Staying Competitive in the Global Economy

COMPENDIUM OF STUDIES ON GLOBAL VALUE CHAINS

OECD

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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Foreword

The rapid process of globalisation is among the most striking features of the current economic landscape. It raises new challenges for policy makers, particularly linked to the impacts of globalisation on production and employment in OECD countries. At the 2004 Ministerial Council Meeting, a number of Ministers considered that the OECD could help to dispel fears about the issues related to the increased outsourcing of industrial production -- often outside the OECD area. Solid facts to underpin the identification of true policy issues and responses were still scarce and a wide range of anecdotal and often contradictory evidence was quoted in the public debate. A systematic empirical overview of trends and developments was considered to be lacking even though the political concerns related to globalisation are high on the policy agenda in many OECD countries.

To help address these concerns, the OECD Council decided at the end of 2004 on an allocation of the OECD's Central Priority Fund to promote work on the globalisation of value chains for 2005 and 2006. This compendium of papers brings together several studies on globalisation, which have been developed in the context of this project over the past years. The work aimed at strengthening the evidence base on globalisation, which should ultimately enable the development of evidence-based policies to address the key concerns. The studies address the main areas of OECD work on the globalisation of value chains, notably the use of input-output tables to better measure global value chains (Chapter 2), the challenges and opportunities for SMEs in global value chains (Chapter 3), the changing nature of manufacturing (Chapter 4), the employment effects of globalisation in services sectors (Chapter 5), the productivity impacts of MNEs (Chapter 6), the effects of outsourcing on firm productivity (Chapter 7) and the trends and patterns of R&D internationalisation (Chapter 8).

These studies, combined with other work undertaken by the OECD, were used in preparing a synthesis report under the title *Staying Competitive in the Global Economy: Moving up the Value Chain*, which was published mid-2007. This report synthesises current globalisation patterns with a focus on science, technology and industry and examines policy issues that are considered the most relevant in addressing the policy concerns related to globalisation. A summary of this report was presented to the OECD Ministerial meeting in May 2007.

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Global value chains and globalisation

The pace and scale of today's globalisation is without precedent and is associated with the rapid emergence of global value chains as production processes have become more geographically fragmented. Globalisation also increasingly involves foreign direct investment (FDI) and trade in services, as many service activities are becoming internationalised. Another distinctive feature of the current process of economic integration is that it is no longer restricted to OECD countries, but also involves large emerging global players such as China, India, Brazil and Russia.

The globalisation of value chains is motivated by a number of factors, of which enhancing efficiency is the most important. One way of achieving that goal is to source inputs from more cost-efficient producers, either domestically or internationally and either within or beyond the boundaries of the firm. Fragmentation of the production process has given rise to considerable restructuring in firms, including the outsourcing and offshoring of certain functions. The growth of international sourcing has also resulted in the relocation of activities abroad, sometimes involving total or partial closure of production in the home country and the creation of new affiliates abroad.

International sourcing

Trade in intermediates is growing and domestic production increasingly relies on foreign inputs. In 2003, 54% of the world's manufactured imports were classified as intermediate goods (these include primary goods, parts and components, and semi-finished goods). As a result of the growing global linkages between countries, a decreasing share of production takes place within national boundaries.

High- and medium-high technology industries are on average more internationalised than less technology-intensive industries. Rapid advances in information and communication technologies (ICT) have increased the tradability of many service activities and created new kinds of tradable services thereby facilitating the sourcing of services from abroad. Although the level of international outsourcing is still much lower in market services than in the manufacturing sector, imported intermediates in services sectors have become more important.

The key role of multinationals

Within global value chains, multinational firms play a prominent role, as their global reach allows them to co-ordinate production and distribution across many countries and shift their activities according to changing demand and cost conditions. Cross-border trade between MNEs and their affiliates, often referred to as intra-firm trade, accounts for a large share of international trade in goods. The development of global value chains also offers SMEs new opportunities by enabling them to expand their business opportunities across borders, although they often face difficulties in reaching international markets.

New centres of economic growth

Although OECD countries still dominate, manufacturing production in certain non-OECD countries has increased significantly and is expected to grow further in the near future. China, in particular, has become a major trading partner for most OECD countries and its market share in OECD export markets has risen significantly. Trade and FDI are still largely concentrated within industrialised countries, suggesting that the globalisation of value chains is not primarily a North-South issue. Globalisation is a two-way process, with trade and FDI between OECD and non-OECD countries flowing in both directions.

The employment effects of globalisation

Offshoring and especially relocation are often perceived as the "exporting of jobs" which directly results in a loss to the country and its workers. The globalisation of value chains affects economic performance in various ways, however, including employment, productivity growth, prices and wages, and these impacts vary across activities, regions and social groups. In general, the process of globalisation has both benefits and costs, some dispersed and some concentrated, some short-term and some long-term. The visible, short-term costs often attract the most attention, as these are more easily measured, while the long-term benefits may be much harder to calculate.

