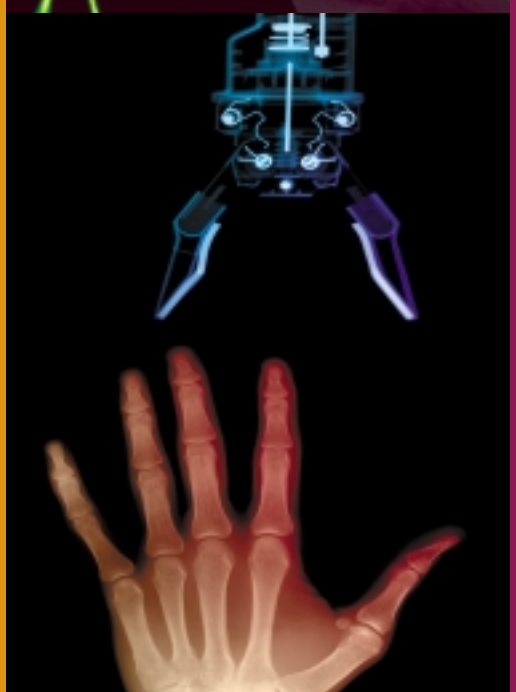
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT



OECD SCIENCE, TECHNOLOGY AND INDUSTRY SCOREBOARD

1999 BENCHMARKING KNOWLEDGE-BASED ECONOMIES

OECD

OECD SCIENCE, TECHNOLOGY AND INDUSTRY SCOREBOARD

1999

Benchmarking Knowledge-based Economies

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Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996) and Korea (12th December 1996). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

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TABLEAU DE BORD DE L'OCDE DE LA SCIENCE, DE LA TECHNOLOGIE ET DE L'INDUSTRIE 1999
Mesurer les économies fondées sur le savoir

Foreword

The *OECD Science, Technology and Industry Scoreboard 1999: Benchmarking Knowledge-based Economies* was prepared by the OECD under the guidance of the Industry Committee and the Committee for Scientific and Technological Policy. Its main objective is to provide in a concise yet accessible format, the most recent information on trends and competitive challenges in science, technology and industry in the OECD countries. It draws on a large number of statistical databases and indicators, most of which are developed in the OECD Directorate for Science, Technology and Industry (DSTI). It is the third in a biennial series, alternating with the more policy-oriented *OECD Science, Technology and Industry Outlook*.

As economies become increasingly knowledge-based and globalised, scientific and technological efforts become essential determinants of industrial performance and international competitiveness. For policy design and evaluation purposes, governments need to be able to monitor as accurately as possible recent trends and structural shifts pertaining to industry and technology, not only in their own countries, but also as they compare to others. The 1998 meeting of the Industry Committee at Ministerial level "reaffirmed the central role of the OECD in providing internationally comparable analytical and statistical information as a basis for informing the policy debate in Member countries" and recommended "that the OECD pursue work on international comparisons ('benchmarking') of the major factors affecting business performance".

The 1999 *Scoreboard* aims to extend the policy relevance of this publication. First, it replaces some less relevant or outdated indicators with new or improved measures. In particular, it adds those that measure innovative performance and other related outputs of a knowledge-based economy, many of which were developed as part of the "blue sky project" of the National Experts of S&T Indicators (NESTI). It builds on indicators published in *The Knowledge-based Economy: A Set of Facts and Figures* prepared for the 1999 Meeting of the Committee for Scientific and Technological Policy at Ministerial level. Second, it gives a more prominent place to international comparisons. Country rankings should be interpreted with caution when absolute differences are small, since many indicators are not extremely precise. The 1999 *Scoreboard* may thus also serve as a starting point for competitiveness and benchmarking studies at the national level.

This publication was prepared by the Economic Analysis and Statistics (EAS) Division of the Directorate for Science, Technology and Industry (DSTI). It is published on the responsibility of the Secretary-General of the OECD.

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Summary

Today's rapid advances in science and technology mean that OECD economies are increasingly based on knowledge. At the same time, countries are increasingly integrated into the world economy, through international flows of goods and services, investment, people and ideas. This has given rise to new forms of competition and co-operation among firms and countries and encourages the diffusion of new ideas and technologies.

These mutually reinforcing changes have profound implications for today's economies. The ability to create, distribute and exploit knowledge and information seems ever more important and is often regarded as the single most important factor underlying economic growth and improvements in the quality of life. The competitiveness of firms depends crucially on how well they make use of their own intangible assets, such as skills and creativity, and gain access to new ones by co-operating with other firms and with universities. How well countries respond to these challenges depends on how well business, government and the labour force work together to exploit these key assets. It also depends on how well firms and governments recognise this common challenge and respond effectively, forcefully and coherently.

For purposes of policy design and evaluation, governments need to be able to monitor, as accurately as possible, recent trends and structural shifts pertaining to science, technology and industry, not only in their own countries, but also as they compare to others. Yet, because of their nature, intangibles are very difficult to measure. It is far less easy to obtain facts and comparable indicators for intangibles than for tangibles. In addition, as no single indicator can fully answer any given question, one must rely on a composite picture. The *Scoreboard* therefore presents a battery of indicators. A special effort is made to provide clear definitions, the method of calculation and, where necessary, any limitations so as to avoid possible misinterpretation.

The *Scoreboard* has three parts:

– The first presents selected indicators for *knowledge-based economies*. It examines the importance of investment in intangibles in OECD economies, compares the weight of knowledge-based industries across countries, highlights the role of information and communication technologies, and looks at expenditures on science and technology.

– The second focuses on the *globalisation challenge*. It highlights recent trends in international trade, foreign investment, and the internationalisation of technology and examines the role played by foreign affiliates of multinational firms in their host countries.

– The third part examines selected indicators of *economic performance and competitiveness*. It compares countries in terms of productivity and unit labour costs, of scientific and technological output, and of international trade.

The picture that emerges is that countries remain internationalised to different degrees, and that they differ substantially in their march towards a knowledge-based economy.

Ireland is a prominent example of a country that has benefited from globalisation in science and technology; its very high growth rate relies to some degree on imports of technology and capital. At the other end of the spectrum, Japan seems relatively insular in terms of science and technology. The European Union, when linkages among its member countries are factored out, seems by and large to be as internationalised as the United States.

Concerning the ability to create, distribute and exploit knowledge and information, some countries – especially certain English-speaking and Nordic countries – seem to enjoy at present a better standing in this respect. However, this finding may unduly emphasise the current overall standing of countries, and thus inadequately

suggest which countries are best prepared for the future. A number of factors should be considered when interpreting the various indicators (see Box).

The *Scoreboard* may serve as a starting point for competitiveness and benchmarking studies at the national level. It may usefully be complemented by more focused benchmarking studies to identify best policy practices in different areas. Further work needs to be undertaken to expand the range and comparability of these indicators and place them in a context where they usefully contribute to policy making.

Note concerning the interpretation of the indicators

- *Indicators only give a partial view of the reality.* By nature, they only measure what can be quantified and for which there are data. The need for internationally comparable data further limits the number of indicators. In addition, many indicators do not reflect the quality or efficiency of countries in particular areas. For example, a high R&D intensity does not necessarily imply that R&D inputs are efficiently used.
- *Many variables are interrelated and have to be seen in a larger context,* such as *e.g.* the national innovation system or the global economic, political and social framework. Only a look "inside the black box" and causal analysis could permit an identification of the reasons why some countries obtain better results than others. This, however, goes beyond the scope of the *Scoreboard.*
- *Some indicators play a more important role than others,* but it is difficult to establish a hierarchy due to a lack of clear criteria.
- *Many global indicators only reflect the performance of a few industries.* However, an average value for a given indicator may result from excellent performance in some industries and poor performance in others. The Annex tables give detailed information for many indicators.
- *The interpretation of some indicators can be ambiguous.* For example, outward foreign direct investment flows should not be systematically interpreted as the result of weak competitiveness of framework conditions unfavourable to domestic investment in the home country. In contrast, the location of activities abroad may reflect internationalisation strategies of firms and be a sign of their dynamism and improved international competitiveness.
- *Country rankings should be interpreted with caution,* especially when absolute differences are small, since many indicators lack precision. But very low rankings may indicate potential areas for improvement.

Towards knowledge-based economies

Structural changes in OECD countries reflect the increasing importance of the production, diffusion and use of knowledge and information for improving the competitiveness of firms and overall economic performance. Scientific and technological advances seem more rapid and more pervasive than ever before, and information and communication technologies (ICTs) are now essential to the operation of any business.

Although the pace may differ, owing to economic, social or institutional factors, OECD countries are moving *towards a knowledge-based economy*. Selected indicators show that:

– Knowledge-based industries have been outpacing growth of GDP for many years in virtually all OECD countries. In OECD-wide GDP, the share of this broadly defined group (*i.e.* high- and medium-high-technology manufacturing industries and services such as finance, insurance and communications) is now more than 50%, up from 45% in 1985. Knowledge-based industries are most important in the larger economies, especially Germany, the United States and Japan. Since 1985, knowledge-based industries have increased fastest in Korea, Portugal, Australia, the United Kingdom, Japan and Finland. In all countries, knowledge-based services are much more important than knowledge-based manufacturing industries (Section 2.2).

– OECD economies spend more and more resources on the production of knowledge. Investment in knowledge as defined here (R&D, software, public spending on education) now represents 8% of OECD-wide GDP, a figure similar to investment in physical equipment. Investment in intangibles is highest in Nordic

countries and France (9-10%), and lowest in Italy and Japan (6-7%). The OECD average exceeds 10% of GDP when private spending on education and training is included (Section 2.1).

– As the knowledge-based economy requires new skills and competencies, the quality of human resources is the major factor behind the invention and diffusion of technology. Overall, 60% of the OECD population aged 25-64 has completed upper secondary schooling, and the share is 80% or more in the United States, the Czech Republic, Norway, Germany, and Switzerland. In contrast, it is below 50% in Turkey, Portugal, Luxembourg, Spain, Italy and Greece. Overall, 13% of the OECD population aged 25-64 has university-level education, but the share varies between less than 9% in Austria, Turkey, Portugal and Italy and more than 20% in the United States and the Netherlands (Section 2.6).

Information and communication technologies (ICTs) are a pillar of the knowledge-based economy. How countries adopt and master ICT is thus key to their future economic performance.

– OECD economies are investing heavily in telecommunications, hardware and software. In 1997, they spent on average almost 7% of GDP on ICT, up from 6% in 1992. This figure differs substantially across countries, however, ranging from almost 9% to less than 3%. In general, ICT intensity is greater in English-speaking countries, in Sweden, Switzerland, and, to a lesser extent, in Japan and the Netherlands. However, Korea and many Mediterranean and central European countries are rapidly catching up: in 1997, annual growth in ICT expenditures as a percentage of GDP was highest in Portugal (10%), Greece (8%) and Poland (6%), followed by Japan, Finland and Korea (around 4%) (Section 2.3).

– The Internet is a key driver of ICT, with more and more households and companies connecting up and using it. The Nordic countries, the United States and Canada are among the most "wired", with between seven and eleven Internet host computers per 100 inhabitants, compared to an OECD average of less than four. The price of accessing the Internet has dropped sharply over the last years, owing to technical change and growing competition in the telecommunications industry. However, high prices remain a barrier to more widespread use in countries such as the Czech Republic, Austria and Belgium, where Internet access costs (calculated in purchasing power parities) are more than three times what they are in Finland and Canada, the countries with the lowest costs (Section 2.4).

– These technologies enable the development and rapid growth of electronic commerce. The number of secure Internet servers gives a broad measurement of the existing infrastructure for electronic commerce. Three-quarters of all servers in the OECD area are located in the United States, although this share is gradually declining as electronic commerce develops in other countries. In general, the number of Internet servers per 100 000 inhabitants is highest in English-speaking and Nordic countries and lowest in Mexico, Korea and Mediterranean and central European countries (Section 2.5).

R&D activities are often viewed, in terms of scientific and technological policy, as an aggregate that constitutes "the national R&D effort". After more than half a decade of stagnation and even decline in some countries, expenditure on R&D is expanding again in most countries, partly owing to higher economic growth since the mid-1990s.

– In 1995, about 2.7 million researchers were engaged in R&D in the OECD area. Gross domestic expenditure on R&D (GERD) in OECD countries amounted to almost USD 500 billion in 1997, or more than 2.2% of GDP. The figure is much higher for Sweden (almost 4%), and for Finland, Japan, Korea and the United States (almost 3%). In contrast, it is significantly below 1% in several countries, notably Mexico, Turkey and Greece. R&D expenditures between 1991 and 1997 have risen most in Korea (+ 1 percentage point of GDP), Sweden (+ 1), Finland (+ 0.7), Ireland (+ 0.5), Iceland (+ 0.4) and Denmark (+ 0.3). However, R&D expenditures continue to level off or to decline in several countries, especially the large economies of the European Union: Germany, United Kingdom, France and Italy (Section 3.1).

– In most countries, the business sector funds and performs an increasing share of R&D. This trend, which began more than two decades ago, has accelerated in the 1990s. On average, more than 60% of R&D is funded, and almost 70% is executed, by business enterprises. However, the relative contribution of government and business varies substantially across countries. Business plays a particularly important role in Japan, Korea, Ireland, Sweden, Switzerland and the United States. Funds from abroad now represent more than 10% of R&D expenditure in Greece, the United Kingdom, Canada and Denmark, partly as a

result of the increased globalisation of R&D and in particular of the R&D activities of multinational firms (Section 3.2).

– R&D performed in the business enterprise sector, regardless of the origin of funding, reflects firms' desire to exploit technological innovations to improve their competitiveness. Business R&D intensity is particularly high in Sweden (at more than 4% of the domestic product of industry, it is more than twice the OECD average), followed by Finland (2.7%) and Korea (2.5%). Annual growth rates of business R&D since the early 1990s in these three countries are among the highest in the OECD area. Business R&D grew even more in Ireland, Iceland and Australia, all of which, however, started from low levels in 1991 (Section 5.1).

Both governments and business enterprises play an important role in science and technology. Both contribute to technological innovation in ways that go well beyond R&D expenditures.

– Government support to industrial technology is more than public funding of R&D. It encompasses financial support (*e.g.* grants, tax relief), public procurement (mostly for defence and space), and science and technology infrastructure and diffusion (*e.g.* public/private partnership in R&D). Among countries for which data are available, government support to industrial technology relative to domestic product of industry is greatest in Finland, the United States and France, followed by the United Kingdom, the Netherlands, and Germany. During the 1990s, government support has shrunk in most countries, especially due to cuts in defence spending. The reduction is particularly pronounced in the United States, France, Germany, and the United Kingdom. In contrast, government support to industrial technology increased in Finland, and to a lesser extent in Japan and Australia (Section 4.3).

– Innovation no longer depends solely on how firms, universities, and research institutes perform independently, but, increasingly, on how they co-operate. Firms' recognition of the usefulness of academic research for their innovative activity translates into business's increasing (although still low) share in the funding of university research. OECD-wide, business provides funding for 6% of university research and 3% of government research. However, countries differ substantially because of differences in national innovation systems. Data from innovation surveys suggest that firms with co-operation arrangements (of any type) are close to 10% of the labour force, except in Nordic countries where the share is much higher. Moreover, such agreements are more common for large firms than for small ones (Section 4.5).

– Expenditure on R&D is only a fraction of total expenditure on technological innovation. Data from innovation surveys for a limited number of countries suggest that the non-R&D portion of technological innovation (which includes innovation-related expenditure on equipment, software, training, design, and marketing) is up to twice the R&D portion. In most countries, expenditure on innovation (relative to sales) is higher for manufacturing than for services. In manufacturing, expenditure on innovation is highest in Sweden (more than 7% of total sales) and Switzerland (more than 6%), followed by Finland, Germany, France and the Netherlands (about 4% each), and is lowest in Spain and Belgium (about 2%). In services, expenditure on innovation is highest in the United Kingdom and Sweden (about 4%) (Section 5.5).

– Venture capital is crucial for promoting innovation, particularly by new firms, and a major source of funding for new technology-based firms. It is expanding rapidly in most countries for which data are available. The United States' venture capital market is by far the largest, followed by the United Kingdom and Canada. Even expressed as a percentage of GDP, investment in venture capital in these three countries is among the highest in all OECD countries. It is also high in the Netherlands, Finland and Belgium. Almost half of venture capital in North America finances firms in their early stages, whereas in Europe it mostly finances the expansion of firms already present in the market (Section 5.6).

The globalisation challenge

More and more firms, including small ones, organise an increasing part of their activities on an international and even world-wide basis.

International trade in goods and, increasingly, in services plays a dominant role in international transactions. While financial transactions (direct investment, portfolio investment, and investment income) have largely outstripped growth in international trade, they are at present significantly less important in absolute value (Section 6.1).

– On average, exports and imports of goods and services represent about 20% of GDP in OECD countries. However, this hides substantial differences among countries, as their trade-to-GDP ratio is strongly affected by characteristics such as size and geographic distance. Thus, international trade in goods and services accounts for more, sometimes substantially more, than 50% of GDP for Luxembourg, Ireland, Belgium, the Czech Republic, the Netherlands and Hungary. In contrast, international trade is much less important for economies such as the United States and Japan, whose trade-to-GDP ratio is about 10%. The figure is similar for the European Union when intra-EU trade flows are excluded (Section 7.1).

– High-technology industries, such as manufacture of computers, electronic equipment, and pharmaceuticals, play an increasing role in international trade of manufactured goods. While high-technology industries represent at present, in absolute terms, about one-fifth of total OECD trade, they are the most dynamic manufacturing industries (Section 7.2).

Since the second half of the 1980s, *foreign direct investment* has played a fundamental role in furthering international integration and has been the single most dynamic factor in industrial restructuring at world level. It most often takes the form of cross-border acquisitions of existing firms and is the fastest route to external growth for firms seeking to achieve "critical mass", want to increase rapidly their market share, rationalise their business or build up their technological potential and competitiveness. The cross-border merger and acquisitions market grew by a substantial 59% in value terms in 1998, *i.e.* a total of over 550 billion US dollars (Section 8.2).

– The importance of foreign direct investment varies markedly across countries. Relative to GDP, it is very important for countries such as the Netherlands, Switzerland, Belgium, Sweden and the United Kingdom. In contrast, it is of little importance for Korea, Japan, Iceland and Poland. Among the main net exporters of direct investment capital are three small European countries: the Netherlands, Switzerland and Sweden. In contrast, Belgium, New Zealand and Australia as well as central European economies receive more foreign capital than they invest abroad (Section 8.1).

– Indicators of the activity of foreign affiliates make it possible to analyse the shares and the performance of these firms and their contribution to the host country's economic activity. The share of foreign-controlled production and employment in OECD Member countries averages between 10% and 20%. It grew during the period 1985-96 in practically all of the countries for which data are available, but varied substantially across countries. The share of foreign affiliates in manufacturing production varies from 66% in Ireland to less than 3% in Japan. Foreign affiliates also play an important role in Canada, the Netherlands, France, the Czech Republic and the United Kingdom. In contrast, the share of foreign affiliates in Japan, Turkey, Germany, Finland, Norway and the United States is limited (Section 8.3).

The *internationalisation of science and technology* is a major aspect of economic globalisation. Information and communication technology has made possible the globalisation of financial markets and largely underpins the expansion of international trade of goods and services and investment flows. Scientific and technological activities are also increasingly performed at international scale.

– The share of foreign affiliates in R&D varies enormously across countries: from 1% of the manufacturing sector in Japan to 68% in Ireland. At more than 30%, it is also very substantial in Spain, Canada, the United Kingdom, Australia and the Czech Republic (Section 9.1).

– Technological alliances, particularly between firms in different countries, can take very different forms, from straightforward partnerships (cross-licensing) to the formation of joint research subsidiaries. While the number of alliances, both national and international, showed no substantial change over the period 1988-90, it increased during the period 1994-96 in the United States, Japan and the European Union (Section 9.2).

– More and more inventions are owned by companies from countries different from the inventor's. On average, 8% of inventions made in any OECD country were owned by a foreign resident in the mid-1990s, against 6% in the mid-1980s. For almost all countries, both ownership of inventions made abroad and foreign ownership of domestic inventions have increased (Section 9.3).

– Cross-border co-authorship of scientific articles and co-invention of patents provide an indication of the level of internationalisation of scientific and technological activities. International co-operation in research is increasing in both scientific research (25% of publications are the work of multinational teams)

and technological research (9% of patents are the result of international co-operative research) (Section 9.4).

Economic performance and competitiveness

– Among the larger countries the standard of living, measured as per capita GDP, is highest in the United States – more than 30% above the OECD average – whereas the other G7 countries lie very close to the average. The picture changes when the focus shifts from per capita income to GDP per person employed. Because of comparatively high unemployment rates and lower rates of labour participation, European countries tend to move up in a ranking in terms of labour productivity. There have been individual cases of rapid convergence, among them Ireland, where output per person employed was around 65% of the labour productivity in the United States in 1985 but 90% in 1997. Portugal and Korea are other examples of a recent catch-up process (Section 10.1).

– Movements in relative unit labour costs are one means of tracking developments in cost and price competitiveness on export markets for different countries and industries. At the level of total manufacturing, and for the set of countries presented, unit labour costs have risen fastest between 1990 and 1996 in Japan, Greece and Portugal, and slowest in Finland, Canada and Italy (Section 10.3).

For science and technology, the relationship between input (*e.g.* R&D) and output (*e.g.* inventions) is not a linear one. As differences in national performance show, the output of science and technology activities depends not only on the amount of input, but also on the efficiency of the entire innovation system, which in turn depends on framework conditions and on government policies. In addition, it is more difficult to measure output than input. Whereas input can be measured in monetary terms or as head counts, output is much more diverse, often indirect, and often without any monetary counterpart. However, selected indicators show that:

– Scientific discoveries and new technological devices are a direct outcome of research. They can be measured through scientific publications and patents, respectively, although these are partial and imperfect indicators. Both indicators exhibited a steady upward trend in the 1990s. Scientific publication counts relative to population size are higher for Switzerland, Nordic countries and English-speaking countries. Korea shows the highest growth rates both in the number of scientific publications and in the number of patent applications to the European Patent Office (EPO) and is catching up with more advanced countries. Growth rates for patent applications in Europe are also high for Nordic countries (Sections 11.1 and 11.2).

– Innovation is particularly important for information and communication technologies. In the late 1990s, almost one patent in five granted by the United States Patent and Trademark Office (UPSTO) is ICT-related, against one in ten in the early 1990s. The share of ICTs in patents is particularly high in Finland (almost 30%), followed by Ireland (with many affiliates of multinational firms), Korea, Japan and the United States (Section 11.3).

– While the technology balance of payments partly reflects a country's capacity to sell its technology abroad and its use of foreign technology, a negative balance is not necessarily an indication of lack of competitiveness. In Ireland, the Netherlands and Belgium, the average of technology receipts and payments exceeds 1.5% of GDP compared to 0.3% for the OECD total. In contrast, this ratio is very low for Iceland, New Zealand, Australia and Mexico. The United States remains the main net exporter of disembodied technology in the OECD area, with a surplus of almost 25 billion US dollars in 1997. Since 1996, Japan has also become a net exporter of technology, while the European Union is an importing area overall, the only net exporters of technology being Sweden, the Netherlands and Belgium (Section 11.5).

– Substantial differences can be found in the share of high- and medium-high-technology industries in manufacturing exports, ranging from less than 5% for Iceland to more than 80% for Japan. In general, high- and medium-high-technology industries account for a large share of exports of countries which have a technological lead, spend a high share of gross domestic product on R&D, and are well-endowed with qualified labour, especially scientists and engineers. These industries account for more than two-thirds of manufacturing exports for Japan, Ireland, Switzerland, the United States, Mexico, Germany, and the United Kingdom. High- and medium-high-technology exports have grown fastest since 1990 in Ireland

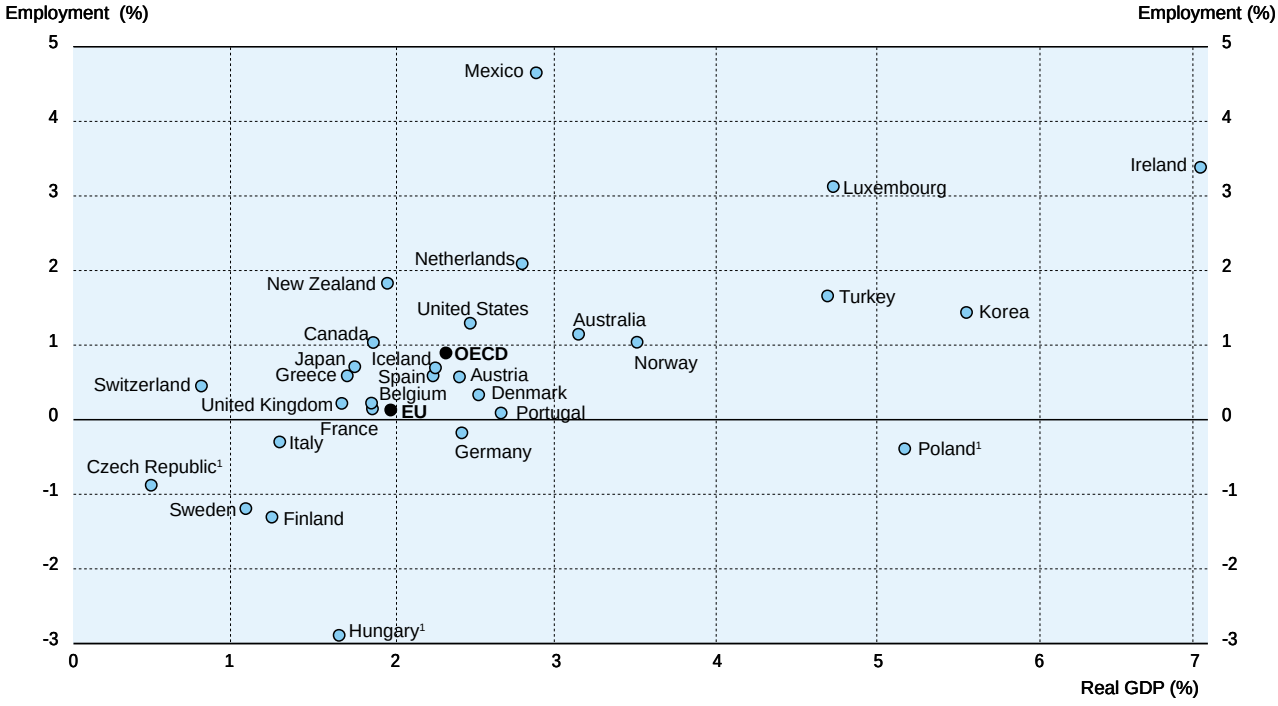
and Mexico. The favourable position of these two countries is less due to domestic R&D efforts; rather it underlines the role of foreign affiliates and international sourcing. Countries such as Iceland, New Zealand or Turkey are catching up (Section 12.1).

– A country's position in terms of market segments (in terms of quality) is important for policy, as it may have important consequences for income distribution. High quality (as revealed by high unit values) depends on R&D expenditures, labour qualifications, internal organisation of firms, etc. Therefore, a country's specialisation is not neutral from a policy point of view. The share of up-market goods in manufacturing exports to the European Union varies from less than one-fifth (Poland, Czech Republic, Turkey and Greece) to three-quarters (Switzerland, followed by Australia, the United States, Ireland and Japan). The share of up-market goods is strongly correlated with per capita income (Section 12.3).

1.1. The current macroeconomic context

- Real GDP in the OECD area grew at an annual average of 2.3% throughout the 1990s, a weaker performance than that of the previous two decades (3.8% in the 1970s and 3.0% in the 1980s).
- Countries such as Ireland, Korea, Poland and Turkey that experienced high GDP growth over this period tended to be still going through a catching-up phase (see Section 10.1).
- After the widespread downturn in the early 1990s, many countries have enjoyed consistent growth. The financial crisis towards the end of 1997 (while it had a particularly adverse effect on most of the Asia-Pacific region) did not have quite the negative impact expected on many OECD countries.
- Growth in employment is closely related to growth in GDP. Both are driven in the long run by similar factors, including advances in technology. However, various patterns of productivity growth and changes in average working time can result in different employment patterns across countries.
- Most European countries performed poorly in this respect over the last decade, although there have been signs of improvement in recent years.

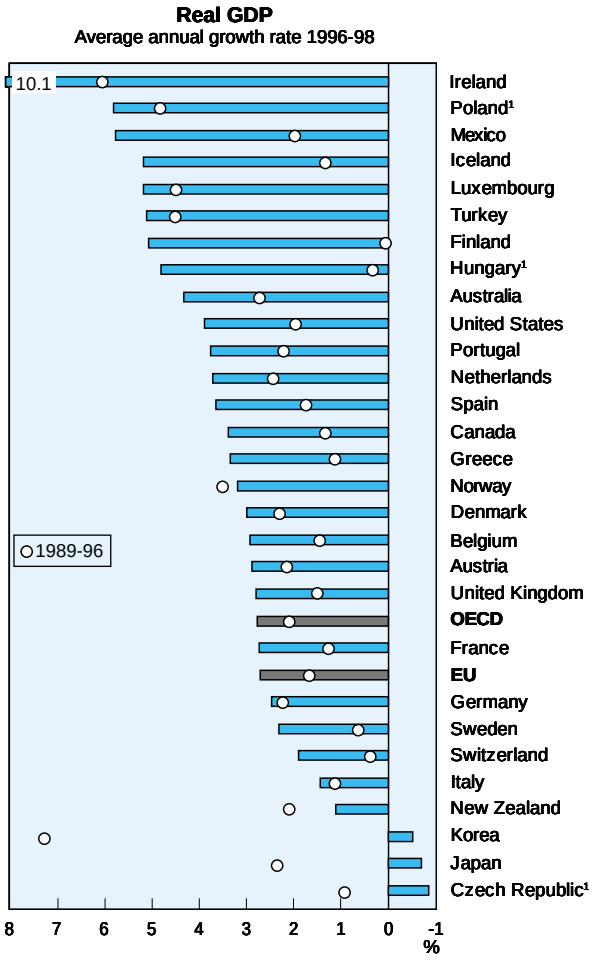
Real GDP and employment
Average annual growth rate 1989-98

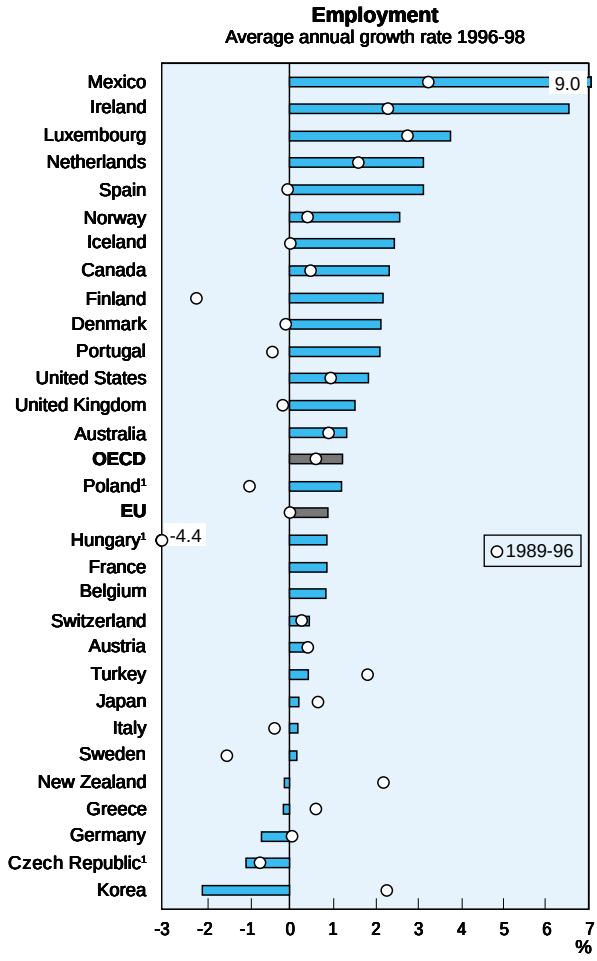


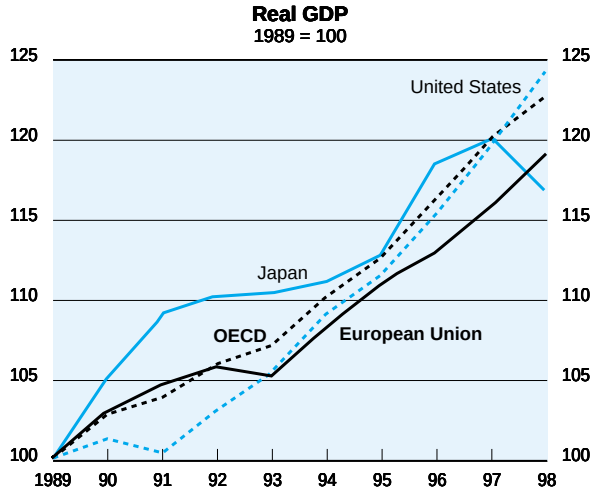
1. 1991-98.
Source: OECD, *Economic Outlook 65*, June 1999.

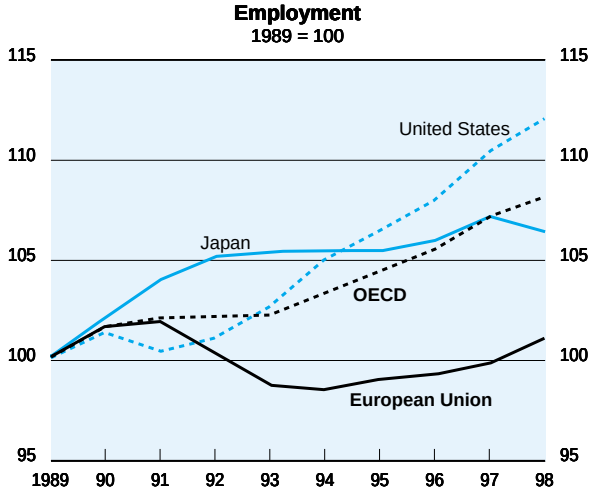
For more details, see Annex, Tables 1.1.1 and 1.1.2.

1.1. The current macroeconomic context









1. 1991-98 instead of 1989-98.

Source: OECD, *Economic Outlook 65*, June 1999.

2.1. Investment in tangibles and in knowledge

- Investment takes various forms, all of which are important to economic growth.
- Physical investment mainly covers expenditure for construction and machinery and equipment, and allows the diffusion of new technology, especially in manufacturing industries. It represents 20% of OECD-wide GDP, ranging from more than 30% for some countries (Korea, Czech Republic) to less than 15% for others (Sweden, Iceland).
- Investment in knowledge is by nature much more difficult to measure. Including public spending on education, expenditures on R&D and investment in software, it represents 8% of OECD-wide GDP, a level similar to investment in equipment. Moreover, this figure would exceed 10% if private expenditure on education and training (not available for all countries) were included in the definition of investment in knowledge.
- Investment in knowledge is highest in Nordic countries and France (around 10% of GDP), countries for which it is more important than investment in equipment. Among countries for which data are available, investment in intangibles is lowest in Italy, Japan and Australia (6-7%).
- Most OECD countries spend more and more resources on the production of knowledge. Since the mid-1980s, investment in knowledge has grown by about 2.8% annually in the OECD area (slightly more rapidly than GDP), growth rates being highest in Nordic countries, Japan and the United States.
- Generally, countries that invest more in knowledge tend to invest less in physical assets.

Investment in knowledge

Total investment in knowledge is calculated as the sum of expenditure on R&D, public spending on education, and investment in software. However, before adding these three components, the data required work:

- The equipment component of R&D expenditure was subtracted, in order to keep only the intangible part.
- The R&D component of higher education, which overlaps with R&D expenditure, was estimated and subtracted from public spending on education.
- All expenditure on software cannot be considered as business investment. Purchase of packaged software by households and operational services in firms were estimated and subtracted.

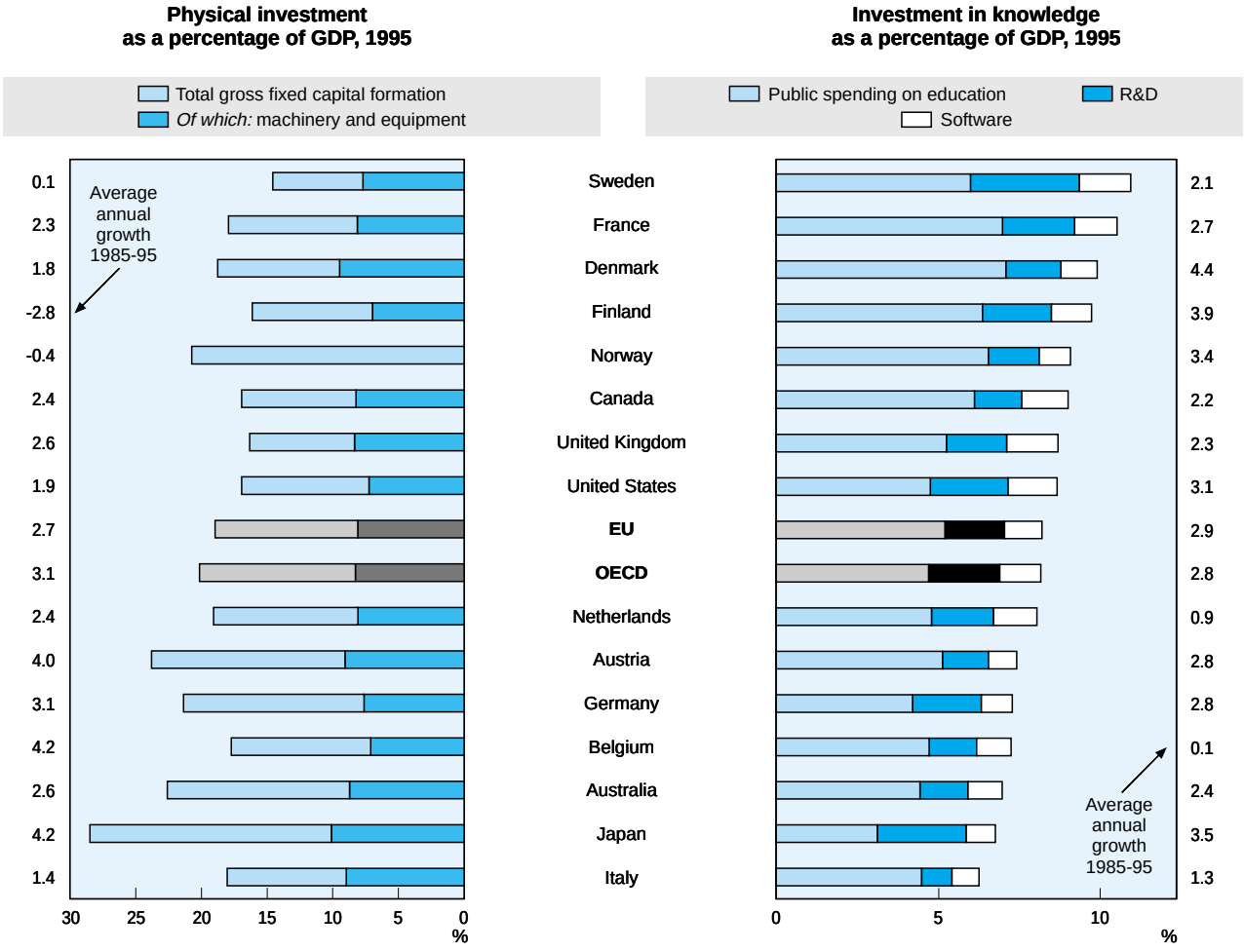
Expenditure on marketing was not included, although it is clearly an investment in an intangible asset, since its objective is not to increase technical knowledge and productive efficiency.

A more complete picture of investment in knowledge would include other components as well:

- For private spending on education and training, data are not available for all OECD countries.
- Data on expenditure on design of new goods are collected from innovation surveys, but are still available only for some countries.
- Other components are even more difficult to estimate at this stage, such an investment in organisation (spending on organisational change, opportunity costs).

For more details, see Annex, Table 2.1.1.

2.1. Investment in tangibles and in knowledge



Source: OECD, *Economic Outlook 65* and International Data Corporation.

2.2. Knowledge-based industries and services

- The importance of technology-based activities has often been approximated by the share of high-technology industries in manufacturing. However, this approach focuses only on the main *producers* of high-technology goods.
- It is desirable to include other activities that are intensive *users* of high technology and/or have the relatively highly skilled workforce that is required to benefit fully from technological innovations. Therefore, in addition to the commonly identified manufacturing industries, service activities such as finance, insurance and communications are included here.
- This broadly defined group (see box) accounted for more than 50% of OECD business value added in the mid-1990s, rising from around 45% in the mid-1980s. Finance, insurance and business services account for the biggest share in all countries.
- Knowledge-based manufacturing industries and services are more predominant in the larger OECD economies.
- In the United States and Japan, growth in high- and medium-high technology manufacturing has outpaced that in services in recent years. In Europe, services have performed significantly better.
- In general, growth in knowledge-based services has been consistent throughout the decade. Growth in high- and medium-high-technology manufacturing tends to be more cyclical in nature. In the United States, little growth occurred in this group of industries between 1988 and 1993; since then, growth has been strong and sustained.

Measuring knowledge-based industries

All industries are to some extent dependent on knowledge inputs. However, some industries rely more on knowledge than others. The term “knowledge-based industries” usually refers to those industries which are relatively intensive in their inputs of technology and/or human capital.

While there are established methods for classifying manufacturing industries according to technology intensity (see Box 7.2), capturing the right service sectors to help measure the impact of knowledge has proved more challenging. Limited data availability and international comparability are the main reasons:

- For many years, a majority of OECD countries have provided data on service sectors only at fairly aggregate levels, concentrating instead on more detailed manufacturing data.
- Even when considering broad service sectors, limited information in areas such as R&D expenditure and skill levels makes it difficult to group them formally according to "knowledge intensity".
- As interest in services has increased, the situation has improved, but difficulties remain when applying a common classification (in this case ISIC Rev. 2) to improve comparability. For example, although imperfect, ISIC Rev. 2 Division 8 is used to capture financial and other business services. However, for some countries, including Germany and Japan, many business services are reported under ISIC Rev. 2 Division 9 and the distinction may thus be blurred.

In view of the above, in addition to the commonly identified manufacturing industries, the following ISIC Rev. 2 service activities are included:

- Division 72: Communications
- Division 8: Finance, insurance, real estate and business services
- Division 9: Community, social and personal services

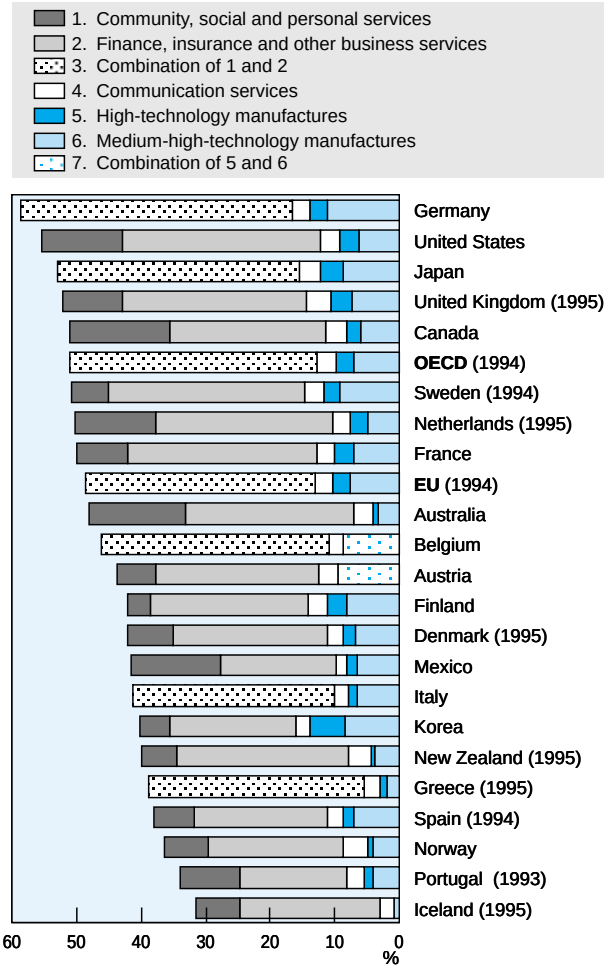
While including health and education services, Division 9 includes many services that may not be considered knowledge-intensive (though health and education are predominant). It is included here for optimal comparability across countries. It should be noted, however, that although many countries report only market services in ISIC Rev. 2 division 9, some include certain non-market services. Nevertheless, the general picture is unchanged when this is taken into account.

"Total business sector" refers to ISIC Rev. 2 Divisions 1 to 9.

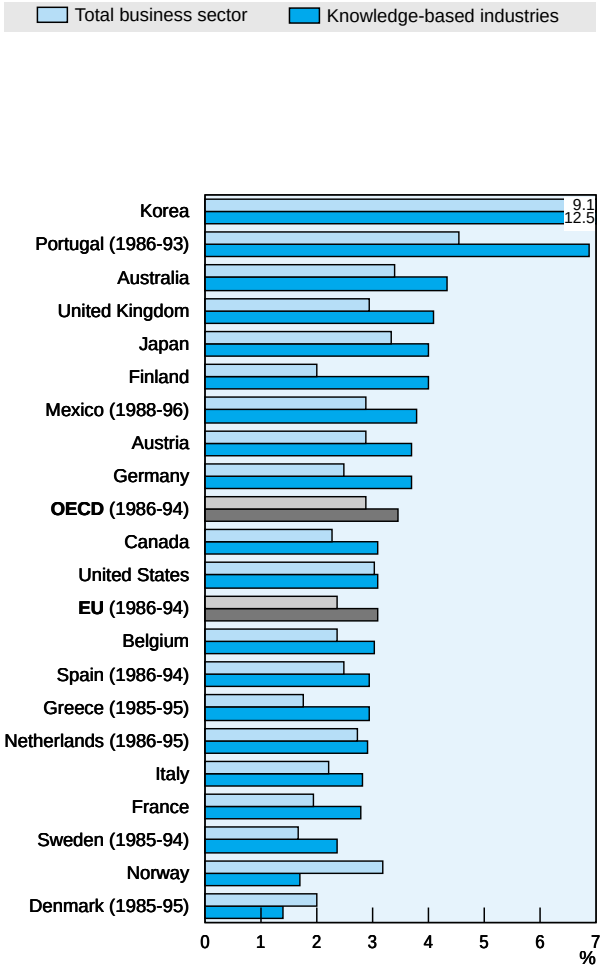
For more details, see Annex, Table 2.2.1.

2.2. Knowledge-based industries and services

Share of value added in the business sector
1996

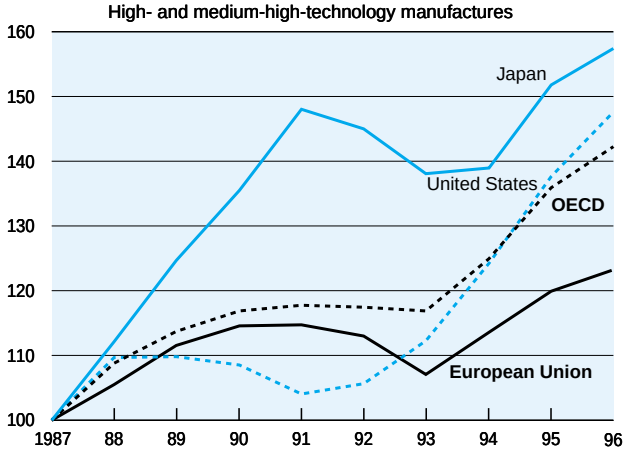


Real value-added growth
Average annual growth rate 1985-96

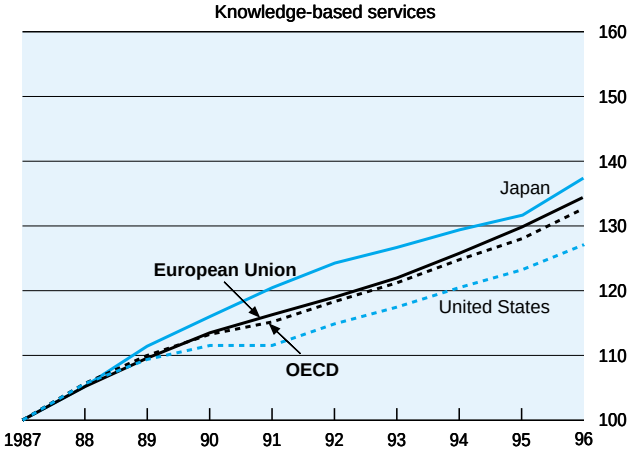


Real value added (1987 = 100)

High- and medium-high-technology manufactures



Knowledge-based services



Source: OECD, STAN database and Main Industrial Indicators, 1999.

2.3. Information and communication technology (ICT) expenditures

- Information and communication technologies (ICTs) have become major drivers of economic growth in OECD countries. These new omnipresent technologies are contributing to productivity growth by allowing firms to operate more efficiently, while creating new markets for products and services.
- In 1997, OECD countries spent on average almost 7% of GDP on ICT, up from 5.9% in 1992.
- ICT intensity (ICT expenditures as a percentage of GDP) in the United States remains 2 percentage points higher than in the European Union. It has risen strongly in Japan, and is close to that of the United States.
- ICT intensity is higher in English-speaking countries, in Sweden, Switzerland, and, to a lesser extent, in Japan and the Netherlands. It is lowest in the Mediterranean and central European countries, and in Mexico.
- Telecommunications accounts for the largest share of ICT expenditures in many countries, particularly in those where ICT intensity is weak, and in the Asia-Pacific region.
- ICT intensity has risen in virtually all OECD countries since 1992, at an annual average of almost 2.2%. Growth was particularly high in countries with a relatively low ICT intensity, such as Portugal, Greece, and Poland.
- For many countries, the increase in ICT intensity is mostly driven by investment in the modernisation of the telecommunication infrastructure.

ICT expenditures

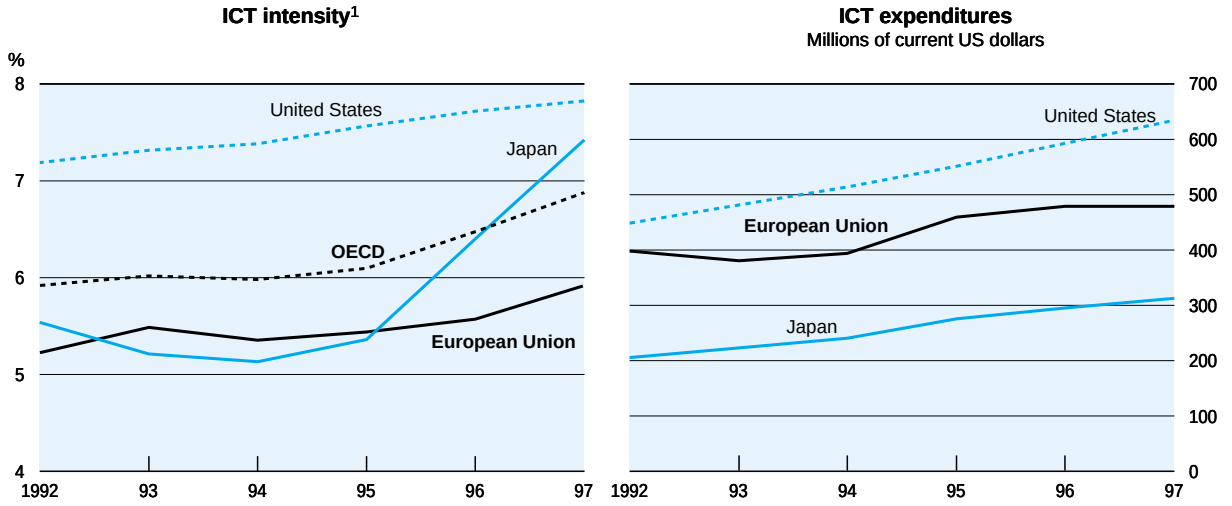
ICT expenditures include both internal and external spending in three main categories of products and services: *i)* information technology (IT) hardware; *ii)* IT services and software; and *iii)* telecommunications. These are defined by International Data Corporation (IDC)* as follows:

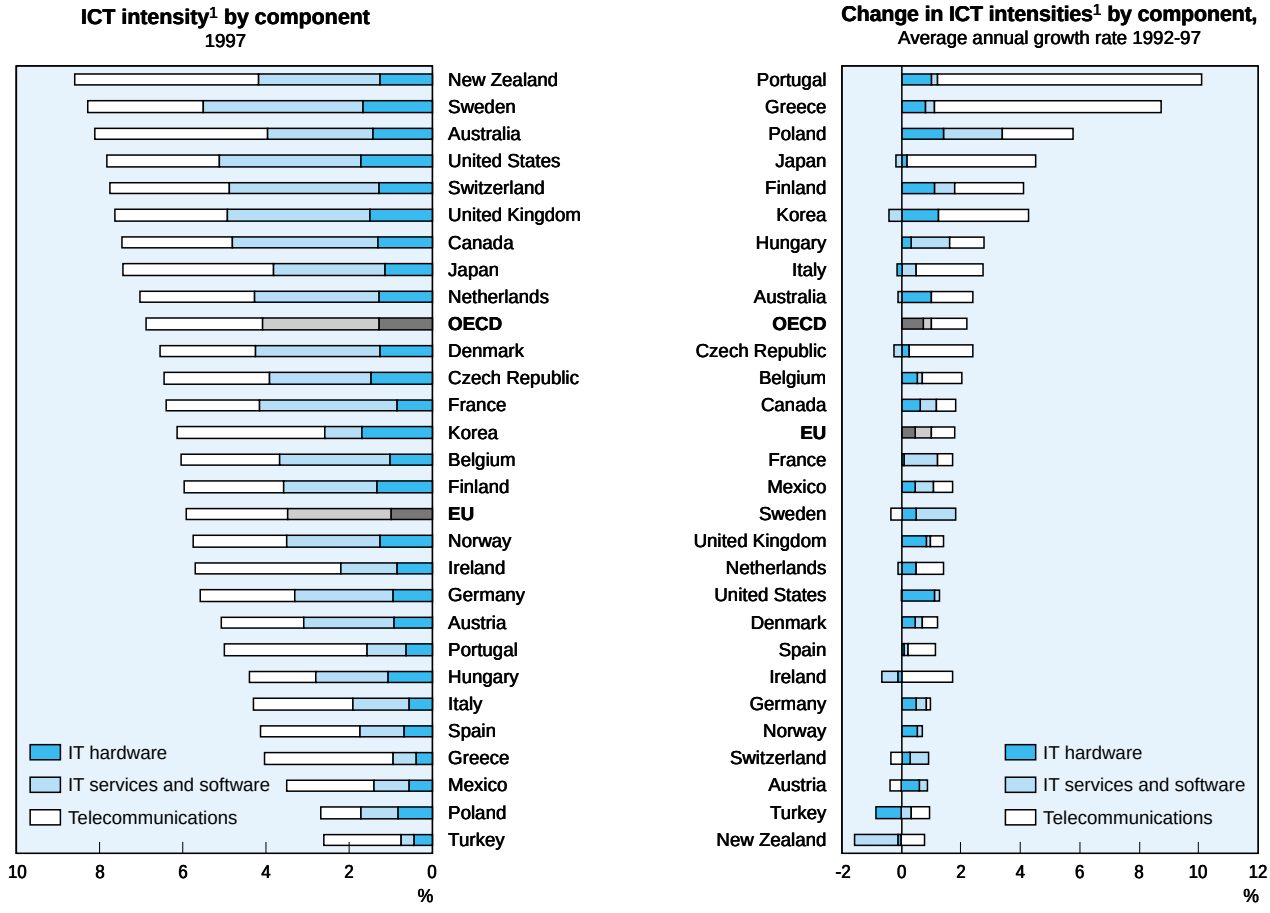
- IT hardware: computer system central units, storage devices, printers, bundled operating systems, and data communications equipment.
- IT services and software: IT software, IT services, internal IT spending including the internal portion of information systems' operating budgets, internally customised software, capital depreciation and any other expense related to IT that cannot be directly tied to a vendor.
- Telecommunications: public network equipment, private network equipment, telecommunications services.

* World Information Technology and Services Alliance (WITSA)/International Data Corporation (IDC), *Digital Planet – The Global Information Economy*, 1998.

For more details, see Annex, Table 2.3.1.

2.3. Information and communication technology (ICT) expenditures





1. ICT expenditures as a percentage of GDP.
Source: OECD, ADB database and IDC.

2.4. Computers and the Internet

- As prices continue to drop sharply, computers become more and more affordable for both businesses and consumers. The US quality-adjusted index for computers shows a drop of almost 90% in prices of personal computers (PCs), workstations and laptops over a six-year period, compared to a decline of 40% for large-scale computers.
- Computer penetration rates are an indicator of information technology (IT) diffusion in households and workplaces. As personal computers continue to become more affordable, the share of households equipped with PCs has grown significantly: by 1997, more than 30% of households in seven OECD countries were equipped with PCs.
- Wide variations still exist with respect to access to computing equipment, and income is clearly the primary differentiating factor within countries. Other socio-demographic characteristics, such as age, occupation and educational attainment, strongly influence the presence of computers in households.
- The number of Internet hosts is a lower bound on the size of a country's "public" Internet and not a precise measurement of the number of online computers. The number of hosts in OECD countries reached 40.8 million in January 1999, or 94% of the world total.
- The Nordic countries, the United States and Canada are among the most "wired", with seven to eleven Internet hosts per 100 inhabitants, compared to an OECD average of less than four.
- High communication costs remain a strong barrier to the widespread use of Internet. Although cost is not the only factor, countries with relatively inexpensive Internet access tend to have a higher Internet host density.

Computers and the Internet

US producer price indices (PPI) are used as a proxy to measure worldwide price fluctuations for computer equipment. A quality adjustment technique using hedonic regressions is used to account for the rapid technological improvements embodied in these products. Data from France (INSEE) suggest that the trend of rapidly declining prices exists outside the US market. Shorter time series for US consumer price indices (CPI) confirm that the cost declines are being passed on to consumers in the form of lower prices.

Surveys of Internet hosts are the most common way of measuring worldwide Internet development. An Internet host is any computer connected to the Internet via full- or part-time, direct or dial-up connections (Network Wizards, 1999). Some of the limitations of using Internet host counts as an indicator of Internet development by country are:

– These surveys do not necessarily reach all hosts or servers connected to the Internet, as access might be blocked, for example by a company firewall.

– Generic Top Level Domains (such as .com and .net) were redistributed among OECD countries based on their relative shares of the domain registrations published by a different source (Internet.org). Although this method is subject to a number of caveats, it does provide a more accurate distribution of Internet hosts than simple country-code Top Level Domain (*e.g.* .ca for Canada) counts. For example, in Canada, more than half of all hosts were registered under .com domains.

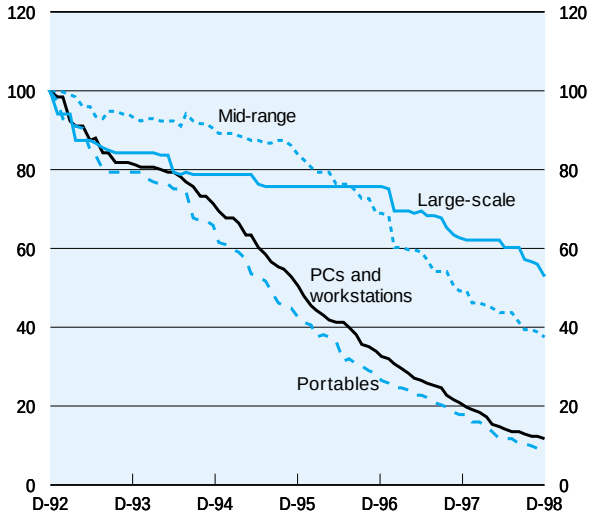
The index of Internet access cost is based on the OECD peak rate Internet access basket (calculated in US dollars using purchasing power parities) for mid-1998 (OECD, 1999). This basket includes two components: PSTN (telephone) and Internet service provider (ISP) charges. It does not take into account various discount schemes, including free subscriptions from ISPs, and assumes that users can access the Internet via a local telephone call (which is not always the case). In most OECD countries, the PSTN charge accounts for a higher share in total cost than the ISP charge.

For further information, see Network Wizards, Domain Survey Definitions, http://www.nw.com/zone/WWW/defs.html, 1999; OECD, *Communications Outlook 1999*, Paris, 1999.

For more details, see Annex, Table 2.4.1.

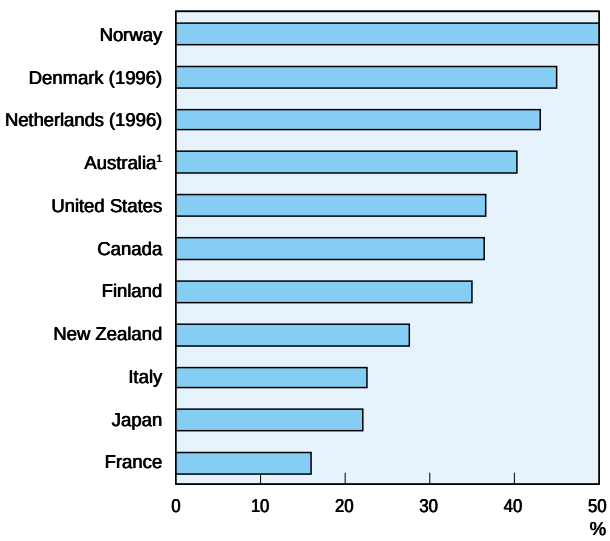
2.4. Computers and the Internet

Computer hardware prices, 1992-99
Index December 1992 = 100



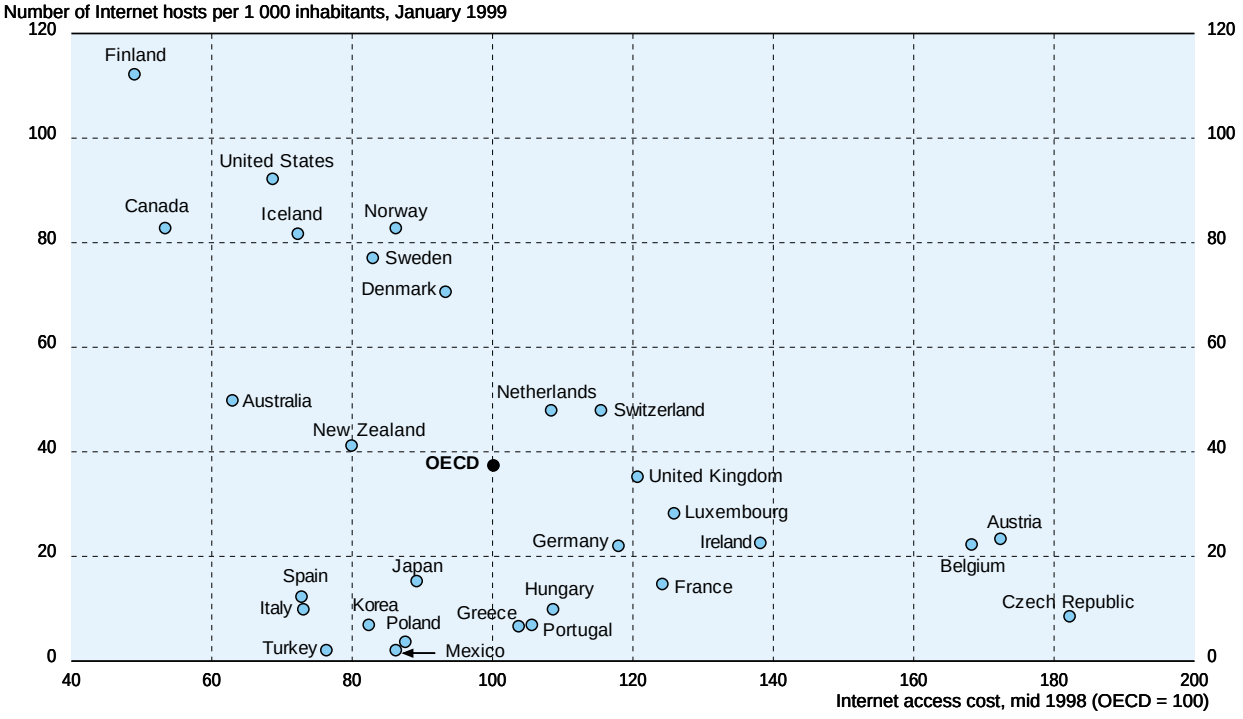
Note: Large-scale systems are those with 64 MB or more in minimum main memory configuration. Mid-range systems are those with less than 64 MB, excluding PCs and workstations.
Source: US Bureau of Labor Statistics (BLS).

Household PC penetration rates, 1997
Percentages



1. Average of 1996 and 1998 data.
Note : Percentage of households owning a personal computer.
Source : OECD, compiled from data from national statistical offices.

Internet access cost and Internet host density, 1998-99



Source : OECD, *Communications Outlook 1999* and OECD calculations from Network Wizards and Internet.org data.

2.5. Infrastructure for the information economy

- As demand from households and businesses for new communication and broadcasting services expands and liberalisation of markets continues, the much-heralded information infrastructure begins to take shape.
- Telecommunication networks continue to expand rapidly throughout OECD countries: by 1997, there was almost one fixed access telephone line for every two inhabitants in the OECD area, and cellular mobile telephony networks covered 95% of the total population.
- One-third of OECD households now have cable access, one-tenth subscribe to Direct Broadcast Satellite services (DBS), and the number of ISDN subscribers in the OECD area increased more than eight-fold between 1993 and 1997.
- Between 1992 and 1997, the number of cellular mobile subscriptions grew by more than 50% annually in OECD countries to reach 170 million subscribers by the end of 1997, or one of out six inhabitants.
- As for Internet host density, the Nordic countries have the highest penetration rates among OECD countries for cellular mobile telephony: Finland, Sweden and Norway had more than one cellular mobile subscription for every three inhabitants in 1997.
- In these countries, the total number of telecommunication access paths (fixed access lines plus mobile subscriptions) now exceeds the total population. In all three Nordic countries mentioned above, as well as in Japan, a substitution effect is now occurring between mobile and fixed communication networks.
- The number of secure Web servers gives a broad measurement of the existing infrastructure for electronic transactions. An August 1998 survey of secure Web servers identified over 22 000 Web sites engaged in electronic commerce in the OECD area.
- The total number of Web servers for electronic commerce in OECD countries grew by 128% between September 1997 and August 1998.
- Three-quarters of all servers are located in the United States, although this share is gradually declining as electronic commerce develops in other countries.

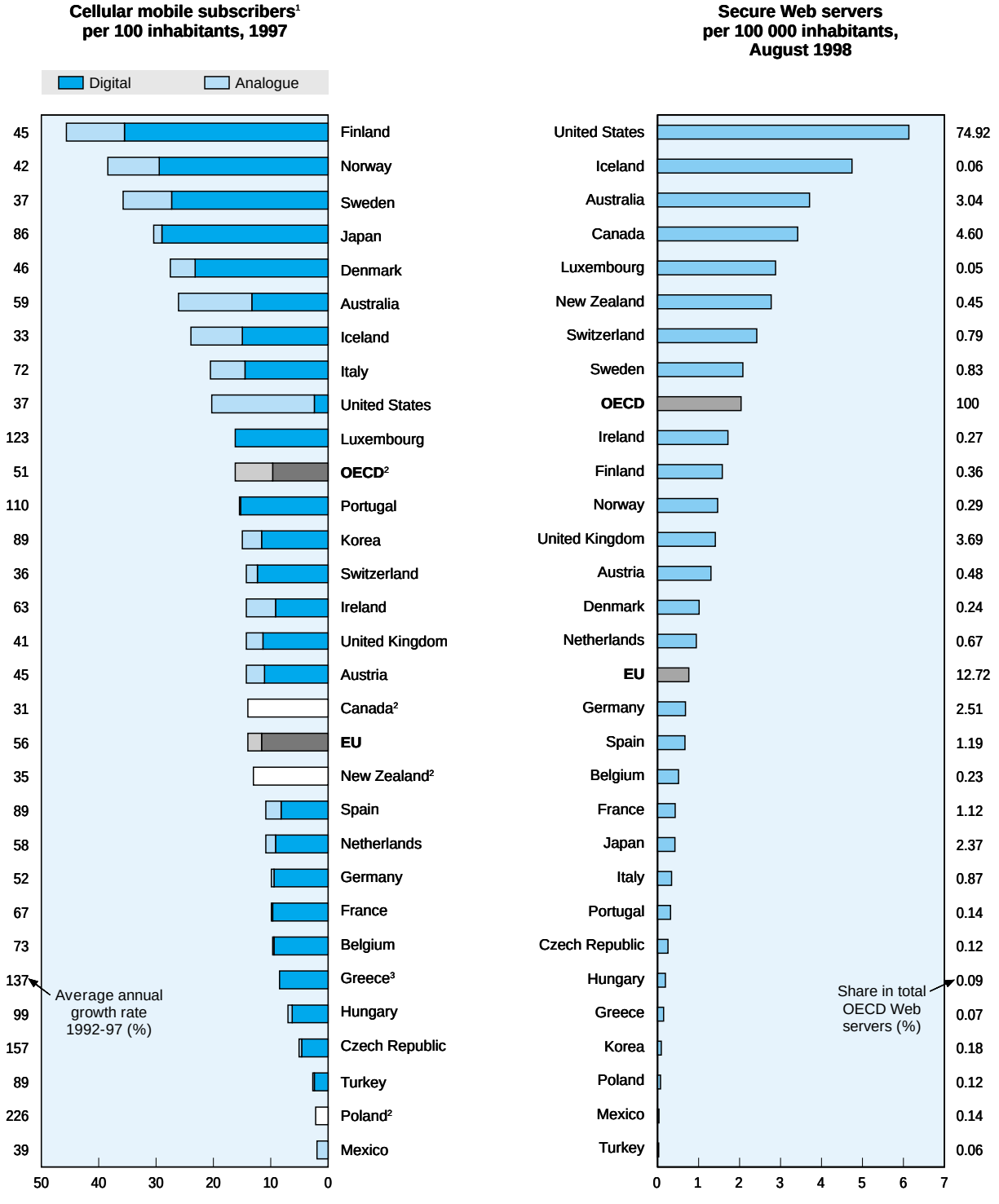
Electronic commerce

The Netcraft Server Survey provides one of the best available indicators of the growth of electronic commerce on the Internet. Their August 1998 survey of the secure socket layer (SSL) protocol identified more than 424 000 Web sites using encryption. Only those with third-party certification were retained since these would conduct electronic commerce activities over the Internet. World-wide, 23 224 such servers were identified, more than 95% of which were located in the OECD area.

For more information, see OECD, *Communications Outlook 1999*, Paris, 1999.

For more details, see Annex, Tables 2.5.1 and 2.5.2.

2.5. Infrastructure for the information economy



1. Data on cellular mobile subscribers include both digital and analogue, but not pagers.
2. Detail is not available for Canada, New Zealand and Poland. These countries are excluded from total OECD.
3. Average annual growth rate 1993-97 instead of 1992-97.

Source: OECD, *Communications Outlook 1999.*

2.6. Human resources

- As the knowledge-based economy requires new skills and competencies, the quality of human resources is the major factor behind the invention and diffusion of technology.
- Measures of educational attainment are the most commonly used proxies for human capital, despite their imperfections; they do not cover quality of schooling and formal or on-the-job training.
- 60% of the OECD population aged 25-64 has completed upper secondary schooling, and the share is 80% or more in the United States, the Czech Republic, Norway, Germany, and Switzerland. In contrast, it is below 50% in Turkey, Portugal, Luxembourg, Spain, Italy and Greece.
- 13% of the OECD population aged 25-64 has university-level education, but the share varies between less than 9% in Austria, Turkey, Portugal and Italy and more than 20% in the United States and the Netherlands.
- Flows of graduates in science and engineering hint at future progress in this area. However, this indicator is also influenced by the population's age structure. It is particularly high in English-speaking countries, France and Spain.

Measuring human capital stocks and flows

Human capital is heterogeneous: no single type of attribute can adequately represent the many human characteristics that bear on the economy and society. While the level of individuals' skills, knowledge and competencies at any one time can be taken to represent the "stock" of human capital, these various attributes cannot be easily quantified.

There are several approaches to estimate human capital stocks and flows, including:

– Occupational classifications, especially ISCO (International Standard Classification of Occupations), which rely on various criteria, including the complexity of the tasks performed.

– The highest level of education completed by each adult (educational attainment) reflects his/her skill level. ISCED (International Standard Classification of Education) classifies educational attainment in seven categories, two of which (categories 6 and 7) are for university degree or equivalent. For Graph 2.6.2 only, the fields of study with explicit technical content were selected for the calculations: natural science, mathematics and comuter sciences, and engineering.

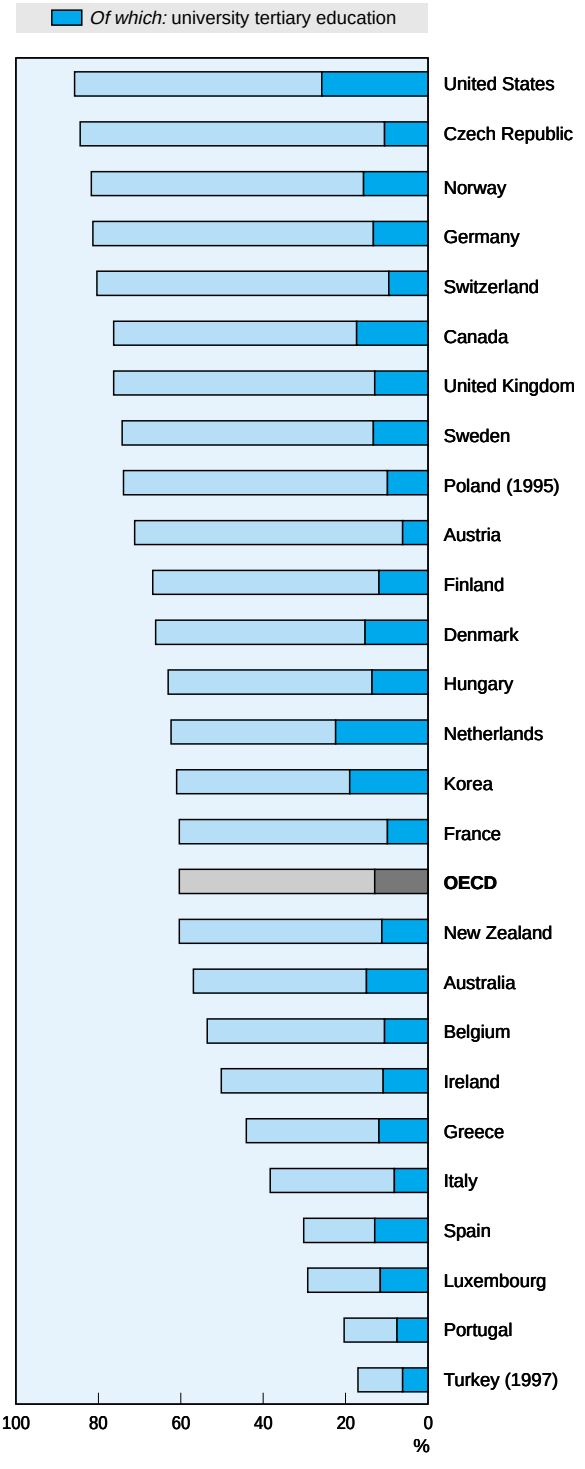
For further information, see OECD, *Manual on the Measurement of Human Resources Devoted to S&T*, "Canberra Manual", Paris, 1995; OECD, *Human Capital Investment*, Paris, 1998.

OECD, *Education at a Glance: OECD Indicators 1998*, Paris, 1998.

For more details, see Annex, Table 2.6.1.

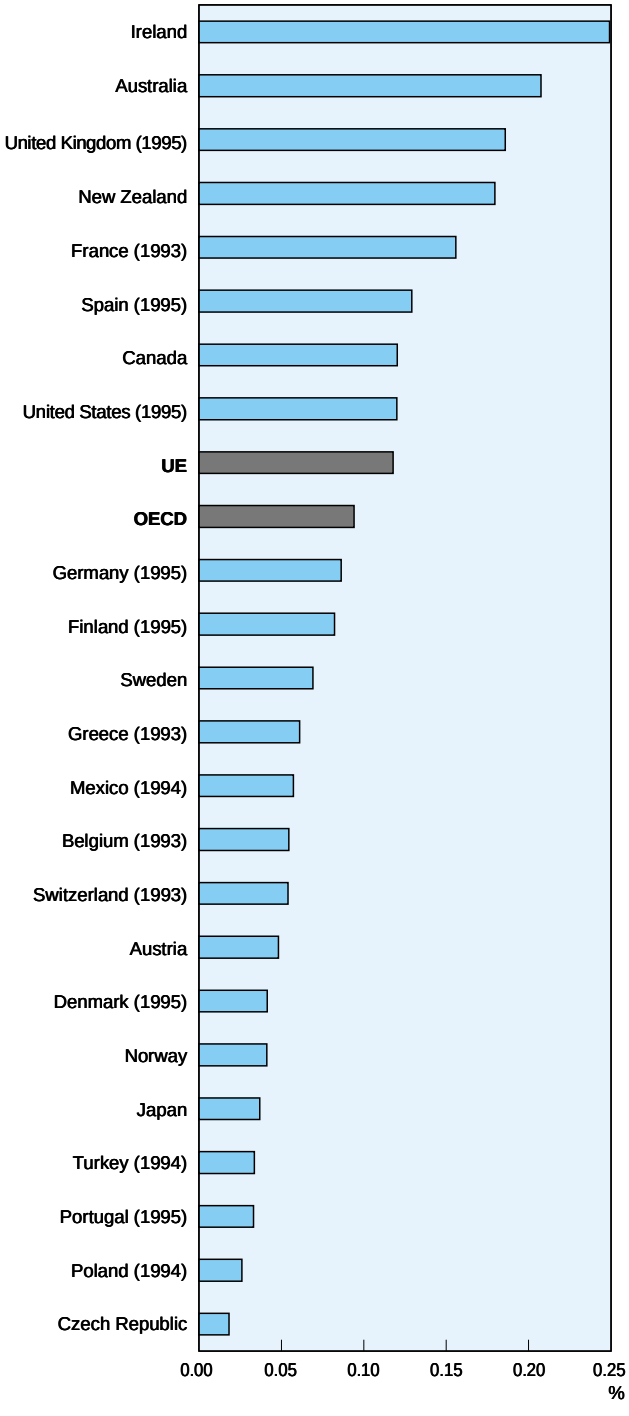
2.6. Human resources

Share of the population aged 25-64 with at least an upper secondary education level
1996 or latest available year



Source: OECD, *Education at a Glance, 1998.*

Flows of graduates in science and engineering, as a percentage of total employment
1996 or latest available year



Source: OECD, based on data from UNESCO.

3.1. Recent trends in total R&D efforts

- R&D activities are often viewed, in science and technology policy, as an aggregate that constitutes "the national R&D effort".
- It is estimated that OECD countries allocated over 495 billion US dollars to R&D in 1997, or more than 2.2% of their combined GDP.
- The slight recovery continued in the United States and Japan, following several years of declining investment in R&D as a percentage of GDP and at constant prices.
- R&D expenditure by the European Union relative to GDP has decreased gradually during the 1990s. This has been chiefly due to the situation in the five main R&D investing countries.
- Several countries, however, speeded up their R&D investment during the 1990s, notably Korea, Sweden, Finland, Ireland and Iceland.
- In 1995, nearly 2.7 million researchers were engaged in R&D in the OECD area, which corresponds to 55 researchers per 10 000 labour force.
- Overall, the number of researchers increased more slowly in the first half of the 1990s than in the preceding decade. In several countries (the Czech Republic, Germany, Hungary, Italy), the number even declined during one or more years in the 1990s.
- The share of researchers in the labour force has remained stable overall during the 1990s, whereas it rose slowly but steadily in the preceding decade.
- However, in Nordic countries, in Ireland and in Australia, this particular indicator of R&D intensity has increased rapidly during the 1990s.

