphasising a European specialisation and strength in this sector.

Table 6.1.

The Top EU and Non-EU Companies by R&D Investment

Top 12 EU Companies					
No	Company name	Country of registration	FTSE Sector of declared activity	R&D investment (€ bn)	Rank in 1994 UK R&D Scoreboard
1	Daimler Chrysler	Germany	Automobiles & parts	5.6	1
2	Siemens	Germany	Electronics & Electrical equipment	5.5	2
3	Volkswagen	Germany	Automobiles & parts	4.1	7
4	Nokia	Finland	IT Hardware	4.0	46
5	Glaxo Smith Kline	United Kingdom	Pharmaceuticals & Biotechnology	4.0	11
6	Ericsson	Sweden	IT Hardware	3.2	9
7	Aventis	France	Pharmaceuticals & Biotechnology	2.9	43
8	Astra Zeneca	United Kingdom	Pharmaceuticals & Biotechnology	2.7	19
9	Robert Bosch	Germany	Automobiles & parts	2.7	-*
10	Philips Electronics	Netherlands	Electronics & Electrical equipment	2.6	6
11	BMW	Germany	Automobiles & parts	2.6	-*
12	Bayer	Germany	Chemicals	2.4	-*
Total R&D investment (€ bn)				42.3	

Top 12 non-EU Companies					
No	Company name	Country of registration	FTSE Sector of declared activity	R&D investment (€ bn)	Rank in 1994 UK R&D Scoreboard
1	Ford Motor	United States	Automobiles & parts	5.9	3
2	Pfizer	United States	Pharmaceuticals & Biotechnology	5.7	47
3	Toyota Motor	Japan	Automobiles & parts	4.9	-*
4	General Motors	United States	Automobiles & parts	4.5	1
5	Matsushita Electric	Japan	Pharmaceuticals & Biotechnology	4.3	7
6	IBM	United States	IT Hardware	4.0	6
7	Johnson & Johnson	United States	Pharmaceuticals & Biotechnology	3.7	34
8	Microsoft	United States	IT Hardware	3.7	86
9	Intel	United States	IT Hardware	3.5	48
10	Sony	Japan	Electronics & Electrical equipment	3.3	15
11	Honda Motor	Japan	Automobiles & parts	3.2	17
12	Roche	Switzerland	Pharmaceuticals & Biotechnology	3.1	-*
Total R&D investment (€ bn)				49.8	

-* means no available figure (no disclosure or no financial accounts/reports) for the company (or its predecessor) in the financial year 1993 (1994 UK R&D Scoreboard).

Table 6.2.

The Top 10 Companies by R&D investment with registered offices in Japan and The US, in 2003

Top 10 US Companies				
No	Company name	FTSE Sector of declared activity	R&D investment (€ bn)	Rank in 1994 UK R&D Scoreboard
1	Ford Motor	Automobiles & parts	5.9	2
2	Pfizer	Pharmaceuticals & Biotechnology	5.7	19
3	General Motors	Automobiles & parts	4.5	1
4	IBM	Software & Computer Services	4.0	3
5	Johnson & Johnson	Pharmaceuticals & Biotechnology	3.7	13
6	Microsoft	Software & Computer Services	3.7	86
7	Intel	IT Hardware	3.5	20
8	Motorola	IT Hardware	3.0	8
9	Hewlett-Packard	IT Hardware	2.9	5
10	Merck	Pharmaceuticals & Biotechnology	2.5	14
Total R&D investment (€ bn)			39.4	

Top 10 Japanese Companies				
No	Company name	FTSE Sector of declared activity	R&D investment (€ bn)	Rank in 1994 UK R&D Scoreboard
1	Toyota Motor	Automobiles & parts	4.9	-*
2	Matsushita Electric	Electronics & Electrical equip.	4.3	2
3	Sony	Electronics & Electrical equip.	3.3	7
4	Honda Motor	Automobiles & parts	3.2	8
5	NTT	Telecommunication services	2.9	5
6	Hitachi	IT Hardware	2.8	1
7	Toshiba	IT Hardware	2.5	4
8	Nissan Motor	Automobiles & parts	2.2	-*
9	Fujitsu	IT Hardware	2.1	3
10	Canon	Electronics & Electrical equip.	1.9	13
Total R&D investment (€ bn)			30.1	

Note: The top 10 for North American companies would look the same as the US top 10; the top 10 for Asian companies would have Samsung (Korea) at rank 8, replacing Canon. Note that “-*” here means no data are available for 1994.

Table 6.3.

The Sector Mix of Top 10 Companies by Economy

	US	EU	Japan
Automobile & parts	2	3	3
Electronics & IT*	5	4	6**
Pharmaceuticals & Health	3	3	0

* Electronics & Electrical equipment, IT Hardware, Software & Computer services.

** Among top 10 Japanese companies there is one active in Telecommunication services. If the Electronic & Electrical equipment and IT Hardware sectors were added together, Japan would have 7 companies in the respective row.

The four largest sectors with companies in both the EU-500 and non-EU 500 groups on the 2004 Scoreboard are automobiles & parts, pharmaceuticals & biotechnology, IT hardware and electronics & electrical equipment.

The four largest sectors with companies in both the EU-500 and non-EU 500 groups on the *Scoreboard* are automobiles & parts, pharmaceuticals & biotechnology, IT hardware and electronics & electrical equipment. The top 5 companies in each sector are shown in Table 6.4, for the EU-500 companies and the non-EU 500 companies, respectively. These figures also show the proportion of total R&D investment accounted for by the top 5 companies in each sector. In all four sectors the top 5 companies account for more than 50 % of sector R&D.

Table 6.4.

Top 5 EU and non-EU Companies in the Four Largest R&D Sectors

A. Automobiles & Parts			
EU		Non-EU	
1	Daimler Chrysler (€ 5.6bn)	1	Ford Motor (€ 5.9bn)
2	Volkswagen (€ 4.1bn)	2	Toyota Motor (€ 4.9bn)
3	Robert Bosch (€ 2.7bn)	3	General Motors (€ 4.5bn)
4	BMW (€ 2.6bn)	4	Honda Motor (€ 3.2bn)
5	Peugeot (PSA) (€ 2.1bn)	5	Nissan Motor (€ 2.2bn)
Top 5 as a percentage of total sector R&D = 71 %		Top 5 as a percentage of total sector R&D = 68 %	
B. Pharmaceuticals & Biotechnology			
EU		Non-EU	
1	GlaxoSmithKline (€ 4.0bn)	1	Pfizer (€ 5.7bn)
2	Aventis (€ 2.9bn)	2	Johnson & Johnson (€ 3.7bn)
3	AstraZeneca (€ 2.7bn)	3	Roche (€ 3.1bn)
4	Sanofi-Synthelabo (€ 1.3bn)	4	Novartis (€ 3.0bn)
5	Boehringer Ingelheim (€ 1.2bn)	5	Merck (€ 2.5bn)
Top 5 as a percentage of total sector R&D = 71 %		Top 5 as a percentage of total sector R&D = 49 %	
C. IT Hardware			
EU		Non-EU	
1	Nokia (€ 4.0bn)	1	Intel (€ 3.5bn)
2	Ericsson (€ 3.2bn)	2	Motorola (€ 3.0bn)
3	Alcatel (€ 1.6bn)	3	Hewlett-Packard (€ 2.9bn)
4	Infineon Technologies (€ 1.1bn)	4	Hitachi (€ 2.8bn)
5	ST Microelectronics (€ 0.9bn)	5	Toshiba (€ 2.5bn)
Top 5 as a percentage of total sector R&D = 55 %		Top 5 as a percentage of total sector R&D = 33 %	
D. Electronics & Electrical Equipment			
EU		Non-EU	
1	Siemens (€ 5.5bn)	1	Matsushita Electric (€ 4.3bn)
2	Philips Electronics (€ 2.6bn)	2	Sony (€ 3.3bn)
3	Schneider (€ 0.5bn)	3	Samsung (€ 2.4bn)
4	Alsthom (€ 0.5bn)	4	Canon (€ 1.9bn)
5	Thomson (€ 0.3bn)	5	Sharp (€ 1.1bn)
Top 5 as a percentage of total sector R&D = 89 %		Top 5 as a percentage of total sector R&D = 60 %	

Note: The company R&D investment in 2003 is given in brackets.

The key points from Table 6.4 are:

- The automobile & parts sector is similar in both EU and non-EU lists as far as both the size of the top 5 companies is concerned and the proportion of sector R&D investment accounted for by the top 5 (~70 % in each case).
- The pharmaceutical & biotechnology and IT hardware sectors both show the fifth EU company having less than 50 % of the R&D of the fifth non-EU company. The percentage of sector R&D accounted for by the top 5 companies is smaller for both sectors in the non-EU case because of the larger size of the non-EU sector (*more than twice the R&D investment for pharmaceuticals & biotechnology and more than three times for IT hardware*).
- The largest difference is in electronics & electrical equipment, where Japanese companies (more generally Asian companies) dominate the non-EU list and the EU has only two large companies (*Siemens and Philips*), while the third EU company is less than half the size of the fifth non-EU company. This size difference is also emphasised by the difference in the share of each sector's R&D investment accounted for by the top 5 companies.

Almost twice as many non-EU as EU companies showed large increases in R&D investment during the 2003 financial year.

The differing relative strengths/specialisations of the EU and non-EU economies suggested by Tables 6.3 and 6.4 are discussed in more detail in the following sections.

6.b. R&D Investment Indicators for the Top 2004 R&D Scoreboard Companies

Since large companies contribute a sizeable fraction of the R&D investment included on the *Scoreboard*, it is worth analysing how many of them have increased their R&D investment between one year and the next. The figures for the top 40 R&D-active companies in each regional section of the *Scoreboard* are given in Table 6.5. This shows that almost twice as many non-EU as EU companies showed large increases (of over 5 %) in R&D investment during the 2003 financial year. There were more decreases amongst the EU companies. However, these results should be viewed in the context of the 3-year CAGRs (compound annual growth rate over the 2000-2003 period), which are also shown in Table 6.5 and are more similar between EU and non-EU companies.

Table 6.5.

Changes in R&D investment for Top 40 Companies from 2000-2003

	R&D Investment Change Over Previous Year (%)		
	Increase > 5 %	Increase 0-5 %	Decrease
EU Top 40	11	13	16
Non-EU Top 40	20	10	10
	R&D Compound Annual Change Over Previous Years 2000-2003 (%)		
	Increase > 5 %	Increase 0-5 %	Decrease
EU Top 40	17	11	10
Non-EU Top 40	20	10	10

Note: For 2 of the top 40 EU companies on the *Scoreboard*, CAGR was not available

The only sector in which more EU-500 companies increased R&D investments than decreased them was pharmaceuticals & biotechnology, a sector where EU companies have a strong relative position.

Turning to the top 10 companies in each of the larger R&D intensive sectors as they appear on the 2004 *Scoreboard* (electronic & electrical equipment, IT hardware, pharmaceuticals & biotechnology and software & computer services) there were increases in R&D investment for 14 out of 40 companies (see Table 6.4) for the EU-500 sectors but 29 out of 40 companies for the non-EU 500 sectors.

The only sector where increases outnumbered decreases among the EU-registered companies was pharmaceuticals & biotechnology, a sector where these companies have a strong relative position. Once again, the situation looks different if one looks at companies' performance over the last three or four years: 25 EU-registered companies out of the 39 (top 10 active in each of the four mentioned sectors, one company has no data available for CAGR computation) show a positive CAGR during 2000-2003, as compared to 29 out of 39²⁴ in the case of non-EU-registered companies.

The top companies ranked by R&D/Sales ratio need to be chosen using both this company R&D effort indicator and another criterion. If R&D effort alone were used, the rankings would all be dominated by very small biotechnology or software companies in the early stages of their existence which have significant R&D investment but very small net sales. In this section, the company R&D/Sales ratio is used as the criterion together with membership of the FTSE global 500 set of companies which comprises the largest 500 companies in the world by market capitalisation.

Table 6.6 shows the top 10 EU and non-EU companies by R&D/Sales ratio from the FTSE global 500.

Table 6.6.

Top Companies in FTSE Global 500 by R&D/Sales Ratio

Top 10 EU Companies					Top 10 Non-EU Companies				
No	Company name	R&D/Sales ratio	Country of registration	Rank in 2004 Scoreboard	No	Company name	R&D/Sales ratio	Country of registration	Rank in 2004 Scoreboard
1	Ericsson	24.9	Sweden	6	1	Allergan	43.4	US	65
2	AstraZeneca	18.3	UK	8	2	Broadcom	40.6	US	79
3	Aventis	16.4	France	7	3	Biogen Idec	34.4	US	195
4	Sanofi-Synthelabo	16.4	France	19	4	Maxim Integrated Products	23.6	US	162
5	ST Microelectronics	16.1	France	27	5	Analog Devices	22.0	US	111
6	Novo Nordisk	15.8	Denmark	36	6	Computer Associates	21.6	US	72
7	SAP	14.2	Germany	25	7	Nortel Networks	21.1	Canada	29
8	Nokia	13.5	Finland	4	8	Applied Materials	20.6	US	53
9	BAE Systems	13.1	UK	18	9	Amgen	19.8	US	37
10	GlaxoSmith Kline	13.0	UK	5	10	Gilead Sciences	19.0	US	262
Total R&D investment			€ 22.2bn		Total R&D investment			€ 6.4bn	

24 One company has no data available for CAGR computations.

The EU list is drawn from six EU countries whereas the non-EU list has nine companies from the US and one from Canada.

Both lists are mainly drawn from the companies active in sectors such as pharmaceuticals & biotechnology (5 EU and 4 non-EU companies) and the IT hardware sector (3 EU and 6 non-EU companies) with software & computer services and aerospace & defence also represented in the EU top 10. The other noteworthy feature is that all ten companies in the non-EU list have a higher R&D/Sales ratio than all but one in the EU list. This reflects the higher R&D efforts generally found in growing US companies and will be discussed in more detail in section 8. The US is of course strong in the R&D intensive sectors, such as IT hardware, pharmaceuticals and software & computer services, which have grown fast over the last two decades. The total R&D investment for the ten companies is very different with the EU total being more than three times larger than the non-EU total. This reflects the Financial Times Global 500's role in representing the largest companies by market capitalisation. A number of the US companies have only medium-sized R&D investment and sales but are R&D intensive and fast growing allowing them to command large market capitalisations. It also reflects the fact that while the EU has large companies (i.e. whose head offices are located in EU countries) that are outstanding performers in the R&D arena, it lacks a critical mass of medium-sized fast-growing companies that are strong on research and innovation, at least compared to the situation in the US.

6.c. Analysis of concentration of top companies by major regions and by sector

As mentioned in section 4.a, there is a high degree of concentration among the top companies (as they appear listed in the 2004 *Scoreboard*) investing in research in many of the heavyweight sectors in total world R&D investment, as is highlighted by the share of R&D investment accounted for by the first two companies in four of the ten sectors we selected for analysis. This section describes the analysis of the concentration issue, which compares the situation of EU companies with that of companies based (in terms of the location of the registered offices of their parent company) outside the EU.

The methodology used starts by looking at the shares of selected samples of top companies in the available overall R&D investment figures for the EU and non-EU 500 companies on the *Scoreboard*, and analysing the share of cumulative R&D investment by the top 20, top 50 and top 100 up to top 400 companies in the total R&D investment during the same period by all the companies from the 2004 *Industrial R&D Investment Scoreboard* in any of the main regions, we have obtained a picture (in the form of a statistical distribution) of the overall concentration of investment in research and development activities for the sample of companies as a whole. High proportions (close to one) for the ratio between the total aggregate R&D investment of the top 20 companies, for example, and the investment of all companies, will mean that most of the R&D is accounted for by the 20 biggest R&D investors with the remaining 480 companies being responsible for the rest. Table 6.7 shows these shares for the various samples of companies (the top 20, 50, 100, 200, 300 and 400 companies) comparing companies registered in EU vs. non-EU registered companies. It also shows the changes undergone by these shares during the period of analysis (i.e. 2000 to 2003).

A number of the US companies have only medium-sized R&D investment and sales but are R&D intensive and fast growing, allowing them to command large market capitalisations.

While the EU has large companies that are outstanding performers in the R&D arena, it lacks a critical mass of medium-sized fast-growing companies that are strong on research and innovation.

R&D activity is more concentrated in the EU: the 20 biggest companies in terms of investment account for more than half of the R&D investment by the top 500 EU R&D-active companies.

Table 6.7.

The share of R&D investment of Top “n” companies in overall Top 500 R&D investment in EU vs. non-EU regions, 2000-2003 (%)

	EU companies				non-EU companies			
	2000	2001	2002	2003	2000	2001	2002	2003
Top 20	57.5	57.1	55.5	55.3	37.4	57.1	55.5	55.3
Top 50	76.1	75.3	75.2	75.2	61.2	75.3	75.2	75.2
Top 100	87.3	86.4	85.7	86.2	73.4	86.4	85.7	86.2
Top 200	94.7	94.2	93.9	93.9	85.6	94.2	93.9	93.9
Top 300	97.4	97.1	97.0	97.1	92.2	97.1	97.0	97.1
Top 400	99.0	98.9	98.9	98.9	97.0	98.9	98.9	98.9

There are several findings generated by this analysis:

- The R&D activity is more concentrated in the European Union, as all the equivalent shares are higher in all the years within the time horizon analysed. The concentration is particularly high at the top spectrum, where the 20 biggest EU companies by R&D investment account for more than half of the R&D investment by the 500 EU R&D-active companies (EU-500).
- The rest of the world shows a high degree of concentration as well. The top 50 companies with registered offices outside the EU are responsible for almost 60 % of the total R&D investment by the 500 companies on the *2004 Scoreboard* in the same geographical area. Given the size-difference factor of almost 1 to 2 between EU and non-EU overall R&D investment, the differences in shares are explained by the different number of companies of the same size (in terms of investment in R&D) that are reported in the two samples of companies.
- A declining trend in the concentration levels of EU companies has been documented since the year 2000. This trend is significant particularly among the top companies (top 20 and top 100), despite the ongoing process of mergers and acquisitions, which would act to counter this. This means that more and more companies in the lower part of the EU-500 list were increasing their R&D investment faster than the companies in the upper part of the EU-500 companies. This indicates that the EU economy may enter a phase of development in which growing and emerging companies may add to the in-depth strength of its R&D and innovation activity²⁵.
- There is no similar trend in concentrations observed for non-EU companies in the *Scoreboard* during the same period.

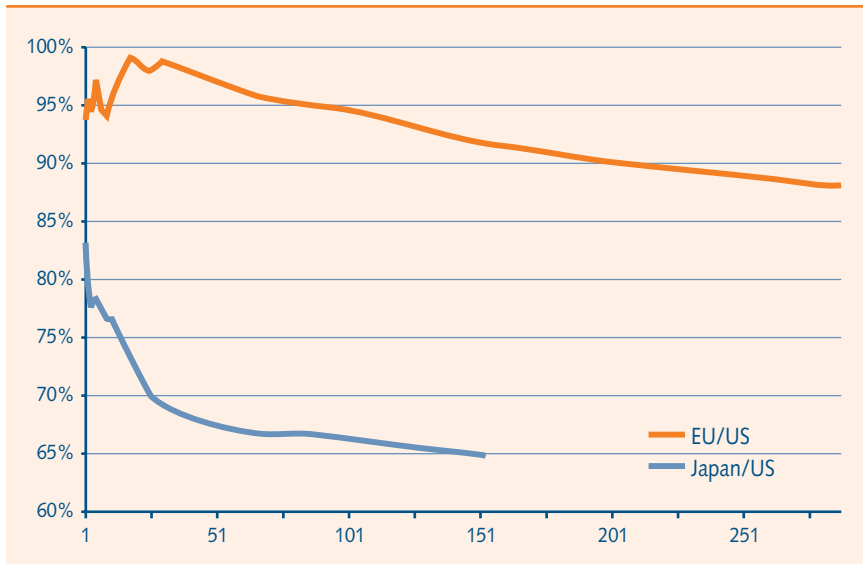
Continuing along the same lines, Figure 6.1 points out the relative “R&D strength” of EU top companies compared to the US and Japanese companies in 2003.

²⁵ It may also mean that top R&D-investing companies started to outsource more of their R&D activities.

A trend towards a reduction in the concentration of R&D in just a few companies in the EU has been apparent since the year 2000.

Figure 6.1.

Ratio of cumulative R&D investment for similar samples of top companies registered in the EU and Japan as compared to US-registered companies, in 2003 (%)



Note: The ratio for top “n” EU companies as compared to top “n” US companies was calculated by dividing the cumulative R&D investment of “n” EU companies by the cumulative R&D investment of the same number of top US companies. The same applies to Japanese companies when compared to US companies. As there are only 153 Japanese companies in the *Scoreboard*, the graph for Japanese companies stops at position 153 on the horizontal axis, while it goes up to 288 for the set of US companies.

The graph above was built by computing the cumulative R&D investment of the top 1 company, then top 2 companies, continuing up to the maximum number of companies available for a given region or country and then calculating the share of each of these sums for all countries in the equivalent (similar) sum for US companies (the sum that proved to have the highest value for all “n”). Therefore, Figure 6.1 has a horizontal axis showing number of companies (maximum 288 available for the US sample, with R&D investment of US companies taken as denominator) and a vertical axis showing the relative ratio between the cumulative R&D investment of the similar number of companies in the three major regions.

The conclusions are as follows:

- For the top 90 companies investing in research, EU companies have almost the same R&D volume of R&D investment as their US counterparts, as the ratio defined above varies between 95 % and 100 %. Japanese companies clearly lag from the outset, and only a small share of top 24 group of companies manage to stay at more than 70 % of the cumulative R&D investment of a similar number of top US companies.
- EU companies are gradually losing ground to their US counterparts. The ratio for US companies reaching 88 % in the case of the top 288 companies (the maximum available for the US companies). A significant number of “smaller” US companies invest strongly in R&D, and more consistently than companies in the EU, thus further bolstering the overall R&D performance of United States. These companies are concentrated in sectors which are intrinsically R&D intensive, which explains the gap in this indicator between the two regions.

Among the top 90 companies investing in research, EU companies have almost the same volume of R&D investment as their US counterparts.

The sector analysis in Section 4 is now extended to all ten sectors covered within the *Scoreboard* analysis, in relation to the concentration issue. Figures 6.2, 6.3 and 6.4 show – for 2003 - the shares of the Top 1, Top 2 and, respectively, Top 5 companies in total R&D investment of all the companies stating their main business to be in the respective sector and which are listed in the top 500 available in the *2004 Industrial R&D Investment Scoreboard*, separately for companies registered in EU and non-EU regions.

Figure 6.2.

Shares of top 1 company in total sector R&D investment of companies listed in *The EU 2004 Industrial R&D Investment Scoreboard* registered in EU vs. non-EU regions – data for 2003 (%)

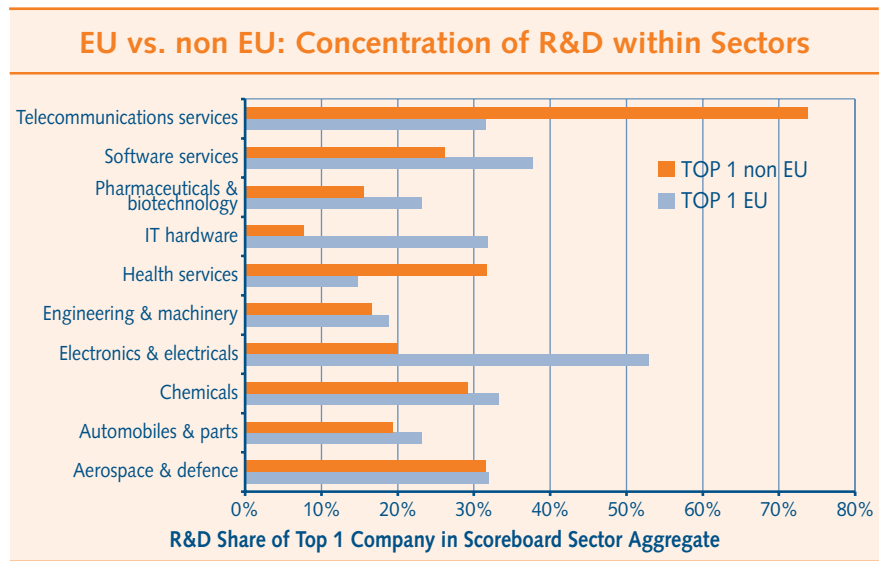


Figure 6.3.