Several studies that provide estimates of the jobs (potentially) lost due to offshoring find a large absolute number of jobs lost because of offshoring, but a relatively small impact when compared with overall churning in the labour market. Furthermore, some of these jobs may have been lost owing to productivity enhancements and technological change, which are not necessarily linked to offshoring.

The long-term effect of globalisation primarily seem to involve the composition, rather than the level, of employment. Trade integration leads to changes in the international division of labour, resulting in employment losses in certain industries (*e.g.* manufacturing). Certain regions, sectors and groups of workers may lose out in this process, *e.g.* those in industries heavily exposed to international competition which have not been able to adjust to that competition. In OECD countries, globalisation is found to have disproportionate impacts on certain types of workers, particularly low-skilled workers who may also be concentrated in certain regions.

The productivity benefits of globalisation

Openness to trade and FDI raises productivity and hence average incomes and wages. Gains from trade typically arise from the exploitation of comparative advantages and economies of scale. At the same time, trade generally results in lower prices for imported goods and services (both final and intermediate) and increases product variety and quality in the home country. In addition, operating in a globally competitive market may force firms to become more engaged in innovative activities and globalisation offers an important channel for flows of foreign technology that embody significant innovations.

MNEs contribute significantly to productivity, but the productivity effects of globalisation diffuse beyond them. Their key role in the current globalisation process may be to generate additional positive effects on host countries' economies because of their typically superior performance. The inflow of FDI may spur domestic competition and result eventually in higher productivity, lower prices and more efficient resource allocation in host countries. Technology and knowledge may also spill over from foreign affiliates to domestic firms in host countries through the many interactions between them. MNEs are not the only firms to benefit from internationalisation. Internationally active firms, because they export or import and/or have affiliates abroad, tend to have higher productivity. Exports and direct investment abroad may provide helpful feedback to firms which can help them to improve productivity.

Structural change towards a knowledge economy

The integration of new players in the global economy challenges existing comparative advantages and the competitiveness of countries, forcing them to search for new activities in which they can excel and confront the competition. The key drive is for countries to move up the value chain and become more specialised in knowledge-intensive, high-value-added activities. Specialisation in more traditional cost-based industries and activities is often no longer a viable option for most industrialised countries. The manufacturing sector is most strongly affected and the process is accompanied by de-industrialisation in most OECD countries, driven by rapid changes in productivity in the manufacturing sector and a shift in demand to services. Investment in knowledge is crucial for sustained economic growth, job creation and improved living standards and has increased in all OECD countries in recent years. At the same time, most OECD countries are shifting into higher-technology-intensive manufacturing industries and into knowledge-intensive market services. A considerable number of OECD countries still have a strong comparative advantage in medium-low-technology and low-technology industries.

Some non-OECD economies are moving up the value chain:China has diversified from traditional industries into higher-technology-intensive industries. The strong growth of Chinese exports of more sophisticated electronics, furniture and transport goods is closely linked to China's growing imports of parts and components. An important question is whether China is merely assembling component parts or whether there are indications that the country has increased value added in higher-value-added ICT goods. China's trade surplus is not due to high-technology exports, but to large exports of lower-technology industries such as toys, textiles and footwear.

MNEs' R&D investment abroad has grown strongly as their strategies focus on global technology sourcing. This involves building global networks of distributed R&D in order to tap into local knowledge and develop sources of new technology. While most internationalisation of R&D still takes place within the OECD area, large increases in foreign R&D investment in Asia, in particular in China and India, have attracted much attention in recent years. This should be seen as an opportunity, as increased international R&D links can promote faster technological change and broader diffusion of technological advances worldwide.

Policy implications

Moving up the value chain implies a continuous process of change, innovation and productivity growth. Industrialised economies can only grow by inventing new technology, by innovations in products and processes, and by designing new management methods. To foster and support the innovation process, a strategy for innovation has to be developed in which several policy areas may be considered:

- Innovation policies help increase the level of knowledge and technology embodied in production and exports. Policies aimed at strengthening creativity in business or on developing intangible assets as sources of value creation are closely related to these policies.
- A more innovative and productive economy may require more highly skilled workers or a different mix of skills. Addressing this through education and training policies requires a growing focus on lifelong learning.
- Policies might also aim at creating new areas of economic activity, by stimulating new firm creation and entrepreneurship, or by stimulating innovation and technology in new areas.
- International and local firms may be attracted to specific activities and skills which exist only in certain regions or locations. Policies aimed at the development of clusters and poles of excellence as well as regional policies may help capitalise on countries' strengths.
- Understanding what determines national attractiveness, building on national strengths and addressing weaknesses to the extent possible can help extract greater benefits from the globalisation process.
- Striking an appropriate balance between diffusion of technology and providing incentives for innovation remains an important consideration in IPR-related policies. Moreover, more can be done to generate value from IPR, *e.g.* through licensing.
- In several OECD countries, the current policy debate looks at possible actions which the government may undertake to strengthen firms' capacity to compete in the global market and which complement efforts towards well-functioning and competitive markets. Such actions include the innovation and entrepreneurship policies that have become the core of industrial policy in the 21st century.