Resources allocated to R&D

Two main input measures are employed. One of them is R&D expenditure: the main aggregate used for international comparisons is gross domestic expenditure on R&D (GERD), which comprises all of a country's domestic R&D-related expenditures for a given year. The other is R&D personnel, a category often limited to researchers (viewed as the central element of the R&D system). Researchers are defined as professionals engaged in the conception and creation of new knowledge, products, processes, methods and systems and in the direct management of the projects concerned. For those countries that compile data by qualification only, data on university graduates are used as a proxy for researchers. R&D personnel data are expressed in full-time equivalent (FTE) staff engaged in R&D during the course of one year. The R&D data have been compiled on the basis of the methodology of the *Frascati Manual 1993* (OECD, Paris, 1994).

The magnitude of estimated resource allocation to R&D is affected by national characteristics. These principally concern:

– Improvements in the national surveys on R&D: wider coverage of firms, particularly in the services sector (United States, 1992; Norway, 1987 and 1995; the Netherlands, 1994; Japan, 1995); improved estimates of resources allocated to R&D by the higher education sector (Finland, 1991; Germany, 1987; Greece, 1989; the Netherlands, 1990; Spain, 1992).

– Improved international comparability: in Japan, R&D personnel data are expressed in full-time equivalent as of 1996 (overestimate of about 30% previously) and R&D expenditure has been adjusted accordingly; in Italy, extramural R&D expenditures have been excluded as of 1991 (GERD overestimate of 6 to 10% previously); in Sweden, R&D in social sciences and the humanities (SSH) in the business enterprises, government and private non-profit institutions (PNP) sectors has been included as of 1993.

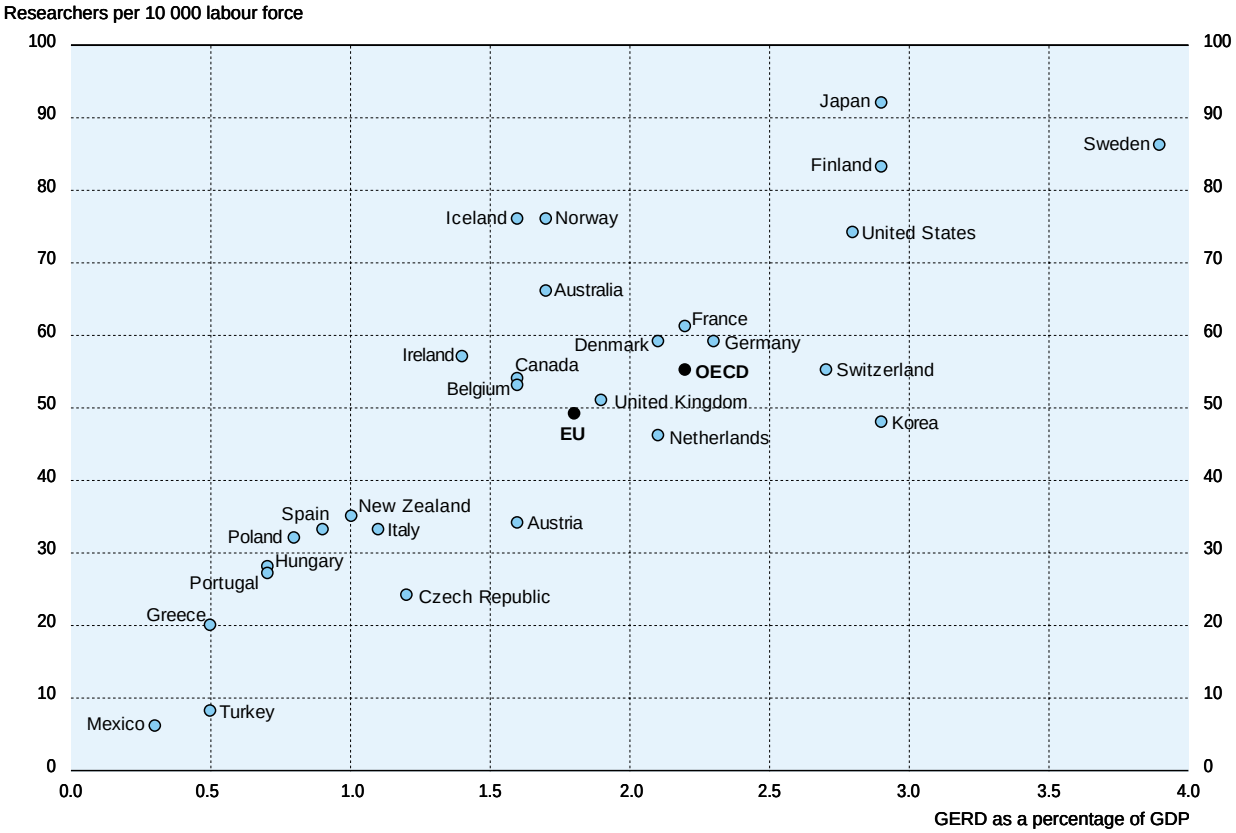
– Other breaks in series, notably: for Germany, data as of 1991 relate to unified Germany; for the United States, capital expenditure by the higher education sector has been excluded as of 1991 (11% of that sector's expenditure in 1990), similarly for Sweden for 1995.

– Probable underestimation of R&D data for Korea (SSH excluded), the United States and Sweden (Box 4.1).

For more details, see Annex, Tables 3.1.1 to 3.1.5.

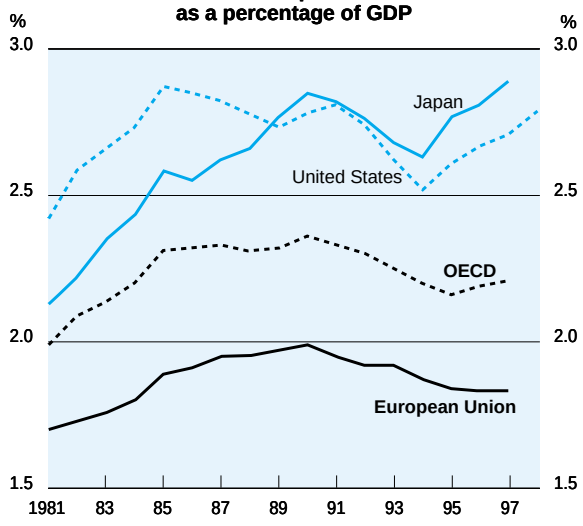
3.1. Recent trends in total R&D efforts

Gross domestic expenditure on R&D as a percentage of GDP and researchers per 10 000 labour force
1997 or latest available year[1]

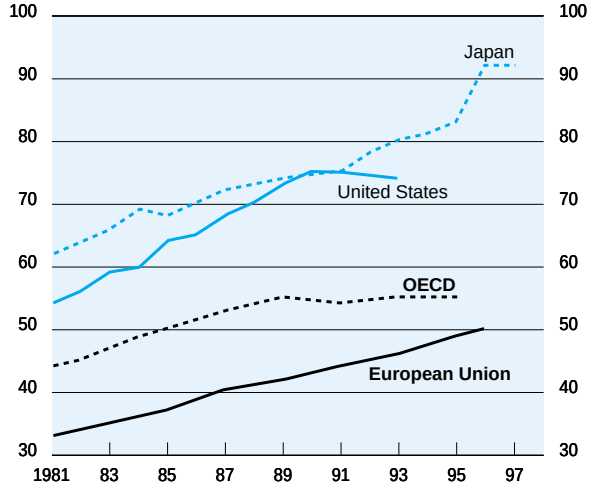


1. See Annex for years.

Gross domestic expenditure on R&D as a percentage of GDP



Researchers per 10 000 labour force



Source: OECD, MSTI database, April 1999.

3.2. R&D financing and performance

- The government sector finances less than one-third of R&D. During the 1990s the government share of R&D funding decreased in most Member countries. However, in seven countries (Hungary, Iceland, Italy, Poland, Portugal, Mexico and Turkey) it represents 50% or more of GERD. The government share has increased in six countries, partly reflecting a decrease in private funding, notably in Japan and Italy.
- The private sector has taken a larger part in the funding of R&D than in the 1980s, contributing more than 60% of the total R&D effort of OECD countries as a whole. It has taken a clear lead in the United States, due to the decrease in government funds and growth in private financing.
- The volume of funds from abroad continued to increase during the 1990s in a number of countries, including Denmark, the United Kingdom and Canada, where they represent over 10% of GERD. This reflects continuing globalisation of R&D. In some European Union countries (Belgium, Greece, Ireland), the development of Community funding has contributed substantially to the increase in funds from abroad, but in most cases (notably Denmark, Finland, France and the Netherlands), non-Community funding has grown more rapidly.
- In 1997, nearly 70% of R&D was performed by the business enterprise sector (see also Section 5.1). However, the share of researchers employed in this sector is less important, particularly in the European Union. This sector's contribution has climbed from the trough of 1993-95 back to its level at the beginning of the decade. The situation in the United States is partly responsible, but there has also been an advance in a number of other countries such as Australia, Canada, most of the Nordic countries and Ireland. The business sector's contribution has declined in a few countries, however, notably in the United Kingdom, Spain and Italy.
- The higher education sector and government research institutes carry out the remaining 25% to 30% of R&D expenditure and employ over 35% of the researchers of the OECD area. The proportions are higher in half of the OECD countries (see also Section 4.1).

Sectors of R&D performance and funding sources

The R&D effort (expenditure and personnel) is usually broken down among four *sectors of performance*: business enterprises, higher education, government and the private non-profit sector (PNP). This breakdown is based to a large extent on the System of National Accounts, but higher education is viewed as a special sector, owing to the important role played by universities and similar institutions in the performance of R&D.

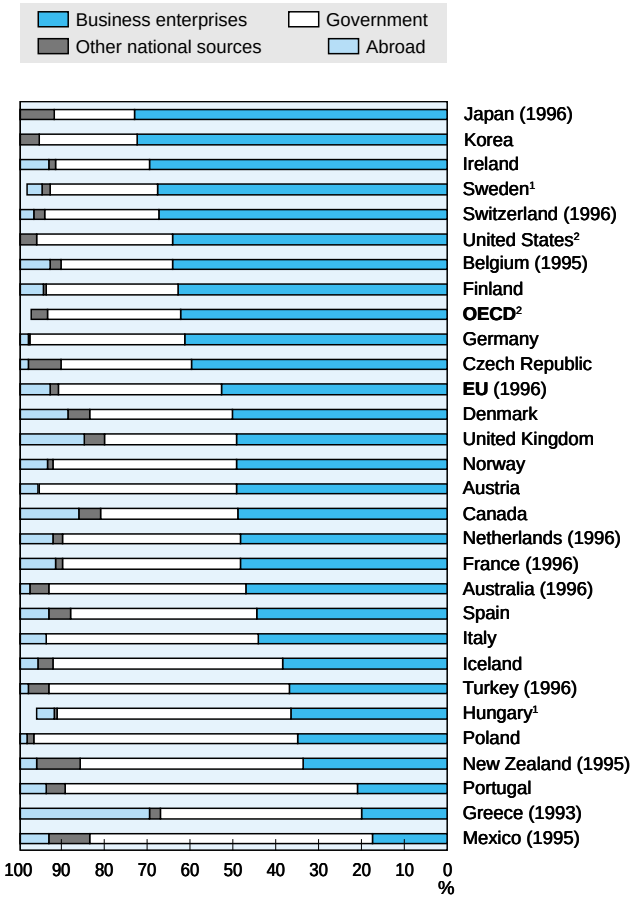
R&D has various *sources of financing*. Flows of funds have been measured using performance-based reporting of the sums which one unit, organisation or sector has received from another unit, organisation or sector for the performance of intramural R&D. What is therefore measured are direct transfers of resources used to carry out R&D; other government provisions to encourage R&D, such as tax concessions, the payment of bonuses for R&D, exemption from taxes and tariffs on R&D equipment, etc., are excluded. Five sources of R&D financing are generally considered: the four R&D-performing sectors previously mentioned and funds from "abroad". Total funds from the higher education and PNP sectors are classified under "other national sources". For the purposes of international comparison, public general university funds (GUF) are included in the sub-total for government funds. They are the funds which higher education establishments allocate to R&D from the general grant they receive from the Ministry of Education or from the corresponding provincial or local authorities in support of their overall research/teaching activities.

When assessing the contributions of the different sectors of R&D performance and sources of financing and the changes in those contributions over time, it is necessary to take account of changes in methods and series breaks (see Box 3.1), as well as undervaluation of the government and higher education sectors in Sweden and the United States (notably as from 1990-91, when changes of method in the United States had the effect of reducing the government sector's contribution to higher education R&D by roughly 20 to 25%). In addition, the transfer of public sector organisations to the private sector in 1992 in France and 1986 in the United Kingdom (see Box 4.1) has reduced the government sector's contribution and increased that of the business enterprise sector.

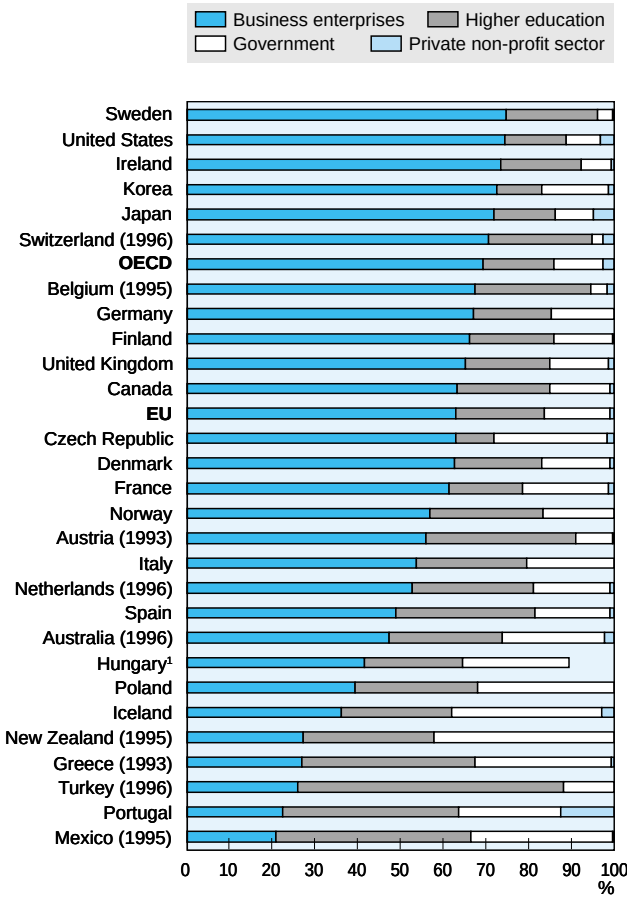
For more details, see Annex, Tables 3.2.1 to 3.2.3, and Tables 4.1.1 and 4.1.2.

3.2. R&D financing and performance

R&D expenditures by source of funds
Share in national total, 1997

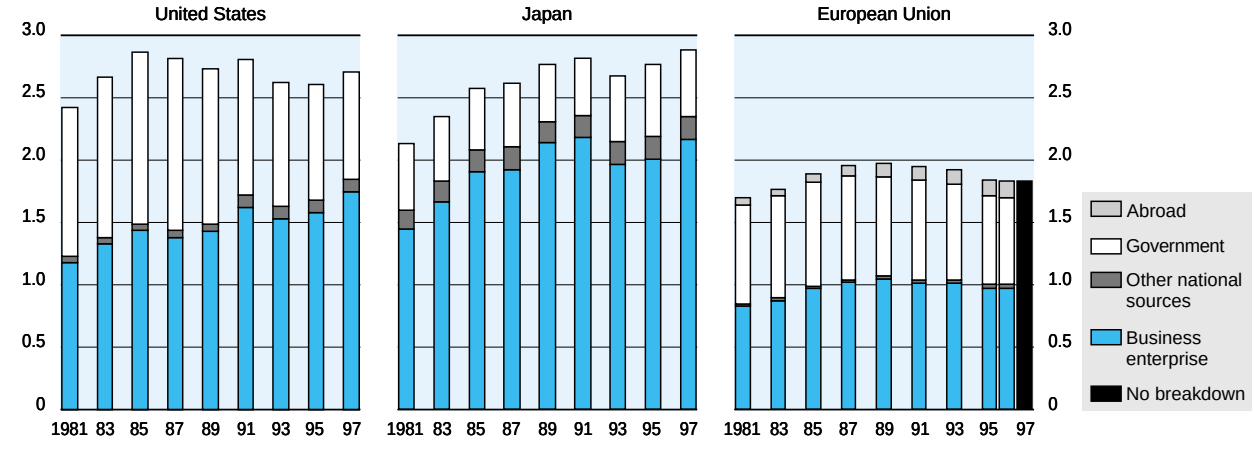


R&D expenditures by performing sector
Share in national total, 1997



1. Underestimated. Total does not add to 100%.
2. R&D financed by abroad not available.

R&D expenditures as a percentage of GDP by source of funds, 1981-97



Source: OECD, R&D and MSTI databases, April 1999.

3.3. Basic research

- OECD countries devote between 12% and more than 30% of their R&D expenditure to basic research, or between close to 0.1 and more than 0.7% of their GDP.
- The major share of basic research is performed in the higher education sector and/or in government research laboratories.
- Industrial basic research is relatively more developed in Switzerland (where there is a strong pharmaceutical industry), Korea, the United States, Japan and Ireland, countries where the business enterprise sector performs more than 70% of total R&D expenditure. In contrast, there is a larger proportion of basic research conducted in government laboratories in the European Union countries, Central Europe and Australia, due to the sometimes more significant role of government in R&D performance.
- In difficult economic times spending on "long-term" research may seem a luxury, not only because the effort will not pay off for a long time, but also because the results are usually disseminated widely and it is hard to establish a direct link between the resources invested and the result obtained. Nevertheless, most countries spent a higher share of GDP on basic research in 1996-97 than in the early 1980s.
- However, in the United States, there was a decrease in the early 1990s of investment in R&D, in percentage of GDP as well as in constant prices. This is reflected in the level of basic research expenditure compared to GDP which diminished throughout the first half of the 1990s and levelled off thereafter. This indicator has decreased in the Netherlands from 1987 to 1995 (latest year for which data is available).
- The trend in basic research expenditure during the 1990s has been somewhat more favourable in other countries, but has been levelling off or diminishing slightly when compared with GDP in several countries since 1994 or 1995: Australia, France, Hungary, Italy, Japan, Norway, Poland, Portugal, Spain.

Basic research

R&D covers three activities: basic research, applied research, and experimental development. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. When there is a significant time lapse before the “results” of basic research can be applied, this is considered long-term research whose results are sometimes utilised at a much later date and to ends not foreseen by the initial researcher.

Analysis by type of activity is of undoubted science policy interest, but is based on an over-simplified model of the workings of the scientific and technological system and also involves an important element of subjective assessment.

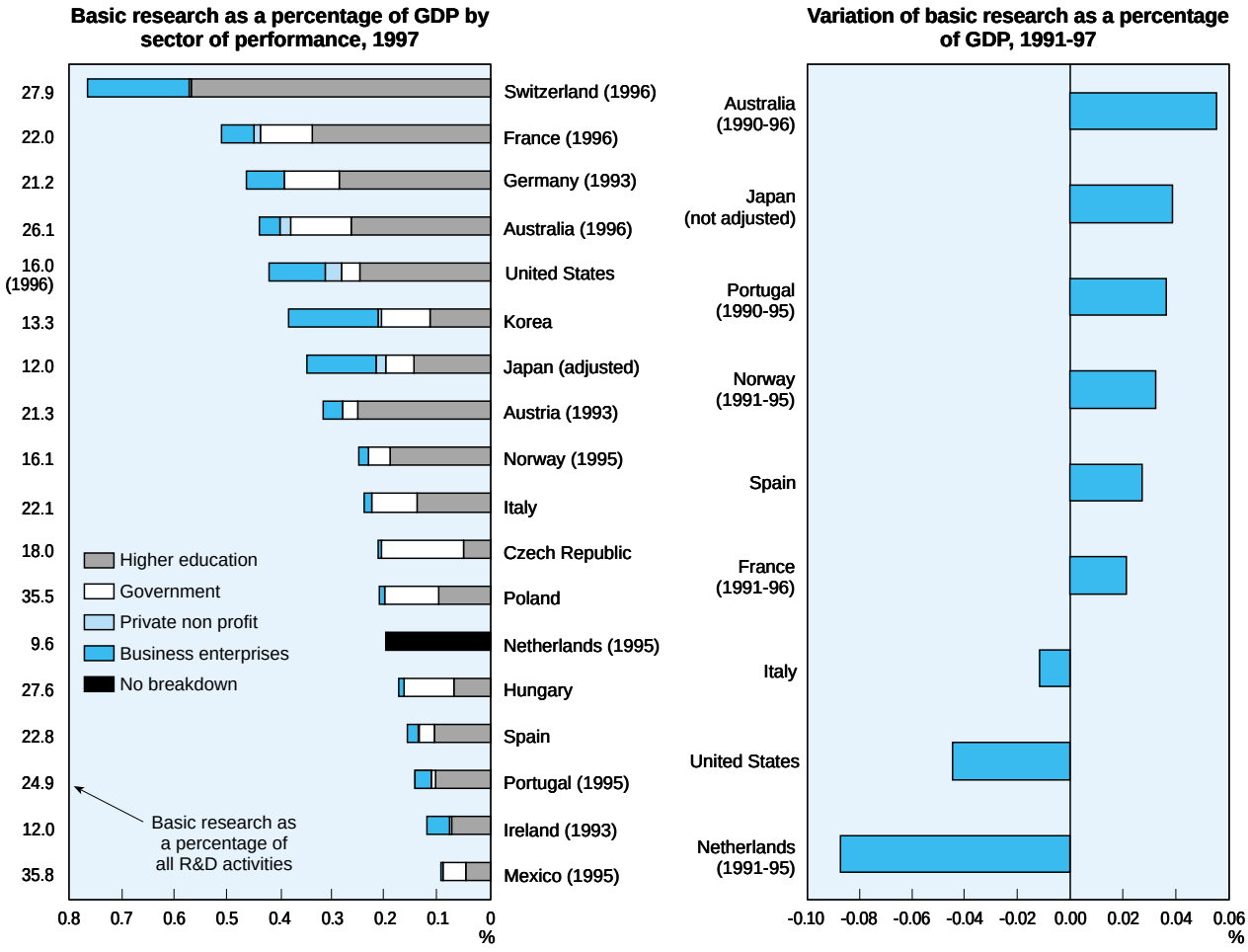
Data on basic research are often estimated in large part by the national authorities, notably for the higher education sector, which is the main performer of basic research in most countries.

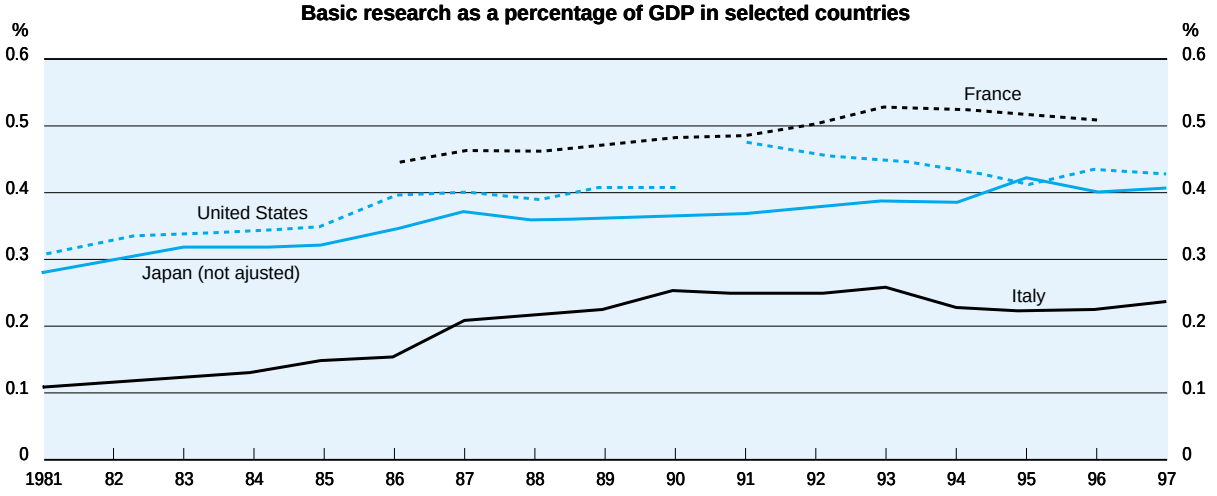
The breakdown may be applied at project level or if necessary at more detailed level, and, for the purposes of international comparison, should be based on current expenditures only.

The magnitude of estimated resources allocated to basic research is also affected by the inclusion or exclusion of capital expenditure. The latter is included by half of the countries for which information is available (Australia, Austria, the Czech Republic, France, Iceland, Italy, Japan, Korea, the Netherlands, Portugal, Switzerland and Turkey). In the case of the United States, capital write-downs are included in place of capital expenditure in the business enterprise sector.

For country details, see Annex, Tables 3.3.1 and 3.3.2.

3.3. Basic research





Source: OECD, R&D database, April 1999.

4.1. R&D performed by higher education and government

- R&D performed by higher education represents on average nearly 0.4% of GDP and exceeds 0.5% in five European countries (Sweden, Switzerland, the Netherlands, Finland and Austria). More than one worker in 1 000 has a research job in higher education. This sector carries out 15-20% of total R&D and employs more than 25% of the research workforce. These proportions, which are influenced by underestimates for the United States (see box below), are much larger in more than half the OECD countries, notably those with low industrial research intensity.
- Resources allocated to R&D in the higher education sector (as a percentage of GDP) continued to rise in the early 1990s, but seem to have levelled off subsequently in the main OECD regions. They have declined in a few countries, notably Canada and Hungary, but increased in a number of others such as the Czech Republic, Finland, Korea, Poland and Switzerland.
- R&D performed by the government sector represents on average 0.25% of GDP and exceeds 0.4% in only five countries (Iceland, Korea, France, New Zealand and Australia). The government sector accounts for one-tenth of R&D performed in the OECD area. Its share is 15% in the European Union and over 20% in a number of European countries and also in Mexico and New Zealand.
- The share of R&D performed by government laboratories has continued to decline, especially since 1993, as a result of decisions by governments to outsource certain R&D activities in order not to substitute for external R&D capacity. This has been the case almost everywhere, the share of GDP represented by government expenditure on R&D having risen in only three or four countries since 1991.

Government and higher education

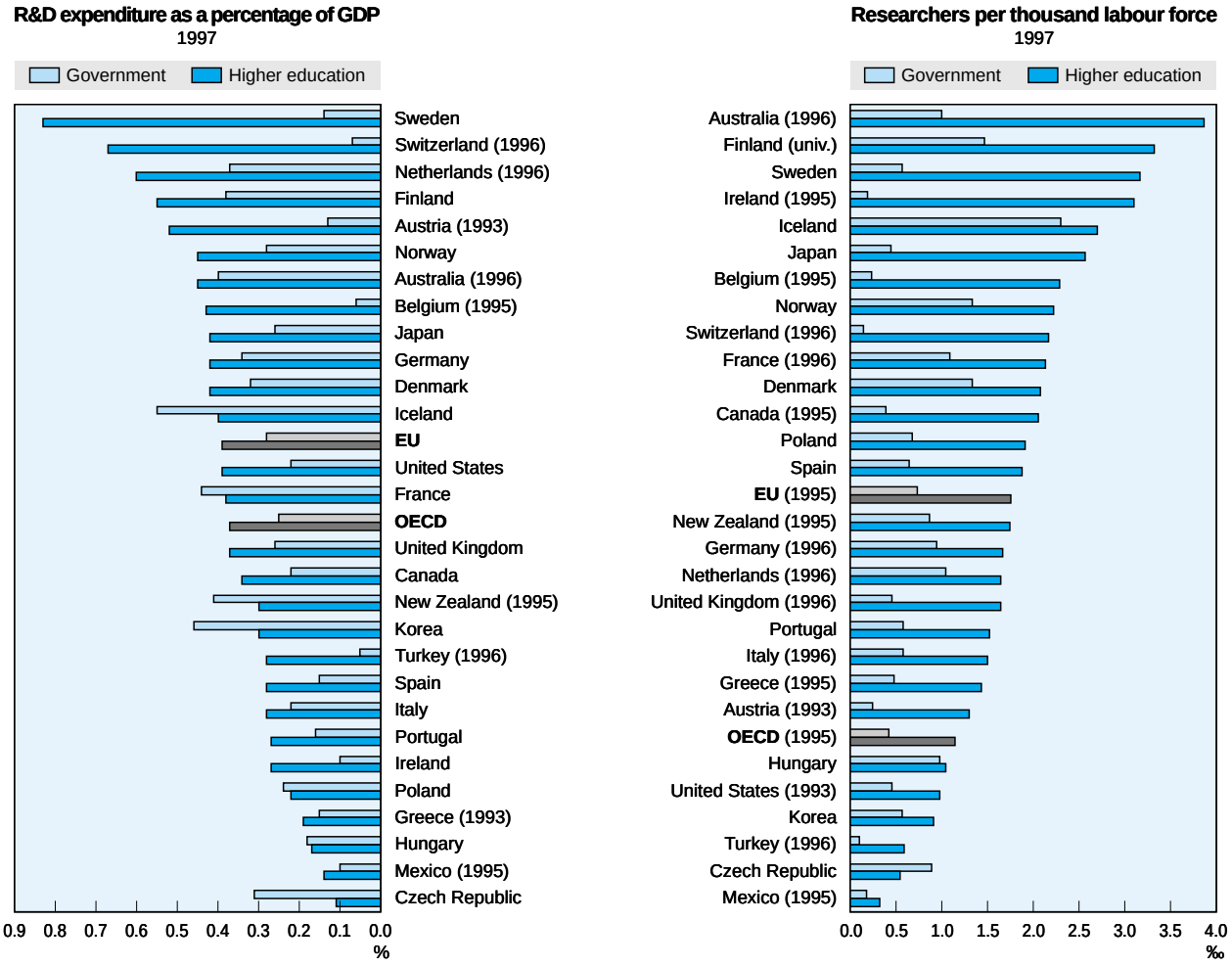
When judging R&D performance in the higher education sector and its development over time, it should be remembered that many of the figures for this sector are estimates by the national authorities and that evaluation methods are periodically revised (see Boxes 3.1 and 3.2).

Furthermore, certain national characteristics may strongly influence R&D performance by government and higher education:

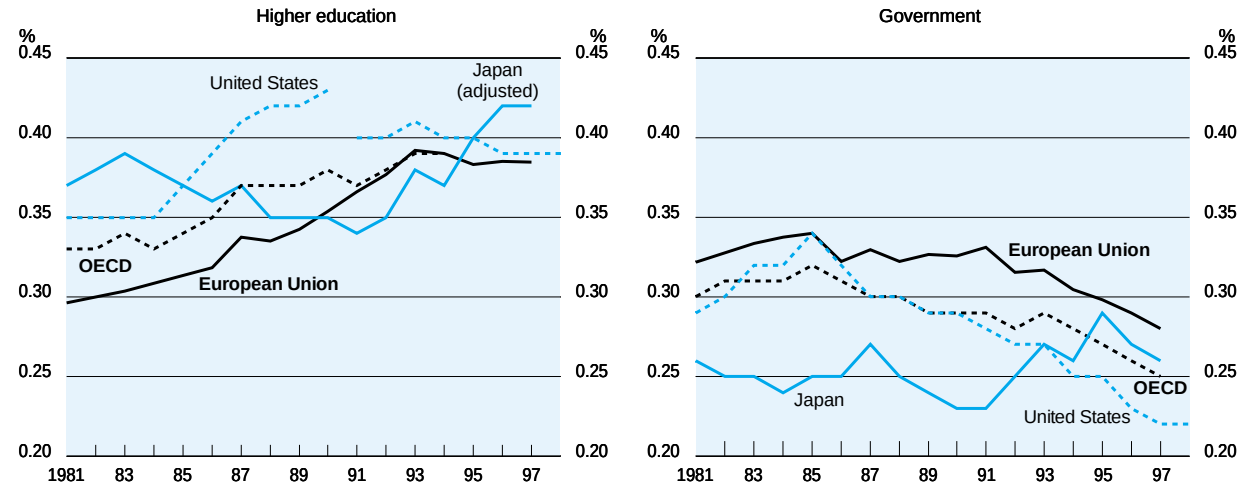
- Figures for the government and higher education sectors in the United States are probably underestimated as public sector R&D only covers federal government activities, not those of individual states and local government. In the higher education sector, R&D in the humanities is not included, and since 1991 capital expenditures have been excluded. In Sweden, too, the government sector, which includes only the central administrative units, is seriously underestimated; inclusion of county and local units might well double these figures. Finally, in Korea the higher education sector is probably very much underestimated owing to the exclusion of R&D in the social sciences and humanities (SSH).
- In Japan, figures for R&D personnel in the higher education sector before 1996 are overestimated by international standards, as researchers were counted in terms of the number of persons "regularly" employed in R&D instead of full-time equivalent (FTE) staff. According to studies conducted by the Japanese authorities, the number of FTE researchers is about 40% lower in the higher education sector and 30% lower in the national total. Because of this overestimation of the number of researchers, the figures for R&D personnel costs are also overestimated, particularly for the higher education sector; the OECD has accordingly computed an "adjusted" series for the years to 1995.
- Certain transfers of public agencies to private enterprise, as in the case of France Telecom in France (1992) and the Atomic Energy Authority in the United Kingdom (privatised in 1986), have had the effect of reducing R&D performance in the government sector and increasing it in the business enterprise sector.
- Finally, it is necessary to bear in mind remarks made (Boxes 3.1 and 3.2) concerning the figures for unified Germany as of 1991 and complete coverage of SSH in Sweden as of 1993.

For more details, see Annex, Tables 4.1.1 and 4.1.2.

4.1. R&D performed by higher education and government



Trends in R&D expenditures as a percentage of GDP of the higher education and government sectors



Source: OECD, MSTI and R&D databases, April 1999.

4.2. Priorities of public funding of R&D by socio-economic objectives

- Data on government budget appropriations or outlays for R&D provide an indication of the relative importance for governments of various socio-economic objectives such as defence, health, or environment.
- Defence R&D budgets as a percentage of GDP continued to decline in the OECD area, mostly owing to overall reductions in military expenditure.
- Defence accounts for more than one-half of government R&D budgets in the United States, more than one-third in the United Kingdom and more than one-quarter in France.
- Public R&D expenditure on health and environment accounts for almost a quarter of civil government R&D budgets in the OECD area. It is especially high in the Nordic and English-speaking countries.
- Government R&D expenditure on health and environment has been increasing in the 1990s in most countries.

Characteristics of GBAORD

GBAORD (government appropriations or outlays for R&D) measures the funds committed by the federal/central government for R&D to be carried out in one of the four sectors of performance (business enterprise, government, higher education, private non-profit sector) at home or abroad (including by international organisations). The data are usually based on budgetary sources and reflect the views of the funding agencies. They are generally considered less internationally comparable than the performer-reported data used in other tables and graphs presented here but have the advantage of being more timely and reflecting current government priorities, as expressed in the breakdown by socio-economic objectives.

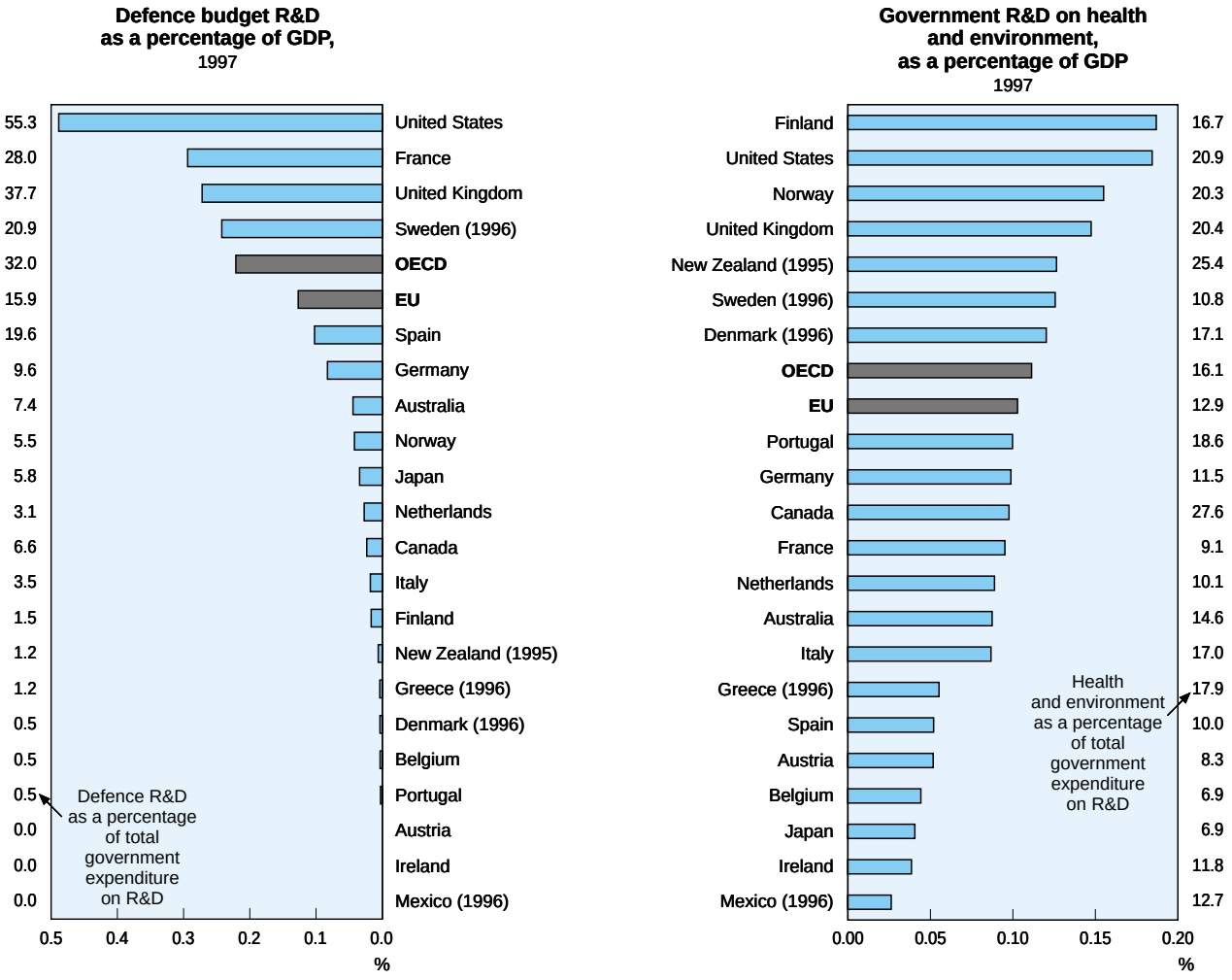
A first distinction can be made between defence programmes, which are concentrated in a small number of countries, and civil programmes, which can usefully be broken down as follows:

- Economic development: promotion of agriculture, fisheries and forestry; promotion of industry; infrastructure; energy.
- Health and environment: human health, social development, protection of the environment, exploration and exploitation of the Earth and the atmosphere.
- Civil space.
- Non-oriented programmes and advancement of research.
- General university funds (GUF): the estimated R&D content of block grants to universities.

It should be noted that the series for Japan excludes the R&D content of military procurement. In the United States, general support for universities is the responsibility of state governments and is therefore not included in GUF and total GBAORD.

For more details, see Annex, Table 4.2.1.

4.2. Priorities of public funding of R&D by socio-economic objectives



Source: OECD, MSTI database, April 1999.

4.3. Government support for industrial technology

- Government support for industrial technology goes well beyond public funding of R&D.
- It can be broken down in three main components: financial incentives (*e.g.* grants, subsidies, tax reliefs, forgiven loans), mission-oriented contracts and procurement (*e.g.* for defence, space, health), and science and technology infrastructure and diffusion (*e.g.* public/private partnerships in R&D).
- Experimental data for ten OECD countries were collected and can be interpreted as broadly reflecting each government's strategy for supporting industrial technology.
- On average, public procurement has the largest share (especially in countries with high spending on defence), followed by public infrastructure and by financial incentives.
- Among countries for which data are available, government support to industrial technology relative to domestic product of industry is greatest in Finland, the United States and France, followed by the United Kingdom, the Netherlands, and Germany.
- During the 1990s, government support has shrunk in most countries. The reduction is particularly pronounced in the United States, France, Germany, and the United Kingdom. In contrast, government support to industrial technology increased in Finland, and to a lesser extent in Japan and Australia.

Government support to industrial technology

The data currently available from standard R&D sources do not give a complete picture of government support for industrial technology which should cover financial incentives, mission-oriented contracts and procurement and support via the S&T infrastructure.

- Financial incentives include all programmes designed to encourage industrial firms to carry out R&D (or other innovation activities) by reducing the cost through grants, loans, fiscal incentives, etc.
- Mission-oriented contracts and procurement cover government payments to industrial firms to carry out R&D to meet government needs, notably for defence or space objectives.
- Support via the S&T infrastructure covers ways in which governments can assist firms without giving them money for R&D: by financing R&D activities aimed at industrial development in institutes and universities; by supporting technological research in academic and similar units; and by funding non-R&D programmes supporting either post-R&D stages of the innovation process or diffusion and extension programmes.

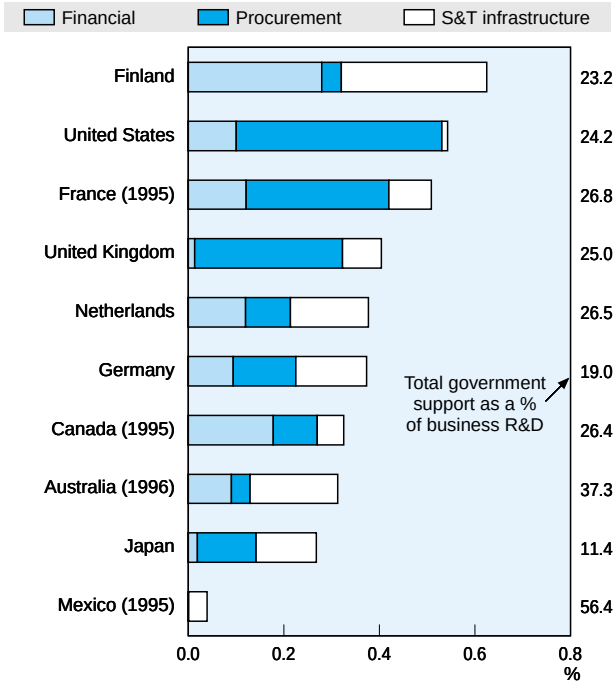
This model has the advantage of giving a coverage that goes beyond the traditional indicators of GBAORD for industrial development and government financed R&D in the business enterprise sector, by including a wider range of financial incentives, notably tax credits, and also general support for engineering via funds for the advancement of knowledge and R&D (academic engineering).

Special sets of data were compiled for ten OECD Member countries within the framework of the OECD Jobs Study (*Technology, Productivity and Job Creation: Best Policy Practices*, OECD, 1998) in order to examine the level and structure of such funding and trends over the last few years. These data have been updated in 1999.

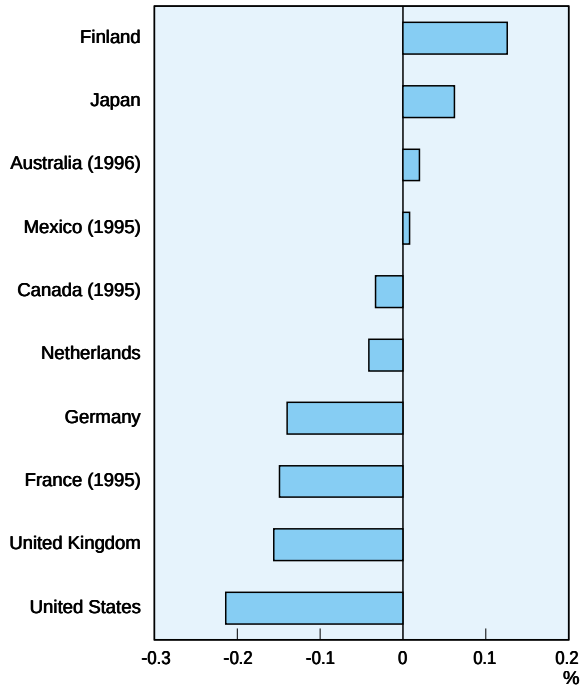
For more details, see Annex, Table 4.3.1.

4.3. Government support for industrial technology

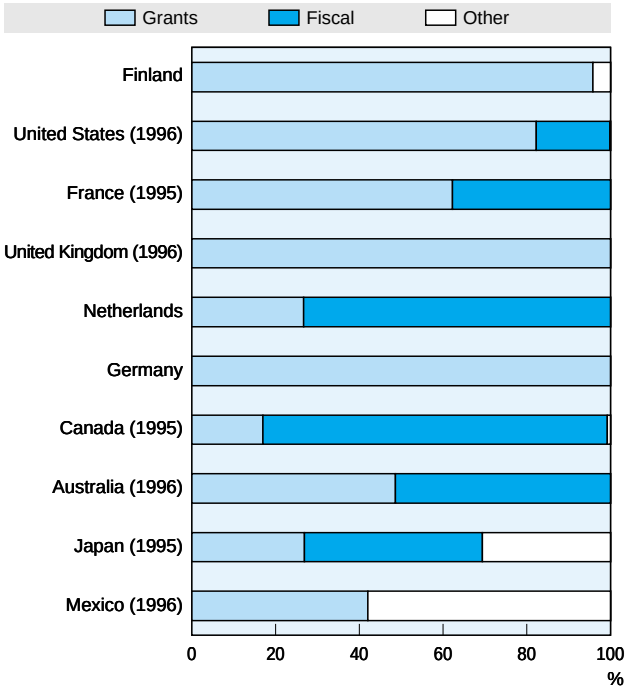
Government support to industrial R&D by type as a percentage of domestic product of industry
1997



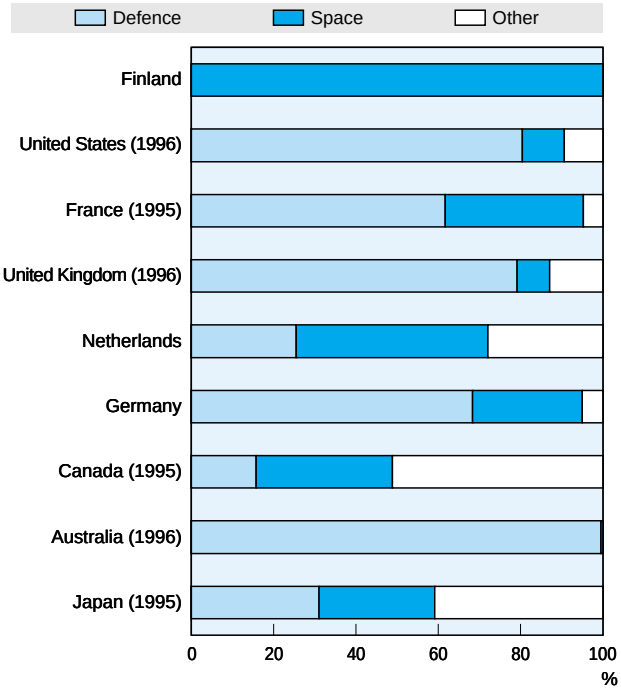
Government support to industrial R&D by type as a percentage of domestic product of industry
Variation 1990-97



Beakdown of financial support
1997



Breakdown of procurement
1997



Source: OECD.

4.4. Tax treatment of R&D

- Most OECD countries have special tax schemes for R&D expenditures, such as immediate write-off of current R&D expenditures (all except New Zealand), and various types of R&D tax credits.
- Depending on the country, R&D tax credits can be a "flat rate" (*e.g.* on the amount of R&D: Canada), or "incremental" (*e.g.* taking account of the difference between current R&D and a past reference point: the United States); tax relief may apply equally to all firms performing R&D or give special treatment to small firms (France) or to collaborative R&D (Japan).
- These schemes result in tax subsidies for R&D in 12 OECD countries in 1998 (the United Kingdom will be added in 2000): tax credits as a policy instrument are on the rise among OECD countries.

The B-index

The B-index is defined as the present value of before-tax income necessary to cover the initial cost of R&D investment and to pay corporate income tax, so *that* it becomes profitable to perform research activities. Algebraically, the B-index is equal to the after-tax cost of an expenditure of 1 US dollar on R&D divided by one minus the corporate income tax rate. The after-tax cost is the net cost of investing in R&D, taking into account all the available tax incentives.

$$\text{B-index} = \frac{(1 - A)}{(1 - \tau)}$$

where A = the net present discounted value of depreciation allowances, tax credits and special allowances on R&D assets; τ = the statutory corporate income tax rate (CITR).

In a country with full write-off of current R&D expenditure and no R&D tax incentive scheme, A = τ, and consequently B = 1. The more favourable a country's tax treatment of R&D, the lower its B-index.

The B-index is a unique tool for comparing the generosity of the tax treatment of R&D in different countries. However, its computation requires some simplifying assumptions and it should therefore be examined together with a set of other relevant policy indicators. Furthermore, its "synthetic" nature does not allow distinguishing the relative importance of the various policy tools it takes into account (*e.g.* depreciation allowances, special R&D allowances, tax credit, CITR).

B-indexes have been calculated under the assumption that the "representative firm" is taxable, so that it may enjoy the full benefit of tax allowance or credit. For incremental tax credits, calculation of the B-index implicitly assumes that R&D investment is fully eligible for the credit, and does not exceed the ceiling where there is one. Some detailed features of R&D tax schemes (*e.g.* refunding, carryback and carryforward of unused tax credit, or flowthrough mechanisms) are therefore not taken into account.

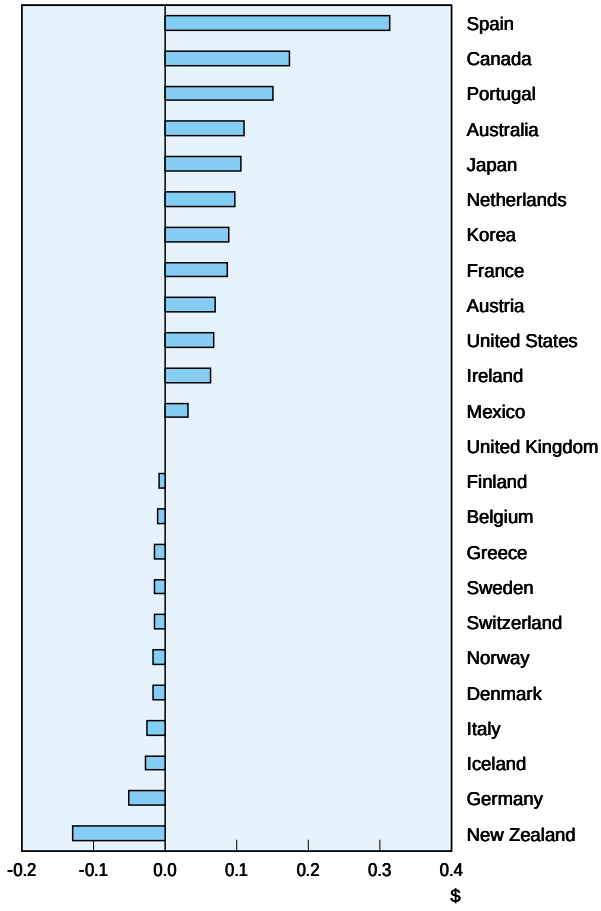
The effective impact of the R&D tax allowance or credit on the after-tax cost of R&D is influenced by the level of the CITR. An increase in the CITR reduces the B-index only in those countries with the most generous R&D tax treatment. If tax credits are taxable (as in Canada and the United States), the effect of the CITR on the B-index depends only on the level of the depreciation allowance. If the latter is over 100% for the total R&D expenditure, an increase in the CITR will reduce the B-index. For countries with less generous R&D tax treatment, the B-index is positively related to the CITR.

For further information, see J. Warda, "Measuring the Value of R&D Tax Provisions", in "Fiscal Measures to Promote R&D and Innovation", OCDE/GD(96)165, Paris, 1996.

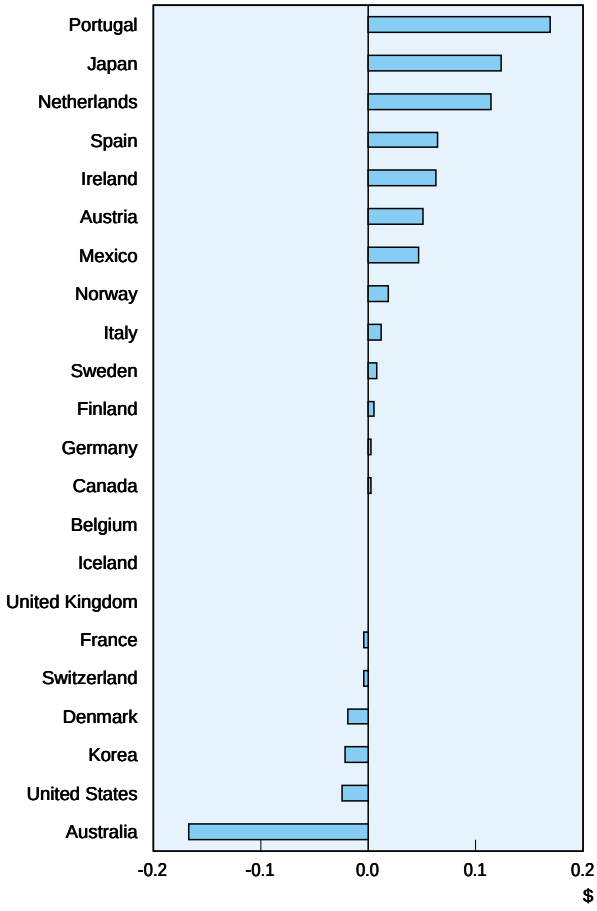
For more details, see Annex, Table 4.4.1.

4.4. Tax treatment of R&D

Amount of tax subsidies for 1 US dollar of R&D, large firms, 1998



Change in tax subsidies for 1 US dollar of R&D, large firms, between 1990 and 1998



Note : Tax subsidies are calculated as 1 minus the B-index.
Source: OECD.

4.5. Co-operation between business and the public sector

- Innovation no longer depends solely on how firms, universities, and research institutes perform independently, but, increasingly, on how they co-operate.
- Co-operation between business and non-business entities is one aspect of a growing trend in co-operation among actors in innovation systems which takes various forms. Firms seek access to the fundamental knowledge necessary for their research; universities seek links to commercialise their research and obtain funding; governments look to alliances that ensure that the economy benefits from public research.
- Firms' recognition of the usefulness of academic research for their innovative activity translates into business's increasing (although still low) share in the funding of university research. OECD-wide, business provides funding for 6% of university research and 3% of government research. However, countries differ substantially because of differences in national innovation systems. Business funding of university research is similar in Europe and in the United States (where there is no business funding of government research).
- For some countries, innovation surveys include a question on firms with co-operation arrangements (of any type) for innovation with universities or government. Firms with such arrangements are close to 10% of the labour force, except in Nordic countries where the percentage is substantially higher. Moreover, such agreements are more common for large firms than for small ones.

Co-operation between business and the public sector and innovation co-operation

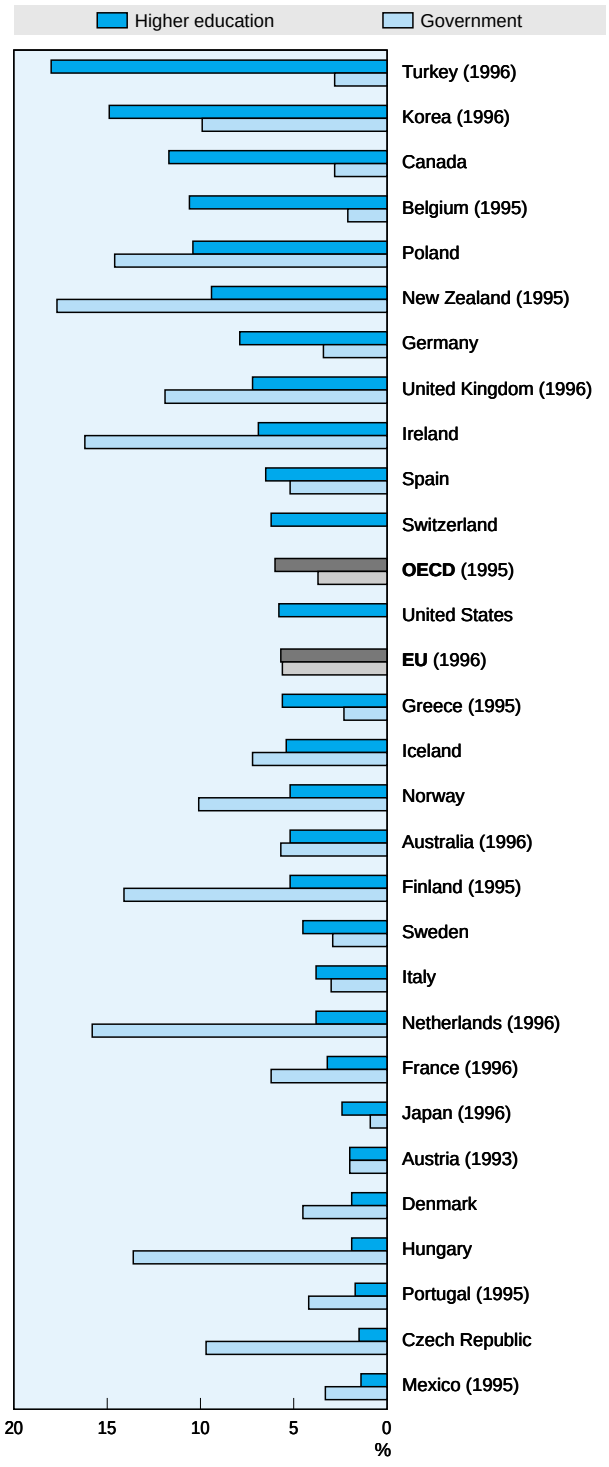
The private sector's use of the research capabilities of universities and public laboratories is shown here by business financing of R&D performed in the higher education and government sectors. Certain types of aid from business to universities, such as charge-free provision of machinery or use of experimental facilities, are not counted in this financing, with the result that co-operation between business and higher education is undervalued.

In innovation surveys (see Box 5.5), co-operation is interpreted more restrictively: innovation co-operation means active participation in joint R&D and other innovation projects with other organisations. It does not necessarily imply that both partners derive immediate commercial benefit from the venture. Pure outsourcing where there is no active participation, is not regarded as co-operation. In the question on co-operation agreements, respondents were asked to break down these agreements by type of partner organisation (universities and other higher education establishments, public institutions, private non-profit institutions, etc.) and by country of residence of the partner.

For more details, see Annex, Table 4.5.1.

4.5. Co-operation between business and the public sector

Share of business in the funding of research performed by government and univesity
1997



Source: OECD, R&D database, April 1999.

Share of firms with co-operation arrangements with university or government research institutions
1994-96

Source: OECD, partly based on data from Eurostat.

5.1. Business R&D

- R&D performed in the business enterprise sector, regardless of the origin of funding, reflects firms' efforts to make technological innovation a basis for their competitiveness.
- Business R&D in the OECD area amounted to 343 billion US dollars in 1997 or 69% of total R&D.
- R&D performed in the business sector declined as a percentage of domestic product of industry from the early 1990s (mid-1980s in the United States), but recovered in most countries, except some in Europe, from 1995. The levelling off was mainly due to the economic downturn of the 1990s and to a reduction in government funding of business R&D (notably for defence), which also affected business funding of R&D, owing to the "leverage effect" of public funding.
- Business R&D intensity is particularly high in Sweden (at 4.4% of the domestic product of industry, it is more than twice the OECD average), followed by Finland (2.7%) and Korea (2.5%). It is lower in those OECD countries with lower GDP per capita.
- Annual growth rates of business R&D since the early 1990s in these three countries are among the highest in the OECD area. Business R&D grew only faster in Ireland, Iceland and Australia, all of which, however, started from low levels in 1991.

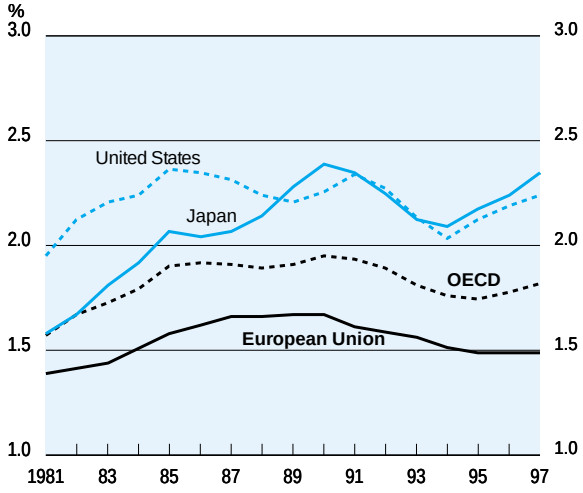
Business enterprise R&D expenditure (BERD)

This section covers R&D activities carried out in the business enterprise sector by performing firms and institutes, regardless of the origin of funding. While the government and the higher education sectors also carry out R&D, industrial R&D is most closely linked to the creation of new products and production techniques, as well as to a country's innovation efforts.

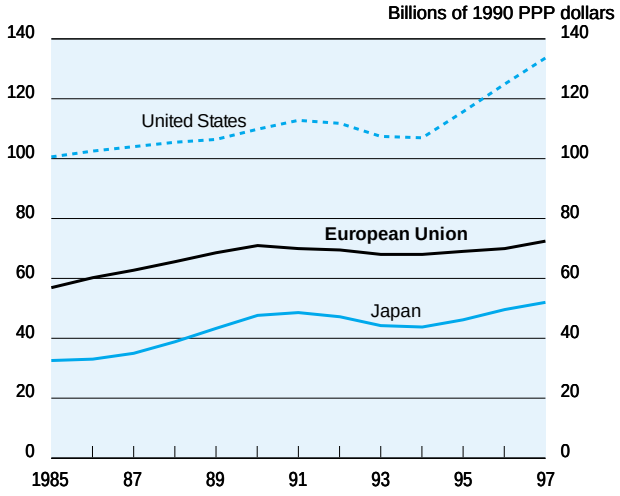
For more details, see Annex, Tables 5.1.1 and 5.1.2.

5.1. Business R&D

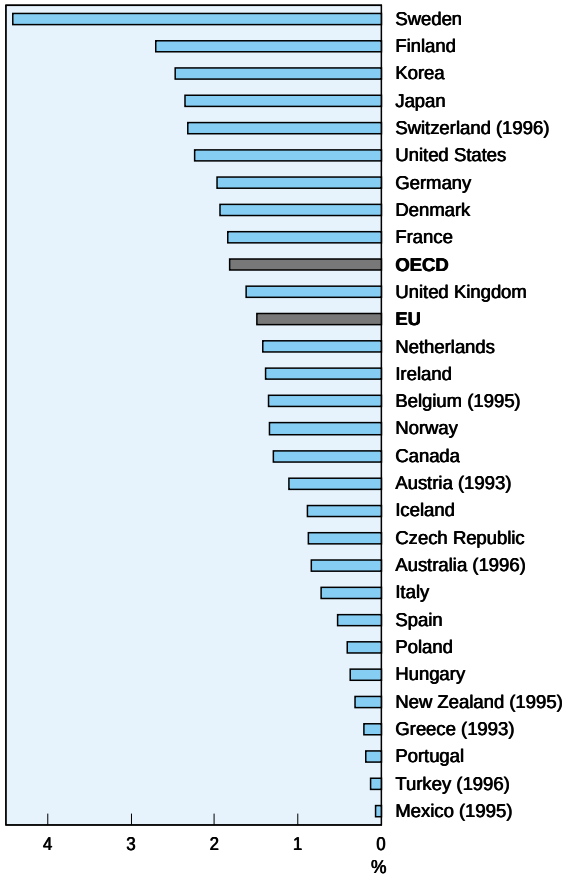
Evolution of business R&D as a percentage of domestic product of industry



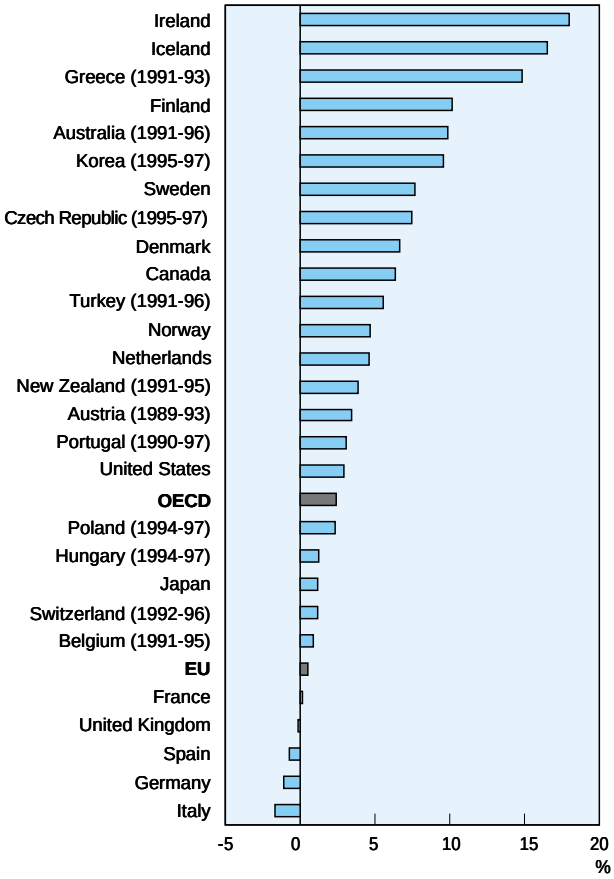
Evolution of business R&D, 1990 PPP[1] dollars



Intensity of business R&D in domestic product of industry
1997



Evolution of business R&D, 1990 PPP[1] dollars
Average annual growth rates, 1991-97



1. 1990 US dollars using purchasing power parities.
Source: OECD, MSTI database, April 1999.

5.2. Business R&D in services

- Services play an increasingly dominant role in OECD Member countries. They now constitute the largest share of GDP in most countries, and their share is rising.
- However, the share of services in R&D is much lower than their share in GDP. Services now account for only about 15% of total business R&D in the OECD area (ranging from almost 40% for Canada to less than 5% for Japan and Germany).
- This is due, in part, to the fact that innovation in services relies less on R&D than in manufacturing, even though some services (especially those related to information and communication technology) have a high technological intensity.
- The low share of services in R&D is also due to the fact that R&D in services is still only partially measured in countries such as France, Germany and Japan.
- Partly owing to improved statistical coverage of services in national R&D surveys, available figures show a steady growth in R&D performed in the services sector in almost all OECD countries.

R&D data in the business enterprise sector

The national statistical authorities recognise the need for improved R&D data for the services sector and R&D surveys are being extended to better capture expenditures in this sector. However, with the extension of the surveys, certain methodological issues arose and still need to be resolved. If data are to be comparable internationally as well as across time, certain practices concerning the allocation of certain sectors formerly included in the manufacturing sectors but now reclassified in services, need to be standardised.

The ANBERD database was constructed to create a consistent data set which overcomes the problems of international comparability and temporal discontinuities associated with the official BERD data provided to the OECD by its Member countries.

In 1999, the OECD has created complete matrices in ISIC, Rev. 3 in the ANBERD database. Hence, the coverage of ANBERD has been extended to 58 sectors, including greater coverage of services, starting with the survey year 1987.

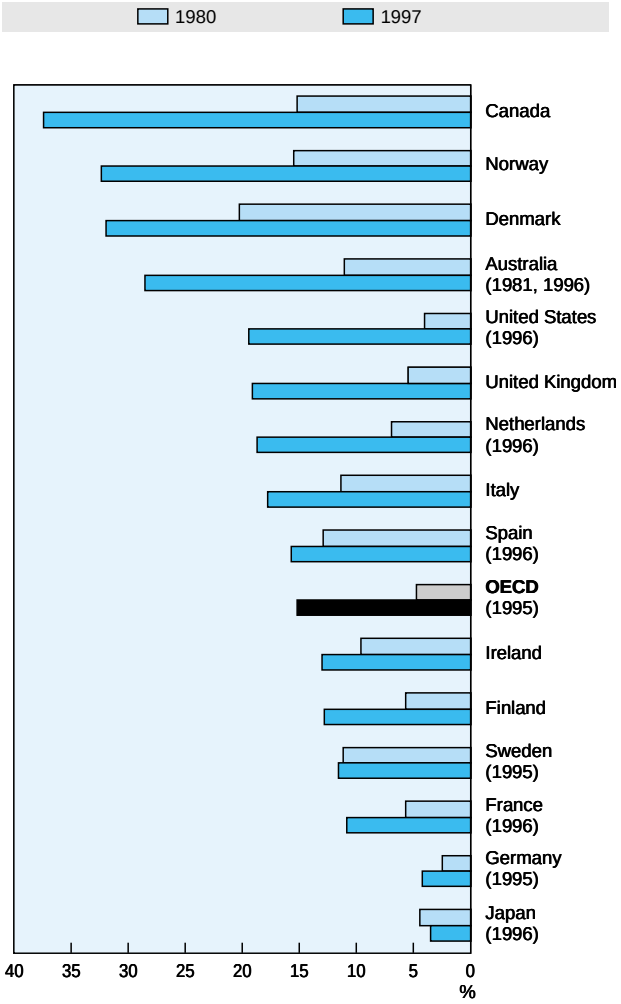
Although the OECD has attempted to resolve comparability issues as they arise, it is still important to exercise caution when analysing these data, as the process is still ongoing.

For more information, see OECD, *Research and Development in Industry – Expenditure and Researchers, Scientists and Engineers 1976-97,* Paris, 1999.

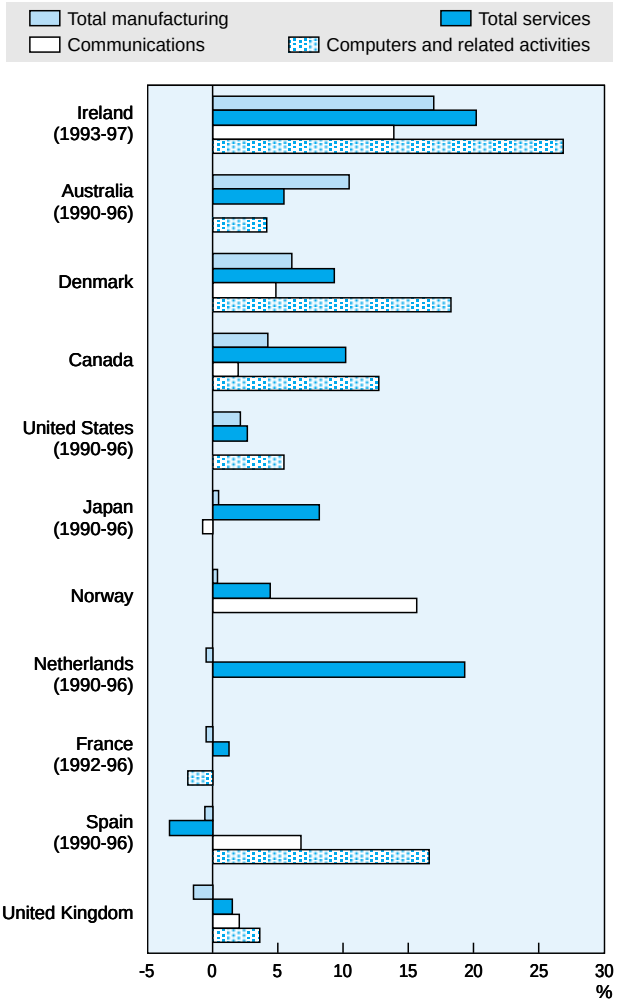
For more details, see Annex, Tables 5.2.1 and 5.2.2.

5.2. Business R&D in services

Share of services in business R&D[1]
1980 and 1997



R&D growth in selected service industries and total manufacturing
Average annual growth rate 1990-97



1. Share of services in total of services and manufacturing industries.
Source: OECD, ANBERD database, May 1999.

5.3. Business R&D in manufacturing

- Manufacturing industries are grouped according to their R&D intensity in four categories: high, medium-high, medium-low and low technology (see Section 7.2).
- The distribution of business R&D intensities differs widely across countries. In countries such as Canada, Italy and the United Kingdom, the difference between high-technology industries and medium-low-technology industries is much larger than in countries such as Japan and Germany.
- Changes in R&D intensity are broken down into three components: intra-sectoral effect, structural effect, and a cross effect.
- In most countries, the bulk of the change in business R&D intensity between 1990 and 1997 stems from the intra-sectoral effect. In countries such as Sweden, Finland and Australia, total business R&D intensity grew because most industries performed more R&D. In other countries such as Norway, the United Kingdom and the Netherlands, R&D intensity in manufacturing declined because most industries performed less R&D.

A breakdown of changes in R&D intensity

Cross-country differences in R&D intensity are often interpreted in terms of "technological level". While important, the technological level is not the whole story. A country's propensity to conduct R&D is influenced by its industrial specialisation: for example, a country with abundant natural resources is likely to specialise in basic industries rather than in R&D-intensive industries. However, this does not prevent the country from having a high technological level in its key industries, *i.e.* above-average R&D intensities in low-technology industries.

Likewise, while the evolution of total R&D intensity reflects changes in a country's "technological level", it also depends on other factors. For example, a country's overall R&D intensity may increase because the country spends generally more on R&D, independently of the industry structure, but it may also do so because R&D-intensive sectors have an increasing weight in the economy over time. Breaking down changes in a country's aggregate R&D intensity r between time 0 and time t makes it possible to identify three different effects:

$$r_{t.} - r_{0.} = \sum_j r_{tj} v_{tj} - \sum_j r_{oj} v_{oj} = \underbrace{\sum_j v_{oj}(r_{tj} - r_{oj})}_{\textit{intra-sectoral effect}} + \underbrace{\sum_j r_{oj}(v_{tj} - v_{oj})}_{\textit{structural effect}} + \underbrace{\sum_j (r_{tj} - r_{oj})(v_{tj} - v_{oj})}_{\textit{cross effect}}$$

where r_{tj} is R&D intensity (BERD/value added) of sector j in time t, v_{tj} is its share of value added. Then, $r_{t.}$ is total R&D intensity of the country in time t, and $r_{0.}$ is total R&D intensity in time 0.

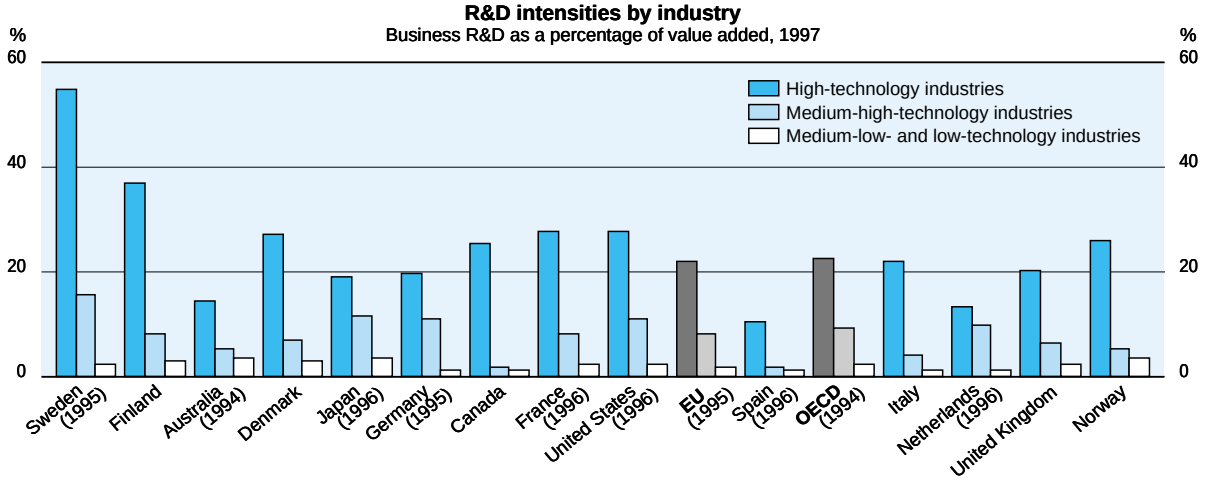
The interpretation of the three effects is as follows:

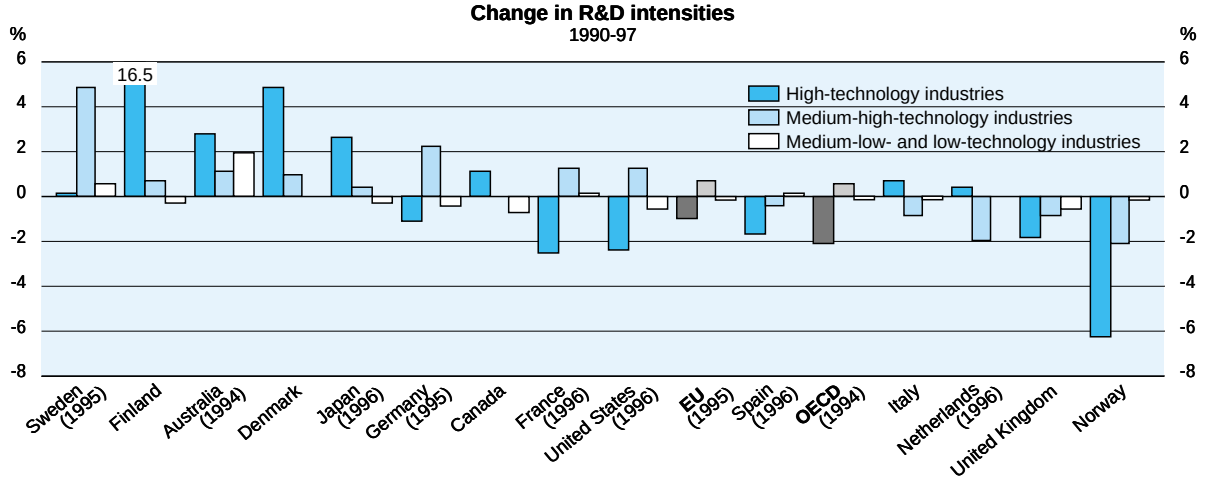
- The intra-sectoral effect is positive (or negative) if the country is more (or less) R&D-intensive in time t than in time 0, independently of its industry structure.
- The structural (or inter-sectoral) effect is positive (or negative) if R&D-intensive sectors have more (or less) weight in value added in the country in time t than they had in time 0.
- The "cross effect" is positive if the country has increased its R&D intensity in industries whose share in value added has increased.