Shares of top 2 companies in total sector R&D investment of companies listed in *The EU 2004 Industrial R&D Investment Scoreboard* registered in EU vs. non-EU regions – data for 2003 (%)

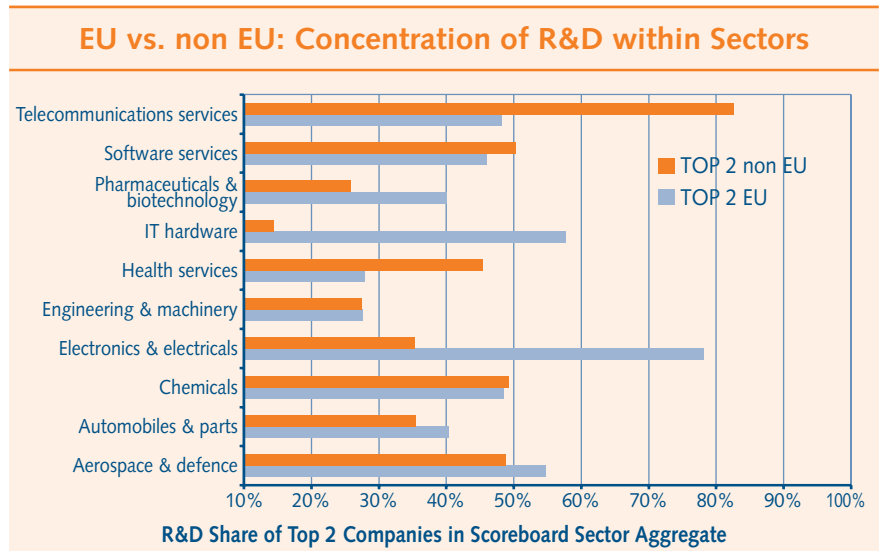
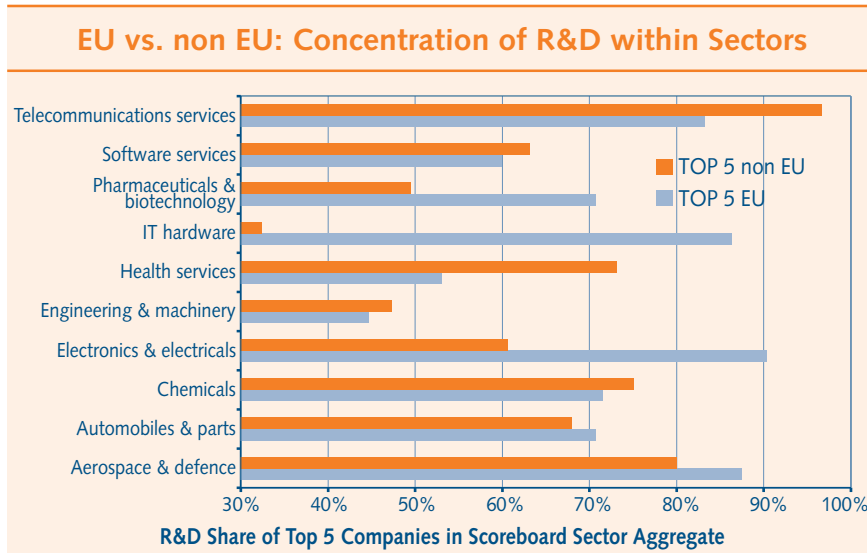


Figure 6.4.

Shares of top 5 companies in total sector R&D investment of companies listed in *The EU 2004 Industrial R&D Investment Scoreboard* registered in EU vs. non-EU regions – data for 2003 (%)



The comments on the above figures apply strictly to the set of companies that are included in the *2004 Industrial R&D Investment Scoreboard* and may be summarised as follows:

- The shares calculated for both EU-based and non-EU-based companies in sectors such as aerospace & defence, automobiles & parts, chemicals and engineering & machinery are similar. These so-called “traditional” sectors are ones in which EU companies account for a large share of worldwide sectoral R&D investment and a higher R&D/Sales ratio (as will be discussed in section 7) than their direct major competitors from outside the EU. This implies the relative strength of EU companies in these traditional sectors in terms of R&D investment.
- The degree of concentration among EU companies is much higher than average among in sectors such as IT hardware, electronics & electrical equipment or pharmaceuticals & biotechnology. These are sectors with high to very high R&D/Sales ratios and which have higher shares in overall R&D investment among non-EU companies than among EU ones. This finding is in line with the fact that regions with a lower degree of concentration in a given sector are usually characterised by the presence of numerous medium-sized companies investing in research and development which thus ensure the strength of the economy in the respective sector of activity.
- The degree of concentration among EU companies is lower than among non-EU companies in sectors such as telecommunications services or health, but the reasons may differ in each of the two cases. In telecommunications services, the presence of a major Japanese company in the area of research investment is increasing the share a small number of top companies account for in the overall R&D investment by all the companies declared as active in this sector (out of the companies listed in the *Scoreboard*). In the case of health, the main reason lies in the

The degree of concentration among EU companies is much higher than average in sectors such as IT hardware, electronics & electrical equipment or pharmaceuticals & biotechnology. In telecommunications and health, the degree of concentration among EU companies is lower than among non-EU companies.

lack of major R&D investors among EU companies operating in this sector, which is only the 11th sector in the ranking of sectors of EU-500 companies by R&D investment.

- In the EU there is only one sector (engineering & machinery) in which the share of the top 5 companies in total R&D investment of companies represented in *Scoreboard's* top 500 in the respective sector is less than 50 %. In the case of non-EU companies there are three sectors (engineering & machinery, IT hardware and pharmaceuticals) in which this is so. This means that the overall degree of concentration is not only high at the global economy level, but also in the case of each sector taken separately, among the top groups of 500 companies investing in R&D.

The Sector Mix for Top Companies Investing in R&D

Section 7

7.a. The Top Ten Sectors Worldwide by Weight of their Business R&D Expenditures

Section 4 discussed how companies whose registered offices are located in each of the three major economies analysed have different R&D-related strengths according to the sectors of activity and that the different sector mixes are in general responsible for a substantial part of the overall R&D intensity differences between economies and their representative companies. The purpose of this section is to examine the effect of the sector mix on the R&D/Sales ratio in much more detail. This is particularly important since there is much discussion at present of differences in R&D intensity between countries and regional economies and it is relevant to understand how much of the overall R&D intensity difference in each case is caused by the sector mix and how much by differences in R&D intensity between similar sectors or by differences between companies in terms of their R&D/Sales ratio. Consequently, a first step in the analysis is to focus on the breakdown of companies by their declared main sector of activity, particularly those sectors in which R&D investment is concentrated around the group of top world companies included in the *2004 Industrial R&D Investment Scoreboard*. The top 10 sectors are ordered by their weight in the total R&D investment of top EU and non-EU *Scoreboard* companies.

The procedure for ordering the sectors considers the weight of each sector in the total R&D expenditure by a number of 685 companies. This number of companies is the sum of top 500 companies in non-EU countries and top 185 companies in EU countries, which are shown in the two groups of companies on the *Scoreboard* to have reported R&D investment in 2003 higher than the threshold of € 51.38 million²⁶.

The starting point for this discussion of R&D /Sales ratio is Table 7.1 which shows the above mentioned shares of the economic sectors with most weight in *Scoreboard's* worldwide R&D investment, the current value of those investments by sector of declared main activity in 2003, the number of companies investing in R&D which are present in the Top 685 by sector and the average R&D investment per company by sector. The main findings from this sectoral view are:

- Three sectors alone account (with almost similar weights) for 56.5 % of the global R&D investment by the top 685 companies investing in research (listed in the *Scoreboard*), in 2003: IT hardware, automobiles & parts and pharmaceuticals & biotechnology.
- The average R&D investment per company varies widely from sector to sector (however, this finding refers only to the top R&D-investing companies). Average R&D investment per company in the automobiles & parts sector among the companies listed on the *Scoreboard* (more

Three sectors alone– IT hardware, automobiles & parts and pharmaceuticals & biotechnology – account for 56.5% of the global R&D investment by the worldwide top 685 companies investing in research.

²⁶ For comparability reasons, worldwide, we have chosen the threshold of €51.38 million as the smallest available for non-EU companies listed in our 2004 *Scoreboard* database. Presumably, the 685 companies selected are the full sample of companies that were spending in R&D, worldwide, more than €51.38 million equivalent in 2003 (financial year) and fulfil the criteria of *Scoreboard's* selection process.

than € 1 billion per year investment in R&D per company) is six and a half times that in the engineering & machinery sector (€ 156 million).

Table 7.1.

The Largest 10 Sectors in Aggregate R&D Investment of top 685 companies listed in the 2004 Industrial R&D Investment Scoreboard (data for 2003)

Rank	Sectors	Aggregate world R&D investment (€ m)	Sector's share (%)	Number of companies	R&D Investment per company
1	IT hardware	56893	19.6	122	466.3
2	Automobiles & parts	54483	18.8	51	1068.3
3	Pharmaceuticals & biotechnology	52404	18.1	84	623.9
4	Electronics & electrical equipment	31237	10.8	50	624.7
5	Software & computer services	17276	6.0	56	308.5
6	Chemicals	15033	5.2	62	242.5
7	Aerospace & defence	10862	3.7	19	571.7
8	Engineering & machinery	8601	3.0	55	156.4
9	Telecommunication services	6677	2.3	16	417.3
10	Health	5880	2.0	27	217.8
Total 10 Sectors		259347	89.5	542	478.5
TOTAL 685 companies		289654	100,0	685	421.6

Note: The worldwide R&D investment (in millions of euros) in each sector is the R&D investment by the top 685 companies (disaggregated by sectors). 685 companies were considered, with more than 51.38 million euro equivalent R&D investment, of which 542 were in the main 10 sectors in terms of their weight in the total R&D investment of the top companies. The sector's share is the share the R&D investment of the companies acting in the respective sector has in total R&D investment of the 685 companies. The number of companies represents how many companies out of the 685 are reporting their main activity in the respective sector. R&D Investment/Company is the average R&D investment per company for all companies that state their main business to be in the sector in question.

The non-EU 500 group of Scoreboard companies has much larger shares of IT hardware (nearly double) and of software & computer services (three times as much) than the EU-500.

Table 7.2 shows a comparison between the EU-500 companies and the non-EU 500 companies on the 2004 *Scoreboard*, from the point of view of the sector's shares in total R&D investment of the top 500 companies and of the R&D/Sales ratio. The big differences between the EU-500 group of companies and the non-EU 500 are as follows:

- The non-EU 500 group of *Scoreboard* companies has much larger proportions of IT hardware (almost twice as much) and of software & computer services (three times as much) than the EU-500 group of companies
- The EU-500 group of companies has larger a larger share of R&D investment in the automobiles & parts sector (50 % more, of aerospace & defence (three times as much) and of engineering & machinery and chemicals (75 % more) than the non EU-500 group of companies.

The non-EU 500 group of companies is, of course, mainly a combination of companies with registered offices in the US and Japan so it conceals big differences between these two economies, for example in software & computer services where the US companies have almost 50 times as much R&D investment as Japanese companies. However, what is clear from the

summary of key differences above is that the companies included in the R&D Scoreboard's EU-500 are likely to have a lower aggregate R&D/Sales ratio than the non-EU 500 group of companies, since they show relative strengths in medium R&D-intensive sectors such as automobiles & parts and engineering & machinery and relative weakness in highly R&D-intensive sectors such as IT hardware and software & computer services.

Table 7.2.

The Largest Sectors among Companies listed in the EU-500 and Non-EU 500 groups on the Scoreboard (data for 2003)

FTSE Sector	EU Top 500		Non-EU Top 500	
	Sector R&D Investment as a percentage of all sectors	R&D/Sales ratio (%)	% of non-EU 500 R&D Investment	R&D/Sales ratio (%)
Automobiles & parts	23.8	4.6	(3) [†] 15.7	4.1
Pharmaceuticals & biotechnology	17.0	15.2	(2) 18.5	15.1
IT Hardware	12.4	15.6	(1) 22.9	8.6
Electronic & Electrical equipment	10.3	6.5	(4) 10.9	5.7
Chemicals	7.2	4.2	(6) 4.2	3.8
Aerospace & Defence	6.8	8.0	(10) 2.1	2.7
Engineering & machinery	4.6	2.5	(7) 2.5	2.8
Telecommunication services	2.8	1.0	(11) 2.0	2.5
Software & Computer services	2.6	12.8	(5) 7.8	10.0
Oil & Gas	1.9	0.3	(14) 1.2	0.5
Health	(11) 1.7*	5.1	(9) 2.2	8.4
Diversified industrials	(13) 1.1*	3.3	(8) 2.4	2.3

* Not in the EU-500 top 10 sectors but are in the non-EU 500 top 10; in brackets their ranking in the EU-500.

[†] The numbers in brackets are the order of sector size for the non-EU 500

This analysis is taken further by combining sectors into five groups, each group containing a set of sectors with similar R&D/Sales ratios. These are:

- **Group 1** - Pharmaceuticals & biotechnology and health, which are closely related and also two of the five highest R&D intensive sectors in Table 7.2.
- **Group 2** - Electronics & IT (electronics & electrical equipment, IT hardware, software & computer services) which are related sectors and the other three top 5 R&D-intensive sectors in Table 7.2.
- **Group 3** - Engineering & chemicals (automobiles & parts, aerospace & defence, engineering & machinery, chemicals and related sectors with medium R&D/Sales ratio of companies above 2.5 % but below 5 %)

The EU-500 are likely to have a lower aggregate R&D/Sales ratio than the non-EU 500 group of companies, since they show relative strengths in medium R&D-intensive sectors such as automobiles & parts and engineering & machinery, and relative weakness in highly R&D-intensive sectors such as IT hardware and software & computer services.

- **Group 4** - Lower intensity sectors with an R&D/Sales ratio of 1 % to 2.5 % (examples being food producers, construction, steel & metals).
- **Group 5** - Very low intensity sectors with an R&D/Sales ratios generally below 1 % (examples are electricity, oil & gas, food retailers).

The sectors have been assigned to groups by range of R&D/Sales ratio on the basis of global R&D/Sales ratios. These five groups are then used to analyse the companies registered in the three major economies using the EU-185, US-288 and Japan-153 sets of companies which have the same R&D investment size range. The aim of the analysis is to identify the proportions of R&D investment in each of the three groups and the individual group R&D/Sales ratio and hence to explain the reasons for the difference in overall R&D/Sales ratio between specific groups of companies from different regions of the world (major economies).

7.b. Sector Group Analysis for the EU, Japan, and the US

Using the 2004 *Scoreboard* data, the proportions of R&D investment of the EU-185, Japan-153 and US-288 groups of companies in each of the five sector groups are shown in Table 7.3 together with the R&D/Sales ratio for each group (*group's R&D as percentage of group's net sales*). There are a series of substantial differences between the sectoral structures of R&D investment for companies with registered offices in the main three world economies as follows:

Table 7.3.

Proportions of total R&D Investment and R&D/Sales Ratios [†] in the five Sector Groups of *Scoreboard* Companies registered in the EU, Japan and the US (in 2003)

Proportions of Total R&D Investment in Each Group					
Economy	Group 1 Pharmaceuticals & biotechnology and Health	Group 2 Electronics & Electrical and IT Hardware	Group 3 Engineering & Chemicals	Group 4 Lower R&D/ Sales ratio Sectors	Group 5 Very Low R&D/Sales ratio
EU-185 (I _T = 3.6 %)	18.8 % (12.9 %)†	25.3 % (10.0 %)	46.9 % (4.5 %)	5.4 % (1.1 %)	3.6 % (0.4 %)
Japan-153 (I _T = 4.2 %)	8.1 % (13.2 %)	43.3 % (5.8 %)	37.9 % (4.2 %)	8.3 % (2.2 %)	2.4 % (0.8 %)
US-288 (I _T = 4.9 %)	25.8 % (13.9 %)	42.3 % (10.1 %)	28.1 % (3.1 %)	1.5 % (2.0 %)	2.3 % (0.5 %)

[†] The R&D/Sales ratio for each group are shown in brackets

- The US companies included in the 2004 *R&D Scoreboard* have over two-thirds (68.1 %) of their R&D investment allocated to the highly R&D-intensive groups 1 and 2. There is a very small proportion of US companies in low R&D/Sales ratio groups 4 and 5 (under 4 %) and 28 % in the medium R&D/Sales ratio group 3 – substantially less than the equivalent proportion of EU and Japanese companies. It is thus the

high proportions in groups 1 and 2 that give the top US companies (listed in the *R&D Scoreboard*) the high overall R&D/Sales ratio of 4.9 %, aided by the very low proportions in groups 4 and 5.

- Japanese companies concentrate over half (51.4 %) of their overall R&D investment in groups 1 and 2 with nearly 11 % in groups 4 and 5 and 38 % in the medium intensity group 3. They have a substantially higher R&D/Sales ratio than the US companies in sector-group 3 (4.2 % vs. 3.1 %) but this is more than offset by the much lower share than the US companies in group 2 (5.8 % vs. 10.1 %). The reason for Japan's low group 2 R&D/Sales ratio is its large proportion of electronics & electrical equipment R&D investment in sector-group 2 compared to the US companies' large presence in IT hardware and software & computer services, which both have higher R&D/Sales ratios. The overall effect is to give Japanese companies an R&D/Sales ratio mid-way between those of EU and US companies.
- The EU-185 group of top companies investing in research has the lowest proportion of R&D investment in groups 1 and 2 (44.1 %) but the highest proportion²⁷ in group 3 (47 %, well above Japan with 38 % and the US with 28 %). The EU also has a similar proportion of R&D investment in sector-groups 4 and 5 to Japan. One reason for the EU companies' low overall R&D/Sales ratio is its small proportion of R&D investment in groups 1 and 2 (particularly group 2), which is not compensated for by its higher proportion (and R&D/Sales ratio) in group 3²⁷. Another more subtle factor is the significant proportion of R&D investment for EU companies that stated their main activity to be in sector-group 5. This is due to the large oil & gas sales which also help depress the overall R&D/Sales ratio.

The above discussion concentrates on the relative strengths of the three economies. The relative weaknesses are also apparent from Table 7.3.

These are principally:

- The lower than average R&D/Sales ratio for the US companies in group 3 (all engineering & machinery and chemicals).
- The very low proportion of R&D investment in group 1 for Japanese companies (one third of the figure for US companies) together with the low proportion of their group 2 in the higher intensity sectors of software & computer services and IT hardware.
- The low proportion of R&D investment in group 2 for the EU-registered companies (less than 60 % of that for the US or Japanese companies).

Another way of illustrating the effects of the five groups on the overall R&D/Sales ratio is to calculate these shares using only some of the groups and comparing these between subsets of companies registered in one economy or another. This is done in Table 7.4 where the notation used is as follows:

²⁷ It is significant that capital expenditure intensity of the EU-185 group of companies is higher than that for the non-EU 500 group of companies for most of the group 3 sectors (i.e. automobiles & parts, aerospace & defence, chemicals and engineering & machinery).

The EU-185 group of top companies investing in research has the lowest proportion – when compared to top Japanese and US companies – of R&D investment in pharmaceuticals, biotechnology & health sector and in the electronics & electrical and IT hardware sector but the highest proportion in the engineering and chemicals sector.

The US companies in the sample enjoy the potential advantage that they have the R&D skills needed that are most likely to be important for the new, cross-disciplinary sectors and sub-sectors that are expected to emerge in the future.

I_{12} = R&D/Sales ratio calculated for groups 1 & 2 only.

I_{123} = R&D/Sales ratio calculated for groups 1, 2 & 3 only.

I_T = R&D/Sales ratio calculated using all 5 groups.

It can be seen from Table 7.4 that Japanese companies on the *Scoreboard* have a low I_{12} (because they have a large electronic & electrical equipment sector compared to software & computer services and IT hardware and a weakly represented sector-group 1) compared to the US- and EU companies. When the R&D/Sales ratios I_{123} are compared, the Japanese companies' figure moves much closer to the values calculated for the US and the EU. The final step to I_T leaves the US companies with the highest R&D effort since groups 4 and 5 are relatively much smaller. The EU companies drop below Japanese ones because of their larger presence in groups 4 and 5, where they have lower aggregate R&D/Sales ratios.

Table 7.4.

R&D/Sales Ratio for Clusters of Groups of Companies registered in the Major Economies, in 2003

Economy	I_{ijk} = R&D/Sales Ratio for Groups i & j & k Only		
	I_{12}	I_{123}	I_T
EU-185	11.1 %	6.2 %	3.6 %
Japan-153	6.4 %	5.2 %	4.2 %
US-288	11.2 %	6.4 %	4.9 %

From this analysis, it can be seen that in R&D/Sales ratio terms, the US-registered companies in the 2004 *R&D Scoreboard* benefit in two ways from their dominant position in groups 1 and 2. These two groups firstly have very high R&D/Sales ratios of themselves but, secondly, their large combined size in the US group of companies reduces the 'diluting' effects of groups 4 and 5 on the overall R&D effort. Groups 4 and 5 contain sectors where capital expenditure tends to be larger and more important than R&D investment, so it is not surprising that they have low R&D/Sales ratios. The US companies enjoy other potential advantages in that the skills needed for R&D activity in groups 1 and 2 are most likely to be important for the new, cross-disciplinary sectors and sub-sectors that are expected to emerge in the future.

7.c. Implications of the Analysis

An important implication of this analysis is that the overall R&D/Sales ratio for a group of companies registered in a particular country or region appears to be a simple single-figure measure but is, in fact, related to the sector mix and sector R&D/Sales ratio in a complex way. The sector group analysis of this section helps explain the way in which five very different groups of sectors contribute to the overall intensity.

It is important to focus on the total volume of R&D investment in each sector group as well as on companies' aggregate R&D/Sales ratios and to be aware of the balance between the different sector groups. Policy-makers can use this analysis to identify priority areas in which the local business environment could be improved. However, it is company R&D investment that leads to new products, processes and services and this of course does not apply only

to those companies listed in this *Scoreboard*. The future competitiveness of an economy will also depend on how many smaller companies can grow successfully to become leading global competitors in their sub-sectors and niches. This is influenced by the quality of the business environment in the countries concerned. A review of global R&D scoreboards²⁸ over the last 15 years shows just how much change can occur in one or two decades with some apparently well established companies disappearing and others growing to dominate newer sectors and take their place amongst the top 30 or so companies.

The future competitiveness of an economy will also depend on how many smaller companies can grow to become leading global competitors in their sub-sectors and niches.