If countries are to realise the potential gains from openness, the factors of production (including labour) must shift from economic activities in which they are relatively less efficiently used towards activities in which the economy enjoys a comparative advantage. However, it can be hard for individuals to move between jobs, industries and regions, and workers losing jobs in firms in import-competing industries sometimes bear large adjustment costs; hence the need for complementary structural policies to help workers reallocate from lagging to more advanced industries and for policies to compensate potential short-term losers from globalisation. Although globalisation benefits economies as a whole, the gains are unevenly distributed. Providing a balanced perspective on the benefits and costs of globalisation can help. The problem is that globalisation may generate highly visible costs for clearly identifiable groups of people, while some benefits may only come later and are widely diffused across society. A promising avenue may be to address more directly the costs of globalisation by compensating those who may suffer a short-term decline in income.

There are concerns that globalisation may put some world regions at particular risk of being left behind. Other concerns relating to globalisation are linked to the potential environmental impacts in developing countries. Further trade liberalisation in sectors in which poorer countries have a comparative advantage (especially agriculture), complemented by efforts at capacity building and development policies, may help to spread the benefits of globalisation to a wider range of countries, including those most at risk of being excluded.

Protectionist measures (for example, that insulate countries from the impacts of globalisation through import barriers, that penalise firms that engage in offshoring, and that slow exposure to international competition) are likely to raise costs for firms and reduce their efficiency. This will have a detrimental impact on consumers who buy products from these firms and may also make the countries adopting such policies a less attractive place to do business. Protectionist measures also have detrimental effects on other, often poorer, countries, by denying them the chance to trade and increase living standards.

Chapter 1

INTRODUCTION AND SYNTHESIS

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Global value chains are radically altering how goods and services are produced – parts made in one country, for instance, are increasingly assembled in another and sold in a third. The globalisation of production has changed the industrial structure within OECD countries, and in some sectors heavily affected their competitiveness. Another major consequence has been fears of job losses, due to outsourcing and offshoring – not only in manufacturing but also in services. The rapid integration of large countries like China and India, with their large pool of educated people, further reinforces these concerns.

This chapter was originally distributed as a brochure at the 2007 meeting of the OECD Council at Ministerial level, under the title "Moving up the Value Chain: Staying Competitive in the Global Economy – Main Findings". Some data have been updated in this version.

Introduction

The rapid pace of the globalisation process has attracted much attention in recent years, but globalisation is not new. The process of international economic integration has been underway for decades, facilitated by more open economic policies and trade liberalisation in a growing number of countries. Technical advances, notably in transport and communication, have lowered costs and also fostered globalisation. Trade and foreign direct investment (FDI) are still the key channels for international economic integration, with migration playing a more limited role. Technology transfer, through multinational enterprises and other channels, has also become an increasingly important factor.

The pace and scale of today's globalisation is without precedent and is associated with the rapid emergence of global value chains as production processes become increasingly fragmented geographically. Information and communication technology (ICT) has made it possible to slice up the value chain and perform activities in any location that can help reduce costs. The globalisation of value chains results in the physical fragmentation of production, where the various stages are optimally located across different sites as firms find it advantageous to source more of their inputs globally. This phenomenon has also been referred to in the literature as international production sharing and vertical integration of production and is closely linked to the growth of global production networks.