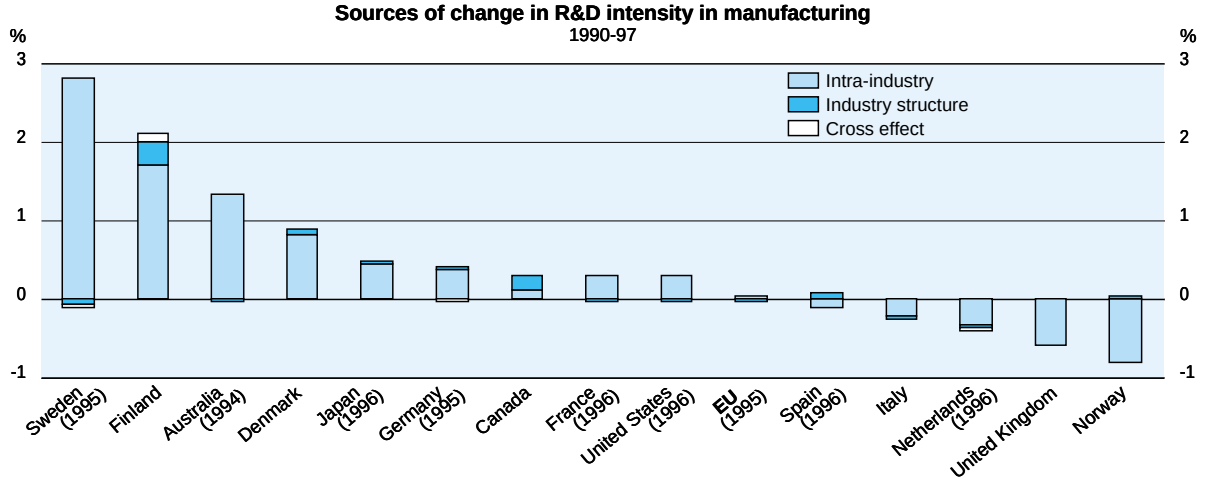
This breakdown must be handled with care, since an economy's sectoral specialisation also depends in part on its ability to conduct R&D (*e.g.* its endowment in skilled labour): the causality does not run only one way, and the three components are not only "causes" of a country's total R&D intensity but also consequences.

For more details, see Annex, Tables 5.3.1 to 5.3.3.

5.3. Business R&D in manufacturing







Source: OECD, STAN and ANBERD databases, May 1999.

5.4. Funding of business R&D by size classes of firms

- Both small and large firms play an important role in innovation, but their relative importance in business R&D varies substantially across OECD countries. Firms with less than 500 employees account for more than 50% of business R&D in Ireland, Poland, Norway and Australia, whereas they represent less than 20% in Korea, Germany, the United States, Sweden and Italy.
- Government support to business R&D, which has various components, notably grants and subsidies and public procurement, also varies strongly across countries. The share of government-financed business R&D ranges from more than 30% in Poland, and more than 10% in Italy, the United States and France, to less than 3% in Mexico, Australia, Switzerland, Turkey and Japan.
- Whatever its level, government support to business R&D is not evenly distributed among small and large firms in most OECD countries.
- On average, OECD countries' government support to business R&D is skewed towards large firms.
- The share of government funding in business R&D is more than twice as high for large firms as for small firms in Norway, France and the Netherlands, followed by the United States, Italy, Sweden and the United Kingdom. The bias towards large firms is stronger in countries with high defence spending, owing to the concentrated market structure of the industries concerned.
- In contrast, government support to business R&D is more than twice as high for small firms as for large firms in Switzerland, Belgium, Korea, Finland, Turkey and Mexico.

R&D data by size class of firms

The importance of small firms in innovation processes is increasingly recognised. They are a source of permanent renewal of technology, of technological breakthroughs, and of competitive pressure for large incumbent firms, which are compelled to innovate in order to maintain their technological edge. The so-called "new technology-based firms", most of which are small, play a crucial role in making radical innovations and creating new markets. At the same time, SMEs face specific problems for innovating and for adopting new technologies (access to funds, to markets, to skilled labour). Moreover, it is often argued that public policies are biased against SMEs and that this justifies "counter-measures" in their favour. This is of particular concern to policy makers.

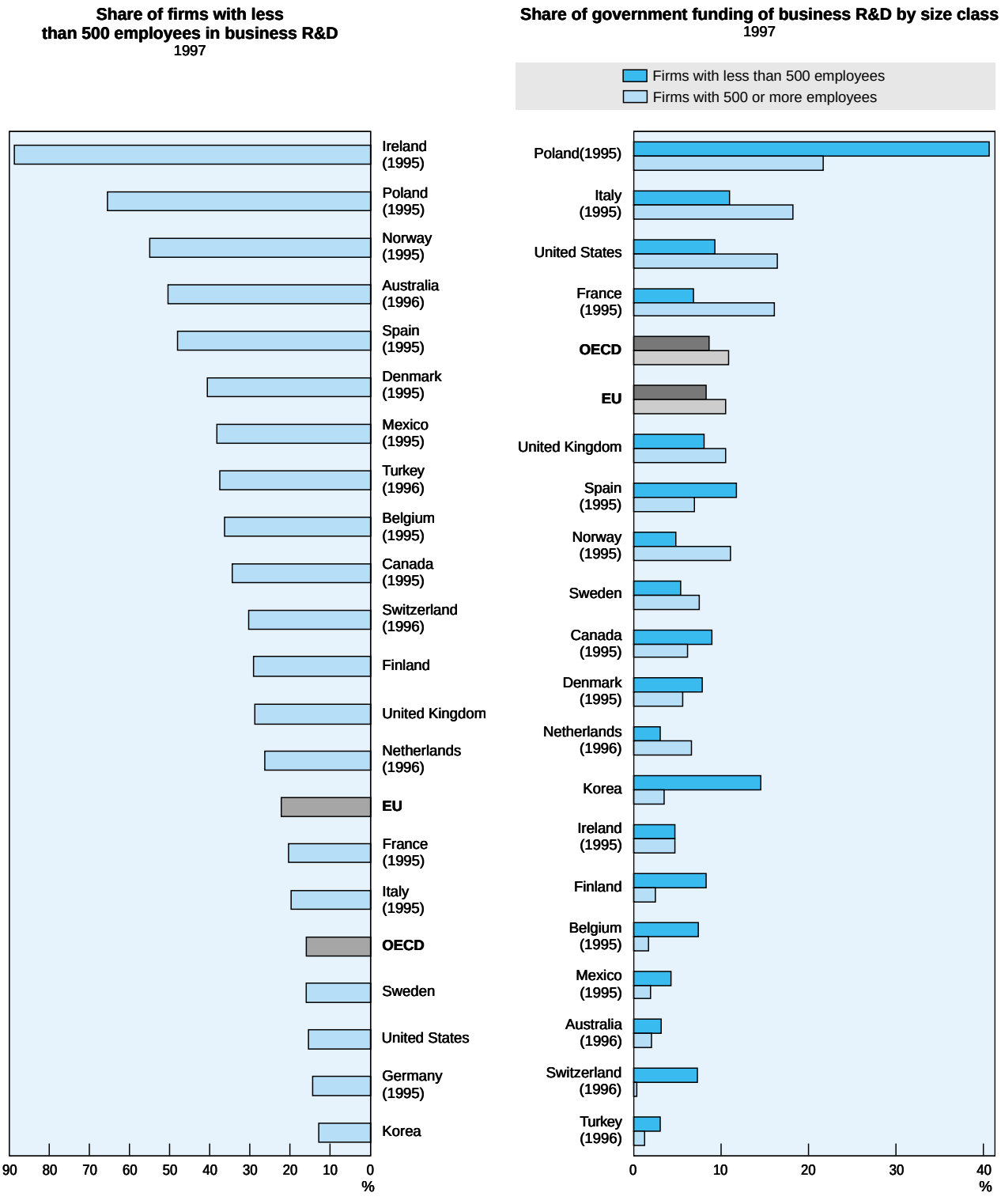
On the other hand, the role of large firms must not be ignored: they play a leading role in structuring markets, carrying out large-scale innovations, and even in co-ordinating smaller firms. The respective and complementary roles of small and large firms may vary across industries and across countries. The relevance of various types of policy tools may vary with the size profile of the target population of firms.

Data in this section are based on a mini-questionnaire first launched in 1997. These data were subsequently updated for the Meeting of the Committee for Scientific and Technological Policy (CSTP) at Ministerial level held in June 1999. In order to compare the countries by size class, data received had to be aggregated according to two categories: fewer than 500 and 500 or more employees. This is due to the fact that the data were not broken down into identical size classes for the various countries. Unfortunately, it was not possible to use all the data sent by Member countries.

These data are quite informative in that they make it possible to discern whether there is a bias in government support towards larger firms. It appears that the bias towards larger firms is particularly significant in those countries with large defence budgets. More detailed information by firm size would make possible a better representation of the situation in the OECD Member countries.

For more details, see Annex, Tables 5.4.1 and 5.4.2.

5.4. Funding of business R&D by size classes of firms



Source: OECD.

5.5. Business expenditure on innovation

- Measuring the total cost of innovation activities in firms and industries is a major aim of innovation surveys.
- Expenditure on R&D is only a fraction of total expenditure on technological innovation.
- Resources devoted to innovation activities also include acquisition of machinery and equipment, acquisition of software and other external technology linked to product and process innovation, and expenditure on training, industrial design and market introduction for aspects of new or improved goods and services or processes.
- Data from innovation surveys for a limited number of countries suggest that the non-R&D portion of technological innovation is up to twice the R&D portion. As such surveys are new, especially in the services sector, data may be only broadly comparable across countries. On average, in manufacturing industries, expenditure on R&D is about half the expenditure on innovation.
- In most countries, expenditure on innovation (relative to sales) is higher for manufacturing than for services.
- In manufacturing, expenditure on innovation is highest in Sweden (more than 7% of total sales) and Switzerland (more than 6%), followed by Finland, Germany, France and the Netherlands (about 4% each), and is lowest in Spain and Belgium (about 2%).
- The services industries also spend heavily on innovation although most is not for formal R&D. In services, expenditure on innovation is highest in the United Kingdom and Sweden (about 4%).

Measuring expenditure on innovation

Innovation surveys, based on the *Oslo Manual* methodology, attempt to collect firm-level data on input and output from innovation*. The most well-known is the Community Innovation Survey (CIS) managed by Eurostat which co-ordinates national innovation surveys in all countries of the European Union plus Norway. These surveys cover manufacturing firms and a selection of services (electricity, gas and water supply, wholesale trade, transport, telecommunications, financial intermediation, computer and related activities and architectural, engineering and other technical activities).

Expenditure on innovation includes all expenditure related to those scientific, technological, commercial, financial and organisational steps which are intended to lead, or actually lead, to the implementation of technologically new or improved products and processes. The information requested is the expenditure in a given year for innovation activities performed by enterprises having introduced a technologically new or improved product (or service) or process over a period of three years ending in the year of expenditure.

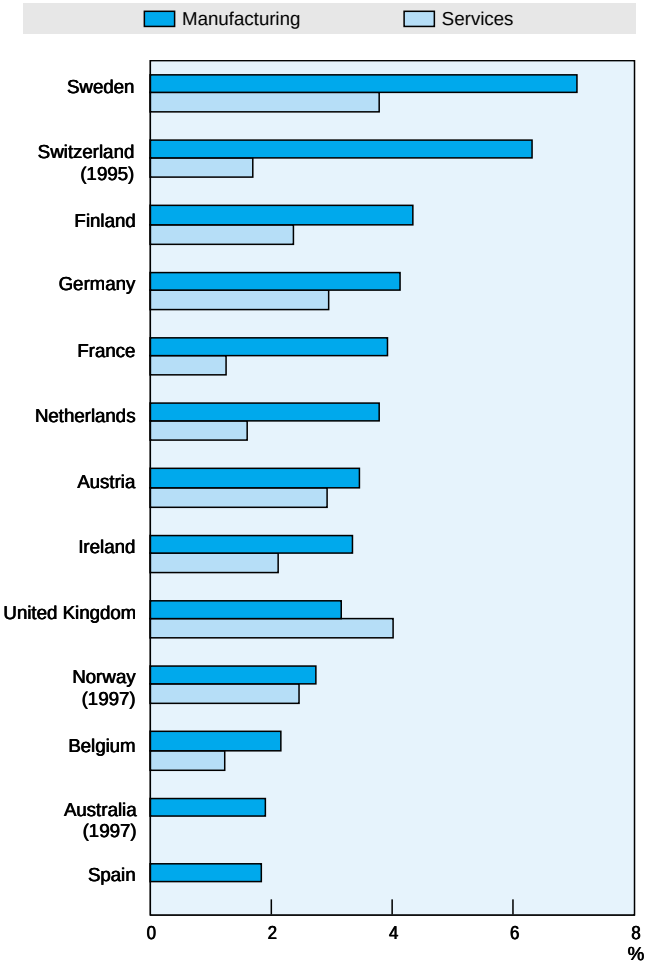
Not many enterprises keep separate records of innovation expenditure other than R&D, and many firms had difficulty in reporting innovation expenditure. But experience has shown that it is possible for them to give acceptable estimates of the non-R&D portion. Another difficulty in the measurement of innovation expenditure is the question of extramural expenditure for innovation activities. They are not separately available for most enterprises, and, in consequence, special care has to be taken when aggregating individual firm numbers to industry or national figures, because of double-counting.

* A general overview of the last round of innovation surveys can be found in G. Muzart (1999), "Description of National Innovation Surveys Carried Out, or Foreseen, in 1997-99 in OECD Non-CIS-2 Participants and NESTI Observer Countries", STI Working Paper 1999/1, OECD, Paris.

For more details, see Annex, Table 5.5.1.

5.5. Business expenditure on innovation

Expenditure on innovation as a share of total sales
1996



Source: OECD, mainly based on data from Eurostat.

5.6. Venture capital

- Venture capital refers to equity investment in new firms. It is a major source of funding for new technology-based firms, and it is key in promoting the radical innovations often carried out by new firms.
- It is expanding rapidly in most countries for which data are available, owing partly to the creation of new financial markets that facilitate the floatation of new firms.
- The United States' venture capital market is by far the largest, followed by the United Kingdom and Canada. Even expressed as a percentage of GDP, investment in venture capital in these three countries is among the highest of all OECD countries. It is also high in the Netherlands, Finland and Belgium. It is still rare in Japan.
- Early stages regroup seed capital and start-up capital, when the firm focuses on research and development. The expansion stage, when the firm begins earning revenue, comes later. Almost half of venture capital in North America finances firms in their early stages, whereas in Europe it mostly finances the expansion of firms already present in the market.
- A striking difference between the major economies concerns the distribution of venture capital by industry. In 1997, information and communication technology (ICT) and health/biotechnology account for more than three quarters of venture capital in the United States. The corresponding figures are only about 20% for Europe, and 10% for Japan.

Venture capital

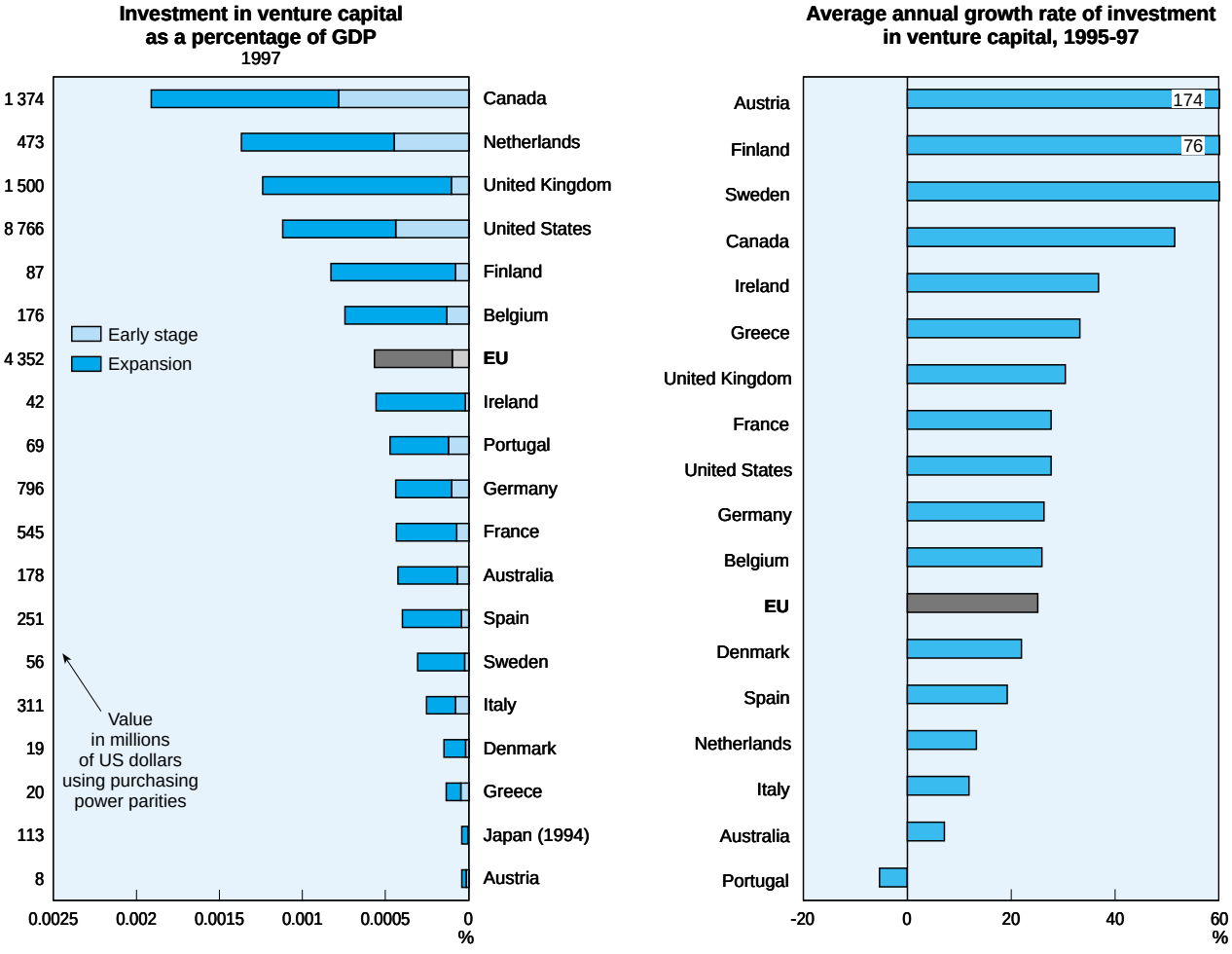
Venture capital is provided both by specialised financial firms acting as intermediaries between primary sources of finance (such as pension funds or banks) and firms (formal venture capital) and by so-called "business angels" (usually wealthy individuals experienced in both business and finance who invest directly in firms).

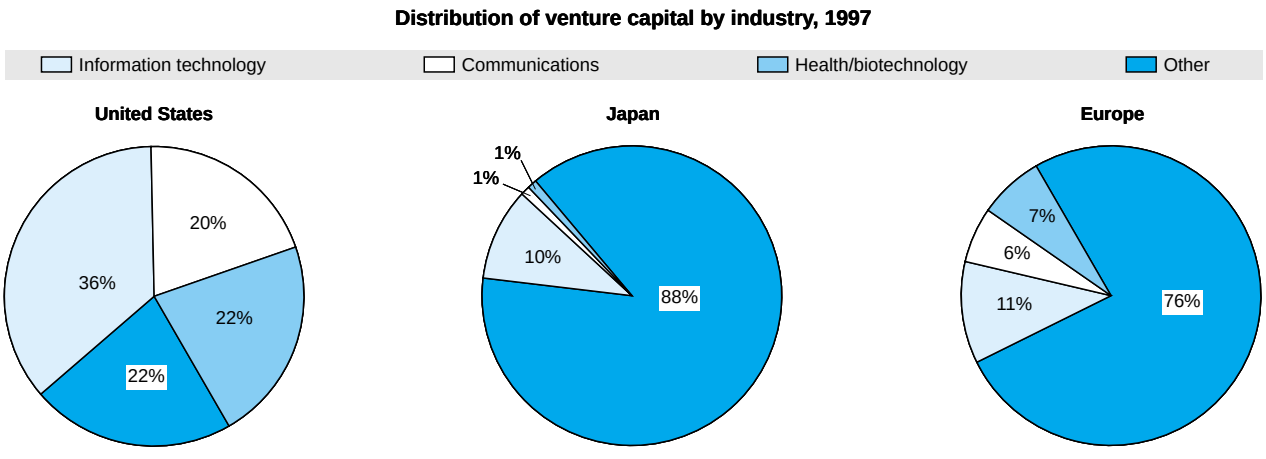
Data on venture capital are collected among their members by national or regional venture capital associations. Only formal venture capital (provided by specialised intermediaries) is captured by statistics. According to estimates, in the United States, business angels invest almost twice as much annually in new firms as venture capital funds. The figure is probably much lower in most other OECD Member countries.

Several financing stages can be identified in relation to the development of a venture-backed company:

- Seed capital is provided to research, assess and develop an initial concept
- Start-up is financing provided to companies for product development and initial marketing. Companies may be in the process of being set up or may have been in business for a short time, but have not sold their product commercially.
- Expansion is financing provided for the growth and expansion of a company which is breaking even or trading profitably. Capital may be used to finance increased production capacity, market or product development and/or to provide additional working capital.

5.6. Venture capital





Source: OECD, based on data from European Venture Capital Association; MITI (Japan); CVCA (Canada); NVCA (United States).

6.1. Trends in the main components of international transactions

- More and more firms, including small ones, increasingly organise their development, production, sourcing, marketing and financing activities on an international and even worldwide basis, giving rise to new forms of competition and co-operation among firms on product and factor markets.
- The most visible features of this globalisation process are international trade and investment flows which, although non-member countries are increasingly integrated into the world economy, are still concentrated in the OECD area.
- The greater openness of OECD countries is apparent in selected international transactions which are growing at a faster pace than GDP.
- Trade in goods, the oldest form of internationalisation, continues to play a dominant role: rising steadily between 1985 and 1997, it represents roughly 16% of OECD GDP. A closer look (Section 7.2) reveals that high-technology industries account for an ever-rising share of trade of manufactured goods.
- While representing only about a quarter of goods trade, trade in services is taking on more importance. This is partly due to the changing nature of services (such as software, financial services, telemarketing, transport, and accounting) which are becoming more and more internationally tradable.
- While financial transactions and technological trade have largely outstripped growth in international trade, their volume remains for the moment significantly less important: portfolio investment as a percentage of OECD GDP stands at less than 4%, direct investment at less than 2%, and technological trade at less than 0.5%.
- However, direct investment (Section 8.1) and trade in ready-to-use technologies (Section 11.5) are important factors in internationalisation and industrial restructuring in OECD countries.

International transactions

Trade in goods and services. Data relating to trade in goods and services correspond to each country's exports to and imports from the rest of the world: these data are collected for use in compiling balances of payments. Data relating to international trade in goods are also collected in customs surveys, but as a general rule they are not comparable to balance of payment data. Since data on trade in services are collected solely for use in compiling balances of payments, the latter have been chosen as source data to ensure that trade in goods and trade in services are suitably comparable.

Direct foreign investment. Foreign investment is defined as being "direct" if the foreign investor holds at least 10% of the ordinary shares or voting rights in the firm in which the investment is made. This 10% limit means that the direct investor is able to influence and participate in the management of a firm but does not necessarily require complete control (see Section 8.1).

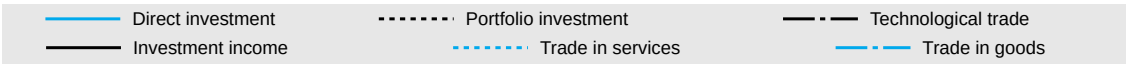
Portfolio investments. In cases where the foreign investor holds less than 10% of the capital (ordinary shares or voting rights) of a firm, the investment is considered to be a "portfolio investment". This type of investment usually corresponds to "short-term" investment transactions in which the investor has no intention of influencing the management of a firm. However, in cases where the shares in a firm are divided among a large number of shareholders, it would be feasible for a shareholder with a shareholding of less than 10% to be able to influence the management of that firm.

Investment income. This type of income consists of: the investor's share of the profits reinvested or placed in reserve by the firm; the dividends payable to the investor in addition to taxes withheld at source; the interests payable by firms in addition to taxes withheld at source; less the interest payable by the investor to the firm in addition to the taxes withheld at source.

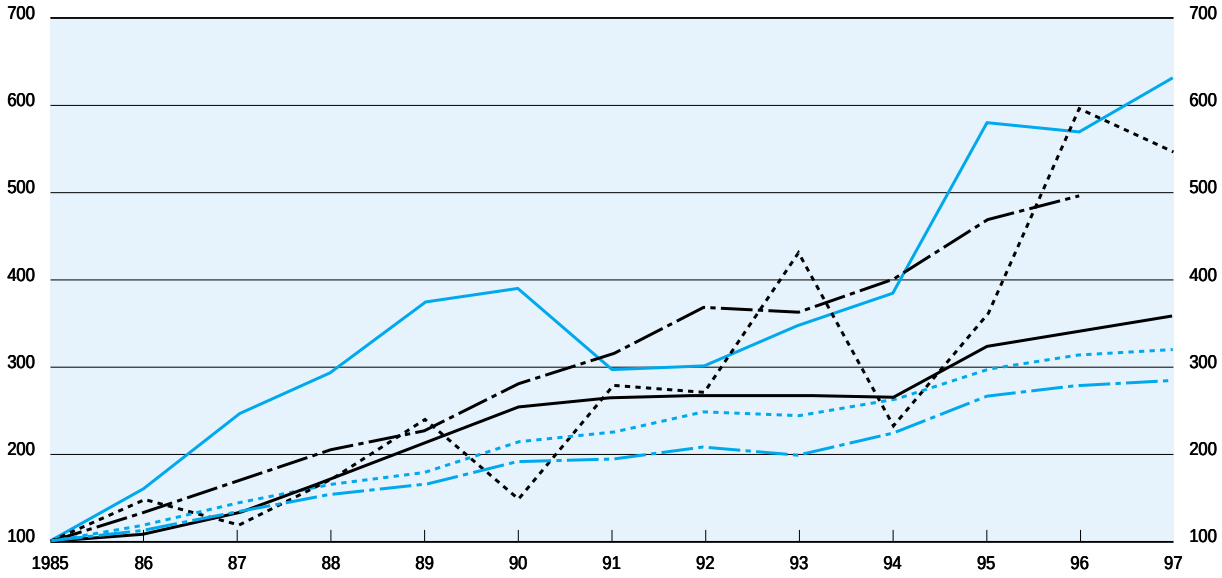
Technological trade. Technology receipts and payments constitute the main form of disembodied technology diffusion. Trade in technology comprises four main categories: transfer of techniques (through patents and licences, disclosure of know-how); transfer (sale, licensing, franchising) of designs, trademarks and patterns; services with a technical content, including technical and engineering studies, as well as technical assistance; and industrial R&D (see also Section 11.5).

For more details, see Annex, Tables 6.1.1 to 6.1.3

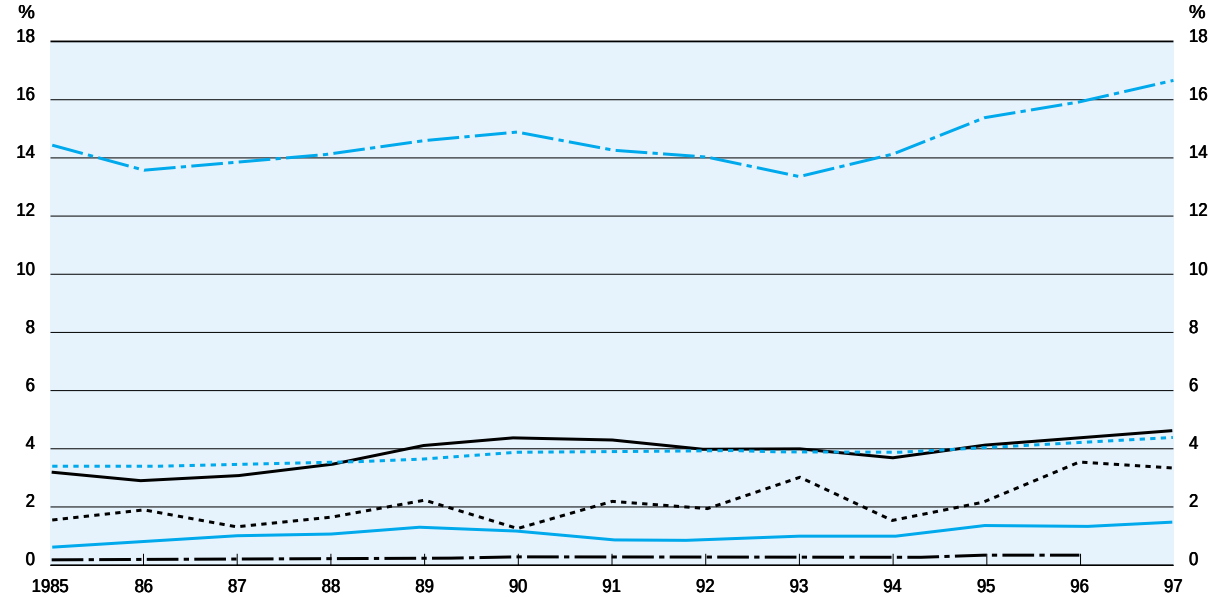
6.1. Trends in the main components of international transactions



Main components of international transactions,[1] total OECD[2]
1985 = 100



Main components of international transactions[1] as a percentage of GDP, total OECD[2]



1. Average of imports and exports (trade) or inflows and outflows (investment).
2. Total OECD excludes Czech Republic, Hungary and Poland.

Source: OECD, ABD and TBP databases, May 1999.

7.1. International trade

- International trade in goods and services plays an increasingly important role for most OECD countries. It can bring about substantial efficiency gains for producers and better satisfy consumer demand through a larger choice of cheaper and better quality goods and services.
- The average of exports and imports of goods and services represents about 20% of GDP in OECD countries (see also Section 6.1). However, this figure hides substantial differences across countries, as the trade-to-GDP ratio is strongly affected by country characteristics such as size and geographic distance.
- Thus, international trade in goods and services accounts for more, sometimes substantially more, than 50% of GDP for Luxembourg, Ireland, Belgium, the Czech Republic, the Netherlands and Hungary. In contrast, international trade is much less important for economies such as the United States or Japan which have a trade-to-GDP ratio of about 10%; a similar figure is obtained for the European Union when intra-EU trade flows are excluded.
- Whatever the level of the trade-to-GDP ratio, trade in goods and services has become increasingly important for virtually all OECD countries during the 1990s, thereby strongly contrasting with the 1985-90 period. The rise is most pronounced for Hungary, the Czech Republic, and Canada, but also for Turkey, Mexico and Spain, countries where trade was less important in the past. Efforts towards stronger regional integration, especially in Europe and North America, and more general policies towards greater liberalisation of trade certainly play a major role in the increased internationalisation of OECD countries.
- While international trade tends to rise faster for services than for goods over the long term, the share of both categories in GDP grew at about the same pace during the 1990s in OECD countries, at slightly more than 2% annually. However, there are substantial differences among countries concerning the relative growth of goods and services.
- Trade in goods increased faster than trade in services for some countries, especially those that opened up most rapidly during the 1990s (Hungary, the Czech Republic, Mexico, and Canada). However, most countries show the opposite trend, with trade in services rising faster than trade in goods. In particular, the increased openness is almost exclusively due to services in the Netherlands and Germany.

The trade-to-GDP ratio

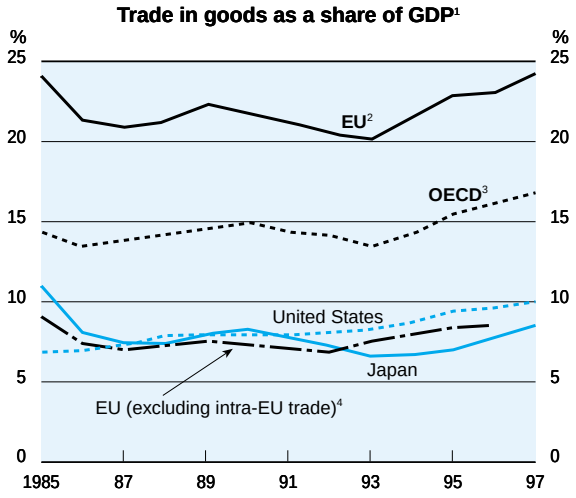
The most frequently used indicator of the importance of international transactions relative to domestic transactions is the trade-to-GDP ratio, which is the average share of exports and imports of goods and services in GDP.

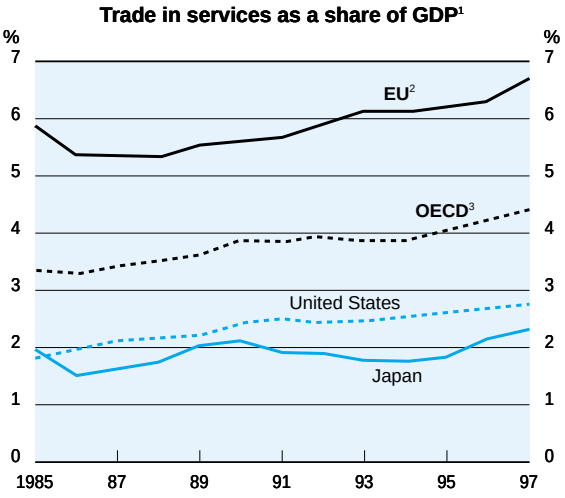
International trade tends to be more important for countries that are small (in terms of size or population) and surrounded by neighbours with open trade regimes than for large, relatively self-sufficient countries or those that are geographically isolated and thus penalised by high transport costs. Other factors also play a role and help explain differences in trade-to-GDP ratios across countries, such as history, culture, (trade) policy, the structure of the economy (especially the weight of non-tradable services in GDP), or the presence of multinational firms (intra-firm trade).

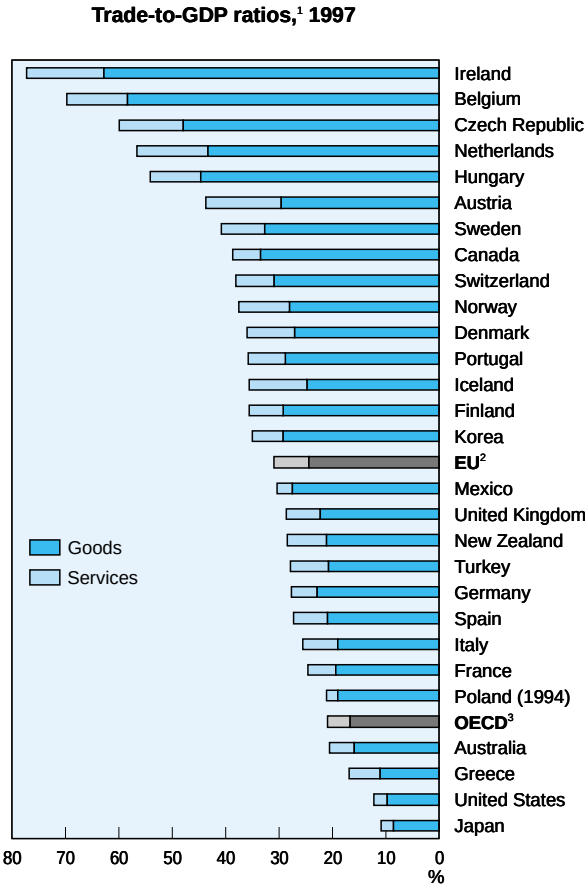
The trade-to-GDP ratio is often called the trade openness ratio. However, the term “openness” to foreign competition may be somewhat misleading. In fact, a low ratio for a country does not necessarily imply high (tariff or non-tariff) obstacles to foreign trade, but may be due to the factors mentioned above, especially size and geographic remoteness from potential trading partners.

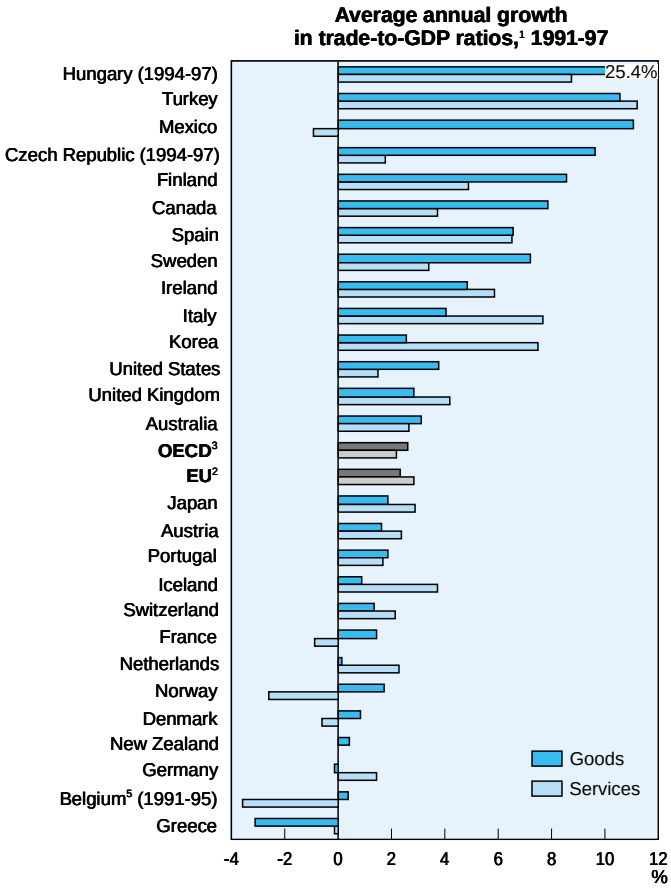
For more details, see Annex, Table 7.1.1.

7.1. International trade









1. Average of imports and exports as a share of nominal GDP.
2. Including intra-EU trade. European Union excludes Luxembourg for 1996 and 1997. For Luxembourg, the openness ratio for goods and services in 1997 was 85.7% (ANA database).
3. OECD excludes Czech Republic, Hungary and Poland. Luxembourg is excluded for 1996 and 1997.
4. Excluding intra-EU trade (calculation based on FTS database).
5. Including Luxembourg.

Source: OECD, ADB database, May 1999.

7.2. The role of high-technology industries in international trade

- High-technology industries play an increasingly important role in international trade of manufactured goods. International demand is rising particularly fast for products of these key industries, as their use throughout the economy can have significant positive effects on productivity and competitiveness (see also Section 12.1).
- High-technology industries are in general more internationalised than less technology-intensive industries (see Section 7.3). While they still account for quite a small share of total OECD trade, their annual growth rate largely outstrips the manufacturing average.
- The three industries with the highest growth rates in OECD manufacturing trade between 1990 and 1996 are all classified as high-technology industries: pharmaceuticals, electronic equipment and computers. In contrast, international demand for another high-technology industry – aircraft – has been below the average since 1990.
- While high-technology industries are the most dynamic manufacturing industries, they represent, at present in absolute terms, only about one-fifth of total OECD trade. They account for about the same proportion as medium-low-technology industries (such as rubber and plastic products and fabricated metal products). If the trend observed over the last ten years continues, high-technology industries will also overtake in importance low-technology industries such as textiles, food and ferrous metals within the next five years.
- Together with medium-high-technology industries (especially motor vehicles, chemicals and machinery and equipment), these industries already account for the main share of OECD manufacturing trade (slightly more than 60%).

The definition of high-technology industries

The very concept of a "high-technology" industry is subject to debate: *i)* is it one which extensively *produces* technology or one which extensively *uses* technology? There are a certain number of potential indicators, ranging from input-related measures (*e.g.* expenditures on research and development, number of scientists and engineers) to output-related measures (*e.g.* number of patents). For all of these indicators, there is a certain arbitrariness in choosing the cut-off points that separate the different technology classes.

Drawing on methodological work carried out at the OECD*, manufacturing industries are classified in four different categories of technology intensity: *i*) high-technology; *ii)* medium-high-technology; *iii)* medium-low-technology; and *iv)* low-technology. For reasons of availability of comparable statistics, this classification is based on indicators of (direct as well as indirect) technology intensity which reflect to some degree "technology-producer" versus "technology-user" aspects: *i)* R&D expenditures divided by value added; *ii*) R&D expenditures divided by production; and *iii*) R&D expenditures plus technology embodied in intermediate and capital goods divided by production. The detail of industrial breakdown is limited only by the availability of comparable input-output tables and R&D surveys. These indicators were calculated in the aggregate for 1990 for ten OECD countries for which the embodied technology variable is available, using purchasing power parities in 1990 US dollars. Embodied technology intensities appear to be highly correlated with direct R&D intensities, reinforcing the view that the latter largely reflect an industry's technological sophistication (see Annex 1).

This classification is particularly useful for analysing industry information, for example on employment or value added by technology intensity. To do likewise for international trade flows – which are defined at product level – requires attributing each product to a specific industry.

However, not all products within a "high-technology industry" necessarily have a high technology content; likewise, some products in industries with lesser technology intensities may well incorporate a high degree of technological sophistication. To provide a more appropriate instrument for analysing international trade (not used here) the OECD, in collaboration with Eurostat, has recently defined* an additional classification of high-technology products.

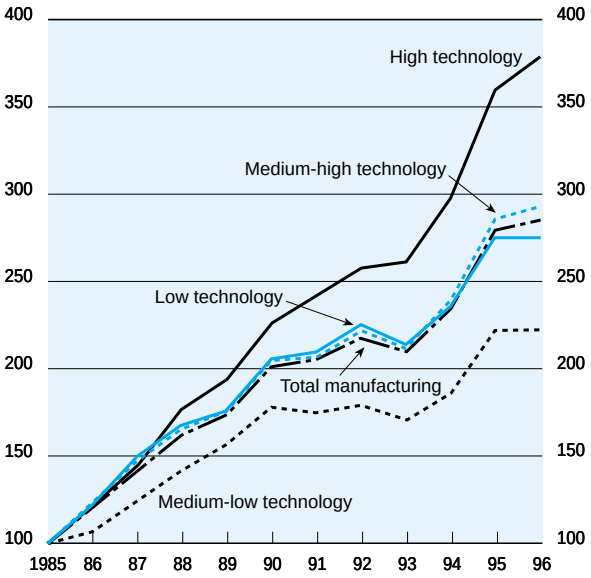
Because no detailed data are available for services, both industry and product classifications only concern manufacturing industry at present.

* See T. Hatzichronoglou, (1997), "Revision of the High-technology Sector and Product Classification", STI Working Paper 1997/2, OECD, Paris.

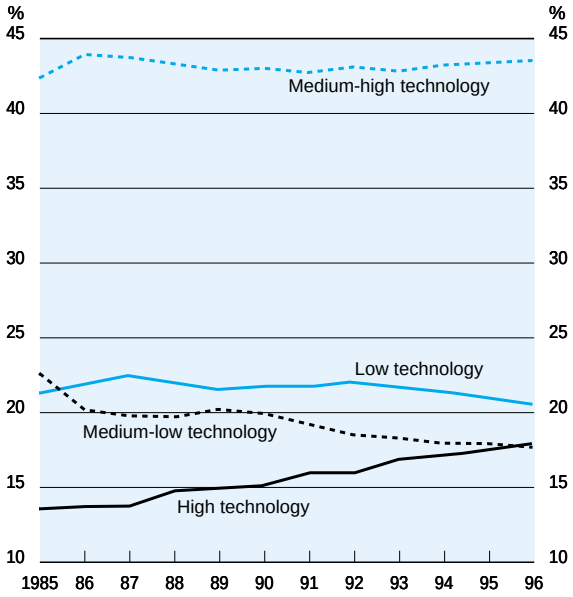
For more details, see Annex, Table 7.2.1 and also Annex 1.

7.2. The role of high-technology industries in international trade

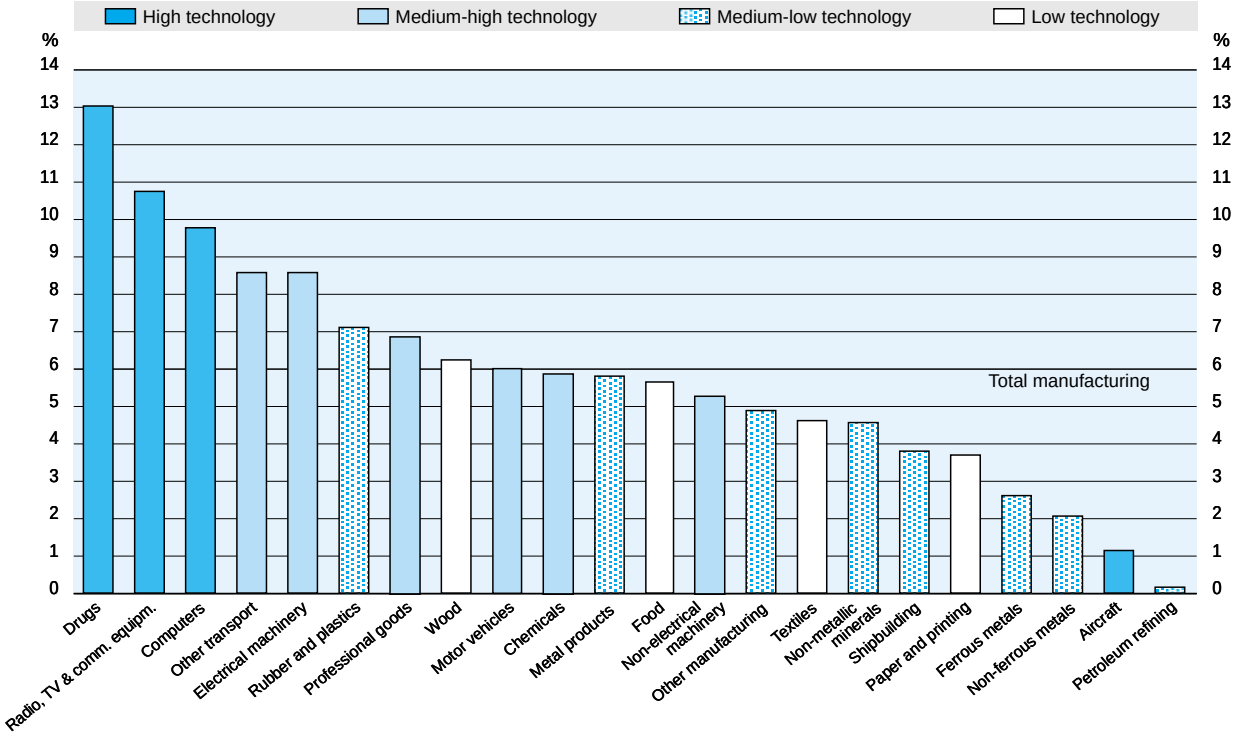
OECD[1] manufacturing trade[2] by technology intensity
1985 = 100



Structure of OECD[1] manufacturing trade[2] by technology intensity
Share in total manufacturing trade



Average annual growth of OECD[1] manufacturing trade[2] by industry and technology intensity
1990-96



1. OECD excludes Czech Republic, Hungary, Korea, Mexico and Poland.
2. Average value of exports and imports.

Source: OECD, Main Industrial Indicators, 1999.

7.3. Export orientation and exposure to foreign trade

- While the importance of international trade compared to domestic production or demand has risen for virtually all industries between 1990 and 1996 in OECD countries, high- and medium-high-technology industries are generally more internationalised than less technology-intensive industries.
- The average of the export ratio and the import penetration is highest – and has generally risen fastest – for computers, professional goods, aircraft, chemicals, and electronic equipment, but also for textiles, whereas resource-based industries are less internationalised. Strong regulation in the pharmaceuticals industry in many countries favours foreign direct investment rather than trade.
- By country, these ratios give an indication of the export orientation and exposure to foreign trade in particular industries.
- Owing to international sourcing and intra-industry trade, strongly export-oriented industries can also have high import penetration ratios. This is the case for computers in the United States, and to a lesser extent in Japan and the European Union.
- A strong difference between export ratio and import penetration shows national specialisation patterns, such as the strong export orientation of aircraft and the high import penetration of textiles in the United States and the European Union.

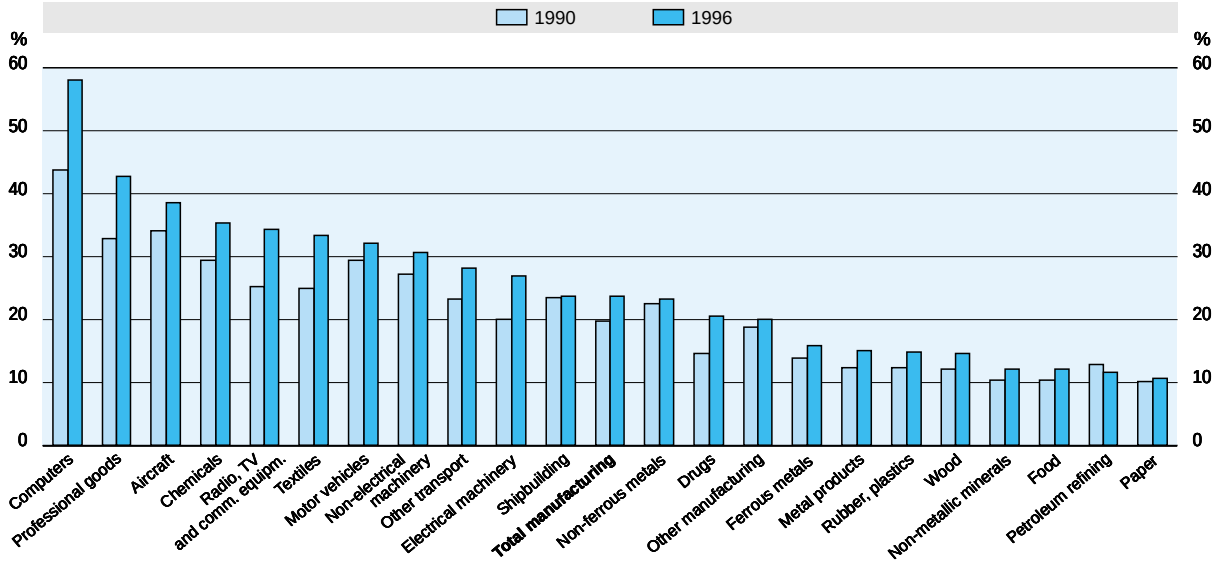
Export ratio and import penetration

The *export ratio* indicates the share of output (Y) which is exported (X), *i.e.* X / Y, and the *import penetration* shows to what degree domestic demand (D) is satisfied by imports (M), *i.e.* M / D = M / (Y – X + M).

As is the case for the trade-to-GDP ratio (Section 6.1), a low penetration rate does not necessarily imply import barriers. In fact, it may reflect industry-specific characteristics unfavourable to international trade such as high transport costs for goods with a low value per ton. But a low penetration rate may also reflect the presence of highly competitive domestic firms capable of resisting foreign competition, especially if the export ratio is high at the same time. Conversely, a high import penetration rate may reflect the weak competitiveness of domestic firms, especially if the export ratio is low. Both indicators are high for some industries, reflecting their internationalisation, especially owing to sourcing of intermediate goods, intra-industry trade and intra-firm trade.

For more details, see Annex, Tables 7.3.1 and 7.3.2.

Importance of international trade for manufacturing industries in OECD[1] countries

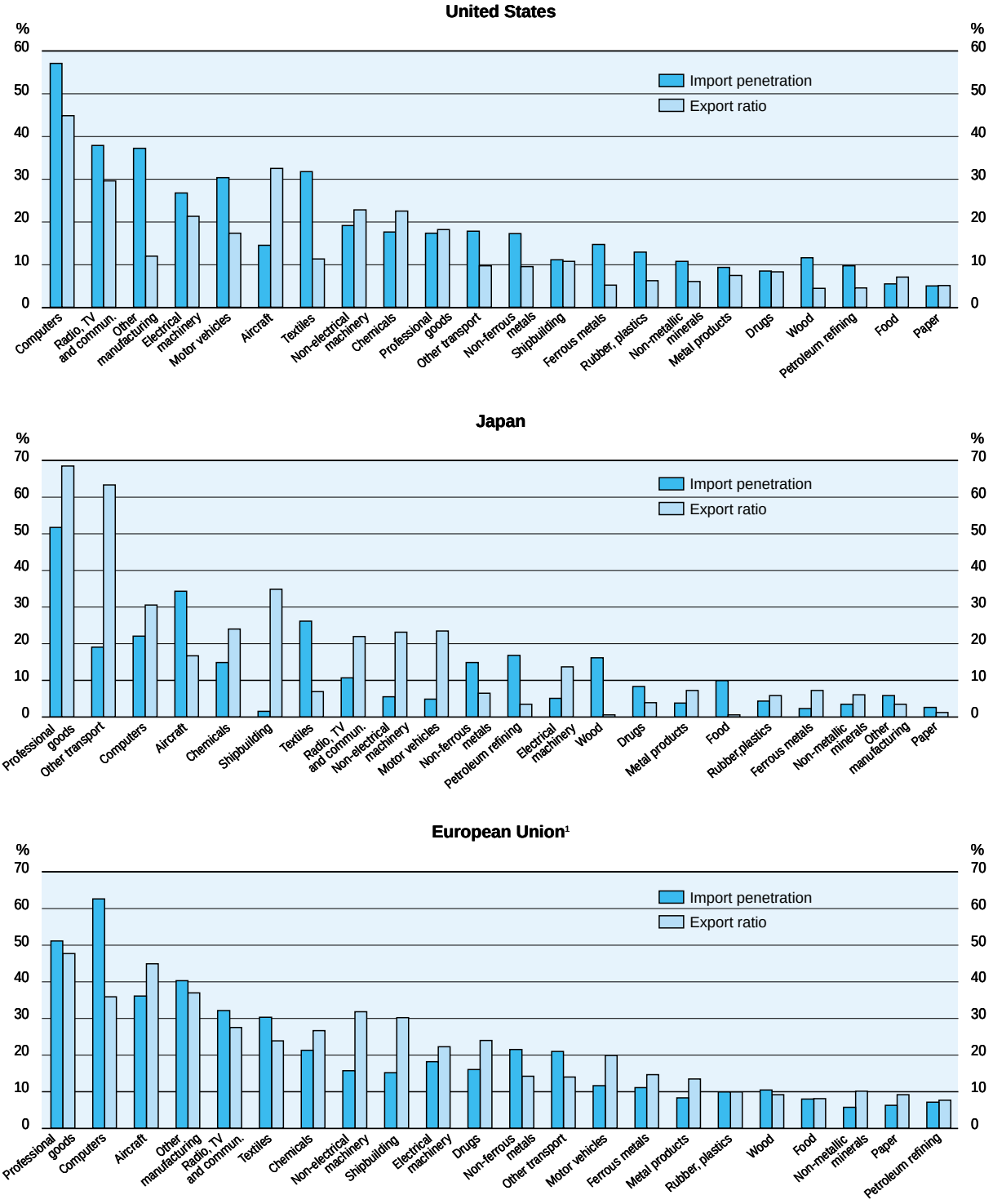


1. Average of export ratio and import penetration rates of 16 countries.

Source: OECD, Main Industrial Indicators, 1999.

7.3. Export orientation and exposure to foreign trade

Exposure of manufacturing industries, 1996



1. European Union excludes Austria, Belgium, Luxembourg and Ireland. Intra-EU trade is excluded.

Source: OECD, Main Industrial Indicators, 1999.

7.4. Intra-industry trade and the role of product differentiation

- Simultaneous exports and imports within the same industry are generally labelled intra-industry trade. It typically occurs among rich countries with similar levels of development which are geographically close, and is often regarded as a corollary of smooth economic integration.
- In OECD trade with the 15 members of the European Union, intra-industry trade – at the most detailed level of product breakdown – is most important for the core EU members, and is also high for countries such as Switzerland and the United States. In contrast, for remote and/or less developed countries such as New Zealand, Australia, Greece, Mexico, Korea and Turkey, trade with the European Union is mainly of an inter-industry nature, *i.e.* based on complementarity.
- Contrary to what is often implicitly assumed, intra-industry trade within the European Union mostly concerns goods which differ by quality, *i.e.* those for which export and import unit values differ substantially, rather than different varieties of similar goods. The same is true for EU trade with non-members. Thus, intra-industry trade not only provides consumers and producers with a larger variety but also with a larger choice of quality.
- At the same time, this "qualitative division of labour" may have different implications for income distribution, as it is not neutral for countries to be specialised in up-market or down-market goods: quality matters and depends on factors such as capital intensity, R&D expenditures and the qualifications of the workforce (see also Section 12.3).

Intra-industry trade

Simultaneous exports and imports within a single industry can result in substantial gains in trade. First, trade makes it possible for firms to reap economies of scale by specialising in, and exporting, a limited number of varieties of goods within an industry, while consumers have a larger choice of (domestic and imported) varieties. Second, compared to traditional inter-industry specialisation, adjustment costs are considered small, as production factors do not have to move between industries, *i.e.* from import-competing towards export-oriented industries. Finally, a high share of bilateral intra-industry trade indicates that production structures among countries are similar. This in turn should favour the symmetry of shocks, reduce exchange rate fluctuations and thus improve the chances of success in case of a monetary union.

However, the extent of measured intra-industry trade strongly depends on the detail of the sectoral breakdown: the more products are grouped together into an "industry", the more likely is an overlap between exports and imports. Thus, imports of intermediate goods (*e.g.* motors) and exports of final goods (*e.g.* assembled cars) are often interpreted as intra-industry trade, as exports and imports concern the same industry. However, this situation corresponds rather to an *international division of production processes* (Section 7.5), where each firm or affiliate (in the case of intra-firm trade within multinational firms) specialises in only those stages of the value-added chain for which it is most competitive.

In contrast, the interpretation and the nature of competition is very different if *intra-industry trade is observed at the product level*, *i.e.* if it concerns simultaneous exports and imports of goods with the same main technical characteristics. In addition, the use of unit values (value of exports or imports divided by quantity) makes it possible to distinguish whether this trade concerns horizontally differentiated, i.e. similar goods or vertically differentiated goods which differ by quality. Owing to the availability of data on values and unit values of bilateral trade flows at a very detailed level (some 10 000 product items), Eurostat data are used here to observe the nature of trade flows of OECD countries with EU members. Two criteria are applied: *i)* the degree of overlap between exports and imports (does the smaller flow of the two, if it exists, represent more or less than 10% of the larger flow?); and *ii*) the difference in export and import unit values (more or less than 15%?). This leads to three trade types*:

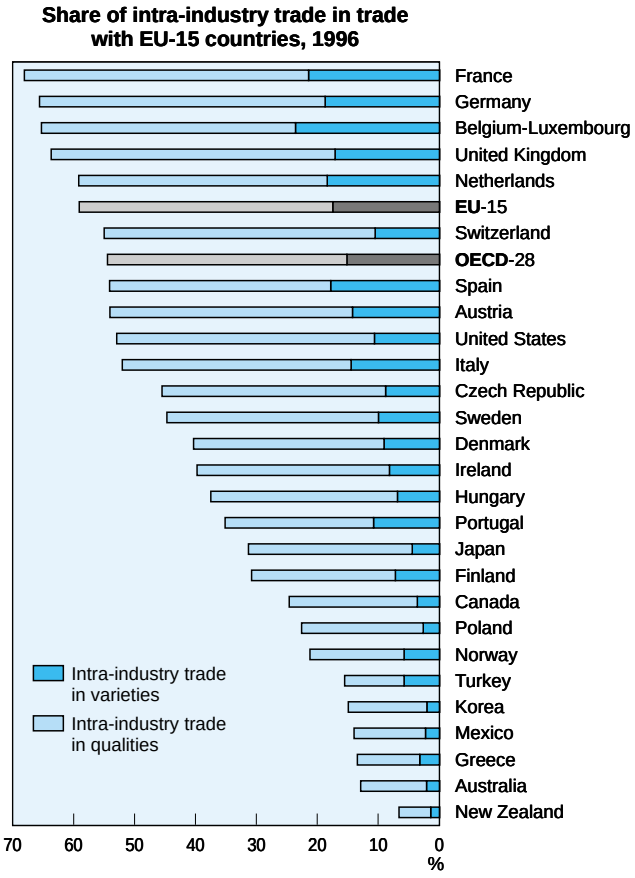
- Inter-industry trade: no or no significant overlap between exports and imports.
- Intra-industry trade in varieties (*i.e.* horizontal differentiation): significant overlap and weak differences in unit value.
- Intra-industry trade in qualities *(i.e.* vertical differentiation): significant overlap and strong differences in unit values.

The relative importance of these trade types is obtained by dividing the exports and imports of each trade type by total trade.

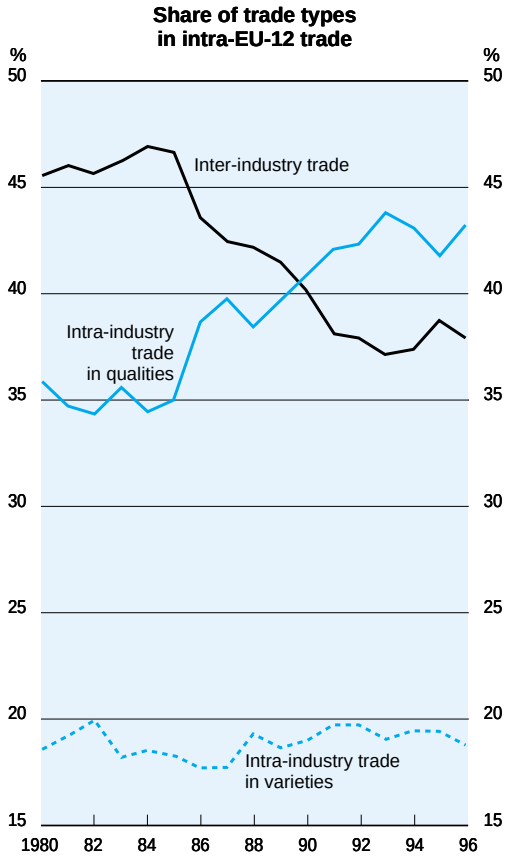
* L. Fontagné and M. Freudenberg, "Marché unique et développement des échanges", *Économie et statistiques*, forthcoming.

For more details, see Annex, Tables 7.4.1 and 7.4.2.

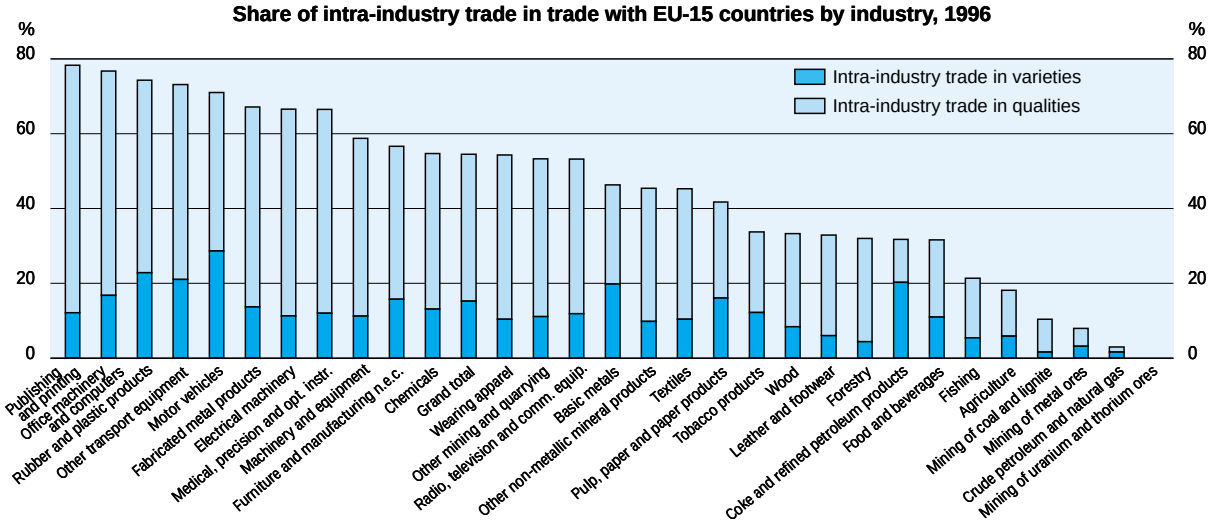
7.4. Intra-industry trade and the role of product differentiation



Note: The complement to 100% yields the share of inter-industry trade.
Source: Eurostat data; OECD calculations.



Source: CEPII (1997); Eurostat data; updated by OECD.



Source: OECD calculations, based on data from Eurostat.

7.5. Role of intermediate goods in international trade

- The international division of production processes replaces older forms of internationalisation based on imports of raw materials and exports of final goods. It is a key feature of modern firm strategies. It implies the international sourcing of intermediate goods on a regional and even worldwide basis, through international subcontracting agreements with independent firms but also within firms (intra-firm trade). These unfinished goods enter the production process for further processing or assembly.
- Intermediate goods have a substantial weight in international trade. They represent about half of total trade between the European Union and other OECD Member countries.
- While the share of intermediate goods in total imports from the European Union differs little across countries, the situation is rather different for exports.
- Exports of intermediate goods to the European Union are particularly high for new EU members (Finland, Sweden and Austria), for central European countries (Czech Republic and Hungary), and for Canada and the United States.
- In contrast, they are less important for New Zealand and Australia, as well as for Turkey, Greece and Portugal. The latter export mainly consumer goods, especially textiles.

International division of the value-added chain

Technological progress and operations on global markets make it possible to break down the production process for a particular good into an increasing number of steps, from upstream to downstream, and thus increase the number of intermediate goods which enter the production process. The (often highly standardised) upstream goods, produced on a large scale by very specialised units which may be located in different countries, are then combined or assembled in different ways to create a large variety of differentiated downstream goods, highly adapted to specific markets.

Several approaches are used to determine the importance of the international division of production processes.

Firm surveys are potentially the richest source of information, but cannot be used for systematic cross-country comparisons, as they exist only for a limited number of countries (*e.g.* the United States, Japan and France), they are not updated regularly, and their methodologies are not compatible.

Input-output tables on intra-industry and inter-industry relations show the extent to which industries rely on inputs from others. However, they are only updated at intervals of several years, the publication delays are quite long, and the data are only available at rather aggregate levels, both sectoral and geographical.

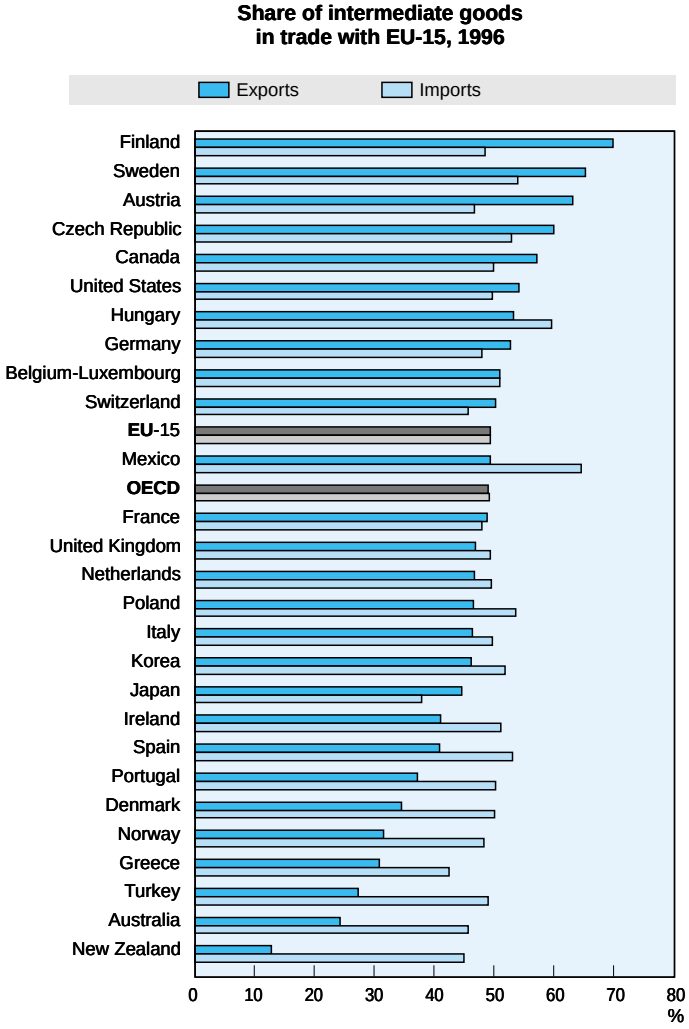
Trade statistics based on end use of products: The United Nations' classification of Broad Economic Categories (BEC) makes it possible to group products of the Standard International Trade Classification (SITC) according to their nature (primary or processed) or according to their end use (intermediate, capital, consumption). The solution adopted here* is the following:

- Primary products: primary food and beverages, mainly for industry (BEC 111); primary food and beverages, mainly for household consumption (112); primary industrial supplies n.e.c. (21); and primary fuels and lubricants (31).
- Intermediate goods: Processed food and beverages, mainly for industry (121); processed industrial supplies n.e.c. (22); other processed fuels and lubricants (322); parts and accessories of capital goods (42); and parts and accessories of transport equipment (53).
- Capital goods: Capital goods, excluding transport equipment (41); and other industrial transport equipment and parts and accessories thereof (521).
- Consumption goods: processed food and beverages, mainly for household consumption (122); processed fuels and lubricants: motor spirit (321); passenger motor cars (51); other non-industrial transport equipment and parts and accessories thereof (522); durable consumer goods n.e.c. (61); semi-durable consumer goods n.e.c. (62); and non-durable consumer goods n.e c. (63).

* See M. Freudenberg and F. Lemoine, "Central and Eastern European Countries in the International Division of Labour in Europe", CEPII Working Paper, No. 99-05, April 1999 (available at http://www.cepii.fr).

For more details, see Annex, Table 7.5.1.

7.5. Role of intermediate goods in international trade



Source: OECD calculations, based on data from Eurostat.

8.1. Foreign direct investment

- Since the second half of the 1980s, foreign direct investment has played a fundamental role in furthering international integration and has been the most dynamic factor in industrial restructuring at world level.
- It should be emphasised, however, that the greater part of direct investment during the past 15 years corresponds to acquisition or capacity enlargement of existing firms, *i.e.* a change of ownership rather than the creation of a new business enterprise (see Section 8.2).
- At the same time, there are wide differences in the weight of investment across countries. Whether measured in terms of flows and stocks or as a percentage of GDP or domestic investment (gross fixed capital formation), foreign direct investment plays an essential role in countries like the Netherlands, Switzerland, Belgium, Sweden and the United Kingdom. On the other hand, it has little prominence in Japan and Korea.
- In some countries, outward investment greatly exceeds inward investment. The main net outward investors include three small European countries: the Netherlands, Switzerland and Sweden. These countries differ from the others in that they are the home of many multinational corporations that invest extensively abroad.
- Conversely, other countries receive more foreign capital than they invest abroad. They include Belgium, New Zealand and the central European economies.
- The magnitude of inward direct investment depends on many factors: size of the domestic market, labour skills and infrastructure quality, labour costs, taxation, level of technology and development of the banking and financial system.

Foreign direct investment

Main definitions

Foreign investment takes the form of direct investment or portfolio investment. A foreign investment is classified as a direct investment if the foreign investor holds at least 10% of the ordinary shares or voting rights in an enterprise and exerts some influence over its management. Any investment amounting to less than 10% of ordinary shares is posted as portfolio investment.

Direct investment is measured in terms of flows and stocks. Direct investment flows, whether inward or outward, comprise investors' net capital contributions, net loans and undistributed (reinvested) profit.

Main limitations of the data

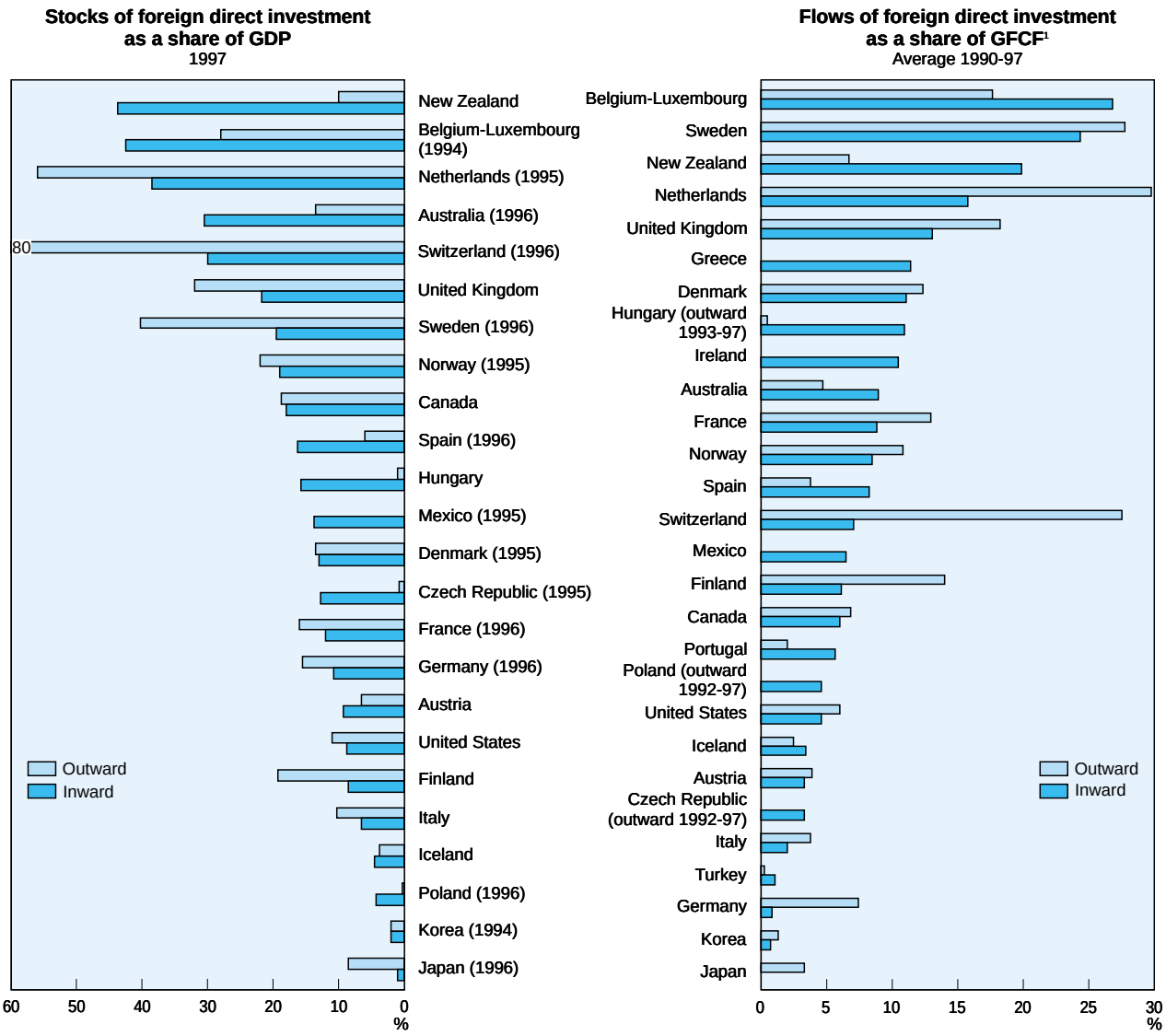
The threshold of 10% of assets or voting rights held in a company has not been adopted by all countries as the rule for distinguishing between direct and portfolio investment. Germany, Italy and the United Kingdom, for example, have adopted a 20% threshold; other countries have not set one (Greece, Japan, Netherlands). This creates distortions in international comparisons.

A number of foreign investors may hold a majority stake in some companies, although each may own less than 10% of ordinary shares. These investments may not be counted, and it will then be considered that the companies are controlled by nationals of the country concerned.

Direct investment flows do not include investment via the host country's capital market or via other financial sources which do not pass through the investor country, although this may represent over half the actual investment total. This is why the data on the activity of foreign affiliates give more complete information on the amount of foreign investment in each country.

For more details, see Annex, Tables 8.1.1 and 8.1.2.

8.1. Foreign direct investment



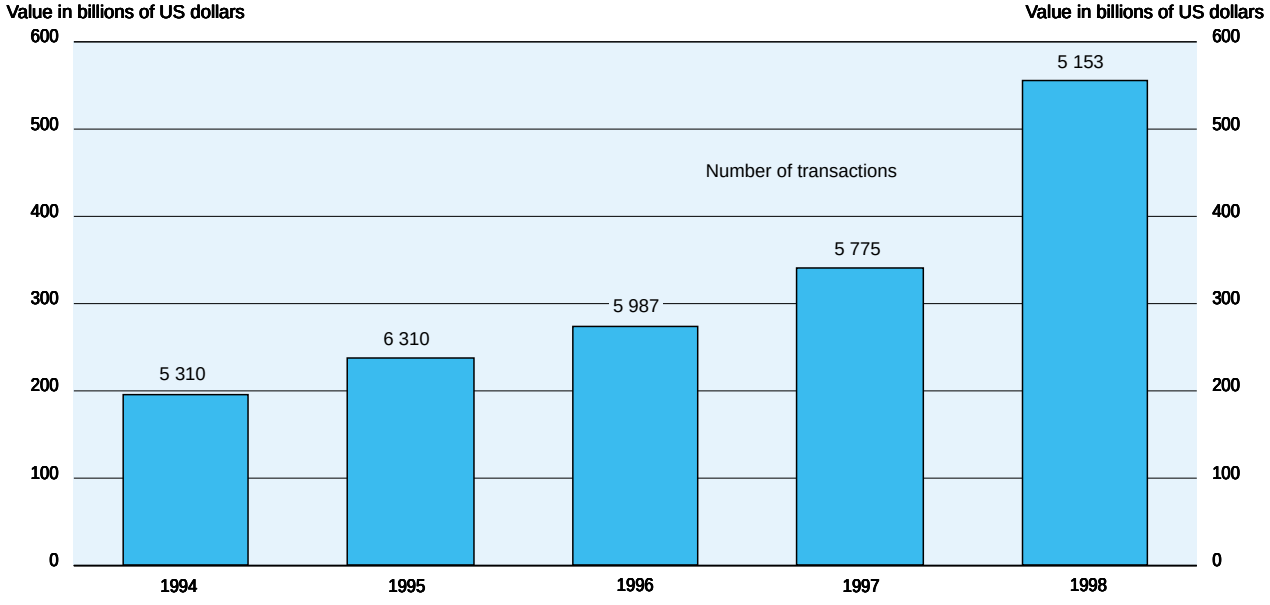
1. GFCF: Gross Fixed Capital Formation

Source : OECD, International Direct Investment database and IMF, May 1999.

8.2. Mergers and acquisitions

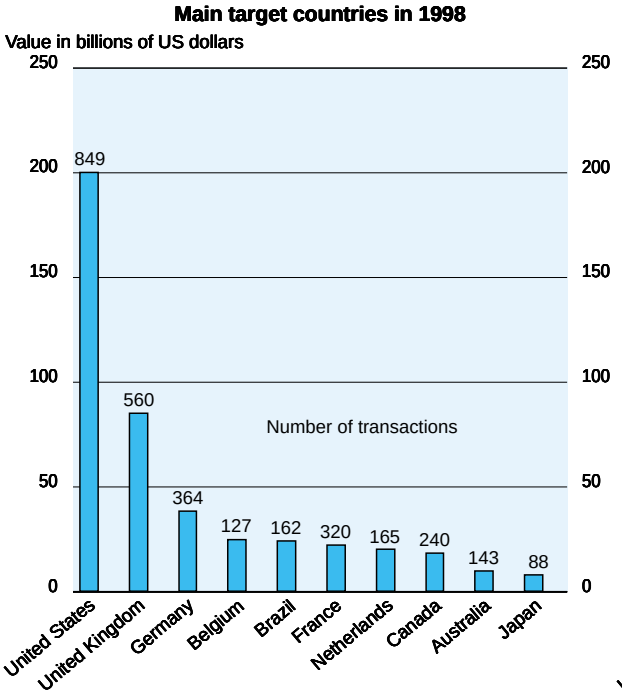
- The form of direct investment most often chosen is cross-border acquisition of existing enterprises. It is the shortest route to external growth for firms wanting to attain "critical mass" and increase their market share rapidly, rationalise their activities and enhance their technological potential and competitive position.
- In 1998, the cross-border mergers and acquisitions market grew by as much as 59% on a value basis, or over 550 billion US dollars, despite a decline in the number of transactions for the fourth straight year.
- The United States was again the main target country in 1998, attracting more than 36% of purchases on a value basis, well ahead of countries like the United Kingdom and Germany.
- The United Kingdom, on the other hand, has moved to the fore of the purchasing countries, just ahead of the United States. This result is very largely due to the merger between British Petroleum and Amoco at a cost of 61 billion US dollars.
- Mergers and acquisitions in Europe increased by 59% or 238 billion US dollars. The United States is the leading investor in Europe, with the United Kingdom drawing the most foreign investment. In relation to 1997, mergers and acquisitions increased significantly in Germany, France, Belgium and the Netherlands, but declined in Spain and Italy.
- Cross-border mergers and acquisitions declined in most of the Asian countries in 1998 as a result of the financial crisis. Only Japan and Korea continued to attract foreign investors. South America too, with the sole exception of Brazil, saw a decline in these investments.
- In 1998, the sectors most active at world level were oil, automotive equipment, banking, finance and telecommunications. There were many acquisitions in sectors like food processing, electronics and engineering but they were of relatively low value.