28 As can be demonstrated using the UK DTI R&D Scoreboards.



Comparison of Top EU and US R&D-Investing Companies

Section 8

The top 500 R&D-active companies on the 2004 *EU Industrial R&D Investment Scoreboard* includes only 185 companies in the same size range as the 288 US companies in the non-EU 500. Therefore, to carry out a more detailed comparison of a much broader range of companies in the two economies, the EU-500 group on the *Scoreboard* has been compared to the *US-1000 Scoreboard*²⁹. However, the US 1000 contains US companies with R&D investment down to \$1m and sales above \$100m. A comparison is therefore made between the 725 companies in the US-1000 *Scoreboard* with R&D above € 8.5m (\$10.7m at the 2003 exchange rate used for this analysis) and the 432 companies within the *EU-500 Scoreboard* with sales above € 79m (\$100m). This provides two comparable sets of companies in terms of the magnitude of both R&D investment and net sales. It would not be meaningful to make a comparison without this correction since R&D-active companies with very different ranges of R&D investment and sales tend to have very different average R&D/Sales ratio³⁰.

Given that the group of companies in the *EU-500 Scoreboard* contains some very large companies and that (see Section 2) the top 25 companies account for over 60 % of the overall R&D investment, a comparison of R&D investment totals or of the R&D/Sales ratio would always be dominated by the largest companies. An alternative approach is therefore used to highlight the differences between companies across the full sample of EU and US companies. This involves two steps:

- A comparison of R&D/Sales ratio distributions to see if there are differences between the proportions of companies in bands of low, medium and high R&D effort
- An examination of the sectors which are responsible for any large differences between the two groups.

A detailed analysis of these two aspects is outlined in the next two subsections.

8.a. Distributions of R&D/Sales ratios of EU and US Companies

The groups of EU and US companies meeting the same criteria (R&D investment over € 8.5m, sales over € 79m), are divided into six R&D/Sales ratio bands³¹ ranging from 0-2 % to over 20 %. Table 8.1 shows the percentages of companies in each group that fall into each of the six intensity bands. There are big differences between the two groups of companies. In the lowest intensity band the EU companies had almost twice the proportion of companies as the US (35 % EU vs. US 18 %) in 2003 but

A group of EU-based companies on the Scoreboard was compared with a somewhat larger group of US-based companies of comparable size from the US-1000 Scoreboard.

Significant differences were found between the two groups. The EU group had almost twice as many companies in the lowest R&D-investment intensity range.

29 U.S. Industrial R&D Scoreboard 2003, Industrial Research Institute, December 2003.

30 On the other hand, the initial exclusion of companies with less than \$100 million net sales from the US Scoreboard introduces a distortion in the statistical characteristics of the US sample of companies from the very beginning. By selecting similar-sized companies, we are improving the quality of comparison of specific groups of companies, but we lose accuracy in the comparisons with a similar number of companies in the two different available sets of companies, in addition to reducing the amount of information.

31 An R&D/Sales ratio band between 10% and 20% means that the R&D/Sales ratio of the companies will be in the range of 10% to 20%.

A major difference between the EU and US groups of companies is in IT hardware and electronics & electrical equipment, where the proportion of US companies is twice as large as the proportion of EU companies, and in software & computer services where the proportion of US companies is almost four times as large.

the US companies had more than twice the proportion of companies in the top two intensity bands for the same year (43 % with R&D/Sales ratios over 10 % compared to 17 % for the EU). The differences in the middle three bands are much smaller and the number of EU companies with R&D/Sales ratios within those ranges accounted for 48 % of total compared to 39 % for the US companies.

Table 8.1.

The breakdown by R&D/Sales ratio band in 2004 of R&D-active companies registered in the EU and the US

	% of companies in each R&D/Sales ratio band					
	0-2 %	2-4 %	4-6 %	6-10 %	10-20 %	>20 %
EU-500 Subset	35 %	19 %	14 %	15 %	13 %	4 %
US-1000 Subset	18 %	14 %	12 %	13 %	26 %	17 %

Note: The percentages are rounded so they sum to 100 %.

The breakdown by R&D/Sales ratio band for the top 40 companies registered in both the EU and US are shown in Table 8.2. If this is compared with Table 8.1, it can be seen that the differences between companies located in the EU vs. the US are much smaller in Table 8.2. Indeed the distributions in Table 8.2 would be almost exactly the same if a group of 15 EU-registered companies were moved from the 6-10 % band to the two highest bands. This confirms that the big differences seen in Table 8.1 are primarily related to companies ranked below the top 40 within the 2004 R&D Scoreboard. In the next sub-section, the sectorial split of the companies with high R&D/Sales ratio is identified.

Table 8.2.

The breakdown by R&D/Sales ratio band for top 40 EU and US R&D-active companies registered in the EU and the US

	% of companies in each R&D/Sales ratio band					
	0-2 %	2-4 %	4-6 %	6-10 %	10-20 %	>20 %
EU Top 40	5	12	20	25	35	3
US Top 40	5	17	18	7	45	8

8.b. Sector Mix of EU and US High R&D/Sales Ratio Companies

The difference between the EU and US companies in Table 8.1 is large. The proportion of companies having a R&D/Sales ratio over 10 % is 17 % in the EU group and 43 % of the US group. In Table 8.3, all the companies with an R&D/Sales ratio over 10 % are assigned to one of four groups. The first three are groups of related highly intensive R&D sectors – IT hardware with electronics & electrical equipment, software & computer services and finally pharmaceuticals & biotechnology with health. The fourth group is an 'others' category which contains all other sectors.

The message from Table 8.3 is clear – the major difference between the EU and US groups of companies is in IT hardware and electronics & electrical equipment, where the proportion of companies registered in US is over twice

as large as the proportion of EU companies and in software & computer services where the proportion of companies registered in US is almost four times as large. These three FTSE sectors alone account for almost three-quarters of the overall difference between the companies registered in the EU vs. those in the US (from the *Scoreboard*) for the two highest intensity bands in Table 8.1.

The conclusion is that the companies registered in the US show 'strength in depth' in the sectors showing large percentages in Table 8.3 with a wide range of companies of different sizes all contributing to the 43 % of companies with R&D/Sales ratio above 10 %.

The companies registered in the US show 'strength in depth' in key sector groups, with 43% of companies with R&D/Sales ratio above 10%

Table 8.3.

Presence of *Scoreboard* Companies registered in the EU vs. the US in R&D Intensive Sector Groups

Sector Group	Percentage of EU-500 Subset with R&D/Sales Ratio above 10 %	Percentage of US-1000 Subset with R&D/Sales Ratio above 10 %
IT Hardware and Electronics & Electrical Equipment	7 %	15 %
Software & Computer Services	4 %	15 %
Pharmaceuticals & Biotechnology and Health	4 %	5 %
Other Sectors	2 %	8 %
Totals	17 %	43 %

Companies registered in 11 EU countries make up the group with R&D/Sales ratio over 10 %. The UK, French and German-registered companies together contribute over 72 % of these R&D intensive companies with nearly 40 % of the total companies that are registered in the UK. It is important for EU policy-makers to ensure that the business environment for developing and growing companies in R&D intensive sectors such as those of Table 8.3 is at least as good as that in competitor economies.



R&D Investment and Business Performance

Section 9

9.a. Links between R&D and Company Performance

There have been many studies of companies that have shown sustained success over many years and each study identifies several factors contributing to success. These success factors usually include innovation (leading to the development of new products and services) and a range of other ingredients such as strategy and leadership, culture and people, efficiency and customer care. For R&D-active companies, these factors can be grouped under the three headings of strategy; operations; and investment in the future. R&D for new products and services is a key aspect of the third category but a successful company also needs to excel in the first two categories. The three categories can be summarised³² as follows:

- **Good strategic choices.** This means that a company carefully selects the sub-sector(s) it will lead in and the growth route (organic growth, acquisitions or a mix of organic growth and smaller acquisitions).
- **Operational excellence.** This involves lean production, efficient business processes and good customer care (quality, on-time delivery and service).
- Wise and balanced **investment in the future** such as in R&D investment, capital expenditure, brands and the development of markets, skills and people.

This implies that a company can have excellent R&D which develops new products, processes and services of high potential but may still not enjoy business success. This could be because of limitations in strategy (such as poorly chosen acquisitions), in operations or in market development or the launch of new products. However, the converse is also true – a company that under-invests in R&D relative to its best competitors will find that its range of products and services become less competitive and it is then difficult for it to maintain business performance. Examples may be found in more mature sectors where one company's product range may become more biased towards the commodity rather than value added part of the sector market than that of its major competitors. In R&D-intensive sectors such as pharmaceuticals, if a company's successful drugs come off patent faster than they are replaced by new patented medicines, then its business performance is likely to fall behind that of its competitors since products previously protected by patents will be competing against generic medicines.

Previous work in both Europe and the US on the links between R&D investment (and similar investments) and company performance has identified several statistically significant links such as:

- Higher R&D/Sales ratio is linked to higher sales growth³³

Companies' success depends on good strategic choices, operational excellence and investment in the future, of which R&D investment is a part.

32 DTI 2004 Value Added Scoreboard, UK Department of Trade & Industry, April 2004. Copies can be obtained by email from publications@dti.gsi.gov.uk. See also the website www.innovation.gov.uk/finance

33 See, for example, G.K.Morbey – Journal of Prod. Innov. Management 5, p191-200, 1988.

Work in both Europe and the US on the links between R&D investment and company performance has found that higher R&D/Sales ratio to be linked to higher sales growth, and that labour productivity to be linked to investment per employee in R&D and capital.

- Labour productivity (sales or value added per employee) is linked to investment (R&D Investment and capital expenditure) per employee across a range of sectors³⁴.
- In the particular case of companies listed in this *2004 Industrial R&D Investment Scoreboard*³⁵, for sectors where R&D investment and capital expenditure are significant, three-quarters of companies with above average wealth creation efficiency³⁶ also have above average investment intensity (R&D/Sales ratio or total fixed asset intensity or both).

As well as these links, there are differences in the valuation that the financial markets put on sectors and the companies within each sector. These differences and particularly those linked to investment in the future are discussed in the next sub-section.

9.b. Market Capitalisation to Sales Ratio

The market capitalisation of a listed company represents the valuation put on it by financial markets. The ratio of market capitalisation to value added (MC/VA) rises with wealth creation efficiency and proves to be a useful measure to distinguish between sectors and between companies within a sector. However, as value added data are only available for EU companies³⁷, the ratio of market capitalisation to net sales (MC/S) is used instead in the analysis of this *Scoreboard*³⁸. The MC/S ratio for several sectors is summarised in Table 9.1 for a range of R&D-active sectors for EU versus non-EU companies listed on the *Scoreboard*.

Table 9.1.

Market Capitalisation to Net Sales Ratios (MC/S) for R&D-Intensive Sectors (companies listed in the *Scoreboard*, data for the 2003 financial year).

Sector	EU-185 MC/S	Non-EU 500 MC/S
Engineering† Sectors & Chemicals	0.3 – 0.7	0.5 – 0.9
IT Hardware	1.6	1.8
Personal Care	2.1	2.8
Software & computer services	3.7	3.8
Health	1.2	4.2
Pharmaceuticals & biotechnology	3.0	4.2

† Aerospace & defence, automobiles & parts, electronics & electrical equipment, engineering & machinery.

34 DTI 2003 Value Added Scoreboard, UK Department of Trade & Industry, April 2003. Copies can be obtained by email from publications@dti.gsi.gov.uk. See also the website www.innovation.gov.uk/finance

35 DTI 2004 Value Added Scoreboard, UK Department of Trade & Industry, April 2004. Copies can be obtained by email from publications@dti.gsi.gov.uk. See also the website www.innovation.gov.uk/finance

36 Wealth creation efficiency is value added divided by the sum of employee costs and depreciation.

37 US and Japanese companies follow US GAAP which does not require companies to disclose enough information to allow VA to be calculated

38 This may introduce a bias (only at aggregate level, not by sector, consequence of the given different sector mixes) against the *Scoreboard* companies registered in EU due to the already proved fact that top EU-registered companies investing in R&D have relatively higher aggregate net sales as compared to their R&D-active competitors (consequently, their share of R&D investment in net sales is smaller).

The message of Table 9.1 is that a substantial group of companies whose main activity is in engineering-related sectors (aerospace & defence, automobiles & parts, chemicals, electronics & electrical equipment, engineering & machinery) all have MC/S ratios below 1.0 (whether they are EU or non-EU companies) and a group of companies with declared main activity in five other sectors have higher MC/S values. This latter 5-sector group consists of the R&D intensive sectors such as health, IT hardware, pharmaceuticals & biotechnology and software & computer services. It also includes personal-care products, a sector in which non-EU companies from the *Scoreboard* show an R&D/Sales ratio of 3.3 % and EU companies (belonging to the subset of 185 companies with a similar size and R&D investment volume as the non-EU 500) have a share of 2.7 %. The EU companies belonging to the top 185 group which are active in the health sector form a sample that is almost too small to be included since three of the larger companies are not listed on an official stock exchange (so they do not have a market capitalisation) leaving only four listed companies with R&D investment over € 100m.

Table 9.1 also suggests that the top 185 EU companies whose stated main business is in software & computer services and IT hardware have similar MC/S ratios to the top 500 non-EU companies, but that there is an apparent gap in the case of companies in pharmaceuticals & biotechnology and in personal care products sectors. Sector averages, however, can be deceptive since one or two companies can dominate the aggregate market capitalisation of a sector on the *Scoreboard* (see Table 9.2). The most extreme case is SAP, which is registered in Germany, and which accounts for over 70 % of the *Scoreboard's* EU-185 software & computer services sector aggregate market capitalisation (and 63 % of the equivalent aggregate for *Scoreboard's* EU-500 companies whose stated main business is in the software & computer services sector).

A substantial group of companies whose main activity is in engineering-related sectors have Market Capitalisation to Net Sales (MC/S) ratios below 1.0 (whether they are EU or non-EU companies) values.

A group of companies whose main activity is in R&D intensive sectors such as health, IT hardware, pharmaceuticals & biotechnology and software & computer services have higher MC/S ratios.

Table 9.2.

Concentration of Market Capitalisation

Sector	Share of Sector Market Capitalisation for Largest Company [†]	
	EU-185	Non-EU 500
IT Hardware	35 % (Nokia)	14 % (Intel)
Personal care products	55 % (L'Oreal)	50 % (Procter & Gamble)
Software & computer services	71 % (SAP)	43 % (Microsoft)
Pharmaceuticals & biotechnology	32 % (GlaxoSmithKline)	19 % (Pfizer)

[†]- only companies included in the *EU 2004 Industrial R&D Investment Scoreboard*

The pharmaceuticals sector is one in which there are several substantial companies in both the EU top 185 group and the non-EU top 500 group and Table 9.3 shows the MC/S ratio and the company net sales for the top 10 R&D-active companies in each case. The MC/S range for the non-EU registered companies is 3.0 to 5.4 except for a low of 2.1 and a high of 8.6. For the top 185 companies with their registered offices in EU, the range is 1.8 to 3.9 except for a low of 0.3 and a high of 4.8. It is interesting that the company with the highest MC/S ratio – Amgen at 8.6 – is also on the list of the top 10 non-EU companies by R&D/Sales ratio. Equally, the two EU companies with the lowest MC/S ratios – Merck and UCB – have the lowest R&D/Sales ratios. However, Merck (which has its registered office

Some differences within a sector may be caused by differences in companies' specialisations in particular sub-sectors.

in Germany) also has non-pharmaceutical activities (e.g. *liquid crystals*), underscoring the point that some differences within a sector can also be caused by differences in companies' specialisations in particular sub-sectors. Within the pharmaceuticals & biotechnology sector, a generic drug division will, for example, make a big difference.

Table 9.3.

MC/S and Net Sales for Top 10 Pharmaceuticals Companies (included in 2004 Industrial R&D Investment Scoreboard), in 2003

EU-185			Non-EU 500		
Company	MC/S	Sales € bn	Company	MC/S	Sales € bn
GlaxoSmithKline	3.1	30.4	Pfizer	5.4	35.8
Aventis	2.8	17.8	Johnson & Johnson	3.9	33.2
AstraZeneca	3.9	14.9	Roche	3.5	20.0
Sanofi-Synthelabo	4.8	8.0	Novartis	5.0	19.7
Schering	1.8	4.8	Merck	4.5	17.8
Merck	0.3	7.2	Eli Lilly	5.7	10.0
Novo Nordisk	3.3	3.6	Bristol-Myers Squibb	2.1	16.6
Altana	2.2	2.7	Wyeth	3.0	12.6
Lundbeck	2.8	1.3	Amgen	8.6	6.6
UCB	1.8	3.0	Schering-Plough	3.4	6.6

In previous sections it has been pointed out that EU companies are relatively strong in the pharmaceuticals & biotechnology sector. If Table 9.3 were recast as Europe vs. the US, Roche and Novartis would move from the non-EU 500 column to the "Europe" column in positions 2 & 3, which will add further "strength" to the new category of companies registered in Europe. However, the point of Table 9.3 is not a non-EU vs. EU companies comparison but a demonstration of the wide variation in MC/S among companies declaring their main activity within a sector.

The overall message of this section is that the financial markets give very different values to the sales of different sectors and of different companies within each sector. Those sectors which have substantial R&D intensities and where R&D investment can give a lasting competitive benefit to companies acting on those markets have the highest MC/S values. Examples are pharmaceuticals & biotechnology (patented medicines) and software & computer services (both copyright and customers' existing investment in the company's software). The reasons for MC/S variations within a sector include, taking pharmaceuticals as an example, sub-sector differences such as between generic and patented medicines and differing success rates of R&D investment in producing new patented medicines.

Sectors such as pharmaceuticals & biotechnology and software & computer services, which have relatively high R&D intensities, and which have mechanisms enabling them to derive lasting benefit from their research, have the highest MC/S values.

Main Findings from the Analysis

This pilot 2004 EU Industrial R&D Investment Scoreboard has explored the research investments of the top 500 R&D-investing companies with registered offices located in the EU, and the top 500 companies registered outside the EU.

The main findings and outcomes are discussed under the following headings:

- Levels and growth of R&D.
- Business performance and R&D.
- How R&D is distributed.
- R&D specialisations and strengths.
- Intensity (R&D/Sales ratios).
- R&D Reporting.

NOTE:

- In this report "R&D Investment" refers to investments in R&D undertaken by companies on their own behalf and funded by the companies themselves. It excludes R&D performed under contract for customers such as governments or other companies. It also excludes the companies' share of any associated company or joint-venture R&D investment. Where part or all of R&D costs have been capitalised, the additions to the appropriate intangible assets are included to calculate the cash investment net of amortisation.
- The definition of "R&D" is that used by companies, following accepted international accounting standards (IAS 38), in accordance with the definitions used in official statistics (as defined in the OECD's 'Frascati Manual').
- The terms "EU-company, non-EU company or German- company, Finnish-company, US- company, Japanese- company, etc. " are used throughout this report to refer to a company whose ultimate parent has chosen to locate its registered office in that country or region.
- The term "R&D/Sales ratio" is used in this report to mean the ratio of a company's R&D investment to its net sales.
- The "sectors" in which groups of companies are classified in this report are those sectors of economic activity as defined by the FTSE (Financial Times Stock Exchange index) sectorial classifications, and corresponds to the sector which individual companies declare their main activity to lie in.
- When a year is mentioned in the analysis of company data, it refers to the company's published accounts for the given financial year. Companies in most countries have discretion in the choice of accounting period end and as a result the current year set can include accounts ending on a range of dates from the middle of one year to early next year.

R&D investment by the EU-500 companies fell in 2003. Growth rates of R&D investment of the two sets of companies in 2003 were -2.0 % for the EU-500 companies and 3.9 % for the non-EU group.

Levels and growth of R&D

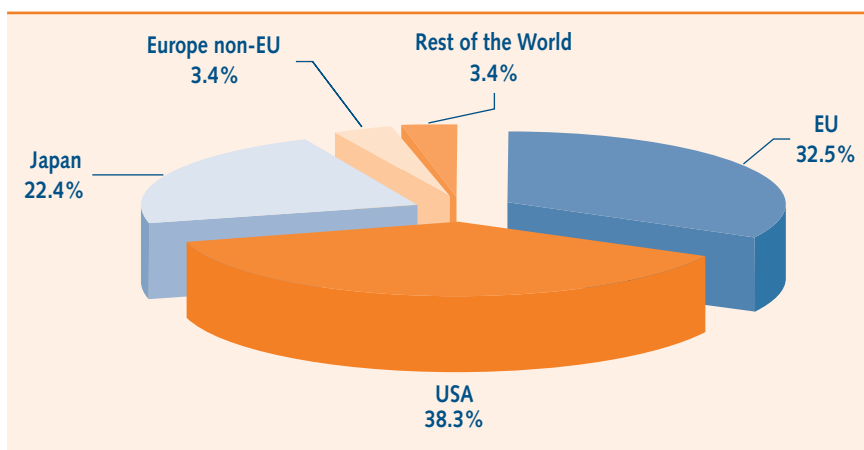
In the 2004 *Scoreboard*, the R&D investment of the EU top 500 companies totalled € 100.8 billion. The overall R&D investment of the non-EU top 500 companies listed in the *Scoreboard* was equivalent to € 195.6 billion.³⁹

R&D investment by the EU-500 companies fell in 2003. Growth rates of R&D investment of the two sets of companies in 2003 were -2.0 % for the EU-500 companies and 3.9 % for the non-EU group. The compound annual growth rates, over the period 2000-2003, were 1.2 % and 3.8 % respectively, the difference between the EU and non-EU companies being mainly caused by the reduction in R&D spending in 2003 by the EU companies.

Using comparable sets of EU and non-EU companies from the *Scoreboard*, the proportion of EU companies in the global top R&D-active companies was 32.5 % in 2003, showing a decrease from 34.2 % in 2001 (computed at 2003 exchange rate equivalents).

Figure 10.1.

The R&D investment share of top 685⁴⁰ *Scoreboard* companies worldwide, by region of office registration, in 2003



In 2003, the top 40 non-EU companies included 20 companies with R&D investment increases of more than 5 % over the previous year and 10 companies for which R&D investment had decreased.

There has been an overall decrease in R&D/Sales ratio in 2003, as compared to 2002, for both EU and non-EU companies (from 3.31 % to 3.21 % in the case of the *Scoreboard's* top 500 EU-based companies (referred to here as the EU-500) and from 4.66 % to 4.51 % in the case of *Scoreboard's* top 500 non-EU companies). In 2003, the top 40 non-EU companies included 20 companies with R&D investment increases of more than 5 % over the previous year and 10 companies for which R&D investment had decreased; the EU top 40 comprised 11 companies whose R&D investment increased over the previous year, but 16 companies whose R&D investment decreased.

³⁹ In order to convert the non-euro currencies the end-of-year exchange rate was used, as reported at 31 December 2003. This applies also to the historical comparative data. The principal rates used are: Sweden: 9.08 (Swedish Kronor); Japan: 135.18 (Yen); Switzerland: 1.56 (Swiss Franc); UK: 0.70 (£ Sterling); US: 1.26 (US\$).

⁴⁰ These are the top 685 EU and non-EU *Scoreboard* companies worldwide – (see beginning of Section 2)

Over the last 4 year period, however, the top 40 companies in both regions show approximately the same growth behaviour in R&D investment.

Business performance and R&D

In 2003, both EU and non-EU firms were recovering from the recession of 2001-2002, but were in different phases of the cycle. Among non-EU companies, sales, profitability and R&D expenditure all rose between 2001 and 2002. EU companies experienced increasing profitability, but sales and R&D investment continued to decline. However, averaged over the past four years, growth shows positive or constant figures for both EU and non EU companies in terms of R&D investment.

How R&D is distributed

The level of concentration of R&D investment among the companies included on the *Scoreboard* is high. The top companies are responsible for a large proportion of overall R&D investment, regardless the region where they are registered, though the degree of concentration is more marked in the case of EU companies than non-EU companies. In 2003, the top 20 EU companies for instance (4 % of the sample of companies) accounted for more than 55 % of the total R&D investment by the EU-500 group of companies from the *Scoreboard*. For the non-EU region, the same proportion was almost 37 %.