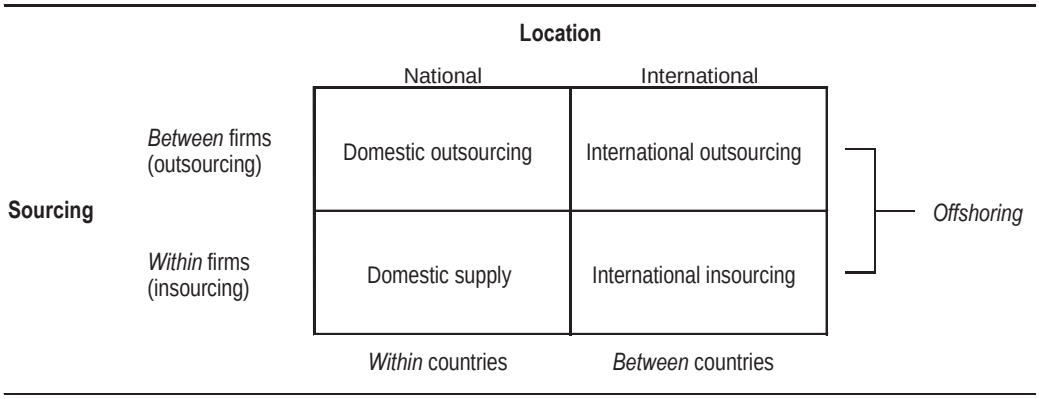
Globalisation also increasingly involves foreign direct investment and trade in services, with many service activities becoming internationalised, especially since ICT has enabled the production of many services independent of a specific location. Another distinctive feature of current economic integration is that it is no longer restricted to OECD countries, but also involves large emerging global players like Brazil, China, India and Russia.

Global value chains, outsourcing and offshoring

The globalisation of value chains is motivated by a number of factors. One is the desire to increase efficiency, as growing competition in domestic and international markets forces firms to become more efficient and lower costs. One way of achieving that goal is to source inputs from more efficient producers, either domestically or internationally, and either within or outside the boundaries of the firm. Other important motivations are entry into new emerging markets and access to strategic assets that can help tap into foreign knowledge. Notwithstanding these anticipated benefits, engaging in global value chains also involves costs and risks for firms.

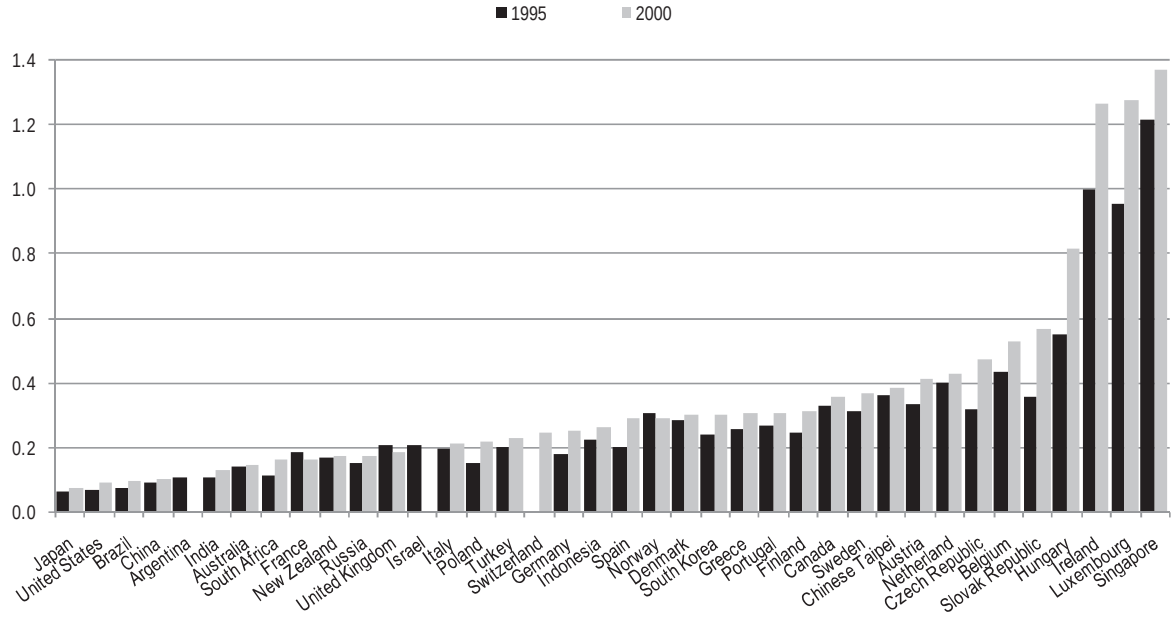
The fragmentation of the production process across various countries has given rise to considerable restructuring in firms including the outsourcing and offshoring of certain functions. Outsourcing typically involves the purchase of intermediate goods and services from outside specialist providers, while offshoring refers to purchases by firms of intermediate goods and services from foreign providers, or to the transfer of particular tasks within the firm to a foreign location (Figure 1.1). Offshoring thus includes both international outsourcing (where activities are contracted out to independent third parties abroad) and international in-sourcing (to foreign affiliates).

Figure 1.1. Outsourcing and offshoring



Sources: OECD (2005g, 2006f).

Figure 1.2. The ratio of imported intermediates to domestic intermediates, 1995 and 2000



Notes:

1995 data is 1994/95 for Australia, 1995/96 for New Zealand, 1996 for Turkey, 1997 for Argentina, 1996 for Chinese Taipei, and 1993/94 for India; no data for Iceland, Mexico and Switzerland.