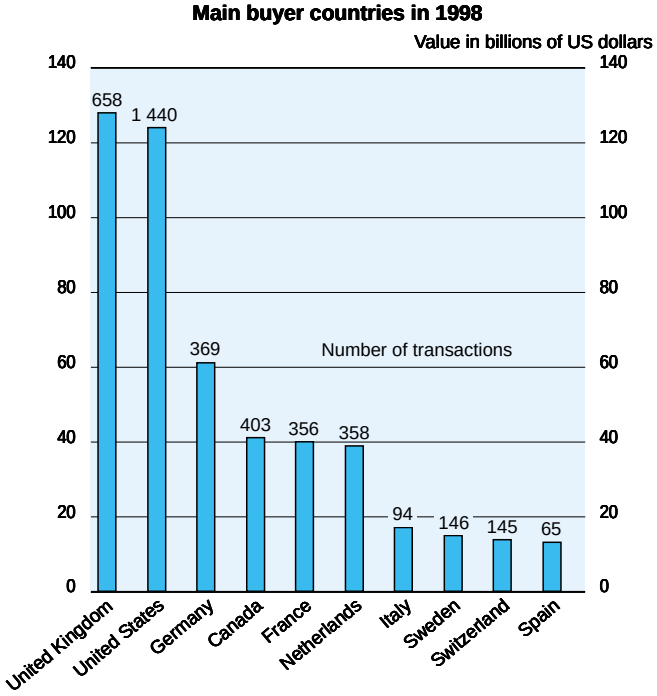
World mergers and acquisition market

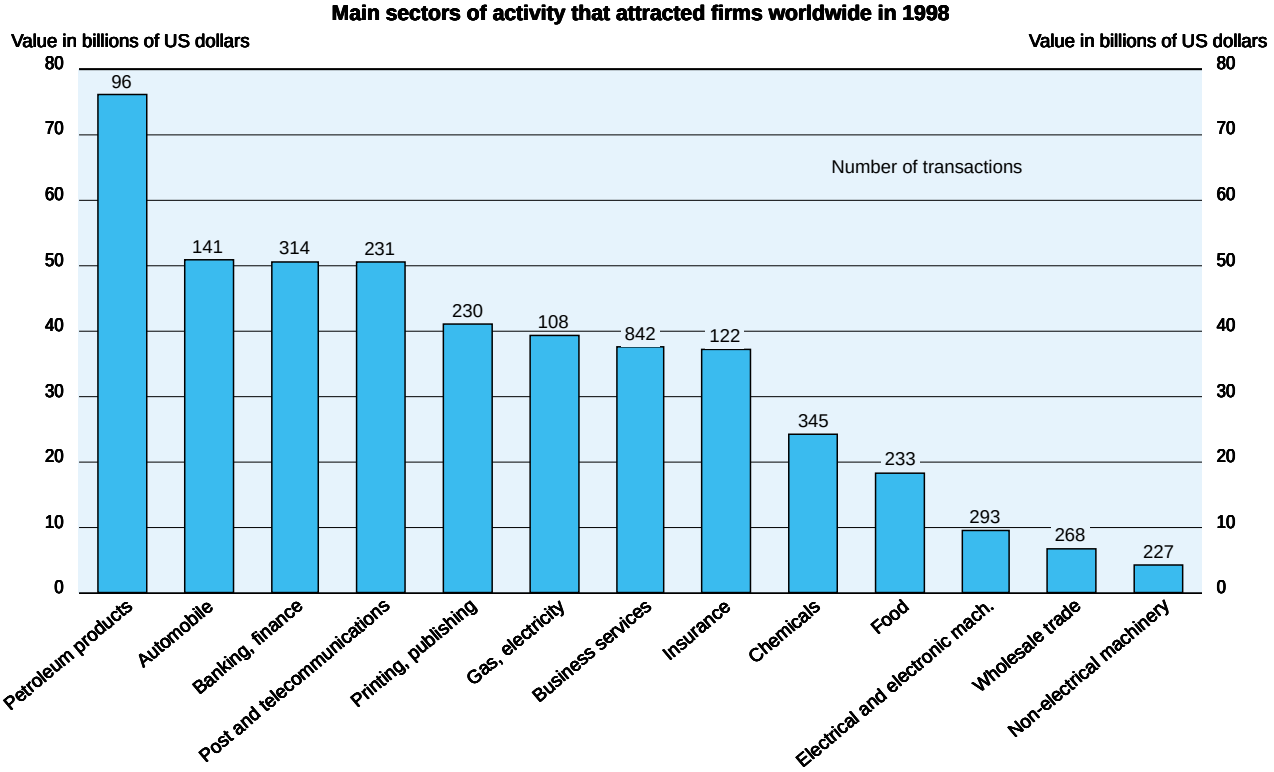


Source: KPMG Corporate Finance.

8.2. Mergers and acquisitions







Source: KPMG Corporate Finance.

8.3. Share of foreign affiliates in manufacturing

- Indicators of the activity of foreign affiliates supplement the information on foreign direct investment by making it possible to analyse the weight and performance of these firms and their contribution to the host country's economic activity.
- The share of production and employment under foreign control in the OECD countries amounts to between 10% and 20% on average. In the period from 1985 to 1996, it rose in nearly all the countries for which data are available.
- As with the figures for inward direct investment (Section 8.1), there are wide differences between countries. The share of foreign affiliates in manufacturing production ranges from 66% in Ireland to under 3% in Japan.
- Foreign affiliates feature prominently in Canada, the Netherlands, France, the Czech Republic and the United Kingdom. Their presence is limited in Turkey, Germany, Finland, Norway and the United States. The share of foreign affiliates depends on various factors, including the size and attractiveness of the country and the ease, from the institutional standpoint, with which such investments can be made.
- Whereas manufacturing employment in national firms has declined in most countries since 1985 (except in Italy, Turkey and Ireland), employee numbers in foreign affiliates have risen in all countries except Germany. Yet the generally more rapid growth in employment or production in foreign affiliates than in national firms does not necessarily point to the creation of new foreign affiliates. In most cases it reflects changes of ownership due to buy-outs and acquisitions.
- The share of foreign affiliates in manufacturing production exceeds their share in manufacturing employment in nearly all countries. Thus, apparent labour productivity in manufacturing (output per employee) in foreign affiliates is higher than in national firms. The mean wage paid by foreign affiliates in the manufacturing sector is also generally higher than in national firms.
- Although the gap has recently narrowed for both productivity and wages, caution must be used in interpreting any average for manufacturing as a whole, since foreign affiliates usually do not have the same profile as national firms: they are generally larger in size and concentrated in the most productive industries, and they demand a higher level of skills than the average in national firms. But given these differences, it still seems that foreign affiliates are more productive and pay higher wages.

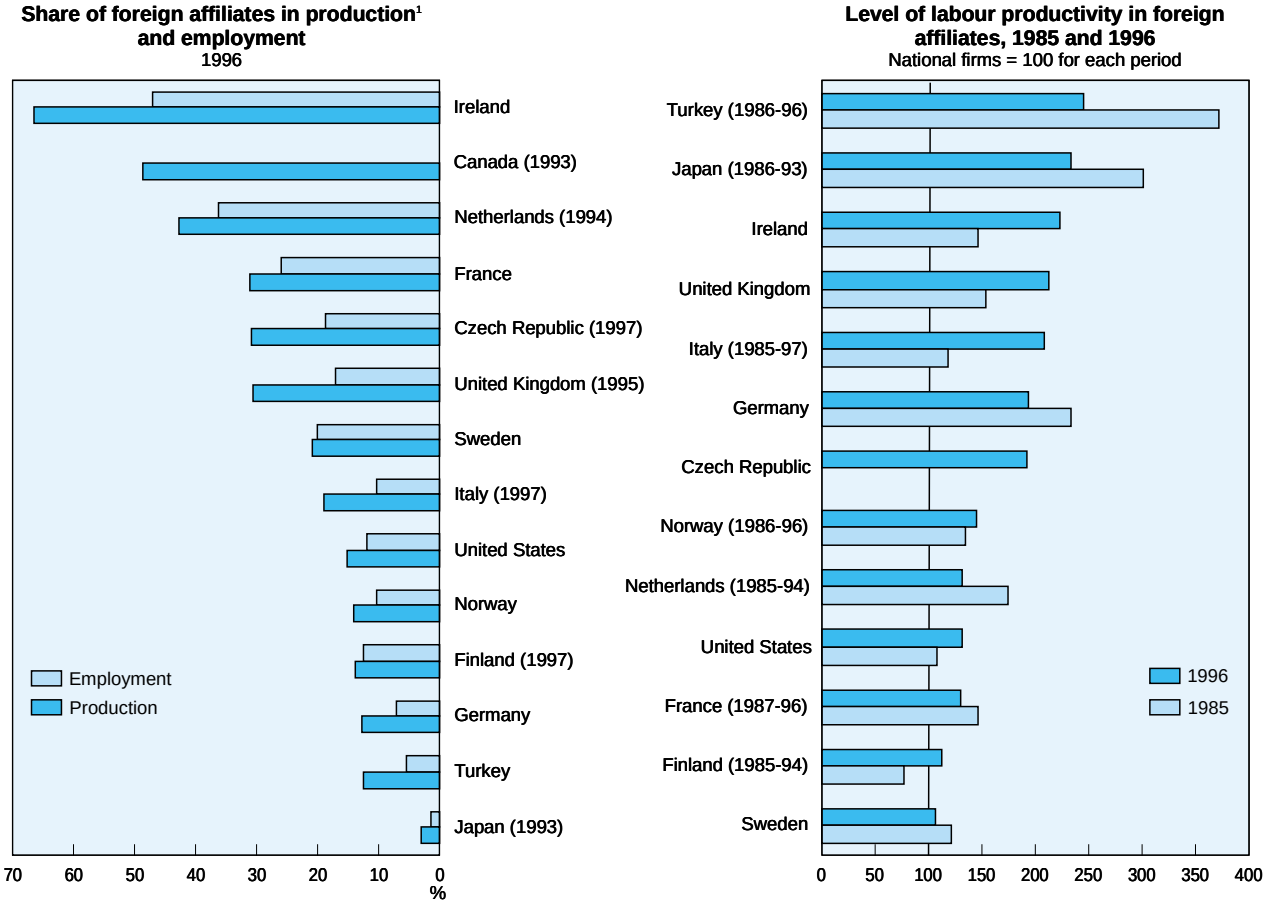
Activity of foreign affiliates in manufacturing industry: main definitions

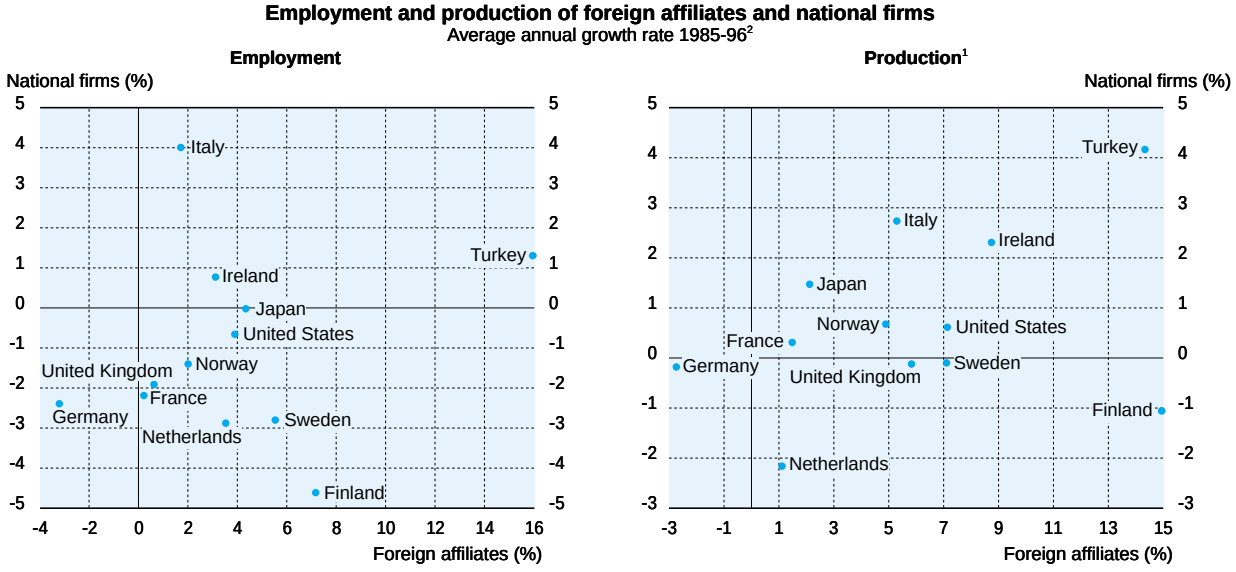
The criterion used for the collection of data on the activity of foreign affiliates is the control of a company, meaning the power to take decisions concerning it. The statistical criterion used for this purpose is a majority holding (over 50%) in a company. It is assumed that the owner of over half of a company's voting shares has, in most cases, real control over the management of the company.

The geographical origin of a foreign affiliate is the country of the parent company if it holds over 50% of the affiliate's voting shares.

For more details, see Annex, Table 8.3.1.

8.3. Share of foreign affiliates in manufacturing





1. Turnover for the following countries: United States, Japan, France, Germany, Italy, Netherlands, Sweden.
2. Except Japan: 1986-93; Finland: 1985-94; France: 1987-96; Italy: 1985-97; Netherlands: 1985-94; Norway, Turkey: 1986-96.

Source: OECD, Activity of Foreign Affiliates database, May 1999.

9.1. Role of foreign affiliates in the internationalisation of industrial R&D

- Although R&D in many countries is less internationalised than production, there has been a significant increase in certain countries in the past 15 years, in the course of the process of economic globalisation.
- The presence of research-performing foreign affiliates enables the host country to benefit from their technological and organisational capabilities.
- The share of foreign affiliates in R&D varies widely across countries, ranging from less than 2% in manufacturing industry in Japan to 68% in Ireland. At over 30%, the share is very large as well in Spain, Canada, the United Kingdom, Australia and the Czech Republic.
- The differences between countries reflect primarily the contribution of foreign affiliates to industrial activity in those countries (see also Section 8.3). Thus, the share of foreign affiliates in manufacturing production is high in Ireland and low in Japan.
- The share of foreign affiliates in R&D also reflects the size of their R&D effort relative to that of domestic firms (small-scale in Ireland and large-scale in Japan). Other factors also play a part, such as the quality of scientific personnel and research centres, and the scale of technology transfers from parent companies to their affiliates abroad in relation to the independent R&D effort of those affiliates.
- Although the ratio of foreign affiliates' R&D to domestic product of industry is highest in Sweden, their share of manufacturing R&D in that country is still relatively small, as the R&D effort of Swedish firms is much greater.
- Similarly, the decline in the foreign affiliates' share of manufacturing R&D in Canada, Australia and Spain is due to the faster growth of R&D spending by national firms.

Internationalisation of R&D

The marked growth in R&D expenditures in OECD countries, especially during the first half of the 1980s, was accompanied by two major trends*:

– First, the growing internationalisation of R&D activities of multinational firms as the result of an increase in the number of R&D laboratories located abroad.

– Second, the emergence and development of international networks of co-operation agreements or alliances either between firms or between firms and government or university R&D bodies (see Section 9.2).

While the first of these trends is restricted to multinationals, the second is typical of all categories of firms.

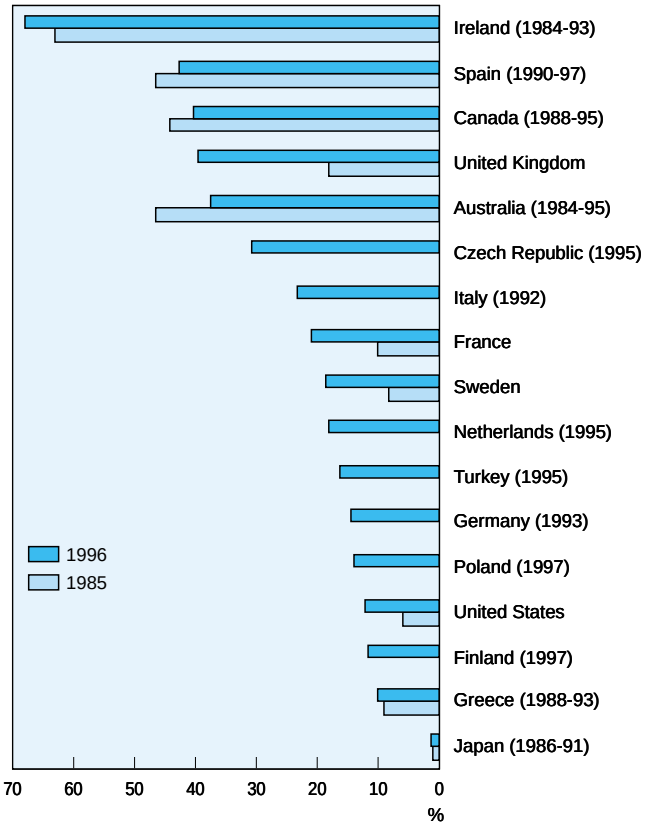
The decentralisation by multinational firms of their R&D activities, *i.e.* the establishment of laboratories outside the home country of the parent company, is by no means a new phenomenon in that decentralised R&D facilities were already being used to service and support overseas production units. Until recently, the absence of data on the R&D activities of multinational firms suggested that internationalisation of R&D was fairly marginal in the general process of economic globalisation. Yet the OECD's surveys, which more broadly cover the activities of foreign affiliates in OECD countries and of national firms abroad (AFA database), show that R&D performed abroad and by foreign affiliates represents on average well over 12% of total expenditure on industrial R&D in the OECD area. In several countries this share is increasing.

* OECD, *Internationalisation of industrial R&D: Patterns and Trends*, Paris, 1998.

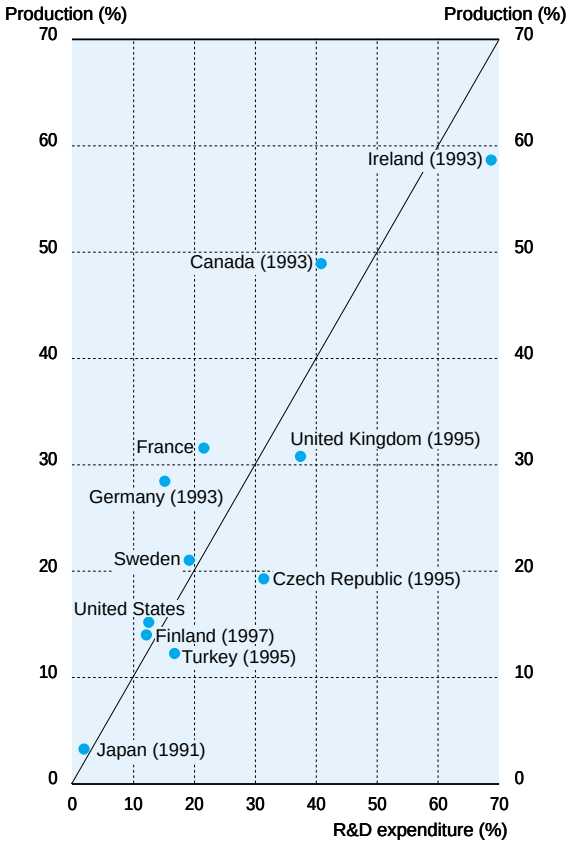
For more details, see Annex, Table 9.1.1.

9.1. Role of foreign affiliates in the internationalisation of industrial R&D

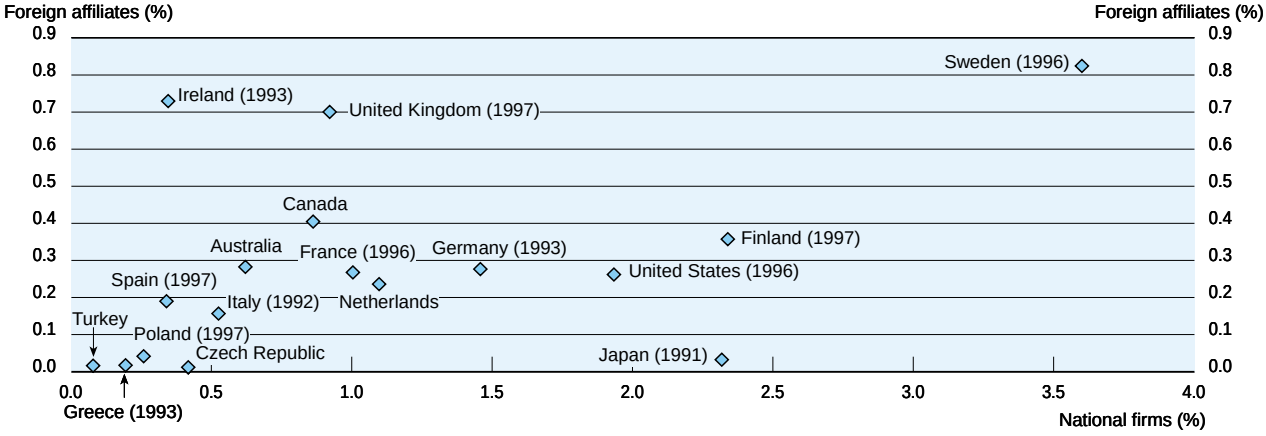
Share of foreign affiliates in manufacturing R&D
1985 and 1996



Share of foreign affiliates in R&D and in manufacturing production[1]
1996



R&D expenditures by foreign affiliates and national firms as a share of domestic product of industry[2]
1995



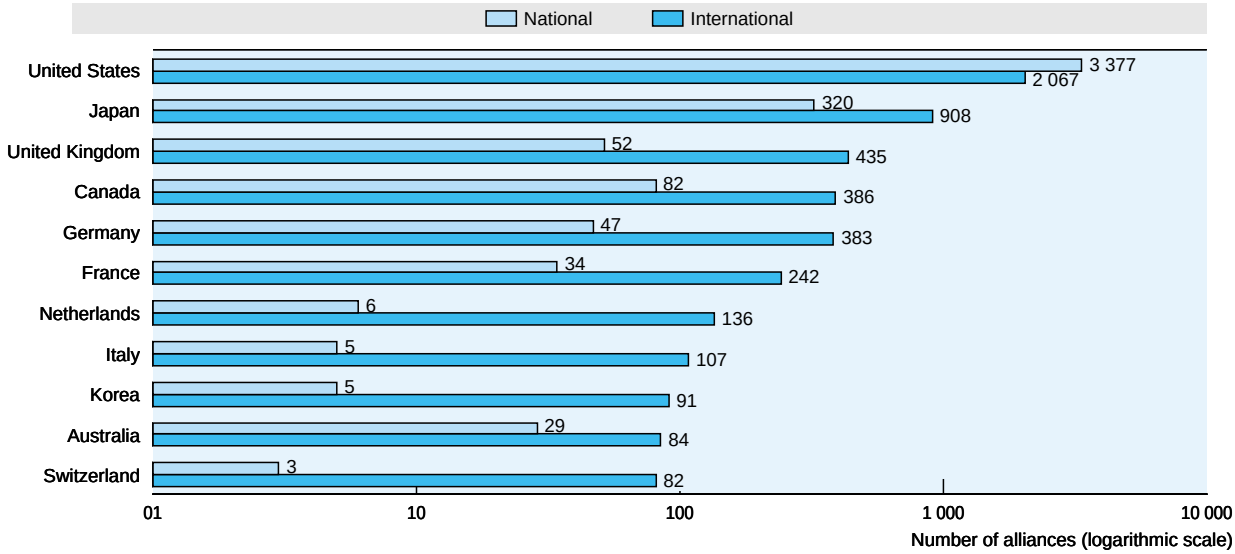
1. Turnover for the following countries: France, Germany, Japan, Sweden and United States.
2. Manufacturing industry rather than total industry for: Czech Republic, Italy, Poland and Turkey.

Source: OECD, Activity of Foreign Affiliates database, May 1999.

9.2. Technological alliances between firms

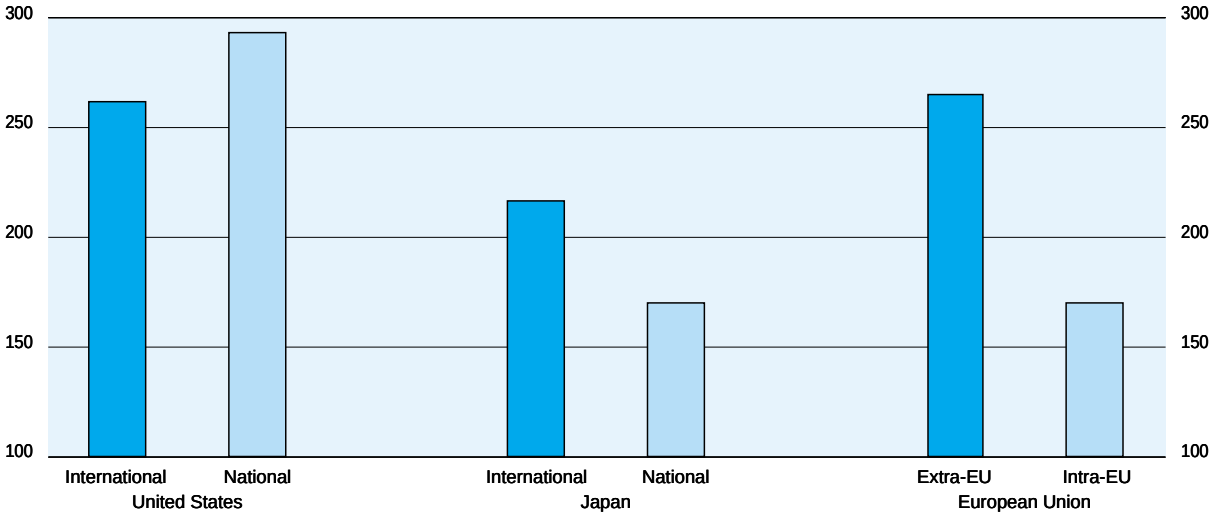
- Technological alliances between firms, and particularly between firms from different countries, enable each partner to reduce its research cost, to extend its range of products and its knowledge sources, and to access new markets.
- Alliances can take a variety of forms, ranging from simple partnerships (cross-licensing) to the establishment of common research subsidiaries.
- The number of national and international technological alliances between firms depends heavily on the size of the country and is by far more important in the United States, followed by Japan and the United Kingdom.
- The number of alliances with foreign firms is generally greater than alliances with firms from the same country. This is especially true for the small countries for which international trade plays an important role (see Section 7.1). The United States is the only country which has more domestic than international alliances.
- While the number of national and international alliances did not change significantly between 1988 and 1990, it rose rapidly during the period 1994-96 in the three zones (United States, European Union, Japan).
- In Japan as in the European Union, alliances with firms from other zones, especially the United States, increased more rapidly than intra-zone alliances. The situation is the opposite in the United States, where national alliances increased very rapidly during this period.

Number of national and international technological alliances between firms, 1992-95

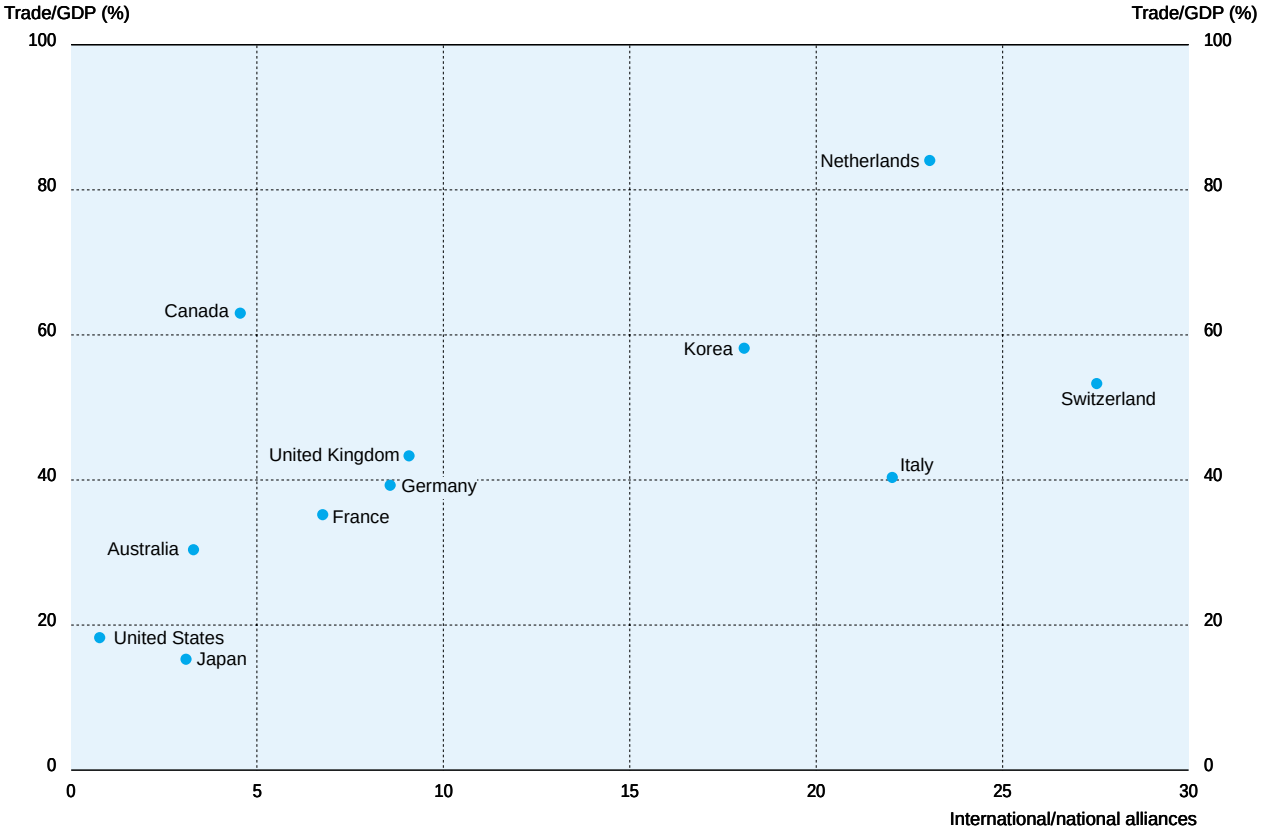


9.2. Technological alliances between firms

Change in the number of national and international technological alliances, 1994-96
1988-90 = 100



Ratio of international to national technological alliances and of trade to GDP, 1992-95



Source: IFR/SDC; European Commission; MERIT.

9.3. Cross-border ownership of inventions

- Cross-border ownership of patents reflects the inventive activity of foreign affiliates of multinational firms. On average, 8% of inventions made in any OECD country were owned by a foreign resident in the mid-1990s, against 6% in the mid-1980s. For almost all countries, both ownership of inventions made abroad and foreign control of domestic inventions have increased.
- Foreign ownership of domestic inventions is high in general in smaller countries such as Austria or Belgium, owing to the attractiveness of local research capacities. In catching-up countries such as Ireland, Hungary, Mexico or Turkey, local research relies heavily on international technology flows. Foreign ownership of domestic inventions is also high in Canada and the United Kingdom, where the larger share of invention is owned by residents of the United States.
- Ownership of inventions made abroad is high in small open countries such as the Netherlands and Switzerland. These two countries and the United States are the largest owners of patents covering foreign inventions; however, because of the size of the United States, the share of foreign inventions is just above the OECD average.
- Japan and Korea seem much less internationalised in this regard.

Cross-border ownership of inventions

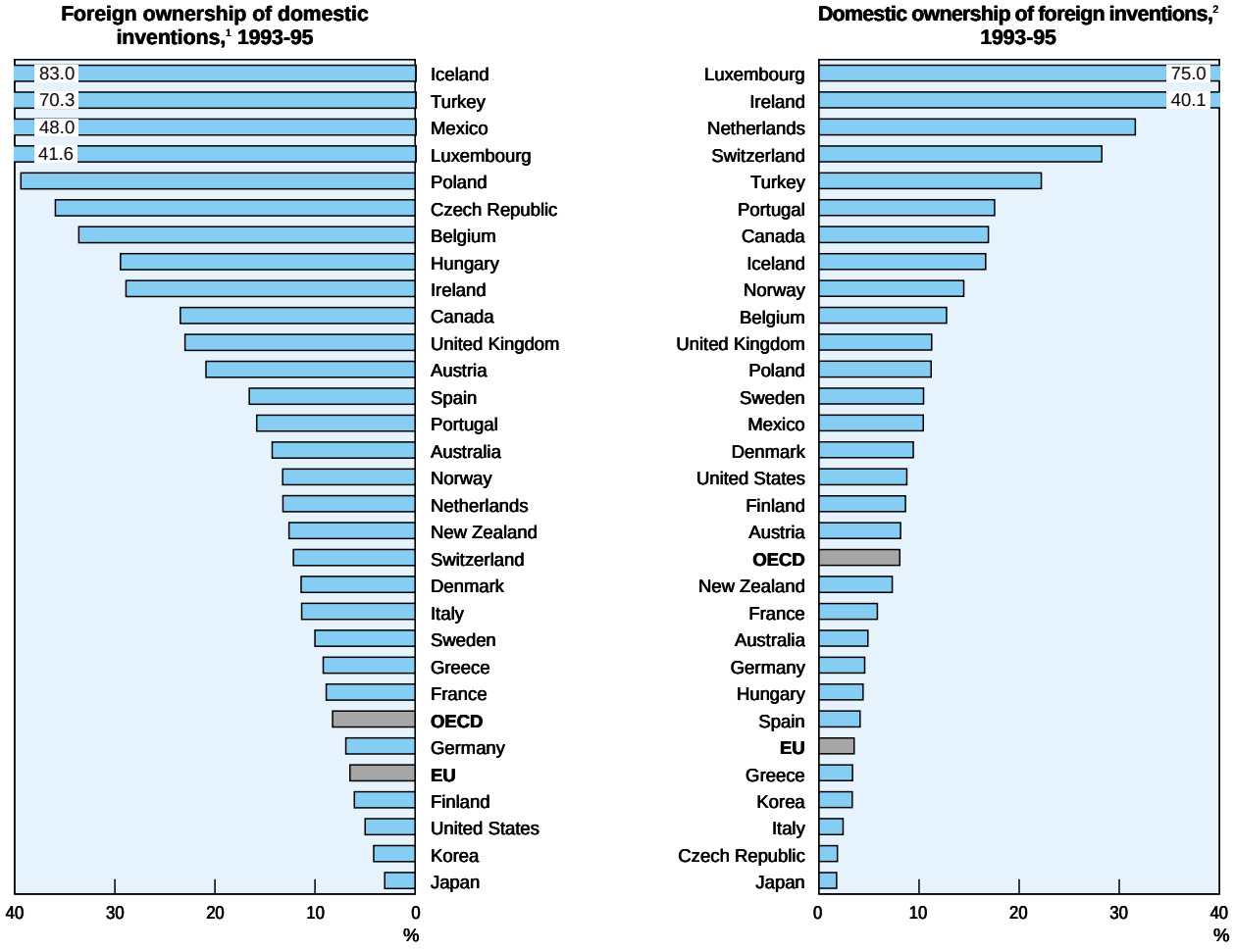
For most patents, the applicant is an institution (generally a firm, a university, a public laboratory), and sometimes an individual, whereas the inventor is always an individual.

An increasing share of European Patent Office (EPO) patent applications is controlled by applicants whose country of residence is different from the country of residence of the inventor (s). Such cross-border ownership practices are mainly the result of multinational activities; the applicant is a conglomerate and the inventors are employees of a foreign subsidiary. It is therefore possible to trace the international circulation of knowledge from "inventor" countries to "applicant" countries. Such information can be used to compute two main types of indicators:

- The first consists in evaluating the extent to which foreign firms control domestic inventions, by dividing the number of domestic inventions controlled by a foreign resident by the total number of domestic inventions.
- The second indicator provides a mirror image: the extent to which domestic firms control non-resident inventions by dividing the number of foreign inventions controlled by resident applicants by the total number of domestic applications.

For more details, see Annex, Table 9.3.1.

9.3. Cross-border ownership of inventions



1. Share of patent applications to the European Patent Office owned by foreign residents in total patents invented domestically.
2. Share of patent applications to the European Patent Office invented abroad in total patents owned by country residents.

Source: OECD, based on data from the European Patent Office.

9.4. International co-operation in science and technology

- Cross-border co-authorship of scientific articles and co-invention of patents provide an indication of the level of internationalisation of scientific and technological activities.
- Internationalisation tends to be higher in smaller countries as each researcher has fewer colleagues in the field and must therefore look abroad for collaboration.
- International co-operation in research is increasing in both scientific research (26% of publications are the work of multinational teams) and technological research (9% of patents are the result of international co-operative research).
- Science is thus more internationalised than technology, except in Mexico, Poland and Turkey. Taking this effect into account, it seems that large European countries, with the exception of the United Kingdom, are more internationalised than other countries in scientific research than in technology.
- The United States and the European Union (factoring out co-operation between member countries) have a similar propensity to co-operate with foreign researchers, while that of Japan is significantly less.

International collaboration in science and technology

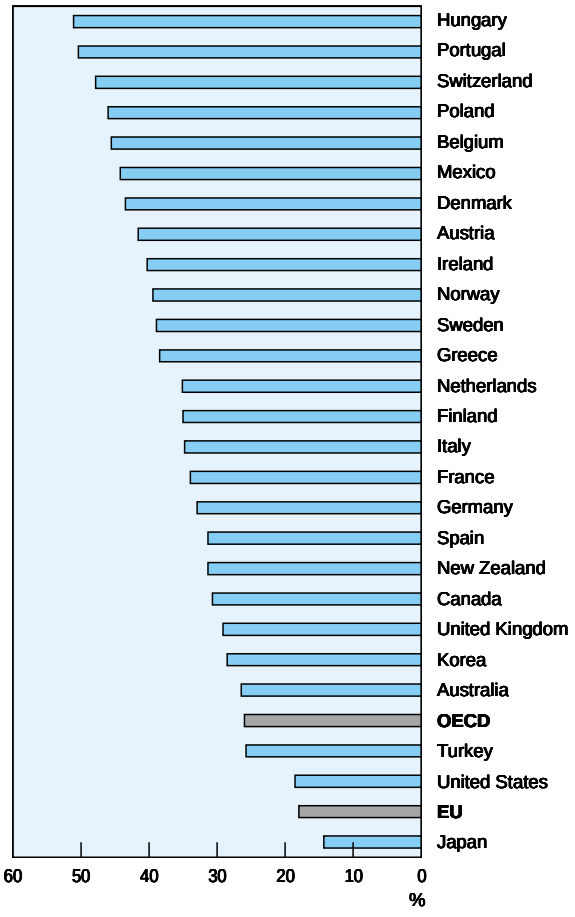
Patent data include the name and address of all inventors (individuals). An increasing share of European Patent Office (EPO) patent applications is invented by inventors with different countries of residence. This kind of international collaboration between researchers can take place either within a multinational corporation (research facilities in several countries), or through a research joint venture between several firms.

The propensity to collaborate internationally can be measured from the address of the inventors listed in the patent file. Here, it is approximated as the ratio of the number of inventions involving a country's residents and at least one inventor with foreign residence to the total number of inventions involving a country's resident. An increasing share of patents involves inventors with residence in more than two countries.

For more details, see Annex, Table 9.4.1.

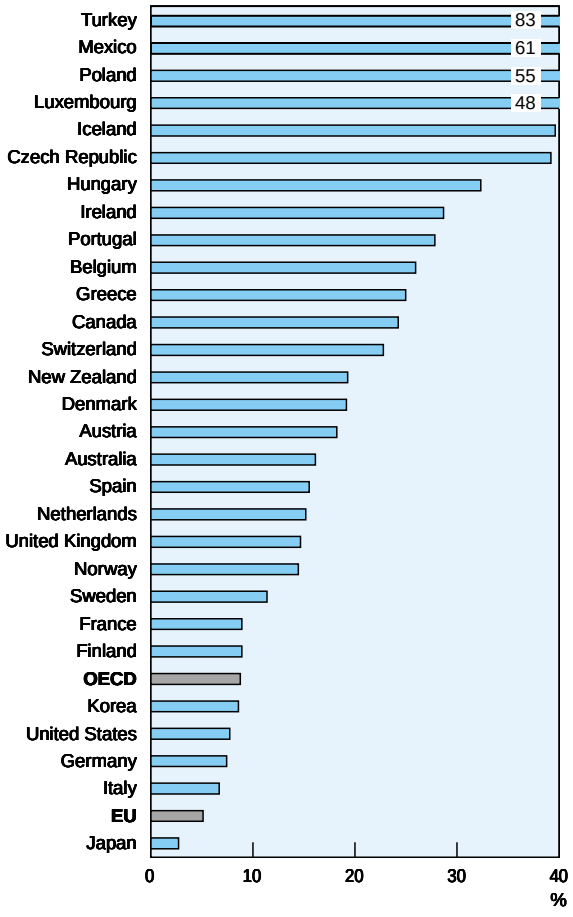
9.4. International co-operation in science and technology

Percentage of scientific publications with a foreign co-author, 1995



Source: OECD, based on data from National Science Foundation and Science Citation Index.

Percentage of patents with foreign co-inventors, 1993-95



Source: OECD, based on data from the European Patent Office.

10.1. Productivity and income levels

- Labour productivity is the ratio of output per unit of labour input, measured as GDP per employed person. It reflects the efficiency with which labour is used in an economy. Several factors influence labour productivity, including the degree of capital intensity and the rate of technical change.
- Economy-wide levels of labour productivity bear a direct relation to a widely used measure of the standard of living, per capita GDP. How closely the two measures match is determined by the share of the population of working age in the total population, by the extent to which the working age population seeks employment and by the rate at which it finds employment. A strong positive relation is expected and visible: those countries with the highest labour productivity level also tend to be the ones with the highest standard of living.
- Nonetheless, differences remain. Among the larger countries, the standard of living is highest in the United States – more than 30% above the OECD average – whereas the other G7 countries are very close to average. The picture changes as one moves from per capita income to GDP per person employed. Because of comparatively high unemployment rates and lower rates of labour participation, European countries tend to move up in the ranking in terms of labour productivity. For example, the United States has a significantly higher per capita GDP than Belgium. However, because Belgium's labour force participation as a share of the active population is lower, their rankings are reversed when GDP is measured in relation to employment.
- The same explanation holds for the differences between the medium-term trends of European per capita GDP and productivity and those of the United States. Whereas European countries' economy-wide labour productivity levels have constantly converged towards those of the United States, this process is much less visible in terms of per capita GDP.
- Nonetheless, there have been individual cases of rapid convergence, among them Ireland, whose output per employed person was around 65% of the U.S. labour productivity in 1985 and rose to 90% in 1997. Portugal and Korea are other examples of a recent catch-up process.

Productivity level comparisons

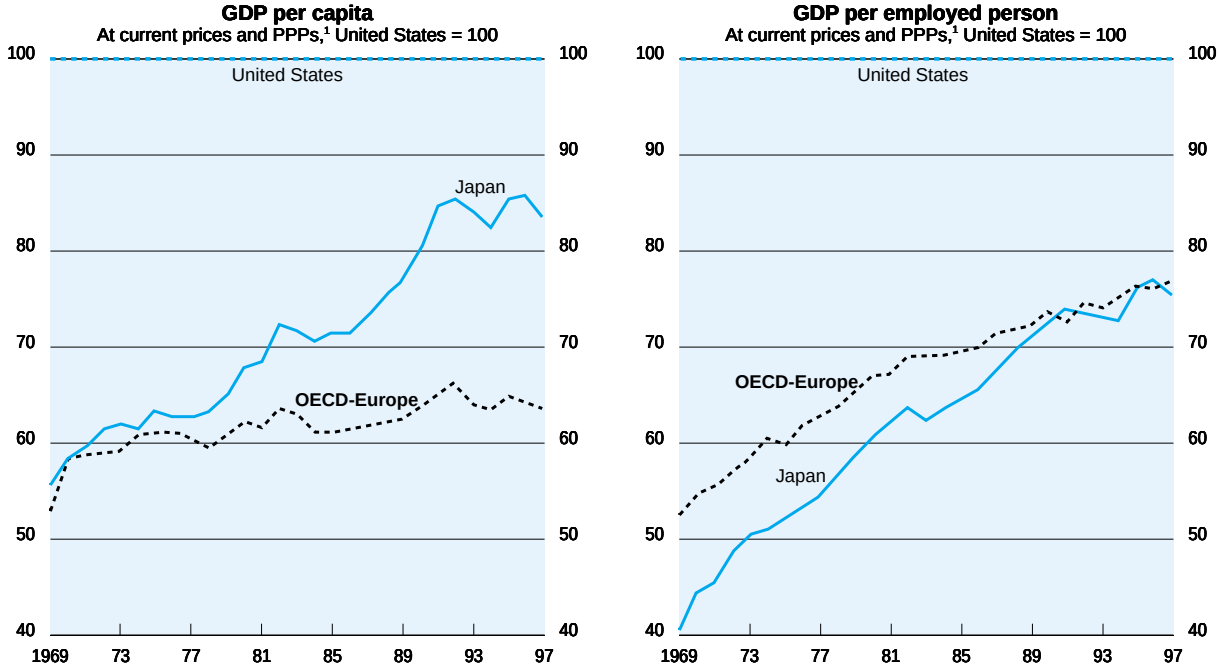
Productivity ratios relate a measure of output to one or several inputs to production. The most common productivity measure is labour productivity, which links output to labour input. The importance of productivity arises from its link to standards of living – in the longer run, economic growth, income and wealth per capita are driven by productivity growth, which represents rising efficiency in the use of available resources.

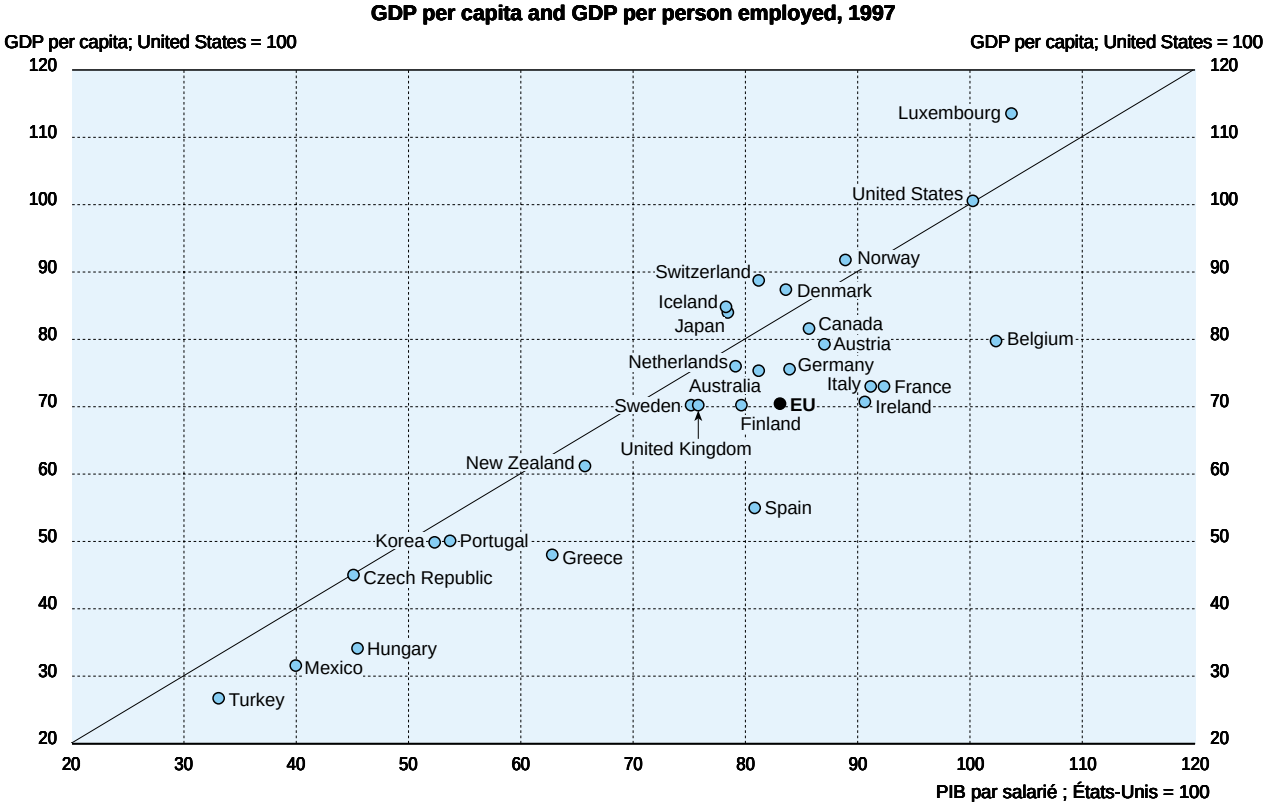
Labour productivity measures as presented here are partial productivity measures – they relate output to only one, albeit important, input in the production process. More complete measures of efficiency of input use relate output to a combined measure of inputs, including labour, capital, and services and material inputs. However, the measurement and weighting of the different inputs remains a major statistical challenge. It should also be noted that productivity levels are measured as output per employed person; a preferred measure of labour input would be the total number of hours worked, which would reflect the differences in average hours worked and in the extent of part-time employment across countries.

In addition, the comparison of countries' productivity levels requires price ratios to convert output expressed in a national currency into a common unit. Exchange rates are of limited use for this purpose because they are volatile and reflect many influences, including capital movements and trade flows. The alternative, adopted in the present indicators, is to use purchasing power parities (PPPs), which measure the relative prices of the same basket of consumption goods in different countries. These are still imperfect measures for comparing productivity levels, as they reflect structures of private consumption rather than structures of domestic output.

For more details, see Annex, Table 10.1.1.

10.1. Productivity and income levels





1. Purchasing power parities.

Source: OECD, National Accounts, Labour Force Statistics, ISDB and STAN databases, March 1999; Projection demographic data, United Nations, 1996.

10.2. Productivity growth

- Over the 1980s and 1990s, output per employed person rose more rapidly in European countries than in the United States. At similar rates of output growth over the same period, this mirrors the more rapid expansion of business sector employment in the United States. Japan's labour productivity growth outpaced that of many other countries, combining an exceptional expansion of output with a steady rise in employment levels. A levelling off of Japan's productivity growth in more recent years is largely attributable to the downturn in the Japanese economy.
- A comparison of the United States and the four large European economies shows that productivy growth patterns are more similar for manufacturing than for the overall business sector. This is in line with the observation that there has been less difference in the rate of labour shedding in manufacturing than in the rate of employment creation in the service industries.
- Trends in labour productivity tend to change when the number of hours worked instead of the number of employed persons is used as a measure of labour input. In most European countries, average hours worked per person declined over the past decades. For example, German manufacturing labour productivity increased at 1.5% annually between 1979 and 1997 when based on persons employed but at a rate of 2.4% when labour input is measured in terms of hours worked.
- Productivity growth rates are highly cyclical. Cyclicality arises because in downturns labour is laid off more gradually than the slowing of production while in upswings hiring lags. As a result, output movements precede and are more pronounced than employment movements.

The measurement of productivity

Labour productivity measures the ratio between output and labour input in production. The rate of change of labour productivity is designed to reflect movements in productive efficiency or shifts in the production function. Although a more comprehensive coverage of inputs, including capital services and materials, would be preferable, measurement problems often limit the possibility to do so and labour productivity is often the only readily available indicator.

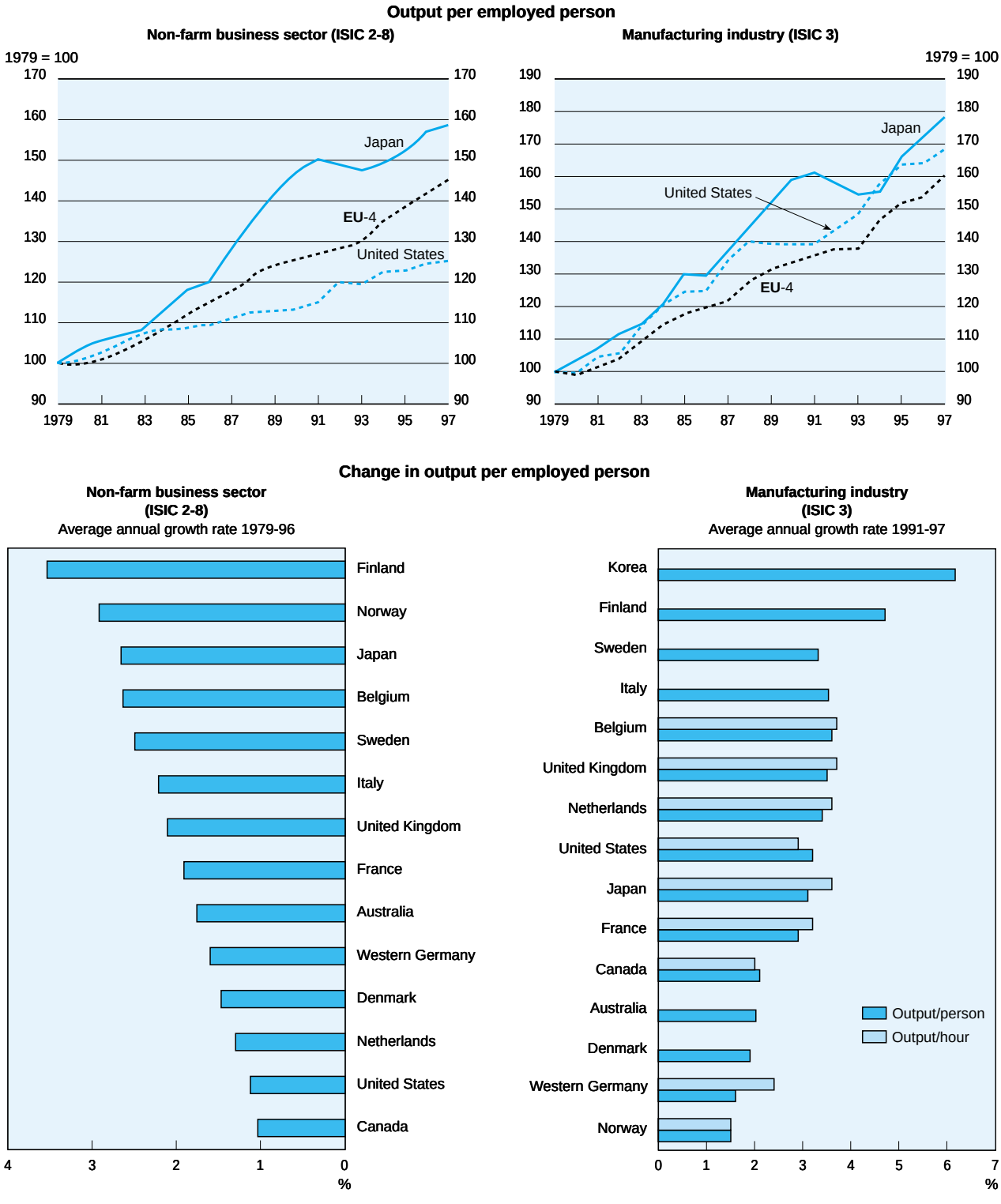
Gross output vs. value added. The choice between gross output and value added as measures of output is mainly governed by data availability. For total factor productivity (TFP) measures, whose objective is to mirror the efficiency of production processes, the preferred concept is gross output in conjunction with measures of primary and intermediate inputs. Where information on intermediate inputs is missing or in the case of simple labour productivity computations, value added may be preferable as it avoids biases due to changes in the structure of the production process. For example, a rise in the share of intermediate inputs (through contracting out of certain activities) leads to a decline in employment but leaves gross output unchanged. This would result in a misleading indication of a rise of labour productivity.

Method of deflation. Derivation of volume measures for output and for intermediate inputs is one of the most difficult aspects of productivity measurement. Price series used to deflate current-price measures of output often fail to reflect adequately rapid quality changes, such as those associated with information technology products. Large differences exist between quality-adjusted and traditional price series for these industries. This can significantly change measured productivity changes. Deflation of value added also relies on the existence of deflators for gross output and intermediate inputs, data that are often unavailable.

Labour input measures. For reasons of data availability, the number of employed persons is frequently chosen as a proxy for labour input. Although employee data have fewer methodological problems, data on hours worked are preferable for purposes of productivity measurement. Also, restricting labour input to employees leaves out self-employed and unpaid family members. Finally, basic measures of labour input do not differentiate between different types of quality of labour and the composition of the workforce. A more satisfactory measure would attach qualification and ability weights to different types of labour to derive an aggregate index of overall labour input.

For further discussion, see OECD (1996), *Industry Productivity: International Comparison and Measurement Issues*; or United States Bureau of Labor Statistics (1996), *A BLS Reader in Productivity*.

10.2. Productivity growth



Source: OECD.

Source: OECD and US Bureau of Labor Statistics.

10.3. Unit labour costs

- Movements in relative unit labour costs are one indicator for tracking developments in cost and price competitiveness on export markets for different countries and industries. A rise in the index of relative unit labour costs marks a decrease in cost competitiveness and *vice versa*.
- At the level of total manufacturing, unit labour costs have risen fastest between 1990 and 1996 in Japan, Greece and Portugal, and slowest in Finland, Canada and Italy.
- Because the indicator is expressed in a common currency, it reflects both movements in national unit labour costs and exchange rate fluctuations. Japan is a case in point. On a national currency basis, its relative unit labour costs show only a moderate rise since 1990 but Japan's trade-weighted nominal exchange rate appreciated sharply (by more than 60%) and led to a decline in Japan's cost competitiveness.
- Greece and Portugal reflect different developments for the period 1990-96: Greece's cost competitiveness worsened despite a depreciation of the nominal effective exchange rate of 24%, pointing to a much stronger increase in relative unit labour costs expressed in national currency. Portugal's effective exchange rate appreciated slightly, by about 6%, implying that relative unit labour costs expressed in national currency account for most of the deterioration in international cost competitiveness.
- Developments at the level of total manufacturing hide significant variation at industry level. For example, over the period 1990-96, western Germany's relative unit labour costs for manufacturing as a whole increased by nearly 20%, but they remained constant in the basic metal industry and increased by almost 30% in fabricated metal production.

Relative trade-weighted unit labour costs

Measures of international competitiveness play an important role in industry indicators. Often, a distinction is made between price and non-price competitiveness: the first represents a firm's or industry's capacity to succeed in terms of price or cost competition (for a given product quality) while non-price competitiveness encompasses all other factors that may account for success, such as product quality, diversity or novelty. The unit labour cost indicator is designed to capture the price competitiveness aspect. The underlying assumptions are that movements in costs approximate movements in prices and that changes in labour costs are representative of changes in total costs.

Unit labour costs are defined as the ratio of total labour costs (expressed in US dollars and converted with current exchange rates) to a measure of volume output (value added expressed in US dollars, at base-year purchasing power parities).

By definition, any measure of cost competitiveness is a relative one, relating one country's costs or prices in a particular industry to those of its competitors. Because the composition of competitors varies between industries and markets, each competitor is given a different weight depending on the country, industry and geographical market under consideration. For the indicator presented here, two points are worth noting:

– The series measure relative developments in unit labour costs on a country's *export* markets, taking only into account *foreign* supply on a country's export market. Hence, the weight and development of domestic suppliers in each market are ignored. Other, more comprehensive, measures exist but are much more demanding in terms of data requirements at industry level. However, a comparison of the different methods* shows that the results are similar except for countries whose export market structure is highly concentrated in large markets where domestic suppliers are important.

– The series is expressed in a common currency – alternatively, movements of relative unit labour costs can be expressed in national currencies. The first measure is often preferred because it reflects exchange rate fluctuations, which have a direct impact on the cost competitiveness on export markets. The second measure is independent of exchange rate movements and tracks changes in wage rates and productivity at the national level more closely than the first measure.

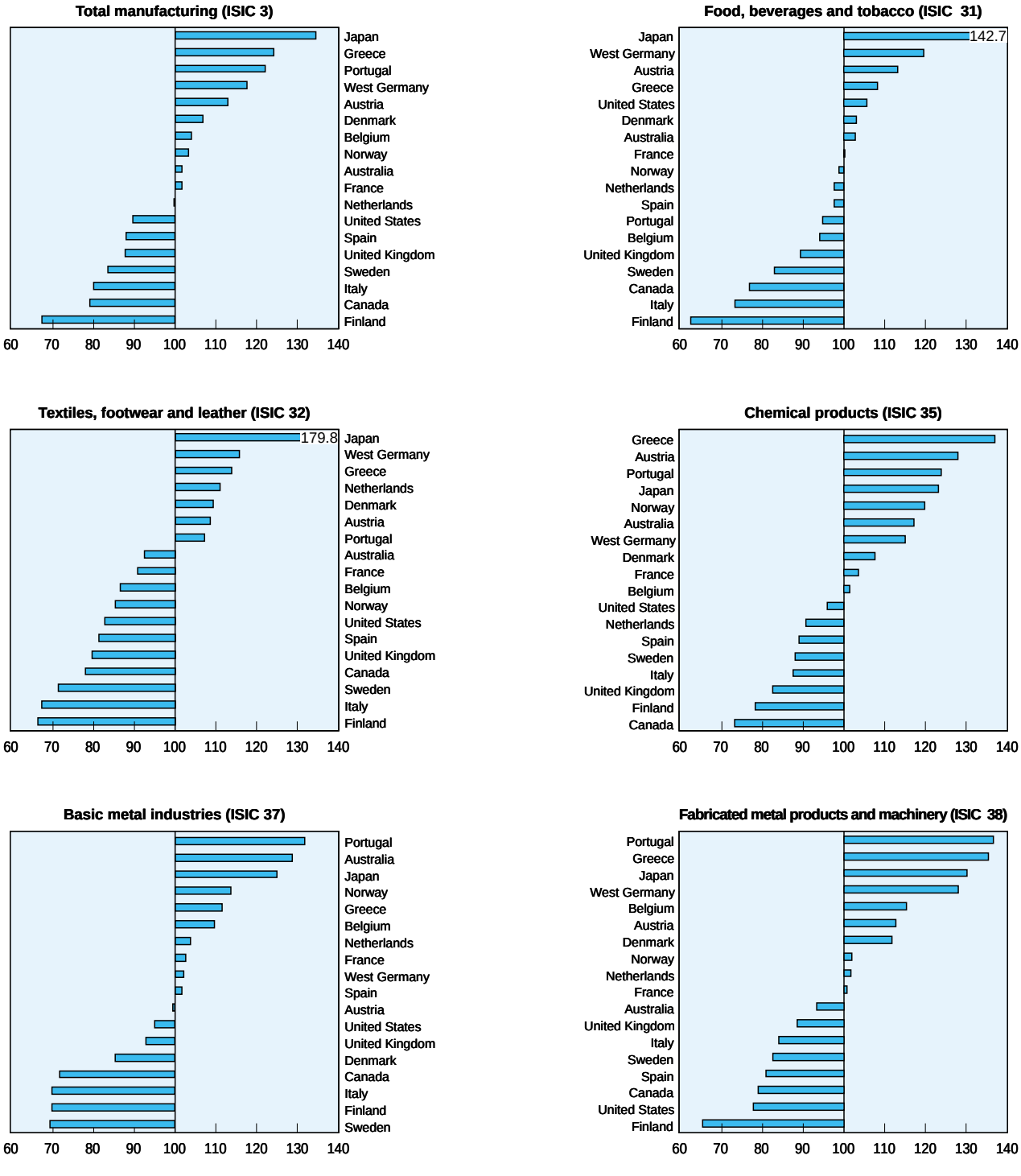
* K. Lepron and P. Schreyer (1998), "Relative Trade-weighted Unit Labour Costs by Industry", STI Working Paper 1998/1, OECD, Paris.

For more details, see Annex, Table 10.3.1.

10.3. Unit labour costs

Relative trade-weighted unit labour costs by industry, 1996

1990 = 100, US dollar basis



Source: OECD, STAN and Bilateral Trade databases, May 1999.

11.1. Scientific publications

- Publications are the major output of scientific research. With the increase in scientific activity and the strong incentive for researchers to publish (publications are used to evaluate researchers in many countries), the number of journals and of articles has long been growing steadily (more than 4% a year from 1990 to 1995 OECD-wide).
- Scientific publication counts relative to population size are higher for Switzerland, Nordic countries and English-speaking countries.
- In terms of absolute numbers, the United States ranks first (although, as a zone, the European Union has more), followed by the United Kingdom and Japan.
- A catching-up process is clearly at work in the 1990s: the seven countries with the highest growth rate are among the ten lowest performers in scientific publications per inhabitant.

Scientific publications

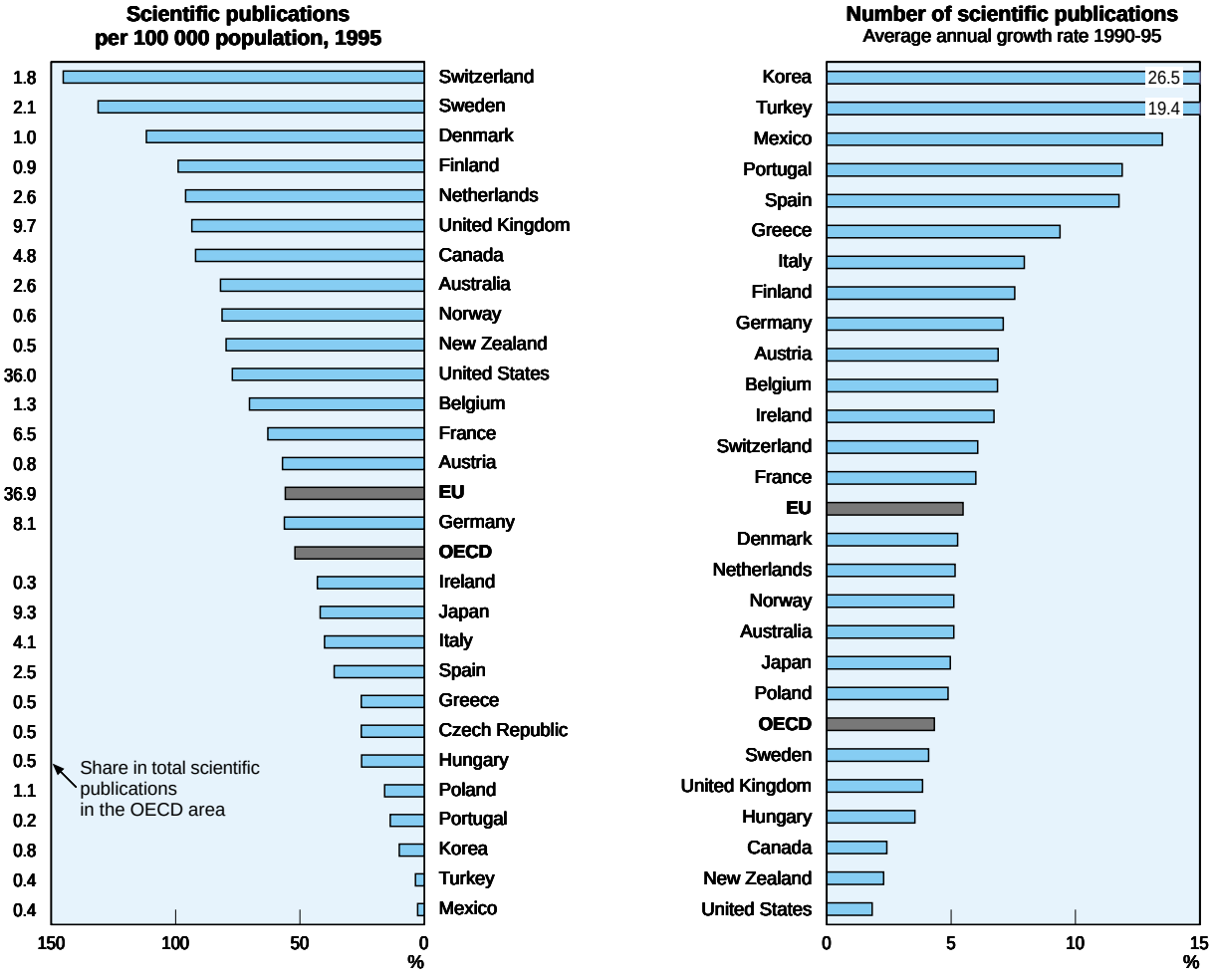
The output of scientific research is varied: it includes improvement of skills (especially for doctorates and post-doctorates), new scientific instruments and intermediate products, new methods, prototypes and publications. The last is the major output in that it partly captures the others and, in addition, contains the abstract knowledge which is the essential form of most discoveries (*e.g.* formula, proof of scientific facts).

Scientometrics, the domain of science which is concerned with measuring scientific output, emphasises various types of counts of scientific publications. Publications counts are affected by various types of statistical difficulties.

- The propensity to publish differs across countries and across scientific fields, biasing the relationship between actual output and publication-based indicators.
- Most journals are published in English. This tends to favour researchers from English-speaking countries (although this bias seems to be decreasing as researchers in most countries are becoming able to communicate in English).
- As publishing is increasingly used as an instrument for evaluating researchers in university and government laboratories, it seems that quantity of papers is often favoured at the expense of quality.
- Publications can also be weighted by citations, the aim of which is to correct for quality. However, at aggregate level (*e.g.* country level), citation-weighted counts do not give a very different result from simple counts.

For more details, see Annex, Table 11.1.1.

11.1. Scientific publications



Source: OECD, based on data from the European Commission (*Second European Report on S&T Indicators*, 1997) and Science Citation Index.

11.2. Patents

- Patent-based statistics are the most widely used indicators of the output of inventive activity. The figures are for patent applications (which may or may not be granted) to the European Patent Office (EPO), and relate to the inventor's country of residence and to the "priority date", which is generally considered as being close to the date of the invention.
- The United States, Germany and Japan are by far the biggest patenting countries. However, the share of European countries (close to 50%) probably overestimates their actual share in inventions by OECD countries since the EPO covers their domestic market.
- Growth rates are not affected by this bias. Smaller countries, especially Korea, New Zealand and the Nordic countries, have experienced high growth in patenting in the 1990s. The share of Japan, which increased rapidly over the 1980s, has shrunk in the 1990s. Most technology fields were concerned by this reduction. The share of European countries in chemicals and motor vehicles increased.

Patents as indicator of technology performance

Patent-based statistics are the most widely used indicators of the output of inventive activity because: patents have a close link to invention (very few major inventions are not patented); patent data are readily available; and they contain much information (applicant, inventor, technology category, claims, etc.).

Patent indicators have some weaknesses, however. Many inventions are not patented, and the propensity to patent differs across countries and industries. Non-patented inventions are either small ones, or inventions that are protected by other means (secrecy, lead time on the market, reputation). Another drawback is related to differences in patent regulations across countries, which make it useless to compare patent counts in different countries. Changes in patent law may also affect patents' time series. Finally, the value distribution of patents is skewed: many patents have no industrial application, whereas a few have huge value.

It is important to rely on a method for counting patents that minimises statistical biases while conveying a maximum amount of information. In particular, four methodological choices have to be made.

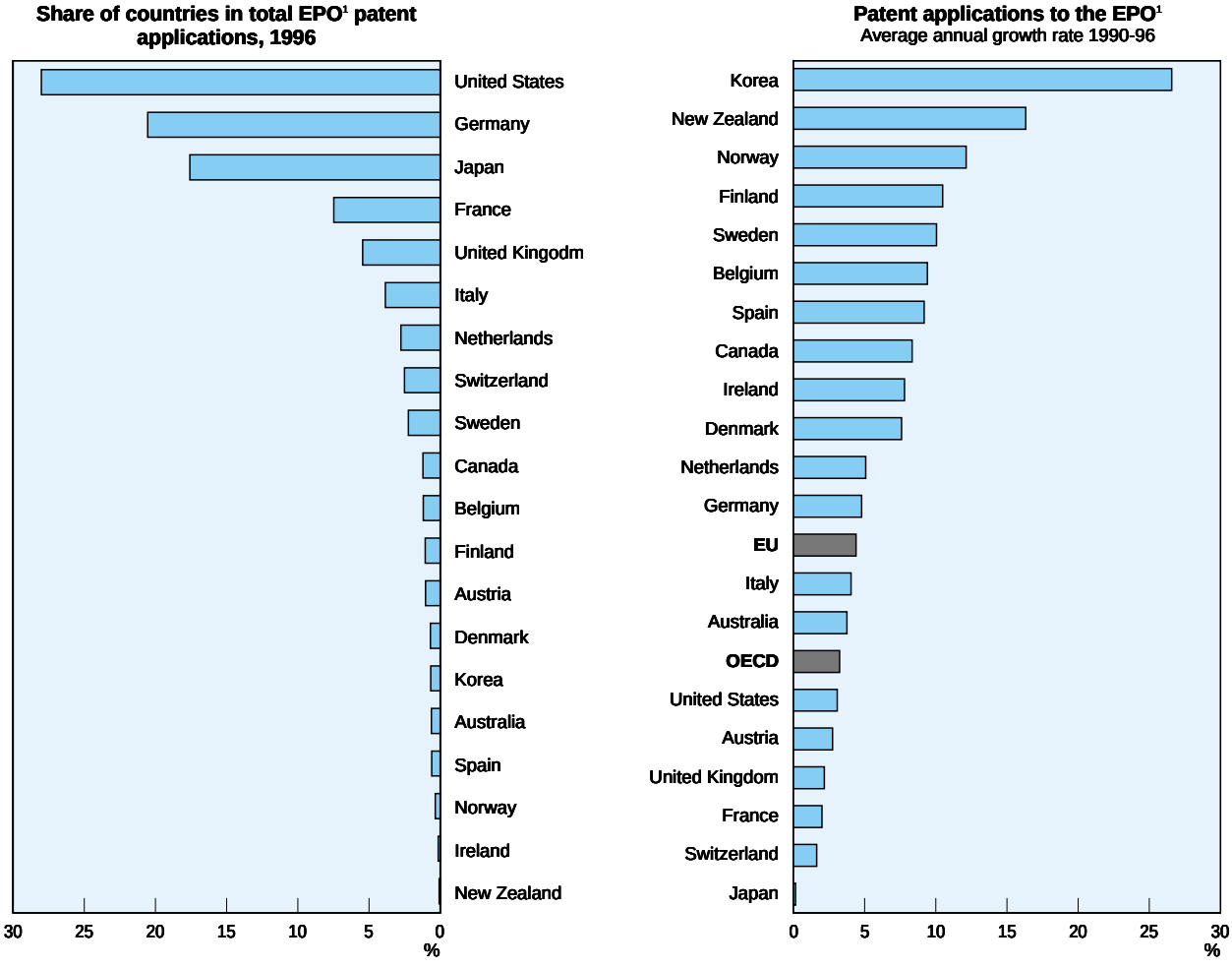
Geographical distribution of patents. Three main criteria can be used for this procedure: *i)* counts by priority office (country where the first application worldwide is filed, before protection is extended to other countries) reflect "technological strength"; *iii*) counts by the applicant's country of residence (the owner of the patent at the time of application) reflect the control of the invention. The method most widely used is counting patents by the inventor's country of residence.

- *Patents with multiple inventors from different countries*. Such patents can be either only partly attributed to each country mentioned (fractional count), or attributed fully to every relevant country, thus generating multiple counting. It is wiser to use fractional counting procedures.
- *Reference date*. The choice of one date, among the set of dates included in patent documents, is also important. The priority date (first filing worldwide) is the earliest one, and therefore closest to the invention date. Counts by application date introduce a bias due to a one-year lag between residents and foreigners: the latter usually first file a patent application at their domestic office (the priority office), and in other countries after the priority year. This lag increases to 2.5 years for *Patent Co-operation Treaty* (PCT) applications. The lag between priority and grant is on average five years in the European Patent Office (EPO) and three years in the United States Patent and Trademark Office (USPTO). To measure inventive activity, patent time series should be computed with respect to the priority date.
- *The increasing use of the Patent Co-operation Treaty procedure*. PCT procedures are options for future filing, which can eventually be exercised (transferred to regional or national offices such as the EPO or USPTO) and then become actual patent applications. Many options are not exercised (on average 40%) and never become actual applications. It is inappropriate to mix PCT applications with other types of applications in counting. Since there is a lag of about three years between priority and publication of transfer, the issue is that patent statistics would be already out of date when published. In order to have recent patents counts, one must estimate ("nowcast") transfers before they are actually performed.

For further information, see OECD (1994), "Using Patent Data as Science and Technology Indicators", *Patent Manual*, OCDE/GD(94)114, Paris.

For more details, see Annex, Table 11.2.1.

11.2. Patents



1. European Patent Office.

Note: The patent data presented here are European Patent Office (EPO) applications, by the inventor's country of residence and priority date, using a fractional counting procedure. The latest figures include estimates of EPO applications originating from PCT options. Countries with less than 100 applications for 1995 plus 1996 are not shown in the graphs.

Source: OECD.

11.3. Innovation in information and communication technology

- Innovation is particularly important for information and communication technologies (ICT).
- The definition of ICT comprises three technology classes: 1. Computing, calculating, counting; 2. Basic electronic circuitry; 3. Electric communication techniques.
- This is an area where patenting is increasing rapidly (18.6% a year, vs. 7% for all patents), owing to the wealth of technological opportunities.
- In 1998, almost one patent in five granted by the United States Patent and Trademark Office (UPSTO) is ICT-related, against one in ten in early 1992. Patents granted in 1998 concern inventions mostly made between 1994 and 1996.
- The share of ICT in patents is particularly high in Finland (almost 30%), followed by Ireland (with many affiliates of multinational firms), Korea, Japan and the United States
- However, when looking at the share of countries in ICT patents granted, the United States ranks first (60%).
- Most larger European countries are relatively weak in this field, and the gap seems to have widened over the last years.