These differences in concentration mean that the non-EU world has a larger proportion of medium-sized R&D performing companies. Nevertheless, from 2000-2003 there is a declining trend in R&D share of the top 20 EU companies, from 57.5 % in 2000 to 55.3 % in 2003, which means that EU companies from the bottom end of the EU-500 increased their R&D investment faster than the very large EU R&D-investing companies.

There is also a significant concentration of R&D investment among the *Scoreboard* companies inside each of the ten main FTSE sectors. Within each sector the top R&D-investing company invested a proportion ranging between 15-35 % of the aggregate R&D investment of all the *Scoreboard* companies active in the respective sector, regardless of location (EU or non-EU), with few exceptions (although non-EU companies active in IT Hardware show less concentration, as do EU companies in health).

Just as R&D investment is concentrated among companies it is also concentrated among sectors. For the world's companies in this *Scoreboard* the four largest FTSE sectors in aggregate R&D investment are IT hardware, pharmaceuticals & biotechnology, automobiles & parts, and electronics & electrical equipment.

When companies of similar size are compared in the *2004 EU Industrial R&D Investment Scoreboard* the four largest sectors for the non-EU world are IT hardware (19.6 % of all RTD), pharmaceuticals & biotechnology (18.8 %), automobiles & parts (18.1 %) and electronics & electrical equipment (10.8 %). The order differs significantly for the EU top 500 companies - automobiles & parts (23.8 %), pharmaceuticals & biotechnology (17 %), IT hardware (12.4 %) and electronics & electrical equipment (10.3 %).

R&D investment is highly concentrated geographically in three major EU Member States: Germany, France and United Kingdom, which in 2003

Among non-EU companies, sales, profitability and R&D expenditure all rose between 2001 and 2002. EU companies experienced increasing profitability, but sales and R&D investment continued to decline

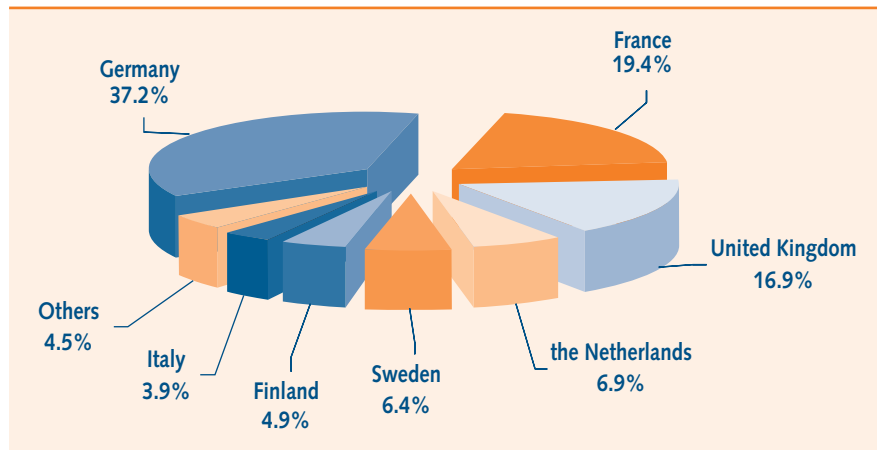
EU companies from the bottom end of the EU-500 increased their R&D investment faster than the very large EU R&D-investing companies.

Worldwide R&D investment is concentrated in four main sectors: IT hardware, pharmaceuticals & biotechnology, automobiles & parts, and electronics & electrical equipment.

accounted for 73.5 % of the aggregate R&D investment of the *Scoreboard's* top 500 EU-based companies.

Figure 10.2.

Share of R&D investment among EU Top 500 Scoreboard companies in 2003, by country of office registration



R&D specialisations and strengths

With one important exception, namely French companies, EU companies, when grouped by Member State, tend to show at least one strong specialisation in terms of R&D investment when compared to the average for the EU-500. In this case, by 'specialisation' we mean that the share of a particular sector's R&D investment in the total R&D investment of Scoreboard companies, registered in a given EU country, is more than twice the similar share for the EU-500 as a whole.

German top R&D-investing companies are particularly strong in automobiles & parts, which is one of the Europe's most important sectors in terms of its investment in research. Finnish companies concentrate more than 80 % of their R&D investment in IT hardware. Swedish companies show R&D strength and specialisation in IT hardware and its traditional engineering & machinery sector. Dutch companies make an interesting case with three clear sector specialisations: aerospace, chemicals and electronics & electrical equipment (although aerospace clearly reflects the fact that EADS is registered in the Netherlands). United Kingdom companies specialise in the pharmaceuticals & biotechnology sector, but are also well above the EU average in aerospace & defence.

Specialisation can also be found across the so-called "Triad" of Europe, Japan and the US, and is linked to concentration among companies. In fact, to understand the relative strengths of the EU and non-EU world is it almost sufficient to look at the top 10 companies in the EU, the US and Japan: i.e. the concentration of R&D investment in these 10 companies reflect the sectoral strengths of these three economies. For example, the EU and the US have three pharmaceutical companies each in their top 10 but Japan has none. Japan, which is strong in electronics & electrical equipment and IT

At the level of individual sectors, EU companies in the Scoreboard can be strong compared to the rest of the world, while the overall R&D/Sales ratio is lower in the EU because the very high R&D/Sales sectors are relatively smaller, not because individual company performance is weaker.

Hardware, has six such companies in its top 10 compared to five in the US and four in the EU. The remaining top 10 companies in each case are active in the automobiles & parts sector, where EU companies show more strength than their non-EU competitors.

Intensity (R&D/Sales ratios)

EU companies have higher R&D/Sales ratios than non-EU companies across all sectors except for engineering & machinery, telecommunications, oil and gas, and health. EU companies have higher R&D/Sales ratios in each of the top 5 R&D performing sectors in the EU, and in each of the top 5 R&D performing sectors in the non-EU. However, looking at the overall R&D/Sales ratio across all sectors for comparable-size companies, the overall R&D/Sales ratio for EU companies is 3.6 %, significantly less than that of Japanese companies at 4.2 % and US companies at 4.9 %.

The analysis of the *Scoreboard* data shows that the reason for this is the EU's sector mix (that is, the composition of main activities declared by the companies listed on the *Scoreboard*).

The findings of the *2004 EU Industrial R&D Investment Scoreboard* confirm that the structure of European industry differs from that of the non EU world – with the EU having a much larger proportion of output flowing from relatively low R&D/Sales sectors, and a smaller proportion of its output flowing from such high R&D/Sales industries such as IT hardware, pharmaceuticals, and software & computer services. In fact, at the level of individual sectors, EU-500 companies can be strong compared to the rest of the world, while the overall R&D/Sales ratio is lower in the EU because the very high R&D/Sales sectors are relatively smaller, not because individual company performance is weaker.

A comparison of US and EU companies in the same size range shows very different distributions of companies by R&D/Sales ratio, with the EU having twice the US' proportion of companies with low R&D/Sales ratio (between 0 and 2 %) and the US having more than twice the EU's proportion (43 % vs. 17 %) of companies with a high R&D/Sales ratio of over 10 %. The main reason for this difference is that there are many more large and medium-sized US companies in the IT hardware sectors and a large proportion of these show high R&D/Sales ratio.

Improving R&D Reporting

There are a number of ways in which our understanding of corporate R&D could be improved by better data gathering.

First, the *Scoreboard* does not list companies with R&D investment below € 8.54 m, so that there is no information on the vigour of smaller size companies by sector. To obtain this in a reasonably complete form, it is necessary to have the annual reports and accounts for smaller companies. To achieve this, clearer requirements for disclosing R&D investment and statistics on other form of intellectual capital in companies are needed, particularly for private companies not listed on a recognised stock exchange.

Second, the EU-500 companies included in the *Scoreboard* are drawn from just 16 of the 25 EU Member States. Regular publication of the *Scoreboard*

EU companies have higher intensity than non-EU companies in almost all sectors (27/31)...

...However, intensity across all sectors for comparable-size companies is significantly less for EU companies (3.6 %) than that of Japanese (4.2 %) and US (4.9 %) companies

There is a need for clearer requirements to disclose industrial R&D investment as well as figures for other forms of intellectual capital.

- with a larger number of companies in it - would provide more complete information and could also contribute to encouraging the disclosure of data in companies registered in all Member States.

Finally, while R&D-active foreign-owned companies are not included in the *Scoreboard's* EU-500 group of top R&D-investing companies, it should not be forgotten that they do contribute in a significant way to the EU economy and are an asset to the EU countries in which their R&D activity is based. Comprehensive data is available for such foreign-owned companies in the UK but is much more difficult to obtain in many other EU countries. It will be important in the future to collect such data on an EU-wide basis.

R&D Indicators for EU companies, by Member State

Figures A.1 to A.6 show the progress over the period 2000-2003 of three important indicators for the aggregate of companies investing in R&D in each of the six Member States analysed in this section (Germany, France, UK, the Netherlands, Sweden and Finland). These indicators are: the annual growth rates for R&D investment; their net sales; the overall employment. Correlations may be assumed to exist between these indicators according to the existing literature on R&D. The following comments arise out of the analysis of data in the *2004 Scoreboard* on which these graphs are based:

- Net sales and employment were synchronised in all years and for companies registered in all the countries looked at, except for the United Kingdom⁴¹, which means that – generally and on aggregate level – EU companies investing in research were trying to maintain or increase their productivity regardless of the overall economic outlook (by adjusting their employment decisions to the growth of net sales). Therefore, it would make sense to look only at the relationship between net sales and R&D investment when analysing companies' performances, as there is empirical evidence for a correlation between net sales and employment in the EU companies included in the *Scoreboard*.
- German companies seem to have a one year lag in adjusting R&D investment decisions to variations in net sales. Anyway, given the longer-term nature of the decisions companies make about investment in research and innovation, net sales are only one factor among others which need to be considered. The structure of the economy and especially the R&D investment structure by sector of the top companies investing in R&D that are registered in a given country may also be an important factor. There is a considerable difference in the way decisions are made within a company depending on the R&D/Sales ratio already achieved and on the speed of product obsolescence within a given sector.
- For most of the companies registered in EU Member States, 2003 was not a good year for R&D investments, particularly in Germany, France and the Netherlands. In the case of French and Dutch companies it followed another year of negative growth. The appreciation of the euro against other currencies may explain some of the recession in R&D activities, particularly during 2003.
- The differing business cycles between EU Member States and the various economic policy mixes leading to differences in business environment may be one explanation for the overall lower performance of EU companies in R&D as compared to US companies. Despite their degree of internationalisation, EU companies still consider (with good reason) other EU Member States to be different from their national territory and business environment, and this may build barriers to the development of research and innovation activity (such as extramural research or scale economy development of R&D).

⁴¹ In the case of the 149 UK companies' aggregate figures from the EU 2004 R&D Scoreboard, the net sales show positive growth rates for all years, while employment presents negative rates, which may lead to the conclusion that UK companies were affected by other economic factors in assuming employment-related decisions during the latest years.

Figures

Annual growth rates of R&D Investment, Net Sales and Employment for EU top 500 companies investing in research, by country of registered office, 2000-2003

Figure A.1

German Companies in Scoreboard

annual growth rates for R&D investment, net sales and employment, 2001-2003

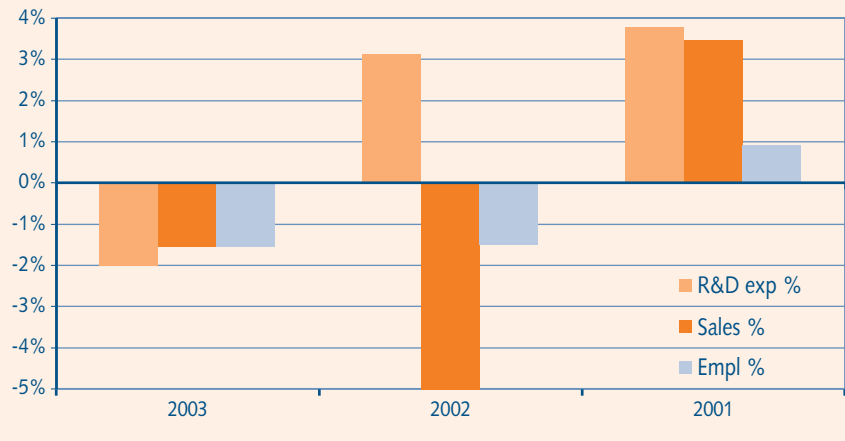


Figure A.2

French Companies in Scoreboard

annual growth rates for R&D investment, net sales and employment, 2001-2003

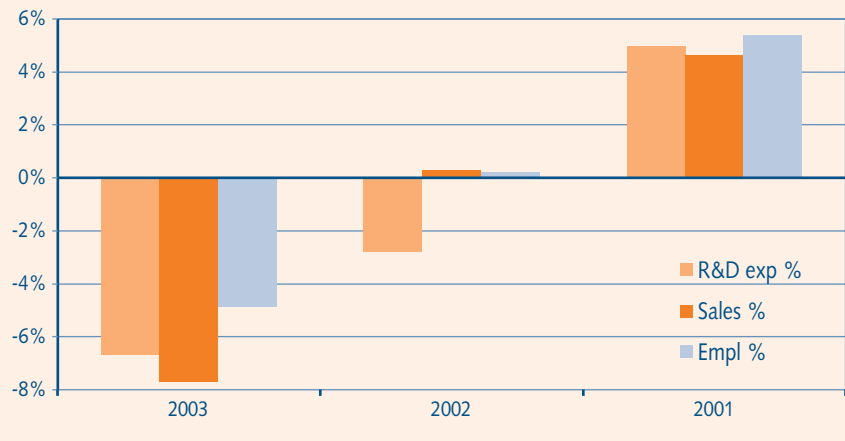


Figure A.3

UK Companies in Scoreboard

annual growth rates for R&D investment, net sales and employment, 2001-2003

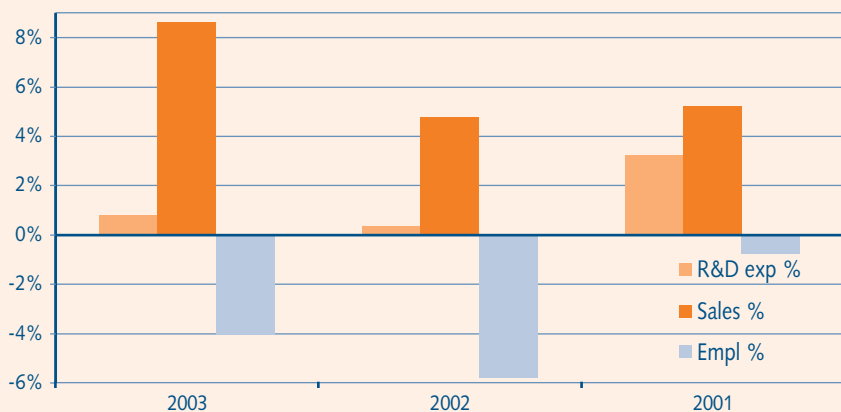


Figure A.4

Dutch Companies in Scoreboard

annual growth rates for R&D investment, net sales and employment, 2001-2003

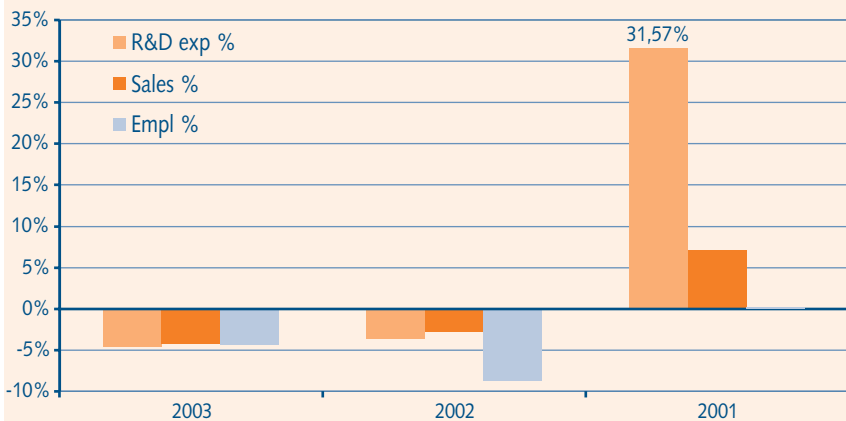


Figure A.5

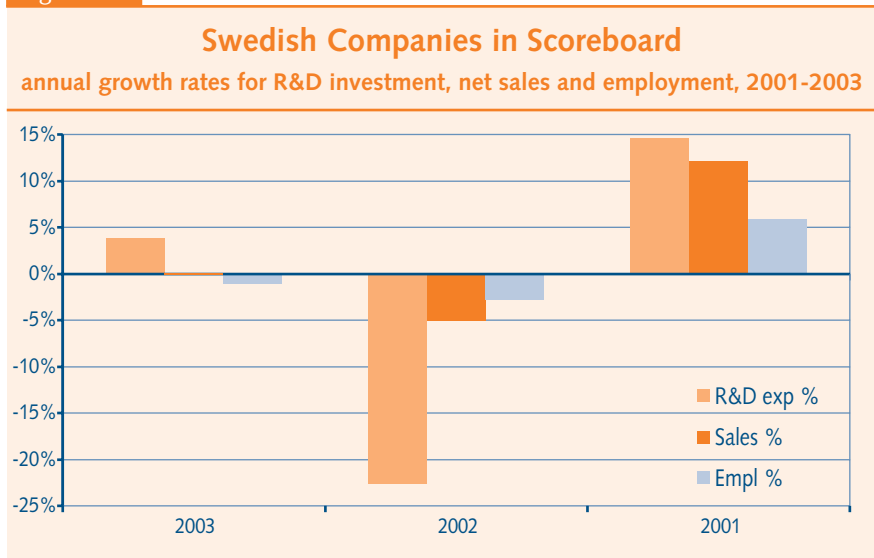
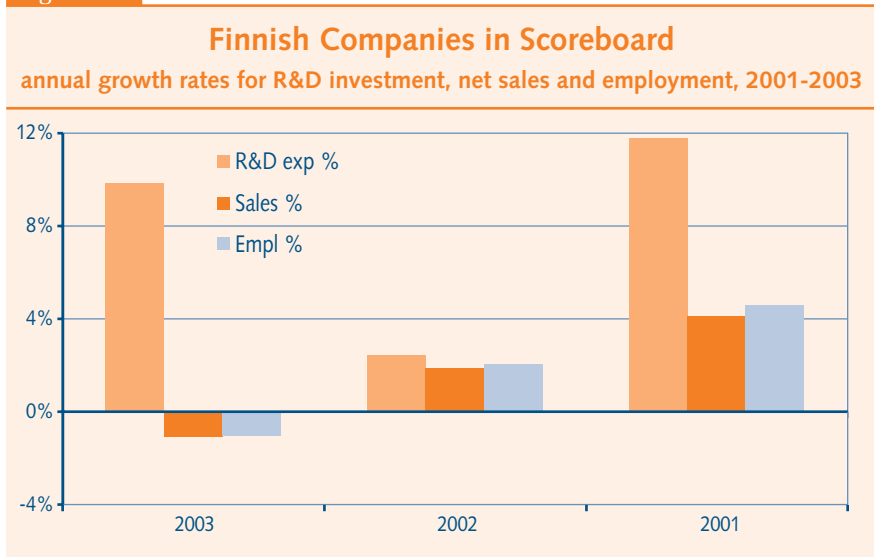


Figure A.6



The 2004 EU Industrial R&D Investment Scoreboard lists of EU-500 and non-EU 500 companies

METHODOLOGICAL NOTE:

The header of the Top 500 listing of ultimate parent companies contains the following notations:

FTSE Sector is the sector of economic activity – according to the FTSE classification – which the company itself has declared as main activity in its financial accounts and/or reports or when listed on a recognised stock exchange. The code number of the FTSE classification for the respective sector is given in brackets.

Country is the country where the ultimate parent company has chosen to site its registered office.

R&D Investment is companies' cash investment in R&D conducted on their own behalf and funded by the companies themselves. It excludes R&D undertaken under contract for customers such as governments or other companies. It also excludes the companies' share of any associated company or joint venture R&D investment. Where all or part of a company's R&D costs have been capitalised, the additions to the appropriate intangible assets are included to calculate the cash investment and any amortisation eliminated. The definitions of "R&D" used by companies, following accepted international accounting standards, accord with definitions used in official statistics (as defined in the OECD's 'Frascati Manual').

Number of companies for calculation is the number of companies for which figures were available in the *2004 Scoreboard* for the given R&D-related indicator in the given year. If a computed indicator which needs data from two or more years in order to be calculated is used, the number in italics is the number of companies used in the aggregate calculations. This number is arrived at by subtracting all the companies for which data for at least one year is missing from the *Scoreboard* (i.e. the data were not available).

The Methodological Notes at the end of Volume II provide more detailed information on all the variables and indicators that are referred to with each company listed in the *2004 EU Industrial R&D Investment Scoreboard*.