2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

Source: OECD (2007c).

The growth of international sourcing has also resulted in the relocation of activities overseas, sometimes implying the total or partial closure of the production in the home country while at the same time creating or expanding affiliates abroad producing the same goods and services as in the host country. More often, it is about the substitution of domestic stages of production by activities performed in foreign locations, with goods

and services being exported from the host country to the home country. Relocation is not always interpreted in such a strict sense, and often encompasses different forms of internationalisation such as the opening of a new affiliate abroad to enhance market presence. While the different concepts may be easily defined, their measurement is more complex. Firms are sometimes reluctant to offer details on outsourcing and offshoring decisions, in particular on relocation. The lack of hard data has contributed to the great diversity in views on the size and effects of internationalisation.

Global value chains allow intermediate and final production to be outsourced abroad, leading to increased trade through exports and imports, and to a rapidly growing volume of intermediate inputs being exchanged between different countries (see Chapter 2). In 2003, 54% of world manufactured imports were classified as intermediate goods (which includes primary goods, parts and components and semi-finished goods). Detailed information from input-output tables shows that the ratio of imported to domestic intermediate inputs has increased in almost all OECD countries (Figure 1.2).

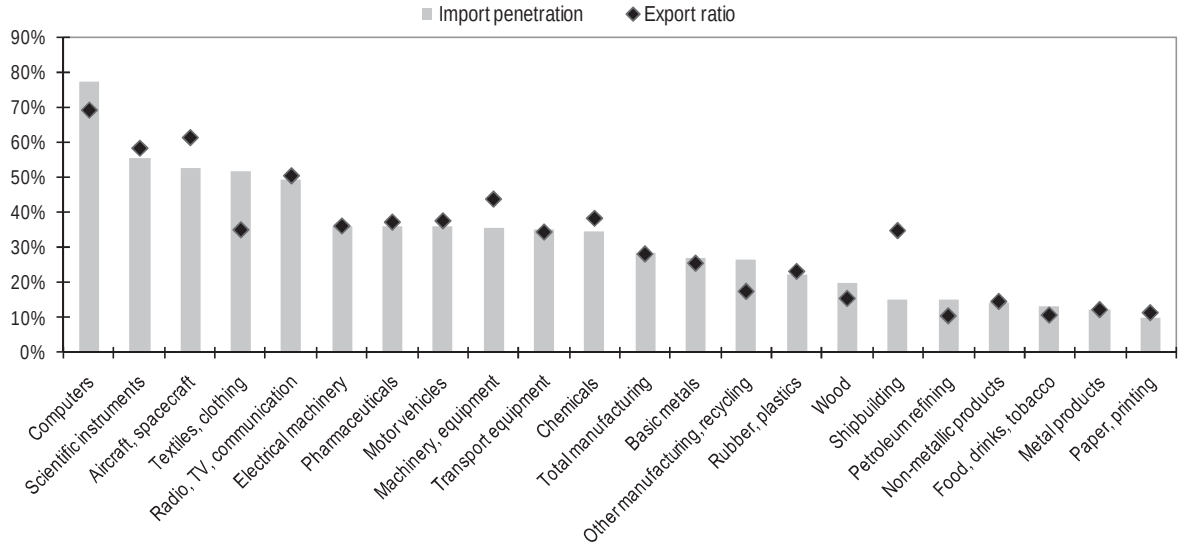
As a result of the growing global linkages between countries, a decreasing share of production is created within national boundaries. A decline in the 'production depth' (value added over production) and a growing importance of intermediates can be observed in the OECD area. The growing international sourcing of intermediates within global value chains has resulted in manufacturing exports and imports of individual countries increasingly moving together and growing faster than production, indicating that international transactions between OECD countries are growing very rapidly. The globalisation of value chains has also resulted in increasing intra-industry trade (*i.e.* trade within the same industry, including the trade in intermediate goods at various stages of production). While these evolutions are observed in almost all countries, they become particularly clear in smaller OECD countries with large FDI inflows.

Global value chains spread out to all industries including the services sector

Economic globalisation has resulted in a growing openness of the manufacturing sector, as reflected in increasing export ratios and import penetration in all manufacturing industries (Figure 1.3). But not all manufacturing industries are affected to the same extent. High and medium-high technology industries are on average generally more internationalised than less technology intensive industries. This difference results partly from the growing complexity of many high technology products; firms no longer have all the required knowledge in-house and increasingly have to look outside. At the same time, traditional industries, such as textiles, are also characterised by a high degree of international openness.