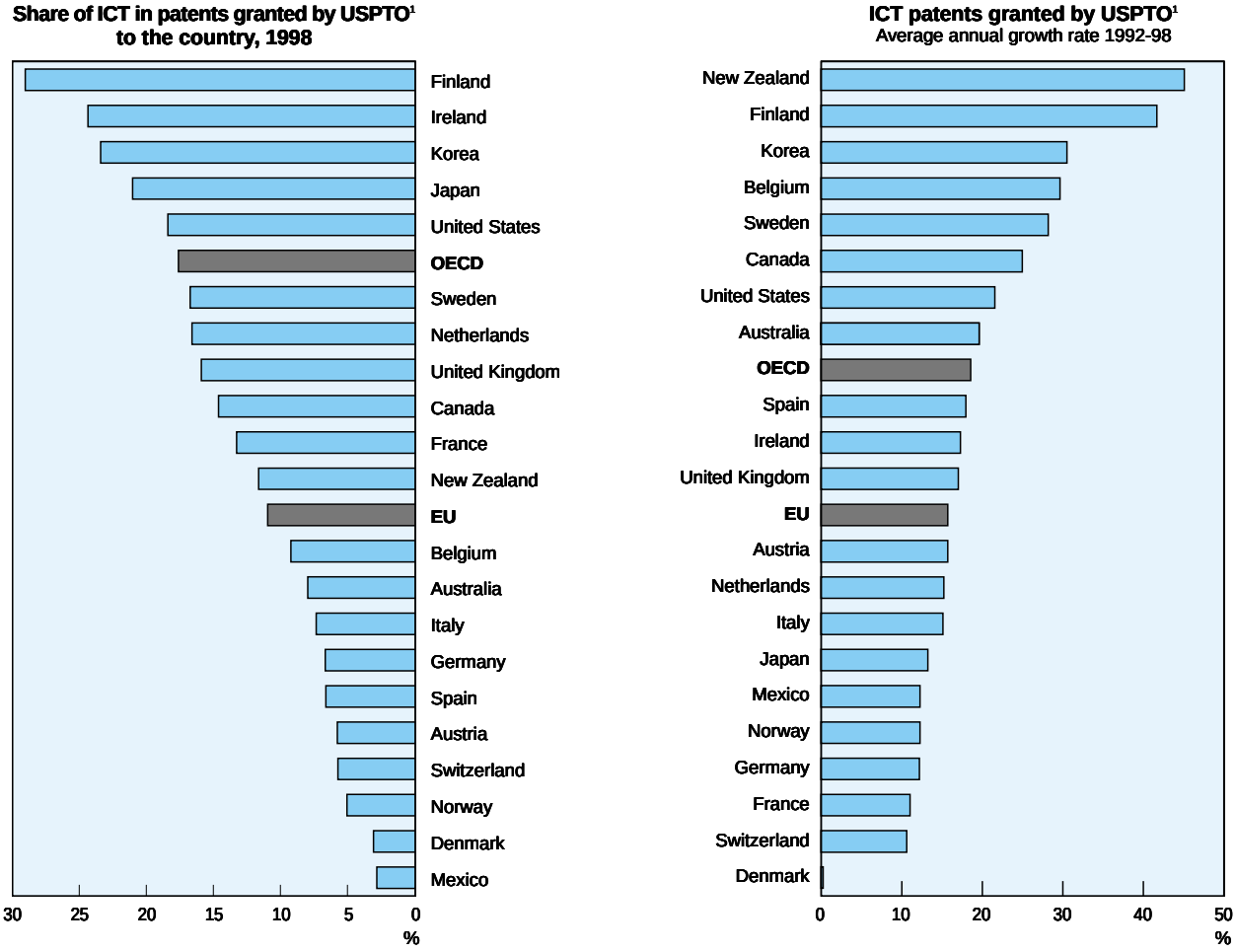
Innovation in ICT

Patents counts are one measure of inventive activity (see Section 11.2). All types of inventions are not patentable in all countries. In particular, software is still subject, in many countries, to copyright laws. It is not the case in the United States, which allows counting USPTO (United States Patent and Trademark Office) patents when measuring innovation in ICT.

USPTO data report only patents granted (not applications). The statistics here refer to the year of grant with a lag of one to five years from the year of invention.

For more details, see Annex, Table 11.3.1.

11.3. Innovation in information and communication technology



1. United States Patent and Trademark Office.
Source: OECD.

11.4. Innovative output

- The share of firms that have introduced at least one new or improved product or process on the market over a given period of time is an indicator of the output of innovative activities. It is weighted here by numbers of employees.
- Data are obtained from innovation surveys, which have not, however, been carried out in all OECD Member countries. As such surveys are new, data may be only broadly comparable across countries. In particular, the coverage of services is partial in some countries.
- In most countries, innovative firms (weighted by size) represent between 60% and 80% of firms.
- On average, the share is similar in manufacturing and in services, with the major exception of Nordic countries where manufacturing firms are more innovative.
- In general, the share of innovators is much higher among large firms than among small ones. However, in Switzerland and Ireland, and to a lesser extent in Austria, small firms seem almost as innovative as large firms.

Results of innovation activities

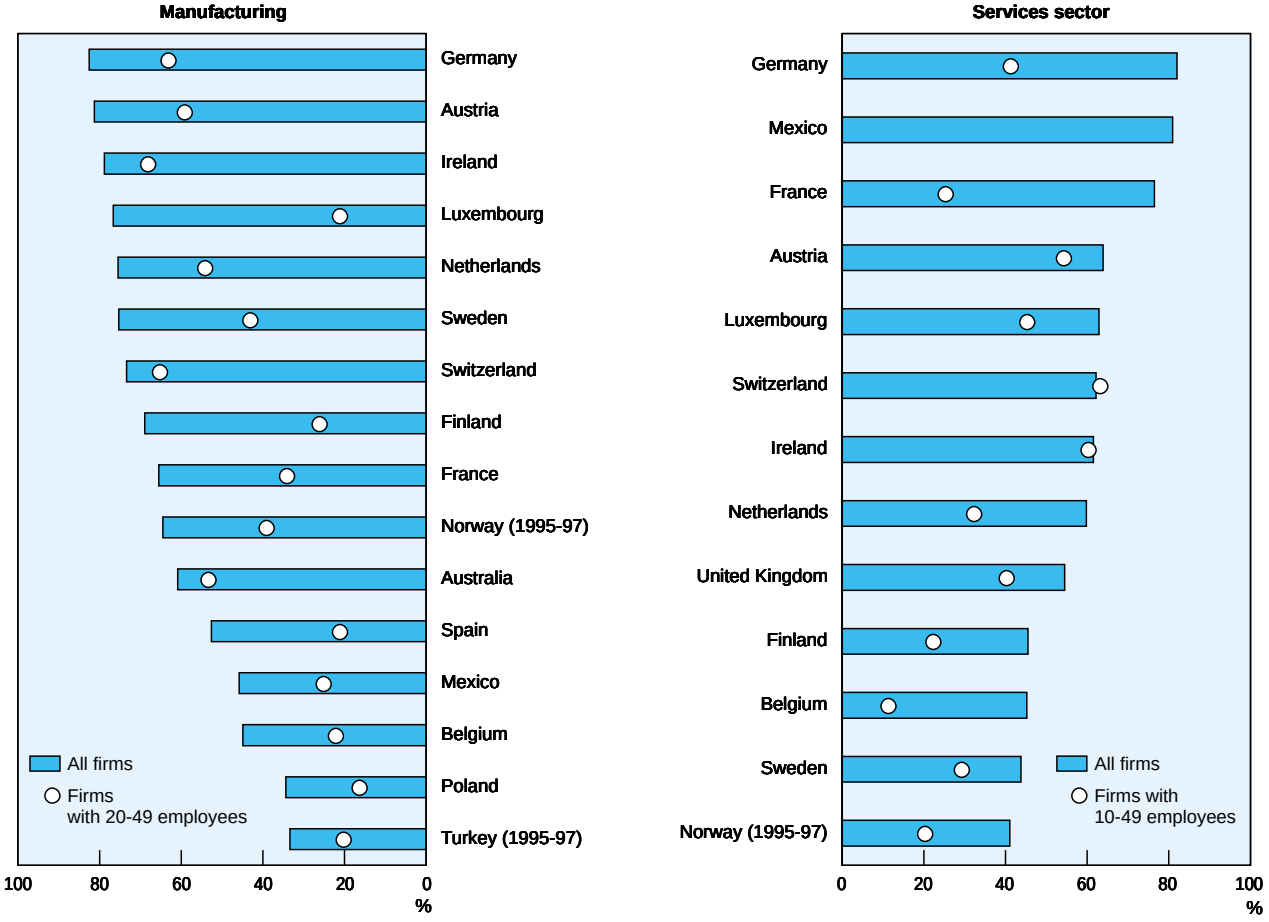
Most of the innovation surveys (see Section 5.5 for general information on national innovation surveys) are not exhaustive. They use a sample of firms and obtaining a sufficient number of replies is one of the difficulties with this type of survey. Another is that the sample is not sufficiently representative. There may not be enough firms in each size category, and differences in response rates in terms of firm size and individual countries' surveys may skew the results. For instance, it is known that firms that innovate are much more inclined to supply answers than those that do not, which means that national surveys with a low response rate show a larger proportion of innovative firms. (The negative cross-country correlation between the proportion of innovative firms and the response rate tends to confirm such a bias.) It has also been noted that small firms have more difficulty in responding to surveys, which is liable to make their results less representative.

The number of firms having introduced at least one technologically new or improved product or process has been weighted by the number of employees, so as not to underestimate the weight of large firms. The latter would otherwise have been swamped by the mass of small firms, and the global results might have been heavily skewed by the response rates or bunching of firms.

For more details, see Annex, Table 11.4.1.

11.4. Innovative output

Share of firms that introduced new or technologically improved products or processes on the market
1994-96



Source: OECD, mainly based on data from Eurostat.

11.5. Technology balance of payments

- The technology balance of payments measures international transfers of technology: licences, patents, know-how and research, technical assistance. Unlike R&D expenditure, these are payments for production-ready technologies.
- The vast majority of these transactions correspond to operations between parent companies and affiliates.
- In the context of globalisation, these transfers of disembodied technology, together with transfers of technology embodied in products (trade) and in persons (migration), have greatly increased during the 1990s for most OECD countries.
- In three countries – Ireland, the Netherlands and Belgium – the average of technology payments and receipts exceeds 1.5% of GDP. By contrast, the ratio of trade in disembodied technology to GDP is very low in Iceland, New Zealand, Australia and Mexico.
- Although the technology balance of payments reflects a country's ability to sell its technology abroad and its use of foreign technologies, a deficit position does not necessarily indicate low competitiveness.
- Overall, the OECD area has a surplus of more than 20 billion US dollars with the rest of the world. The United States is still the main net exporter of disembodied technology in the OECD area. Since 1993, Japan has become a net exporter, while the European Union is a net importer overall.
- Only three EU countries are net exporters of technology: Sweden, the Netherlands and Belgium (the United Kingdom has had a deficit only in the most recent period). In Sweden, the surplus represents a relatively small volume of payments and receipts, probably because only firms engaged in R&D are surveyed. Belgium and the Netherlands are close to equilibrium for very large amounts, on approximately the same scale as expenditure on industrial R&D.
- The magnitude of Ireland's technology payments is probably due to the strong presence of foreign affiliates, which import technology extensively from their countries of origin (North America essentially).
- Switzerland is the only non-EU European country which is a net exporter of technology. Its many multinational corporations transfer technology extensively to their affiliates in many foreign countries.

Technology balance of payment

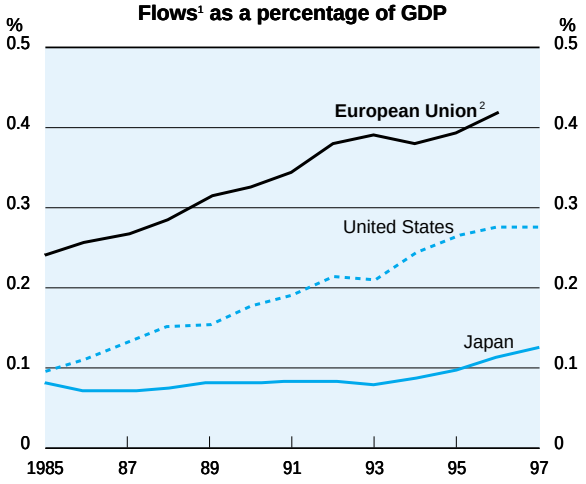
Technology receipts and payments constitute the main form of disembodied technology diffusion. Trade in technology comprises four main categories:

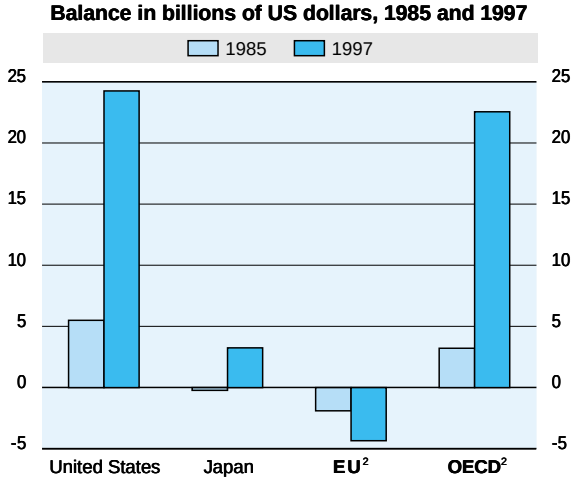
- Transfer of techniques (through patents and licences, disclosure of know-how).
- Transfer (sale, licensing, franchising) of designs, trademarks and patterns.
- Services with a technical content, including technical and engineering studies, as well as technical assistance.
- Industrial R&D.

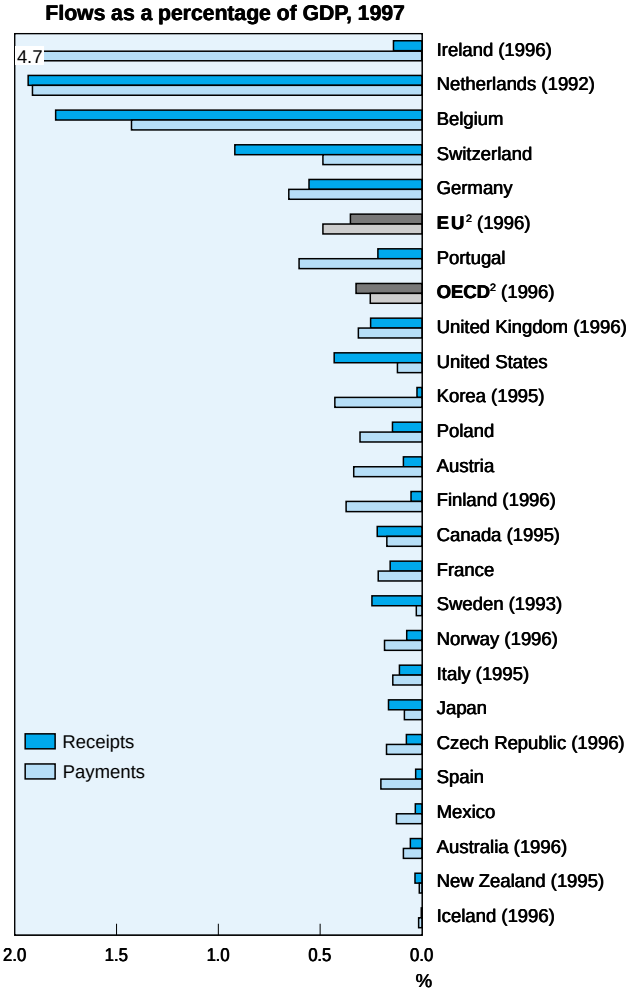
The main limitations of these data are the heterogeneity of their content at country level and the difficulty of dissociating the technological from the non-technological aspect of trade in services, which falls under the heading of pure industrial property. Trade in services may be underestimated when a significant proportion does not give rise to any financial payments or when payments are not made in the form of technology payments.

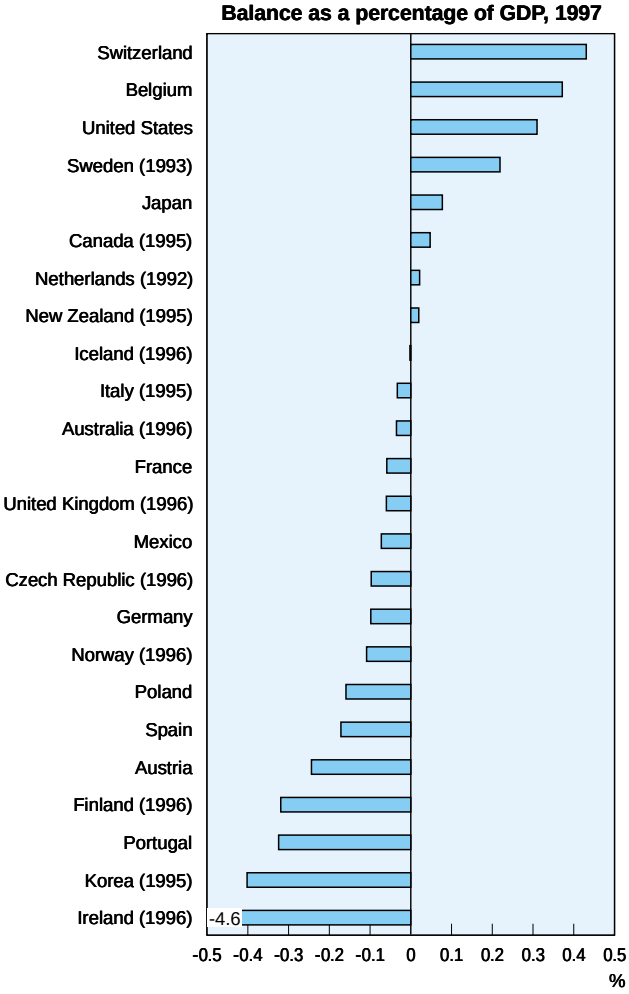
For more details, see Annex, Table 11.5.1.

11.5. Technology balance of payments









1. Average of technological payments and receipts.
2. Including intra-area flows. Data partially estimated.

Source: OECD, TBP database, May 1999.

12.1. Exports by technology intensity

- High-technology industries play an increasingly important role in international manufacturing trade (see Section 7.2). These dynamic industries are often seen as key industries whose presence in the economy can have important positive effects on productivity and competitiveness, thereby laying the ground for future economic growth.
- Substantial differences in the share of high- and medium-high-technology industries in manufacturing exports can be found across countries, ranging from less than 5% for Iceland to more than 80% for Japan.
- In general, high- and medium-high-technology industries account for a large share of exports for countries which lead technologically, spend a high share of GDP on R&D, and are well-endowed with qualified labour, scientists and engineers.
- These industries account for more than two-thirds of manufacturing exports for Japan, Ireland, Switzerland, the United States, Mexico, Germany, and the United Kingdom. In contrast, for Iceland, Greece, New Zealand and Turkey, they have a limited weight in manufacturing exports, and, owing to the structure of these economies, an even smaller weight in total exports.
- The case of Ireland is particularly striking if only high-technology industries are examined: these represent about 45% of Irish manufacturing exports, a figure which is almost twice what is found for countries such as the United States, Japan, the United Kingdom, and Korea. Ireland's, and also Mexico's, favourable position is less due to domestic R&D efforts; rather, it underlines the role of foreign affiliates and international sourcing: both countries import many intermediate goods (mainly from the United States) for assembly and then export finished goods.
- Ireland and Mexico are also the countries for which high- and medium-high-technology exports have grown fastest since 1990. Countries such as Iceland, New Zealand or Turkey seem to be catching up, as the high growth in these industries starts from very low levels.

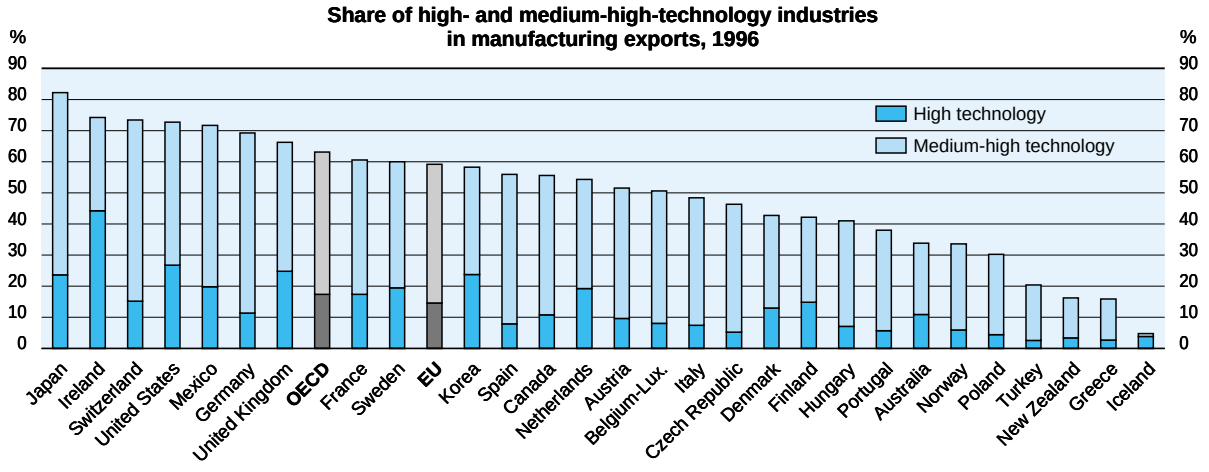
Classification of manufacturing industries by technology intensity

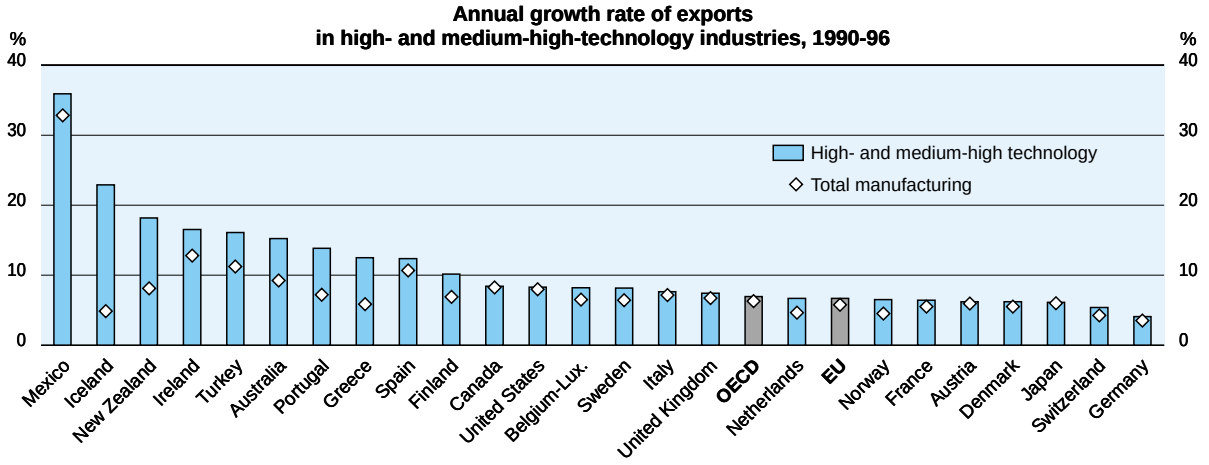
Drawing on methodological work carried out at the OECD, manufacturing industries are classified in four different categories of technology intensity (see Section 7.2):

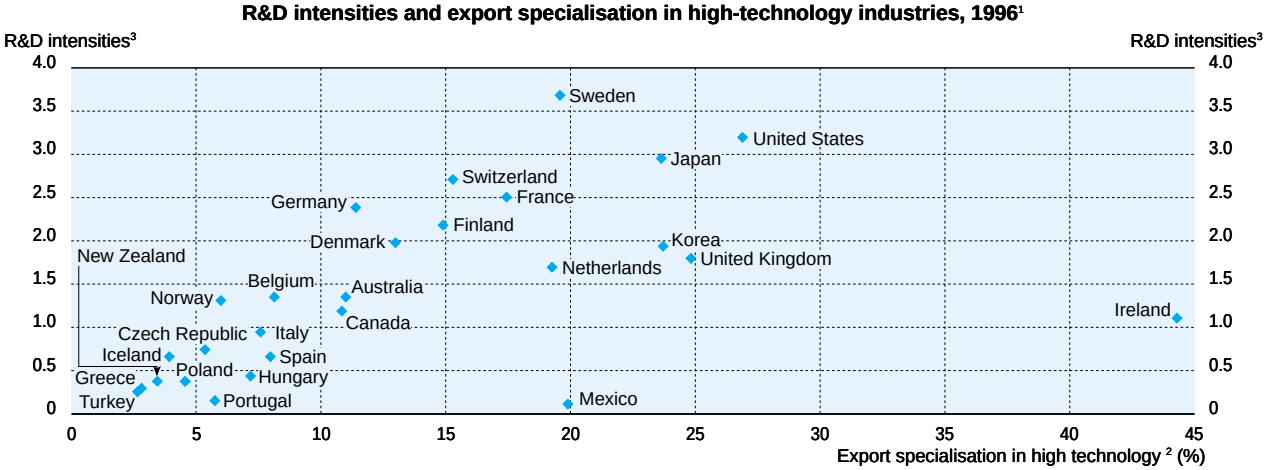
- High-technology industries: aircraft; office and computing equipment; drugs and medicines; radio, TV and communication equipment.
- Medium-high-technology industries: professional goods; motor vehicles; electrical machinery excluding communication equipment; chemicals excluding drugs; other transport equipment; non-electrical machinery.
- Medium-high-technology industries: rubber and plastic products; shipbuilding and repairing; other manufacturing; non-ferrous metals; non-metallic mineral products; metal products; petroleum refineries and products; ferrous metals
- Low-technology industries: paper, paper products and printing; textiles, apparel and leather; food, beverages and tobacco; wood products and furniture.

For more details, see Annex, Tables 12.1.1 to 12.1.3.

12.1. Exports by technology intensity







1. Or latest available year. Greece: 1993; Belgium, Hungary, Iceland, Ireland, Mexico, New Zealand, Portugal: 1995.
2. High-technology exports/Manufacturing exports.
3. Manufacturing R&D expenditures/Manufacturing production.

Source: OECD, Main Industrial Indicators and R&D database, 1999.

12.2. Revealed comparative advantage by technology intensity

- An assessment of countries' strengths and weaknesses by technology intensity must not focus solely on exports (see Section 12.1) but must also include imports, as exports can depend heavily on imports in the same industry. To gain a better understanding of countries' specialisation profiles, the indicator of revealed comparative advantage used here is therefore based on the trade balance (see Box).
- Few OECD countries are specialised in high- and medium-high-technology industries. The structural surplus in these industries represents more than 15% of total manufacturing trade for Japan, about 10% for Switzerland and Germany, 5% for the United States, Mexico and Ireland, followed by the United Kingdom and France.
- The structural surplus for some of these countries stems mainly from medium-high-technology industries, especially Japan and Germany (motor vehicles and non-electrical machinery) and Switzerland (non-electrical machinery and professional goods).
- High-technology industries contribute positively to the manufacturing trade balance for the United States (mainly aircraft), Japan (electronic equipment), the United Kingdom (aircraft, drugs and, to a lesser extent, computers), France (aircraft and, to a lesser extent, drugs), and, to a lesser extent, Sweden.
- But the specialisation in high-technology industries is most pronounced for Ireland (electronic equipment, computers, and drugs), Korea (electronic equipment and computers), and, since the early 1990s, Mexico (computers and electronic equipment). The presence of foreign affiliates certainly plays a major role in explaining Ireland's and Mexico's situation. All three countries are still in a catching-up process and import massively foreign technology (Section 11.5) and investment goods. Ireland and Korea are specialised in the extreme ends of the technology ladder, *i.e.* both in high-technology and in low-technology industries such as food and beverages (Ireland) or textiles (Korea).

Contribution to the trade balance

The "contribution to the trade balance"* makes it possible to identify structural strengths and weaknesses in an economy via the composition of international trade flows. It takes into account not only exports, but also imports, and tries to eliminate business cycle variations by comparing an industry's trade balance to the overall trade balance. It can be interpreted as an indicator of "revealed comparative advantage", as it examines whether an industry performs relatively better or worse than the manufacturing total, no matter whether the manufacturing total itself is in deficit or surplus.

If there were no comparative advantage or disadvantage for any industry *j*, then a country's total trade balance (surplus or deficit) should be distributed across industries according to their share in total trade. The "contribution to the trade balance" is the difference between the actual and this theoretical balance:

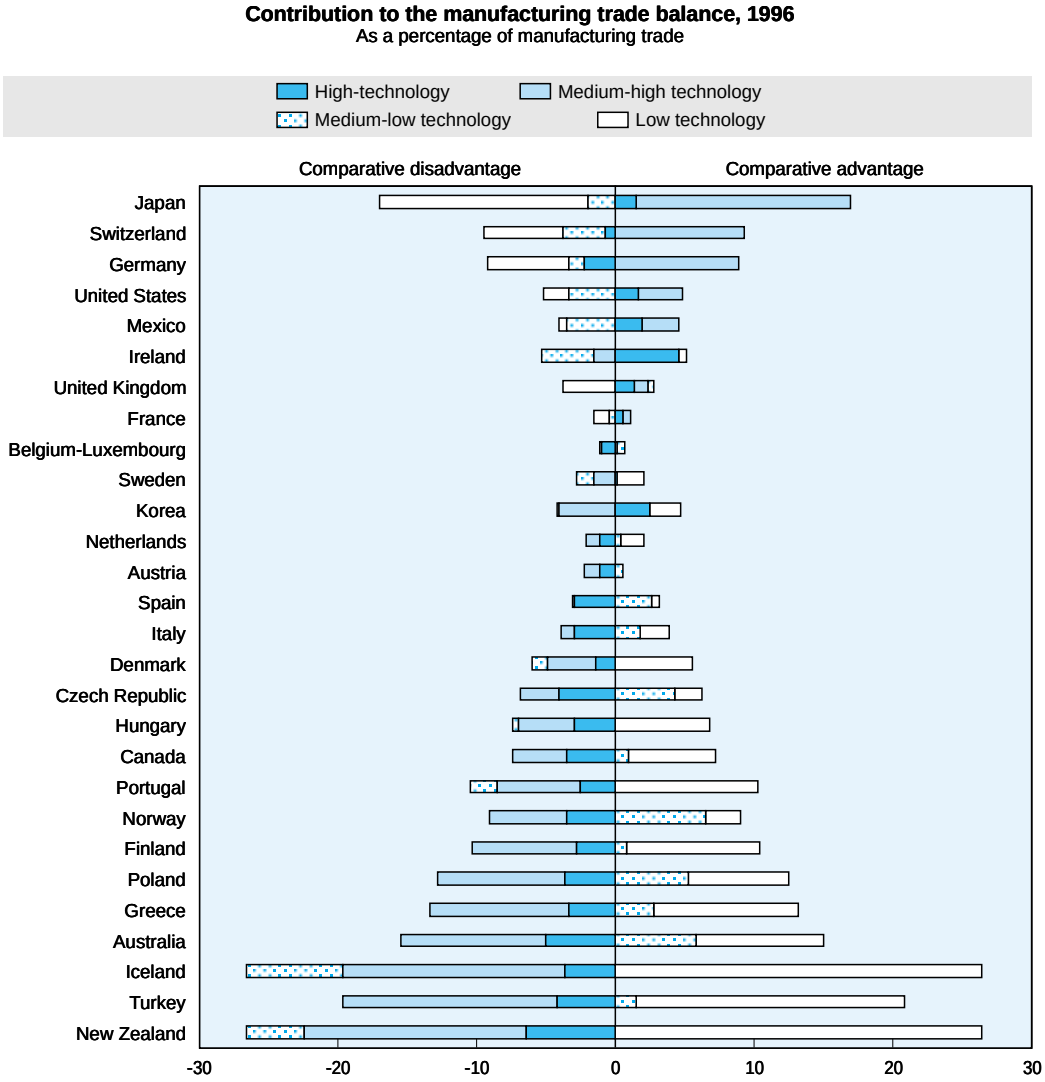
$$\underbrace{(X_j - M_j)}_{\text{observed industry trade balance}} - \underbrace{(X - M)\frac{(X_j + M_j)}{(X + M)}}_{\text{theorical industry trade balance}}$$

A positive value for an industry indicates a structural surplus, and a negative one a structural deficit. The indicator is additive, and individual industries can be grouped together by summing up their respective values: by construction, the sum over all industries is zero. To allow comparisons across countries, the indicator is generally expressed as a percentage of total trade or of GDP.

* See G. Lafay, "La mesure des avantages comparatifs révélés", *Économie prospective internationale*, No. 41, 1987.

For more details, see Annex, Table 12.2.1.

12.2. Revealed comparative advantage by technology intensity



Source: OECD.

12.3. Countries' position on price-quality ranges in trade with EU-15

- Section 7.3 showed the importance of intra-industry trade in vertically differentiated products in trade with EU-15 countries. The simultaneous exports and imports of products with the same technical characteristics, but different unit values, can be interpreted as a "qualitative" division of labour within narrowly defined product groups between EU members and other OECD countries.
- The question of countries' position in various market segments in terms of quality is important, as this might have important consequences in terms of income distribution. High quality (as revealed by high unit values) depends on R&D expenditures, labour qualification, specific organisation of internal procedures of firms, etc. Therefore, countries' range of specialisation is not neutral from a policy point of view.
- The share of up-market goods in manufacturing exports to members of the European Union varies from three-quarters (Switzerland, followed by Australia, the United States, Ireland and Japan) to less than one-fifth (Poland, Czech Republic, Turkey and Greece). This share is strongly correlated with per capita income.

Quality, prices and unit values

On an ideal market, homogeneous goods sell at the same price. However, products are often differentiated and sold at different prices, and can thus be considered outputs of distinctive production functions. The idea of defining a product as a "bundle of attributes" has found its empirical counterpart in so-called "hedonic prices". These implicit prices of attributes are derived through econometric estimates which relate observed prices of goods to specific amounts of characteristics associated with them: a product with a higher amount of a specific (quality) attribute usually sells at a higher price.

However, several factors can undermine the positive link between quality and price. While low-priced goods are not necessarily of low quality, owing to lower production costs (price-competitiveness) or firms' strategies (mark-up), high-priced good need to have a minimum (objective or subjective) quality to be sold on the market (non-price competitiveness). Prices of goods are also influenced by factors such as market structure, firm strategies, income distribution, consumer tastes and behaviour, and consumers' perception of quality. In addition, prices of imported goods are influenced by factors such as exchange rate movements and trade restrictions.

Another difficulty arises as unit values (value of exports or imports divided by quantity) are imperfect proxies for prices. However, unit values are increasingly used in the literature, partly because there is no alternative for systematic empirical analysis: the results should nevertheless be interpreted with caution.

For reasons of data availability and comparability, the reference market is the European Union.* Countries' exports to EU (*i.e.* EU imports) include cost, insurance and freight. Calculated bilaterally for some 10 000 goods, exports of a given product to a given trade partner can exist in the following price-quality ranges:**

- Up-market products (with unit values exceeding the intra-EU-15 average by at least 15%).
- Down-market products (more than 15% below the average).
- Middle-market products (between + /- 15% around the average).

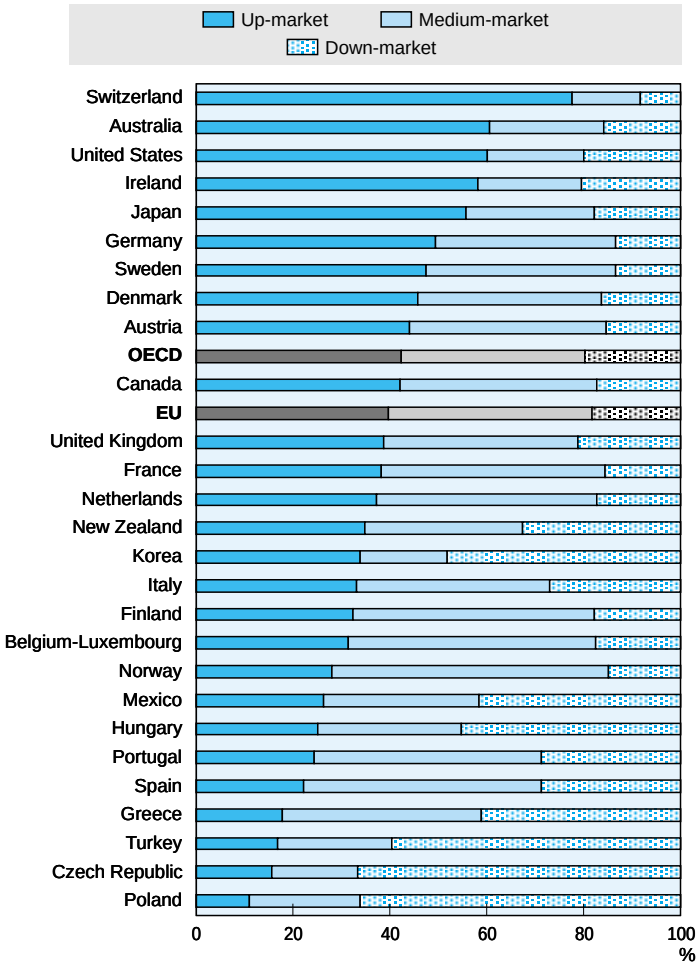
*However, EU-15 may not be a representative market for all OECD Member countries. In addition, exports of large EU members (especially Germany) are biased towards the medium-market segment, as their weight in intra-EU trade strongly influences the average European unit value.

** See L. Fontagné and M. Freudenberg, "Intra-Industry Trade: Methodological Issues Reconsidered", CEPII Working Paper, No. 97-01, January 1997 (available at http://www.cepii.fr).

For more details, see Annex, Table 12.3.1.

12.3. Countries' position on price-quality ranges in trade with EU-15

Share of price/quality ranges in total manufacturing exports to EU-15, 1996



Source: OECD calculations, based on Eurostat data.

ANNEXES

Annex 1. **Classification of industries based on technology**

	ISIC Rev. 2	1990			1980		
		(R&D + acquired technology) divided by production	R&D divided by production	R&D divided by value added	(R&D + acquired technology) divided by production	R&D divided by production	R&D divided by value added
High-technology industries							
Aircraft	3845	17.30	14.98	36.25	16.06	14.13	41.11
Office & computing equipment	3825	14.37	11.46	30.49	11.19	9.00	26.01
Drugs & medicines	3522	11.35	10.47	21.57	8.37	7.62	16.89
Radio, TV & communication equipment	3832	9.40	8.03	18.65	9.33	8.35	18.43
Medium-high-technology industries							
Professional goods	385	6.55	5.10	11.19	4.69	3.61	8.63
Motor vehicles	3843	4.44	3.41	13.70	3.68	2.81	10.05
Electrical machines excl. commun. equip.	383 - 3832	3.96	2.81	7.63	4.25	3.48	8.85
Chemicals excl. drugs	351 + 352 - 3522	3.84	3.20	8.96	2.67	2.15	7.60
Other transport equipment	3842 + 3844 + 3849	3.03	1.58	3.97	1.69	0.98	2.70
Non-electrical machinery	382 - 3825	2.58	1.74	4.58	2.00	1.32	3.48
Medium-low-technology industries							
Rubber & plastic products	355 + 356	2.47	1.07	3.02	2.20	1.08	3.27
Shipbuilding & repairing	3841	2.21	0.74	2.13	1.42	0.39	1.11
Other manufacturing	39	1.76	0.63	1.52	1.45	0.79	2.19
Non-ferrous metals	372	1.57	0.93	3.48	1.04	0.54	2.29
Non-metallic mineral products	36	1.44	0.93	2.20	1.10	0.66	1.72
Metal products	381	1.35	0.63	1.39	1.06	0.45	1.08
Petroleum refineries & products	353 + 354	1.33	0.96	8.43	0.80	0.58	6.17
Ferrous metals	371	1.10	0.64	2.48	0.78	0.45	1.71
Low-technology industries							
Paper, paper products & printing	34	0.88	0.31	0.76	0.68	0.23	0.61
Textiles, apparel & leather	32	0.78	0.23	0.65	0.56	0.13	0.38
Food, beverages & tobacco	31	0.73	0.34	1.14	0.56	0.23	0.93
Wood products & furniture	33	0.65	0.18	0.47	0.55	0.14	0.39

Source: OECD, ANBERD, STAN, Input-Output and Bilateral Trade databases.

ANNEX 2

MAIN OECD DATABASES USED IN THIS DOCUMENT

Databases managed by the Directorate for Science, Technology and Industry (DSTI)

Industrial structure and performance databases

STAN: The **Structural Analysis** database contains estimates compatible with national accounts for eight variables of industrial activity: production, value added, gross fixed capital formation, employees engaged, labour compensation, exports, imports and constant price value added. It covers 49 manufacturing sectors in 22 OECD countries.

Publication: OECD (1998), *The OECD STAN Database for Industrial Analysis*: *1978-97*. Annual. Also available on diskette.

Main Industrial Indicators (MI2): Drawing on existing OECD databases, this newly created database provides indicators which highlight trends in industrial structure and performance in selected OECD countries and zones. It covers five categories: international trade, industrial structure, business enterprise R&D, employment and productivity, and physical investment. Indicators are provided for 31 manufacturing sectors, for technology groups and for selected service sectors.

Publication: OECD (1999), *Main Industrial Indicators 1980-97.* Biennial. Only available on diskette.

Input-Output (I-O): This database contains flow matrices of intermediate and final goods (both domestic and imported) for selected years in the 1970-90 period. It covers 10 OECD countries and 36 industries, of which 22 are in the manufacturing sector.

Publication: OECD (1996), *The OECD Input-Output Database.* Also available on diskette.

Science & technology databases

R&D and TBP: The **R&D** database contains the full results of the OECD surveys on **R&D expenditure and personnel** from the 1960s, and the **TBP** database presents information on the **Technology Balance of Payments**. These databases serve as the raw material for both the ANBERD and MSTI databases.

Publication: OECD (1997), *Basic Science and Technology Statistics*. Biennial (also available annually on diskette).

MSTI: The **Main Science and Technology Indicators** database provides a selection of the most frequently used yearly data on the scientific and technological performance of the OECD Member countries expressed in the form of ratios, percentages, growth rates, etc. Of the 89 indicators included, 70 deal with resources devoted to R&D, and 19 are measures of output and the impact of S&T activities (patents, technology balance of payments and trade of high technology industries).

Publication: OECD (1999), *Main Science and Technology Indicators 1999/1*. Biannual. Also available on diskette.

ANBERD: The **Analytical Business Enterprise Research and Development** database is an estimated database constructed with the objective of creating a consistent data set that overcomes the problems of international comparability and time discontinuity associated with the official business enterprise R&D data provided to the OECD by its Member countries. ANBERD contains R&D expenditures for the period 1973-97, by industry, for 15 OECD countries.

Publication: OECD (1999), *Research and Development in Industry: Expenditure and Researchers, Scientists and Engineers, 1976-97*. Annual. Also available on diskette.

Globalisation and international trade databases

AFA: The **Activities of Foreign Affiliates** database presents detailed data on the performance of foreign affiliates in OECD countries (inward investment). The data indicate the increasing importance of foreign affiliates in the economies of host countries, particularly in production, employment, value added, research and development, exports, wages and salaries. AFA contains 18 variables broken down by country of origin and by industrial sector for 15 OECD countries.

Publication: OECD (1997), *Activities of Foreign Affiliates in OECD countries*. Biennial (also available annually on diskette).

Bilateral Trade (BTD): The Bilateral Trade database for industrial analysis includes detailed trade flows by manufacturing industry between a set of OECD *declaring* countries and a selection of *partner* countries and geographical regions. Data are presented in thousands of US dollars and cover the period 1970-95. The data have been derived from OECD *Foreign Trade Statistics* database by means of standard conversion matrices. The database covers 22 manufacturing sectors, following the same manufacturing classification as used for the input-output and ANBERD databases and compatible with the STAN database.

Publication: OECD (1998), *Bilateral Trade Database 1998*. Also available on diskette.

Information and Communication Technology (ICT) databases

Telecommunications: This database is produced in association with the biennial publication *Communications Outlook*. The database provides time-series data covering all OECD Member countries, from 1980-97 where available. It contains both telecommunication and economic indicators.

Publication: OECD (1999), *Telecommunications Database 1999*. Only available on diskette and CD-ROM.

Further details on these databases are available on the Internet at:
http://www.oecd.org/dsti/sti/stat-ana/index.htm (select Statistics to view a list of products).

COUNTRY COVERAGE OF MAIN DSTI DATABASES USED IN THIS DOCUMENT

	Industry			Science & technology				Globalisation		ICT
	STAN	MI2	I-O	R&D	TBP	MSTI	ANBERD	AFA	BTD	Telecom
Australia	✓	✓	✓	✓	✓	✓	✓		✓	✓
Austria	✓	✓		✓	✓	✓			✓	✓
Belgium	✓	✓		✓	✓	✓			✓	✓
Canada	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Czech Republic		✓		✓	✓	✓		✓		✓
Denmark	✓	✓	✓	✓	✓	✓	✓		✓	✓
Finland	✓	✓		✓	✓	✓	✓	✓	✓	✓
France	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Germany	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Greece	✓	✓		✓		✓			✓	✓
Hungary		✓		✓		✓				✓
Iceland	✓	✓		✓	✓	✓			✓	✓
Ireland		✓		✓	✓	✓	✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Japan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Korea	✓	✓		✓	✓	✓				✓
Luxembourg		✓								✓
Mexico	✓	✓		✓	✓	✓		✓		✓
Netherlands	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Zealand	✓	✓		✓	✓	✓			✓	✓
Norway	✓	✓		✓	✓	✓	✓	✓	✓	✓
Poland		✓		✓	✓	✓				✓
Portugal	✓	✓		✓	✓	✓			✓	✓
Spain	✓	✓		✓	✓	✓	✓		✓	✓
Sweden	✓	✓		✓	✓	✓	✓	✓	✓	✓
Switzerland		✓		✓	✓	✓			✓	✓
Turkey		✓		✓		✓		✓	✓	✓
United Kingdom	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
United States	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

OTHER OECD DATABASES

ADB: Analytical DataBase (Economics Department).
ANA: Annual National Accounts (Statistics Directorate).
FTS: Foreign Trade Statistics (Statistics Directorate).
International Direct Investment database (Directorate for Financial, Fiscal and Enterprise Affairs).
ISDB: International Sectoral DataBase (Statistics Directorate).
LFS: Labour Force Statistics (Statistics Directorate).

Further details on OECD statistics are available on the Internet at: *http://www.oecd.org/statlist.htm*

STATISTICAL ANNEX

Table 1.1.1. **Real Gross Domestic Product**

	Percentage change from previous period										Average annual growth rate				
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1969-79	1979-89	1989-98	1989-96	1996-98
Canada	2.5	0.3	-1.9	0.9	2.3	4.7	2.6	1.2	3.8	3.0	4.4	2.9	1.9	1.4	3.4
Mexico	3.3	4.5	3.6	2.8	0.7	4.5	-6.2	5.1	6.8	4.8	6.4	2.0	2.9	2.1	5.8
United States	3.4	1.2	-0.9	2.7	2.3	3.5	2.3	3.4	3.9	3.9	3.2	2.7	2.5	2.1	3.9
Australia	4.5	1.4	-1.0	2.6	3.8	5.2	4.3	3.6	3.6	5.1	3.6	3.4	3.2	2.8	4.3
Japan	4.8	5.1	3.8	1.0	0.3	0.6	1.5	5.1	1.4	-2.8	5.2	3.8	1.7	2.5	-0.7
Korea	6.4	7.8	9.2	5.4	5.5	8.3	8.9	6.8	5.0	-5.8	..	12.2	5.6	7.4	-0.6
New Zealand	-0.8	0.3	-2.3	0.6	4.9	6.1	3.5	2.4	3.0	-0.8	1.9	2.4	2.0	2.2	1.1
Austria	4.2	4.6	3.4	1.3	0.5	2.4	1.7	2.0	2.5	3.3	4.1	2.1	2.4	2.3	2.9
Belgium	3.6	3.0	1.6	1.5	-1.5	2.6	2.3	1.3	3.0	2.9	3.5	2.0	1.9	1.5	2.9
Czech Republic[1]	..	..	..	-6.4	-0.9	2.6	6.4	3.9	1.0	-2.7	..	..	0.5	1.0	-0.9
Denmark	0.3	1.2	1.4	1.3	0.8	5.8	3.0	3.3	3.1	2.9	2.5	1.8	2.5	2.4	3.0
Finland	5.5	-0.5	-5.9	-3.2	-0.6	3.7	3.9	4.1	5.5	4.7	3.7	3.6	1.2	0.2	5.1
France	4.3	2.5	0.8	1.2	-1.3	2.8	2.1	1.6	2.3	3.2	3.7	2.3	1.7	1.4	2.7
Germany[2]	3.6	5.7	5.0	2.2	-1.2	2.7	1.2	1.3	2.2	2.8	3.1	1.8	2.4	2.4	2.5
Greece	3.8	0.0	3.1	0.7	-1.6	2.0	2.1	2.4	3.2	3.5	5.3	1.8	1.7	1.2	3.4
Hungary[1]	..	..	..	-3.1	-0.6	2.9	1.5	1.3	4.6	5.1	..	..	1.7	0.4	4.8
Iceland	0.3	1.2	1.1	-3.3	1.0	3.7	1.0	5.6	5.4	5.0	6.5	3.2	2.3	1.4	5.2
Ireland	5.8	8.5	2.0	4.2	3.1	7.3	11.1	7.4	9.8	10.4	4.7	3.1	7.0	6.2	10.1
Italy	2.9	2.2	1.1	0.6	-1.2	2.2	2.9	0.9	1.5	1.4	3.7	2.4	1.3	1.2	1.4
Luxembourg	9.8	2.2	6.1	4.5	8.7	4.2	3.8	3.0	4.7	5.7	2.7	4.3	4.7	4.6	5.2
Netherlands	4.7	4.1	2.3	2.0	0.8	3.2	2.3	3.1	3.6	3.8	3.4	1.9	2.8	2.5	3.7
Norway	0.9	2.0	3.1	3.3	2.7	5.5	3.8	4.9	4.3	2.1	4.4	2.7	3.5	3.6	3.2
Poland[1]	..	..	..	2.6	3.8	5.2	7.0	6.1	6.9	4.8	..	..	5.2	4.9	5.8
Portugal	5.1	4.4	2.3	2.5	-1.1	2.2	2.9	3.2	3.7	3.9	5.2	2.9	2.6	2.3	3.8
Spain	4.7	3.7	2.3	0.7	-1.2	2.3	2.7	2.4	3.5	3.8	3.8	2.8	2.2	1.8	3.7
Sweden	2.4	1.4	-1.1	-1.4	-2.2	3.3	3.9	1.3	1.8	2.9	2.5	2.0	1.1	0.7	2.3
Switzerland	4.3	3.7	-0.8	-0.1	-0.5	0.5	0.6	0.0	1.7	2.1	1.6	2.6	0.8	0.5	1.9
Turkey	0.3	9.3	0.9	6.0	8.0	-5.5	7.2	7.0	7.5	2.8	4.8	4.0	4.7	4.6	5.1
United Kingdom	2.1	0.6	-1.5	0.1	2.3	4.4	2.8	2.6	3.5	2.1	2.4	2.4	1.9	1.6	2.8
European Union	3.5	3.0	1.6	1.1	-0.5	3.0	2.4	1.8	2.7	2.8	3.4	2.2	2.0	1.8	2.7
Total OECD	3.6	2.8	1.1	1.9	1.1	2.9	2.3	3.2	3.3	2.3	3.8	3.0	2.3	2.2	2.8

1. 1991-96 instead of 1989-96 and 1991-98 instead of 1989-98.
2. Western Germany up to and including 1991, total Germany thereafter.
Source: OECD, *Economic Outlook 65*, June 1999.

Table 1.1.2. **Employment**

	Percentage change from previous period										Average annual growth rate				
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1969-79	1979-89	1989-98	1989-96	1996-98
Canada	2.1	0.6	-1.9	-0.6	1.4	2.1	1.6	1.2	1.9	2.8	3.2	2.0	1.0	0.6	2.3
Mexico	3.6	1.9	5.5	4.7	4.1	0.9	1.9	5.0	13.3	4.9	..	..	4.6	3.4	9.0
United States	2.0	1.3	-0.9	0.7	1.5	2.3	1.5	1.4	2.2	1.5	2.4	1.7	1.3	1.1	1.9
Australia	4.7	1.4	-2.1	-0.7	0.4	3.1	4.1	1.3	0.8	1.9	1.6	2.4	1.1	1.1	1.3
Japan	1.9	2.0	1.9	1.1	0.2	0.1	0.1	0.4	1.1	-0.6	0.8	1.1	0.7	0.8	0.2
Korea	4.1	3.0	2.9	1.9	1.5	3.0	2.7	1.9	1.4	-5.3	3.7	2.6	1.4	2.4	-2.0
New Zealand	-2.6	0.9	-1.3	0.8	2.6	4.7	5.2	3.7	0.4	-0.6	1.9	0.1	1.8	2.4	-0.1
Austria	1.5	1.9	1.9	1.5	-0.3	0.2	-0.4	-0.7	0.3	0.7	0.6	0.1	0.5	0.6	0.5
Belgium	1.6	1.5	0.1	-0.4	-1.1	-0.9	0.5	0.4	0.3	1.4	0.2	0.0	0.2	0.0	0.9
Czech Republic[1]	..	..	..	-1.6	-1.1	1.3	0.6	-3.2	-0.6	-1.5	..	..	-0.9	-0.8	-1.0
Denmark	-0.7	-0.8	-0.6	-0.9	-1.5	-0.4	1.4	1.3	2.1	2.2	0.6	0.5	0.3	-0.2	2.2
Finland	1.6	-0.1	-5.2	-7.1	-6.1	-0.8	2.2	1.4	2.0	2.4	0.7	1.1	-1.3	-2.3	2.2
France	1.5	0.8	0.0	-0.6	-1.2	0.1	0.8	0.1	0.4	1.4	0.6	0.2	0.2	0.0	0.9
Germany[2]	1.5	3.0	2.5	-1.8	-1.7	-0.7	-0.4	-1.3	-1.3	0.0	0.1	0.4	-0.2	-0.1	-0.7
Greece	0.4	1.3	-2.3	1.5	0.9	1.9	0.9	1.3	-0.5	0.2	0.5	1.0	0.6	0.8	-0.1
Hungary[1]	..	..	..	-9.6	-6.4	-3.4	-1.9	-0.5	0.3	1.5	..	..	-2.9	-4.4	0.9
Iceland	-1.5	-0.9	-0.1	-1.4	-0.8	0.5	1.5	2.4	2.9	2.1	2.7	2.1	0.7	0.2	2.5
Ireland	0.0	4.4	-0.3	0.6	1.4	3.0	4.8	3.4	4.8	8.4	0.7	-0.5	3.4	2.5	6.6
Italy	-0.1	1.2	0.7	-0.9	-2.5	-1.7	-0.6	0.4	0.0	0.4	0.6	0.2	-0.3	-0.5	0.2
Luxembourg	3.5	4.1	4.1	2.5	1.7	2.6	2.5	2.9	3.2	4.4	1.8	1.4	3.1	2.9	3.8
Netherlands	1.8	3.0	2.6	1.6	0.7	-0.1	2.4	2.0	3.4	2.9	0.3	0.7	2.1	1.8	3.2
Norway	-3.0	-0.9	-1.0	-0.3	0.0	1.5	2.2	2.5	2.9	2.4	1.6	0.8	1.0	0.6	2.6
Poland[1]	..	..	..	-3.7	-2.1	-1.6	0.9	1.2	1.3	1.2	..	..	-0.4	-1.1	1.2
Portugal	2.3	2.2	3.0	-6.4	-2.0	-0.1	-0.6	0.5	1.9	2.4	1.8	1.5	0.1	-0.5	2.1
Spain	4.1	2.6	0.2	-1.9	-4.3	-0.9	1.8	1.5	2.9	3.4	0.2	0.1	0.6	-0.2	3.2
Sweden	1.5	1.0	-2.0	-4.3	-5.8	-0.9	1.6	-0.6	-1.1	1.4	1.0	0.6	-1.2	-1.6	0.2
Switzerland	2.7	3.2	1.9	-1.6	-0.8	-0.3	0.3	0.3	-0.3	1.2	0.0	1.8	0.4	0.4	0.5
Turkey	2.6	1.7	1.7	0.8	0.9	2.5	3.7	2.5	-1.9	2.8	2.1	1.6	1.6	2.0	0.4
United Kingdom	2.4	0.3	-3.0	-2.1	-0.4	1.0	1.2	1.1	1.6	1.4	0.2	0.6	0.1	-0.3	1.5
European Union	1.6	1.6	0.2	-1.5	-1.7	-0.3	0.6	0.3	0.6	1.3	2.5	2.7	0.1	-0.1	0.9
Total OECD	2.0	1.6	0.4	0.0	0.2	1.0	1.1	1.0	1.5	1.0	1.2	1.5	0.9	0.8	1.3

1. 1991-96 instead of 1989-96 and 1991-98 instead of 1989-98.
2. Western Germany up to and including 1991, total Germany thereafter.
Source: OECD, *Economic Outlook 65* , June 1999.

Table 2.1.1. **Investment in knowledge compared to physical investment**

	Physical investment				Investments in knowledge				
	As a percentage of GDP, 1995			Average annual growth rate 1985-95	As a percentage of GDP, 1995				Average annual growth rate 1985-95
	Total	Machinery and equipment	Other		Total	Public spending on education	R&D	Software	
Canada	16.9	8.2	8.7	2.4	8.8	5.9	1.4	1.4	2.2
Mexico	16.1	7.6	8.5	0.2	..	..	..	..	..
United States	16.9	7.2	9.7	1.9	8.4	4.6	2.3	1.5	3.1
Australia	22.6	8.7	13.9	2.6	6.8	4.3	1.4	1.0	2.4
Japan	28.5	10.1	18.4	4.2	6.6	3.0	2.7	0.9	3.5
Korea	36.6	13.1	23.4	12.5	..	..	..	..	..
New Zealand	20.9	10.2	10.7	2.1	..	..	..	..	..
Austria	23.8	9.1	14.7	4.0	7.2	5.0	1.4	0.8	2.8
Belgium	17.7	7.1	10.6	4.2	7.0	4.6	1.4	1.0	0.1
Czech Republic	32.8	..	..	..	..	..	..	..	..
Denmark	18.8	9.5	9.3	1.8	9.6	6.9	1.6	1.1	4.4
Finland	16.1	7.0	9.2	-2.5	9.5	6.2	2.1	1.2	3.9
France	17.9	8.1	9.8	2.3	10.2	6.8	2.2	1.3	2.7
Germany	21.4	7.6	13.7	3.1	7.1	4.1	2.1	0.9	2.8
Greece	18.5	8.4	10.1	0.8	..	..	..	..	..
Hungary	19.1	..	..	..	..	..	..	..	..
Iceland	14.6	4.6	10.0	-1.6	..	..	..	..	..
Ireland	17.1	7.0	10.1	3.3	..	..	..	..	..
Italy	18.0	9.0	9.1	1.4	6.1	4.4	0.9	0.8	1.3
Luxembourg	21.2	..	..	10.2	..	..	..	..	..
Netherlands	19.1	8.1	11.0	2.4	7.8	4.7	1.9	1.3	0.9
Norway	20.7	..	..	-0.4	8.8	6.4	1.5	0.9	3.4
Poland	16.9	..	..	..	..	..	..	..	..
Portugal	23.6	10.7	12.9	6.0	..	..	..	..	..
Spain	20.8	6.8	14.0	5.2	..	..	..	..	..
Sweden	14.6	7.7	6.9	0.1	10.6	5.8	3.3	1.5	2.1
Switzerland	21.4	9.3	12.1	2.2	..	..	..	..	..
Turkey	23.8	10.8	13.0	8.6	..	..	..	..	..
United Kingdom	16.3	8.3	8.0	2.6	8.5	5.1	1.8	1.5	2.3
European Union	19.0	8.1	10.9	3.0	8.0	5.1	1.8	1.1	2.9
Total OECD	20.1	8.3	11.9	2.7	7.9	4.6	2.1	1.2	2.8

Source: OECD, *Economic Outlook 65* , June 1999 and International Data Corporation.

Table 2.2.1. **Value added of knowledge-based industries**

Percentages

	Share in business sector value added, current prices							Real value added growth Average annual growth rate		
		Total knowledge-based industries	High-technology industries	Medium-high-technology industries	Communi-cations services	Finance, insurance and other business services	Community, social and personal services		Knowledge-based industries	Business sector
Canada	1996	51.0	2.2	6.1	3.3 [1]	24.1 [1]	15.4 [1]	1985-96	3.2	2.3
Mexico	1996	41.6	1.8	6.4	1.6	17.8	14.0	1988-96	3.8	2.9
United States	1996	55.3	3.0	6.1	2.9	30.8	12.4	1985-96	3.1	3.0
Australia	1996	48.0	0.9	3.2	2.9	26.1	14.9	1985-96	4.3	3.4
Japan	1996	53.0	3.7	8.6	3.0 [1]	37.7 [2] →		1985-96	4.0 [1]	3.3
Korea	1996	40.3	5.4	8.4	2.4 [1]	19.5	4.7	1985-96	12.5 [1]	9.1
New Zealand	1995	39.9	0.5	3.9	3.6	26.4	5.5	-	..	..
Austria	1996	43.8	9.6 [3] →		2.9	25.2	6.0	1985-96	3.7	2.9
Belgium	1996	46.3	8.7 [3,4] →		2.2	35.4 [2] →		1985-96	3.0	2.4
Denmark	1995	42.1	1.8	6.9	2.5	23.9	7.0	1985-95	1.4	2.0
Finland	1996	42.1	3.0	8.2	3.0	24.5	3.4	1985-96	4.0	2.0
France	1996	50.0	3.0	7.0	2.9	29.1	8.0	1985-96	2.8	2.0
Germany[5]	1996	58.6	2.9	11.1	2.6	42.1 [2] →		1985-96	3.7	2.5
Greece	1995	38.9	0.9	2.0	2.4 [1]	33.6 [2] →		1985-95	2.9 [1]	1.8
Iceland	1995	31.4	0.0	0.7	2.3	21.8	6.6	-	..	..
Italy	1996	41.3	1.4	6.4	2.1	31.4 [2] →		1985-96	2.8	2.2
Netherlands	1995	50.2	2.7	5.0	2.5	27.5	12.5	1986-95	2.9	2.7
Norway	1996	35.3	0.9	4.1	2.5	21.1	6.6	1985-96	1.7	3.2
Portugal	1993	33.9	1.4	4.0	2.8	16.4	9.3	1986-93	6.9	4.6
Spain	1994	37.9	1.6	7.2	2.5	20.4	6.3	1986-94	2.9	2.5
Sweden	1994	50.7	2.6	9.1	3.0	30.3	5.7	1986-94	2.4	1.7
United Kingdom	1995	51.5	3.3	7.2	3.3 [1]	28.3	9.4	1985-96	4.1	2.9
European Union[6]	1994	48.4	2.5	7.7	2.7	35.5 [2] →		1986-94	3.1	2.4
Total OECD[7]	1994	50.9	2.9	6.9	2.8	38.2 [2] →		1986-94	3.5	2.9

1. Secretariat estimate.
2. Includes Community, social and personal services.
3. Includes medium-high-technology industries.
4. Includes Shipbuilding.
5. Germany refers to western Germany.
6. Calculated with above EU countries, excluding Austria, Belgium and Portugal for shares; excluding Portugal for growth.
7. Calculated with above countries, excluding Austria, Belgium and Portugal for shares; excluding Mexico, New Zealand, Iceland and Portugal for growth.

Source: OECD, STAN database and Main Industrial Indicators, 1999.

Table 2.3.1. **Information and communication technology (ICT) intensity, current prices**

ICT expenditures as a percentage of GDP

	1992	1993	1994	1995	1996	1997				Average annual growth rate 1992-97	Contributions to growth		
						Total	IT hardware	IT services and software	Telecom-munications		IT hardware	IT services and software	Telecom-munications
Canada	6.6	6.6	6.9	6.9	7.1	7.5	1.3	3.5	2.7	1.8	0.6	0.6	0.7
Mexico	3.1	3.4	3.5	3.7	3.8	3.5	0.6	0.8	2.1	1.7	0.5	0.6	0.7
United States	7.2	7.3	7.4	7.6	7.7	7.8	1.7	3.4	2.7	1.2	1.1	0.2	0.0
Australia	6.9	7.5	7.6	7.4	7.4	8.1	1.4	2.5	4.2	2.3	1.0	-0.1	1.4
Japan	5.5	5.2	5.1	5.3	6.4	7.4	1.1	2.7	3.6	4.3	0.2	-0.2	4.3
Korea	4.7	4.7	4.7	4.9	6.1	6.1	1.7	0.9	3.6	3.8	1.2	-0.4	3.0
New Zealand	9.0	8.5	8.5	8.3	7.9	8.6	1.3	2.9	4.4	-0.7	-0.1	-1.4	0.8
Austria	4.9	5.1	4.5	4.6	4.7	5.1	0.9	2.2	2.0	0.5	0.6	0.3	-0.3
Belgium	5.3	5.4	5.3	5.3	5.6	6.0	1.0	2.7	2.4	2.0	0.5	0.1	1.3
Czech Republic	5.6	5.5	5.4	6.0	5.8	6.5	1.5	2.4	2.5	2.1	0.2	-0.3	2.1
Denmark	6.0	6.3	5.9	6.1	6.3	6.5	1.2	3.0	2.3	1.2	0.4	0.3	0.5
Finland	4.5	5.0	5.3	5.5	5.7	6.0	1.3	2.2	2.4	4.1	1.1	0.7	2.3
France	5.7	6.0	5.6	5.8	5.9	6.4	0.9	3.3	2.2	1.7	0.1	1.1	0.5
Germany	5.2	5.4	5.2	5.1	5.2	5.6	0.9	2.4	2.3	1.0	0.5	0.3	0.1
Greece	2.2	2.2	3.5	3.7	3.8	4.0	0.4	0.6	3.1	8.7	0.8	0.3	7.6
Hungary	3.6	4.1	4.3	3.8	4.2	4.4	1.1	1.7	1.6	2.8	0.3	1.3	1.1
Ireland	5.3	5.2	5.6	5.6	5.9	5.7	0.8	1.4	3.5	1.1	-0.1	-0.5	1.7
Italy	3.6	3.8	4.1	4.1	4.1	4.3	0.6	1.4	2.4	2.6	-0.2	0.5	2.2
Netherlands	6.4	6.5	6.3	6.4	6.6	7.0	1.3	3.0	2.7	1.3	0.5	-0.1	0.9
Norway	5.5	5.6	5.3	5.5	5.5	5.7	1.2	2.3	2.2	0.7	0.5	0.2	0.0
Poland	1.8	2.0	2.2	2.3	2.4	2.7	0.8	0.9	1.0	5.8	1.4	2.0	2.4
Portugal	2.6	2.7	4.2	4.5	4.8	5.0	0.6	0.9	3.4	10.1	1.0	0.2	8.9
Spain	3.8	3.9	3.7	3.7	4.0	4.1	0.7	1.1	2.4	1.2	0.1	0.1	0.9
Sweden	7.5	8.4	7.8	7.6	7.6	8.3	1.7	3.8	2.8	1.4	0.5	1.3	-0.4
Switzerland	7.4	7.6	6.8	6.9	7.2	7.7	1.3	3.6	2.9	0.6	0.3	0.7	-0.4
Turkey	2.6	2.2	2.5	1.6	2.5	2.6	0.4	0.3	1.9	0.1	-0.8	0.4	0.6
United Kingdom	6.9	7.3	7.0	7.4	7.6	7.6	1.5	3.4	2.7	1.4	0.8	0.1	0.5
European Union	5.2	5.5	5.4	5.4	5.6	5.9	1.0	2.5	2.4	1.8	0.4	0.6	0.8
Total OECD	5.9	6.0	6.0	6.1	6.5	6.9	1.3	2.8	2.8	2.2	0.7	0.3	1.2

Source: OECD calculations from ADB database and World Information Technology and Services Alliance (WITSA) / International Data Corporation (IDC), 1998.

Table 2.4.1. **Percentage of households owning a personal computer**

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Canada	10.3	11.8	13.3	14.7	16.2	18.5	20.0	23.0	25.0	28.8	31.6	36.4	..	..
United States (November)	..	..	..	..	..	..	..	..	23.0	..	..	36.6	..	..
Australia	..	..	..	..	..	..	..	..	26.9	..	34.7	..	45.9	..
Japan (March)	..	11.7	9.7	11.6	10.6	11.5	12.2	11.9	13.9	15.6	17.3	22.1	25.2	..
Korea	..	..	..	..	..	..	8.6	10.4	12.0	13.4	..	..	..	..
New Zealand (March)	6.7	8.6	9.6	11.5	11.6	13.3	15.9	17.1	18.6	21.7	24.8	27.6	32.9	37.5
Denmark	..	..	..	..	..	..	15.0	27.0	33.0	37.0	45.0	..	..	..
Finland	..	..	..	..	8.0	10.3	12.5	14.8	17.0	19.0	24.0	35.0	38.0	..
France (May)	..	7.0	7.6	8.2	9.1	10.1	11.0	12.1	13.2	14.3	15.0	16.0	19.0	..
Italy	..	..	..	..	..	..	..	..	..	..	..	22.5	..	..
Netherlands	..	11.0	14.0	18.0	21.0	25.0	29.0	31.0	34.0	39.0	43.0	..	..	..
Norway	10.0	12.5	15.0	17.5	20.0	22.5	25.0	29.0	33.0	39.0	43.0	50.0	..	..

Source: OECD, compiled from national statistical offices, May 1999.

Table 2.5.1. **Total mobile cellular subscribers per 100 inhabitants**[1]

	Total mobile cellular subscribers per 100 inhabitants							Share of digital mobile cellulars in total, 1997
	1992	1993	1994	1995	1996	1997	Average annual growth rate 1992-97	
Canada[2]	3.6	4.6	6.4	8.8	11.5	14.1	31.4	-
Mexico	0.4	0.4	0.6	0.8	1.1	1.9	38.7	0.0
United States	4.3	5.6	8.5	11.8	16.3	20.4	36.8	11.7
Australia	2.5	3.9	6.2	10.7	21.5	26.0	59.2	51.5
Japan	1.4	1.7	3.5	8.2	16.7	30.4	85.7	95.4
Korea	0.6	1.1	2.2	3.7	7.0	15.1	89.2	77.3
New Zealand[2,3]	2.9	4.1	5.3	9.2	11.7	13.1	35.0	-
Austria	2.2	2.8	3.5	4.8	7.4	14.3	45.3	78.5
Belgium	0.6	0.7	1.3	2.3	4.7	9.6	73.2	98.2
Czech Republic	0.0	0.1	0.3	0.4	2.0	5.1	157.3	88.0
Denmark	4.1	6.9	9.7	15.7	25.1	27.5	46.5	84.0
Finland	7.0	9.1	12.8	19.9	42.2	45.6	45.3	78.0
France	0.8	0.8	1.4	2.5	4.2	9.8	66.8	97.8
Germany	1.2	2.2	3.0	4.6	7.1	9.9	52.3	94.2
Greece[4]	0.0	0.3	1.5	5.3	6.7	8.6	137.2	100.0
Hungary	0.2	0.4	1.4	2.6	4.7	7.1	98.9	88.8
Iceland	5.9	6.6	8.2	11.5	17.1	24.0	32.5	62.2
Ireland	1.3	1.6	2.3	3.7	8.2	14.4	62.8	64.8
Italy	1.4	2.1	3.9	6.9	11.2	20.5	71.8	71.1
Luxembourg	0.3	1.3	3.2	6.6	10.9	16.1	123.1	100.0
Netherlands	1.1	1.4	2.1	3.5	2.0	10.8	58.0	84.7
Norway	6.5	8.6	13.5	22.6	29.0	38.4	42.5	76.9
Poland[2]	0.0	0.0	0.1	0.2	0.6	2.1	225.8	-
Portugal	0.4	1.0	1.8	3.5	6.8	15.4	109.8	99.5
Spain	0.5	0.7	1.0	2.3	7.6	10.9	88.6	74.6
Sweden	7.5	9.0	15.8	22.8	28.3	35.8	36.6	76.2
Switzerland	3.1	3.7	4.6	6.2	9.2	14.4	36.0	85.3
Turkey	0.1	0.1	0.3	0.7	1.3	2.6	89.2	92.1
United Kingdom	2.6	3.8	6.8	9.8	11.7	14.3	40.6	78.8
European Union	1.5	2.2	3.7	5.9	9.0	14.0	55.9	82.6
Total OECD[2]	2.0	2.7	4.3	6.7	10.5	15.5	50.8	59.8

1. Data on cellular mobile subscribers include both digital and analogue, but not pagers.
2. The share of digital equipment in total is not available for Canada, New Zealand and Poland. These countries are excluded from total OECD.
3. Figures for 1996 and 1997 concern Telecom New Zealand only.
4. 1993-97 instead of 1992-97.

Source: OECD, *Communications Outlook 1999.*

Table 2.5.2. **Secure web servers for electronic commerce**

	September 1997	August 1998	Share in total OECD, September 1997	Share in total OECD, August 1998	Per 100 000 inhabitants, August 1998	Growth rate Sept.1997-Aug. 1998 in percent
Canada	547	1 023	5.61	4.60	3.42	87
Mexico	22	32	0.23	0.14	0.03	45
United States	7 513	16 663	77.01	74.92	6.13	122
Australia	249	677	2.55	3.04	3.71	172
Japan	196	528	2.01	2.37	0.42	169
Korea	19	41	0.19	0.18	0.09	116
New Zealand	58	101	0.59	0.45	2.77	74
Austria	26	106	0.27	0.48	1.30	308
Belgium	21	52	0.22	0.23	0.51	148
Czech Republic	6	26	0.06	0.12	0.25	333
Denmark	11	53	0.11	0.24	1.01	382
Finland	20	81	0.21	0.36	1.58	305
France	65	250	0.67	1.12	0.43	285
Germany	147	558	1.51	2.51	0.68	280
Greece	5	15	0.05	0.07	0.14	200
Hungary	7	19	0.07	0.09	0.19	171
Iceland	10	13	0.10	0.06	4.74	30
Ireland	17	61	0.17	0.27	1.71	259
Italy	88	193	0.90	0.87	0.34	119
Luxembourg	3	12	0.03	0.05	2.88	300
Netherlands	75	148	0.77	0.67	0.95	97
Norway	23	64	0.24	0.29	1.47	178
Poland	6	27	0.06	0.12	0.07	350
Portugal	16	31	0.16	0.14	0.32	94
Spain	120	265	1.23	1.19	0.67	121
Sweden	53	184	0.54	0.83	2.08	247
Switzerland	58	176	0.59	0.79	2.42	203
Turkey	4	14	0.04	0.06	0.02	250
United Kingdom	353	821	3.62	3.69	1.41	133
Not identified	18	7	0.18	0.03	..	-61
European Union	1 020	2 830	10.46	12.72	0.76	177
Total OECD	9 756	22 241	100.00	100.00	2.04	128
Non-OECD	396	983	-	-	0.02	148
World	10 152	23 224	-	-	0.40	129

Source: OECD, *Communications Outlook 1999.*

Table 2.6.1. **Human resources**

	Distribution of the population aged 25-64 by the highest completed level of education, 1996				Flows of graduates in science and engineering	
	Below upper secondary education	Upper secondary education	Non-university tertiary education	University-level education		Percentage of total employment
Canada	24	29	31	17	1996	0.12
Mexico	..	..	..	..	1994	0.06
United States	14	52	8	26	1995	0.12
Australia	43	32	10	15	1996	0.21
Japan	..	..	..	..	1996	0.04
Korea	39	42	..	19	-	..
New Zealand	40	35	14	11	1996	0.18
Austria	29	63	2	6	1996	0.05
Belgium	47	30	13	11	1993	0.05
Czech Republic	16	74	..	10	1996	0.02
Denmark	34	44	7	15	1995	0.04
Finland	33	46	9	12	1995	0.08
France	40	41	9	10	1993	0.16
Germany	19	60	9	13	1995	0.09
Greece	56	25	7	12	1993	0.06
Hungary	37	50	..	13	-	..
Ireland	50	28	12	11	1996	0.25
Italy	62	30	..	8	-	..
Luxembourg	71	18	..	11	-	..
Netherlands	37	40	..	23	-	..
Norway	18	55	11	16	1996	0.04
Poland[1]	26	61	3	10	1994	0.03
Portugal	80	9	3	7	1995	0.03
Spain	70	13	5	13	1995	0.13
Sweden	26	47	14	13	1996	0.07
Switzerland	20	58	12	10	1993	0.05
Turkey[2]	83	11	..	6	1994	0.03
United Kingdom	24	55	9	13	1995	0.19
European Union	..	..	..	..		0.12
Total OECD[3]	40	40	10	13		0.09

1. 1995.
2. 1997.
3. Average of above countries.

Sources: OECD, *Education at a Glance 1998* for the level of education;
OECD, based on data from UNESCO for graduates in science and engineering.

Table 3.1.1. **Gross domestic expenditure on R&D (GERD) as a percentage of GDP**

	1981	1985	1990	1991	1993	1995	1996	1997	1998
Canada	1.2	1.4	1.5	1.5	1.6	1.6	1.6	1.6	1.6
Mexico	..	..	..	..	0.2	0.3	..	..	..
United States	2.4	2.9	2.8	2.8 [10]	2.6	2.6	2.7	2.7	2.8
Australia[1]	1.0	1.1	1.4	..	1.6	1.6	1.7	..	..
Japan[2]	2.1	2.6	2.9	2.8	2.7	2.8	2.8 [10]	2.9	..
Korea	..	..	..	1.9	2.3	2.7	2.8	2.9	..
New Zealand	..	..	1.0	1.0	1.0	1.0	..	..	..
									..
Austria	1.1	1.3	1.4	1.5	1.5	1.5	1.5	1.5	1.6
Belgium[3]	1.4	1.7	1.7 [10]	1.6	1.6	1.6 [10]	..	..	..
Czech Republic	..	..	..	2.0	1.2	1.0 [10]	1.1	1.2	..
Denmark	1.1	1.3	1.6	1.7	1.8	1.9	2.0	2.0	2.1
Finland	1.2	1.6	1.9	2.1 [10]	2.2	2.4	2.6	2.8 [10]	2.9
France	2.0	2.3	2.4	2.4	2.5	2.3	2.3	2.2	..
Germany[4]	2.4	2.7	2.8	2.6 [10]	2.4 [10]	2.3	2.3	2.3	2.3
Greece[5]	0.2	0.3	0.4 [10]	0.4	0.5	..	..	..	..
Hungary	..	..	1.5	1.1	1.0	0.7 [10]	0.7	0.7	..
Iceland	0.6	0.7	1.0	1.2	1.3	1.5	1.5	1.6	..
Ireland	0.7	0.8	0.9	1.0	1.2	1.4	1.4	1.4	..
Italy	0.9	1.1	1.3	1.2 [10]	1.1	1.0	1.0	1.1	1.1
Netherlands	1.9	2.1	2.2 [10]	2.1	2.0	2.1 [10]	2.1	..	..
Norway[6]	1.2	1.5 [10]	1.7	1.7	1.7	1.7 [10]	..	1.7	..
Poland	..	..	..	..	..	0.7	0.8	0.8	..
Portugal[7]	0.3	0.4	0.5	..	0.6	0.6	..	0.7	..
Spain	0.4	0.6	0.9	0.9	0.9 [10]	0.9	0.9	0.9	0.9
Sweden[6]	2.3	2.9	2.9	2.9	3.4 [10]	3.6 [10]	..	3.9 [10]	..
Switzerland[5,8]	2.2	2.8 [10]	2.8 [10]	..	2.7	..	2.7	..	..
Turkey	..	..	0.3	0.5	0.4	0.4	0.5	..	..
United Kingdom	2.4	2.2 [10]	2.2	2.1	2.2	2.0	2.0	1.9	..
European Union	1.7	1.9	2.0	2.0 [10]	1.9 [10]	1.8	1.8	1.8	..
Total OECD[9]	2.0	2.3	2.4	2.3 [10]	2.3	2.2 [10]	2.2	2.2	..