Table A2.1

Listing of the EU-500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
Top 500 companies				100 790	-2.0	3 139 330	3.2	7.1	8.4	89.0
<i>number of companies for calculation</i>				<i>500</i>	<i>493</i>	<i>497</i>	<i>497</i>	<i>499</i>	<i>497</i>	<i>431</i>
1	DaimlerChrysler	Automobiles & parts (31)	Germany	5 571	-8	136 437	4	1	15	26
2	Siemens	Electronic & electrical (25)	Germany	5 511	-5	74 233	7	4	13	67
3	Volkswagen	Automobiles & parts (31)	Germany	4 140	-5	88 414	5	3	13	14
4	Nokia	IT hardware (93)	Finland	3 978	15	29 455	14	17	77	144
5	GlaxoSmithKline	Pharma & biotech (48)	UK	3 961	-5	30 429	13	30	38	308
6	Ericsson	IT hardware (93)	Sweden	3 229	-0	12 973	25	-9	57	262
7	Aventis	Pharma & biotech (48)	France	2 924	-15	17 815	16	14	39	280
8	AstraZeneca	Pharma & biotech (48)	UK	2 736	12	14 944	18	22	45	391
9	Robert Bosch	Automobiles & parts (31)	Germany	2 650	7	36 357	7	5	12	..
10	Philips Electronics	Electronic & electrical (25)	The Netherlands	2 617	-14	29 037	9	3	18	87
11	BMW	Automobiles & parts (31)	Germany	2 559	10	41 525	6	8	25	56
12	Bayer	Chemicals (11)	Germany	2 414	-5	28 567	9	-7	20	54
13	EADS	Aerospace & defence (21)	The Netherlands	2 193	5	30 133	7	1	20	58
14	Peugeot (PSA)	Automobiles & parts (31)	France	2 098	13	54 238	4	4	11	21
15	Istituto Finanziario Industriale	Automobiles & parts (31)	Italy	1 763	0	53 509	3	-4	9	1
16	Renault	Automobiles & parts (31)	France	1 737	-2	37 525	5	8	13	47
17	Alcatel	IT hardware (93)	France	1 593	-33	12 513	13	-13	26	102
18	BAE Systems	Aerospace & defence (21)	UK	1 560	22	11 903	13	5	23	82
19	Sanofi-Synthelabo (now Sanofi-Aventis)	Pharma & biotech (48)	France	1 316	8	8 048	16	37	40	480
20	Finmeccanica	Aerospace & defence (21)	Italy	1 227	24	7 497	16	6	27	63
21	Boehringer Ingelheim	Pharma & biotech (48)	Germany	1 176	-10	7 382	16	12	35	..
22	BASF	Chemicals (11)	Germany	1 105	-3	33 361	3	7	13	72
23	Infineon Technologies	IT hardware (93)	Germany	1 083	12	6 152	18	-5	34	104
24	Unilever	Food producers (43)	UK	1 065	-9	42 693	3	12	4	111
25	SAP	Software & computer services (97)	Germany	996	10	7 025	14	24	34	573
26	Schering	Pharma & biotech (48)	Germany	947	-2	4 828	20	15	36	181
27	STMicroelectronics	IT hardware (93)	France	921	23	5 735	16	4	20	230
28	Deutsche Telekom	Telecommunication services (67)	Germany	900	0	55 838	2	8	4	103
29	AKZO Nobel	Chemicals (11)	The Netherlands	892	-2	13 051	7	8	13	57
30	Volvo	Engineering & machinery (26)	Sweden	865	4	20 195	4	2	12	62
31	Michelin	Automobiles & parts (31)	France	711	1	15 370	5	5	6	41
32	Total	Oil & gas (07)	France	667	1	104 652	1	13	6	95
33	Snecma	Aerospace & defence (21)	France	624	0	6 431	10	6	16	66
34	Merck	Pharma & biotech (48)	Germany	605	2	7 202	8	7	18	32
35	Valeo	Automobiles & parts (31)	France	564	-2	9 234	6	3	8	29
36	Novo Nordisk	Pharma & biotech (48)	Denmark	563	1	3 564	16	24	31	335
37	ZF	Automobiles & parts (31)	Germany	524	-3	8 928	6	-0	10	..
38	Continental	Automobiles & parts (31)	Germany	498	1	11 534	4	7	8	47
39	Schneider	Electronic & electrical (25)	France	494	5	8 780	6	7	7	133
40	L'Oreal	Personal care & household (47)	France	480	3	14 029	3	16	10	272
41	France Telecom	Telecommunication services (67)	France	478	-17	46 121	1	24	2	103
42	BT	Telecommunication services (67)	UK	474	-12	26 282	2	15	5	87
43	ALSTOM	Electronic & electrical (25)	France	473	-24	16 688	3	-5	6	3
44	Shell	Oil & gas (07)	UK	463	24	159 931	0	11	4	70
45	RWE	Utilities - other (73. 78)	Germany	436	0	42 771	1	7	3	50
46	Solvay	Chemicals (11)	Belgium	420	2	7 557	6	9	14	74
47	Altana	Pharma & biotech (48)	Germany	412	12	2 735	15	21	41	222
48	MAN	Engineering & machinery (26)	Germany	407	-4	15 021	3	3	6	29
49	Rolls-Royce	Aerospace & defence (21)	UK	399	-5	8 011	5	4	11	70

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
50	Electricite de France	Electricity (72)	France	381	-12	44 919	1	5	2	..
51	Thales	Aerospace & defence (21)	France	381	-12	10 569	4	2	7	45
52	Heidelberger Druckmaschinen	Engineering & machinery (26)	Germany	365	-7	3 661	10	-9	16	58
53	Degussa	Chemicals (11)	Germany	355	..	11 427	3	3	8	48
54	Groupe Lagardere	Diversified industrials (24)	France	330	4	12 454	3	4	8	54
55	Saint-Gobain	Construction & building (13)	France	306	-2	29 590	1	8	2	45
56	Thomson	Electronic & electrical (25)	France	295	-21	8 459	4	2	5	49
57	ASML	IT hardware (93)	The Netherlands	287	-4	1 543	19	-14	54	354
58	AREVA	Electricity (72)	France	285	-14	8 255	4	3	6	4
59	TeliaSonera	Telecommunication services (67)	Sweden	280	118	9 082	3	17	11	179
60	Marconi	IT hardware (93)	UK	280	-40	2 211	13	-16	19	80
61	BP	Oil & gas (07)	UK	277	-6	184 383	0	7	3	87
62	DSM	Chemicals (11)	The Netherlands	268	-1	6 050	4	2	13	66
63	Amersham <i>(now part of General Electric, US)</i>	Health (44)	UK	258	-1	2 228	12	13	25	..
64	Henkel	Personal care & household (47)	Germany	257	-1	9 436	3	6	5	85
65	Lundbeck	Pharma & biotech (48)	Denmark	246	25	1 335	18	21	47	276
66	Reuters	Media & entertainment (54)	UK	243	-15	4 537	5	3	14	146
67	Vodafone	Telecommunication services (67)	UK	243	4	47 627	1	-13	4	237
68	Autoliv	Automobiles & parts (31)	Sweden	242	33	4 203	6	8	8	75
69	ENI	Oil & gas (07)	Italy	238	36	51 487	1	18	3	126
70	Scania	Engineering & machinery (26)	Sweden	237	4	5 613	4	10	9	94
71	Invensys	Electronic & electrical (25)	UK	234	-26	5 522	4	-6	5	23
72	Agfa-Gevaert	Health (44)	Belgium	233	-6	4 215	6	8	13	58
73	ICI	Chemicals (11)	UK	221	5	8 301	3	2	6	46
74	UCB	Pharma & biotech (48)	Belgium	216	1	2 966	7	16	18	182
75	Dassault Systemes	Software & computer services (97)	France	216	-3	755	29	28	53	532
76	Oce	IT hardware (93)	The Netherlands	208	-2	2 769	8	5	9	38
77	Pirelli	Diversified industrials (24)	Italy	204	-7	6 671	3	3	6	41
78	Rhodia	Chemicals (11)	France	203	1	5 453	4	-16	9	12
79	Elan	Pharma & biotech (48)	Ireland	202	-20	604	33	-140	75	1 041
80	Carl-Zeiss	Health (44)	Germany	190	2	2 029	9	2	13	..
81	Rheinmetall	Engineering & machinery (26)	Germany	189	-9	4 248	4	4	8	26
82	Sandvik	Engineering & machinery (26)	Sweden	185	11	5 378	3	10	5	134
83	Smiths	Aerospace & defence (21)	UK	184	11	4 337	4	12	6	134
84	Behr	Automobiles & parts (31)	Germany	184	5	3 005	6	3	11	..
85	Electrolux	Household goods & textiles (34)	Sweden	184	-8	13 671	1	6	2	31
86	Thyssen Krupp	Engineering & machinery (26)	Germany	183	-4	36 137	1	3	1	20
87	Shire Pharmaceuticals	Pharma & biotech (48)	UK	182	8	1 080	17	-40	96	306
88	Linde	Chemicals (11)	Germany	179	4	8 992	2	5	4	63
89	Vivendi Universal	Media & entertainment (54)	France	170	45	25 482	1	1	3	83
90	Hella	Automobiles & parts (31)	Germany	168	12	3 028	6	0	8	..
91	Diehl Stiftung	Diversified industrials (24)	Germany	161	-10	1 433	11	5	16	..
92	Deutsche Post	Support services (58)	Germany	156	-36	40 017	0	6	0	22
93	Wacker-Chemie	Chemicals (11)	Germany	152	-4	2 468	6	-2	9	..
94	Celltech <i>(now part of UCB, Belgium)</i>	Pharma & biotech (48)	UK	151	11	501	30	-20	78	..
95	UBI Soft Entertainment	Software & computer services (97)	France	147	119	449	33	6	74	66
96	Amadeus Global Travel	Leisure & hotels (53)	Spain	145	16	1 929	8	16	28	156
97	Schwarz Pharma	Pharma & biotech (48)	Germany	144	16	1 496	10	18	37	82
98	Freudenberg	Diversified industrials (24)	Germany	140	40	3 867	4	6	5	..
99	Telecom Italia	Telecommunication services (67)	Italy	139	..	30 850	1	19	2	111
100	Ipsen	Pharma & biotech (48)	Luxembourg	136	4	737	19	21	36	..

Table A2.1 (cont.)

Listing of the EU-500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02					
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
101	JM Voith	Diversified industrials (24)	Germany	135	-3	3 109	4	5	6	..
102	Repsol YPF	Oil & gas (07)	Spain	134	2	36 069	0	10	4	59
103	BioMerieux	Health (44)	France	131	11	915	14	11	24	122
104	Danone	Food producers (43)	France	130	-2	13 131	1	12	2	133
105	Phoenix Venture	Automobiles & parts (31)	UK	128	99	2 470	5	-5	20	..
106	Atlas Copco	Engineering & machinery (26)	Sweden	128	-4	4 916	3	12	5	118
107	Metso	Engineering & machinery (26)	Finland	126	-14	4 250	3	-6	5	33
108	Misys	Software & computer services (97)	UK	126	-2	1 277	10	3	20	108
109	Fresenius	Health (44)	Germany	121	-12	7 064	2	11	2	104
110	Knorr-Bremse	Engineering & machinery (26)	Germany	120	1	2 206	5	8	11	..
111	SNPE	Chemicals (11)	France	115	8	784	15	-7	22	..
112	GKN	Automobiles & parts (31)	UK	115	-1	4 732	2	5	3	51
113	Merial	Pharma & biotech (48)	UK	106	2	1 368	8	13	17	..
114	B Braun Melsungen	Health (44)	Germany	105	3	2 647	4	6	4	..
115	Essilor International	Health (44)	France	104	20	2 116	5	15	5	238
116	BAT	Tobacco (49)	UK	104	18	15 001	1	18	2	171
117	Novozymes	Chemicals (11)	Denmark	101	5	779	13	17	26	..
118	Beiersdorf	Personal care & household (47)	Germany	100	8	4 673	2	10	6	164
119	Dragerwerk	Health (44)	Germany	97	25	1 413	7	4	9	19
120	Smith & Nephew	Health (44)	UK	95	6	1 673	6	17	13	440
121	Amdocs	Software & computer services (97)	UK	95	-4	1 176	8	14	9	316
122	L'Air Liquide	Chemicals (11)	France	94	2	8 394	1	14	3	167
123	Spirent	IT hardware (93)	UK	94	-15	662	14	5	21	113
124	MG Technologies	Engineering & machinery (26)	Germany	94	3	8 157	1	-2	3	24
125	GUS	General retailers (52)	UK	92	-4	10 712	1	9	1	116
126	HVB	Banks (81)	Germany	91	-38	7 183	1	-37	1	131
127	SAAB	Aerospace & defence (21)	Sweden	89	-1	1 901	5	7	7	75
128	Stora Enso	Forestry & paper (15)	Finland	89	-23	12 172	1	4	2	76
129	Trumpf	Diversified industrials (24)	Germany	89	77	1 193	7	8	16	..
130	Kone	Engineering & machinery (26)	Finland	88	40	5 344	2	6	3	47
131	Kerry	Food producers (43)	Ireland	88	13	3 693	2	7	5	82
132	Corus	Steel & other metals (18)	UK	88	-5	11 287	1	-3	2	25
133	Adidas-Salomon	Household goods & textiles (34)	Germany	86	1	6 267	1	8	6	75
134	Orion	Health (44)	Finland	86	-22	2 262	4	4	15	61
135	Bouygues	Construction & building (13)	France	85	-73	21 822	0	5	1	41
136	British Nuclear Fuels	Electricity (72)	UK	84	-12	3 295	3	-12	4	..
137	Tomkins	Engineering & machinery (26)	UK	83	14	4 471	2	7	2	62
138	SKF	Engineering & machinery (26)	Sweden	83	-2	4 559	2	8	2	75
139	Sage	Software & computer services (97)	UK	82	0	795	10	28	14	395
140	Avecia	Chemicals (11)	UK	82	-2	689	12	-16	26	..
141	LogicaCMG	Software & computer services (97)	UK	82	-10	2 422	3	-1	4	72
142	Reckitt Benckiser	Personal care & household (47)	UK	81	6	5 269	2	18	4	300
143	ASM International	IT hardware (93)	The Netherlands	79	-11	582	14	2	11	113
144	Celanese	Chemicals (11)	Germany	79	7	4 075	2	4	8	57
145	Suez	Utilities - other (73. 78)	France	79	-37	39 622	0	7	1	39
146	Danfoss	Engineering & machinery (26)	Denmark	78	20	2 073	4	5	4	..
147	Johnson Matthey	Chemicals (11)	UK	77	13	6 376	1	4	10	45
148	Business Objects	Software & computer services (97)	France	76	27	445	17	8	19	342
149	Cadbury Schweppes	Food producers (43)	UK	75	66	9 141	1	11	1	145
150	Stork	Engineering & machinery (26)	The Netherlands	74	131	1 946	4	5	5	29

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
151	Telefonica	Telecommunication services (67)	Spain	73	-22	28 400	0	11	1	199
152	Gemplus International	Electronic & electrical (25)	Luxembourg	72	-31	749	10	-19	14	129
153	Gambro	Health (44)	Sweden	71	20	2 879	2	6	3	99
154	Wartsila	Engineering & machinery (26)	Finland	70	-20	2 358	3	-2	6	46
155	Barco	Electronic & electrical (25)	Belgium	70	-37	629	11	9	17	134
156	EPCOS	Electronic & electrical (25)	Germany	69	-26	1 272	6	1	5	79
157	Svenska Cellulosa	Forestry & paper (15)	Sweden	69	-29	9 403	1	9	2	73
158	Infogrames Entertainment	Software & computer services (97)	France	69	-38	661	11	-6	38	24
159	E ON	Utilities - other (73. 78)	Germany	69	-82	42 541	0	9	1	93
160	ARM	IT hardware (93)	UK	68	-4	182	38	14	94	840
161	Danisco	Food producers (43)	Denmark	68	-2	2 202	3	11	8	93
162	Chr Hansen	Pharma & biotech (48)	Denmark	67	17	582	12	5	19	78
163	Claas	Engineering & machinery (26)	Germany	67	7	1 496	5	3	9	..
164	Cognis Deutschland	Chemicals (11)	Germany	65	-15	2 950	2	1	8	..
165	Cambridge Antibody	Pharma & biotech (48)	UK	64	44	12	532	-542	216	2 400
166	Belgacom	Telecommunication services (67)	Belgium	63	43	5 377	1	9	4	177
167	Grundfos	Engineering & machinery (26)	Denmark	62	2	1 498	4	10	5	..
168	Wavecom	IT hardware (93)	France	62	-3	276	23	-11	90	16
169	Eberspaecher	Automobiles & parts (31)	Germany	61	-5	1 336	5	0	12	..
170	Bull	IT hardware (93)	France	60	-18	1 265	5	4	8	20
171	IWKA	Engineering & machinery (26)	Germany	60	-1	2 287	3	3	5	21
172	Software	Software & computer services (97)	Germany	58	-9	422	14	-1	21	169
173	VA Technologie	Engineering & machinery (26)	Austria	58	-8	3 923	2	2	3	31
174	Koenig & Bauer	Engineering & machinery (26)	Germany	58	17	1 232	5	-4	8	17
175	Salzgitter	Steel & other metals (18)	Germany	58	22	4 842	1	1	3	13
176	Cobham	Aerospace & defence (21)	UK	57	28	1 182	5	15	6	184
177	BOC	Chemicals (11)	UK	57	-15	5 277	1	11	1	127
178	Lafarge	Construction & building (13)	France	56	2	13 658	0	12	1	85
179	NEG Micon <i>(now part of Vestas Wind Systems)</i>	Engineering & machinery (26)	Denmark	55	39	707	8	-7	21	..
180	Deutz	Automobiles & parts (31)	Germany	55	17	1 173	5	3	10	24
181	Deutsche Borse	Speciality & other finance (87)	Germany	55	-38	1 650	3	27	17	258
182	Intracom	IT hardware (93)	Greece	54	-17	641	8	8	..	67
183	Trelleborg	Automobiles & parts (31)	Sweden	53	3	1 979	3	7	3	53
184	Vattenfall	Electricity (72)	Sweden	53	-2	12 333	0	14	2	40
185	Voest-Alpine	Steel & other metals (18)	Austria	52	12	4 646	1	5	2	32
186	Zeltia	Pharma & biotech (48)	Spain	51	15	74	69	-32	87	1 373
187	Arla Foods	Food producers (43)	Denmark	51	..	5 459	1	3	3	..
188	Bookham Technology	IT hardware (93)	UK	51	-10	127	40	-98	28	190
189	Intentia International	Software & computer services (97)	Sweden	51	-15	323	16	-8	16	43
190	SNIA	Health (44)	Italy	50	11	881	6	-2	9	5
191	Eircom	Telecommunication services (67)	Ireland	50	-68	1 628	3	7	6	62
192	Assa Abloy	Engineering & machinery (26)	Sweden	49	4	2 653	2	5	2	123
193	Spectris	Electronic & electrical (25)	UK	48	15	806	6	8	9	90
194	UPM-Kymmene	Forestry & paper (15)	Finland	48	4	9 948	1	6	1	80
195	Outokumpu	Steel & other metals (18)	Finland	48	2	5 921	1	1	3	38
196	Bang & Olufsen	Electronic & electrical (25)	Denmark	48	7	534	9	8	17	99
197	Kemira	Chemicals (11)	Finland	48	4	2 738	2	5	5	46
198	Nexans	Electronic & electrical (25)	France	47	-2	4 046	1	1	3	15
199	Symbian	Software & computer services (97)	UK	47	4	42	112	-136	72	..
200	Genmab	Pharma & biotech (48)	Denmark	47	-13	9	516	-522	234	3 611

Table A2.1 (cont.)

Listing of the EU-500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02					
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
201	Eidos	Software & computer services (97)	UK	46	-16	215	22	9	86	90
202	Cookson	Engineering & machinery (26)	UK	46	-2	2 328	2	0	3	41
203	Vernalis	Pharma & biotech (48)	UK	44	33	18	247	-389	210	861
204	Heraeus	Steel & other metals (18)	Germany	44	..	7 412	1	2	5	..
205	Draka	Electronic & electrical (25)	The Netherlands	44	-3	1 420	3	3	6	26
206	Phoenix	Automobiles & parts (31)	Germany	44	-10	1 153	4	3	5	23
207	Borealis	Chemicals (11)	Denmark	43	5	3 673	1	2	9	..
208	HeidelbergCement	Construction & building (13)	Germany	43	-2	6 372	1	7	1	54
209	Telekom Austria	Telecommunication services (67)	Austria	43	41	3 970	1	10	3	155
210	Novar	Construction & building (13)	UK	42	15	2 030	2	-2	3	44
211	Enel	Electricity (72)	Italy	42	-58	28 937	0	14	1	132
212	Umicore	Steel & other metals (18)	Belgium	42	4 784	4 677	1	2	4	28
213	Gildemeister	Engineering & machinery (26)	Germany	42	-13	978	4	4	8	27
214	Pilkington	Construction & building (13)	UK	41	-3	3 463	1	8	2	50
215	Burelle	Automobiles & parts (31)	France	41	9	1 951	2	4	5	..
216	Christian Dior	Household goods & textiles (34)	France	41	-13	12 466	0	13	1	70
217	Gamesa	Engineering & machinery (26)	Spain	41	22	1 572	3	15	7	172
218	Groupe SEB	Household goods & textiles (34)	France	41	9	2 348	2	8	3	64
219	Alfa Laval	Engineering & machinery (26)	Sweden	41	4	1 533	3	8	4	93
220	Filtronic	IT hardware (93)	UK	40	-12	342	12	3	14	54
221	CSM	Food producers (43)	The Netherlands	40	14	3 517	1	7	3	42
222	GN Store Nord	IT hardware (93)	Denmark	40	-50	637	6	2	9	228
223	IMI	Engineering & machinery (26)	UK	40	0	2 232	2	8	2	81
224	William Demant	Health (44)	Denmark	40	8	520	8	22	9	370
225	Sidel	Engineering & machinery (26)	France	40	5	981	4	5	9	..
226	Industria de Turbo Propulsores	Aerospace & defence (21)	Spain	39	3	405	10	7	18	..
227	Pace Micro Technology	Household goods & textiles (34)	UK	38	-27	236	16	-30	50	81
228	e Biscom	Telecommunication services (67)	Italy	38	-32	529	7	-69	26	..
229	Aegis	Media & entertainment (54)	UK	37	5	921	4	8	4	144
230	Leoni	Electronic & electrical (25)	Germany	37	12	1 080	3	5	2	38
231	Gedeon Richter	Pharma & biotech (48)	Hungary	36	16	555	7	22	..	263
232	Bekaert	Engineering & machinery (26)	Belgium	36	-14	1 797	2	8	3	59
233	Metsaliitto	Forestry & paper (15)	Finland	36	13	8 318	0	1	1	..
234	SkyePharma	Pharma & biotech (48)	UK	36	66	75	47	-75	75	659
235	Fortum	Oil & gas (07)	Finland	35	-8	11 392	0	12	3	82
236	GPC Biotech	Pharma & biotech (48)	Germany	35	-10	21	166	-129	193	1 314
237	Ingenico	Electronic & electrical (25)	France	34	-20	356	10	-7	19	128
238	Barilla	Food producers (43)	Italy	34	..	3 436	1	3	3	..
239	Technip-Coflexip (now Technip)	Engineering & machinery (26)	France	33	-11	4 711	1	2	2	58
240	Jungheinrich	Engineering & machinery (26)	Germany	33	11	1 471	2	5	4	19
241	Duerr	Engineering & machinery (26)	Germany	33	-6	2 265	2	1	3	11
242	Ahlstrom	Chemicals (11)	Finland	33	19	1 556	2	3	5	..
243	Micronic Laser Systems	IT hardware (93)	Sweden	33	-5	47	70	-45	105	468
244	Neopost	Electronic & electrical (25)	France	33	-2	751	4	20	7	186
245	Recordati	Pharma & biotech (48)	Italy	33	-7	488	7	9	15	162
246	Haldex	Automobiles & parts (31)	Sweden	33	2	665	5	3	8	38
247	Zambon	Pharma & biotech (48)	Italy	32	2	459	7	10	13	..
248	TTP Communications	IT hardware (93)	UK	32	5	70	46	-7	65	257
249	IBS	Software & computer services (97)	Sweden	32	-8	265	12	1	16	29
250	BHP Billiton	Mining	UK	32	0	12 374	0	21	1	142

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
251	AP Moller-Maersk	Transport (59)	Denmark	32	59	21 100	0	16	1	113
252	Jenoptik	Engineering & machinery (26)	Germany	31	6	1 982	2	-1	3	18
253	Active Biotech	Pharma & biotech (48)	Sweden	31	1	..	..	..	175	..
254	lastminute.com	General retailers (52)	UK	31	82	267	12	-26	26	235
255	Krka	Pharma & biotech (48)	Slovenia	31	13	408	8	15	7	251
256	Anglo American	Mining	UK	31	35	14 776	0	14	0	211
257	AMER	Household goods & textiles (34)	Finland	31	29	1 104	3	9	8	92
258	Dialog Semiconductor	IT hardware (93)	UK	31	-2	93	33	-31	112	136
259	Boots	General retailers (52)	UK	30	-17	7 557	0	10	0	97
260	De La Rue	Support services (58)	UK	30	-17	969	3	3	4	87
261	Societe BIC	Household goods & textiles (34)	France	30	-18	1 360	2	13	4	134
262	PUMA	Household goods & textiles (34)	Germany	30	24	1 274	2	21	11	245
263	BBC	Media & entertainment (54)	UK	30	23	5 259	1	-10	1	..
264	Industrial & Financial Systems	Support services (58)	Sweden	30	18	257	12	-1	10	30
265	Beru	Automobiles & parts (31)	Germany	30	69	354	8	15	11	151
266	Sud-Chemie	Chemicals (11)	Germany	29	3	763	4	6	6	43
267	Sopra	Software & computer services (97)	France	29	11	521	6	7	5	72
268	Getinge	Health (44)	Sweden	28	4	1 009	3	14	5	171
269	Meggitt	Aerospace & defence (21)	UK	28	-13	571	5	16	8	161
270	Acambis	Pharma & biotech (48)	UK	28	22	240	12	22	91	214
271	Vestas Wind Systems	Electronic & electrical (25)	Denmark	28	38	1 653	2	5	4	107
272	Coloplast	Health (44)	Denmark	28	..	761	4	16	5	223
273	Tessenderlo	Chemicals (11)	Belgium	27	5	1 972	1	5	3	38
274	NKT	Electronic & electrical (25)	Denmark	27	-15	782	4	2	6	56
275	BTG	Support services (58)	UK	27	23	69	39	-57	167	320
276	Nolato	Chemicals (11)	Sweden	27	4	294	9	2	12	42
277	M-real	Media & entertainment (54)	Finland	27	4	6 044	0	1	1	17
278	Compagnie Generale de Geophysique	Oil & gas (07)	France	27	-1	612	4	1	8	80
279	Campina	Food producers (43)	The Netherlands	27	11	3 655	1	1	4	..
280	Kidde	Engineering & machinery (26)	UK	27	2	1 331	2	12	3	107
281	Kontron	IT hardware (93)	Germany	26	1	229	12	-11	17	119
282	Sudzucker	Food producers (43)	Germany	26	2	4 575	1	10	1	60
283	Henlys	Engineering & machinery (26)	UK	26	13	445	6	-8	9	..
284	Andritz	Engineering & machinery (26)	Austria	26	-16	1 225	2	4	6	41
285	Innogenetics	Pharma & biotech (48)	Belgium	25	17	65	39	-26	43	528
286	Merant (now part of Serena Software, US)	Software & computer services (97)	UK	25	-25	112	23	-18	42	..
287	Dunlop Standard Aerospace	Aerospace & defence (21)	UK	25	20	648	4	13	6	..
288	JCB Service	Engineering & machinery (26)	UK	24	-11	1 159	2	2	6	..
289	Tate & Lyle	Food producers (43)	UK	24	-6	4 079	1	9	4	55
290	Nutreco	Food producers (43)	The Netherlands	24	12	3 674	1	-3	2	22
291	KSB	Engineering & machinery (26)	Germany	24	3	1 178	2	3	2	21
292	Guerbet	Pharma & biotech (48)	France	24	33	225	11	10	21	72
293	Elisa Communications	Telecommunication services (67)	Finland	24	-33	1 538	2	-2	3	91
294	Qiagen	Pharma & biotech (48)	The Netherlands	23	8	279	8	20	15	409
295	Telelogic	Software & computer services (97)	Sweden	23	-17	103	23	1	34	291
296	KPN	Telecommunication services (67)	The Netherlands	23	-28	11 870	0	27	1	122
297	Auriga Industries	Chemicals (11)	Denmark	23	-9	600	4	6	8	26
298	Imagination Technologies	IT hardware (93)	UK	23	25	44	52	-14	84	377
299	Galen (now Warner Chilcott)	Pharma & biotech (48)	UK	23	15	343	7	29	22	470
300	OMV	Oil & gas (07)	Austria	23	-0	7 644	0	9	4	62

Table A2.1 (cont.)