While manufactured goods still account for the largest share of international trade, globalisation increasingly extends to FDI and trade in services. The offshoring of services has been significantly increasing in all OECD countries, driven by the liberalisation in services sectors and technological advances (Chapter 2). Improvements in technology, standardisation, infrastructure growth and decreasing data transmission costs have all facilitated the sourcing of services from abroad. Rapid advances in ICT have also increased the tradability of many service activities and created new kinds of tradable services. In particular, 'knowledge work' such as data entry and information processing services and research and consultancy services can easily be carried out via the Internet and e-mail, and through tele- and video-conferencing (Figure 1.4).

Figure 1.3. Import propensity and export ratio[1] in selected OECD countries[2], 2003

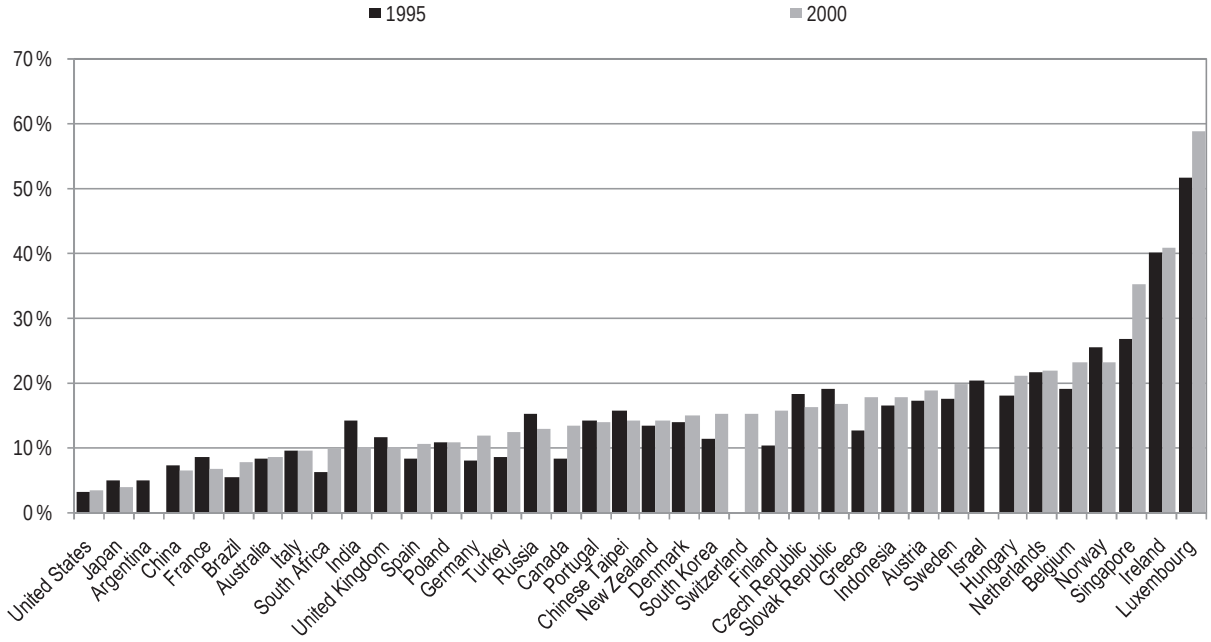


1. The export ratio measures the share of production that is exported (i.e. X/Y); the import propensity shows to what degree domestic demand is satisfied by imports M (i.e. M/(Y-X+M)).

2. OECD includes Austria, Canada, Denmark, Finland, France, Germany, Italy, Japan, Korea, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, and the United States.

Source: OECD (2005a).

Figure 1.4. Offshoring/outsourcing[1] abroad in market services, 1995 and 2000[2]



1. Offshoring/outsourcing is calculated as the share (in %) of imported intermediates in the total of non-energy inputs.

2. Australia: 1995 and 1999; Canada: 1997 and 2000; Greece: 1995 and 1999; Hungary: 1998 and 2000; Norway: 1995 and 2001; Portugal: 1995 and 1999.

Source: OECD (2007c).