1. 1984 instead of 1985; 1992 instead of 1993; 1994 instead of 1995.

2. Adjusted by OECD up to 1995.

3. 1979 instead of 1981 and 1989 instead of 1990.

4. Figures for Germany from 1991 onwards refer to unified Germany.

5. 1986 instead of 1985 and 1989 instead of 1990.

6. 1989 instead of 1990.

7. 1980 instead of 1981; 1984 instead of 1985 and 1992 instead of 1993.

8. 1992 instead of 1993.

9. Including Mexico and Korea from 1991 ownwards, and Czech Republic, Hungary and Poland from 1995 ownwards.

10. Break in series from previous year for which data are available.

Source: OECD, MSTI database, April 1999.

Table 3.1.2. **Researchers[1] per ten thousand labour force**

	1981	1985	1989	1991	1993	1995	1996	1997
Canada	31	40	44	46	50	54	..	..
Mexico	..	..	..	..	4	6	..	..
United States	62	68 [10]	74	75	74	..	..	..
Australia[2]	35	41	50	50	60	64	66	..
Japan[3]	54	64	73	75	80	83	92 [10]	92
Korea	..	..	..	..	..	48	47	48
New Zealand	..	..	30	29	37 [10]	35	..	..
Austria	21	23	25	..	34	..	..	..
Belgium	31	36	43 [10]	43	..	53 [10]	..	..
Czech Republic	..	..	..	..	27	23 [10]	25	24
Denmark	25	31	38	41	47	57	58	59
Finland[4]	..	37	41	55	61	67	..	83
France	36	43	50	52	58	60	61	..
Germany[5,6]	44	50	59 [10]	61 [10]	59 [10]	59	..	..
Greece	..	..	14	16	20	..	..	..
Hungary	..	..	..	..	27	26	26	28
Iceland	31	38	54	49	57	72	61	76
Ireland	17	22	32	39	45	57	..	..
Italy	23	27	31	31	32 [10]	32	33	..
Netherlands	34	42 [10]	40	..	45 [10]	46 [10]	46	..
Norway	38	47	56	63	69	73 [10]	..	76
Poland	..	..	..	..	..	29	31	32
Portugal[7]	7	10	11 [10]	12	20 [10]	24	..	27
Spain	14	15	22	26	28	30	32	33
Sweden	41	50	57 [10]	59	68 [10]	78	..	86
Switzerland[8]	..	43	44 [10]	..	45 [10]	..	55	..
Turkey	..	..	..	6	6	7	8	..
United Kingdom	47	47	47	45 [10]	47	51 [10]	51	..
European Union	33	37	42	44 [10]	46 [10]	49	50	..
Total OECD[9]	44	50	55	54 [10]	55	55 [10]	..	..

1. Or university graduates.
2. 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993 and 1994 instead of 1995.
3. Adjusted by OECD up to 1995.
4. 1983 instead of 1985 and 1987 instead of 1989.
5. Figures for Germany from 1991 onwards refer to unified Germany.
6. 1992 instead of 1993.
7. 1980 instead of 1981; 1986 instead of 1985; 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993.
8. 1986 instead of 1985 and 1992 instead of 1993.
9. Including Mexico from 1991 onwards, and Czech Republic, Hungary, Korea and Poland as from 1995 ownward
10. Break in series from previous year for which data are available.

Source: OECD, MSTI database, April 1999.

Table 3.1.3. **Trends in gross domestic expenditure on R&D (GERD)**

Percentage, based on constant prices

	Average annual growth rate				Percentage change from previous year(s)			
	1981-85 [1]	1985-90 [1]	1991-95 [1]	1995-97 [1]	1995	1996	1997	1998
Canada	6.6	3.1	3.5	3.0	1.1	2.1	4.0	3.2
Mexico	..	..	17.4	..	-1.0	..	..	..
United States	7.0	2.1	1.0	5.7	6.4	5.7	5.6	6.5
Australia	8.3	4.7	7.8	5.4	..	5.4	..	..
Japan[2]	8.5	6.7	0.4	.. [5]	6.6	.. [5]	3.9	..
Korea	..	..	16.3	10.4	13.2	11.4	9.4	..
New Zealand	..	..	3.7	..	2.0	..	..	..
Austria	4.3	5.7	2.5	1.4	1.8	0.0	2.8	4.8
Belgium	3.6	.. [5]	-1.7	..	3.6	..	..	..
Czech Republic	..	..	-17.6	9.3	.. [5]	6.3	12.4	..
Denmark	7.0	6.9	5.2	6.0	6.8	7.9	4.2	4.1
Finland	10.5	7.3	4.4	.. [5]	5.6	14.3	.. [5]	10.4
France	4.9	4.5	0.4	-0.4	0.5	0.6	-1.5	..
Germany[3]	4.3	.. [5]	-1.4	1.8	0.7	0.7	2.9	3.3
Greece	11.5	.. [5]	13.3	..	..	..	..	..
Hungary	..	..	-6.2	2.2	-15.5	-10.1	16.1	..
Iceland	5.9	9.4	7.9	5.5	12.0	3.2	7.9	..
Ireland	5.6	6.3	16.7	12.0	15.9	12.8	11.2	..
Italy	8.3	5.9	-3.9	4.8	-2.2	2.2	7.6	3.6
Netherlands	4.5	3.6	.. [5]	4.1	4.1	4.1	..	..
Norway	.. [5]	2.5	3.9	4.6	.. [5]	..	4.6	..
Poland	..	..	..	7.7	-3.3	9.3	6.1	..
Portugal	7.5	14.0	3.8	9.4	-1.3	..	9.4	..
Spain	8.6	13.9	-1.3	4.0	2.8	5.2	2.8	5.3
Sweden	8.2	3.0	.. [5]	.. [5]	.. [5]	..	.. [5]	..
Switzerland	.. [5]	.. [5]	0.9	..	..	0.9	..	..
Turkey	..	..	-4.4	27.1	12.7	27.1	..	..
United Kingdom	-1.3	2.8	1.0	-1.1	-1.5	-1.3	-0.8	..
European Union	4.5	4.3	.. [5]	1.9	0.9	1.5	2.4	..
Total OECD[4]	6.4	3.7	.. [5]	4.5	.. [5]	4.4	4.5	..

1. Or nearest years.
2. Adjusted by OECD up to 1995.
3. Figures for Germany from 1991 onwards refer to unified Germany.
4. Including Korea and Mexico from 1991 onwards, and Czech Republic, Hungary and Poland from 1995 onwards.
5. Break in series from previous year for which data are available.

Source: OECD, MSTI and R&D databases, April 1999.

Table 3.1.4. **Trends in total numbers of researchers**[1]

	Average annual growth rate				Percentage change from previous year(s)				
	1981-85 [2]	1985-89 [2]	1991-93 [2]	1993-96 [2]	1993	1994	1995	1996	1997
Canada	7.6	4.8	5.1	4.2	5.8	5.1	3.4	..	..
Mexico	..	..	..	17.4	..	21.0	13.9	..	..
United States	5.3	3.6	0.2	..	0.2	..	..	..	..
Australia	5.4	10.2	9.9	3.9	..	4.4	..	3.5	..
Japan[3]	5.2	4.7	3.5	.. [6]	3.0	2.8	2.0	.. [6]	1.3
Korea	..	..	..	-1.0	..	..	..	-1.0	3.2
New Zealand	..	..	.. [6]	-0.8	5.0	..	-0.8	..	..
Austria	3.2	3.6	9.9	..	9.9	..	..	..	..
Belgium	3.7	4.1	..	1.6	..	.. [6]	1.6	..	..
Czech Republic	..	..	-18.5	.. [6]	-32.1	-2.2	.. [6]	8.2	-2.6
Denmark	6.0	6.4	6.5	6.2	6.3	..	8.0	2.6	2.5
Finland	3.0	7.3	4.2	8.6	4.2	..	5.2	..	12.0
France	4.6	4.2	6.0	2.0	3.0	2.3	1.4	2.4	..
Germany[4]	3.6	.. [6]	.. [6]	-0.5	..	..	-0.5	..	..
Greece	..	..	13.5	..	13.5	..	..	..	..
Hungary	..	..	-9.6	-4.1	-4.0	-0.6	-10.7	-0.9	7.2
Iceland	7.9	10.0	8.9	3.7	15.1	3.7	27.4	-15.6	24.4
Ireland	7.4	9.9	10.5	15.2	13.7	15.9	14.5	..	..
Italy	5.2	4.5	-0.5	0.9	0.0	1.7	-0.2	1.2	..
Netherlands	5.6	2.5	4.8	0.4	4.8	.. [6]	-0.5	1.3	..
Norway	6.6	5.8	4.7	.. [6]	4.7	..	.. [6]	..	4.8
Poland	..	..	..	5.4	..	..	6.3	4.1	6.0
Portugal	10.4	.. [6]	.. [6]	7.1	..	..	7.1	..	8.1
Spain	2.5	11.6	3.3	6.0	4.0	10.4	-1.1	9.1	4.4
Sweden	5.2	4.0	.. [6]	6.0	.. [6]	..	7.3	..	4.7
Switzerland	..	.. [6]	.. [6]	5.1	..	..	..	5.1	..
Turkey	..	..	6.7	10.0	8.2	6.3	9.6	14.1	..
United Kingdom	0.8	0.4	2.7	1.4	3.1	.. [6]	2.8	0.0	..
European Union	3.4	.. [6]	1.9	2.7	1.7	..	2.9	2.5	..
Total OECD[5]	4.6	4.1	1.8	.. [6]	1.8	..	.. [6]	..	..

1. Or university graduates.
2. Or nearest years.
3. Adjusted by OECD up to 1995.
4. Figures for Germany from 1991 onwards refer to unified Germany.
5. Including Mexico from 1991 onwards, and Czech Republic, Hungary, Korea and Poland from 1995 onwards.
6. Break in series from previous year for which data are available.

Source: OECD, MSTI database, April 1999.

Table 3.1.5. **Estimates of share of OECD gross domestic expenditure on R&D (GERD) and of total number of researchers[1] by OECD country/zone**

Percentage

	Share of GERD [2]						Share of researchers [2]				
	1981	1985	1989	1993	1995	1997	1981	1985	1989	1993	1995
Canada	2.2	2.2	2.1	2.3	2.4	2.3	2.5	2.8	2.9	3.0	2.9
Mexico	..	..	..	0.3	0.4	0.4	..	..	..	0.6	0.7
United States	47.2	48.3	45.4	42.5 [7]	41.8	42.7	43.3	43.0 [7]	42.2	39.2	36.0
Australia	1.0	1.0	1.1	1.3	1.5	1.4	1.5	1.7	1.9	2.2	2.2
Japan[3]	14.6	15.8	17.6	17.7	18.0	18.2 [7]	19.7	20.4	20.9	21.4	20.0
Korea	..	..	..	2.7	3.5	3.9	..	..	..	..	3.6
New Zealand	0.2	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.2	0.3 [7]	0.2
Austria	0.5	0.5	0.5	0.6	0.6	0.6	0.4	0.4	0.4	0.5	0.6
Belgium	0.9	0.8 [7]	0.8 [7]	0.8 [7]	0.8	0.8	0.8	0.8	0.8 [7]	0.8 [7]	0.8 [7]
Czech Republic	..	..	..	..	0.3	0.3	..	..	..	..	0.4
Denmark	0.3	0.4	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.6	0.6
Finland	0.3	0.4	0.4	0.4 [7]	0.5	0.6	0.5	0.6	0.6	0.6	0.6
France	7.0	6.6	6.8	6.8	6.3	5.6	5.4	5.5	5.5	5.9	5.5
Germany[4]	9.9	9.2	9.6 [7]	9.3 [7]	9.0	8.5	7.9	7.7	8.1 [7]	9.3 [7]	8.4
Greece	0.1	0.1	0.1 [7]	0.1	0.1	0.1	0.2	0.2	0.2 [7]	0.3	0.4
Hungary	..	..	..	..	0.2	0.1	..	..	..	..	0.4
Iceland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ireland	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.3	0.3
Italy	2.9	3.1	3.4	2.9 [7]	2.6	2.7	3.3	3.4	3.5	3.0	2.7
Netherlands	1.7	1.5 [7]	1.5	1.4 [7]	1.5	1.5	1.3	1.3 [7]	1.2	1.3	1.2 [7]
Norway	0.3	0.4 [7]	0.4	0.4	0.4 [7]	0.4	0.5	0.5	0.6	0.6	0.6 [7]
Poland	..	..	..	..	0.4	0.4	..	..	..	..	1.8
Portugal	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3 [7]	0.4 [7]	0.4
Spain	0.6	0.7	1.0	1.2 [7]	1.1	1.1	1.2	1.1	1.5	1.8	1.7
Sweden	1.2	1.3	1.3	1.3 [7]	1.4 [7]	1.4	1.1	1.2	1.2	1.2 [7]	1.2
Switzerland	1.2	1.2 [7]	1.2 [7]	1.1	1.1	1.0	0.8	0.8	0.8	0.8 [7]	0.8
Turkey	0.3	0.3	0.2	0.4	0.3	0.4	0.6	0.5	0.5	0.6	0.6
United Kingdom	7.3	6.0 [7]	5.9	5.4	4.9	4.6	8.0	7.0	6.1	5.5 [7]	5.3 [7]
European Union	33.0	30.8	31.9 [7]	31.1 [7]	29.6	28.3	30.9	30.0	30.0 [7]	31.5 [7]	29.8
Total OECD[5,6]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1. Or university graduates
2. Based on OECD estimates for missing data.
3. Adjusted up to 1995.
4. Figures for Germany from 1991 onwards refer to unified Germany.
5. Mexico included as from 1991 onwards ; and Czech Republic, Hungary and Poland included as from 1995.
6. Korea included in expenditures as from 1991 and in researchers as from 1995.
7. Break in series from previous year for which data are available.

Source: OECD, MSTI and R&D databases, April 1999.

Table 3.2.1. **R&D expenditure by source of funds in per cent**

	Business enterprise						Government						Other national sources						Abroad					
	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997
Canada	40.8	41.5	41.3	44.1	46.2	48.9	50.6	44.7	43.4	40.3	35.4	32.3	4.8	4.5	5.4	5.3	5.6	5.2	3.8	9.3	10.0	10.3	12.8	13.5
Mexico	..	..	..	14.3	17.6	..	..	..	..	73.4	66.2	..	..	..	..	10.1	9.5	..	..	..	..	2.3	6.7	..
United States	48.8	52.2	57.6 [10]	58.3	60.4	64.3	49.3	45.6	38.7 [10]	37.7	35.6	31.9	1.9	2.2	3.7 [10]	4.0	4.0	3.8	..	..	..	..	..	..
Australia[1]	20.2	41.7	41.1	44.0	46.1	47.0	72.8	54.2	54.9	50.2	47.5	46.4	2.1	2.8	2.7	3.9	4.4	4.5	1.0	1.3	1.2	1.8	2.0	2.1
Japan[2,3]	67.7 [8]	77.1 [8]	77.4 [8]	73.4 [8]	72.3 [8]	73.4 [10]	24.9 [9]	16.8 [9]	16.4 [9]	19.7 [9]	20.9 [9]	18.7 [10]	7.3 [9]	6.1 [9]	6.1 [9]	6.8 [9]	6.7 [9]	7.8 [10]	0.1 [8]	0.1 [8]	0.1 [8]	0.1 [8]	0.1 [8]	0.1 [10]
Korea	..	..	..	..	76.3	72.5	..	..	..	..	19.0	22.9	..	..	..	..	4.7	4.5	..	..	..	..	0.0	0.1
New Zealand	..	33.2	27.4 [10]	33.9	33.7	..	..	64.7	61.8 [10]	54.8	52.3	..	..	0.1	8.2 [10]	8.9	10.1	..	..	2.0	2.5 [10]	2.4	3.9	..
Austria	50.2	53.0	50.2	49.0	47.8	49.3	46.9	43.4	46.5	48.0	48.4	46.2	0.4	0.3	0.3	0.4	0.4	0.4	2.5	3.2	3.0	2.6	3.4	4.1
Belgium	..	63.9	64.8	62.7	64.2 [10]	..	..	32.0	31.3	32.5	26.4 [10]	..	..	1.5	0.9	1.0	2.5 [10]	..	..	2.7	3.0	3.9	6.9 [10]	..
Czech Republic	..	..	..	..	63.1	59.8	..	..	..	..	32.3 [9]	30.8 [9]	..	..	..	..	1.3	7.5	..	..	..	..	3.3	1.9
Denmark	42.5	46.8	51.4	50.0	46.7	50.2	53.5	45.5	39.7	37.7	39.2	33.7	2.0	4.6	4.6	5.0	4.1	4.8	2.1	3.1	4.4	7.3	9.9	11.3
Finland	54.5	62.2	56.3 [10]	56.6	59.5	62.9 [10]	43.4	35.3 [10]	40.9 [10]	39.8	35.1	30.9 [10]	1.1	1.6	1.5 [10]	1.8	1.0	0.9 [10]	1.0	0.9	1.3 [10]	1.8	4.5	5.3 [10]
France[3]	40.9	43.9	42.5	47.0 [10]	48.3	48.5	53.4	48.1	48.8	43.5 [10]	41.9	41.5	0.6	0.6	0.7	1.3 [10]	1.7	1.6	5.0	7.4	8.0	8.1	8.0	8.3
Germany[4]	57.9	63.3	61.7 [10]	61.5 [10]	61.1	61.6	40.7	34.1	35.8 [10]	36.5 [10]	36.8	36.3	0.4	0.5	0.5 [10]	0.3 [10]	0.3	0.2	1.0	2.1	1.9 [10]	1.6 [10]	1.8	1.9
Greece	21.4	19.4 [10]	21.7	20.2	..	..	78.6	68.9 [10]	57.7	46.9	..	..	..	0.1	0.7	2.6	..	..	..	11.6	19.9	30.3	..	..
Hungary	..	..	56.0	53.1	38.4 [10]	36.6	..	..	40.0	40.5	53.1 [10]	54.8	..	..	0.1	0.4	0.5 [10]	0.5	..	..	1.8	2.5	4.8 [10]	4.3
Iceland	5.7	23.9	24.5	31.6	34.6	38.4	85.6	65.8	69.7	62.9	57.3	54.0	5.0	7.3	1.7	2.3	3.7	3.4	4.3	3.0	4.1	3.2	4.4	4.2
Ireland	37.7	55.4	60.6	62.3	68.5	69.6	56.5	34.0	27.8	27.9	21.6	22.0	1.1	2.2	2.2	1.9	1.8	1.7	4.8	8.4	9.4	7.9	8.1	6.7
Italy	50.1 [8]	46.4 [8]	44.4 [10]	44.3	41.7	44.3	47.2 [8]	49.5 [8]	49.6 [10]	51.3	53.0	49.8	0.0 [8]	0.0 [8]	0.0 [10]	0.0	0.0	0.0	2.7 [8]	4.1 [8]	6.1 [10]	4.4	5.3	6.0
Netherlands[3]	46.3	53.4 [10]	47.8 [10]	44.1	46.0 [10]	48.5	47.2	41.8 [10]	48.6 [10]	48.5	42.2 [10]	41.5	1.3	1.7 [10]	1.8 [10]	2.1	2.6 [10]	2.4	5.2	3.0 [10]	1.9 [10]	5.3	9.3	7.6
Norway	40.1	45.6 [10]	44.5	44.3	49.9 [10]	49.4	57.2	50.8 [10]	49.5	49.1	44.0 [10]	42.9	1.4	1.3	1.3	1.3	1.2 [10]	1.2	1.4	2.3	4.6	5.4	4.9 [10]	6.5
Poland	..	..	..	..	36.0	35.1	..	..	..	..	60.2	61.7	..	..	..	..	2.1	1.6	..	..	..	..	1.7	1.6
Portugal[5]	30.0	27.4	27.0	20.2	19.5	21.1	61.9	66.1	61.8	59.4	65.3	68.3	4.8	3.9	6.5	5.4	3.3	4.4	3.3	2.7	4.6	14.9	11.9	6.1
Spain	42.8	47.8	48.1	41.0 [10]	44.5	44.7	56.0	46.8	45.7	51.6 [10]	43.6 [10]	43.6	0.1	0.7	0.6	1.0 [10]	5.2 [10]	4.9	1.1	4.7	5.6	6.4 [10]	6.7	6.7
Sweden	54.9 [9]	58.6 [9]	61.9 [9]	61.2 [9,10]	65.6 [10]	67.7 [10]	42.3 [9]	38.1 [9]	34.0 [9]	33.0 [9,10]	28.8 [10]	25.2 [10]	1.4 [9]	1.7 [9]	2.7 [9]	3.0 [9,10]	2.2 [10]	2.1 [10]	1.5 [9]	1.6 [9]	1.5 [9]	2.9 [9,10]	3.4 [10]	3.4 [10]
Switzerland[6]	75.1	73.9 [10]	..	67.4	..	67.5	24.9	23.2 [10]	..	28.4	..	26.9	..	1.3	..	2.3	..	2.5	..	1.6	..	1.9	..	3.1
Turkey[3]	..	..	28.5	31.8	32.9	36.8	..	..	70.1	65.2	62.4	56.6	..	..	1.3	2.2	2.7	4.7	..	..	0.2	0.8	2.0	1.9
United Kingdom	42.0	50.6 [10]	49.6	51.5	48.0	49.5	48.1	36.4 [10]	35.0	32.5	33.2	30.8	3.0	2.9 [10]	3.5	4.1	4.4	4.8	6.9	10.1 [10]	11.9	11.9	14.4	15.0
European Union[3]	48.6	53.2 [10]	51.9 [10]	52.5 [10]	52.5	52.8	46.7	40.5 [10]	41.2 [10]	40.0 [10]	39.0	38.3	1.1	1.1 [10]	1.3 [10]	1.5 [10]	1.8	1.8	3.6	5.1 [10]	5.6 [10]	5.9 [10]	6.7	7.1
Total OECD[7]	51.2	56.7	59.0 [10]	58.9	59.9 [10]	62.3	45.0	38.9	35.5 [10]	35.1	33.8 [10]	31.4	2.5	2.6	3.4 [10]	3.8	3.9 [10]	3.8	..	..	..	..	..	..

1. 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993; 1994 instead of 1995; 1996 instead of 1997.
2. Adjusted by OECD up to 1995.
3. 1996 instead of 1997.
4. Figures for Germany and zone totals from 1991 onwards refer to unified Germany.
5. 1982 instead of 1981; 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993.
6. 1992 instead of 1993; 1996 instead of 1997.
7. Including Mexico and Korea from 1991 onwards; and including Czech Republic, Hungary and Poland as from 1995 onwards.
8. Overestimated.
9. Underestimated
10. Break in series from previous year for which data are available.

Source: OECD, MSTI database, April 1999.

Table 3.2.2. **Financing of expenditures on R&D by source as a percentage of GDP**

	Business enterprise						Government						Other national sources						Abroad					
	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997
Canada	0.51	0.57	0.63	0.70	0.73	0.78	0.63	0.62	0.66	0.64	0.56	0.52	0.06	0.06	0.08	0.08	0.09	0.08	0.05	0.13	0.15	0.16	0.20	0.22
Mexico	..	..	0.10	0.03 [10]	0.05	..	..	..	0.21	0.16 [10]	0.20	..	..	..	..	0.02	0.03	..	..	..	..	0.01	0.02	..
United States	1.18	1.43	1.62	1.52	1.58	1.74	1.20	1.25	1.09 [10]	0.99	0.93	0.86	0.05	0.06	0.10 [10]	0.11	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Australia[1]	0.20	0.52	0.56	0.70	0.75	0.79	0.73	0.68	0.75	0.80	0.77	0.78	0.02	0.04	0.04	0.06	0.07	0.08	0.01	0.02	0.02	0.03	0.03	0.04
Japan[2,3]	1.44 [8]	2.13 [8]	2.18 [8]	1.97 [8]	2.00 [8]	2.08 [10]	0.53	0.46	0.46	0.53	0.58	0.53 [10]	0.15	0.17	0.17	0.18	0.19	0.22 [10]	0.00	0.00	0.00	0.00	0.00	0.00 [10]
Korea	..	..	..	..	2.05	2.10	..	..	..	..	0.51	0.66	..	..	..	..	0.13	0.13	..	..	..	..	0.00	0.00
New Zealand	0.18	0.29	0.27	0.35	0.33	..	0.83	0.57	0.61 [10]	0.56	0.51	..	..	0.00	0.08	0.09	0.10	..	..	0.02	0.02	0.02	0.04	..
Austria	0.57	0.73	0.75	0.73	0.74	0.75	0.53	0.59	0.69	0.72 [8]	0.75	0.70	0.00	0.00	0.00	0.01	0.01	0.01	0.03	0.04	0.04	0.04	0.05	0.06
Belgium	..	1.06	1.06	0.99	1.02 [10]	..	..	0.53	0.51	0.51	0.42 [10]	..	..	0.02	0.02	0.02	0.04 [10]	..	..	0.04	0.05	0.06	0.11 [10]	..
Czech Republic	..	..	..	..	0.65	0.71	..	..	0.60 [9]	0.28 [9]	0.33 [9,10]	0.36 [9]	..	..	..	..	0.01	0.09	..	..	..	..	0.03	0.02
Denmark	0.47	0.73	0.87	0.90	0.89	1.02	0.59	0.71	0.68	0.68	0.75	0.68	0.02	0.07	0.08	0.09	0.08	0.10	0.02	0.05	0.07	0.13	0.19	0.23
Finland	0.65	1.14	1.17	1.25	1.40	1.75	0.52	0.65 [10]	0.85 [10]	0.88	0.82	0.86	0.01	0.03	0.03	0.04	0.02	0.02	0.01	0.02	0.03	0.04	0.10	0.15
France[3]	0.81	1.02	1.02	1.15 [10]	1.13	1.13	1.05	1.12	1.17	1.07 [10]	0.98	0.96	0.01	0.02	0.02	0.03	0.04	0.04	0.10	0.17	0.19	0.20	0.19	0.19
Germany[4]	1.41	1.82	1.61 [10]	1.49	1.41	1.42	0.99	0.98	0.94 [10]	0.88 [10]	0.85	0.84	0.01	0.01	0.01 [10]	0.01	0.01	0.01	0.02	0.06	0.05 [10]	0.04 [10]	0.04	0.04
Greece	0.04	0.07	0.08	0.10	..	..	0.14	0.26 [10]	0.21	0.22	..	..	..	0.00	0.00	0.01	..	..	..	0.04	0.07	0.14	..	..
Hungary	..	..	0.60 [8]	0.52 [8]	0.28 [10]	0.27	..	..	0.43 [8]	0.40 [8]	0.39 [8,10]	0.40	..	..	0.00	0.00	0.00	0.00	..	..	0.02	0.02	0.04	0.03
Iceland	0.04	0.24	0.28	0.42	0.53	0.60	0.54	0.67	0.81	0.84	0.88	0.84	0.03	0.08	0.02	0.03	0.06	0.05	0.03	0.03	0.05	0.04	0.07	0.07
Ireland	0.27	0.46	0.58	0.75	0.93	0.99	0.40	0.28	0.27	0.33	0.29	0.31	0.01	0.02	0.02	0.02	0.03	0.02	0.03	0.07	0.09	0.10	0.11	0.10
Italy	0.44 [8]	0.58 [8]	0.55 [10]	0.50	0.42	0.48	0.42 [8]	0.61 [8]	0.61 [10]	0.58	0.53	0.54	..	..	..	..	..	..	0.02	0.05	0.08	0.05	0.05	0.06
Netherlands[3]	0.86	1.13	0.98	0.88	0.95 [10]	1.01	0.88	0.89 [10]	0.99 [10]	0.97	0.87	0.87	0.02	0.04	0.04	0.04	0.05	0.05	0.10	0.06	0.04	0.11	0.19	0.16
Norway	0.47	0.77 [10]	0.74	0.77	0.85 [10]	0.83	0.67	0.86	0.82	0.85	0.75	0.72	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.08	0.09	0.08	0.11
Poland	..	..	..	..	0.27	0.27	..	..	..	..	0.45	0.47	..	..	..	..	0.02	0.01	..	..	..	..	0.01	0.01
Portugal[5]	0.09	0.12	0.14	0.13	0.11	0.14	0.19	0.28	0.33	0.37	0.38	0.45	0.01	0.02	0.03	0.03	0.02	0.03	0.01	0.01	0.02	0.09	0.07	0.04
Spain	0.18	0.36	0.42	0.38	0.38	0.39	0.24	0.35	0.40	0.47 [10]	0.37 [10]	0.38	0.00	0.00	0.01	0.01	0.04	0.04	0.00	0.04	0.05	0.06	0.06	0.06
Sweden	1.26 [9]	1.72 [9]	1.78 [9]	2.07 [9,10]	2.36	2.61	0.97 [9]	1.12 [9]	0.98 [9]	1.12 [9,10]	1.04	0.97	0.03 [9]	0.05 [9]	0.08 [9]	0.10 [9]	0.08	0.08	0.03 [9]	0.05 [9]	0.04 [9]	0.10 [9,10]	0.12	0.13
Switzerland[6]	1.64	2.09 [10]	..	1.79	..	1.85	0.54	0.65 [10]	..	0.75	..	0.74	..	0.04	..	0.06	..	0.07	..	0.04	..	0.05	..	0.08
Turkey[3]	..	..	0.15	0.14	0.13	0.17	..	..	0.37	0.29	0.24	0.26	..	..	0.01	0.01	0.01	0.02	..	..	0.00	0.00	0.01	0.01
United Kingdom	1.00	1.09 [10]	1.05	1.11	0.97	0.93	1.14	0.78 [10]	0.74	0.70	0.67	0.57	0.07	0.06	0.07	0.09	0.09	0.09	0.16	0.22 [10]	0.25	0.26	0.29	0.28
European Union[3]	0.83	1.05 [10]	1.01 [10]	1.01 [10]	0.97	0.97	0.80	0.80 [10]	0.80 [10]	0.77 [10]	0.72	0.70	0.02	0.02	0.02 [10]	0.03	0.03	0.03	0.06	0.10	0.11 [10]	0.11 [10]	0.12	0.13
Total OECD[7]	1.02	1.32	1.38 [10]	1.32	1.29 [10]	1.38	0.90	0.90	0.83 [10]	0.79	0.73 [10]	0.69	0.05	0.06	0.08 [10]	0.08	0.08 [10]	0.08	..	..	..	..	..	..

1. 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993; 1994 instead of 1995; 1996 instead of 1997.
2. Adjusted by OECD up to 1995.
3. 1996 instead of 1997.
4. Figures for Germany and zone totals from 1991 onwards refer to unified Germany.
5. 1982 instead of 1981; 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993.
6. 1992 instead of 1993; 1996 instead of 1997.
7. Including Mexico and Korea from 1991 onwards; and including Czech Republic, Hungary and Poland as from 1995 onwards.
8. Overestimated.
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10. Break in series from previous year for which data are available.

Source: OECD, R&D database, April 1999.

Table 3.2.3. **R&D expenditure by sector of performance in per cent**

	Business enterprise						Higher education						Government						Private non-profit sector					
	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997
Canada	48.1	54.1	53.3	56.5	59.9	63.4	26.7	24.7	26.1	24.7	23.1	21.5	24.4	20.2	19.5	17.7	15.8	14.0	0.8	1.0	1.1	1.1	1.2	1.2
Mexico	..	..	..	10.4	20.8	..	..	..	..	53.7	45.8	..	..	..	..	35.5	33.0	..	..	..	..	0.4	0.4	..
United States	70.3	71.0	72.8 [11]	70.8	71.9	74.3	14.5	15.5	14.1 [11]	15.5	15.3	14.4	12.1	10.7	9.8 [11]	10.2	9.6	8.2	3.1	2.8	3.3	3.5	3.3	3.0
Australia[1]	25.0	42.1	40.2	44.1	46.9	47.4	28.5	25.1	25.5	26.1	24.5	26.5	45.1	31.6	32.6	28.1	26.6	24.0	1.3	1.2	1.6	1.6	2.1	2.0
Japan[2]	66.0 [9]	74.3 [9]	75.4 [9]	71.1 [9]	70.3 [9]	72.0 [11]	17.6 [10]	12.5 [10]	12.1 [10]	14.0 [10]	14.5 [10]	14.3 [11]	12.0 [10]	8.6 [10]	8.1 [10]	10.0 [10]	10.4 [10]	8.8 [11]	4.5 [9]	4.5 [9]	4.4 [9]	4.9 [9]	4.8 [9]	4.8 [11]
Korea	..	..	..	..	73.7	72.6	..	..	..	..	8.2	10.4	..	..	..	..	17.0	15.8	..	..	..	..	1.1	1.2
New Zealand	..	32.2	26.8 [11]	30.1	27.0	..	..	19.2	28.6 [11]	28.3	30.7	..	..	48.6	44.6 [11]	41.6	42.2	..	..	..	..	..	..	..
Austria	55.8	58.6	..	55.9	..	..	32.8	32.4	..	35.0	..	..	9.0	7.5	..	8.9	..	..	2.3	1.6	..	0.3	..	..
Belgium	..	67.0	66.5	63.8	67.4 [11]	..	..	25.7	26.2	28.7	27.3 [11]	..	..	6.1	6.1	6.2	3.8 [11]	..	..	1.2	1.2	1.3	1.5 [11]	..
Czech Republic	..	..	69.4	73.2	65.1 [11]	62.8	..	..	1.6	3.2	8.5 [11]	9.1	..	..	29.0	23.6	26.4 [11]	26.6	..	..	..	..	..	1.4
Denmark	49.7	55.0	58.5	58.3	57.4	62.5	26.7	24.8	22.6	22.8	24.5	20.6	22.7	19.1	17.7	17.8	17.0	15.8	0.9	1.1	1.2	1.0	1.1	1.1
Finland	54.7	61.6	57.0 [11]	58.4	63.2	66.0 [11]	22.2	19.3 [11]	22.1 [11]	20.5	19.5	20.0 [11]	22.5	18.5	20.2 [11]	20.5	16.6 [11]	13.6 [11]	0.6	0.5	0.7 [11]	0.7	0.6	0.5 [11]
France	58.9	60.3	61.5	61.7 [11]	61.0	61.5	16.4	14.9	15.1	15.8	16.7	17.2	23.6	23.9	22.7	21.1 [11]	21.0	19.9	1.1	0.9	0.8	1.4 [11]	1.3	1.3
Germany[3]	70.2	72.2 [11]	69.3 [11]	66.9 [11]	66.4	67.2	15.6	14.4 [11]	16.3 [11]	18.1 [11]	18.1 [11]	18.0	13.7	12.9 [11]	13.9 [11]	15.0 [11,12]	15.4 [12]	14.8 [12]	0.5	0.5	0.4 [11]	.. [12]	.. [12]	.. [12]
Greece	22.5	22.3 [11]	26.1	26.8	..	..	14.5	35.3 [11]	33.8	40.7	..	..	63.1	42.4 [11]	40.1	32.0	..	..	..	..	..	0.6	..	..
Hungary[4]	..	..	41.4	32.5	43.4 [11]	41.5	..	..	20.3	22.6	24.8 [11]	23.0	..	..	24.5	25.7	25.6 [11]	25.1	..	..	..	..	..	..
Iceland	9.6	19.4	21.8	31.1	31.9	36.1	26.0	25.0	29.4	24.0	27.5	25.8	60.7	49.2	44.5	40.9	37.4	35.1	3.7	6.4	4.4	4.0	3.2	3.0
Ireland	43.6	58.3	63.6	67.9	71.2	73.6	16.0	22.6	23.2	21.1	19.4	18.6	39.3	17.5	11.6	10.2	8.7	7.1	1.1	1.6	1.7	0.8	0.7	0.7
Italy	56.4 [9]	58.8 [9]	55.8 [11]	53.7	53.4	53.8	17.9 [9]	19.8 [9]	21.5 [11]	25.0	25.5	25.8	25.7 [9]	21.5 [9]	22.7 [11]	21.4	21.1	20.4	..	..	..	..	..	..
Netherlands[5]	53.3	59.2 [11]	49.7 [11]	49.4	52.1 [11]	52.7	23.2	21.4 [11]	29.7 [11]	30.0	28.8 [11]	28.6	20.8	17.3 [11]	18.3 [11]	18.1	18.1 [11]	17.7	2.8	2.1 [11]	2.3 [11]	2.5	1.0 [11]	1.0
Norway	52.9	56.6 [11]	54.6	53.5	56.7 [11]	56.9	29.0	24.0 [11]	26.7	27.3	26.0 [11]	26.6	17.7	19.4 [11,12]	18.8 [12]	19.2 [12]	17.3 [11,12]	16.4 [12]	0.5	.. [12]	.. [12]	.. [12]	.. [12]	.. [12]
Poland	..	..	..	..	38.7	39.4	..	..	..	..	26.3	28.6	..	..	..	..	35.0	32.0	..	..	..	..	0.0	0.0
Portugal[6]	31.2	24.6	26.1	21.7	20.9 [11]	22.4	20.6	34.0	36.0	43.0	37.0 [11]	41.1	43.6	33.1	25.4	22.1	27.0	24.0	4.6	8.4	12.4	13.1	15.0 [11]	12.6
Spain	45.5	56.3	56.0	47.8 [11]	48.2	48.8	22.9	20.4	22.2	31.3 [11]	32.0	32.7	31.6	22.7	21.3	20.0 [11]	18.6	17.4	..	0.5 [11]	0.5	1.0 [11]	1.1	1.1
Sweden	63.7 [9]	65.4 [10]	68.5 [10]	69.6 [10,11]	74.3 [11]	74.8 [11]	30.0 [9]	30.6 [9]	27.4 [9]	25.7 [9,11]	21.9 [11]	21.5 [11]	6.1 [9]	3.9 [10]	4.1 [10]	4.1 [10,11]	3.7 [11]	3.5 [11]	0.3 [9]	0.1 [9]	0.1 [9]	0.7 [9,11]	0.2 [11]	0.1 [11]
Switzerland[7]	74.2	74.9 [11]	..	70.1	..	70.7	19.9	19.9 [11]	..	25.0	..	24.3	5.9	4.3	..	3.7	..	2.5	..	0.8	..	1.2	..	2.5
Turkey[5]	..	..	21.1	22.9	23.6	26.0	..	..	71.1	67.2	69.0	62.1	..	..	7.9	9.9	7.4	11.9	..	..	..	..	..	..
United Kingdom	63.0	69.1 [11]	67.1	67.0	65.3	65.2	13.6	15.3 [11]	16.7	17.1 [11]	19.0	19.7	20.6	13.9 [11]	14.5	14.2	14.4	13.8	2.8	1.8 [11]	1.8	1.7	1.3	1.3
European Union	62.4	65.2 [11]	63.4 [11]	62.2 [11]	62.1	62.8	17.4	17.4 [11]	18.8 [11]	20.4 [11]	20.8 [11]	21.0	18.9	16.6 [11]	17.0 [11]	16.5 [11]	16.2	15.3	1.4	0.9 [11]	0.9 [11]	1.0 [11]	0.9	0.9
Total OECD[8]	65.8	68.9	69.1 [11]	67.0	67.5 [11]	69.2	16.5	16.1	16.0 [11]	17.4	17.3 [11]	16.9	15.0	12.6	12.4 [11]	12.8	12.6 [11]	11.3	2.6	2.4	2.6 [11]	2.7	2.6 [11]	2.6

1. 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993; 1994 instead of 1995; 1996 instead of 1997.
2. Adjusted by OECD up to 1995.
3. Figures for Germany and zone totals from 1991 onwards refer to unified Germany.
4. The breakdown of R&D expenditure data by sector of performance is not complete.
5. 1996 instead of 1997.
6. 1982 instead of 1981; 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993.
7. 1992 instead of 1993; 1996 instead of 1997.
8. Including Mexico and Korea from 1991 onwards; and including Czech Republic, Hungary and Poland as from 1995 onwards.
9. Overestimated.
10. Underestimated.
11. Break in series from previous year for which data are available.
12. Government data include private non-profit sector.

Source: OECD, MSTI database, April 1999.

Table 3.3.1. **Basic research as a percentage of total R&D activities and as a percentage of GDP[1]**

	As a percentage of all R&D activities							As a percentage of GDP						
	1981	1985	1989	1991	1993	1995	1997	1981	1985	1989	1991	1993	1995	1997
Mexico	..	..	..	..	27.7	35.8	..	..	..	..	..	0.05	0.09	..
United States[2]	13.3	12.5	15.0	16.6	17.0	15.7	16.0	0.32	0.35	0.40	0.47	0.44	0.41	0.42
Australia[3]	34.7	31.4	26.8	28.0	28.4	27.1	26.1	0.35	0.35	0.34	0.38	0.45	0.44	0.44
Japan	12.1	11.6	12.3	12.3	13.5	14.2	12.0	0.28	0.32	0.36	0.37	0.39	0.42	0.35
Korea	..	..	..	..	..	12.5	13.3	..	..	..	..	..	0.33	0.38
Austria	..	21.1	21.7	..	21.3	..	..	..	0.21	0.30	..	0.32	..	..
Czech Republic	..	..	..	..	..	17.0	18.0	..	..	..	..	..	0.18	0.21
France[4]	..	19.9	20.3	20.3	21.7	22.2	22.0	..	0.44	0.47	0.49	0.53	0.52	0.51
Germany[5]	20.8	18.4	19.8	21.0 [12]	21.2 [12]	..	..	0.44	0.43	0.49	0.49 [12]	0.46 [12]	..	..
Hungary[6]	..	..	..	25.0	25.5	27.9	27.6	..	..	..	0.23	0.22	0.18	0.18
Iceland[7]	28.4	20.7 [12]	23.5	24.9	25.1	..	..	0.16	0.14 [12]	0.24	0.29	0.33	..	..
Ireland	12.0	14.4	11.2	10.5	12.0	..	..	0.07	0.10	0.08	0.09	0.12	..	..
Italy	15.5	16.4	18.3	20.3 [12]	22.8	22.1	22.1	0.11	0.15	0.23	0.25 [12]	0.26	0.22	0.24
Netherlands[8]	27.3	14.5 [12]	15.1	14.0	13.1	9.6	..	0.50	0.30 [12]	0.32	0.29	0.26	0.20	..
Norway	17.5	13.7	15.1	14.8	16.5	16.1 [12]	..	0.19	0.18	0.23	0.22	0.25	0.25	..
Poland[9]	..	..	..	..	35.1	38.4	35.5	..	..	..	..	0.23	0.23	0.21
Portugal[10]	17.3	17.7	20.5	20.6	23.8	24.9	..	0.05	0.06	0.09	0.11	0.15	0.15	..
Spain	18.2	19.3	18.7	18.3	21.3	25.3	22.8	0.06	0.08	0.11	0.13	0.16	0.18	0.16
Sweden	24.6	22.8	23.0	20.0	..	..	..	0.52	0.59	0.61	0.53	..	..	..
Switzerland[11]	..	..	..	..	..	..	27.9	..	..	..	..	..	..	0.77

1. No corresponding data is available during the nineties for Belgium, Canada, Denmark, Finland, Greece, New-Zealand, Turkey and United-Kingdom.
2. 1996 instead of 1997 for percentage of R&D activities.
3. 1984 instead of 1985; 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993; 1994 instead of 1995; 1996 instead of 1997.
4. 1986 instead of 1985; 1996 instead of 1997.
5. Figures for Germany from 1991 onwards refer to unified Germany.
6. 1992 instead of 1991.
7. 1992 instead of 1993.
8. 1983 instead of 1981.
9. 1994 instead of 1993.
10. 1982 instead of 1981; 1984 instead of 1985; 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993.
11. 1996 instead of 1997.
12. Break in series from previous year for which data are available.

Source: OECD, R&D database, April 1999.

Table 3.3.2. **Basic research by main sectors of performance**

as a percentage of GDP

	Business enterprise				Government				Higher education				Private non-Profit			
	1993	1995	1996	1997	1993	1995	1996	1997	1993	1995	1996	1997	1993	1995	1996	1997
Mexico	0.00	0.00	..	..	0.02	0.04	-	-	0.03	0.05	-	-	0.00	0.00	-	-
United States	0.11	0.09	0.11	0.11	0.04	0.04	0.04	0.03	0.26	0.25	0.25	0.25	0.03	0.03	0.03	0.03
Australia[1]	0.04	0.05	0.04	..	0.13	0.13	0.12	-	0.26	0.24	0.26	-	0.02	0.02	0.02	-
Japan	0.13 [4]	0.13 [4]	0.12 [5]	0.13	0.05	0.06	0.05	0.05	0.19 [4]	0.21 [4]	0.15 [5]	0.14	0.02	0.02	0.02	0.02
Korea	..	..	0.17	0.17	-	-	0.08	0.09	-	0.11	0.12	0.11	-	-	0.01	0.01
Austria	0.04	..	..	..	0.03	-	-	-	0.25	-	-	-	0.00	-	-	-
Czech Republic	..	0.01	0.00	0.01	-	0.13	0.16	0.16	-	0.04	0.04	0.05	-	-	0.00	0.00
France	0.07	0.06	0.06	..	0.11	0.11	0.10	-	0.34	0.34	0.34	-	0.01	0.01	0.01	-
Germany[2]	0.07	..	..	..	0.11	-	-	-	0.29	-	-	-	-	-	-	-
Hungary	0.01	0.01 [5]	0.01	0.01	0.12	0.10	0.10	0.10	0.08	0.07	0.07	0.07	-	-	-	-
Iceland[3]	-	..	..	..	0.12	-	-	-	0.19	-	-	-	0.03	-	-	-
Ireland	0.04	..	..	..	0.00	-	-	-	0.07	-	-	-	0.00	-	-	-
Italy[3]	0.02	0.02	0.01	0.01	0.09	0.08	0.08	0.08	0.14	0.13	0.14	0.14	-	-	-	-
Netherlands	..	..	..	..	-	-	-	-	-	-	-	-	-	-	-	-
Norway	0.01	0.02 [5]	..	..	0.04	0.04	-	-	0.20	0.19	-	-	-	-	-	-
Poland	..	0.01 [4]	0.01 [4]	0.01 [4]	-	0.12 [4]	0.09 [4]	0.10 [4]	-	0.10 [4]	0.10 [4]	0.10 [4]	-	0.00	0.00	0.00
Portugal[3]	0.00	0.00	..	..	0.01	0.01	-	-	0.12	0.10	-	-	0.02	0.03	-	-
Spain	0.02	0.02	..	0.02	0.02	0.04	-	0.03	0.11	0.11	-	0.11	0.00	0.00	-	0.00
Sweden	..	..	..	..	0.01	0.08	-	0.08	-	-	-	-	-	-	-	-
Switzerland[3]	0.17	..	0.19	..	0.00	-	0.00	-	-	-	0.57	-	0.00	-	-	-

1. 1992 instead of 1993 ; 1994 instead of 1995.

2. Figures for Germany and zone totals from 1991 onwards refer to unified Germany.

3. 1992 instead of 1993.

4. Overestimated.

5. Break in series from previous year for which data are available.

Source: OECD, R&D database, April 1999.

Table 4.1.1. **R&D expenditures as a percentage of GDP by main sectors of performance**

	Business enterprise						Government						Higher education					
	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997
Canada	0.60	0.75	0.81	0.90	0.95	1.01	0.30	0.28	0.30	0.28	0.25	0.22	0.33	0.34	0.40	0.40	0.37	0.34
Mexico	..	0.08 [8]	0.09	0.02 [10]	0.06	..	..	..	0.15	0.08 [10]	0.10	..	..	..	..	0.12	0.14	..
United States	1.70	1.94	2.05	1.85	1.88	2.01	0.29	0.29	0.28	0.27 [10]	0.25	0.22	0.35	0.42	0.40 [10]	0.41 [10]	0.40	0.39
Australia[1]	0.25	0.53	0.55	0.70	0.76	0.80	0.45	0.40	0.45	0.45	0.43	0.40	0.29	0.32	0.35	0.42	0.40	0.45
Japan[2]	1.41 [8]	2.06 [8]	2.13 [8]	1.90 [8]	1.94 [8]	2.10 [10]	0.26	0.24	0.23	0.27	0.29	0.26	0.37	0.35	0.34	0.38	0.40	0.42 [10]
Korea	..	..	..	..	1.98	2.10	..	..	..	..	0.45	0.46	..	..	..	..	0.22	0.30
New Zealand	..	0.28	0.27	0.31	0.26	..	..	0.43	0.44	0.42	0.41	..	..	0.17	0.28	0.29	0.30	..
Austria	0.64	0.80	..	0.83	..	..	0.10	0.10	..	0.13 [10]	..	..	0.37	0.44	..	0.52	..	..
Belgium	1.03	1.11 [10]	1.08	1.01	1.07 [10]	..	..	0.10	0.10	0.10	0.06 [10]	..	..	0.43	0.43	0.45	0.43 [10]	..
Czech Republic	..	..	1.41	0.90	0.67 [10]	0.74	..	..	0.59	0.29	0.27 [10]	0.31	..	..	0.03	0.04	0.09 [10]	0.11
Denmark	0.54	0.85	1.00	1.05	1.10	1.27	0.25	0.30	0.30	0.32	0.33	0.32	0.29	0.38	0.38	0.41	0.47	0.42
Finland	0.65	1.13	1.18	1.29	1.49	1.83	0.27	0.34	0.42	0.45	0.39	0.38	0.27	0.35	0.46 [10]	0.45	0.46	0.55 [10]
France	1.16	1.41	1.48	1.51 [10]	1.43	1.37	0.47	0.56	0.55	0.52 [10]	0.49	0.44	0.32	0.35	0.36	0.39	0.39	0.38
Germany[3]	1.71	2.07	1.81 [10]	1.62	1.53	1.55	0.33	0.37	0.36 [10]	0.36 [8]	0.36 [8]	0.34 [8]	0.38	0.41 [10]	0.43 [10]	0.44 [10]	0.42 [10]	0.42
Greece	0.04	0.08	0.10	0.13	..	..	0.11	0.16	0.15	0.15	0.13	..	0.02	0.13 [10]	0.12	0.19	0.22	..
Hungary	..	..	0.44	0.32	0.32 [10]	0.30	..	..	0.26	0.25	0.19	0.18	..	..	0.22	0.22	0.18	0.17
Iceland	0.06	0.20	0.25	0.42	0.49	0.56	0.38	0.50	0.52	0.55	0.58	0.55	0.16	0.26	0.34	0.32	0.42	0.40
Ireland	0.31	0.48	0.61	0.81	0.97	1.05	0.28	0.15	0.11	0.12 [10]	0.12	0.10	0.11	0.19	0.22	0.25	0.26	0.27
Italy	0.50 [8]	0.73 [8]	0.69 [10]	0.61	0.54	0.58	0.23 [8]	0.27 [8]	0.28 [10]	0.24	0.21	0.22	0.16	0.25	0.27	0.28	0.26	0.28
Netherlands[4]	0.99	1.25	1.02	0.99	1.08 [10]	1.10	0.39	0.37	0.37	0.36	0.37 [10]	0.37	0.43	0.45 [10]	0.61 [10]	0.60	0.60	0.60
Norway	0.62	0.96	0.90	0.93	0.97 [10]	0.95	0.21	0.33 [8]	0.31 [8]	0.33 [8]	0.30 [8]	0.28 [8]	0.34	0.41	0.44	0.47	0.45	0.45
Poland	..	..	..	..	0.29	0.30	..	..	..	..	0.26	0.24	..	..	..	..	0.19	0.22
Portugal[5]	0.10	0.10	0.14	0.14	0.12 [10]	0.15	0.13	0.14	0.13	0.14	0.16	0.16	0.06	0.14	0.19	0.27	0.22 [10]	0.27
Spain	0.19	0.42	0.49	0.44	0.41	0.42	0.13	0.17	0.19	0.18	0.16	0.15	0.10	0.15	0.19	0.29 [10]	0.27	0.28
Sweden	1.46	1.93 [9]	1.98 [9]	2.36 [9]	2.67 [10]	2.88	0.14	0.11 [9]	0.12 [9]	0.14 [9]	0.13	0.14	0.69	0.90	0.79	0.87	0.79 [10]	0.83 [10]
Switzerland[4,6]	1.62	2.12 [10]	..	1.86	..	1.94	0.13	0.12 [10]	0.10	0.10	0.08	0.07	0.43	0.56 [10]	..	0.66	0.65	0.67
Turkey[4]	..	..	0.11	0.10	0.09	0.12	..	..	0.04	0.04	0.03	0.05	..	..	0.38	0.30	0.26	0.28
United Kingdom	1.49	1.49 [10]	1.42	1.44	1.32	1.22	0.49	0.30	0.31 [10]	0.31	0.29	0.26	0.32	0.33 [10]	0.35	0.37 [10]	0.38	0.37
European Union	1.06	1.28 [10]	1.23 [10]	1.19 [10]	1.14	1.15	0.32	0.33 [10]	0.33 [10]	0.32 [10]	0.30	0.28	0.30	0.34 [10]	0.37 [10]	0.39 [10]	0.38 [10]	0.39
Total OECD[7]	1.31	1.60	1.61 [10]	1.51	1.46 [10]	1.53	0.30	0.29	0.29 [10]	0.29	0.27 [10]	0.25	0.33	0.37	0.37 [10]	0.39	0.37 [10]	0.37

1. 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993; 1994 instead of 1995; 1996 instead of 1997.
2. Adjusted by OECD up to 1995.
3. Figures for Germany and zone totals from 1991 onwards refer to unified Germany.
4. 1996 instead of 1997
5. 1982 instead of 1981; 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993.
6. 1992 instead of 1993; 1994 instead of 1995.
7. Including Mexico and Korea from 1991 onwards; and including Czech republic, Hungary and Poland as from 1995 onwards.
8. Overestimated.
9. Underestimated
10. Break in series from previous year for which data are available.

Source: OECD, MSTI database, April 1999.

Table 4.1.2. **Researchers[1] per thousand labour force by sector of employment**

	Business enterprise						Government						Higher education					
	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997	1981	1989	1991	1993	1995	1997
Canada[2]	1.20	2.03	2.09	2.46	2.88	3.01	0.45	0.44	0.43	0.42	0.39	0.39	1.47	1.93	2.07	2.10	2.06	..
Mexico	..	..	..	0.03	0.06	..	..	..	..	0.17	0.18	..	..	..	..	0.24	0.33	..
United States	4.52	5.84	6.07	5.87	5.91	6.69	0.54	0.47 [11]	0.46 [10]	0.46 [10]	..	..	0.89	0.98 [11]	0.92	0.98	1.00	..
Australia[3]	0.51	1.49	1.47	1.61	1.68	1.64	0.99	1.05	1.09	1.11	1.00	1.00	1.99	2.43	2.42	3.22	3.65	3.87
Japan[4]	3.38 [9]	5.01 [9]	5.24 [9]	5.55 [9]	5.76 [9]	5.96 [11]	0.51	0.47	0.46	0.45	0.46	0.45	1.43	1.64	1.65	1.73	1.82	2.57 [11]
Korea	..	..	..	..	3.23	3.23	..	..	..	..	0.61	0.57	..	..	..	..	0.93	0.91
New Zealand	..	0.95	0.83	0.91	0.91	..	..	0.90	0.93	1.00	0.86	..	..	1.18	1.14	1.82 [11]	1.74	..
Austria	0.91	1.16	..	1.87	..	..	0.17	0.15	..	0.24 [11]	..	..	0.96	1.15	..	1.30	..	..
Belgium	1.26	2.02 [11]	2.08	..	2.74 [11]	..	0.15	0.20 [11]	0.19	..	0.24 [11]	..	1.61	1.99 [11]	2.00	..	2.29 [11]	..
Czech Republic	..	..	..	1.48	0.95 [11]	0.99	..	..	..	0.91	0.83 [11]	0.89	..	..	..	0.27	0.52 [11]	0.55
Denmark	0.87	1.53	1.77	2.03	2.39	2.39	0.66	0.85	0.88	1.04	1.28	1.34	0.98	1.37	1.42	1.60	1.97	2.08
Finland	1.11	1.99	2.02	2.17	2.65	3.39	0.94	1.26	1.27	1.39	1.39	1.47	..	..	2.13	2.43	2.57	3.32
France[2]	1.49	2.24	2.38	2.64 [11]	2.63	2.68	0.67	1.00	1.04	1.02 [11]	1.07	1.09	1.39	1.64	1.68	1.98	2.12	2.13
Germany[5]	2.72	3.80	3.56 [11]	3.26	3.27	..	0.63	0.77	0.94 [11]	0.86 [9]	0.94 [9]	0.95 [9]	1.01	1.30 [11]	1.57 [11]	..	1.63	1.66
Greece	..	0.19	0.26	0.32	..	..	..	0.53	0.49	0.46	0.47	..	..	0.66 [11]	0.83	1.16	1.43	..
Hungary	..	..	..	0.81	0.71	0.76	..	..	..	0.87	0.86	0.98	..	..	..	1.05	0.99	1.05
Iceland	0.31	1.05	1.19	1.90	2.41	2.55	1.57	2.32	2.06	2.22	2.17	2.30	1.15	1.44	1.52	1.42	2.55	2.70
Ireland	0.48	1.19	1.60	1.84	2.32	3.31	0.50	0.34	0.26	0.18 [11]	0.19	0.20	0.65	1.52	1.86	2.36	3.10	..
Italy[2]	0.86	1.26	1.20	1.20	1.16	1.19	0.35	0.58	0.51	0.57	0.60	0.58	1.09	1.30	1.34	1.42	1.48	1.50
Netherlands[2]	1.49	1.60	..	1.60	1.79 [11]	1.84	0.80	1.01	..	1.02	1.06 [11]	1.04	1.08	1.28	..	1.79	1.68	1.65
Norway	1.59	2.81 [11]	3.16	3.35	3.62 [11]	4.07	0.70	1.12 [9]	1.21 [9]	1.35 [9]	1.38 [9]	1.33 [9]	1.47	1.70	1.95 [11]	2.22	2.28	2.22
Poland	..	..	..	..	0.65	0.64	..	..	..	..	0.65	0.68	..	..	..	..	1.63	1.91
Portugal[6]	0.15	0.10 [11]	0.09	0.21 [11]	0.22 [11]	0.25	0.23	0.23	0.22	0.43 [11]	0.57	0.57	0.29	0.69	0.76	1.15 [11]	1.22 [11]	1.53
Spain	0.24	0.62	0.76	0.72	0.68	0.74	0.27	0.39	0.53	0.50	0.53	0.64	0.92	1.16	1.35	1.54	1.75	1.88
Sweden	2.21	2.72 [10]	2.95 [10]	3.59 [10]	4.41 [11]	4.91	0.33	0.34 [10]	0.38 [10]	0.53 [10, 11]	0.63	0.57	1.57	2.57	2.53	2.65 [11]	2.75	3.17
Switzerland[7]	..	2.53	..	2.48 [11]	..	3.15	0.24	0.16 [11]	0.16	0.16 [11]	0.14	0.14	..	1.69	..	1.84 [11]	1.95	2.16
Turkey[2]	..	..	0.06	0.08	0.10	0.11	..	..	0.09	0.08	0.08	0.10	..	..	0.42	0.48	0.53	0.58
United Kingdom[2]	2.88	2.99 [11]	2.80	3.02 [11]	2.92	2.91	0.75	0.53	0.53	0.49	0.49	0.46	0.93	0.95	1.02	1.12	1.65 [11]	1.65
European Union[2]	1.67	2.18	2.22 [11]	2.28 [11]	2.31	..	0.53	0.64	0.71 [11]	0.69 [11]	0.74	0.73	1.07	1.31	1.45 [11]	..	1.75	1.80
Total OECD[8]	2.70	3.66	3.51 [11]	3.53	3.44 [11]	3.73	0.52	0.53 [11]	0.53 [11]	0.52	0.54 [11]	..	1.07	1.26 [11]	1.24 [11]	1.34	1.41 [11]	..

1. Or university graduates.
2. 1996 instead of 1997.
3. 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993; 1994 instead of 1995; 1996 instead of 1997.
4. Adjusted by OECD up to 1995.
5. Figures for Germany and zone totals from 1991 onwards refer to unified Germany.
6. 1982 instead of 1981; 1988 instead of 1989; 1990 instead of 1991; 1992 instead of 1993.
7. 1990 instead of 1991; 1992 instead of 1993; 1994 instead of 1995; 1996 instead of 1997.
8. Including Mexico from 1991 onwards; and including Czech republic, Hungary, Korea and Poland as from 1995 onwards.
9. Overestimated.
10. Underestimated
11. Break in series from previous year for which data are available.

Source: OECD, MSTI database, April 1999.

Table 4.2.1. **Government budget appropriations or outlays for R&D (GBAORD) by socio-economic objective**

	Defence as a percentage of total R&D budget		Percentages of civil[1] R&D budget									
			Economic development		Health and environment		Space		Non-oriented		General university funds	
	1991	1997	1991	1997	1991	1997	1991	1997	1991	1997	1991	1997
Canada	5.6	6.5	39.9	48.8	16.3	29.6	8.5	8.4	14.8	8.9	20.5	..
Mexico[2]	0.0	0.0	32.6	23.0	14.2	12.7	0.0	0.0	20.4	18.5	32.8	45.8
United States	59.7	55.3	22.1	19.7	43.5	46.6	24.5	24.5	9.9	9.2	..	..
Australia	10.3	7.4	28.8	25.8	16.3	15.8	..	..	23.3	23.8	31.7	34.6
Japan (adjusted)	5.7	5.8	33.5	34.8	5.7	7.3	7.2	6.7	8.5	11.5	45.1	39.7
Korea	..	..	..	..	..	..	..	..	..	..	..	..
New Zealand[3]	1.5	1.2	47.5	50.9	25.7	25.7	..	0.0	1.2	1.8	24.5	21.6
Austria	0.0	0.0	14.6	12.6	8.6	8.3	0.4	0.1	12.4	13.6	64.0	65.2
Belgium	0.2	0.5	22.4	24.6	8.8	6.9	10.9	12.2	19.9	21.0	33.6	30.9
Czech Republic	..	..	..	..	..	..	..	..	..	..	..	..
Denmark[2]	0.6	0.4	26.5	22.4	14.2	17.2	2.7	1.8	23.4	20.0	33.1	38.6
Finland	1.4	1.5	41.0	41.3	16.5	17.0	3.1	2.6	10.7	12.3	28.7	26.9
France	36.1	28.0	32.8	18.8	9.8	12.6	13.5	15.6	23.9	26.8	19.4	22.9
Germany	11.0	9.6	25.5	22.8	13.0	12.7	6.0	5.3	17.0	17.3	37.3	42.2
Greece[2]	1.4	1.2	30.1	28.0	17.8	18.1	0.3	0.6	3.5	9.8	46.8	43.4
Hungary	..	..	..	..	..	..	..	..	..	..	..	..
Iceland	0.0	0.0	51.4	29.9	7.2	..	..	..	16.6	37.0	24.9	7.0
Ireland	0.0	0.0	48.5	59.7	12.7	11.8	3.8	3.1	5.1	7.2	29.9	18.3
Italy	7.9	3.5	23.6	16.5	19.7	17.6	7.6	4.2	11.5	12.6	34.0	49.2
Netherlands	3.5	3.1	34.3	22.5	10.7	10.4	3.2	3.6	12.9	10.8	34.2	48.6
Norway	6.2	5.5	33.6	29.4	19.5	21.5	2.9	2.8	11.2	7.1	32.9	39.2
Poland	..	..	..	..	..	..	..	..	..	..	..	..
Portugal	0.8	0.5	39.4	26.2	17.6	18.7	0.3	0.6	9.4	8.3	28.6	41.2
Spain	16.8	19.6	33.1	32.4	18.2	12.4	8.4	8.1	13.0	9.7	24.0	35.7
Sweden[2]	27.3	20.9	24.4	20.5	11.4	13.7	2.3	1.8	20.1	14.6	41.8	49.4
Switzerland[4]	9.0	..	12.8	..	7.4	..	..	..	..	..	..	..
Turkey	..	..	..	..	..	..	..	..	..	..	..	..
United Kingdom	43.9	37.7	28.8	13.6	22.3	32.8	4.8	4.3	9.1	18.9	33.7	29.7
European Union	21.0	15.8	30.3	23.3	14.3	15.3	7.2	7.2	15.7	16.3	30.8	35.2
Total OECD	37.3	31.4	28.6	24.3	22.3	23.1	12.2	11.6	13.4	13.3	..	..

1. For some countries, the categories do not add to 100 because of a residual category.
2. 1996.
3. 1995.
4. 1990.

Source: OECD, MSTI database, April 1999.

Table 4.3.1. **Government support to industrial technology by type**

Total as a percentage of domestic product of industry and breakdown in percentage of total

		1989	1990	1991	1992	1993	1994	1995	1996	1997
Canada	Total	0.35	0.36	0.38	0.39	0.41	0.36	0.32	..	..
	Financial	48.9	50.5	46.0	49.4	55.4	55.3	54.8	..	..
	Procurement	24.9	23.4	30.0	28.8	26.8	26.1	28.4	..	..
	S&T infrastructure	26.2	26.0	24.0	21.8	17.8	18.6	16.8	..	..
Mexico	Total	..	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	Financial	..	19.3	22.2	20.0	16.4	5.4	2.3	9.3	10.3
	Procurement	..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	S&T infrastructure	..	80.7	77.8	80.0	83.6	94.6	97.7	90.7	89.7
United States	Total	0.76	0.76	0.68	0.72	0.66	0.63	0.60	0.56	0.54
	Financial	15.1	15.8	19.3	20.1	19.5	20.6	21.6	19.2	18.5
	Procurement	83.4	82.7	78.8	78.2	78.7	77.4	76.3	78.6	79.3
	S&T infrastructure	1.5	1.5	1.9	1.7	1.8	1.9	2.1	2.2	2.2
Australia	Total	0.29	0.29	0.33	0.38	0.38	0.39	0.36	0.31	0.31
	Financial	38.8	36.9	39.0	41.4	40.9	45.2	44.0	28.8	28.9
	Procurement	5.9	5.7	6.5	9.2	6.8	8.4	7.2	12.6	11.3
	S&T infrastructure	55.0	57.2	54.2	49.0	52.2	46.4	48.9	58.6	59.8
Japan	Total	0.20	0.21	0.20	0.21	0.23	0.24	0.24	0.25	0.27
	Financial	10.2	10.0	9.6	8.5	7.6	7.6	6.8	7.0	7.0
	Procurement	39.1	40.4	40.1	40.5	41.3	41.1	41.9	44.0	46.0
	S&T infrastructure	50.7	49.6	50.3	51.0	51.1	51.3	51.2	49.0	47.1
Finland	Total	0.45	0.50	0.66	0.73	0.65	0.53	0.61	0.65	0.63
	Financial	33.9	31.9	30.3	31.8	26.1	35.2	41.4	45.4	44.7
	Procurement	2.1	4.4	4.4	4.9	9.0	9.5	8.2	7.4	6.5
	S&T infrastructure	64.0	63.7	65.4	63.4	64.9	55.3	50.3	47.2	48.8
France	Total	0.63	0.66	0.74	0.67	0.62	0.57	0.51	..	..
	Financial	28.1	28.3	28.0	31.4	30.6	27.3	23.8	..	..
	Procurement	58.5	58.9	60.5	55.6	54.7	57.2	58.7	..	..
	S&T infrastructure	13.4	12.8	11.6	13.0	14.7	15.5	17.5	..	..
Germany	Total	0.55	0.51	0.44	0.46	0.43	0.39	0.40	0.40	0.37
	Financial	35.4	32.3	29.7	27.6	28.0	28.4	26.8	26.8	25.1
	Procurement	33.8	36.4	35.8	34.3	32.5	32.6	33.8	33.3	35.1
	S&T infrastructure	30.8	31.4	34.5	38.1	39.5	39.0	39.4	39.9	39.7
Netherlands	Total	0.38	0.42	0.34	0.32	0.29	0.32	0.35	0.34	0.38
	Financial	44.0	49.3	39.5	27.7	24.4	30.7	32.3	37.0	31.8
	Procurement	17.0	17.8	24.5	34.3	31.5	26.6	25.0	21.2	24.9
	S&T infrastructure	39.0	32.9	36.0	38.1	44.1	42.7	42.7	41.7	43.2
United Kingdom	Total	0.57	0.56	0.57	0.55	0.56	0.45	0.44	0.42	0.40
	Financial	9.5	10.7	7.4	6.5	4.6	5.3	5.2	4.0	3.3
	Procurement	68.0	65.5	69.0	66.7	70.0	73.0	71.7	73.5	76.6
	S&T infrastructure	22.6	23.8	23.6	26.8	25.4	21.7	23.0	22.5	20.1

Source: OECD.

Table 4.4.1. **Amount of tax subsidies for 1 US dollar of R&D, large firms**

	1990	1998	Change
Canada	0.170	0.173	0.003
Mexico	-0.018	0.031	0.048
United States	0.090	0.066	-0.024
Australia	0.276	0.110	-0.166
Japan	-0.021	0.104	0.125
Korea	0.108	0.088	-0.020
New Zealand	..	-0.131	..
Austria	0.017	0.068	0.051
Belgium	-0.012	-0.012	0.000
Denmark	0.000	-0.018	-0.018
Finland	-0.015	-0.009	0.006
France	0.090	0.086	-0.003
Germany	-0.054	-0.051	0.003
Greece	..	-0.015	..
Iceland	-0.028	-0.028	0.000
Ireland	0.000	0.063	0.063
Italy	-0.040	-0.027	0.013
Netherlands	-0.020	0.096	0.115
Norway	-0.037	-0.018	0.020
Portugal	-0.021	0.150	0.171
Spain	0.248	0.313	0.065
Sweden	-0.024	-0.015	0.009
Switzerland	-0.012	-0.016	-0.004
United Kingdom	0.000	0.000	0.000

Source: OECD.

Table 4.5.1. **Co-operation between business and the public sector**

	Percentage share of business in the funding of research performed by government and university, 1997		Percentage share of firms with co-operation arrangements with university or government research institutions, 1994-96	
	Government	Higher education	All firms	Firms with fewer than 50 employees
Canada	2.8	11.7	..	..
Mexico[1]	3.3	1.4	16.3	..
United States	0.0	5.8	..	..
Australia[2]	5.7	5.2	..	..
Japan[2]	0.9	2.4	..	..
Korea[2]	9.9	14.9	..	..
New Zealand[1]	17.7	9.4	..	..
Austria[3]	2.0	2.0	11.9	4.4
Belgium[1]	2.1	10.6	11.9	2.0
Czech Republic	9.7	1.5	..	..
Denmark	4.5	1.9	..	..
Finland[1]	14.1	5.2	38.2	8.6
France[2]	6.2	3.2	9.9	2.7
Germany	3.4	7.9	12.3	4.3
Greece[1]	2.3	5.6	..	..
Hungary	13.6	1.9	..	..
Iceland	7.2	5.4	..	..
Ireland	16.2	6.9	10.5	3.8
Italy	3.0	3.8	..	..
Luxembourg	..	..	5.6	0.0
Netherlands[2]	15.8	3.8	11.2	2.4
Norway[4]	10.1	5.2	19.0	4.2
Poland	14.6	10.4	12.3	3.6
Portugal[1]	4.2	1.7	..	..
Spain	5.2	6.5	13.0	1.0
Sweden	2.9	4.5	44.5	5.9
Switzerland	..	6.2	9.8	5.1
Turkey[2,4]	2.8	18.0	9.0	6.4
United Kingdom[2]	11.9	7.2	10.7	3.7
European Union[2]	5.6	5.7	..	..
Total OECD[1]	3.7	6.0	..	..

1. 1995 instead of 1997.
2. 1996 instead of 1997.
3. 1993 instead of 1997.
4. 1995-97 instead of 1994-96.

Sources: OECD, R&D database, April 1999 (col. 1-2);
OECD, mainly based on data from Eurostat (col 3-4).

Table 5.1.1. **Business Enterprise R&D (BERD) as a percentage of domestic product of industry**

	1981	1985	1990	1991	1993	1995	1996	1997	Average annual growth rate	
Canada	0.75	0.96	1.02	1.07	1.20	1.23	1.24	1.29	1991-97	3.2
Mexico[1]	..	..	0.09	0.10	0.03 [2]	0.07	..	..	-	..
United States	1.95	2.36	2.26	2.34	2.13	2.12	2.19	2.24	1991-97	-0.7
Australia	0.27	0.42	0.58	0.64	0.76	0.92	0.84	..	1991-96	5.6
Japan	1.58	2.07	2.39	2.35	2.12	2.17	2.24	2.35	1991-97	0.0
Korea	..	..	..	..	..	2.30	2.39	2.47	1995-97	3.6
New Zealand	..	..	0.36	0.33	0.38	0.32	..	..	1991-95	-0.8
Austria[1]	0.84	0.92	1.06	..	1.11	..	..	..	1989-93	1.2
Belgium[1]	1.36	1.53	1.40 [2]	1.37	1.27	1.35 [2]	..	..	1991-95	-0.4
Czech Republic	..	..	..	1.63	1.06 [2]	0.79 [2]	0.75	0.87	1995-97	4.9
Denmark	0.86	1.06	1.40	1.51	1.58	1.67	1.89	1.93	1991-97	4.2
Finland	0.89	1.30	1.73	1.77	1.92	2.15	2.49	2.70	1991-97	7.3
France	1.56	1.78	1.91	1.94	2.01 [2]	1.90	1.91	1.84	1991-97	-0.9
Germany[3]	2.18	2.51	2.48	2.29 [2]	2.08	1.96	1.94	1.97	1991-97	-2.5
Greece[1,4]	0.06	0.12	0.13	0.16	0.21	..	..	..	1991-93	14.6
Hungary	..	..	0.78	0.54	0.40	0.40 [2]	0.35	0.37	1994-97	-1.7
Iceland	0.10	0.18	0.30	0.40	0.65	0.78	0.75	0.89	1991-97	14.3
Ireland	0.44	0.58	0.68 [2]	0.80	1.07	1.28	1.35	1.39	1991-97	9.6
Italy	0.61	0.79	0.94	0.87 [2]	0.76	0.66	0.67	0.72	1991-97	-3.1
Netherlands	1.26	1.46	1.41	1.26	1.22	1.34 [2]	1.37	1.42	1991-97	2.0
Norway[1]	0.84	1.26 [2]	1.32	1.25	1.30	1.38 [2]	..	1.34	1991-97	1.2
Poland	..	..	..	..	..	0.39	0.43	0.41	1994-97	-3.8
Portugal[5,6]	0.13	0.14	0.18 [2]	..	0.18	0.16 [2]	..	0.19	1990-97	0.8
Spain	0.22	0.36 [2]	0.61	0.61	0.55	0.51	0.52	0.53	1991-97	-2.3
Sweden[1]	2.27	3.00	2.86	3.08	3.60	3.92 [2]	..	4.42	1991-97	6.2
Switzerland[1,4,6]	1.90	2.60 [2]	2.50	..	2.20	..	2.32	..	1992-96	1.3
Turkey	..	..	0.08	0.13	0.12	0.10	0.13	..	1991-96	0.0
United Kingdom	2.11	1.99	2.07	1.97	1.96	1.77	1.68	1.62	1991-97	-3.2
European Union	1.39	1.58	1.67 [2]	1.61 [2]	1.56 [2]	1.49	1.49	1.49	1991-97	-1.3
Total OECD[7]	1.57	1.90	1.95	1.93 [2]	1.81	1.74 [2]	1.78	1.82	1991-97	-1.0

1. 1989 instead of 1990.
2. Break in series from previous year for which data are available.
3. Figures for Germany from 1991 onwards refer to unified Germany.
4. 1986 instead of 1985.
5. 1982 instead of 1981; 1984 instead of 1985.
6. 1992 instead of 1993.
7. Including Mexico and Korea from 1991 onwards, and Czech Republic, Hungary and Poland from 1995 ownwards.

Source: OECD, MSTI database, April 1999.

Table 5.1.2. **Business Enterprise R&D (BERD) in millions of 1990 US dollars using purchasing power parities**

	1981	1985	1990	1991	1993	1995	1996	1997	1998	Average annual growth rate	
Canada	2 400	3 397	4 034	4 080	4 703	5 253	5 437	5 897	6 137	1991-97	6.3
Mexico[1]	..	..	352	453	121 [2]	335	..	..	..	-	..
United States	74 443	100 838	109 727	112 602	107 196	115 673	124 860	133 487	143 717	1991-97	2.9
Australia	524	945	1 511	1 670	2 151	2 853	2 674	..	..	1991-96	9.9
Japan	21 633	32 607	47 524	48 664	44 178	46 063	49 540	52 196	..	1991-97	1.2
Korea	..	..	..	..	..	9 465	10 469	11 360	..	1995-97	9.6
New Zealand	..	..	127	118	146	137	..	..	..	1991-95	3.9
Austria[1]	656	761	994	..	1 137	..	..	..	..	1989-93	3.4
Belgium[1]	1 398	1 687	1 792 [2]	1 829	1 696	1 890 [2]	..	..	..	1991-95	0.8
Czech Republic	..	..	..	1 378	855 [2]	705 [2]	690	813	..	1995-97	7.4
Denmark	376	548	788	860	919	1 031	1 202	1 263	1 326	1991-97	6.6
Finland	396	636	965	887	925	1 167	1 397	1 581	1 793	1991-97	10.1
France	9 284	11 226	14 365	14 686	14 993 [2]	14 800	15 033	14 800	..	1991-97	0.1
Germany[3]	15 877	19 539	22 967	23 612 [2]	21 326	21 010	21 093	22 016	23 050	1991-97	-1.2
Greece[1,4]	31	68	78	92	121	..	..	..	..	1991-93	14.8
Hungary	..	..	487	338	234	247 [2]	221	247	..	1994-97	1.2
Iceland	2	4	8	11	18	22	23	28	..	1991-97	16.5
Ireland	88	129	206 [2]	251	362	521	595	676	..	1991-97	18.0
Italy	3 685	5 116	6 977	6 439 [2]	5 653	5 250	5 372	5 808	6 012	1991-97	-1.7
Netherlands	1 885	2 359	2 706	2 477	2 474	2 849 [2]	2 997	3 234	..	1991-97	4.5
Norway[1]	407	699 [2]	696	686	726	820 [2]	..	901	..	1991-97	4.7
Poland	..	..	..	..	..	594	686	701	..	1994-97	2.3
Portugal[5,6]	69	73	131 [2]	..	136	126 [2]	..	161	..	1990-97	3.0
Spain	658	1 113 [2]	2 239	2 278	2 026	1 989	2 097	2 175	2 306	1991-97	-0.8
Sweden[1]	1 739	2 552	2 765	2 845	3 271	3 978 [2]	..	4 430	..	1991-97	7.7
Switzerland[1,4,6]	1 938	2 812 [2]	2 943	..	2 659	..	2 781	..	..	1992-96	1.1
Turkey	..	..	174	297	309	277	388	..	..	1991-96	5.5
United Kingdom	10 357	11 143	13 817	12 680	13 100	12 840	12 612	12 551	..	1991-97	-0.2
European Union	46 495	56 953	70 910 [2]	70 207 [2]	68 157 [2]	68 826	70 182	72 272	..	1991-97	0.5
Total OECD[7]	148 043	198 270	237 656	246 347 [2]	237 232	253 990 [2]	269 314	284 228	..	1991-97	2.4

1. 1989 instead of 1990.
2. Break in series from previous year for which data are available.
3. Figures for Germany from 1991 onwards refer to unified Germany.
4. 1986 instead of 1985.
5. 1982 instead of 1981; 1984 instead of 1985.
6. 1992 instead of 1993.
7. Including Mexico and Korea from 1991 onwards, and Czech Republic, Hungary and Poland from 1995 ownwards.