Listing of the EU-500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02					
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
301	Rexam	Support services (58)	UK	23	-20	4 417	1	7	1	79
302	Fuchs Petrolub	Chemicals (11)	Germany	23	-4	1 041	2	7	5	43
303	Seco Tools	Engineering & machinery (26)	Sweden	23	14	432	5	17	6	136
304	Radiometer	Health (44)	Denmark	22	-9	241	9	17	13	201
305	Morgan Crucible	Engineering & machinery (26)	UK	22	-22	1 206	2	-4	2	45
306	Unit 4 Agresso	Software & computer services (97)	The Netherlands	22	-3	219	10	9	15	120
307	IONA Technologies	Software & computer services (97)	Ireland	22	-31	59	37	-59	61	131
308	Euronext	Speciality & other finance (87)	The Netherlands	21	21	975	2	19	8	258
309	Xenova	Pharma & biotech (48)	UK	21	-15	11	195	-218	204	518
310	Rockwool International	Construction & building (13)	Denmark	21	8	1 103	2	6	3	70
311	Diageo	Beverages (41)	UK	21	-46	13 397	0	24	1	221
312	Karstadt Quelle	General retailers (52)	Germany	21	28	15 270	0	2	0	13
313	Vaisala	Electronic & electrical (25)	Finland	21	-5	189	11	13	19	134
314	Raisio	Food producers (43)	Finland	21	4	861	3	-2	8	33
315	Aviagen	Food producers (43)	UK	21	-13	225	9	17	14	..
316	SGL Carbon	Electronic & electrical (25)	Germany	21	-18	1 046	2	1	3	46
317	TUI	Leisure & hotels (53)	Germany	21	-22	19 215	0	2	0	15
318	NSB	Software & computer services (97)	UK	21	-15	91	23	-44	22	139
319	Elekta	Health (44)	Sweden	21	31	306	7	12	21	181
320	Stada Arzneimittel	Pharma & biotech (48)	Germany	21	29	745	3	11	8	113
321	MGI Coutier	Automobiles & parts (31)	France	21	-6	489	4	2	7	15
322	ELMOS Semiconductor	IT hardware (93)	Germany	20	-9	121	17	17	23	182
323	LGP ALLGON <i>(now part of Powerwave Technologies, US)</i>	IT hardware (93)	Sweden	20	116	233	9	-5	16	112
324	Medigene	Pharma & biotech (48)	Germany	20	-37	2	1 013	-1 600	163	4 250
325	Renishaw	Electronic & electrical (25)	UK	20	2	157	13	14	13	358
326	Charter	Engineering & machinery (26)	UK	20	4	1 236	2	3	2	27
327	Clarins	Personal care & household (47)	France	20	20	889	2	11	4	169
328	Crucell	Pharma & biotech (48)	The Netherlands	20	-9	5	401	-580	110	4 360
329	Abengoa	Diversified industrials (24)	Spain	20	103	1 635	1	5	2	38
330	International Power	Electricity (72)	UK	20	..	1 209	2	-14	8	191
331	British Energy	Electricity (72)	UK	20	-7	2 152	1	24	4	9
332	Anoto	IT hardware (93)	Sweden	19	-32	21	91	-181	105	724
333	iXOS Software	Software & computer services (97)	Germany	19	21	127	15	-3	22	143
334	Ureco	Support services (58)	UK	19	22	632	3	27	11	..
335	Egis Pharmaceuticals	Pharma & biotech (48)	Hungary	19	30	307	6	8	4	85
336	Enodis	Engineering & machinery (26)	UK	19	-2	964	2	5	3	54
337	Antisoma	Pharma & biotech (48)	UK	19	10	17	109	-47	411	312
338	Union Electrica Fenosa	Electricity (72)	Spain	19	-81	5 509	0	10	1	97
339	IMERYS	Construction & building (13)	France	18	-26	2 729	1	11	1	115
340	Biotest	Pharma & biotech (48)	Germany	18	-2	222	8	3	17	25
341	Recticel	Chemicals (11)	Belgium	18	19	1 238	2	1	2	14
342	Ion Beam Applications	Health (44)	Belgium	18	48	234	8	-44	11	61
343	Axis-Shield	Pharma & biotech (48)	UK	18	30	71	26	-20	40	172
344	Rio Tinto	Mining	UK	18	-8	7 316	0	24	1	438
345	ISOFT	Software & computer services (97)	UK	18	61	212	9	14	14	558
346	Compagnie Industriali Riunite	Diversified industrials (24)	Italy	18	11	2 839	1	8	2	40
347	GW Pharmaceuticals	Pharma & biotech (48)	UK	18	18	7	257	-214	153	2 671
348	Ultra Electronics	Aerospace & defence (21)	UK	18	19	404	5	11	7	145
349	Oxford Instruments	Electronic & electrical (25)	UK	18	-4	266	7	3	11	49
350	Psion	IT hardware (93)	UK	18	0	183	10	-17	19	197

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
351	London Bridge Software <i>(now part of Fair Isaac, US)</i>	Software & computer services (97)	UK	18	-7	83	22	1	24	..
352	Transgene	Pharma & biotech (48)	France	18	2	3	592	-733	107	2 267
353	Spector Photo	Media & entertainment (54)	Belgium	18	-3	377	5	5	11	16
354	ARC International	IT hardware (93)	UK	18	-5	15	118	-267	89	340
355	Oberthur Card Systems	Electronic & electrical (25)	France	18	-12	430	4	7	6	99
356	Hunter Douglas	Household goods & textiles (34)	The Netherlands	17	-19	1 655	1	11	1	92
357	Rautaruukki	Steel & other metals (18)	Finland	17	0	2 953	1	4	1	33
358	Q-Med	Pharma & biotech (48)	Sweden	17	3	67	25	-3	40	157
359	Delft Instruments	Engineering & machinery (26)	The Netherlands	17	-2	237	7	8	15	..
360	Dyson Technology	Household goods & textiles (34)	UK	17	48	333	5	8	10	..
361	RM	Software & computer services (97)	UK	17	-15	306	5	2	11	50
362	Singulus Technologies	Engineering & machinery (26)	Germany	16	1	363	5	17	27	134
363	SSL International	Health (44)	UK	16	-12	855	2	6	3	94
364	Alizyme	Pharma & biotech (48)	UK	16	18	2	809	-800	1 079	16 100
365	Flamel Technologies	Pharma & biotech (48)	France	16	65	20	80	-20	92	1 600
366	Yule Catto	Chemicals (11)	UK	16	-8	766	2	11	5	76
367	Aliaxis	Construction & building (13)	Belgium	16	-28	1 612	1	9	1	..
368	Sanitec	Construction & building (13)	Finland	16	-19	951	2	-5	2	..
369	Uponor	Engineering & machinery (26)	Finland	16	0	1 021	2	2	3	98
370	Halma	Engineering & machinery (26)	UK	16	17	415	4	16	6	188
371	Exact	Software & computer services (97)	The Netherlands	16	-16	206	8	20	8	241
372	FKI	Engineering & machinery (26)	UK	16	44	1 909	1	3	1	52
373	Wagon	Automobiles & parts (31)	UK	16	-23	691	2	3	3	24
374	Systems Union	Software & computer services (97)	UK	16	4	111	14	6	18	118
375	ML Laboratories	Pharma & biotech (48)	UK	16	1	9	172	-133	100	611
376	Evotec OAI	Pharma & biotech (48)	Germany	16	-33	77	20	-20	24	130
377	Hexagon	Engineering & machinery (26)	Sweden	15	26	783	2	6	3	60
378	Bohler-Uddeholm	Steel & other metals (18)	Austria	15	-9	1 500	1	8	2	47
379	Oxford Biomedica	Pharma & biotech (48)	UK	15	-1	1	1 529	-1 900	212	8 500
380	Lenzing	Chemicals (11)	Austria	15	13	622	3	12	5	..
381	NicOx	Pharma & biotech (48)	France	15	7	1	1 522	-2 000	254	6 800
382	Hoganas	Mining	Sweden	15	3	413	4	15	9	150
383	FLS Industries	Engineering & machinery (26)	Denmark	15	-26	2 003	1	-21	2	29
384	Dynaction	Chemicals (11)	France	15	-10	257	6	2	8	19
385	Provimi	Food producers (43)	France	15	40	1 545	1	6	2	24
386	Saipem	Oil & gas (07)	Italy	15	7	4 105	0	11	1	81
387	Ilog	Software & computer services (97)	France	15	23	73	21	3	25	201
388	Cardo	Engineering & machinery (26)	Sweden	15	-43	847	2	6	2	71
389	Microscience	Pharma & biotech (48)	UK	15	-5	..	..	..	204	..
390	Anite	Software & computer services (97)	UK	15	65	307	5	-44	7	81
391	Lectra	Software & computer services (97)	France	14	5	185	8	5	11	129
392	Intec Telecom Systems	Software & computer services (97)	UK	14	26	72	20	-4	27	253
393	Aixtron	IT hardware (93)	Germany	14	18	91	16	-32	35	299
394	Balfour Beatty	Construction & building (13)	UK	14	-17	4 486	0	4	1	42
395	mm02	Telecommunication services (67)	UK	14	11	8 081	0	3	1	136
396	National Grid Transco	Utilities - other (73, 78)	UK	14	-45	12 820	0	23	1	149
397	Interbrew	Beverages (41)	Belgium	14	-7	7 044	0	12	0	147
398	Huhtamaki	Support services (58)	Finland	14	17	2 108	1	5	1	51
399	PPL Therapeutics	Pharma & biotech (48)	UK	14	-13	..	..	..	68	..
400	WEB DE	Software & computer services (97)	Germany	14	17	33	42	-9	42	809

Table A2.1 (cont.)

Listing of the EU-500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02					
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
401	Axis	IT hardware (93)	Sweden	14	5	69	20	0	39	145
402	Empire Interactive	Software & computer services (97)	UK	14	-11	43	32	2	87	21
403	Biacore International	Health (44)	Sweden	14	18	57	24	7	41	191
404	AMS	Aerospace & defence (21)	UK	13	-7	698	2	7	3	..
405	BBA	Transport (59)	UK	13	-8	1 888	1	6	1	95
406	Intercell	Pharma & biotech (48)	Austria	13	35	1	1 333	-1 600	111	..
407	BE Semiconductor Industries	IT hardware (93)	The Netherlands	13	6	86	15	-23	19	159
408	K+S	Chemicals (11)	Germany	13	-1	2 288	1	5	1	54
409	Cambridge Silicon Radio (now CSR)	Electronic & electrical (25)	UK	13	32	54	24	-4	71	1 078
410	Gardena	Household goods & textiles (34)	Germany	13	-6	398	3	1	4	..
411	Edison	Utilities - other (73. 78)	Italy	13	-74	5 426	0	8	3	102
412	Augusta Technologie	IT hardware (93)	Germany	13	-14	236	5	-1	12	4
413	SAES Getters	Electronic & electrical (25)	Italy	13	-6	126	10	-4	12	69
414	Lucite International	Chemicals (11)	UK	13	-10	985	1	10	6	..
415	AGBAR	Utilities - other (73. 78)	Spain	13	-39	2 677	1	6	1	78
416	Simcorp	Software & computer services (97)	Denmark	13	-16	67	19	9	24	236
417	Villeroy & Boch	Household goods & textiles (34)	Germany	13	-5	949	1	5	1	13
418	LION Bioscience	Software & computer services (97)	Germany	13	-64	20	63	-115	71	45
419	Radiall	IT hardware (93)	France	13	3	145	9	-2	8	89
420	Vitec	Engineering & machinery (26)	UK	13	11	274	5	6	8	69
421	Telemetrix (now Zetex)	IT hardware (93)	UK	12	17	130	10	-11	12	169
422	ADVA	Software & computer services (97)	Germany	12	7	90	14	4	31	189
423	Pharmexa	Pharma & biotech (48)	Denmark	12	-29	3	411	-533	116	1 200
424	TT Electronics	Electronic & electrical (25)	UK	12	6	758	2	1	2	47
425	Bacou-Dalloz	Household goods & textiles (34)	France	12	-4	796	2	8	2	44
426	Funkwerk	Support services (58)	Germany	12	41	179	7	10	13	150
427	Domino Printing Sciences	Electronic & electrical (25)	UK	12	3	233	5	12	7	141
428	Danieli	Engineering & machinery (26)	Italy	12	-25	987	1	3	4	23
429	Plasmon	IT hardware (93)	UK	12	-17	71	17	-7	29	238
430	Melexis	IT hardware (93)	Belgium	12	20	134	9	19	22	283
431	Cerep	Pharma & biotech (48)	France	12	8	34	35	-3	35	324
432	Dyckerhoff (now part of Buzzi Unicem, Italy)	Construction & building (13)	Germany	12	-27	1 320	1	7	1	73
433	Autonomy	Software & computer services (97)	UK	12	35	47	25	2	55	555
434	XRT	Software & computer services (97)	France	12	13	39	29	0	31	54
435	Brembo	Automobiles & parts (31)	Italy	11	25	634	2	9	3	60
436	Roxboro	Electronic & electrical (25)	UK	11	-15	194	6	5	7	70
437	Genus	Support services (58)	UK	11	-7	245	5	5	8	43
438	Beta Systems Software	Software & computer services (97)	Germany	11	29	56	20	9	31	113
439	LISI	Aerospace & defence (21)	France	11	-17	506	2	8	2	78
440	Muhlbauer	Engineering & machinery (26)	Germany	11	6	95	12	8	9	185
441	Rational	Engineering & machinery (26)	Germany	11	12	187	6	23	17	293
442	First Technology	Electronic & electrical (25)	UK	11	-3	181	6	9	7	177
443	BG	Oil & gas (07)	UK	11	-27	5 091	0	34	3	338
444	Pharmagene	Pharma & biotech (48)	UK	11	-8	7	160	-157	141	500
445	Holmen	Forestry & paper (15)	Sweden	11	10	1 743	1	15	2	112
446	Eniro	Media & entertainment (54)	Sweden	11	2	540	2	13	2	190
447	Swedish Match	Tobacco (49)	Sweden	11	1	1 436	1	17	1	190
448	Sygen International	Food producers (43)	UK	11	12	188	6	6	9	70
449	Tarkett Sommer (now Tarkett)	Household goods & textiles (34)	Germany	11	-4	1 349	1	7	2	34
450	Photo-Me	Media & entertainment (54)	UK	11	55	312	4	10	6	189

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
451	Northgate Information Solutions	Software & computer services (97)	UK	11	11	194	6	-6	6	203
452	Head	Household goods & textiles (34)	The Netherlands	11	24	342	3	0	..	28
453	ESI	Software & computer services (97)	France	11	11	43	25	-2	29	140
454	Skanditek	Electronic & electrical (25)	Sweden	11	17	57	19	-4	31	240
455	Energie Baden	Electricity (72)	Germany	11	..	10 609	0	-5	0	24
456	Channel Four Television	Media & entertainment (54)	UK	11	6	1 092	1	6	13	..
457	Staffware (now part of Tibco Software, US)	Software & computer services (97)	UK	11	6	61	17	7	30	..
458	Biotie Therapies	Pharma & biotech (48)	Finland	11	-51	2	528	-700	160	..
459	SUSS MicroTec	IT hardware (93)	Germany	11	-16	96	11	-18	14	90
460	Thrane & Thrane	Electronic & electrical (25)	Denmark	10	63	86	12	14	26	176
461	Miba	Automobiles & parts (31)	Austria	10	-4	294	4	8	4	12
462	Mayflower	Automobiles & parts (31)	UK	10	181	884	1	3	2	..
463	DICOM	Software & computer services (97)	UK	10	-2	222	5	5	13	103
464	Phytopharm	Pharma & biotech (48)	UK	10	20	3	342	-267	302	3 033
465	Medisys	Health (44)	UK	10	-52	56	18	-13	32	86
466	Biotage	Pharma & biotech (48)	Sweden	10	-30	19	53	-153	61	284
467	Vectura	Pharma & biotech (48)	UK	10	163	5	200	-200	102	1 760
468	Hellenic Telecommunications	Telecommunication services (67)	Greece	10	93	4 270	0	16	1	111
469	Ubizen	Software & computer services (97)	Belgium	10	5	72	14	-53	29	114
470	BWT	Engineering & machinery (26)	Austria	10	-21	416	2	3	4	79
471	Elektrobit	Support services (58)	Finland	10	1	149	7	11	9	194
472	Boliden	Mining	Sweden	10	-6	1 052	1	4	3	36
473	Kyro	Engineering & machinery (26)	Finland	10	49	227	4	9	10	125
474	Coop Norden	Food & drug retailers (63)	Sweden	10	-14	8 736	0	0	0	..
475	AVEVA	Software & computer services (97)	UK	10	16	54	18	17	30	306
476	Sydsvenska Kemi	Chemicals (11)	Sweden	10	24	633	2	6	4	..
477	Royalblue	Software & computer services (97)	UK	10	13	80	12	14	20	258
478	Croda International	Chemicals (11)	UK	10	11	431	2	14	6	130
479	AEA Technology	Support services (58)	UK	10	-52	357	3	2	3	55
480	Memscap	IT hardware (93)	France	10	70	6	158	-483	37	467
481	Epigenomics	Pharma & biotech (48)	Germany	10	1	11	86	-64	66	..
482	Schouw	Diversified industrials (24)	Denmark	10	13	414	2	1	4	52
483	Games Workshop	Household goods & textiles (34)	UK	9	6	215	4	13	3	141
484	Tecnomen	Software & computer services (97)	Finland	9	-16	45	21	-16	21	158
485	Innovation	Software & computer services (97)	UK	9	-19	83	11	-42	9	181
486	Baxi	General retailers (52)	UK	9	-5	933	1	8	2	..
487	Gyrus	Health (44)	UK	9	-18	111	8	4	14	217
488	NXT	Electronic & electrical (25)	UK	9	3	11	82	-136	52	636
489	Bespak	Health (44)	UK	9	15	125	7	2	11	147
490	Karo Bio	Pharma & biotech (48)	Sweden	9	3 654	9	100	-267	77	267
491	Morphosys	Pharma & biotech (48)	Germany	9	-54	15	60	-20	95	787
492	Vacon	Electronic & electrical (25)	Finland	9	14	112	8	11	21	146
493	Baltimore Technologies	Speciality & other finance (87)	UK	9	-43	26	35	-96	40	65
494	PSI	Software & computer services (97)	Germany	9	-22	138	7	0	7	24
495	Pfeiffer Vacuum Technology	Engineering & machinery (26)	Germany	9	-14	144	6	13	12	188
496	F-Secure	Software & computer services (97)	Finland	9	-10	39	22	8	30	577
497	Alvis	Aerospace & defence (21)	UK	9	11	495	2	5	3	101
498	Hackman	Household goods & textiles (34)	Finland	9	5	346	3	6	3	..
499	Glunz & Jensen	IT hardware (93)	Denmark	9	30	92	9	-9	22	11
500	Bavarian Nordic	Pharma & biotech (48)	Denmark	9	5	68	13	43	104	499