Multinational enterprises (MNEs) are central in global value chains

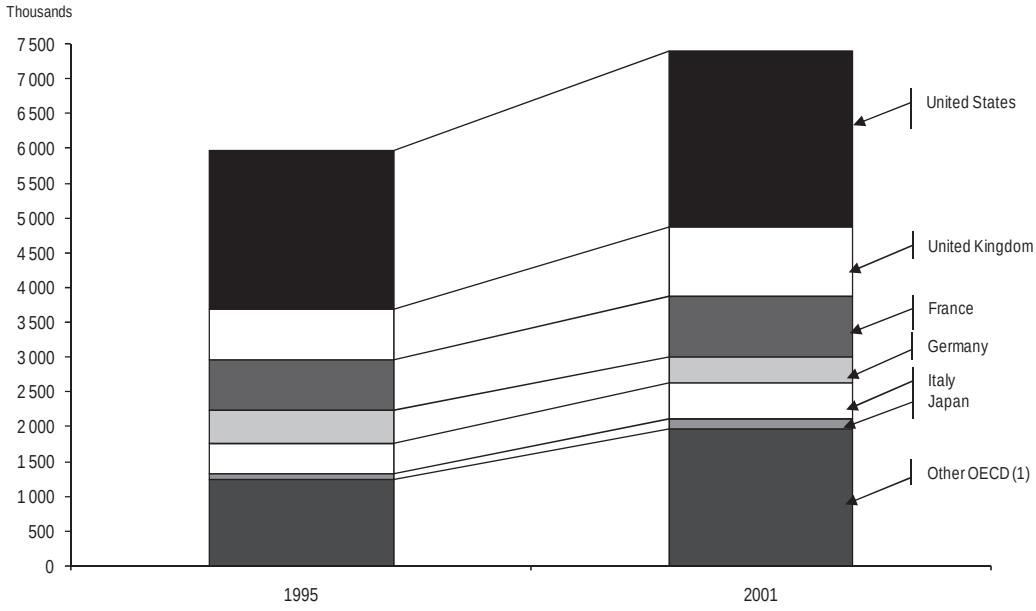
The growth of international outsourcing involves the sourcing of inputs internationally through arm's-length relationships as well as within firms. Within this global value chain, multinational firms play a prominent role as they have a global reach that allows them to co-ordinate production and distribution across many countries and shift their activities depending on changing demand and cost conditions. Corresponding to the strong increase of FDI, foreign affiliates have become increasingly important in host countries where they account for a growing part of turnover, value added, employment and R&D (Figure 1.5). The importance of MNEs in today's global economy is linked to their strengths in a range of knowledge-based assets, such as management and intellectual property, that allow them to take advantage of profitable opportunities in foreign markets by setting up subsidiaries and affiliates abroad.

Affiliates under foreign control are not only engaged in serving local markets in the host country, but have become essential links in global value chains as they serve other (neighbouring) markets and produce inputs for other affiliates in the multinational's network. Cross-border trade between multinational firms and their affiliates, often referred to as intra-firm trade, accounts for a large share of international trade in goods. A growing part of such intra-firm trade concerns the exports and imports by foreign affiliates that manufacture (part of) products destined for other markets. These intra-firm trade flows increasingly affect the interpretation of trade deficits: part of the US trade deficit in ICT products with China relates to intra-firm imports from subsidiaries of US firms.

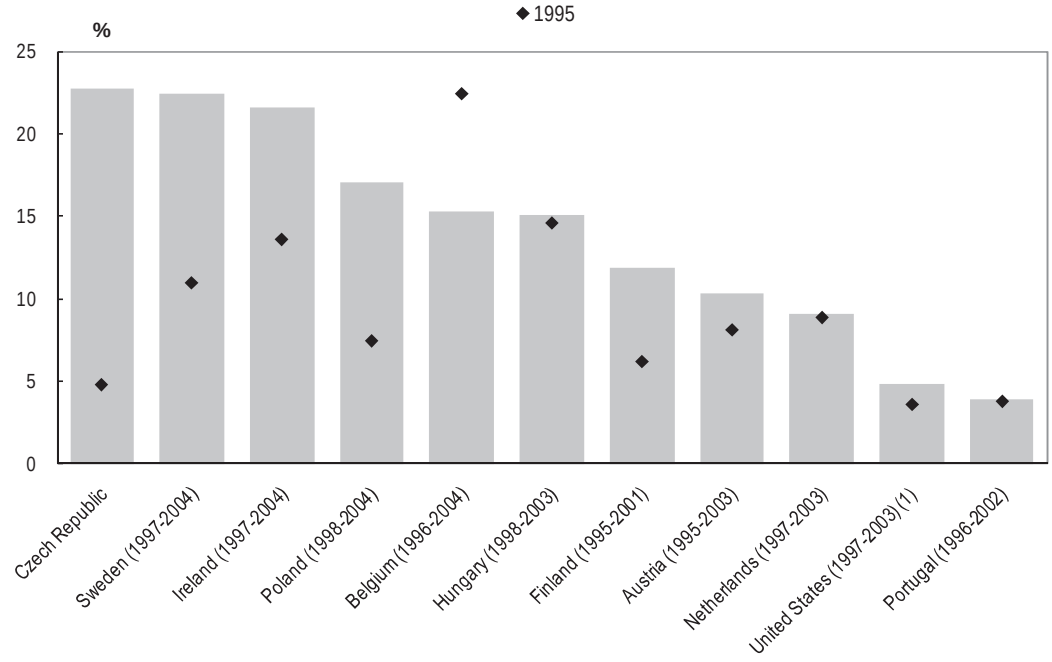
The development of global value chains also offers new opportunities to SMEs by enabling them to expand their business opportunities across borders, although reaching international markets is often a difficult step for SMEs (see Chapter 3). The increased opportunities for SMEs come along with important challenges in terms of management, finance and the ability to upgrade and protect in-house technology. Suppliers are often given more responsibilities in the value chain to undertake more and more complex tasks than in the past. SMEs increasingly feel pressures to merge, in order to achieve the critical mass to support R&D, training of personnel, control over firms in lower levels of the chain, and to fulfil requirements in terms of standards and quality.