Source: OECD, MSTI database, April 1999.

Table 5.2.1. **R&D expenditures in the services, 1990 US dollars using purchasing power parities**

	ISIC Rev. 3 Division	Canada		United States		Australia		Japan		Denmark	
		1990	1997	1990	1996	1990	1996	1990	1996	1990	1997
Total manufacturing	15/37	2 717	3 626	88 934	100 565	923	1 672	45 645	46 798	568	858
Total services	50/99	1 014	1 998	20 793	24 295	427	588	1 315	2 104	212	395
Wholesale and retail trade, motor veh. repair, etc.	50/52	145	383	..	5 514	..	..	..	..	38	64
Hotels and restaurants	55	..	..	..	235	..	..	..	..	..	..
Transport and storage	60/63	15	12	..	192	..	..	80	56	..	..
Communications	64	109	125	..	3 541	..	..	1 235	1 175	22	31
Post	641	..	..	..	63	..	..	..	..	..	..
Telecommunications	642	..	..	..	3 478	..	..	..	..	..	..
Financial intermediation (incl. insurance)	65/67	175	329	..	1 119	..	5	..	..	..	..
Real estate, renting and business activities	70/74	569	1 149	..	..	..	..	..	873	151	300
Computer and related activities	72	176	406	4 629	6 369	388	495	..	873	30	96
Software consultancy	722	..	..	..	..	..	..	..	..	..	..
Other computer services nec	72-722	..	..	..	..	..	..	..	..	..	..
Research and development	73	321	573	1 335	4 733	..	..	..	..	..	38
Other business activities	70+71+74	73	171	..	..	..	..	..	..	122	166
Community, social and personal service activities, etc.	75/99	..	..	..	..	..	10	..	..	..	..
Total business enterprise	01/99	4 034	5 958	109 727	124 860	1 511	2 674	47 523	49 540	788	1 263

	ISIC Rev. 3 Division	Finland		France		Germany[1]		Ireland		Italy	
		1990	1997	1990	1996	1990	1995	1990	1997	1991	1998
Total manufacturing	15/37	783	1 369	13 266	13 177	22 061	19 868	183	587	5 785	5 040
Total services	50/99	63	158	557	1 030	..	741	17	86	520	772
Wholesale and retail trade, motor veh. repair, etc.	50/52	..	1	..	..	..	26	..	0	0	14
Hotels and restaurants	55	..	..	..	..	..	..	..	0	0	0
Transport and storage	60/63	..	5	32	438	..	52	0	1	0	10
Communications	64	..	78	..	..	..	..	3	29	25	260
Post	641	..	..	..	..	..	..	..	0	0	7
Telecommunications	642	..	..	..	..	..	..	..	29	25	253
Financial intermediation (incl. insurance)	65/67	..	..	..	..	..	21	..	5	0	0
Real estate, renting and business activities	70/74	..	..	525	592	..	531	..	51	482	477
Computer and related activities	72	..	43	..	346	..	87	..	36	77	70
Software consultancy	722	..	..	..	..	..	69	..	32	72	62
Other computer services nec	72-722	..	..	..	..	..	18	..	5	4	8
Research and development	73	..	..	..	..	..	142	1	9	374	327
Other business activities	70+71+74	..	23	..	246	..	302	..	6	31	79
Community, social and personal service activities, etc.	75/99	..	9	..	..	..	17	..	0	12	12
Total business enterprise	01/99	921	1 581	14 365	15 033	22 967	21 010	206	676	6 439	6 012

	ISIC Rev. 3 Division	Netherlands		Norway[2]		Spain		Sweden		United Kingdom	
		1990	1996	1990	1997	1990	1996	1990	1995	1990	1997
Total manufacturing	15/37	2 443	2 372	445	457	1 789	1 728	2 467	3 479	11 188	10 088
Total services	50/99	171	492	270	365	325	264	240	399	1 983	2 199
Wholesale and retail trade, motor veh. repair, etc.	50/52	..	125	..	2	1	1	..	..	7	7
Hotels and restaurants	55	..	..	..	0	0	0	..	..	..	..
Transport and storage	60/63	..	..	3	5	3	8	..	8	12	16
Communications	64	..	..	19	52	57	85	..	100	566	652
Post	641	..	..	4	0	0	0	..	..	..	..
Telecommunications	642	..	5	15	52	57	85	..	..	..	..
Financial intermediation (incl. insurance)	65/67	..	56	..	8	0	0	..	..	..	..
Real estate, renting and business activities	70/74	..	229	243	298	255	162	..	283	1 367	1 508
Computer and related activities	72	..	75	..	106	23	59	..	61	723	924
Software consultancy	722	..	37	..	63	20	52	..	47	..	..
Other computer services nec	72-722	..	38	..	43	3	7	..	13	..	..
Research and development	73	..	26	189	157	99	4	..	199	405	438
Other business activities	70+71+74	..	128	35	34	133	99	..	24	239	147
Community, social and personal service activities, etc.	75/99	120	9	..	0	8	9	..	7	32	17
Total business enterprise	01/99	2 703	2 997	684	802	2 239	2 097	2 791	3 978	13 817	12 551

1. 1990 refers to western Germany.
2. The sum of manufacturing and services is greater than total business enterprise because of different classifications.
Source: OECD, ANBERD database, May 1999.

Table 5.2.2. **Share of services in business R&D**[1]

Percentages

	1980	1997
Canada	15.2	37.4
United States[2]	4.1	19.5
Australia[2,3]	11.1	28.5
Japan[2]	4.5	3.5
Denmark	20.3	31.9
Finland	5.7	12.8
France[2]	5.7	10.8
Germany[4]	2.5	4.3
Ireland	9.6	13.0
Italy	11.4	17.8
Netherlands[2]	6.9	18.7
Norway	15.5	32.4
Spain[2]	12.9	15.7
Sweden[4]	11.2	11.6
United Kingdom	5.5	19.1
Total OECD[4]	4.7	15.2

1. Share in total of manufacturing and services industries.
2. 1996 instead of 1997.
3. 1981 instead of 1980.
4. 1995 instead of 1997.

Source: OECD, ANBERD database, May 1999.

Table 5.3.1. **R&D intensity by industry**

Business enterprise R&D expenditure as a percentage of value added

	Canada		United States		Australia		Japan		Denmark		Finland		France		Germany[1]	
	1990	1997	1990	1996	1990	1994	1990	1996	1990	1997	1990	1997	1990	1996	1990	1995
Total manufacturing	3.4	3.7	8.6	8.9	2.3	3.5	7.3	7.8	4.1	5.0	4.7	7.1	6.3	6.6	6.2	6.5
Food, beverages and tobacco	0.5	0.5	1.3	1.2	0.8	1.1	1.9	1.8	1.4	1.7	2.7	1.9	0.9	0.9	0.4	0.5
Textiles, apparel & leather	0.7	0.8	0.6	0.9	0.2	0.7	1.6	1.8	0.4	0.2	1.2	1.7	0.4	1.0	0.6	1.5
Wood and wood products	0.7	0.3	0.5	1.2	0.2	0.8	0.7	1.2	0.3	0.2	0.6	0.8	0.2	1.0	0.7	0.9
Paper and printing	0.8	0.7	0.9	1.5	0.6	1.0	1.0	0.9	0.2	0.2	2.0	1.6	0.3	0.3	0.3	0.6
Chemicals	4.5	4.4	9.4	9.4	3.4	4.8	11.6	11.5	8.9	12.1	9.1	8.9	7.6	8.4	8.1	6.7
Industrial chemicals	2.4	2.1	8.4	8.3	3.8	4.0	13.3	12.7	3.6	3.9	8.8	6.9	8.6	10.6	12.6	11.7
Pharmaceuticals	11.8	17.1	23.1	21.1	15.3	21.3	18.6	21.2	26.6	29.7	27.7	40.0	28.6	28.6	22.1	18.2
Petroleum refining	16.8	5.7	7.0	5.6	0.3	1.1	12.8	4.9	0.0	0.0	6.1	2.3	2.4	1.5	0.6	0.3
Rubber & plastics	0.5	0.6	3.4	3.1	1.5	1.9	4.8	5.3	1.3	2.6	4.8	11.5	4.1	4.8	2.1	2.3
Non-metallic mineral products	0.5	0.3	2.5	1.5	0.9	0.8	4.9	4.9	1.9	0.7	2.1	2.0	1.6	2.5	1.6	1.6
Basic metals	3.2	1.9	1.7	1.4	1.6	4.5	4.7	4.0	4.7	2.5	3.8	2.3	2.5	3.0	1.0	1.0
Ferrous metals	0.8	0.4	0.9	0.9	2.6	7.3	4.3	3.1	5.6	3.2	3.2	2.9	2.5	3.5	1.0	1.1
Non-ferrous metals	5.4	3.4	3.3	2.3	1.1	2.6	5.9	6.6	1.9	0.9	5.2	1.0	2.6	2.2	1.1	0.9
Fabricated metals and machinery	6.5	7.1	15.3	15.4	4.4	6.3	10.6	11.6	5.7	6.6	7.7	13.5	11.1	11.1	9.3	10.5
Fabricated metals	0.5	0.9	1.4	1.7	1.4	2.5	1.8	2.1	0.9	0.4	2.2	2.3	0.8	1.2	2.1	1.1
Non-electrical machinery	1.7	2.0	3.1	5.1	4.6	5.3	6.7	7.5	4.5	7.3	5.8	7.0	3.9	6.1	7.2	9.5
Computers, office machinery	34.7	26.6	46.7	43.1	4.5	4.4	22.7	27.4	15.9	12.4	8.6	8.8	10.0	9.7	14.5	27.0
Electrical machinery	1.8	1.9	9.2	6.5	3.3	3.9	11.8	12.1	5.9	3.9	8.6	11.7	4.0	4.1	8.1	9.1
Communic. equip. and semicond.	31.4	33.3	17.4	21.3	..	..	13.2	15.5	16.9	23.8	26.1	44.9	32.3	32.1	16.6	11.4
Shipbuilding	0.0	0.0	0.0	0.0	2.2	7.8	1.8	1.0	3.2	6.1	2.4	1.3	1.4	4.3	2.9	6.3
Motor vehicles	0.7	0.9	23.1	20.2	3.9	5.8	12.2	12.5	0.0	0.0	4.3	4.3	10.4	11.6	9.4	11.1
Aerospace	21.4	20.2	40.0	38.7	2.5	1.5	30.3	21.2	0.0	0.0	2.2	0.5	45.3	32.2	59.2	86.2
Other transportation	0.5	0.4	4.5	4.9	4.0	7.8	4.7	5.2	17.6	8.9	8.4	25.8	4.9	7.5	3.2	21.3
Scientific instruments	3.6	3.7	13.5	21.9	11.0	12.2	15.2	20.4	17.8	17.0	19.2	11.2	4.0	4.0	4.7	18.9
Other manufacturing	2.8	4.3	3.0	2.0	5.0	23.5	1.2	1.5	13.4	17.0	2.8	6.8	0.9	1.2	1.3	2.5
High-technology industries	24.3	25.5	30.1	27.9	11.7	14.5	16.4	19.1	22.0	26.9	20.4	36.9	30.2	27.8	20.5	19.5
Medium-high-technology industries	1.6	1.6	10.0	11.2	4.2	5.3	10.8	11.3	5.8	6.8	7.6	8.3	6.8	8.1	9.0	11.2
Medium-low-technology industries	2.0	1.4	2.8	2.3	1.4	3.5	3.6	3.4	2.9	2.9	3.1	2.9	2.0	2.2	1.6	1.2
Low-technology Industries	0.7	0.6	0.9	1.3	0.6	0.9	1.4	1.5	0.8	0.9	1.9	1.5	0.6	0.8	0.5	0.7

	Italy		Netherlands		Norway		Spain		Sweden		United Kingdom		EU-9		OECD-14	
	1990	1997	1990	1996	1990	1997	1990	1996	1990	1995	1990	1997	1990	1995	1990	1994
Total manufacturing	3.0	2.8	5.4	5.0	4.8	4.0	1.7	1.7	8.6	11.2	6.1	5.5	5.2	5.2	6.8	6.6
Food, beverages and tobacco	0.3	0.3	1.9	2.1	1.0	0.9	0.3	0.4	1.6	1.7	1.3	0.9	0.8	0.8	1.1	1.1
Textiles, apparel & leather	0.0	0.1	0.7	1.0	0.9	2.2	0.1	0.5	1.2	1.7	0.3	0.4	0.3	0.5	0.6	0.7
Wood and wood products	0.0	0.1	0.1	1.1	0.6	0.9	0.2	0.3	0.2	0.7	0.2	0.1	0.3	0.5	0.5	0.5
Paper and printing	0.0	0.1	0.2	0.4	0.7	0.9	0.3	0.4	2.1	1.8	0.3	0.2	0.4	0.5	0.7	0.9
Chemicals	5.8	4.7	8.3	6.2	9.0	7.3	1.9	1.7	13.4	18.7	11.8	12.7	7.8	7.0	8.9	8.8
Industrial chemicals	4.1	3.4	11.3	7.4	7.9	4.8	1.5	1.0	6.9	5.2	7.8	6.4	8.5	7.4	9.0	8.5
Pharmaceuticals	23.0	19.3	28.8	20.6	36.7	18.8	5.2	5.9	55.3	49.6	34.5	32.5	25.0	22.8	22.5	22.6
Petroleum refining	3.7	3.4	1.8	1.5	3.5	11.9	1.5	0.9	0.6	3.0	16.5	20.5	3.0	2.0	5.2	3.9
Rubber & plastics	1.5	1.1	1.4	1.8	1.5	3.5	0.8	0.8	2.9	5.9	0.9	0.9	2.0	1.9	3.0	3.1
Non-metallic mineral products	0.2	0.2	0.4	0.7	2.1	2.2	0.4	0.5	1.6	2.6	1.3	1.0	1.0	1.1	2.1	1.9
Basic metals	1.6	0.7	2.4	3.0	6.2	5.7	0.6	1.0	3.7	2.7	1.7	1.0	1.6	1.4	2.6	2.5
Ferrous metals	1.1	0.8	3.0	2.3	3.9	1.0	0.5	1.1	3.9	2.9	1.4	1.0	1.4	1.5	2.2	2.3
Non-ferrous metals	3.5	0.3	1.1	4.6	7.2	7.9	0.9	0.7	3.3	2.0	2.5	1.1	1.9	1.3	3.5	3.1
Fabricated metals and machinery	5.9	5.8	8.6	8.8	8.7	6.8	4.1	3.6	14.0	19.0	9.1	7.4	8.8	9.2	11.4	11.1
Fabricated metals	0.5	1.0	1.0	0.9	2.3	0.9	0.8	0.7	0.9	1.5	0.8	1.1	1.2	1.0	1.4	1.3
Non-electrical machinery	2.4	1.7	2.2	2.5	4.8	4.1	1.8	3.2	8.9	11.0	4.5	3.9	4.9	5.8	4.6	5.6
Computers, office machinery	19.9	12.5	47.3	53.2	32.2	23.3	40.2	7.5	39.0	51.9	19.1	4.8	16.0	14.9	30.1	28.6
Electrical machinery	4.4	3.2	..	..	7.9	5.4	3.0	2.6	10.2	10.7	10.5	7.2	7.5	7.2	9.1	8.6
Communic. equip. and semicond.	16.7	25.5	8.5	8.3	45.6	36.0	12.5	14.7	68.5	59.4	16.1	13.7	19.3	18.3	17.0	16.7
Shipbuilding	4.6	9.0	0.5	0.8	3.5	3.8	1.3	12.9	3.6	3.1	3.0	1.2	2.5	4.7	2.2	2.7
Motor vehicles	10.7	13.1	10.9	17.4	5.9	9.5	2.8	1.9	17.4	23.0	8.9	10.9	9.2	10.6	12.7	11.9
Aerospace	29.3	25.1	10.8	15.0	1.6	4.4	25.7	32.0	28.8	56.8	19.4	18.1	33.7	35.3	37.2	33.5
Other transportation	3.5	3.2	0.0	0.0	1.7	0.3	1.5	4.2	7.3	10.6	3.9	4.9	3.7	7.1	4.2	4.1
Scientific instruments	2.2	2.3	4.0	4.5	44.0	11.5	11.2	7.6	2.7	31.5	4.3	3.2	4.4	10.6	11.4	17.6
Other manufacturing	0.3	0.4	0.0	1.1	1.2	1.9	0.6	0.9	3.1	1.1	1.7	1.5	1.3	1.6	1.9	1.9
High-technology industries	21.0	21.8	12.6	13.0	32.2	26.0	11.8	10.2	54.8	55.0	21.7	20.0	22.5	21.7	24.2	22.2
Medium-high-technology industries	4.8	4.0	12.0	10.1	7.1	5.0	2.3	1.9	10.4	15.3	7.2	6.4	7.2	8.0	8.8	9.3
Medium-low-technology industries	0.9	0.9	1.3	1.4	3.7	3.6	0.7	0.9	1.9	2.4	2.6	2.2	1.6	1.5	2.4	2.3
Low-technology Industries	0.1	0.2	1.1	1.4	0.8	0.9	0.2	0.4	1.5	1.6	0.7	0.5	0.5	0.6	0.8	0.9

1. 1990 refers to western Germany.

Source: OECD, STAN and ANBERD databases, May 1999.

Table 5.3.2. **R&D shares by industry**

Shares of the different sectors in business R&D

	Canada		United States		Australia		Japan		Denmark		Finland		France		Germany[1]	
	1990	1997	1990	1996	1990	1994	1990	1996	1990	1997	1990	1997	1990	1996	1990	1995
Total manufacturing	67.4	60.9	81.1	80.5	61.1	63.1	96.0	94.5	72.1	67.9	85.0	86.6	92.3	87.7	96.1	94.6
Food, beverages and tobacco	1.4	1.1	1.3	1.1	3.7	3.4	2.5	2.5	5.0	4.2	5.7	2.2	1.8	1.8	0.7	0.8
Textiles, apparel & leather	0.8	0.6	0.3	0.3	0.4	0.6	1.0	0.8	0.4	0.1	0.8	0.5	0.4	0.6	0.4	0.6
Wood and wood products	0.8	0.4	0.2	0.5	0.3	0.8	0.3	0.3	0.3	0.2	1.0	0.7	0.1	0.4	0.3	0.5
Paper and printing	2.3	1.5	1.0	1.5	1.7	1.9	0.9	0.8	0.4	0.3	7.7	4.3	0.3	0.3	0.2	0.4
Chemicals	11.9	9.8	15.3	15.2	13.1	11.3	18.8	19.1	21.2	24.2	18.3	10.8	21.1	22.4	22.4	19.6
Industrial chemicals	3.2	2.1	6.4	6.3	6.1	4.2	9.7	9.2	3.2	3.0	9.3	4.4	9.3	10.0	15.1	13.3
Pharmaceuticals	4.9	6.3	5.7	6.8	5.2	5.3	5.6	6.6	17.2	20.0	4.7	3.5	7.4	8.6	5.5	4.6
Petroleum refining	3.5	0.9	2.1	1.1	0.2	0.4	1.0	0.6	0.0	0.0	2.8	0.7	2.1	1.3	0.4	0.2
Rubber & plastics	0.4	0.4	1.1	1.0	1.6	1.4	2.5	2.6	0.8	1.1	1.6	2.1	2.4	2.5	1.4	1.5
Non-metallic mineral products	0.3	0.1	0.6	0.3	1.3	0.8	2.3	2.1	1.5	0.5	1.8	0.8	1.0	1.2	1.0	1.0
Basic metals	3.5	1.8	0.7	0.5	5.1	8.9	4.8	3.5	1.1	0.4	3.0	1.5	1.9	1.7	1.2	1.0
Ferrous metals	0.4	0.2	0.2	0.2	3.1	5.9	3.3	2.0	0.9	0.4	1.8	1.3	1.2	1.2	0.8	0.7
Non-ferrous metals	3.1	1.6	0.5	0.3	2.0	3.0	1.5	1.5	0.1	0.0	1.2	0.2	0.7	0.5	0.3	0.3
Fabr. metals and machinery	45.7	45.0	61.2	60.7	34.5	32.4	64.7	64.5	36.3	33.1	46.3	65.3	65.7	58.9	69.8	70.4
Fabricated metals	0.7	0.9	0.9	1.1	3.0	3.1	1.4	1.5	1.4	0.5	2.6	2.0	0.9	1.2	2.9	1.4
Non-electrical machinery	1.8	1.9	2.5	4.2	4.9	3.7	8.6	8.7	11.2	15.3	11.8	10.6	4.1	4.6	10.3	11.3
Computers, office machinery	5.7	4.1	10.7	8.8	2.0	1.6	9.7	9.9	2.0	0.9	2.3	1.1	3.6	2.6	3.5	3.9
Electrical machinery	1.1	0.9	3.1	2.3	2.5	2.0	10.7	10.9	3.4	1.8	5.6	5.8	3.2	3.3	7.4	7.2
Communic. equip. and semicond.	22.0	23.8	9.1	13.2	..	..	15.7	16.1	7.1	6.3	15.6	39.8	22.0	20.2	18.4	10.0
Shipbuilding	0.0	0.0	0.0	0.0	0.9	1.9	0.1	0.1	1.8	2.1	1.0	0.4	0.1	0.1	0.1	0.3
Motor vehicles	1.3	1.8	9.3	11.1	7.4	7.8	13.8	12.8	..	..	1.5	0.7	11.4	11.9	17.0	21.2
Aerospace	11.6	10.3	18.8	11.2	0.7	0.3	0.9	0.7	0.0	0.0	0.2	0.0	19.0	13.7	8.4	8.1
Other transportation	0.1	0.1	0.4	0.3	0.4	0.8	0.2	0.2	0.9	0.3	1.2	1.2	0.3	0.5	0.1	1.0
Scientific instruments	1.3	1.2	6.4	8.4	2.7	2.0	3.6	3.6	8.3	6.0	4.5	3.6	0.9	0.9	1.7	6.0
Other manufacturing	0.5	0.6	0.6	0.3	1.1	2.9	0.7	0.8	6.0	4.9	0.4	0.5	0.2	0.3	0.1	0.2
High-technology industries	44.2	44.6	44.3	40.0	17.8	16.4	31.8	33.4	26.3	27.2	22.7	44.5	52.0	45.0	35.7	26.7
Medium-high-technology industries	8.8	8.0	28.2	32.6	24.1	20.6	46.7	45.4	27.1	26.4	33.8	26.3	29.3	31.1	51.6	60.0
Medium-low-technology industries	8.9	4.7	5.8	4.4	13.2	19.4	12.9	11.3	12.6	9.5	13.2	8.1	8.5	8.4	7.1	5.7
Low-technology Industries	5.4	3.6	2.7	3.4	6.1	6.8	4.7	4.4	6.1	4.8	15.2	7.7	2.5	3.2	1.6	2.3

	Italy		Netherlands		Norway		Spain		Sweden		United Kingdom		EU-9		OECD-14	
	1990	1997	1990	1996	1990	1997	1990	1996	1990	1995	1990	1997	1990	1995	1990	1994
Total manufacturing	89.6	82.2	90.4	79.2	65.1	57.0	79.9	82.4	88.4	87.5	81.0	80.4	90.0	87.4	86.3	84.8
Food, beverages and tobacco	0.8	1.1	5.2	6.0	2.8	3.0	2.6	3.4	1.7	1.2	2.4	1.9	1.7	1.8	1.7	1.7
Textiles, apparel & leather	0.2	0.4	0.4	0.4	0.2	0.5	0.5	1.6	0.3	0.2	0.2	0.3	0.3	0.5	0.4	0.5
Wood and wood products	0.1	0.1	0.0	0.4	0.5	0.7	0.3	0.4	0.1	0.3	0.1	0.1	0.2	0.3	0.2	0.3
Paper and printing	0.0	0.2	0.4	0.6	1.5	1.8	0.8	1.0	3.3	2.8	0.5	0.4	0.5	0.6	0.9	1.0
Chemicals	22.3	18.7	35.4	26.4	15.7	11.8	18.4	21.4	16.3	17.6	28.2	33.9	23.4	22.5	18.3	19.5
Industrial chemicals	6.4	5.4	24.7	14.1	7.8	4.5	6.7	5.3	3.3	2.0	8.7	7.1	11.1	9.7	8.4	8.1
Pharmaceuticals	12.6	10.6	7.6	9.2	6.6	4.6	8.0	11.9	12.1	14.3	14.5	22.5	9.0	10.0	6.6	8.4
Petroleum refining	1.2	1.1	2.3	1.9	0.9	1.6	1.7	1.4	0.2	0.3	4.5	3.7	1.8	1.4	1.8	1.4
Rubber & plastics	2.1	1.6	0.8	1.2	0.5	1.0	2.0	2.8	0.7	1.0	0.6	0.6	1.5	1.5	1.5	1.6
Non-metallic mineral products	0.5	0.3	0.3	0.4	1.0	0.8	1.5	1.7	0.5	0.5	0.6	0.5	0.8	0.9	1.0	0.9
Basic metals	2.0	1.1	1.4	1.7	7.0	5.1	1.3	2.1	1.8	1.2	1.0	0.6	1.4	1.2	1.8	1.6
Ferrous metals	1.2	1.0	1.2	0.9	1.3	0.3	0.8	1.7	1.3	1.0	0.6	0.4	0.9	0.9	1.1	1.0
Non-ferrous metals	0.8	0.1	0.2	0.8	5.7	4.8	0.5	0.4	0.5	0.2	0.4	0.2	0.5	0.3	0.8	0.6
Fabr. metals and machinery	63.6	60.2	47.2	43.1	36.3	33.1	54.1	50.0	64.1	63.6	47.7	42.4	61.4	59.3	61.5	58.8
Fabricated metals	1.6	2.4	1.4	1.0	1.9	0.8	2.2	1.9	1.0	1.1	0.6	0.9	1.7	1.3	1.2	1.2
Non-electrical machinery	6.1	5.0	2.6	2.8	6.9	7.6	4.6	7.4	12.0	10.8	5.8	5.8	7.2	8.0	5.2	5.8
Computers, office machinery	5.8	3.3	4.0	4.2	3.9	1.1	7.4	1.9	2.3	1.4	5.7	1.1	4.3	3.0	8.4	6.6
Electrical machinery	5.7	4.5	..	..	3.3	2.5	5.2	4.2	3.4	1.6	6.0	4.4	6.2	5.6	5.5	5.3
Communic. equip. and semicond.	14.5	17.7	14.5	12.0	13.6	14.2	13.4	11.9	24.8	19.9	9.5	9.6	16.7	13.9	12.9	13.4
Shipbuilding	0.5	0.8	0.1	0.2	2.2	2.5	0.7	1.8	0.3	0.1	0.4	0.2	0.3	0.4	0.1	0.2
Motor vehicles	16.5	15.3	4.0	5.3	0.8	1.9	10.2	9.8	14.7	16.4	6.9	10.1	12.4	14.5	11.0	11.7
Aerospace	10.5	8.6	1.8	1.8	0.3	0.4	8.0	8.5	4.6	5.1	11.8	9.3	10.9	8.8	12.5	8.5
Other transportation	0.8	1.0	0.0	0.0	0.1	0.0	0.5	1.4	0.4	0.3	0.2	0.3	0.3	0.6	0.3	0.3
Scientific instruments	1.5	1.6	1.0	1.1	3.4	2.2	2.0	1.3	0.7	6.9	0.8	0.8	1.4	3.3	4.3	5.8
Other manufacturing	0.1	0.1	0.0	0.1	0.1	0.2	0.4	0.7	0.2	0.1	0.3	0.3	0.3	0.3	0.5	0.5
High-technology industries	43.5	40.1	27.9	27.2	24.3	20.3	36.8	34.1	43.8	40.6	41.5	42.5	40.9	35.6	40.5	36.9
Medium-high-technology industries	37.0	32.8	50.1	38.0	22.4	18.7	29.2	29.4	34.4	38.0	28.4	28.5	38.6	41.6	34.7	37.0
Medium-low-technology industries	8.0	7.5	6.3	6.5	13.5	12.1	9.9	12.4	4.8	4.3	7.9	6.7	7.8	7.0	8.0	7.4
Low-technology Industries	1.1	1.8	6.1	7.4	5.0	5.9	4.1	6.4	5.4	4.5	3.2	2.7	2.7	3.2	3.2	3.5

1. 1990 refers to western Germany.

Source: OECD, STAN and ANBERD databases, May 1999.

Table 5.3.3. **Sources of change in R&D intensity[1] in manufacturing, 1990-97**

	Total percentage change	Intra-industry effect	Structural effect	Cross effect
Canada	0.31	0.10	0.20	0.006
United States[2]	0.28	0.30	-0.02	0.000
Australia[3]	1.30	1.35	-0.04	-0.004
Japan[2]	0.48	0.43	0.06	-0.003
Denmark	0.88	0.83	0.05	0.005
Finland	2.13	1.72	0.29	0.119
France[2]	0.28	0.30	-0.02	0.000
Germany[4]	0.37	0.39	0.01	-0.019
Italy	-0.26	-0.21	-0.05	0.000
Netherlands[2]	-0.39	-0.34	-0.05	-0.009
Norway	-0.79	-0.81	0.04	-0.018
Spain[2]	-0.01	-0.09	0.09	-0.003
Sweden[4]	2.69	2.82	-0.09	-0.041
United Kingdom	-0.60	-0.59	-0.01	0.003
European Union[4]	0.01	0.05	-0.04	-0.005

1. Business R&D as a percentage of value added. Due to rounding, total percentage change may differ from percentage changes calculated from data presented in Annex, Table 5.3.1.
2. 1990-96.
3. 1990-94.
4. 1990-95.

Source: OECD, STAN and ANBERD databases, May 1999.

Table 5.4.1. **Total business R&D broken down by size classes of firms**

1997 percentages and total in millions of US dollars using purchasing power parities

	Employees						
	Less than 100	100 to 499	500 to 999	1 000 and more	Less than 500	500 and more	Average
Canada[1]	19.6	15.0	9.7	55.8	34.6	65.4	6 195
Mexico[1,2]	13.8	24.5	61.6	→	38.4	61.6	449
United States	←	15.3	3.2	81.6	15.3	84.7	157 539
Australia[3]	26.8	23.7	13.9	35.5	50.5	49.5	3 172
Japan[4]	←	6.2	9.5	84.3	6.2	93.8	64 760
Korea[5]	4.1	8.8	8.2	78.9	12.9	87.1	13 996
Belgium[1]	19.0	17.3	12.3	51.4	36.3	63.7	2 218
Denmark[1,6,7]	10.3	30.4	14.6	44.7	40.7	59.3	1 080
Finland	14.3	15.0	14.5	56.2	29.3	70.7	1 928
France[1]	←	20.4	9.6	70.0	20.4	79.6	16 497
Germany[1,7]	5.4	9.0	4.8	80.8	14.4	85.6	25 720
Iceland	59.0	41.0	→		..	..	50
Ireland[1]	32.0	56.9	11.1	→	88.9	11.1	610
Italy[1]	4.3	15.5	15.1	65.1	19.8	80.2	6 005
Netherlands[3,8]	9.8	16.6	73.6	→	26.4	73.6	3 610
Norway[1,7,9]	25.8	29.4	44.8	→	55.2	44.8	460
Poland[1]	9.5	56.0	14.3	20.2	65.5	34.5	612
Spain[1]	17.9	30.1	17.3	34.7	48.0	52.0	2 277
Sweden[7,10]	3.3	12.8	11.2	72.7	16.1	83.9	5 106
Switzerland[3]	10.1	20.3	11.3	58.3	30.4	69.6	3 302
Turkey[3]	6.0	31.5	13.2	49.2	37.5	62.5	415
United Kingdom	5.9	23.0	12.5	58.6	28.9	71.1	14 742

1. 1995.
2. 51 to 100 employees.
3. 1996.
4. Less than 300 and 300 to 999.
5. Companies only.
6. Smaller industries and technological service institutes are excluded.
7. Sum does not include institutes.
8. 10 to 99 employees.
9. Total Manufacturing and mining only.
10. 50 to 99 employees.

Source: OECD.

Table 5.4.2. **Share of government-financed business R&D by size-classes of firms in total business R&D**

1997 percentages

	Employees						
	Less than 100	100 to 499	500 to 999	1 000 and more	Less than 500	500 and more	Average
Canada[1]	11.1	5.9	4.7	6.3	8.9	6.1	7.1
Mexico[1,2]	1.9	5.5	1.9	→	4.2	1.9	2.8
United States	←	9.2	7.5	16.6	9.2	16.3	15.2
Australia[3]	4.4	1.5	2.0	0.0	3.1	2.0	2.5
Japan	..	..	..	..	..	..	1.3
Korea[4]	23.2	10.3	4.6	3.3	14.4	3.5	4.9
Belgium[1]	11.4	2.7	2.1	1.5	7.3	1.6	3.7
Denmark[1,5,6]	10.7	6.8	5.3	5.6	7.8	5.5	6.5
Finland	11.7	5.0	6.0	1.5	8.2	2.4	4.1
France[1]	←	6.7	11.3	16.6	6.7	16.0	14.1
Germany[1,6]	..	..	..	..	..	..	7.7
Iceland	3.5	7.2	→		..	..	5.0
Ireland[1]	7.1	3.1	4.5	→	4.6	4.6	4.5
Italy[1]	14.8	9.8	17.7	18.2	10.9	18.1	16.7
Netherlands[3,7]	1.5	3.9	6.6	→	3.0	6.6	5.6
Norway[1,6,8]	6.8	2.9	10.9	→	4.7	10.9	7.5
Poland[1]	29.8	42.1	29.6	15.7	40.3	21.4	33.8
Spain[1]	14.4	9.9	6.1	7.4	11.6	6.9	9.2
Sweden[6,9]	9.8	4.1	15.9	6.1	5.3	7.4	7.8
Switzerland[3]	18.3	1.7	2.1	0.0	7.2	0.3	2.4
Turkey[3]	4.2	2.8	0.7	1.4	3.0	1.3	1.9
United Kingdom	8.1	8.0	13.5	9.7	8.0	10.4	9.7

1. 1995.
2. 51 to 100 employees.
3. 1996.
4. Companies only.
5. Smaller industries and technological service institutes are excluded.
6. Sum does not include institutes.
7. 10 to 99 employees.
8. Total manufacturing and mining only.
9. 50 to 99 employees.

Source: OECD.

Table 5.5.1. **Expenditure on innovation as a share of total sales, 1996**

Percentages

	Manufacturing sector	Services sector
Australia[1]	1.90	..
Austria	3.45	2.93
Belgium	2.15	1.22
Finland	4.34	2.36
France	3.92	1.25
Germany	4.12	2.95
Ireland	3.33	2.11
Netherlands	3.79	1.60
Norway[1]	2.73	2.46
Spain	1.83	..
Sweden	7.04	3.78
Switzerland[2]	6.30	1.70
United Kingdom	3.16	4.02

1. 1997.
2. 1995.
Source: OECD, mainly based on data from Eurostat.

Table 6.1.1. **Main components of international transactions[1], total OECD[2]**

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Index 1985 = 100													
Trade in goods	100	114	135	155	168	192	195	207	199	224	267	278	286
Trade in services	100	120	145	165	179	214	225	248	245	263	298	314	321
Direct investment	100	161	246	294	374	391	298	301	349	384	580	569	631
Portfolio investment	100	149	117	171	241	149	280	270	431	231	360	597	547
Investment income	100	110	135	172	212	255	264	266	267	265	324	342	359
Technological trade	100	135	172	205	228	281	315	368	362	401	469	497	..
As a percentage of GDP													
Trade in goods	14.3	13.4	13.7	14.0	14.5	14.8	14.1	13.9	13.3	14.0	15.3	15.8	16.5
Trade in services	3.3	3.3	3.4	3.5	3.6	3.8	3.8	3.9	3.8	3.8	4.0	4.2	4.3
Direct investment	0.6	0.7	1.0	1.0	1.3	1.2	0.8	0.8	0.9	0.9	1.3	1.3	1.4
Portfolio investment	1.5	1.8	1.2	1.6	2.1	1.2	2.1	1.9	3.0	1.5	2.1	3.5	3.3
Investment income	3.1	2.8	3.0	3.4	4.0	4.3	4.2	3.9	3.9	3.6	4.1	4.3	4.6
Technological trade	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	..

1. Average of imports and exports (trade), inflows and outflows (investment).
2. Total OECD excludes Czech Republic, Hungary and Poland.

Source: OECD, ADB and TBP databases, May 1999.

Table 6.1.2. **Outward direct investment flows as a percentage of GDP**

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Canada	1.1	1.0	1.7	1.3	1.0	0.9	1.0	0.6	1.0	1.7	2.0	1.9	2.2
Mexico	..	..	..	..	..	..	..	..	..	..	..	..	..
United States	0.3	0.4	0.6	0.3	0.7	0.5	0.5	0.7	1.2	1.1	1.3	1.1	1.5
Australia	1.1	2.0	2.5	2.3	1.1	0.3	0.5	1.7	0.8	0.7	1.1	1.5	1.5
Japan	0.5	0.7	0.8	1.2	1.6	1.7	0.9	0.5	0.3	0.4	0.4	0.5	0.6
Korea	0.6	1.1	0.4	0.4	0.3	0.4	0.5	0.4	0.4	0.6	0.7	0.9	0.9
New Zealand	1.4	2.2	1.3	0.9	4.6	3.7	1.6	-2.1	2.9	3.4	-0.6	-1.5	-0.3
Austria	0.1	0.3	0.3	0.2	0.7	1.0	0.8	0.9	0.7	0.6	0.5	0.8	0.9
Belgium[1]	0.3	1.4	1.8	2.3	3.9	3.0	3.0	4.8	2.1	0.5	16.1	12.0	3.3
Czech Republic	..	..	..	..	..	..	..	..	..	-0.3	-0.1	-0.1	0.0
Denmark	0.5	0.8	0.6	0.6	1.9	1.1	1.4	1.5	1.0	2.7	1.7	1.4	2.2
Finland	0.6	1.1	1.3	2.5	2.6	2.0	-0.1	-0.7	1.6	4.3	1.2	2.8	4.1
France	0.4	0.7	1.0	1.5	2.0	2.9	2.0	2.4	1.7	1.8	1.0	2.0	2.6
Germany	0.8	1.1	0.9	1.0	1.3	1.6	1.4	1.0	0.8	0.8	1.6	1.3	1.6
Greece	..	..	..	..	..	..	..	..	..	..	..	..	..
Hungary	..	..	..	..	..	..	..	..	..	-0.1	-0.1	0.0	-0.9
Iceland	..	0.1	..	0.0	0.1	0.2	0.5	0.1	0.2	0.4	0.4	0.9	0.3
Ireland	..	..	..	..	..	0.8	0.4	0.4	0.5	0.8	1.3	1.1	1.4
Italy	0.4	0.4	0.3	0.6	0.2	0.7	0.6	0.6	0.9	0.6	0.7	0.7	1.1
Netherlands	2.1	2.3	4.0	3.1	6.5	5.4	4.7	4.5	3.9	5.2	5.0	8.0	5.5
Norway	1.9	2.1	1.0	1.0	1.4	1.3	1.5	0.3	0.8	1.8	2.0	3.6	2.6
Poland	..	..	..	..	..	..	..	..	..	..	..	..	..
Portugal	0.1	..	0.0	0.2	0.2	0.2	0.6	0.7	0.2	0.3	0.7	0.7	1.6
Spain	0.2	0.2	0.3	0.4	0.4	0.7	0.8	0.4	0.6	0.8	0.6	0.9	1.9
Sweden	1.8	3.0	3.0	4.1	5.4	6.4	2.9	0.2	0.7	3.4	4.8	2.0	5.1
Switzerland	4.7	1.1	0.7	4.7	4.4	2.8	2.8	2.5	3.7	4.1	4.0	5.4	5.7
Turkey	..	..	0.0	..	..	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
United Kingdom	2.4	3.1	4.6	4.5	4.2	1.9	1.6	1.8	2.8	3.3	4.0	3.0	4.9
European Union	0.9	1.2	1.5	1.8	2.1	2.0	1.5	1.4	1.4	1.6	2.3	2.2	2.6
Total OECD[2]	0.6	0.8	1.0	1.1	1.4	1.3	1.0	0.9	1.1	1.1	1.5	1.4	1.7

1. Belgium includes Luxembourg until 1995.
2. Total OECD excludes Czech Republic, Hungary and Poland.

Source: OECD, ADB database, May 1999.

Table 6.1.3. **Inward direct investment flows as a percentage of GDP**

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Canada	0.4	0.8	1.9	1.2	1.1	1.3	0.5	0.8	0.8	1.5	1.6	1.1	1.1
Mexico	1.3	1.7	1.7	1.5	1.4	1.0	1.5	1.2	1.1	2.6	3.3	2.8	3.2
United States	0.5	0.8	1.2	1.1	1.2	0.8	0.4	0.3	0.7	0.6	0.8	1.0	1.2
Australia	1.3	3.1	2.5	2.9	2.7	2.4	1.4	1.7	1.3	1.4	3.5	1.3	2.1
Japan	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1
Korea	0.2	0.4	0.5	0.6	0.5	0.3	0.4	0.2	0.2	0.2	0.4	0.4	0.6
New Zealand	5.6	4.4	3.6	4.0	3.9	4.0	3.1	5.3	5.6	4.8	5.9	2.5	1.3
Austria	0.3	0.2	0.3	0.3	0.5	0.4	0.2	0.8	0.6	1.1	0.8	2.0	1.2
Belgium[1]	1.2	0.6	1.6	3.1	4.3	3.8	4.4	4.8	4.7	3.4	14.9	20.6	4.9
Czech Republic	..	..	..	..	..	..	..	..	..	2.2	5.1	2.5	2.5
Denmark	0.1	0.1	0.2	0.1	0.6	0.2	0.2	0.1	0.1	0.1	0.6	-0.1	0.0
Finland	0.2	0.2	0.1	0.5	1.0	0.8	1.1	0.7	1.2	3.2	2.3	0.4	1.7
France	0.2	0.5	0.3	0.5	0.4	0.6	-0.2	0.4	1.0	1.6	0.8	0.9	1.4
Germany	0.5	0.4	0.6	0.9	1.1	1.1	1.2	1.7	1.7	1.2	1.5	1.4	1.7
Greece	1.1	1.0	1.2	1.4	1.1	1.2	1.3	1.2	1.1	1.0	0.9	0.9	0.8
Hungary	..	..	..	..	..	..	..	..	..	2.7	10.1	4.4	4.5
Iceland	0.8	0.2	0.1	-0.3	-0.5	0.4	0.3	-0.2	0.0	0.0	0.2	0.8	1.7
Ireland	0.8	-0.2	0.3	0.3	0.2	1.4	3.0	2.8	2.2	1.6	2.3	3.8	3.7
Italy	0.3	0.0	0.6	0.8	0.3	0.6	0.2	0.3	0.4	0.2	0.4	0.3	0.3
Netherlands	1.1	1.7	1.4	2.1	3.7	4.3	2.3	2.4	2.7	2.2	3.1	3.7	2.5
Norway	-0.6	1.4	0.2	0.3	1.5	0.9	-0.3	0.6	1.7	2.3	1.6	2.0	2.3
Poland	..	..	..	..	..	..	..	..	..	0.6	..	..	..
Portugal	1.1	0.7	1.1	1.9	3.3	3.8	3.1	2.0	1.8	1.4	0.7	0.6	1.7
Spain	1.2	1.5	1.6	2.0	2.2	2.8	2.4	2.3	1.7	1.9	1.1	1.1	1.0
Sweden	0.4	0.8	0.4	0.9	0.9	0.9	2.6	0.0	2.0	3.2	6.2	2.2	4.3
Switzerland	1.3	1.5	1.3	0.2	1.6	2.2	1.4	0.5	0.4	1.6	1.2	1.4	2.2
Turkey	0.1	0.2	0.1	0.4	0.6	0.5	0.5	0.5	0.3	0.5	0.5	0.4	0.4
United Kingdom	1.3	1.5	2.3	2.6	3.6	3.3	1.6	1.5	1.6	0.9	1.8	2.2	2.8
European Union	0.6	0.6	0.8	1.1	1.5	1.5	1.1	1.1	1.2	1.0	1.8	1.6	1.4
Total OECD[2]	0.5	0.7	0.9	0.9	1.1	1.0	0.7	0.6	0.8	0.7	1.1	1.1	1.1

1. Belgium includes Luxembourg until 1995.
2. Total OECD excludes Czech Republic, Hungary and Poland.

Source: OECD, ADB database, May 1999.

Table 7.1.1. **Trade-to-GDP ratio**[1]

	Goods							Services							Goods and services						
					Average annual growth							Average annual growth							Average annual growth		
	1985	1991	1996	1997	1985-91	1991-97	1985-97	1985	1991	1996	1997	1985-91	1991-97	1985-97	1985	1991	1996	1997	1985-91	1991-97	1985-97
Canada	23.6	21.1	31.2	33.4	-1.9	7.9	2.9	3.3	4.2	5.4	5.3	4.1	3.8	3.9	27.0	25.3	36.6	38.7	-1.0	7.3	3.0
Mexico	14.3	14.6	27.9	27.4	0.4	11.1	5.6	3.2	3.0	3.2	2.9	-0.9	-0.9	-0.9	17.5	17.6	31.0	30.3	0.1	9.5	4.7
United States	6.6	7.7	9.2	9.6	2.5	3.8	3.1	1.7	2.4	2.6	2.6	5.5	1.5	3.5	8.4	10.1	11.8	12.2	3.2	3.3	3.2
Australia	14.1	13.1	14.9	15.8	-1.2	3.1	0.9	3.6	3.9	4.6	4.6	1.6	2.7	2.2	17.7	17.0	19.5	20.4	-0.6	3.0	1.2
Japan	11.0	7.6	7.8	8.5	-5.8	1.9	-2.1	2.0	1.9	2.1	2.3	-0.3	2.9	1.3	12.9	9.6	9.9	10.8	-4.9	2.1	-1.5
Korea	28.2	25.0	26.4	29.2	-2.0	2.6	0.3	3.8	3.8	5.1	5.8	-0.2	7.6	3.6	32.1	28.8	31.5	35.1	-1.8	3.3	0.7
New Zealand	25.3	20.6	21.4	21.1	-3.4	0.4	-1.5	7.3	7.2	7.5	7.2	-0.2	0.0	-0.1	32.6	27.8	29.0	28.3	-2.6	0.3	-1.1
Austria	27.6	26.7	27.0	29.5	-0.6	1.7	0.5	12.1	12.2	13.9	14.1	0.3	2.4	1.3	39.7	39.0	40.9	43.6	-0.3	1.9	0.8
Belgium-Luxembourg[2]	55.7	49.1	54.3	58.4	-2.1	0.4	-1.1	10.3	11.9	10.9	11.5	2.5	-3.6	0.0	66.0	60.9	65.1	69.8	-1.3	2.3	0.5
Czech Republic[3]	..	..	43.6	47.9	..	9.7	..	..	..	12.8	12.0	..	1.8	..	..	..	56.4	59.9	..	7.9	..
Denmark	29.2	25.6	25.6	27.0	-2.2	0.9	-0.7	8.6	9.2	8.5	8.9	1.2	-0.6	0.3	37.8	34.8	34.1	35.9	-1.4	0.5	-0.4
Finland	23.7	17.7	27.4	29.1	-4.7	8.7	1.7	4.9	4.8	6.5	6.4	-0.3	4.9	2.3	28.5	22.5	33.8	35.5	-3.9	7.9	1.8
France	18.9	17.8	17.8	19.4	-1.0	1.5	0.2	5.8	5.5	4.9	5.2	-1.0	-0.9	-0.9	24.7	23.2	22.7	24.6	-1.0	0.9	0.0
Germany	27.0	22.9	20.8	22.7	-2.7	-0.1	-1.4	5.3	4.5	4.6	4.9	-2.6	1.5	-0.6	32.3	27.4	25.4	27.7	-2.7	0.2	-1.3
Greece	16.9	13.4	11.1	11.0	-3.9	-3.1	-3.5	4.9	5.8	5.5	5.8	2.8	-0.1	1.4	21.9	19.2	16.6	16.9	-2.2	-2.2	-2.2
Hungary[3]	..	..	34.3	44.7	..	25.4	..	..	..	9.4	9.3	..	8.8	..	..	..	43.7	54.0	..	21.8	..
Iceland	28.0	23.5	25.7	24.8	-2.9	0.9	-1.0	13.0	8.7	10.3	10.9	-6.5	3.8	-1.5	41.0	32.2	36.0	35.6	-3.9	1.7	-1.2
Ireland	50.3	47.2	60.1	62.9	-1.0	4.9	1.9	7.2	10.3	13.9	14.5	6.0	5.9	6.0	57.6	57.5	74.0	77.4	0.0	5.1	2.5
Italy	18.8	14.8	18.2	18.8	-3.9	4.1	0.0	4.3	4.2	6.0	6.6	-0.3	7.7	3.6	23.1	19.0	24.2	25.4	-3.2	5.0	0.8
Netherlands	50.4	42.8	41.6	43.3	-2.7	0.2	-1.3	11.1	11.7	12.1	13.4	0.9	2.3	1.6	61.5	54.6	53.7	56.7	-2.0	0.6	-0.7
Norway	27.7	25.3	27.6	28.0	-1.5	1.8	0.1	11.7	11.1	8.8	9.4	-1.0	-2.6	-1.8	39.4	36.3	36.4	37.5	-1.4	0.5	-0.4
Poland[4]	..	..	18.9	..	..	..	..	..	..	2.2	..	..	..	..	..	..	21.1	..	..	..	..
Portugal	26.8	25.8	27.8	28.8	-0.6	1.9	0.6	6.6	6.2	6.9	6.9	-1.1	1.7	0.3	33.4	32.0	34.7	35.7	-0.7	1.9	0.6
Spain	16.3	14.2	19.0	20.9	-2.3	6.6	2.1	5.2	4.4	5.9	6.5	-2.7	6.6	1.9	21.5	18.6	24.9	27.3	-2.4	6.6	2.0
Sweden	28.6	21.4	29.9	32.6	-4.7	7.3	1.1	6.3	6.7	7.1	8.2	1.0	3.5	2.2	34.9	28.1	37.0	40.8	-3.6	6.4	1.3
Switzerland	31.1	28.5	27.8	30.9	-1.5	1.4	-0.1	6.7	6.3	6.7	7.2	-1.0	2.2	0.6	37.8	34.8	34.6	38.1	-1.4	1.5	0.1
Turkey	14.4	11.3	20.4	20.7	-4.0	10.7	3.1	3.1	3.8	5.3	7.2	3.3	11.3	7.2	17.5	15.1	25.7	27.9	-2.5	10.8	3.9
United Kingdom	22.5	18.7	23.0	22.2	-3.0	2.9	-0.1	5.9	5.0	6.4	6.4	-2.7	4.2	0.7	28.4	23.7	29.5	28.6	-3.0	3.2	0.1
European Union	24.9	21.1	23.0	24.3	-2.7	2.4	-0.2	6.0	5.6	6.3	6.7	-1.1	2.9	0.9	30.9	26.7	29.3	31.0	-2.4	2.5	0.0
Total OECD[5]	14.3	14.1	15.8	16.5	-0.2	2.7	1.2	3.3	3.8	4.2	4.3	2.2	2.2	2.2	17.6	17.9	20.0	20.9	0.3	2.6	1.4

1. Average of imports and exports as a share of nominal GDP.
2. Luxembourg is excluded from 1996 onwards. Average annual growth rates 1991-95 and 1985-95 instead of 1991-97 and 1985-97.
3. 1994-97 instead of 1991-97.
4. 1994 instead of 1996.
5. Total OECD excludes Czech Republic, Hungary and Poland.

Source: OECD, ADB database, May 1999.

Table 7.2.1. **Manufacturing trade[1] by industry, total OECD[2]**

	Share in total manufacturing[3]												Average annual growth			Index[4] 1985=100
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1985-90	1990-96	1985-96	1996
High-technology industries	13.5	13.7	13.7	14.7	15.0	15.1	16.0	15.9	16.8	17.1	17.4	17.9	2.3	2.8	2.6	379
Aircraft	2.6	2.4	2.3	2.6	3.0	3.2	3.5	3.3	2.9	2.6	2.2	2.4	4.2	-4.6	-0.7	266
Office & computing equipment	4.1	4.2	4.5	4.7	4.7	4.6	4.7	4.7	5.1	5.2	5.5	5.7	2.2	3.6	3.0	395
Drugs & medicines	1.1	1.3	1.3	1.3	1.2	1.3	1.5	1.7	1.8	1.8	1.8	1.9	2.9	6.7	5.0	486
Radio, TV & communication equipment	5.7	5.8	5.7	6.1	6.1	6.0	6.3	6.3	7.0	7.5	7.9	7.9	1.3	4.5	3.0	397
Medium-high-technology industries	42.1	43.7	43.6	43.0	42.6	42.7	42.5	42.9	42.5	42.9	43.0	43.3	0.3	0.2	0.2	294
Professional goods	3.4	3.6	3.6	3.6	3.6	3.6	3.7	3.8	3.9	3.8	3.7	3.8	1.0	0.8	0.9	315
Motor vehicles	13.8	14.5	14.3	13.7	13.4	13.2	13.2	13.6	13.3	13.5	13.0	13.3	-0.9	0.1	-0.4	275
Electrical machinery excl. commun. equipment	3.9	4.2	4.2	4.3	4.4	4.4	4.6	4.7	4.9	5.0	5.1	5.1	2.6	2.5	2.5	376
Chemicals excl. drugs	10.9	10.9	11.0	10.9	10.7	10.7	10.5	10.5	10.4	10.5	10.9	10.6	-0.5	-0.1	-0.3	278
Other transport equipment	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.5	0.5	-0.8	2.5	1.0	317
Non-electrical machinery	9.5	10.0	10.0	10.0	10.1	10.3	9.9	9.7	9.4	9.4	9.7	9.9	1.5	-0.7	0.3	296
Medium-low-technology industries	22.5	20.2	19.8	19.6	20.2	19.8	19.2	18.5	18.3	17.8	17.9	17.6	-2.5	-2.0	-2.2	223
Rubber & plastic products	2.0	2.2	2.3	2.3	2.2	2.3	2.4	2.5	2.5	2.4	2.4	2.4	2.4	1.1	1.7	344
Shipbuilding & repairing	0.8	0.7	0.8	0.6	0.7	0.7	0.7	0.7	0.8	0.6	0.6	0.6	-3.7	-2.1	-2.8	209
Other manufacturing	2.2	2.3	2.4	2.4	2.5	2.4	2.4	2.4	2.6	2.4	2.2	2.3	2.1	-1.0	0.4	299
Non-ferrous metals	2.8	2.5	2.5	2.9	3.1	2.8	2.5	2.2	2.1	2.2	2.5	2.2	0.0	-3.7	-2.0	229
Non-metallic mineral products	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	-1.3	0.0	285
Metal products	3.3	3.5	3.5	3.3	3.4	3.4	3.5	3.6	3.4	3.4	3.4	3.4	0.7	-0.1	0.2	294
Petroleum refineries & products	5.7	3.5	3.2	2.5	2.7	3.0	2.8	2.4	2.4	2.1	1.8	2.2	-11.8	-5.5	-8.4	109
Ferrous metals	4.1	3.8	3.5	3.8	3.9	3.5	3.3	3.0	2.9	3.0	3.3	2.9	-3.4	-3.2	-3.3	198
Low-technology industries	21.2	21.8	22.4	21.9	21.5	21.6	21.6	22.0	21.6	21.3	20.9	20.5	0.4	-0.9	-0.3	276
Paper, paper products & printing	3.6	3.8	4.0	4.1	4.1	4.0	3.8	3.7	3.5	3.5	4.0	3.5	1.9	-2.1	-0.3	275
Textiles, apparel & leather	7.6	8.0	8.3	7.8	7.6	7.8	7.9	8.0	7.8	7.6	7.2	7.3	0.7	-1.2	-0.4	274
Food, beverages & tobacco	7.9	7.8	7.8	7.7	7.5	7.5	7.7	8.0	7.9	7.7	7.4	7.4	-1.0	-0.3	-0.6	267
Wood products & furniture	2.1	2.2	2.3	2.3	2.3	2.3	2.2	2.3	2.4	2.4	2.3	2.3	1.5	0.3	0.8	313
Total manufacturing[3]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-	-	-	286

1. Average value of exports and imports.
2. Total OECD excludes Czech Republic, Hungary, Korea, Mexico and Poland.
3. Total may not add to 100% because of residual category.
4. Index of the average value of exports and imports at current prices.

Source: OECD, Main Industrial Indicators, 1999.

Table 7.3.1. **Export ratio by industry**[1]

	Total manufacturing		High-technology industries										Medium-high-technology industries													
			Total		Aircraft		Office & computing equipment		Drugs & medicines		Radio, TV & communication equipment		**Total**		Professional goods		Motor vehicles		Electrical machinery excl. commun. equipment		Chemicals excl. drugs		Other transport equipment		Non-electrical machinery	
	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996
Canada	36	50	51	60	64	71	76	72	6	13	52	67	55	69	30	51	75	72	23	47	40	65	44	56	44	77
Mexico	10	39	10	70	..	..	42	95	4	11	3	75	20	65	15	86	27	57	10	133	16	29	4	18	23	101
United States	11	14	26	29	27	33	41	45	7	8	24	30	17	20	13	18	16	17	18	21	17	23	7	10	20	23
Australia	14	20	23	37	42	57	24	43	15	31	18	27	11	23	35	52	8	15	8	30	10	19	4	10	17	35
Japan	12	13	20	22	12	17	27	31	3	4	21	22	21	23	49	69	25	23	12	14	19	24	59	63	18	23
Korea	..	27	..	49	..	48	..	129	..	6	..	46	..	31	..	34	..	27	..	50	..	27	..	28	..	32
New Zealand[2]	33	36	14	29	8	16	10	26	21	33	14	32	16	27	50	71	4	5	26	36	19	38	1	1	18	23
Austria	45	50	..	..	..	..	..	..	46	60	90	90	..	..	219	190	98	112	30	30	57	62	..	..	..	..
Belgium[3]	73	86	..	..	..	..	..	..	69	100	..	..	..	..	131	150	..	..	..	..	102	122	..	..	..	..
Denmark	56	58	125	131	..	..	190	290	80	90	119	148	71	68	110	112	129	120	75	86	66	68	22	32	62	54
Finland	34	46	53	65	17	17	44	54	24	29	69	75	45	56	59	45	63	148	42	79	37	46	35	15	47	47
France	28	34	31	47	40	58	37	59	26	34	25	42	44	49	71	76	43	44	37	49	53	59	26	29	34	43
Germany[4]	32	34	38	46	91	74	49	68	32	43	28	36	44	47	99	115	42	38	28	37	49	53	37	30	48	56
Greece	23	28	8	16	2	10	178	304	11	10	21	37	19	33	87	254	10	28	16	25	19	29	0	0	33	67
Iceland[2]	50	56	..	..	..	..	..	..	..	..	..	..	9	25	..	..	..	..	..	..	1	3	..	..	..	..
Italy	22	34	33	51	52	40	44	66	15	40	29	60	28	42	21	30	27	49	20	33	25	36	30	38	37	51
Netherlands	68	73	83	129	115	41	664	1174	51	76	41	70	101	117	242	327	103	138	502	542	89	98	42	80	78	77
Norway	35	38	53	50	76	30	91	170	18	17	46	53	36	41	151	111	85	79	28	45	67	79	1	11	18	19
Portugal	30	35	41	47	..	..	200	73	13	18	43	54	40	66	104	94	55	96	52	80	26	36	39	81	32	37
Spain	18	29	25	42	96	127	98	88	10	16	15	50	29	44	67	155	39	55	23	42	19	27	7	28	29	41
Sweden	40	52	65	72	52	104	85	131	61	66	64	67	55	64	69	68	59	65	53	111	45	42	16	30	57	64
United Kingdom	27	37	48	75	60	69	69	117	30	44	35	75	39	51	102	116	35	46	28	45	40	55	17	19	38	45
EU-11 (non-intra)[5]	14	19	20	31	37	45	19	36	17	24	15	28	20	26	39	48	17	20	14	22	22	27	11	14	24	32
EU-11[6]	30	37	41	59	59	64	61	103	28	41	32	52	42	50	76	88	41	45	30	45	45	53	26	32	43	51
Total OECD-16	20	24	30	37	38	44	42	55	15	21	25	34	30	35	34	44	31	34	21	29	31	37	25	30	30	36

1. Exports as a percentage of production.
2. 1995 instead of 1996.
3. Belgium includes Luxembourg.
4. Western Germany in 1990, total Germany in 1996.
5. Excluding intra-EU trade. Excluding Austria, Belgium, Luxembourg and Ireland.
6. Intra-EU trade not excluded. Excluding Austria, Belgium, Luxembourg and Ireland.
7. Calculated with above countries except Austria, Belgium (and Luxembourg), Iceland, Korea and Portugal.

Source: OECD, Main Industrial Indicators, 1999.

Table 7.3.1. **Export ratio by industry**[1] *(cont.)*

	Medium-low-technology industries																		Low-technology industries									
	Total		Rubber & plastic products		Shipbuilding & repairing		Other manufacturing		Non-ferrous metals		Non-metallic mineral products		Metal products		Petroleum refineries & products		Ferrous metals		**Total**		Paper, paper products & printing		Textiles, apparel & leather		Food, beverages & tobacco		Wood products & furniture	
	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996
Canada	23	37	20	34	9	67	17	32	52	69	12	27	14	31	19	25	28	33	26	38	41	50	7	25	13	17	43	67
Mexico	11	27	3	27	86	35	5	50	28	31	7	16	8	37	15	12	11	28	3	14	3	11	4	38	3	5	3	35
United States	5	7	4	6	10	11	10	12	9	9	5	6	5	7	4	5	4	5	5	7	4	5	8	11	6	7	4	4
Australia	12	17	3	5	9	31	28	43	32	34	2	5	4	8	17	23	10	15	16	18	3	4	21	39	22	23	6	6
Japan	6	7	5	6	42	35	4	3	4	7	5	6	6	7	3	3	6	7	2	2	2	1	6	7	1	1	1	1
Korea	..	17	..	13	..	56	..	54	..	8	..	4	..	18	..	14	..	13	..	23	..	7	..	79	..	5	..	6
New Zealand[2]	24	22	10	15	6	29	18	18	98	95	4	5	8	13	48	1	43	39	42	43	20	23	47	57	52	52	17	22
Austria	39	42	53	54	53	271	127	134	40	62	24	23	40	42	6	10	55	51	29	32	40	41	62	81	8	12	39	35
Belgium[3]	..	..	39	49	..	..	524	677	80	86	68	69	39	42	67	63	128	158	40	43	40	46	86	108	27	30	34	38
Denmark	40	42	56	65	37	43	21	28	104	94	28	27	37	36	33	36	102	118	47	51	15	13	70	81	52	59	62	60
Finland	28	41	25	33	51	68	32	40	44	42	10	24	24	31	12	37	41	50	30	38	50	51	36	46	4	10	31	46
France	20	23	21	26	25	45	28	28	26	32	18	22	18	21	9	9	33	37	20	23	12	14	32	41	20	23	13	15
Germany[4]	20	19	19	21	46	41	60	58	25	25	16	15	23	23	6	5	25	28	19	21	23	27	42	51	12	13	15	12
Greece	22	28	8	15	4	11	6	21	46	47	18	22	13	23	17	30	55	38	26	28	5	10	44	67	20	19	4	7
Iceland[2]	34	39	5	6	30	72	0	0	99	109	2	2	4	5	3	102	103	87	57	61	1	2	33	26	70	73	0	1
Italy	20	30	17	28	21	36	60	66	17	21	15	25	30	54	15	13	15	20	18	27	8	14	29	44	9	15	16	24
Netherlands	57	49	50	48	25	27	103	118	114	98	31	24	36	29	69	55	103	99	50	49	27	24	112	122	53	53	34	27
Norway	57	56	22	19	78	44	31	29	81	74	16	15	24	22	60	95	72	96	18	22	24	26	33	39	14	19	16	21
Portugal	18	18	15	21	20	20	22	13	15	10	23	23	15	17	18	13	13	19	31	32	31	27	53	56	8	11	45	39
Spain	17	24	14	20	33	148	14	22	18	32	11	20	15	24	23	20	20	27	11	18	12	16	20	35	8	13	10	19
Sweden	31	39	38	61	43	17	28	28	40	52	15	27	21	26	32	42	48	56	27	35	41	44	46	77	6	11	28	50
United Kingdom	20	25	15	18	15	22	100	101	39	49	11	15	17	23	13	14	25	31	13	17	10	12	29	45	11	13	5	8
EU-11 (non-intra)[5]	11	13	8	10	21	30	34	37	11	14	7	10	11	13	8	8	12	15	8	11	7	9	15	24	6	8	7	9
EU-11[6]	22	25	20	24	30	40	51	55	29	33	16	20	22	27	15	14	27	32	20	25	19	21	35	48	16	19	17	21
Total OECD-16	13	15	11	14	29	33	15	16	20	22	10	13	13	16	10	10	14	16	12	14	10	11	20	28	10	12	11	13

1. Exports as a percentage of production.
2. 1995 instead of 1996.
3. Belgium includes Luxembourg.
4. Western Germany in 1990, total Germany in 1996.
5. Excluding intra-EU trade. Excluding Austria, Belgium, Luxembourg and Ireland.
6. Intra-EU trade not excluded. Excluding Austria, Belgium, Luxembourg and Ireland.
7. Calculated with above countries except Austria, Belgium (and Luxembourg), Iceland, Korea and Portugal.

Source: OECD, Main Industrial Indicators, 1999.

Table 7.3.2. **Import penetration by industry**[1]

	Total manufacturing		**High-technology industries**										**Medium-high-technology industries**													
			Total		Aircraft		Office & computing equipment		Drugs & medicines		Radio, TV & communication equipment		**Total**		Professional goods		Motor vehicles		Electrical machinery excl. commun. equipment		Chemicals excl. drugs		Other transport equipment		Non-electrical machinery	
	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996
Canada	37	49	62	71	60	66	87	84	20	33	65	77	61	71	60	75	72	68	49	71	43	69	18	31	68	87
Mexico	16	40	27	66	..	..	50	91	11	17	23	74	25	63	43	88	7	38	22	144	22	44	21	17	65	100
United States	14	18	23	33	10	14	43	57	5	8	33	38	19	23	11	17	31	30	22	27	12	18	14	18	17	19
Australia	24	31	61	68	79	80	63	71	35	48	59	70	39	52	72	79	32	43	35	57	32	42	31	34	53	67
Japan	7	9	7	14	47	34	8	22	8	8	4	11	6	8	25	52	4	5	3	5	13	15	10	19	4	6
Korea	..	26	..	42	..	88	..	148	..	14	..	34	..	35	..	66	..	8	..	42	..	31	..	20	..	58
New Zealand[2]	36	40	78	82	82	81	89	92	66	70	73	80	53	60	89	94	54	64	53	53	48	59	19	22	53	58
Austria	47	52	..	..	..	..	..	..	54	68	90	89	..	..	157	146	99	111	32	33	64	70	..	..	..	..
Belgium[3]	71	84	..	..	..	..	..	..	66	99	..	..	..	..	115	138	..	..	..	..	102	129	..	..	..	..
Denmark	54	56	123	127	..	..	123	141	62	77	120	135	74	71	115	117	112	105	77	85	78	76	47	58	54	44
Finland	31	36	65	63	66	68	70	62	48	59	69	62	55	56	74	53	83	122	49	74	49	52	33	31	47	39
France	30	32	33	43	32	42	50	66	19	28	31	40	43	47	76	79	39	40	35	42	52	56	31	36	39	42
Germany[4]	26	28	41	47	91	72	59	78	23	34	29	36	28	31	98	123	23	25	19	27	39	40	40	41	26	30
Greece	43	48	48	64	29	45	101	105	38	54	79	81	71	77	99	108	86	91	50	53	58	67	9	12	88	94
Iceland[2]	55	57	107	135	109	-550	113	133	102	129	100	100	86	89	102	111	100	100	101	103	57	61	100	101	105	109
Italy	21	27	42	58	48	34	49	74	25	41	46	68	28	36	33	34	33	50	14	21	38	46	18	20	21	26
Netherlands	68	71	85	129	115	49	260	807	53	77	44	68	101	118	236	487	102	121	240	369	85	97	59	86	79	76
Norway	43	46	77	76	92	60	96	113	48	49	68	73	51	58	117	106	96	96	54	66	66	78	11	49	32	34
Portugal	37	41	64	68	..	..	109	97	34	49	60	64	66	78	101	98	78	97	60	80	50	64	59	84	73	64
Spain	24	32	50	58	98	118	99	94	14	24	46	68	39	47	93	114	36	47	34	46	33	40	26	28	48	51
Sweden	37	43	67	64	62	106	91	108	47	46	60	51	52	58	72	68	47	49	59	112	56	57	23	28	48	52
United Kingdom	31	39	48	74	53	62	74	116	19	31	41	77	42	51	102	117	46	53	32	48	40	53	31	31	35	39
EU-11 (non-intra)[5]	13	16	27	35	37	36	42	63	11	16	23	32	15	18	43	51	11	12	11	18	18	21	19	21	12	16
EU-11[6]	29	34	46	60	57	57	71	102	24	36	38	52	38	44	77	88	36	41	28	39	44	51	31	35	35	38
Total OECD-16[7]	20	23	29	38	30	33	45	61	14	20	25	34	26	30	32	42	28	30	19	25	28	34	22	26	24	26

1. Imports as a percentage of domestic demand (estimated as production plus imports minus exports).
2. 1995 instead of 1996.
3. Belgium includes Luxembourg.
4. Western Germany in 1990, total Germany in 1996.
5. Excluding intra-EU trade. Excluding Austria, Belgium, Luxembourg and Ireland.
6. Intra-EU trade not excluded. Excluding Austria, Belgium, Luxembourg and Ireland.
7. Calculated with above countries except Austria, Belgium (and Luxembourg), Iceland, Korea and Portugal.

Source: OECD, Main Industrial Indicators, 1999.

Table 7.3.2. **Import penetration by industry**[1] *(cont.)*

	Medium-low-technology industries																		Low-technology industries									
	Total		Rubber & plastic products		Shipbuilding & repairing		Other manufacturing		Non-ferrous metals		Non-metallic mineral products		Metal products		Petroleum refineries & products		Ferrous metals		**Total**		Paper, paper products & printing		Textiles, apparel & leather		Food, beverages & tobacco		Wood products & furniture	
	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996
Canada	24	34	30	39	21	41	48	58	29	47	23	34	21	36	11	12	30	36	17	24	16	24	33	45	12	16	16	28
Mexico	14	37	12	52	90	21	16	38	16	35	5	15	16	54	20	28	15	29	8	16	13	30	8	35	7	7	6	20
United States	12	14	11	13	4	11	33	37	16	17	9	11	7	9	10	10	11	15	9	11	5	5	26	32	5	5	8	12
Australia	13	17	20	25	16	28	54	69	5	7	10	12	12	17	19	16	8	11	14	16	15	14	30	46	8	9	11	9
Japan	6	6	3	4	5	2	6	6	17	15	3	3	2	4	21	17	2	2	8	11	3	3	15	26	9	10	11	16
Korea	..	17	..	4	..	16	..	39	..	29	..	10	..	22	..	20	..	16	..	19	..	12	..	58	..	11	..	27
New Zealand[2]	31	32	23	29	36	42	46	51	97	92	19	19	18	21	47	30	48	49	17	19	15	19	41	52	12	14	8	6
Austria	38	42	55	59	29	-68	126	132	45	63	19	22	40	43	24	28	40	39	30	33	32	33	69	85	11	16	29	31
Belgium[3]	..	..	40	48	..	..	574	679	80	85	58	57	41	43	65	58	204	359	38	40	47	49	85	109	23	25	38	42
Denmark	45	43	54	63	32	26	30	38	101	98	25	25	33	32	44	35	101	108	37	40	26	22	75	85	30	38	46	42
Finland	27	30	42	44	24	17	53	48	32	31	14	21	26	24	22	30	34	35	12	15	7	7	55	63	6	13	8	10
France	22	22	21	23	17	26	34	32	36	37	18	19	19	19	16	13	30	33	22	23	18	16	41	49	16	18	22	20
Germany[4]	18	17	16	18	18	10	62	64	30	26	14	14	14	16	14	10	21	22	26	27	23	23	56	67	15	16	20	20
Greece	34	41	31	44	59	74	37	60	42	44	20	23	44	51	15	15	67	61	32	34	31	34	40	65	29	24	28	29
Iceland[2]	51	51	47	49	54	78	21	18	97	130	21	22	33	34	100	100	103	82	33	36	29	29	65	63	21	26	41	43
Italy	16	20	10	16	24	11	33	38	36	36	6	9	14	25	23	19	17	21	14	18	12	14	14	22	17	20	9	10
Netherlands	56	45	56	53	21	21	102	111	112	98	39	32	42	32	53	32	102	99	47	44	32	28	107	115	35	36	58	50
Norway	59	54	49	51	86	46	66	65	70	62	27	29	40	42	39	85	73	96	21	23	18	20	80	81	9	11	25	32
Portugal	26	26	31	38	25	10	38	32	56	59	12	13	22	22	19	18	47	53	21	26	21	23	34	40	14	19	13	18
Spain	16	21	12	18	15	445	24	30	23	32	8	9	18	23	18	16	19	27	13	18	18	20	20	34	9	14	15	18
Sweden	33	34	47	61	49	12	48	43	46	53	26	31	21	20	34	38	36	45	20	23	11	11	77	90	13	18	13	20
United Kingdom	23	25	19	22	9	9	100	101	49	58	12	13	19	23	13	9	24	29	22	25	19	18	44	56	16	19	25	23
EU-11 (non-intra)[5]	10	11	7	10	12	15	36	40	22	22	4	6	7	8	10	7	10	11	10	12	6	6	20	30	7	8	9	10
EU-11[6]	22	23	19	23	22	21	52	56	38	38	13	15	19	21	18	14	25	29	22	25	19	18	38	50	16	19	19	20
Total OECD-16	15	16	13	16	18	14	23	24	25	25	10	11	12	14	16	13	13	15	15	17	10	10	30	39	11	12	14	16

1. Imports as a percentage of domestic demand (estimated as production plus imports minus exports).
2. 1995 instead of 1996.
3. Belgium includes Luxembourg.
4. Western Germany in 1990, total Germany in 1996.
5. Excluding intra-EU trade. Excluding Austria, Belgium, Luxembourg and Ireland.
6. Intra-EU trade not excluded. Excluding Austria, Belgium, Luxembourg and Ireland.
7. Calculated with above countries except Austria, Belgium (and Luxembourg), Iceland, Korea and Portugal.

Source: OECD, Main Industrial Indicators, 1999.

Table 7.4.1. **Share of intra-industry trade in trade with EU countries, 1996**

Percentages

	Intra-industry trade in varieties	Intra-industry trade in qualities	Inter-industry trade
Canada	3.6	21.0	75.4
Mexico	2.3	11.7	86.0
United States	10.7	42.3	47.1
Australia	2.1	10.8	87.1
Japan	4.5	26.9	68.7
Korea	2.1	12.9	85.0
New Zealand	1.4	5.2	93.4
Austria	14.3	39.8	45.9
Belgium-Luxembourg	23.6	41.7	34.7
Czech Republic	8.8	36.7	54.5
Denmark	9.1	31.2	59.7
Finland	7.2	23.6	69.2
France	21.5	46.6	31.9
Germany	18.7	46.9	34.4
Greece	3.2	10.2	86.5
Hungary	6.9	30.6	62.5
Ireland	8.2	31.6	60.2
Italy	14.5	37.5	48.0
Netherlands	18.4	40.7	40.8
Norway	5.8	15.4	78.8
Poland	2.7	20.0	77.4
Portugal	10.8	24.4	64.8
Spain	17.8	36.3	45.9
Sweden	10.0	34.7	55.3
Switzerland	10.6	44.4	45.0
Turkey	5.8	9.8	84.4
United Kingdom	17.1	46.6	36.3
European Union	17.5	41.6	40.9
Total OECD	15.2	39.3	45.5

Source: OECD calculations based on data from Eurostat.

Table 7.4.2. **Share of intra-industry trade in trade with EU countries by industry, 1996**

Percentages

	ISIC Rev.3 Division	Intra-industry trade in varieties	Intra-industry trade in qualities	Inter-industry trade
Agriculture	01	5.8	12.3	82.0
Forestry	02	4.3	27.6	68.1
Fishing	05	5.4	15.9	78.7
Mining of coal and lignite	10	1.6	8.7	89.7
Crude petroleum and natural gas	11	1.6	1.3	97.1
Mining of uranium and thorium ores	12	0.0	0.0	100.0
Mining of metal ores	13	3.1	4.8	92.1
Other mining and quarrying	14	11.0	42.2	46.8
Food and beverages	15	10.9	20.6	68.5
Tobacco products	16	12.1	21.6	66.3
Textiles	17	10.3	34.8	54.8
Wearing apparel	18	10.3	43.9	45.8
Leather and footwear	19	6.0	26.9	67.2
Wood	20	8.3	24.9	66.8
Pulp, paper and paper products	21	16.0	25.7	58.3
Publishing and printing	22	12.0	66.2	21.7
Coke and refined petroleum products	23	20.2	11.5	68.3
Chemicals	24	13.0	41.6	45.4
Rubber and plastic products	25	22.8	51.4	25.8
Other non-metallic mineral products	26	9.8	35.6	54.7
Basic metals	27	19.7	26.5	53.8
Fabricated metal products	28	13.7	53.5	32.9
Machinery and equipment	29	11.1	47.6	41.3
Office machinery and computers	30	16.7	60.0	23.3
Electrical machinery	31	11.2	55.3	33.5
Radio, television and comm. equip.	32	11.8	41.3	46.8
Medical, precision and opt. instr.	33	11.9	54.5	33.6
Motor vehicles	34	28.6	42.4	29.0
Other transport equipment	35	20.9	52.1	26.9
Furniture and manufacturing n.e.c.	36	15.7	40.9	43.5
Grand Total		15.2	39.3	45.5

Source: OECD calculations based on data from Eurostat.