Table A2.2

Listing of the non-EU 500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
Top 500 companies				195 637	3.9	4 342 382	4.5	9.1	12.1	138
<i>number of companies for calculation</i>				<i>500</i>	<i>496</i>	<i>500</i>	<i>500</i>	<i>500</i>	<i>477</i>	<i>492</i>
1	Ford Motor	Automobiles & parts (31)	US	5 946	-3	130 865	5	6	18	16
2	Pfizer	Pharma & biotech (48)	US	5 654	38	35 825	16	7	46	544
3	Toyota Motor	Automobiles & parts (31)	Japan	4 945	13	114 672	4	8	19	99
4	General Motors	Automobiles & parts (31)	US	4 519	-2	147 084	3	7	14	13
5	Matsushita Electric	Electronic & electrical (25)	Japan	4 285	5	55 331	8	3	15	47
6	IBM	Software & computer services (97)	US	4 011	7	70 663	6	11	13	165
7	Johnson & Johnson	Pharma & biotech (48)	US	3 714	18	33 188	11	25	34	392
8	Microsoft	Software & computer services (97)	US	3 694	8	25 518	15	40	67	957
9	Intel	IT hardware (93)	US	3 457	8	23 896	15	24	43	536
10	Sony	Electronic & electrical (25)	Japan	3 278	2	55 286	6	2	20	46
11	Honda Motor	Automobiles & parts (31)	Japan	3 232	11	58 969	6	8	26	64
12	Roche	Pharma & biotech (48)	Switzerland	3 055	12	20 012	15	18	47	351
13	Motorola	IT hardware (93)	US	2 990	1	21 452	14	4	34	141
14	Novartis	Pharma & biotech (48)	Switzerland	2 978	7	19 712	15	23	38	502
15	NTT	Telecommunication services (67)	Japan	2 929	1	80 803	4	13	14	129
16	Hewlett-Packard	IT hardware (93)	US	2 895	10	57 923	5	4	20	85
17	Hitachi	IT hardware (93)	Japan	2 751	-1	63 858	4	2	8	26
18	Merck	Pharma & biotech (48)	US	2 520	19	17 827	14	42	40	449
19	Toshiba	IT hardware (93)	Japan	2 491	2	41 274	6	3	16	23
20	Cisco Systems	IT hardware (93)	US	2 485	-9	14 967	17	23	73	761
21	Samsung Electronic	Electronic & electrical (25)	South Korea	2 382	18	43 127	6	10	..	104
22	Nissan Motor	Automobiles & parts (31)	Japan	2 222	15	50 514	4	10	17	75
23	Fujitsu	IT hardware (93)	Japan	2 114	-18	34 158	6	-3	14	29
24	General Electric	Diversified industrials (24)	US	2 106	20	105 356	2	21	7	256
25	Canon	Electronic & electrical (25)	Japan	1 917	11	23 658	8	15	19	145
26	NEC	IT hardware (93)	Japan	1 899	-13	36 298	5	3	13	26
27	Eli Lilly	Pharma & biotech (48)	US	1 863	9	9 975	19	26	40	570
28	Bristol-Myers Squibb	Pharma & biotech (48)	US	1 807	3	16 565	11	23	41	213
29	Nortel Networks	IT hardware (93)	Canada	1 768	-31	8 372	21	-37	34	146
30	Wyeth	Pharma & biotech (48)	US	1 660	1	12 566	13	11	32	298
31	Delphi	Automobiles & parts (31)	US	1 586	18	22 275	7	2	8	19
32	Sun Microsystems	IT hardware (93)	US	1 456	0	9 065	16	-24	40	116
33	Texas Instruments	IT hardware (93)	US	1 386	8	7 796	18	9	41	373
34	Abbott Laboratories	Health (44)	US	1 374	11	15 603	9	20	20	312
35	Denso	Automobiles & parts (31)	Japan	1 353	-2	17 256	8	10	15	99
36	Procter & Gamble	Personal care & household (47)	US	1 320	4	34 389	4	18	14	316
37	Amgen	Pharma & biotech (48)	US	1 312	48	6 625	20	37	102	863
38	Boeing	Aerospace & defence (21)	US	1 309	1	40 025	3	2	8	84
39	Mitsubishi Electric	IT hardware (93)	Japan	1 196	-21	26 920	4	0	11	29
40	Lucent Technologies	IT hardware (93)	US	1 180	-36	6 715	18	-9	34	154
41	Fuji Photo Film	Media & entertainment (54)	Japan	1 177	8	18 536	6	5	16	66
42	Schering-Plough	Pharma & biotech (48)	US	1 165	3	6 607	18	-1	38	341
43	Sharp	Electronic & electrical (25)	Japan	1 126	21	14 819	8	3	24	86
44	El du Pont de Nemours	Chemicals (11)	US	1 070	7	21 403	5	2	13	159
45	Oracle	Software & computer services (97)	US	936	10	7 512	13	35	23	582
46	Takeda Chemical	Pharma & biotech (48)	Japan	919	24	7 738	12	37	63	429
47	Sanyo Electric	Electronic & electrical (25)	Japan	894	13	16 821	5	-3	11	33
48	Agilent Technologies	Electronic & electrical (25)	US	833	-10	4 801	17	-16	29	189
49	United Technologies	Diversified industrials (24)	US	814	-14	24 604	3	12	4	154

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
50	Mitsubishi Heavy	Engineering & machinery (26)	Japan	810	-8	19 188	4	4	13	36
51	Dow Chemical	Chemicals (11)	US	778	-8	25 871	3	7	17	114
52	Nestle	Food producers (43)	Switzerland	772	-0	56 396	1	11	3	145
53	Applied Materials	IT hardware (93)	US	730	-13	3 550	21	-7	61	646
54	Lockheed Martin	Aerospace & defence (21)	US	716	9	25 230	3	6	6	75
55	Visteon	Automobiles & parts (31)	US	716	0	14 001	5	-6	10	8
56	Xerox	IT hardware (93)	US	688	-5	12 448	6	3	11	71
57	Ricoh	Electronic & electrical (25)	Japan	684	11	13 169	5	6	9	87
58	Advanced Micro Devices	IT hardware (93)	US	676	4	2 434	28	-7	47	143
59	Mitsubishi Chemical	Chemicals (11)	Japan	674	8	13 963	5	4	18	30
60	EMC	IT hardware (93)	US	660	-8	4 945	13	6	33	425
61	Mazda Motor	Automobiles & parts (31)	Japan	650	-8	17 491	4	2	18	19
62	Sankyo	Pharma & biotech (48)	Japan	641	6	4 216	15	13	56	70
63	Hyundai Motor	Automobiles & parts (31)	South Korea	638	55	30 998	2	6	..	24
64	Eastman Kodak	Media & entertainment (54)	US	619	3	10 558	6	1	10	57
65	Allergan	Pharma & biotech (48)	US	604	227	1 392	43	-1	123	578
66	Altria	Tobacco (49)	US	604	11	64 877	1	19	4	120
67	Honeywell	Aerospace & defence (21)	US	595	-1	18 316	3	8	6	140
68	Medtronic	Health (44)	US	594	16	6 077	10	31	22	784
69	3M	Diversified industrials (24)	US	594	2	14 454	4	20	9	354
70	Aisin Seiki	Automobiles & parts (31)	Japan	592	18	10 416	6	8	13	49
71	Syngenta	Chemicals (11)	Switzerland	576	4	5 215	11	8	27	141
72	Computer Associates	Software & computer services (97)	US	560	0	2 597	22	0	37	443
73	Sumitomo Chemical	Chemicals (11)	Japan	539	9	8 220	7	6	30	67
74	LG Electronics	Electronic & electrical (25)	South Korea	532	-13	13 425	4	5	19	37
75	Tyco International	Diversified industrials (24)	Bermuda	532	6	23 330	2	10	2	211
76	Caterpillar	Engineering & machinery (26)	US	530	2	18 047	3	8	8	110
77	Bridgestone	Automobiles & parts (31)	Japan	525	4	17 043	3	8	5	72
78	Micron Technology	IT hardware (93)	US	520	17	2 451	21	-37	31	264
79	Broadcom	IT hardware (93)	US	518	-9	1 276	41	-59	190	556
80	Yamanouchi Pharmaceutical	Pharma & biotech (48)	Japan	495	3	3 748	13	19	53	264
81	Exxon Mobil	Oil & gas (07)	US	490	-2	169 025	0	15	5	142
82	Asea Brown Boveri	Electronic & electrical (25)	Switzerland	486	12	14 901	3	-1	4	59
83	BMC Software	Software & computer services (97)	US	465	20	1 125	41	-2	72	242
84	Fujisawa Pharmaceutical	Pharma & biotech (48)	Japan	462	9	2 826	16	11	..	225
85	Deere	Engineering & machinery (26)	US	458	9	10 583	4	6	11	117
86	Suzuki Motor	Automobiles & parts (31)	Japan	447	34	14 908	3	3	..	50
87	Fuji Heavy Industries	Automobiles & parts (31)	Japan	445	10	10 152	4	4	16	33
88	Eisai	Pharma & biotech (48)	Japan	442	9	3 452	13	15	59	196
89	Schlumberger	Oil & gas (07)	US	441	-14	11 014	4	5	6	273
90	Baxter International	Health (44)	US	438	10	7 069	6	14	8	207
91	Qualcomm	IT hardware (93)	US	415	16	3 148	13	30	56	1 481
92	Yamaha Motor	Automobiles & parts (31)	Japan	414	15	7 495	6	6	13	44
93	Guidant	Health (44)	US	411	19	2 932	14	10	34	469
94	Emerson Electric	Electronic & electrical (25)	US	408	-3	11 066	4	12	4	184
95	Electronic Arts	Software & computer services (97)	US	405	27	2 344	17	26	84	502
96	ADP	Support services (58)	US	396	5	5 666	7	21	10	345
97	Daiichi Pharmaceutical	Pharma & biotech (48)	Japan	395	10	2 382	17	11	..	172
98	Matsushita Electric Works	Construction & building (13)	Japan	391	-4	9 122	4	4	8	53
99	Millennium Pharmaceuticals	Pharma & biotech (48)	US	387	45	344	113	-112	253	799
100	Serono	Pharma & biotech (48)	Switzerland	387	36	1 473	26	22	84	385

Table A2.2 (cont.)

Listing of the non-EU 500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02					
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
101	Raytheon	Aerospace & defence (21)	US	386	-17	14 357	3	6	5	78
102	Johnson Controls	Automobiles & parts (31)	US	384	10	17 954	2	5	3	47
103	Pioneer	Electronic & electrical (25)	Japan	381	13	5 185	7	7	11	60
104	Apple Computer	IT hardware (93)	US	373	6	4 921	8	0	34	193
105	Tokyo Electron	IT hardware (93)	Japan	371	-7	3 407	11	-4	37	202
106	Agere Systems	IT hardware (93)	US	370	-33	1 458	25	-15	54	110
107	Asahi Kasei	Chemicals (11)	Japan	365	-1	8 830	4	-7	14	58
108	Sumitomo Electric	Electronic & electrical (25)	Japan	360	0	11 014	3	-1	5	50
109	Boston Scientific	Health (44)	US	358	32	2 756	13	20	24	917
110	Mitsubishi Pharma	Pharma & biotech (48)	Japan	357	41	2 077	17	3	41	201
111	Analog Devices	IT hardware (93)	US	357	6	1 623	22	18	43	729
112	Telstra	Telecommunication services (67)	Australia	356	7	12 242	3	27	10	139
113	Kyocera	IT hardware (93)	Japan	350	17	7 914	4	6	..	146
114	National Semiconductor	IT hardware (93)	US	345	-1	1 326	26	-2	35	368
115	Peoplesoft	Software & computer services (97)	US	343	27	1 797	19	5	28	284
116	LSI Logic	IT hardware (93)	US	343	-5	1 342	26	-16	73	115
117	Japan Tobacco (49)	Tobacco (49)	Japan	329	-16	33 231	1	4	9	14
118	Northrop Grumman	Aerospace & defence (21)	US	317	-2	20 776	2	6	3	72
119	Komatsu	Engineering & machinery (26)	Japan	315	9	8 850	4	3	10	52
120	Chiron	Pharma & biotech (48)	US	310	20	1 400	22	17	58	490
121	Tokyo Electric Power	Electricity (72)	Japan	298	-16	36 389	1	10	6	67
122	Omron	Electronic & electrical (25)	Japan	298	-3	3 958	8	1	13	108
123	Taiwan Semiconductor	IT hardware (93)	Taiwan	297	8	4 840	6	26	19	483
124	Avaya	IT hardware (93)	US	288	-21	3 439	8	2	17	150
125	Kao	Personal care & household (47)	Japan	285	2	6 677	4	13	15	168
126	Maxtor	IT hardware (93)	US	281	-12	3 240	9	3	21	28
127	Alps Electric	Electronic & electrical (25)	Japan	280	28	4 584	6	7	9	41
128	Goodyear	Automobiles & parts (31)	US	278	-8	11 986	2	-2	3	13
129	Mitsui Chemicals	Chemicals (11)	Japan	275	-5	7 791	4	4	22	36
130	Corning	IT hardware (93)	US	273	-29	2 450	11	-14	13	549
131	Cadence Design Systems	Software & computer services (97)	US	270	4	888	30	-3	56	319
132	Asahi Glass	Construction & building (13)	Japan	270	18	12 260	2	7	5	69
133	Genzyme	Pharma & biotech (48)	US	266	14	1 359	20	-2	47	674
134	Toray Industries	Chemicals (11)	Japan	264	-4	7 641	4	4	8	69
135	Dell	IT hardware (93)	US	262	3	32 857	1	9	6	216
136	Whirlpool	Household goods & textiles (34)	US	258	15	9 653	3	6	4	35
137	Olympus Optical	Electronic & electrical (25)	Japan	257	14	4 175	6	9	11	94
138	Applera	Pharma & biotech (48)	US	256	-15	1 409	18	3	47	270
139	JFE	Steel & other metals (18)	Japan	245	..	17 953	1	3	5	62
140	Siebel Systems	Software & computer services (97)	US	245	-16	1 074	23	-3	49	291
141	Veritas Software	Software & computer services (97)	US	241	11	1 385	17	22	37	470
142	NCR	IT hardware (93)	US	240	2	4 438	5	1	8	79
143	TDK	Electronic & electrical (25)	Japan	236	-18	4 504	5	3	7	158
144	Rohm	IT hardware (93)	Japan	235	48	2 591	9	27	14	385
145	Murata Manufacturing	IT hardware (93)	Japan	233	-1	2 922	8	14	9	315
146	Shionogi	Pharma & biotech (48)	Japan	231	2	2 118	11	4	38	227
147	PetroChina	Oil & gas (07)	China	231	34	29 039	1	33	1	239
148	PPG Industries	Chemicals (11)	US	230	6	6 942	3	11	7	116
149	Kyowa Hakko Kogyo	Pharma & biotech (48)	Japan	229	6	2 658	9	4	34	89
150	Synopsys	Software & computer services (97)	US	229	27	933	25	18	52	279

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
151	Tellabs	IT hardware (93)	US	227	-15	777	29	-28	65	378
152	Ono Pharmaceutical	Pharma & biotech (48)	Japan	225	7	999	23	35	..	457
153	Konica (now Konica Minolta)	Media & entertainment (54)	Japan	224	4	4 135	5	6	13	131
154	General Dynamics	Aerospace & defence (21)	US	224	12	13 174	2	8	3	118
155	Kimberly-Clark	Personal care & household (47)	US	223	-3	11 375	2	16	4	227
156	Unisys	Software & computer services (97)	US	222	3	4 686	5	8	6	59
157	Teijin	Chemicals (11)	Japan	221	-6	6 587	3	-1	10	39
158	Toyota Industries	Automobiles & parts (31)	Japan	220	-1	7 909	3	3	9	75
159	AT&T	Telecommunication services (67)	US	220	9	27 375	1	15	4	35
160	Adobe Systems	Software & computer services (97)	US	220	13	1 026	21	29	63	781
161	Taisho Pharmaceutical	Pharma & biotech (48)	Japan	218	-8	2 027	11	20	45	271
162	Maxim Integrated Products	IT hardware (93)	US	216	-1	914	24	39	35	1 369
163	Nvidia	IT hardware (93)	US	214	20	1 445	15	5	117	140
164	Kla-Tencor	IT hardware (93)	US	213	-7	1 049	20	11	43	612
165	Lexmark	IT hardware (93)	US	211	7	3 770	6	13	18	242
166	Sega	Software & computer services (97)	Japan	205	19	1 459	14	2	59	128
167	Amazon.com	General retailers (52)	US	204	2	4 173	5	3	26	301
168	Nikon	IT hardware (93)	Japan	204	1	3 469	6	-3	15	80
169	Intuit	Software & computer services (97)	US	203	14	1 309	16	22	30	442
170	Textron	Diversified industrials (24)	US	202	23	7 816	3	5	5	86
171	Teradyne	IT hardware (93)	US	202	-13	1 073	19	-13	33	245
172	Kansai Electric Power	Electricity (72)	Japan	202	-11	19 345	1	9	6	73
173	Symantec	Software & computer services (97)	US	200	28	1 483	14	28	38	774
174	Dana	Automobiles & parts (31)	US	200	-12	6 314	3	6	3	36
175	Cypress Semiconductor	IT hardware (93)	US	199	-13	663	30	-1	49	167
176	Accenture	Support services (58)	Bermuda	199	7	10 621	2	12	3	103
177	Fuji Electric	Electronic & electrical (25)	Japan	198	-5	6 158	3	2	8	23
178	Clariant	Chemicals (11)	Switzerland	197	-13	5 459	4	4	7	45
179	Korea Electric Power	Electricity (72)	South Korea	197	-14	14 528	1	23	6	58
180	Atmel	IT hardware (93)	US	196	-2	1 055	19	-6	25	153
181	Xilinx	IT hardware (93)	US	196	12	1 108	18	23	71	731
182	Ajinomoto	Food producers (43)	Japan	196	-2	7 307	3	7	8	82
183	Forest Laboratories	Pharma & biotech (48)	US	195	20	2 101	9	35	39	671
184	Shin-Etsu Chemical	Chemicals (11)	Japan	195	-4	6 161	3	15	11	185
185	Kirin Brewery	Beverages (41)	Japan	192	13	8 624	2	8	8	89
186	Navistar International	Engineering & machinery (26)	US	192	11	5 819	3	3	14	34
187	St Jude Medical	Health (44)	US	191	20	1 532	13	24	26	621
188	KT	Telecommunication services (67)	South Korea	190	4	7 701	3	8	5	90
189	Comverse Technology	IT hardware (93)	US	190	-3	607	31	-3	41	436
190	Rohm & Haas	Chemicals (11)	US	189	-9	5 091	4	8	11	137
191	ChevronTexaco	Oil & gas (07)	US	189	8	80 966	0	14	4	100
192	Halliburton	Oil & gas (07)	US	189	-3	12 900	2	-3	2	86
193	Yokogawa Electric	Electronic & electrical (25)	Japan	187	31	2 432	8	-5	10	95
194	Becton Dickinson	Health (44)	US	186	-22	3 590	5	17	8	264
195	Biogen Idec	Pharma & biotech (48)	US	185	157	538	34	-133	50	2 854
196	Furukawa Electric	Electronic & electrical (25)	Japan	184	8	5 257	4	-20	..	41
197	McKesson	Food & drug retailers (63)	US	183	-31	55 105	0	1	7	14
198	Tanabe Seiyaku	Pharma & biotech (48)	Japan	182	5	1 284	14	16	..	137
199	Novellus Systems	IT hardware (93)	US	180	2	733	25	-10	62	432
200	Ciba Specialty Chemicals	Chemicals (11)	Switzerland	180	-4	4 260	4	8	10	91

Table A2.2 (cont.)

Listing of the non-EU 500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02					
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
201	Minolta (now part of Konica Minolta)	Electronic & electrical (25)	Japan	180	-16	3 907	5	4	9	..
202	Dai Nippon Printing	Media & entertainment (54)	Japan	178	3	9 683	2	3	5	88
203	Goodrich	Aerospace & defence (21)	US	177	28	3 475	5	7	9	87
204	Daikin Industries	Electronic & electrical (25)	Japan	177	2	4 237	4	7	11	117
205	Eaton	Electronic & electrical (25)	US	177	10	6 391	3	9	4	121
206	Advantest	IT hardware (93)	Japan	175	-12	723	24	-19	50	644
207	Sepracor	Pharma & biotech (48)	US	175	-10	273	64	-30	178	1 125
208	Sekisui Chemical	Construction & building (13)	Japan	173	4	5 916	3	2	8	53
209	Kubota	Engineering & machinery (26)	Japan	172	-12	6 881	3	3	8	71
210	Marvell Technology	IT hardware (93)	Bermuda	172	44	650	26	7	103	754
211	Rockwell Collins	Aerospace & defence (21)	US	171	-15	2 015	9	15	12	239
212	POSCO	Steel & other metals (18)	South Korea	170	27	11 836	1	17	..	80
213	Teva Pharmaceutical Industries	Pharma & biotech (48)	Israel	169	29	2 598	7	27	15	557
214	ATI Technologies	IT hardware (93)	Canada	169	29	1 098	15	4	77	278
215	Yamaha	Household goods & textiles (34)	Japan	167	0	3 991	4	10	9	61
216	Autodesk	Software & computer services (97)	US	166	21	754	22	11	48	471
217	Calsonic Kansei	Automobiles & parts (31)	Japan	166	8	4 032	4	3	11	31
218	SunGard Data Systems	Software & computer services (97)	US	165	19	2 276	7	22	17	239
219	Yahoo!	Software & computer services (97)	US	164	34	1 288	13	21	30	2 522
220	Danaher	Engineering & machinery (26)	US	164	19	4 197	4	16	6	295
221	IHI	Engineering & machinery (26)	Japan	163	-12	7 538	2	-1	7	20
222	Colgate-Palmolive	Personal care & household (47)	US	162	4	7 851	2	22	4	287
223	Storage Technology	IT hardware (93)	US	162	-5	1 730	9	9	23	129
224	Ingersoll-Rand	Engineering & machinery (26)	US	162	2	7 830	2	9	4	121
225	Gillette	Personal care & household (47)	US	160	9	7 335	2	22	5	422
226	Petroleo Brasileiro	Oil & gas (07)	Brazil	159	37	24 416	1	31	3	97
227	Cummins	Engineering & machinery (26)	US	159	3	4 992	3	3	7	47
228	Ciena	IT hardware (93)	US	158	-22	224	71	-131	87	567
229	Brother Industries	Electronic & electrical (25)	Japan	156	16	3 023	5	8	10	61
230	Beckman Coulter	Health (44)	US	154	6	1 738	9	15	16	155
231	AlCoA	Steel & other metals (18)	US	154	-9	17 048	1	9	1	130
232	Japan Radio	Electronic & electrical (25)	Japan	150	-11	1 919	8	2	..	23
233	Toppan Printing	Media & entertainment (54)	Japan	150	6	9 259	2	5	5	61
234	SK Telecom	Telecommunication services (67)	South Korea	149	15	6 334	2	32	36	142
235	Eastman Chemical	Chemicals (11)	US	149	6	4 598	3	-4	10	60
236	Mentor Graphics	Software & computer services (97)	US	147	13	536	27	2	41	119
237	Networks Associates	Software & computer services (97)	US	146	24	742	20	7	40	317
238	Novell	Software & computer services (97)	US	146	9	876	17	-7	25	255
239	DST Systems	Software & computer services (97)	US	146	25	1 916	8	14	13	161
240	Human Genome Sciences	Pharma & biotech (48)	US	145	-9	6	2 422	-3 000	132	16 767
241	China Petroleum & Chemical	Oil & gas (07)	China	145	17	31 339	1	9	0	184
242	Stryker	Health (44)	US	143	27	2 874	5	19	10	526
243	Cerner	Software & computer services (97)	US	143	20	666	21	9	28	195
244	Altera	IT hardware (93)	US	142	-2	656	22	24	71	942
245	Juniper Networks	IT hardware (93)	US	140	9	556	25	9	90	1 735
246	Givaudan	Personal care & household (47)	Switzerland	139	5	1 740	8	13	23	216
247	Compuware	Software & computer services (97)	US	139	13	1 003	14	4	16	154
248	Baker Hughes	Oil & gas (07)	US	137	5	4 196	3	7	5	253
249	Winbond Electronic	IT hardware (93)	Taiwan	137	-25	778	18	-14	36	175
250	EMBRAER	Aerospace & defence (21)	Brazil	137	9	1 699	8	12	11	219