Table 7.5.1. **Share of end-use categories in exports to and imports from EU countries, 1996**

Percentages

	Share in imports				Share in exports			
	Primary products	Intermediate goods	Capital goods	Consumption goods	Primary products	Intermediate goods	Capital goods	Consumption goods
Canada	4.2	50.0	18.8	27.0	19.6	57.4	14.4	8.6
Mexico	1.2	64.8	22.0	11.9	28.2	49.5	8.9	13.3
United States	3.4	49.9	21.4	25.3	8.7	54.4	26.1	10.8
Australia	0.8	45.8	25.9	27.6	56.6	24.4	7.1	11.8
Japan	2.4	38.0	15.3	44.3	0.3	44.8	29.3	25.6
Korea	3.7	52.1	28.7	15.5	0.5	46.4	24.9	28.3
New Zealand	0.9	45.1	26.8	27.2	33.6	12.8	3.3	50.3
Austria	4.0	47.0	16.9	32.2	2.8	63.4	14.0	19.8
Belgium-Luxembourg	11.9	51.3	11.0	25.9	6.1	51.1	10.0	32.7
Czech Republic	3.0	53.2	21.4	22.3	6.9	60.3	10.7	22.1
Denmark	3.9	50.2	19.4	26.5	11.6	34.7	15.7	38.0
Finland	8.6	48.8	20.4	22.3	2.1	70.3	20.9	6.8
France	5.4	48.1	18.0	28.5	7.4	49.1	15.8	27.7
Germany	8.2	48.2	14.0	29.5	3.4	52.9	18.9	24.8
Greece	4.8	42.7	14.9	37.6	19.7	30.9	3.6	45.8
Hungary	1.9	59.9	18.9	19.3	6.6	53.5	9.0	30.9
Ireland	4.4	51.3	14.7	29.6	4.4	41.1	24.3	30.1
Italy	8.0	50.0	15.2	26.9	3.3	46.6	15.5	34.6
Netherlands	7.9	49.8	16.6	25.7	13.6	46.9	14.9	24.6
Norway	3.8	48.5	19.2	28.5	58.9	31.7	4.6	4.8
Poland	5.9	53.8	19.2	21.2	9.7	46.8	6.4	37.1
Portugal	6.1	50.4	15.2	28.3	3.8	37.4	6.8	52.0
Spain	6.2	53.4	16.4	24.1	11.0	41.1	10.8	37.1
Sweden	4.8	54.3	19.0	21.9	3.0	65.5	17.0	14.5
Switzerland	4.2	45.9	17.5	32.4	8.1	50.6	18.9	22.4
Turkey	5.4	49.3	31.7	13.7	14.0	27.3	7.1	51.5
United Kingdom	4.4	49.5	16.9	29.2	10.5	47.1	17.6	24.9
Total OECD	6.1	49.3	17.0	27.6	8.4	49.2	16.8	25.7

Source: OECD calculations based on data from Eurostat.

Table 8.1.1. **Outward and inward direct investment flows in OECD countries**

In billions of US dollars

	Outward direct investment flows								Inward direct investment flows							
	1990	1991	1992	1993	1994	1995	1996	1997	1990	1991	1992	1993	1994	1995	1996	1997
Canada	7.6	2.9	4.7	4.7	8.4	10.8	6.4	8.2	5.2	5.8	3.6	5.9	9.1	11.2	8.5	12.9
Mexico	2.6	4.8	4.4	4.4	11.0	9.5	9.2	12.5	..	..	..	..	..	..	..	..
United States	48.4	22.8	19.2	50.7	45.1	58.8	76.5	90.7	31.0	32.7	42.6	78.2	73.3	92.1	74.8	114.5
Australia	6.5	4.0	5.0	3.0	4.0	13.2	5.5	9.3	0.3	3.0	1.0	1.8	5.3	3.7	6.3	6.2
Japan	1.8	1.3	2.8	0.2	0.9	0.0	0.2	3.2	50.8	31.7	17.3	13.9	18.1	22.6	23.4	26.0
Korea	0.8	1.2	0.7	0.6	0.8	1.2	2.3	2.3	1.1	1.5	1.2	1.3	2.5	3.6	4.7	4.3
New Zealand	1.7	1.7	1.1	2.2	2.7	2.7	3.7	1.3	2.4	1.5	0.4	-1.4	2.0	1.7	-1.3	-0.8
Austria	0.6	0.4	0.9	1.0	1.3	0.6	3.8	1.7	1.7	1.3	1.9	1.5	1.2	1.0	1.4	1.5
Belgium-Luxembourg	8.0	9.3	11.3	10.8	8.3	10.6	14.1	12.5	6.1	6.5	10.4	4.7	1.2	11.8	8.4	6.7
Czech Republic	..	..	1.0	0.7	0.9	2.6	1.0	1.3	..	..	0.0	0.1	0.1	0.0	0.0	0.0
Denmark	1.2	1.5	1.0	1.7	4.9	4.2	0.8	3.0	1.5	1.8	2.2	1.4	4.0	3.0	2.5	4.0
Finland	0.8	-0.2	0.4	0.9	1.6	1.1	1.1	1.5	2.7	-0.1	-0.8	1.4	4.3	1.5	3.6	4.4
France	15.6	15.2	17.9	16.4	15.6	23.7	22.0	23.2	36.2	25.1	30.4	19.7	24.4	15.8	30.4	35.6
Germany	2.5	4.1	2.7	1.9	1.8	13.4	-2.7	-0.2	24.0	23.6	19.5	15.3	17.2	38.8	29.5	33.2
Greece	1.0	1.1	1.1	2.6	3.1	4.3	5.9	3.6	..	..	..	..	..	..	..	..
Hungary	0.3	1.5	1.5	2.4	1.1	4.5	2.0	2.1	..	..	..	0.0	0.0	0.0	0.0	0.4
Iceland	0.0	0.0	0.0	..	..	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Ireland	0.3	1.2	1.2	0.9	0.4	0.6	1.9	1.7	..	..	..	..	..	..	..	..
Italy	6.3	2.5	3.2	3.7	2.2	4.8	3.5	3.8	7.6	7.3	5.9	7.2	5.1	5.7	6.5	12.2
Netherlands	12.2	6.6	7.8	8.6	7.6	11.6	7.8	8.7	15.3	13.6	14.4	12.3	17.4	19.6	23.2	20.2
Norway	1.8	0.7	-0.4	2.2	1.4	1.6	3.4	3.7	1.5	1.8	-0.1	0.8	2.1	2.8	5.3	4.1
Poland	0.1	0.4	0.7	1.7	1.9	3.7	4.5	3.1	..	..	0.0	0.0	0.0	0.0	0.1	0.0
Portugal	2.6	2.5	1.9	1.6	1.3	0.7	0.7	1.7	0.2	0.5	0.7	0.1	0.3	0.7	0.8	1.9
Spain	13.8	12.4	13.4	8.1	9.4	6.2	6.5	5.5	3.4	4.4	2.2	2.6	3.9	3.6	5.2	10.1
Sweden	2.0	6.4	0.0	3.8	6.3	14.5	5.1	9.7	14.7	7.1	0.4	1.4	6.7	11.2	4.7	11.4
Switzerland	5.5	2.6	0.4	-0.1	3.4	2.2	2.8	4.4	6.7	6.2	6.1	8.8	10.8	12.2	16.0	14.5
Turkey	0.8	0.9	0.9	0.7	0.6	0.9	0.9	0.9	0.1	0.1	0.1	0.2	0.1	0.2	0.3	0.3
United Kingdom	32.9	16.0	16.2	15.5	10.5	22.7	26.1	37.0	18.6	16.0	19.2	25.6	28.3	44.3	34.1	58.3

Source: OECD, International Direct Investment database, May 1999.

Table 8.1.2. **Outward and inward direct investment stocks in OECD countries**

In billions of US dollars

	Outward direct investment stocks								Inward direct investment stocks							
	1990	1991	1992	1993	1994	1995	1996	1997	1990	1991	1992	1993	1994	1995	1996	1997
Canada	112.8	117.0	108.5	106.9	110.0	122.9	127.5	131.3	84.8	94.4	87.9	92.5	102.0	118.3	129.3	135.5
Mexico	20.6	27.3	31.7	39.6	34.8	39.8	..	..	..	..	..	..	..	..	..	..
United States	394.9	419.1	423.1	467.4	480.7	535.6	594.1	681.7	430.5	467.8	502.1	564.3	640.3	717.6	777.2	860.7
Australia	75.8	78.0	79.9	75.5	92.4	101.5	119.1	..	31.2	29.4	32.5	30.4	37.2	41.1	52.5	..
Japan	9.9	12.3	15.5	16.9	19.2	33.5	29.9	..	201.4	231.8	248.1	259.8	275.6	238.5	258.6	..
Korea	4.8	5.9	6.5	7.0	7.7	..	..	..	2.3	3.4	4.5	5.6	7.6	10.5	13.8	16.5
New Zealand	..	..	..	15.6	22.6	26.2	33.2	29.5	..	..	..	4.4	5.9	7.7	9.3	6.8
Austria	10.0	10.4	11.2	11.4	13.1	17.5	18.3	17.4	4.5	6.0	6.9	8.1	9.3	11.7	12.8	12.3
Belgium-Luxembourg	58.4	70.2	75.7	94.3	105.9	..	..	..	40.6	48.4	55.6	62.6	69.5	..	..	..
Czech Republic	..	..	..	2.2	3.2	5.9	..	..	0.0	0.0	0.0	0.2	0.3	0.3	..	..
Denmark	..	14.7	14.4	14.2	17.9	23.6	..	..	..	15.7	16.0	15.5	19.6	24.5	..	..
Finland	5.1	4.2	3.7	4.2	6.7	8.5	8.8	9.0	11.2	10.8	8.6	9.2	12.5	15.0	17.7	20.3
France	86.5	97.8	100.2	103.2	123.9	143.7	143.9	..	110.1	129.9	140.7	141.4	163.1	184.4	193.0	..
Germany	58.8	67.8	65.7	61.6	160.1	192.9	188.5	..	112.0	129.4	133.8	138.0	213.7	258.1	271.2	..
Greece	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hungary	0.6	2.1	3.4	5.6	7.1	11.9	14.7	15.9	..	..	..	0.2	0.3	0.5	0.5	0.9
Iceland	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Ireland	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Italy	58.0	59.7	48.5	52.5	58.8	63.5	72.5	81.1	59.0	65.9	65.8	76.4	81.4	97.0	107.4	125.0
Netherlands	73.8	78.1	81.2	82.8	103.4	122.0	..	..	109.1	119.7	124.7	124.8	149.0	177.3	..	..
Norway	17.7	14.6	15.2	14.5	16.3	19.5	20.5	..	10.3	11.2	13.1	13.5	16.9	22.5	..	..
Poland	0.1	0.4	1.4	2.3	3.8	7.8	11.5	..	..	..	0.1	0.2	0.5	0.5	0.7	..
Portugal	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Spain	65.9	79.6	79.2	71.1	86.2	99.8	98.4	..	15.7	20.5	20.9	22.4	28.3	34.5	36.6	..
Sweden	12.5	18.1	13.8	13.0	22.2	30.5	34.2	..	49.5	53.5	47.7	44.6	59.2	71.9	70.9	..
Switzerland	34.2	35.7	33.0	38.7	48.7	57.1	53.8	..	66.1	75.9	74.4	91.6	112.6	142.5	143.2	..
Turkey	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
United Kingdom	218.2	224.7	185.9	196.8	218.2	203.8	235.5	266.3	230.8	234.1	223.8	253.2	286.4	314.3	360.5	390.3

Source: OECD, International Direct Investment database and IMF, May 1999.

Table 8.3.1. **Trends in the share of foreign affiliates in manufacturing employment, production [1] and labour productivity**

	Employment			Production [1]			Labour productivity			
	Share of affiliates		Average annual	Share of affiliates		Average annual	Level of affiliates [2]		Average annual growth rate	
	1985	1996	growth rate	1985	1996	growth rate	1985	1996	Affiliates	National firms
Canada [3]	..	..	..	..	48.6	..	..	..	..	..
United States	7.6	11.9	3.9	8.1	15.0	7.2	107.1	130.7	3.1	1.3
Japan [3,4]	1.0	1.3	4.3	2.8	2.9	2.1	301.2	233.3	-2.1	1.5
Czech Republic [5]	..	18.7	..		30.7	..	..	192.2	..	..
Finland [6]	3.2	8.6	7.1	2.5	9.0	15.0	77.4	112.8	7.3	3.7
France [7]	21.9	25.8	0.2	29.0	31.2	1.5	146.1	130.4	1.3	2.1
Germany	7.7	7.1	-3.3	16.3	12.8	-2.8	233.5	192.8	0.5	2.3
Ireland	40.7	47.0	3.1	50.2	66.4	8.8	146.7	223.5	5.5	1.6
Italy [5]	12.9	10.2	1.7	14.9	19.0	5.3	118.0	207.8	3.6	-1.2
Netherlands [6]	24.3	36.3	3.5	35.8	42.8	1.1	173.5	131.4	-2.3	0.8
Norway [4]	7.5	10.2	2.0	9.8	14.2	4.9	134.5	144.8	2.9	2.1
Sweden	9.1	19.9	5.5	10.9	20.8	7.1	121.5	105.6	1.5	2.8
Turkey [4]	1.5	5.5	16.0	5.3	12.4	14.4	372.7	245.5	-1.4	2.8
United Kingdom [8]	13.8	17.1	0.6	19.7	30.5	5.8	153.6	212.6	5.2	1.8

1. Turnover instead of production for the following countries : United States, Japan, France, Germany, Italy, Netherlands, Sweden. National currency, 1990 prices.
2. National firms = 100.
3. 1993 instead of 1996.
4. 1986 instead of 1985.
5. 1997 instead of 1996.
6. 1994 instead of 1996.
7. 1987 instead of 1985.
8. 1995 instead of 1996.

Source : OECD, Activity of Foreign Affiliates database, May 1999.

Table 9.1.1. **R&D expenditure of foreign affiliates and national firms**

	Total R&D expenditures as a percentage of DPI[1]				Share of foreign affiliates in manufacturing R&D	
	Foreign affiliates		National firms			
	1985	1996	1985	1996	1985	1996
Canada[2,3]	0.35	0.40	0.63	0.86	44.2	40.3
United States	0.15	0.26	2.22	1.93	5.9	12.0
Australia[3,4]	..	0.28	..	0.62	46.4	37.6
Japan[5]	0.02	0.03	2.02	2.32	1.0	1.3
Czech Republic[3]	..	0.19	..	0.41	..	30.9
Finland[6]	..	0.36	..	2.34	..	11.5
France	..	0.27	..	1.00	10.1	21.0
Germany[7]	..	0.27	..	1.46	..	14.5
Greece[2,7]	0.01	0.01	0.12	0.19	9.2	10.1
Ireland[4,7]	0.31	0.73	0.21	0.34	63.1	68.0
Italy[8]	..	0.16	..	0.52	..	23.1
Netherlands[3]	..	0.24	..	1.09	..	18.0
Poland[6]	..	0.04	..	0.26	..	13.9
Spain[6,9]	0.24	0.19	0.37	0.34	46.4	42.7
Sweden	..	0.82	..	3.59	8.2	18.7
Turkey[3]	..	0.02	..	0.08	..	16.1
United Kingdom[10]	..	0.70	..	0.92	18.0	39.5

1. Total manufacturing instead of total industry for Italy, Turkey, Poland and Czech Republic.
2. 1988 instead of 1985.
3. 1995 instead of 1996.
4. 1984 instead of 1985.
5. 1986 instead of 1985 and 1991 instead of 1996.
6. 1997 instead of 1996.
7. 1993 instead of 1996.
8. 1992 instead of 1996.
9. 1990 instead of 1985.
10. 1997 instead of 1996 for R&D as a percentage of domestic product of industry.

Source: OECD, Activity of Foreign Affiliates database, May 1999.

Table 9.3.1. **Cross-border ownership of inventions**

Percentages

	Foreign ownership of domestic inventions[1]	Domestic ownership of foreign inventions[2]
	1993-95	1993-95
Canada	23.5	16.9
Mexico	48.0	10.4
United States	5.0	8.8
Australia	14.3	4.9
Japan	3.0	1.8
Korea	4.1	3.3
New Zealand	12.6	7.3
Austria	20.9	8.2
Belgium	33.6	12.7
Czech Republic	35.9	1.8
Denmark	11.4	9.4
Finland	6.1	8.6
France	8.9	5.8
Germany	6.9	4.6
Greece	9.2	3.4
Hungary	29.4	4.4
Iceland	83.0	16.7
Ireland	28.9	40.1
Italy	11.3	2.4
Luxembourg	41.6	75.0
Netherlands	13.2	31.6
Norway	13.2	14.5
Poland	39.4	11.2
Portugal	15.8	17.6
Spain	16.6	4.1
Sweden	10.0	10.4
Switzerland	12.2	28.3
Turkey	70.3	22.2
United Kingdom	23.0	11.3
European Union	6.5	3.5
Total OECD	8.2	8.1

1. Share of patent applications to the European Patent Office owned by foreign residents in total patents invented domestically.

2. Share of patent applications to the European Patent Office invented abroad in total patents owned by country residents.

Source: OECD, based on data from the European Patent Office.

Table 9.4.1. **International co-operation in science and technology**

	Percentage of scientific publications with a foreign co-author	Percentage of patents with foreign co-inventors
	1995	1993-95
Canada	30.7	24.2
Mexico	44.2	60.8
United States	18.6	7.7
Australia	26.5	16.1
Japan	14.3	2.7
Korea	28.5	8.6
New Zealand	31.3	19.3
Austria	41.6	18.2
Belgium	45.6	26.0
Czech Republic	..	39.2
Denmark	43.5	19.2
Finland	35.0	8.9
France	33.9	8.9
Germany	32.9	7.4
Greece	38.4	25.0
Hungary	51.1	32.3
Iceland	..	39.6
Ireland	40.3	28.7
Italy	34.8	6.7
Luxembourg	..	47.6
Netherlands	35.1	15.2
Norway	39.4	14.5
Poland	46.0	54.7
Portugal	50.4	27.8
Spain	31.4	15.5
Sweden	38.9	11.4
Switzerland	47.9	22.8
Turkey	25.8	82.7
United Kingdom	29.2	14.7
European Union	18.0	5.1
Total OECD	26.0	8.8

Sources: OECD, based on data from National Science Foundation and Science Citation Index for scientific publications; OECD, based on data from the European Patent Office for patents.

Table 10.1.1. **GDP per capita and GDP per person employed**

United States=100

	GDP per person employed (as % of US)		Total effect of labour force participation		Effect of % active population (15-64 years) to total population		Effect of % labour force[1] to active population		Effect of unemployment		**GDP per head of population (as % of US)**	
	(1)		(2) [(3) + (4) + (5)]		(3)		(4)		(5)		(6) [(1) + (2)]	
	1985	1997	1985	1997	1985	1997	1985	1997	1985	1997	1985	1997
Canada	84	85	1	-4	1	0	3	0	-4	-4	85	81
Mexico	..	33	..	-7	..	-2	..	-5	..	1	..	26
United States	100	100	0	0	0	0	0	0	0	0	100	100
Australia	77	81	-5	-6	-2	-1	-2	-2	-1	-3	73	75
Japan	67	78	5	6	1	3	0	1	4	1	72	84
Korea	31	52	-6	-3	-1	3	-6	-8	1	1	25	49
New Zealand	..	66	..	-5	..	-3	..	0	..	-1	..	61
Austria	..	87	..	-8	..	2	..	-11	..	1	..	79
Belgium	90	102	-19	-23	0	0	-14	-17	-5	-5	71	79
Czech Republic	..	45	..	-1	..	1	..	-2	..	0	..	45
Denmark	72	83	8	4	-1	0	9	4	-1	0	79	87
Finland	61	80	7	-10	1	0	5	0	2	-10	69	70
France	87	92	-11	-20	-2	-2	-6	-9	-3	-9	75	73
Germany	91	84	-22	-9	2	2	-23	-6	-1	-5	70	75
Greece	53	63	-10	-15	-1	0	-9	-12	0	-4	42	47
Hungary	..	46	..	-12	..	0	..	-10	..	-2	..	34
Iceland	..	78	..	6	..	-2	..	7	..	1	..	84
Ireland	65	90	-21	-20	-6	-3	-6	-11	-9	-6	44	70
Italy	77	91	-8	-18	0	2	-5	-12	-3	-9	69	73
Luxembourg	72	103	13	10	3	1	7	6	4	3	85	113
Netherlands	90	79	-20	-3	1	2	-14	-5	-7	-1	70	76
Norway	75	89	6	3	-4	-4	6	5	4	1	81	91
Poland	..	..	..	..	..	..	..	..	..	..	..	..
Portugal	38	54	-2	-4	-2	0	1	-2	-1	-2	36	50
Spain	74	81	-27	-26	-2	2	-10	-10	-15	-18	47	55
Sweden	67	75	10	-6	-3	-3	10	0	4	-3	77	70
Switzerland	..	81	..	7	..	4	..	3	..	1	..	88
Turkey[2]	..	40	..	..	..	..	..	..	..	..	..	31
United Kingdom	71	75	-3	-5	-2	-3	2	0	-4	-2	67	70
European Union	78	83	-12	-13	-1	0	-8	-7	-4	-6	66	70
Total OECD	81	81	-5	-6	0	0	-4	-4	-1	-2	76	75

1. Labour force is defined as all employed and unemployed persons.
2. Figures for Turkey come from *STI Outlook 1998* and were only available for 1996.

Sources: OECD, National Accounts, Labour Force Statistics, ISDB and STAN databases, March 1999; Projection demographic data, United Nations 1996.

Table 10.3.1. **Relative trade-weighted unit labour costs by industry**

1990=100, US dollar basis

	Manufacturing ISIC 3		Food, beverages and tobacco ISIC 31		Textiles, apparel and leather ISIC 32		Wood and wood products ISIC 33		Paper and printing ISIC 34	
	1985	1996	1985	1996	1985	1996	1985	1996	1985	1996
Canada	119.5	79.1	119.7	77.1	130.4	78.2	129.5	77.7	119.4	89.3
United States	167.7	89.7	146.3	105.7	179.1	82.9	153.5	113.2	145.7	118.3
Australia	113.4	101.6	119.4	102.8	115.9	92.5	89.6	104.1	111.2	91.2
Japan	95.0	134.4	72.9	142.7	94.4	179.8	90.0	169.7	99.8	151.2
Austria	86.2	112.8	81.3	113.2	79.5	108.4	100.3	103.8	90.9	122.6
Belgium-Luxembourg	88.4	103.9	85.6	94.3	121.9	86.6	110.6	130.2	107.5	102.8
Denmark	74.9	106.7	93.9	103.1	73.9	109.1	67.2	99.8	70.9	99.4
Finland	86.3	67.6	82.8	62.8	88.9	66.9	90.0	63.6	87.1	68.7
France	94.2	101.5	92.6	100.3	96.8	91.0	101.1	103.5	89.7	117.8
West Germany	76.3	117.6	83.1	119.3	91.4	115.3	81.3	110.9	84.8	124.6
Greece	87.5	124.2	87.3	108.2	98.9	113.5	82.2	126.2	84.7	116.4
Italy	83.5	80.0	87.9	73.5	89.6	67.7	86.5	75.3	88.8	82.9
Netherlands	89.6	99.8	100.7	97.8	88.5	110.7	92.5	121.8	92.0	104.8
Norway	92.1	103.2	86.3	98.8	106.4	85.6	91.4	94.2	91.0	104.9
Portugal	82.7	121.9	97.7	95.0	83.1	107.0	74.6	144.0	67.1	110.4
Spain	72.8	88.2	70.2	97.6	77.1	81.6	77.1	102.5	59.2	96.7
Sweden	83.7	83.6	78.1	83.3	101.7	71.7	89.6	90.8	84.9	83.8
United Kingdom	99.5	87.9	86.6	89.4	93.8	79.8	101.3	89.5	115.6	99.3

	Chemicals ISIC 35		Non-metallic mineral products ISIC 36		Basic metals ISIC 37		Fabricated metal products ISIC 38		Other manufacturing ISIC 39	
	1985	1996	1985	1996	1985	1996	1985	1996	1985	1996
Canada	129.2	73.9	124.2	76.5	117.2	71.9	112.4	79.4	106.5	70.5
United States	178.8	96.1	176.5	93.7	150.8	95.1	167.0	78.3	197.6	97.7
Australia	120.8	116.9	123.8	86.6	128.5	128.5	107.6	93.3	105.2	84.7
Japan	89.3	122.7	92.4	136.9	95.5	124.9	102.0	129.5	110.4	144.9
Austria	99.0	127.4	77.3	105.3	125.7	99.5	78.4	112.3	72.0	100.0
Belgium-Luxembourg	91.7	101.4	119.3	95.1	98.9	109.7	73.5	114.9	62.7	73.5
Denmark	77.0	107.5	76.7	111.6	91.8	85.5	67.6	111.4	88.0	92.6
Finland	84.2	78.7	87.8	62.3	88.0	70.0	83.5	66.1	108.5	68.1
France	95.9	103.4	99.4	97.3	118.0	102.6	89.1	100.6	86.7	110.2
West Germany	71.0	114.7	90.5	110.1	83.0	102.1	70.3	127.3	95.6	93.1
Greece	95.4	136.3	98.2	131.1	89.3	111.5	78.1	134.6	87.4	220.2
Italy	83.9	87.7	85.0	78.4	83.6	70.1	78.5	84.3	90.1	70.9
Netherlands	91.1	90.8	91.3	110.8	78.6	103.8	82.9	101.5	92.6	117.3
Norway	114.8	119.4	96.1	83.0	99.3	113.6	83.4	101.8	91.5	78.3
Portugal	71.9	123.3	83.3	120.5	119.6	131.5	90.8	135.9	110.9	69.9
Spain	77.1	89.1	83.6	82.3	74.9	101.6	72.6	81.4	91.9	83.5
Sweden	94.8	88.2	92.0	108.0	92.6	69.6	76.5	83.0	91.7	88.7
United Kingdom	94.2	82.9	101.3	87.4	105.7	93.1	98.6	88.8	108.2	107.1

Source: OECD, STAN and Bilateral Trade databases, May 1999.

Table 11.1.1. **Number of scientific publications**

	1990	1995	Average annual growth rate 1990-95	Share in total OECD, 1995	Per 100 000 population, 1995
Canada	24 164	27 229	2.4	4.8	92
Mexico	1 258	2 370	13.5	0.4	3
United States	185 599	203 164	1.8	36.0	77
Australia	11 552	14 820	5.1	2.6	82
Japan	41 275	52 599	5.0	9.3	42
Korea	1 395	4 514	26.5	0.8	10
New Zealand	2 603	2 915	2.3	0.5	80
Austria	3 286	4 585	6.9	0.8	57
Belgium	5 114	7 129	6.9	1.3	70
Czech Republic	..	2 609	..	0.5	25
Denmark	4 525	5 846	5.3	1.0	112
Finland	3 510	5 054	7.6	0.9	99
France	27 359	36 607	6.0	6.5	63
Germany	32 585	45 903	7.1	8.1	56
Greece	1 693	2 650	9.4	0.5	25
Hungary	2 169	2 582	3.5	0.5	25
Ireland	1 118	1 548	6.7	0.3	43
Italy	15 661	22 949	7.9	4.1	40
Netherlands	11 543	14 846	5.2	2.6	96
Norway	2 764	3 546	5.1	0.6	81
Poland	4 854	6 160	4.9	1.1	16
Portugal	775	1 359	11.9	0.2	14
Spain	8 141	14 189	11.8	2.5	36
Sweden	9 479	11 586	4.1	2.1	131
Switzerland	7 659	10 286	6.1	1.8	145
Turkey	884	2 143	19.4	0.4	3
United Kingdom	45 355	54 781	3.8	9.7	93
European Union	159 279	207 973	5.5	36.9	56
Total OECD	379 173	463 465	4.1	100.0	52

Source: OECD, based on data from the European Commission (*Second European Report on S&T Indicators*, 1997) and Science Citation Index.

Table 11.2.1. **EPO[1] patent applications by priority year and by inventor**

	1990	1991	1992	1993	1994	1995 [2]	1996 [2]	Average annual growth rate 1990-96	Share in total EPO applications	
									1990	1996
Canada	550	541	589	633	670	752	890	8.4	0.90	1.20
Mexico	14	14	9	14	13	20	22	7.8	0.02	0.03
United States	17 298	17 083	17 296	17 490	18 161	19 095	20 748	3.1	28.38	28.01
Australia	361	395	369	408	432	453	451	3.8	0.59	0.61
Japan	12 914	11 631	10 577	10 607	10 128	11 529	13 026	0.1	21.19	17.59
Korea	118	166	194	287	347	447	484	26.5	0.19	0.65
New Zealand	23	42	60	56	64	52	56	16.0	0.04	0.08
Austria	652	654	610	659	670	656	767	2.7	1.07	1.04
Belgium	512	595	657	779	747	796	878	9.4	0.84	1.19
Czech Republic	0	1	16	20	23	21	36	..	0.00	0.05
Denmark	325	356	388	418	441	455	504	7.6	0.53	0.68
Finland	429	416	522	568	677	681	781	10.5	0.70	1.05
France	4 916	4 960	4 652	4 735	4 941	5 094	5 540	2.0	8.07	7.48
Germany	11 490	11 318	11 482	11 700	12 375	12 885	15 220	4.8	18.85	20.55
Greece	27	25	36	16	30	25	38	5.9	0.04	0.05
Hungary	70	55	50	49	43	44	50	-5.5	0.11	0.07
Iceland	9	8	6	6	10	9	11	3.4	0.01	0.01
Ireland	68	65	76	66	82	95	106	7.7	0.11	0.14
Italy	2 246	2 299	2 176	2 252	2 311	2 455	2 848	4.0	3.69	3.85
Luxembourg	41	32	27	34	23	33	56	5.3	0.07	0.08
Netherlands	1 519	1 430	1 453	1 456	1 470	1 692	2 045	5.1	2.49	2.76
Norway	128	173	194	173	178	208	254	12.1	0.21	0.34
Poland	20	19	13	18	19	12	17	-2.7	0.03	0.02
Portugal	8	10	11	18	14	13	16	12.2	0.01	0.02
Spain	256	316	295	362	377	371	434	9.2	0.42	0.59
Sweden	933	919	1 057	1 099	1 308	1 384	1 656	10.0	1.53	2.24
Switzerland	1 684	1 600	1 728	1 651	1 689	1 658	1 856	1.6	2.76	2.51
Turkey	4	4	0	4	4	3	7	9.8	0.01	0.01
United Kingdom	3 546	3 416	3 398	3 407	3 490	3 634	4 034	2.2	5.82	5.45
European Union	26 967	26 814	26 840	27 569	28 955	30 270	34 922	4.4	44.25	47.15
Total OECD	60 160	58 546	57 943	58 985	60 737	64 573	72 828	3.2	98.71	98.33
World	60 946	59 404	58 973	59 981	61 766	65 662	74 064	3.3	100.00	100.00

1. European Patent Office.
2. The latest figures include estimates of EPO applications originating from Patent Co-operation Treaty options.
Source: OECD.

Table 11.3.1. **Innovation in information and communication technology (ICT)**

ICT patents granted by USPTO[1]

	Share of ICT patents in total		Average annual growth rate of ICT patents 1992-98
	1992	1998	
Canada	5.8	14.7	25.0
Mexico	2.6	2.9	12.2
United States	8.8	18.4	21.5
Australia	4.8	8.0	19.6
Japan	14.1	21.0	13.2
Korea	28.8	23.4	30.5
New Zealand	3.3	11.7	45.1
Austria	2.7	5.8	15.7
Belgium	4.1	9.3	29.7
Denmark	6.4	3.1	0.0
Finland	6.0	29.0	41.7
France	8.7	13.3	11.0
Germany	4.2	6.7	12.2
Ireland	14.2	24.4	17.3
Italy	4.0	7.4	15.1
Netherlands	10.2	16.6	15.2
Norway	4.5	5.1	12.2
Spain	4.8	6.6	17.9
Sweden	7.3	16.8	28.2
Switzerland	3.4	5.7	10.6
United Kingdom	9.1	15.9	17.0
European Union	6.2	11.0	15.7
Total OECD	9.5	17.6	18.6

1. United States Patents and Trademarks Office.
Source: OECD.

Table 11.4.1. **Share of firms having introduced on the market any new or technologically improved product or process, 1994-96**

Percentages

	Manufacturing sector		Services sector	
	All firms	Firms with 20-49 employees	All firms	Firms with 10-49 employees
Mexico	45.8	25.0	81.0	..
Australia[1]	60.8	53.2	..	..
Austria	81.3	59.0	63.9	54.0
Belgium	44.9	22.0	45.2	11.0
Finland	68.9	26.0	45.5	22.0
France	65.5	34.0	76.5	25.0
Germany	82.5	63.0	82.0	41.0
Ireland	78.9	68.0	61.6	60.0
Luxembourg	76.7	21.0	62.9	45.0
Netherlands	75.4	54.0	59.8	32.0
Norway[2]	64.5	39.0	41.1	20.0
Poland	34.3	16.2	..	..
Spain	52.6	21.0	..	..
Sweden	75.3	43.0	43.8	29.0
Switzerland	73.4	65.1	62.2	62.9
Turkey[2]	33.3	20.0	..	..
United Kingdom	..	..	54.5	40.0

1. 1994-97.
2. 1995-97.
Source: OECD, mainly based on data from Eurostat.

Table 11.5.1. **Technology balance of payments**

	In millions of US dollars						As a percentage of GDP						Receipts / payments ratio (%)	
	Receipts		Payments		Balance		Receipts		Payments		Balance			
	1985	1997	1985	1997	1985	1997	1985	1997	1985	1997	1985	1997	1985	1997
Canada[1]	397.8	1 261.3	548.2	989.8	- 150.4	271.5	0.11	0.22	0.16	0.17	-0.04	0.05	73	127
Mexico	13.8	129.9	160.8	500.9	- 146.9	- 371.0	0.01	0.03	0.08	0.12	-0.08	-0.09	9	26
United States	6 678.0	33 676.0	1 170.0	9 411.0	5 508.0	24 265.0	0.16	0.43	0.03	0.12	0.14	0.31	571	358
Australia[2,3]	68.0	228.1	187.3	368.0	- 119.3	- 139.8	0.04	0.06	0.11	0.09	-0.07	-0.03	36	62
Japan	981.9	6 873.8	1 229.0	3 623.4	- 247.1	3 250.4	0.07	0.16	0.09	0.09	-0.02	0.08	80	190
Korea[1]	11.3	112.4	295.5	1 947.0	- 284.2	-1 834.6	0.00	0.02	0.00	0.43	0.00	-0.40	4	6
New Zealand[1]	..	20.2	..	8.2	..	12.0	..	0.03	..	0.01	..	0.02	..	248
Austria	29.8	187.6	113.5	689.6	- 83.8	- 502.0	0.04	0.09	0.17	0.33	-0.13	-0.24	26	27
Belgium	673.9	4 350.3	781.6	3 447.7	- 107.7	902.6	0.83	1.79	0.96	1.42	-0.13	0.37	86	126
Czech Republic[3]	..	42.9	..	98.0	..	- 55.0	..	0.08	..	0.17	..	-0.10	..	44
Denmark	183.6	..	161.0	..	22.6	..	0.32	..	0.28	..	0.04	..	114	..
Finland[3]	4.4	66.2	106.8	465.1	- 102.4	- 398.9	0.01	0.05	0.20	0.37	-0.19	-0.32	4	14
France	893.3	2 164.7	1 063.0	2 989.4	- 169.6	- 824.7	0.17	0.16	0.20	0.21	-0.03	-0.06	84	72
Germany	1 172.8	11 605.2	1 652.4	13 656.1	- 479.6	-2 050.9	0.19	0.55	0.27	0.65	-0.08	-0.10	71	85
Greece	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hungary	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Iceland[3]	..	0.2	..	1.2	..	- 1.0	..	0.03	..	0.18	..	-0.15	..	16
Ireland[3]	..	100.8	..	3 414.2	..	-3 313.4	..	0.14	..	4.74	..	-4.60	..	3
Italy[1]	144.2	1 207.2	545.9	1 562.2	- 401.8	- 355.0	0.03	0.11	0.13	0.14	-0.09	-0.03	26	77
Netherlands[4]	1 196.1	6 202.8	1 503.9	6 133.5	- 307.8	69.3	0.93	1.93	1.17	1.91	-0.24	0.02	80	101
Norway[3]	28.3	118.1	76.4	290.4	- 48.1	- 172.2	0.04	0.07	0.12	0.18	-0.08	-0.11	37	41
Poland	..	195.5	..	411.4	..	- 215.9	..	0.14	..	0.30	..	-0.16	..	48
Portugal	..	179.5	..	532.7	..	- 353.2	..	0.22	..	0.60	..	-0.39	..	34
Spain	137.5	161.8	551.7	1 073.8	- 414.2	- 912.1	0.08	0.03	0.33	0.20	-0.25	-0.17	25	15
Sweden[5]	87.4	457.1	49.3	49.9	38.1	407.2	0.09	0.25	0.05	0.03	0.04	0.22	177	916
Switzerland	870.2	2 771.9	232.8	1 262.6	637.4	1 509.3	0.90	1.09	0.24	0.49	0.66	0.59	374	220
Turkey	..	..	..	..	..	..	..	..	..	..	..	..	..	..
United Kingdom[3]	1 037.2	2 907.8	921.8	3 596.9	115.4	- 689.1	0.23	0.25	0.20	0.31	0.03	-0.06	113	81
European Union[3,6]	5 376.5	28 432.9	7 289.9	39 355.7	-1 913.4	-10 922.8	0.21	0.35	0.28	0.49	-0.07	-0.13	74	72
Total OECD[3,6]	14 406.3	72 272.9	11 159.2	56 669.8	3 247.1	15 603.1	0.16	0.32	0.12	0.25	0.04	0.07	129	128

1. 1995 instead of 1997.
2. 1986 instead of 1985.
3. 1996 instead of 1997.
4. 1992 instead of 1997.
5. 1993 instead of 1997.
6. Including intra-zone flows. Data partly estimated.

Source: OECD, TBP database, May 1999.

Table 12.1.1. **Export shares**[1]

	Total manufacturing		High-technology industries										Medium-high-technology industries													
			Total		Aircraft		Office & computing equipment		Drugs & medicines		Radio, TV & communication equipment		**Total**		Professional goods		Motor vehicles		Electrical machinery excl. commun. equipment		Chemicals excl. drugs		Other transport equipment		Non-electrical machinery	
	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996
Canada	100.0	100.0	10.4	10.8	3.4	2.9	2.3	2.7	0.2	0.4	4.5	4.8	44.5	44.8	1.1	1.2	29.0	27.5	1.7	2.0	7.2	7.4	0.8	0.8	4.8	5.8
Mexico	100.0	100.0	6.3	19.8	1.0	0.4	3.3	4.9	0.6	0.5	1.4	14.0	56.2	51.9	1.4	2.6	31.9	23.7	3.6	15.4	14.5	5.6	0.2	0.1	4.6	4.5
United States	100.0	100.0	27.6	26.8	10.8	7.2	7.4	7.6	1.2	1.3	8.2	10.7	43.9	45.9	4.8	5.2	9.9	10.6	4.4	5.3	12.4	12.0	0.3	0.3	12.1	12.5
Australia	100.0	100.0	7.8	10.9	2.1	2.0	2.7	4.4	1.2	2.2	1.8	2.3	16.8	22.9	1.9	2.4	4.2	4.9	1.6	3.1	4.5	5.9	0.1	0.2	4.4	6.3
Japan	100.0	100.0	23.5	23.6	0.2	0.3	7.4	7.4	0.3	0.5	15.6	15.4	58.1	58.6	5.9	6.3	23.7	19.1	6.5	7.8	7.7	9.0	1.3	1.4	12.9	14.9
Korea	..	100.0	..	23.7	..	0.3	..	4.7	..	0.2	..	18.4	..	34.6	..	1.4	..	10.4	..	6.6	..	10.1	..	0.4	..	5.6
New Zealand	100.0	100.0	1.1	3.4	0.1	1.0	0.1	0.6	0.4	0.6	0.4	1.1	8.4	12.8	0.5	0.8	0.5	0.5	2.0	2.8	3.3	5.6	0.0	0.0	2.2	3.0
Austria	100.0	100.0	9.5	9.6	0.2	0.3	1.4	1.0	1.6	2.3	6.3	6.0	41.3	42.0	2.5	2.3	9.4	12.9	5.8	5.7	8.5	7.3	0.6	0.9	14.5	12.9
Belgium-Luxembourg	100.0	100.0	5.9	8.0	0.7	0.4	1.1	1.6	1.5	2.7	2.5	3.2	40.2	42.5	1.1	1.7	17.0	16.2	2.4	2.5	13.8	16.0	0.2	0.3	5.8	6.0
Czech Republic	..	100.0	..	5.2	..	0.7	..	1.0	..	0.9	..	2.6	..	41.1	..	1.5	..	10.0	..	7.7	..	9.0	..	1.3	..	11.6
Denmark	100.0	100.0	11.6	12.9	1.7	0.5	1.7	2.4	3.6	5.2	4.5	4.8	29.6	29.9	3.9	3.9	2.7	2.6	3.7	4.5	6.3	6.5	0.1	0.1	12.9	12.1
Finland	100.0	100.0	7.0	14.8	0.1	0.2	1.3	2.5	0.5	0.4	5.1	11.7	28.2	27.4	1.6	1.6	3.6	3.2	3.5	6.1	6.5	6.1	0.6	0.1	12.5	10.3
France	100.0	100.0	13.4	17.4	4.7	5.3	2.8	3.5	2.0	2.6	3.9	6.0	44.2	43.2	2.8	2.7	13.9	13.0	4.8	5.5	13.7	13.3	0.4	0.4	8.5	8.3
Germany[2]	100.0	100.0	9.9	11.3	2.2	1.9	2.4	2.4	1.3	1.9	4.0	5.1	57.0	57.9	3.7	3.9	18.5	18.6	5.8	6.7	12.9	12.8	0.3	0.3	15.8	15.5
Greece	100.0	100.0	1.9	2.7	0.3	0.5	0.1	0.3	0.9	0.8	0.5	1.2	9.2	13.2	0.3	0.9	0.5	0.9	1.9	3.0	4.8	5.8	0.0	0.0	1.6	2.6
Hungary	..	100.0	..	7.1	..	0.2	..	0.4	..	2.5	..	4.0	..	33.9	..	1.6	..	4.6	..	11.5	..	9.8	..	0.7	..	5.6
Iceland	100.0	100.0	1.2	3.9	0.8	2.2	0.3	1.2	0.0	0.4	0.0	0.0	0.6	0.9	0.1	0.2	0.0	0.0	0.1	0.1	0.0	0.2	0.0	0.0	0.5	0.5
Ireland	100.0	100.0	33.6	44.3	1.0	0.8	21.1	22.8	4.3	5.8	7.2	14.9	27.5	30.0	4.3	4.3	0.7	0.4	4.0	3.6	14.3	18.7	0.0	0.0	4.2	2.9
Italy	100.0	100.0	8.1	7.4	2.0	1.0	2.6	1.9	0.9	1.7	2.5	2.8	39.0	41.0	1.9	2.1	8.3	8.1	4.9	5.5	6.6	6.9	0.8	1.0	16.5	17.3
Netherlands	100.0	100.0	12.7	19.2	2.1	0.7	5.2	9.7	1.1	2.1	4.3	6.8	35.7	35.1	3.6	4.1	4.7	5.4	3.0	3.7	17.6	15.5	0.2	0.4	6.6	6.1
Norway	100.0	100.0	5.9	5.9	1.4	0.5	1.9	1.7	0.4	0.5	2.1	3.1	24.2	27.7	1.7	2.4	2.2	2.6	2.1	2.8	11.5	12.2	0.0	0.1	6.6	7.6
Poland	..	100.0	..	4.5	..	0.5	..	0.3	..	1.1	..	2.6	..	25.7	..	0.7	..	6.0	..	5.0	..	7.8	..	0.4	..	5.9
Portugal	100.0	100.0	5.0	5.7	0.4	0.3	0.6	0.3	0.5	0.6	3.5	4.4	21.5	32.4	0.7	1.1	7.0	15.4	5.0	7.6	5.3	4.2	0.2	0.5	3.3	3.6
Spain	100.0	100.0	7.1	7.9	2.1	1.5	2.0	1.8	1.3	1.5	1.7	3.1	44.0	48.1	1.0	1.3	22.9	27.2	4.2	4.8	8.4	7.9	0.2	0.6	7.4	6.4
Sweden	100.0	100.0	12.2	19.5	1.6	2.3	2.6	1.3	2.3	3.6	5.7	12.3	42.3	40.5	2.9	2.9	14.3	14.6	4.1	5.4	5.5	4.1	0.3	0.4	15.1	13.1
Switzerland	100.0	100.0	10.9	15.2	0.6	1.1	1.2	1.5	6.8	9.9	2.4	2.6	57.9	58.2	13.9	13.8	1.3	1.2	5.5	6.2	16.3	17.6	0.3	0.6	20.7	18.8
Turkey	100.0	100.0	2.9	2.5	0.0	0.4	0.2	0.1	0.5	0.4	2.2	1.6	12.9	17.9	0.3	0.3	1.5	4.4	2.0	4.8	7.9	5.9	0.0	0.1	1.3	2.6
United Kingdom	100.0	100.0	21.6	24.7	7.7	4.9	6.2	7.6	2.3	3.2	5.3	8.9	42.2	41.6	4.3	4.1	9.1	10.4	4.0	4.4	12.8	12.1	0.2	0.2	11.8	10.3
European Union	100.0	100.0	11.7	14.6	2.9	2.2	3.2	4.0	1.6	2.4	4.0	5.9	44.5	44.6	3.0	3.1	12.9	13.1	4.6	5.2	11.8	11.5	0.4	0.4	11.9	11.3
Total OECD[3]	100.0	100.0	15.3	17.4	3.6	2.6	4.2	4.7	1.4	1.9	6.0	8.1	45.8	45.8	3.8	3.8	13.9	13.6	4.6	5.7	11.1	10.9	0.5	0.5	11.8	11.2

1. Share of industries in total manufacturing exports.
2. Western Germany in 1990, total Germany in 1996.
3. Excluding Mexico, Korea, Czech Republic, Hungary and Poland in 1990.

Source: OECD, Main Industrial Indicators, 1999.

Table 12.1.1. **Export shares**[1] *(cont.)*

	Medium-low-technology industries																		Low-technology industries									
	Total		Rubber & plastic products		Shipbuilding & repairing		Other manufacturing		Non-ferrous metals		Non-metallic mineral products		Metal products		Petroleum refineries & products		Ferrous metals		**Total**		Paper, paper products & printing		Textiles, apparel & leather		Food, beverages & tobacco		Wood products & furniture	
	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996
Canada	17.0	17.3	1.6	2.1	0.1	0.5	0.4	0.6	6.3	5.6	0.8	1.0	2.4	3.1	3.2	2.6	2.1	1.9	27.2	26.6	13.8	10.8	0.9	1.7	5.4	5.0	7.0	9.1
Mexico	24.4	13.4	1.0	2.0	0.5	0.1	0.6	1.6	5.9	1.5	3.2	1.7	3.1	3.0	4.8	0.7	5.2	2.8	12.7	13.9	1.4	1.1	3.7	7.4	6.5	3.3	1.1	2.1
United States	11.5	11.2	1.4	1.8	0.5	0.3	1.2	1.2	1.8	1.5	0.9	0.9	2.4	3.1	2.1	1.5	1.1	1.0	16.0	15.4	3.8	3.6	3.3	3.6	7.4	6.8	1.5	1.4
Australia	31.8	28.2	0.7	1.1	0.8	1.4	1.4	1.2	16.8	11.2	0.7	1.0	2.0	2.6	5.4	5.5	3.9	4.2	42.9	37.2	1.5	1.7	8.6	9.1	30.8	24.5	1.9	1.9
Japan	14.6	14.7	1.6	1.7	2.2	2.6	1.5	1.3	0.9	1.0	1.2	1.3	2.3	2.6	0.5	0.5	4.4	3.7	3.7	2.9	0.9	0.6	2.1	1.7	0.6	0.5	0.1	0.1
Korea	..	21.9	..	2.4	..	6.1	..	1.8	..	0.8	..	0.5	..	2.7	..	3.3	..	4.2	..	19.8	..	1.2	..	16.2	..	2.1	..	0.3
New Zealand	14.9	11.0	1.1	1.4	0.1	0.4	0.5	0.5	6.2	4.6	0.4	0.4	1.6	2.1	2.7	0.2	2.2	1.6	75.3	72.5	7.7	6.4	10.3	9.1	54.7	52.8	2.7	4.3
Austria	23.6	21.5	3.0	3.0	0.2	0.3	1.9	1.8	2.5	2.5	3.1	2.6	5.8	6.0	0.5	0.6	6.6	4.7	24.8	22.9	7.4	6.7	9.1	7.7	2.8	4.0	5.5	4.6
Belgium-Luxembourg	31.6	26.7	2.3	2.4	0.1	0.0	7.6	7.8	3.6	2.4	2.7	2.3	3.3	2.8	3.7	3.4	8.4	5.6	21.9	21.0	3.0	2.8	8.1	7.1	8.9	9.5	1.9	1.6
Czech Republic	..	30.2	..	3.4	..	0.1	..	1.9	..	1.4	..	5.9	..	8.0	..	2.0	..	7.5	..	22.4	..	3.1	..	9.8	..	4.8	..	4.8
Denmark	16.7	16.7	2.8	2.9	2.2	2.2	0.7	0.7	0.6	0.5	1.8	1.6	5.0	5.1	1.9	2.0	1.7	1.6	41.4	39.7	2.7	2.4	6.0	6.4	26.7	24.5	6.0	6.4
Finland	19.6	21.3	1.1	1.0	3.5	4.4	0.6	0.5	3.1	2.6	1.1	1.2	3.7	3.6	1.5	2.7	5.0	5.2	44.9	36.0	31.7	24.7	3.3	2.1	2.2	2.7	7.5	6.6
France	19.1	17.1	2.8	2.9	0.6	0.7	1.3	1.1	2.1	1.9	2.2	2.0	3.9	3.5	1.6	1.4	4.7	3.5	22.7	21.3	3.2	3.0	6.7	5.7	11.5	11.3	1.3	1.3
Germany[2]	17.3	15.7	2.5	2.5	0.6	0.4	1.1	0.9	2.0	1.8	1.7	1.5	4.5	4.4	1.0	0.9	4.0	3.2	14.5	13.7	3.1	3.2	5.4	4.5	4.5	4.8	1.5	1.2
Greece	29.9	28.7	1.0	1.4	0.2	0.4	0.4	0.7	6.1	6.1	4.9	5.0	1.9	2.4	7.7	9.3	7.7	3.4	58.9	55.0	1.0	1.9	35.3	28.6	21.9	23.9	0.6	0.7
Hungary	..	19.8	..	2.7	..	0.0	..	0.6	..	3.3	..	2.3	..	4.4	..	3.4	..	3.1	..	37.9	..	2.2	..	14.8	..	17.1	..	3.8
Iceland	17.5	16.7	0.2	0.3	0.8	1.4	0.0	0.5	12.6	10.5	0.1	0.1	0.6	0.4	0.0	0.1	3.2	3.3	80.5	78.2	0.1	0.3	2.8	1.9	77.6	76.0	0.0	0.0
Ireland	9.5	5.6	2.1	1.2	0.1	0.1	1.2	0.9	1.2	0.7	1.3	0.7	2.2	1.2	0.7	0.4	0.7	0.3	29.3	20.1	1.5	1.0	4.6	2.5	22.6	16.2	0.6	0.4
Italy	23.1	22.4	3.0	3.0	0.4	0.7	3.3	3.1	1.1	1.1	4.1	3.8	5.7	6.1	2.1	1.3	3.5	3.1	29.1	28.6	2.0	2.3	18.7	17.2	5.0	5.5	3.4	3.7
Netherlands	21.7	18.1	2.3	2.2	0.6	0.5	0.7	0.7	2.2	1.7	1.3	1.0	3.6	2.9	8.2	6.7	2.8	2.4	28.9	26.9	3.6	3.2	5.0	4.6	19.1	18.3	1.2	0.9
Norway	47.4	41.3	1.1	0.9	10.1	6.1	0.4	0.4	15.8	13.0	1.2	0.9	3.0	2.6	10.1	10.6	5.7	6.8	21.9	24.5	8.6	8.1	1.4	1.4	9.3	12.2	2.6	2.7
Poland	..	30.7	..	2.9	..	5.0	..	0.6	..	5.0	..	3.1	..	6.6	..	1.9	..	5.6	..	38.5	..	3.0	..	15.0	..	10.3	..	10.3
Portugal	14.6	13.1	1.2	1.6	0.6	0.5	1.0	0.7	0.4	0.2	4.3	4.1	2.5	2.9	3.8	2.3	0.8	0.9	58.6	48.6	6.2	5.2	39.1	31.4	6.6	6.8	6.7	5.2
Spain	25.9	21.8	3.1	3.3	1.7	1.2	1.1	1.0	1.9	1.9	3.6	3.9	4.0	4.0	5.2	2.7	5.3	3.9	22.2	21.7	3.2	2.9	8.1	7.5	9.2	9.5	1.7	1.8
Sweden	18.9	16.7	1.9	2.3	1.0	0.3	0.5	0.4	1.9	1.6	1.0	0.9	4.3	4.0	2.8	2.2	5.5	5.1	24.8	21.2	15.5	11.8	2.0	1.8	1.9	2.2	5.4	5.4
Switzerland	19.3	16.3	1.7	1.8	0.0	0.0	8.1	5.4	2.3	2.1	0.8	0.9	4.8	5.0	0.1	0.2	1.3	1.1	11.7	10.0	2.5	2.6	5.2	3.5	2.9	3.0	0.9	0.9
Turkey	24.6	21.1	0.9	2.2	0.6	0.3	0.3	0.8	2.0	1.4	3.5	3.6	1.7	2.5	2.4	1.2	13.2	9.1	59.4	58.2	0.6	0.7	43.7	42.1	14.7	14.8	0.4	0.6
United Kingdom	19.0	16.4	2.2	2.1	0.4	0.4	3.5	3.2	2.5	1.8	1.4	1.4	3.2	2.9	2.6	2.0	3.2	2.6	15.5	14.8	3.1	2.9	5.1	5.3	6.7	6.0	0.6	0.6
European Union	20.4	18.3	2.5	2.5	0.6	0.6	2.1	2.0	2.1	1.7	2.2	2.0	4.2	4.0	2.5	2.1	4.3	3.4	22.4	21.2	4.2	3.8	7.8	7.1	8.2	8.2	2.1	2.0
Total OECD[3]	18.5	17.2	2.1	2.2	0.8	1.0	2.0	1.8	2.3	2.0	1.7	1.7	3.6	3.6	2.3	1.9	3.7	3.1	19.5	18.7	4.1	3.5	6.2	6.2	7.3	7.0	2.0	2.0

1. Share of industries in total manufacturing exports.
2. Western Germany in 1990, total Germany in 1996.
3. Excluding Mexico, Korea, Czech Republic, Hungary and Poland in 1990.

Source: OECD, Main Industrial Indicators, 1999.

Table 12.1.2. **Growth of the value of exports in current dollars by industry group**

Average annual growth rate 1990-96 in per cent

	Total manufacturing	High- and medium-high-technology industries	High-technology industries	Medium-high-technology industries	Medium-low- and low-technology industries	Medium-low-technology industries	Low-technology industries
Canada	8.2	8.4	8.8	8.3	8.1	8.6	7.8
Mexico	32.8	35.9	60.7	31.1	26.2	20.2	34.8
United States	8.0	8.3	7.5	8.8	7.4	7.6	7.3
Australia	9.3	15.2	15.6	15.1	6.9	7.1	6.7
Japan	6.0	6.1	6.1	6.2	5.3	6.2	1.6
New Zealand	8.1	18.2	30.9	15.9	6.8	2.9	7.5
Austria	5.9	6.2	6.1	6.2	4.5	4.4	4.6
Belgium-Luxembourg	6.5	8.2	12.2	7.5	4.5	3.6	5.8
Denmark	5.5	6.2	7.5	5.7	5.0	5.5	4.8
Finland	6.9	10.1	21.0	6.4	4.8	8.4	3.1
France	5.5	6.4	10.3	5.1	4.1	3.7	4.4
Germany	3.5	4.1	5.9	3.8	2.1	1.8	2.5
Greece	5.8	12.5	12.7	12.4	4.8	5.1	4.7
Iceland	4.9	22.9	26.6	13.0	4.3	4.0	4.3
Ireland	12.8	16.5	18.1	14.4	5.3	3.2	5.9
Italy	7.1	7.6	5.6	8.0	6.7	6.5	6.9
Netherlands	4.6	6.7	12.1	4.3	2.6	1.5	3.4
Norway	4.5	6.5	4.6	6.9	3.6	2.1	6.5
Portugal	7.2	13.8	9.3	14.7	4.2	5.3	3.9
Spain	10.7	12.4	12.5	12.3	8.9	7.6	10.3
Sweden	6.4	8.1	15.1	5.6	3.9	4.2	3.7
Switzerland	4.2	5.4	10.2	4.3	1.4	1.4	1.5
Turkey	11.2	16.1	8.5	17.5	10.2	8.4	10.9
United Kingdom	6.7	7.4	9.2	6.5	5.0	4.1	6.0
European Union	5.8	6.7	9.7	5.8	4.4	3.9	4.8
Total OECD[1]	6.3	7.0	8.5	6.4	5.0	4.7	5.4

1. Excludes Korea, Mexico, Czech Republic, Hungary and Poland.
Source: OECD, Main Industrial Indicators, 1999.

Table 12.1.3. **R&D intensities[1] and export specialisation in high-technology industries[2], 1996**

	R&D intensity	Export specialisation in high-technology industries
Canada	1.16	10.75
Mexico[3]	0.07	19.85
United States	3.17	26.81
Australia	1.32	10.93
Japan	2.91	23.61
Korea	1.91	23.69
New Zealand[3]	0.35	3.36
Belgium[3,4]	1.32	8.03
Czech Republic	0.72	5.24
Denmark	1.95	12.92
Finland	2.16	14.80
France	2.48	17.39
Germany	2.35	11.34
Greece[5]	0.27	2.70
Hungary[3]	0.41	7.12
Iceland[3]	0.64	3.85
Ireland[3]	1.07	44.25
Italy	0.92	7.45
Netherlands	1.66	19.21
Norway	1.27	5.90
Poland	0.34	4.45
Portugal[3]	0.12	5.67
Spain	0.64	7.88
Sweden	3.66	19.50
Switzerland	2.69	15.18
Turkey	0.21	2.51
United Kingdom	1.77	24.74

1. Manufacturing R&D expenditures / Manufacturing production.
2. High-technology exports / Manufacturing exports.
3. 1995.
4. Includes Luxembourg for exports data.
5. 1993.

Source: OECD, Main Industrial Indicators and R&D database, 1999.

Table 12.2.1. **Contribution to the manufacturing trade balance**[1]

	Total manufacturing		High-technology industries										Medium-high-technology industries													
			Total		Aircraft		Office & computing equipment		Drugs & medicines		Radio, TV & communication equipment		**Total**		Professional goods		Motor vehicles		Electrical machinery excl. commun. equipment		Chemicals excl. drugs		Other transport equipment		Non-electrical machinery	
	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996
Canada	0.0	0.0	-25.6	-34.0	3.9	2.8	-11.9	-14.7	-2.9	-4.4	-14.7	-17.7	-40.8	-38.8	-12.2	-11.6	24.2	23.6	-17.0	-18.0	-2.2	-8.6	2.9	2.6	-36.4	-27.0
Mexico	0.0	0.0	-31.8	19.9	-3.9	1.2	2.9	11.9	-2.4	-1.4	-28.4	8.0	59.5	27.4	-10.3	-2.8	129.6	66.1	-8.3	16.3	7.9	-23.3	-2.7	0.0	-56.7	-28.9
United States	0.0	0.0	44.8	17.2	40.8	26.2	7.4	-7.5	3.0	1.6	-6.4	-3.1	20.2	32.4	7.9	7.8	-41.0	-27.1	0.1	0.3	32.0	27.1	-0.9	-0.8	22.2	25.2
Australia	0.0	0.0	-57.2	-50.0	-16.2	-6.5	-20.1	-15.3	-2.8	-1.8	-18.1	-26.5	-117.0	-104.3	-11.8	-10.0	-31.1	-31.3	-14.8	-10.3	-23.0	-20.1	-2.0	-1.8	-34.4	-30.7
Japan	0.0	0.0	50.6	15.4	-11.2	-4.9	17.9	0.2	-6.5	-5.5	50.5	25.5	149.5	154.6	9.9	7.2	85.5	67.7	17.1	17.8	-4.9	6.5	5.3	5.5	36.7	49.8
Korea	..	0.0	..	25.7	..	-11.9	..	6.5	..	-2.2	..	33.4	..	-39.8	..	-20.3	..	39.4	..	8.1	..	-11.5	..	0.6	..	-56.1
New Zealand	0.0	0.0	-94.5	-62.8	-30.6	-2.2	-23.6	-22.5	-11.2	-10.8	-29.1	-27.3	-167.7	-161.1	-15.4	-13.7	-56.3	-67.0	-16.9	-8.8	-39.6	-29.7	-2.4	-2.0	-37.0	-39.9
Austria	0.0	0.0	-10.8	-10.8	-1.7	-3.8	-11.2	-10.4	-1.9	-3.4	4.1	6.7	-18.4	-10.4	-4.2	-4.6	-17.5	-4.2	0.9	-0.9	-9.4	-11.9	0.1	1.1	11.6	10.2
Belgium-Luxembourg	0.0	0.0	-10.5	-8.7	-2.6	-2.4	-6.6	-5.6	0.4	1.6	-1.7	-2.3	1.5	1.9	-5.1	-3.1	25.3	10.1	-5.3	-4.2	0.0	5.8	-0.6	-0.7	-12.9	-6.1
Czech Republic	..	0.0	..	-39.9	..	1.1	..	-14.4	..	-9.1	..	-17.5	..	-27.1	..	-10.9	..	9.2	..	-6.6	..	-13.4	..	3.1	..	-8.5
Denmark	0.0	0.0	-8.3	-13.2	-3.1	-2.4	-15.0	-17.6	10.2	15.5	-0.4	-8.7	-32.8	-34.8	4.7	4.6	-16.9	-32.7	-3.9	-0.9	-29.2	-19.8	-1.4	-1.6	14.0	15.5
Finland	0.0	0.0	-32.9	-26.5	-7.4	-11.2	-16.0	-14.4	-6.0	-9.0	-3.6	8.1	-97.3	-76.0	-10.1	-8.2	-40.8	-26.5	-9.4	-5.4	-28.0	-28.9	-0.2	-1.6	-8.8	-5.4
France	0.0	0.0	-1.9	5.9	8.1	11.6	-8.3	-8.1	3.4	2.2	-5.2	0.2	16.0	5.7	-2.7	-4.0	15.5	5.3	3.7	4.4	6.2	2.9	-0.4	-1.0	-6.3	-1.9
Germany[2]	0.0	0.0	-21.1	-21.3	-3.5	-1.4	-11.2	-13.6	1.2	1.0	-7.6	-7.2	97.7	90.3	2.5	1.6	39.7	28.5	6.2	5.5	10.2	14.4	-0.8	-1.8	40.0	42.3
Greece	0.0	0.0	-26.0	-32.1	-7.3	-4.4	-5.6	-5.8	-3.4	-12.2	-9.7	-9.7	-113.5	-100.9	-8.7	-8.6	-42.0	-36.5	-8.0	-4.8	-24.4	-26.4	-0.1	-0.4	-30.3	-24.2
Hungary	..	0.0	..	-28.3	..	-1.4	..	-11.3	..	-3.4	..	-12.2	..	-41.0	..	-6.8	..	-13.5	..	20.9	..	-21.1	..	-0.6	..	-20.0
Iceland	0.0	0.0	-73.0	-35.0	-37.8	8.0	-10.2	-11.5	-8.6	-9.8	-16.4	-21.7	-144.5	-160.8	-12.2	-13.0	-34.4	-40.5	-28.1	-27.4	-35.1	-34.0	-1.1	-1.0	-33.6	-44.9
Ireland	0.0	0.0	57.9	47.0	-9.0	-4.3	49.1	16.6	9.6	14.8	8.2	19.9	-35.8	-14.9	7.9	5.3	-30.0	-27.4	-3.3	-6.5	11.5	31.8	-1.0	-0.9	-20.9	-17.1
Italy	0.0	0.0	-24.8	-28.7	0.5	-0.5	-4.6	-10.4	-4.6	-3.8	-16.1	-14.0	-15.6	-9.6	-9.8	-7.5	-20.3	-18.2	6.0	7.0	-35.3	-37.7	1.6	2.2	42.2	44.4
Netherlands	0.0	0.0	-14.6	-9.9	-0.4	-1.8	-10.3	-6.7	-0.7	-1.6	-3.2	0.2	-4.2	-10.2	-0.6	1.0	-17.2	-19.6	-5.8	-4.0	24.3	14.4	-1.1	-1.3	-3.7	-0.7
Norway	0.0	0.0	-31.5	-34.3	-9.9	-4.0	-9.2	-13.4	-4.3	-6.0	-8.0	-11.0	-34.8	-55.8	-5.3	-2.8	-19.8	-41.5	-11.6	-9.7	18.8	19.7	-0.5	-2.0	-16.3	-19.4
Poland	..	0.0	..	-36.2	..	1.3	..	-15.0	..	-10.4	..	-12.2	..	-91.3	..	-9.9	..	-14.9	..	-3.1	..	-28.5	..	-1.2	..	-33.7
Portugal	0.0	0.0	-22.8	-24.4	-1.4	-0.5	-10.6	-12.0	-3.9	-7.5	-7.0	-4.4	-126.9	-59.8	-8.6	-7.2	-39.8	-5.8	-0.1	8.1	-29.1	-30.7	-0.8	0.1	-48.4	-24.3
Spain	0.0	0.0	-36.2	-28.8	-4.8	-1.9	-12.5	-9.0	-0.2	-4.0	-18.7	-14.0	-20.3	-1.2	-15.4	-10.8	43.3	46.6	-3.7	-1.1	-19.4	-24.1	-2.7	0.3	-22.3	-12.1
Sweden	0.0	0.0	-12.5	1.4	-5.4	-0.2	-12.9	-22.3	4.3	6.8	1.5	17.2	0.9	-14.3	-4.9	-5.7	21.3	20.7	-9.0	-6.8	-21.1	-30.0	-0.9	-0.5	15.5	8.0
Switzerland	0.0	0.0	0.2	-6.4	-2.7	-8.9	-14.6	-17.2	25.0	31.0	-7.6	-11.3	90.7	94.2	50.0	48.1	-41.6	-37.1	5.6	8.3	24.5	25.9	-2.1	-1.7	54.5	50.6
Turkey	0.0	0.0	-38.9	-41.2	-8.5	-13.9	-12.1	-9.2	-4.3	-5.8	-13.9	-12.4	-187.7	-154.8	-13.4	-11.2	-29.1	-17.2	-14.7	1.8	-51.1	-49.4	-1.3	-3.0	-78.2	-75.9
United Kingdom	0.0	0.0	17.9	15.1	14.3	8.3	-1.3	1.9	6.3	7.5	-1.5	-2.6	18.1	9.2	3.5	2.1	-13.0	-12.4	-0.3	-1.4	12.2	8.2	-0.9	-0.8	16.5	13.5
European Union	0.0	0.0	-12.0	-9.7	0.5	1.1	-7.9	-8.6	1.3	1.3	-5.9	-3.5	22.5	17.5	-1.9	-1.9	9.2	3.4	1.3	1.6	-0.2	-1.6	-0.5	-0.6	14.7	16.6
Total OECD[3]	0.0	0.0	2.1	-4.4	4.5	3.3	-3.4	-7.8	1.1	0.7	-0.1	-0.7	31.3	26.5	2.0	0.6	7.0	5.7	1.7	2.6	4.9	3.3	0.2	0.2	15.4	14.1

1. Observed trade balance of industry minus theoretical trade balance, expressed in thousandths of manufacturing trade (see textbox in text).
2. Western Germany in 1990, total Germany in 1996.
3. Excluding Mexico, Korea, Czech Republic, Hungary and Poland in 1990.

Source: OECD.

Table 12.2.1. **Contribution to the manufacturing trade balance**[1] *(cont.)*

	Medium-low-technology industries																		Low-technology industries									
	Total		Rubber & plastic products		Shipbuilding & repairing		Other manufacturing		Non-ferrous metals		Non-metallic mineral products		Metal products		Petroleum refineries & products		Ferrous metals		**Total**		Paper, paper products & printing		Textiles, apparel & leather		Food, beverages & tobacco		Wood products & furniture	
	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996	1990	1996
Canada	4.0	10.0	-4.8	-2.9	-0.9	1.6	-6.5	-5.6	20.4	16.7	-4.6	-2.1	-6.6	-4.2	7.7	7.8	-0.7	-1.3	60.2	62.5	51.9	36.9	-22.7	-13.6	4.1	2.1	26.9	37.0
Mexico	22.4	-33.9	-6.4	-16.9	0.5	0.3	-3.4	3.4	19.1	-0.8	9.1	1.3	-4.0	-15.0	3.9	-5.9	3.5	-0.3	-41.2	-5.1	-14.1	-12.8	-2.9	5.4	-24.0	-3.7	-0.3	6.0
United States	-45.4	-33.3	-6.9	-5.5	1.8	0.3	-14.1	-12.8	-4.1	-3.3	-2.2	-1.8	-1.8	1.0	-11.4	-4.9	-6.7	-6.3	-22.5	-17.0	2.9	5.0	-34.4	-29.5	13.3	14.9	-4.2	-7.4
Australia	63.6	58.6	-11.5	-10.4	-0.3	3.5	-3.5	-3.6	71.3	47.5	-5.5	-2.2	-6.8	-4.2	9.6	16.6	10.2	11.5	108.2	93.1	-15.4	-9.9	6.7	10.7	117.2	90.9	-0.4	1.5
Japan	-61.8	-19.4	0.5	-1.1	8.7	11.9	-13.7	-10.1	-27.5	-13.4	-0.6	1.0	3.1	2.7	-38.4	-20.1	6.1	9.7	-134.7	-149.0	-7.7	-7.1	-42.1	-51.5	-63.7	-64.6	-21.2	-25.7
Korea	..	-1.9	..	8.2	..	25.4	..	4.1	..	-14.8	..	-4.6	..	-3.8	..	-9.0	..	-7.5	..	21.8	..	-5.2	..	49.9	..	-15.9	..	-7.0
New Zealand	-20.1	-41.0	-7.3	-7.7	-4.9	-5.2	-6.2	-6.3	13.2	9.5	-6.7	-6.5	-10.0	-7.5	2.4	-12.9	-0.6	-4.3	282.1	265.6	15.3	9.0	16.3	11.8	241.9	228.9	8.5	16.0
Austria	17.4	6.0	0.4	-2.0	0.6	1.0	0.6	0.2	-0.7	0.4	5.1	1.9	2.6	1.2	-8.1	-6.6	16.9	9.9	10.6	0.1	13.7	11.2	-9.7	-10.2	-5.3	-6.1	11.9	5.2
Belgium-Luxembourg	16.3	6.1	-1.6	-1.7	-0.2	-0.2	-2.7	-5.6	-1.7	-0.7	3.8	3.6	-3.6	-2.5	0.0	1.5	22.4	11.7	-4.3	-1.5	-6.6	-4.3	0.7	1.4	4.8	4.3	-3.2	-2.8
Czech Republic	..	44.4	..	1.5	..	0.0	..	3.2	..	-5.1	..	19.3	..	10.7	..	0.0	..	14.7	..	19.1	..	-2.8	..	10.9	..	-4.2	..	15.3
Denmark	-26.1	-10.6	0.1	0.1	1.3	5.2	-2.4	-2.8	-7.4	-5.6	1.0	0.0	3.4	2.7	-7.1	-0.5	-15.0	-9.6	65.1	57.0	-15.1	-12.3	-11.6	-13.0	79.0	67.5	12.8	14.8
Finland	-11.3	8.9	-8.7	-6.8	11.5	18.0	-4.5	-2.7	4.7	1.0	-3.4	-1.3	-5.8	-2.0	-9.3	-1.6	4.3	4.4	142.4	95.7	145.1	104.9	-24.9	-21.2	-6.9	-13.7	29.2	25.7
France	-6.3	-3.9	1.2	0.6	1.2	2.0	-1.6	-1.9	-5.2	-3.0	0.7	0.8	0.0	0.1	-7.2	-4.4	4.6	2.0	-9.0	-10.6	-7.1	-5.1	-12.3	-13.7	15.7	11.5	-5.3	-3.3
Germany[2]	-14.1	-12.1	-0.1	-1.2	1.8	1.6	-2.1	-3.1	-7.1	-3.7	-0.8	-1.9	5.9	3.1	-11.3	-7.5	-0.3	0.6	-62.3	-57.2	-5.4	-0.6	-35.1	-33.1	-16.4	-15.4	-5.4	-8.2
Greece	30.7	29.1	-4.5	-4.9	-11.5	-16.0	-3.6	-3.9	16.3	16.1	11.3	11.8	-8.4	-4.8	20.5	32.2	10.5	-1.3	110.5	104.5	-11.0	-8.7	95.2	73.7	32.1	43.6	-5.8	-4.2
Hungary	..	-4.2	..	-1.2	..	-0.1	..	-2.7	..	-1.4	..	0.8	..	-2.1	..	2.7	..	-0.3	..	68.9	..	-12.9	..	13.4	..	59.4	..	9.0
Iceland	-55.9	-68.9	-15.9	-15.5	-5.0	-17.9	-7.6	-4.3	45.9	35.4	-7.2	-6.3	-22.6	-27.0	-49.4	-39.3	5.9	5.9	275.1	265.6	-22.3	-20.7	-27.7	-29.3	347.2	334.0	-22.1	-18.4
Ireland	-39.8	-37.1	-4.5	-6.4	-0.1	-0.3	0.3	-0.3	-2.1	-3.1	-2.7	-3.2	-8.5	-7.3	-15.5	-10.6	-6.6	-5.9	18.7	5.6	-16.7	-12.7	-23.4	-17.8	65.3	40.2	-6.5	-4.0
Italy	18.3	19.3	5.9	4.1	-0.6	2.5	10.4	8.5	-11.2	-10.0	12.1	11.1	16.4	18.4	-9.1	-8.5	-5.7	-6.7	24.3	20.5	-6.4	-4.4	53.0	40.7	-29.5	-24.5	7.2	8.6
Netherlands	1.1	4.3	-3.5	-3.5	0.6	0.5	-2.1	-2.6	-1.7	-0.7	-3.0	-2.8	-4.6	-3.6	19.3	19.2	-3.9	-2.2	16.8	17.0	-5.0	-5.0	-17.2	-11.8	48.5	42.0	-9.6	-8.3
Norway	54.2	65.9	-8.2	-9.5	-12.0	6.3	-4.0	-4.5	46.4	37.3	-1.9	-3.0	-7.4	-10.9	34.3	40.5	6.9	9.6	11.7	25.4	22.1	19.4	-32.4	-27.5	24.5	36.8	-2.4	-3.3
Poland	..	53.8	..	-1.6	..	23.6	..	-3.1	..	17.3	..	3.3	..	6.8	..	-4.3	..	11.6	..	71.7	..	-9.0	..	23.4	..	13.0	..	44.4
Portugal	-13.1	-19.4	-4.5	-6.4	0.0	1.6	-2.7	-4.7	-8.1	-7.1	13.9	12.1	-2.2	-1.5	3.9	-1.2	-13.3	-12.2	162.8	103.4	17.3	9.4	126.2	91.9	-9.1	-16.8	28.4	18.9
Spain	45.2	27.4	6.8	2.6	6.1	3.7	-1.5	-2.1	0.5	1.2	9.2	12.0	3.0	3.6	12.2	4.1	8.9	2.3	13.7	5.7	-2.1	-3.0	10.8	5.0	5.7	2.0	-0.7	1.6
Sweden	-19.7	-13.5	-6.3	-4.2	-2.0	0.1	-4.3	-3.4	-4.2	-3.4	-5.9	-2.9	-1.9	-0.7	-3.2	-2.1	8.1	3.2	26.2	20.8	61.4	44.2	-34.7	-22.9	-15.1	-17.6	14.5	17.2
Switzerland	-37.1	-30.3	-4.1	-3.8	-0.6	-0.4	-1.7	-6.9	-0.9	-1.4	-6.1	-5.3	1.6	3.1	-17.0	-9.5	-8.4	-5.9	-53.3	-57.2	-8.3	-9.5	-23.4	-26.3	-8.9	-10.4	-12.7	-11.0
Turkey	23.5	16.6	-1.9	2.9	-2.5	-4.9	-1.4	0.3	-4.9	-3.9	9.5	11.1	-3.6	-3.2	0.1	-3.1	28.2	17.4	217.4	192.6	-6.5	-8.7	188.8	161.6	34.3	39.5	0.7	0.2
United Kingdom	4.8	4.2	-0.9	-1.6	1.1	1.4	0.6	-1.7	-2.8	-3.1	0.2	1.4	0.9	0.9	1.9	4.5	3.7	2.4	-48.0	-37.5	-10.5	-6.3	-15.3	-12.4	-10.9	-12.4	-11.2	-6.5
European Union	-0.1	0.5	0.1	-0.9	1.0	1.6	-0.5	-1.6	-4.7	-3.2	1.8	2.0	2.9	2.7	-3.5	-1.2	2.8	1.0	-11.4	-10.4	-0.5	0.5	-8.1	-7.7	-0.9	-2.2	-1.8	-1.0
Total OECD[3]	-13.4	-6.7	-1.9	-2.3	1.7	3.4	-4.6	-4.5	-4.2	-2.6	0.3	0.8	1.2	1.2	-7.7	-3.4	1.8	0.8	-20.7	-16.2	0.9	1.1	-16.4	-12.7	-2.0	-2.0	-3.2	-2.6

1. Observed trade balance of industry minus theoretical trade balance, expressed in thousandths of manufacturing trade (see textbox in text).
2. Western Germany in 1990, total Germany in 1996.
3. Excluding Mexico, Korea, Czech Republic, Hungary and Poland in 1990.

Source: OECD.

Table 12.3.1. **Manufacturing trade with EU countries by price/quality range, 1996**

Percentages

	Exports			Imports		
	Up-market	Medium-market	Down-market	Up-market	Medium-market	Down-market
Canada	42.0	40.8	17.2	51.2	30.3	18.5
Mexico	26.3	32.1	41.6	52.3	26.6	21.1
United States	60.1	19.9	20.0	62.2	22.5	15.3
Australia	60.6	23.5	15.8	60.4	23.1	16.5
Japan	55.7	26.5	17.8	79.5	13.6	6.9
Korea	33.9	18.0	48.1	68.5	18.0	13.5
New Zealand	34.7	32.7	32.6	52.7	27.8	19.4
Austria	44.1	40.6	15.3	52.9	32.7	14.4
Belgium-Luxembourg	31.3	51.3	17.4	35.3	46.7	18.1
Czech Republic	15.5	17.9	66.6	42.6	31.1	26.3
Denmark	45.7	37.9	16.4	43.4	36.3	20.4
Finland	32.5	49.8	17.8	50.6	29.0	20.3
France	38.3	46.0	15.6	38.3	41.5	20.2
Germany	49.5	37.1	13.4	37.4	46.8	15.9
Greece	17.9	41.0	41.1	36.4	35.2	28.3
Hungary	25.1	29.6	45.3	46.1	25.6	28.3
Ireland	58.3	21.4	20.3	39.4	35.5	25.1
Italy	33.1	40.0	26.9	44.0	42.7	13.4
Netherlands	37.3	45.5	17.2	36.1	44.2	19.7
Norway	28.1	57.0	14.9	50.0	31.9	18.1
Poland	10.9	23.0	66.2	37.3	28.7	34.0
Portugal	24.4	47.0	28.6	40.0	37.8	22.2
Spain	22.2	49.0	28.7	33.4	44.7	21.9
Sweden	47.5	39.0	13.5	51.6	32.8	15.6
Switzerland	77.7	14.1	8.2	64.4	26.0	9.6
Turkey	16.7	23.7	59.6	42.0	37.1	20.9
United Kingdom	38.8	40.0	21.3	39.8	40.3	19.9
European Union	39.6	42.1	18.3	39.6	42.1	18.3
Total OECD	42.2	38.0	19.7	44.3	37.9	17.8

Source: OECD calculations based on data from Eurostat.

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