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
251	United Microelectronics	IT hardware (93)	Taiwan	137	-21	2 235	6	8	15	399
252	Chubu Electric Power	Electricity (72)	Japan	136	-8	16 097	1	13	8	77
253	Lear	Automobiles & parts (31)	US	136	-3	12 484	1	5	1	24
254	Silicon Graphics	IT hardware (93)	US	136	-6	762	18	-14	37	42
255	Cephalon	Pharma & biotech (48)	US	135	33	567	24	22	82	395
256	Mattel	Household goods & textiles (34)	US	133	5	3 932	3	16	5	149
257	ArvinMeritor	Automobiles & parts (31)	US	132	27	6 174	2	4	4	18
258	Harley-Davidson	Automobiles & parts (31)	US	132	9	3 888	3	24	14	360
259	Kobe Steel	Steel & other metals (18)	Japan	132	-19	8 912	2	4	5	37
260	Meiji Seika Kaisha	Food producers (43)	Japan	131	-6	2 615	5	2	..	50
261	Koito Manufacturing	Automobiles & parts (31)	Japan	131	-8	2 302	6	5	10	45
262	Gilead Sciences	Pharma & biotech (48)	US	131	22	688	19	-18	92	1 566
263	Shiseido	Personal care & household (47)	Japan	130	2	4 618	3	8	5	91
264	Lam Research	IT hardware (93)	US	127	-10	599	21	-1	61	420
265	UTStarcom	IT hardware (93)	US	126	85	1 557	8	14	23	106
266	Conexant Systems	IT hardware (93)	US	126	-51	476	27	-125	87	123
267	eBay	General retailers (52)	US	126	33	1 716	7	29	22	1 917
268	International Flavors & Fragrances	Personal care & household (47)	US	126	11	1 508	8	15	23	185
269	Dover	Diversified industrials (24)	US	126	-6	3 499	4	10	5	183
270	Showa Denko	Chemicals (11)	Japan	126	10	5 100	3	5	12	39
271	Scientific-Atlanta	Media & entertainment (54)	US	124	2	1 150	11	9	18	325
272	MedImmune	Pharma & biotech (48)	US	124	8	836	15	23	75	536
273	GlobespanVirata <i>(now part of Conexant Systems)</i>	IT hardware (93)	US	124	13	181	68	-290	177	..
274	Dow Corning	Chemicals (11)	US	123	-11	2 069	6	6	15	..
275	JDS Uniphase	IT hardware (93)	US	122	-40	536	23	-3	22	767
276	Skyworks Solutions	IT hardware (93)	US	120	14	490	25	-69	32	203
277	Statoil	Oil & gas (07)	Norway	120	36	29 616	0	17	6	73
278	OKI Electric	Electronic & electrical (25)	Japan	119	6	4 840	3	2	6	36
279	Bausch & Lomb	Health (44)	US	119	17	1 601	7	13	10	161
280	General Mills	Food producers (43)	US	118	14	8 329	1	17	4	163
281	Pitney Bowes	Electronic & electrical (25)	US	117	4	3 629	3	19	5	214
282	Thermo Electron	Engineering & machinery (26)	US	116	-6	1 663	7	9	11	203
283	Bombardier	Aerospace & defence (21)	Canada	115	-34	13 080	1	3	2	27
284	Brocade Communications	IT hardware (93)	US	115	10	416	28	-27	94	241
285	Sybase	Software & computer services (97)	US	115	-4	617	19	14	31	178
286	Kawasaki Heavy Industries	Engineering & machinery (26)	Japan	115	-6	9 170	1	2	4	19
287	Hasbro	Household goods & textiles (34)	US	114	-7	2 488	5	10	17	102
288	Harman International Industries	Electronic & electrical (25)	US	114	30	1 767	6	8	11	254
289	East Japan Railway	Transport (59)	Japan	113	13	18 979	1	14	1	94
290	Dainippon Pharmaceutical	Pharma & biotech (48)	Japan	113	16	1 274	9	6	45	84
291	BEA Systems	Software & computer services (97)	US	112	6	803	14	18	36	258
292	JSR	Chemicals (11)	Japan	112	8	2 035	6	11	26	169
293	Alcan	Steel & other metals (18)	Canada	111	22	10 814	1	5	2	107
294	Vertex Pharmaceuticals	Pharma & biotech (48)	US	111	24	55	201	-382	154	1 013
295	Time Warner	Media & entertainment (54)	US	110	2	31 367	0	15	1	185
296	Bandai	Household goods & textiles (34)	Japan	110	4	1 812	6	10	42	105
297	Nintendo	Software & computer services (97)	Japan	108	-14	3 726	3	20	..	331
298	ConocoPhillips Petroleum	Oil & gas (07)	US	108	25	71 684	0	10	3	60
299	Western Digital	IT hardware (93)	US	107	12	2 155	5	7	9	53
300	Swatch	Household goods & textiles (34)	Switzerland	105	16	2 553	4	15	5	243

Table A2.2 (cont.)

Listing of the non-EU 500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
301	Parametric Technology	Software & computer services (97)	US	105	-3	533	20	-13	30	175
302	Ebara	Engineering & machinery (26)	Japan	104	-18	3 832	3	-7	7	26
303	Casio Computer	IT hardware (93)	Japan	104	0	3 259	3	3	9	88
304	Kaneka	Chemicals (11)	Japan	103	1	2 754	4	7	15	94
305	Rockwell Automation	Electronic & electrical (25)	US	103	-1	3 254	3	9	5	168
306	Nitto Denko	Chemicals (11)	Japan	103	6	2 801	4	9	10	213
307	RF Micro Devices	Electronic & electrical (25)	US	102	26	516	20	6	54	170
308	Osaka Gas	Utilities - other (73. 78)	Japan	102	-9	7 013	1	6	7	73
309	Applied Micro Circuits	IT hardware (93)	US	102	-37	104	98	-114	140	856
310	American Standard Companies	Engineering & machinery (26)	US	102	-27	6 792	2	8	2	95
311	Norsk Hydro	Diversified industrials (24)	Norway	101	4	20 470	1	14	2	65
312	Exelixis	Pharma & biotech (48)	US	101	14	41	247	-185	177	1 063
313	NGK Spark Plug	Automobiles & parts (31)	Japan	101	2	1 693	6	1	11	107
314	Kellogg	Food producers (43)	US	101	19	6 986	1	17	4	194
315	Sumitomo Metal	Steel & other metals (18)	Japan	100	-27	9 059	1	4	4	45
316	Newell Rubbermaid	Household goods & textiles (34)	US	99	42	6 144	2	1	3	77
317	Unaxis	Diversified industrials (24)	Switzerland	99	-2	1 032	10	0	15	112
318	Anritsu	IT hardware (93)	Japan	98	-13	581	17	1	26	105
319	Federal-Mogul	Automobiles & parts (31)	US	98	11	4 397	2	0	2	0
320	SMC	Engineering & machinery (26)	Japan	97	2	1 530	6	13	9	369
321	Kissei Pharmaceutical	Pharma & biotech (48)	Japan	97	0	440	22	8	58	207
322	ITT Industries	Engineering & machinery (26)	US	96	6	4 461	2	9	3	131
323	NGK Insulators	Diversified industrials (24)	Japan	96	-16	2 232	4	6	9	100
324	Air Products and Chemicals	Chemicals (11)	US	96	0	4 993	2	11	5	187
325	Dainippon Ink & Chemicals	Chemicals (11)	Japan	96	1	7 116	1	3	4	20
326	Intermune	Pharma & biotech (48)	US	95	-8	122	78	-59	366	243
327	Fanuc	Electronic & electrical (25)	Japan	95	13	1 585	6	30	..	677
328	PMC-Sierra	IT hardware (93)	US	95	-13	198	48	-7	102	840
329	Santen Pharmaceutical	Pharma & biotech (48)	Japan	94	4	668	14	11	38	180
330	BorgWarner	Automobiles & parts (31)	US	94	8	2 433	4	10	7	86
331	Brunswick	Household goods & textiles (34)	US	94	15	3 273	3	6	4	89
332	Dade Behring	Pharma & biotech (48)	US	93	2	1 139	8	11	35	148
333	Molex	Electronic & electrical (25)	US	93	5	1 461	6	6	5	278
334	Kuraray	Chemicals (11)	Japan	93	3	2 386	4	5	13	97
335	Yokohama Rubber	Automobiles & parts (31)	Japan	93	2	2 962	3	6	7	36
336	Incyte	Pharma & biotech (48)	US	92	-24	37	249	-338	203	941
337	Openwave Systems	Software & computer services (97)	US	91	-20	212	43	-80	63	273
338	Ceridian	Support services (58)	US	91	22	994	9	15	10	213
339	3Com	IT hardware (93)	US	90	-60	740	12	-32	27	206
340	Network Appliance	IT hardware (93)	US	90	-3	707	13	10	38	775
341	Schindler	Engineering & machinery (26)	Switzerland	89	8	4 892	2	5	2	60
342	Hilti	Construction & building (13)	Liechtenstein	88	2	1 931	5	8	6	..
343	Palm (now palmOne)	IT hardware (93)	US	88	-22	691	13	-25	89	208
344	Vitesse Semiconductor	IT hardware (93)	US	87	-35	124	70	-104	110	389
345	Daicel Chemical Industries	Chemicals (11)	Japan	87	2	2 007	4	4	16	68
346	Tokyo Gas	Utilities - other (73. 78)	Japan	87	..	8 342	1	10	8	96
347	Symbol Technologies	Electronic & electrical (25)	US	86	49	1 213	7	1	16	201
348	ADC Telecommunications	IT hardware (93)	US	86	-38	613	14	-12	15	251
349	Ivax	Pharma & biotech (48)	US	86	43	1 126	8	16	10	327
350	Mitsubishi Materials	Steel & other metals (18)	Japan	86	-25	7 137	1	-2	4	26

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
351	Pliva	Pharma & biotech (48)	Croatia	86	20	854	10	17	13	..
352	Mitsubishi Gas Chemical	Chemicals (11)	Japan	85	-3	2 309	4	0	18	65
353	Celgene	Pharma & biotech (48)	US	85	40	215	40	-1	121	1 576
354	Maytag	Household goods & textiles (34)	US	85	-3	3 799	2	6	4	34
355	Illinois Tool Works	Engineering & machinery (26)	US	85	5	7 956	1	16	2	279
356	Kajima	Construction & building (13)	Japan	85	-0	13 869	1	2	8	18
357	Terumo	Health (44)	Japan	84	11	1 484	6	18	10	272
358	Fujikura	Electronic & electrical (25)	Japan	84	-5	2 344	4	-3	4	63
359	UBE Industries	Chemicals (11)	Japan	84	-12	3 799	2	5	8	24
360	Zimmer	Health (44)	US	84	31	1 507	6	27	13	975
361	Toto	Construction & building (13)	Japan	84	-8	3 253	3	4	5	87
362	Acterna	IT hardware (93)	US	83	-35	539	15	-49	29	..
363	Rieter	Engineering & machinery (26)	Switzerland	83	-0	1 999	4	6	6	46
364	Ballard Power Systems	Automobiles & parts (31)	Canada	82	-9	95	87	-132	75	699
365	Quantum	IT hardware (93)	US	82	-8	641	13	-2	45	54
366	Adaptec	IT hardware (93)	US	82	-13	359	23	6	54	182
367	Kyushu Electric Power	Electricity (72)	Japan	81	-10	9 992	1	12	4	72
368	Tektronix	IT hardware (93)	US	80	-17	627	13	-2	19	325
369	Mylan Laboratories	Pharma & biotech (48)	US	80	16	1 090	7	37	29	289
370	Mitsubishi Rayon	Chemicals (11)	Japan	80	-0	2 224	4	5	9	75
371	Dainippon Screen Mfg	Engineering & machinery (26)	Japan	80	7	1 242	6	-3	18	77
372	Black & Decker	Household goods & textiles (34)	US	80	4	3 554	2	9	4	126
373	Sasol	Oil & gas (07)	South Africa	80	-35	7 667	1	19	3	114
374	Tohoku Electric Power	Electricity (72)	Japan	79	-7	11 790	1	12	4	56
375	AU Optronics	Electronic & electrical (25)	Taiwan	79	52	2 449	3	15	5	177
376	Harris	IT hardware (93)	US	79	-4	1 659	5	3	8	151
377	Watson Pharmaceuticals	Pharma & biotech (48)	US	79	22	1 156	7	21	20	184
378	Integrated Device Technology	IT hardware (93)	US	78	-24	274	29	-2	25	351
379	Activision	Software & computer services (97)	US	78	72	751	10	12	59	215
380	KDDI	Telecommunication services (67)	Japan	77	17	20 604	0	5	6	81
381	Tosoh	Chemicals (11)	Japan	77	6	3 491	2	5	8	45
382	Electronics For Imaging	Software & computer services (97)	US	77	8	301	26	9	56	282
383	SPX	Electronic & electrical (25)	US	76	-19	4 029	2	11	3	61
384	Sumitomo Heavy Industries	Engineering & machinery (26)	Japan	76	..	3 560	2	2	7	37
385	SIG	Support services (58)	Switzerland	76	9	1 896	4	0	8	52
386	Sumitomo Bakelite	Chemicals (11)	Japan	76	5	1 186	6	1	..	97
387	Medarex	Pharma & biotech (48)	US	76	16	9	841	-1 144	179	4 189
388	International Game Technology	Leisure & hotels (53)	US	75	18	1 687	5	32	14	530
389	Tularik	Pharma & biotech (48)	US	75	52	24	313	-350	185	5 517
390	Convergys	Support services (58)	US	75	-17	1 815	4	12	1	102
391	Saurer	Engineering & machinery (26)	Switzerland	75	3	1 746	4	5	7	35
392	Bio-Rad Laboratories	Health (44)	US	75	14	795	9	15	16	134
393	Lubrizol	Chemicals (11)	US	74	0	1 625	5	9	15	87
394	Nippon Oil	Oil & gas (07)	Japan	74	-4	23 320	0	3	5	32
395	Parker Hannifin	Engineering & machinery (26)	US	74	-15	5 082	2	6	2	107
396	Engelhard	Chemicals (11)	US	74	6	2 945	3	9	11	98
397	OSI Pharmaceuticals	Pharma & biotech (48)	US	74	3	26	284	-558	154	7 254
398	Taisei	Construction & building (13)	Japan	73	0	12 166	1	2	..	20
399	Linear Technology	IT hardware (93)	US	73	15	481	15	48	28	2 013
400	Intersil	IT hardware (93)	US	72	-30	402	18	16	45	508

Table A2.2 (cont.)

Listing of the non-EU 500 group of companies on the 2004 Scoreboard ranked by their R&D investment in financial year 2003

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
401	Macromedia	Software & computer services (97)	US	72	-7	293	25	13	60	384
402	Barr Laboratories <i>(now Barr Pharmaceuticals)</i>	Pharma & biotech (48)	US	72	21	716	10	29	59	397
403	Georg Fischer	Engineering & machinery (26)	Switzerland	72	-8	2 113	3	-3	5	31
404	Cell Therapeutics	Pharma & biotech (48)	US	71	52	20	355	-485	191	1 060
405	McData	IT hardware (93)	US	70	50	332	21	-2	69	143
406	ImClone Systems	Pharma & biotech (48)	US	70	-29	70	101	-123	121	5 019
407	Regeneron Pharmaceuticals	Pharma & biotech (48)	US	70	-22	46	153	-172	104	783
408	Reynolds and Reynolds	Software & computer services (97)	US	70	-0	799	9	19	16	148
409	Campbell Soup	Food producers (43)	US	70	14	5 294	1	16	3	157
410	Qlogic	IT hardware (93)	US	70	8	415	17	38	85	431
411	FMC	Chemicals (11)	US	69	7	1 523	5	5	13	81
412	CR Bard	Health (44)	US	69	42	1 136	6	16	8	402
413	Lattice Semiconductor	IT hardware (93)	US	69	2	166	42	-45	66	265
414	Nippon Shokubai	Chemicals (11)	Japan	68	1	1 214	6	6	23	96
415	ICOS	Pharma & biotech (48)	US	68	41	60	113	-188	101	1 958
416	Avid Technology	IT hardware (93)	US	68	4	374	18	9	43	309
417	ON Semiconductor	IT hardware (93)	US	68	26	848	8	0	7	95
418	Microchip Technology	IT hardware (93)	US	68	-3	554	12	25	18	857
419	Cell Genesys	Pharma & biotech (48)	US	68	14	14	483	-529	194	1 629
420	Toyo Tire	Automobiles & parts (31)	Japan	67	3	1 888	4	4	11	27
421	Hyundai Heavy Industries	Engineering & machinery (26)	South Korea	67	11	6 358	1	4	..	19
422	Yue Yuen Industrial	Household goods & textiles (34)	Hong Kong	67	39	1 990	3	13	0	161
423	SanDisk	IT hardware (93)	US	67	33	856	8	22	89	363
424	Enterasys Networks	IT hardware (93)	US	67	-1	329	20	-28	48	85
425	Andrew	IT hardware (93)	US	67	45	804	8	2	11	167
426	ECI Telecom	IT hardware (93)	Israel	66	-10	334	20	-17	27	160
427	Nippon Sheet Glass	Construction & building (13)	Japan	66	9	2 072	3	1	5	63
428	PerkinElmer	IT hardware (93)	US	66	-4	1 217	5	9	7	146
429	Weatherford International	Oil & gas (07)	US	66	4	2 054	3	11	4	239
430	Yamatate	Electronic & electrical (25)	Japan	66	1	1 243	5	8	9	48
431	Abgenix	Pharma & biotech (48)	US	66	-24	13	505	-1 223	163	5 139
432	Science Applications International	Software & computer services (97)	US	65	-5	5 328	1	7	2	..
433	Toyobo	Household goods & textiles (34)	Japan	65	-3	2 784	2	-4	7	49
434	Hamamatsu Photonics	Engineering & machinery (26)	Japan	65	11	451	14	7	21	219
435	Delta Electronics	Electronic & electrical (25)	Taiwan	65	19	1 135	6	9	..	134
436	Paccar	Engineering & machinery (26)	US	64	45	6 497	1	12	4	128
437	Akebono Brake Industry	Automobiles & parts (31)	Japan	64	-9	936	7	4	14	42
438	Denki Kagaku Kogyo	Chemicals (11)	Japan	64	6	1 804	4	5	..	69
439	I2 Technologies	Software & computer services (97)	US	64	-53	392	16	4	26	67
440	National Instruments	Software & computer services (97)	US	64	26	338	19	10	21	533
441	Neurocrine Biosciences	Pharma & biotech (48)	US	64	-17	110	58	-42	194	1 186
442	Chugoku Electric Power	Electricity (72)	Japan	64	-14	7 466	1	13	4	68
443	Amcor	Support services (58)	Australia	63	51	6 397	1	6	2	52
444	Nippon Kayaku	Chemicals (11)	Japan	63	-2	913	7	6	17	85
445	Macronix International	IT hardware (93)	Taiwan	63	-29	406	16	-42	18	292
446	Micronas Semiconductor	IT hardware (93)	Switzerland	63	13	491	13	17	36	216
447	International Rectifier	IT hardware (93)	US	63	13	685	9	-15	11	300
448	Citizen Watch	Household goods & textiles (34)	Japan	62	-21	2 471	3	5	4	99
449	Mettler-Toledo International	Engineering & machinery (26)	US	62	10	1 034	6	12	7	142
450	NSK	Engineering & machinery (26)	Japan	62	3	3 868	2	1	3	50

Rank	Company	FTSE Sector	Country	R&D Investment		Net Sales	R&D Sales ratio	Operating Profit	R&D per employee	Market Capitalisation
				2003	change 03/02	2003	2003	2003	2003	2003
				€m	%	€m	%	% of Net sales	€k	% of Net Sales
451	FileNET	Software & computer services (97)	US	61	7	289	21	3	36	199
452	Hydro-Quebec	Electricity (72)	Canada	61	-8	7 009	1	69	3	..
453	Cirrus Logic	IT hardware (93)	US	60	-20	156	39	13	79	262
454	Clorox	Personal care & household (47)	US	60	13	3 285	2	19	7	258
455	Zarlink Semiconductor	IT hardware (93)	Canada	60	-15	157	38	-22	57	225
456	Praxair	Chemicals (11)	US	60	9	4 450	1	17	2	228
457	Avery Dennison	Chemicals (11)	US	59	0	3 776	2	8	3	141
458	Fairchild Semiconductor	IT hardware (93)	US	59	-9	1 107	5	-1	6	125
459	Toyo Ink Manufacturing	Chemicals (11)	Japan	59	2	1 606	4	4	..	49
460	Pentax	Media & entertainment (54)	Japan	59	17	800	7	3	11	64
461	Hyperion Solutions	Software & computer services (97)	US	59	1	405	14	10	26	314
462	Nippon Shinyaku	Pharma & biotech (48)	Japan	58	12	392	15	8	32	78
463	Credence Systems	IT hardware (93)	US	58	-14	145	40	-63	56	471
464	Tekelec	IT hardware (93)	US	58	23	209	28	4	55	458
465	International Paper	Forestry & paper (15)	US	58	-5	19 962	0	4	1	83
466	Brooks Automation	IT hardware (93)	US	58	-3	272	21	-51	30	187
467	Edwards Lifesciences	Health (44)	US	58	12	682	9	12	12	243
468	Aspen Technology	Software & computer services (97)	US	58	-12	256	23	-50	33	72
469	Polycom	Software & computer services (97)	US	58	-5	333	17	5	49	437
470	Tokuyama	Chemicals (11)	Japan	58	-4	1 668	4	3	13	59
471	Genencor International	Pharma & biotech (48)	US	58	43	304	19	8	46	243
472	AGCO	Engineering & machinery (26)	US	57	25	2 771	2	6	5	54
473	NetIQ	Software & computer services (97)	US	56	17	246	23	-296	41	172
474	Cooper Tire & Rubber	Automobiles & parts (31)	US	56	-4	2 786	2	6	3	50
475	MeadWestvaco	Forestry & paper (15)	US	56	-22	5 988	1	0	2	81
476	Nissan Chemical Industries	Chemicals (11)	Japan	55	12	1 123	5	6	..	101
477	Shimizu	Construction & building (13)	Japan	55	-10	11 463	1	3	..	23
478	Valspar	Chemicals (11)	US	55	6	1 782	3	10	8	112
479	Taiheiyo Cement	Construction & building (13)	Japan	55	0	6 865	1	3	3	26
480	CV Therapeutics	Pharma & biotech (48)	US	55	-19	9	612	989	211	3 689
481	Telenor	Telecommunication services (67)	Norway	55	-13	6 303	1	17	3	153
482	Asahi Breweries	Beverages (41)	Japan	55	7	6 321	1	8	4	68
483	Sollectron	Electronic & electrical (25)	US	55	-8	8 732	1	-24	1	48
484	Intergraph	Software & computer services (97)	US	55	9	418	13	4	15	187
485	Sealed Air	Support services (58)	US	55	16	2 800	2	15	3	114
486	Trimble Navigation	Electronic & electrical (25)	US	54	11	429	13	9	25	260
487	American Power Conversion	Electronic & electrical (25)	US	54	13	1 161	5	16	8	206
488	Fair Isaac	Software & computer services (97)	US	54	67	499	11	28	23	322
489	Quest Software	Software & computer services (97)	US	54	14	241	22	8	31	366
490	Zeon	Chemicals (11)	Japan	53	12	1 560	3	4	18	78
491	Lonza	Chemicals (11)	Switzerland	53	-20	1 437	4	6	9	123
492	Redback Networks	IT hardware (93)	US	53	-27	85	62	-91	109	259
493	Advanced Fibre Communications	IT hardware (93)	US	52	7	264	20	7	68	443
494	LTX	IT hardware (93)	US	52	-7	95	55	-119	91	414
495	Affymetrix	Pharma & biotech (48)	US	52	-8	238	22	6	60	547
496	LG Chem	Chemicals (11)	South Korea	52	..	4 589	1	10	..	40
497	Showa	Engineering & machinery (26)	Japan	52	3	1 455	4	8	8	50
498	Triquint Semiconductor	IT hardware (93)	US	52	11	248	21	-22	25	176
499	Benq	IT hardware (93)	Taiwan	51	34	2 576	2	7	17	75
500	Yaskawa Electric	Engineering & machinery (26)	Japan	51	-10	1 673	3	-0	7	57





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