Figure 1.5. Trends in employment of foreign affiliates in selected OECD member countries

a) Manufacturing, in thousand persons, 1995-2003



b) Services, in % of total employment, 1995 and 2004



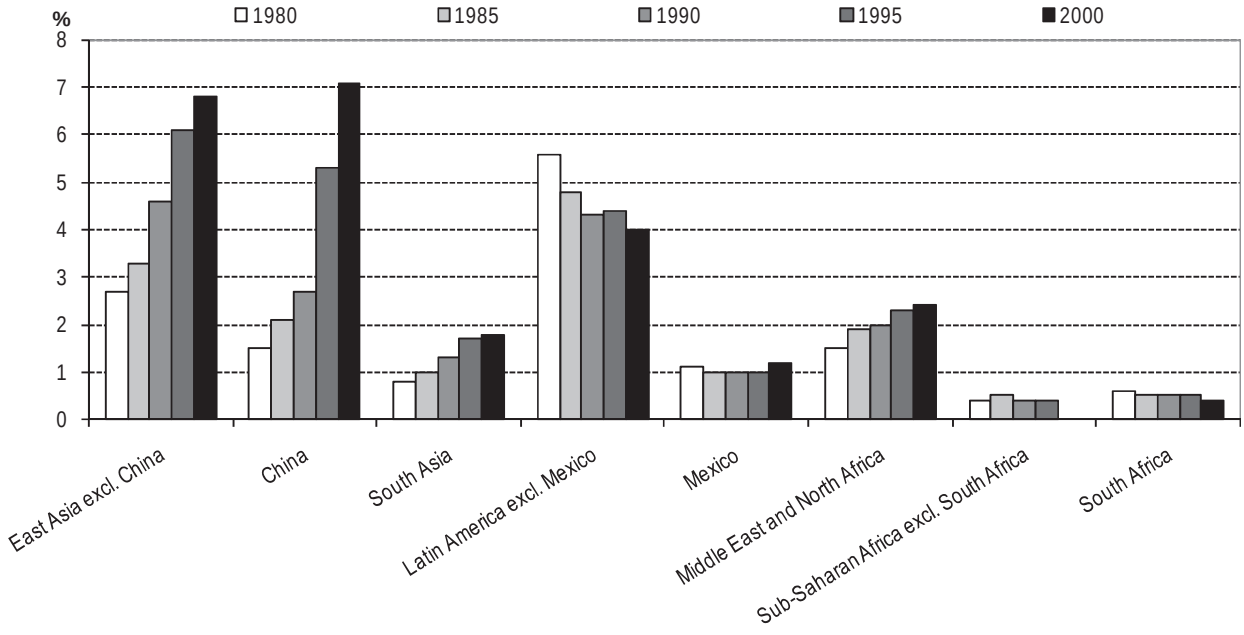
1. The data used here for foreign affiliates are broken down by industry of sales to be compatible with national total data.

Source: OECD (2007b).

Some non-OECD countries have emerged as major players

The development of global value chains in recent years is also associated with the growing integration of developing countries in the global economy (see Chapter 4). Although OECD countries still dominate global manufacturing, accounting for just below 80% of global value added (at market prices) in 2002, manufacturing production in certain non-OECD economies has increased significantly and is expected to grow further in the near future (Figure 1.6). China, in particular, has recorded very high growth rates of manufactured exports and recently surpassed Japan to become the third-largest trading economy in the world, after the United States and Germany. China has become a major trading partner for most OECD countries and its market share in OECD export markets has risen significantly (Table 1.1).

Figure 1.6. Share of major developing regions in global manufacturing value added



Source: UNIDO (2004) in OECD (2006a).

The emergence of China is also observed in recent data on FDI, with inflows estimated at USD 72 billion in 2005, making it the largest recipient of FDI flows among developing economies, even if some FDI is linked to intra-China investment occurring through Hong Kong, China. China still ranks lower than all OECD countries save one in terms of FDI inflows per capita, suggesting that the size of FDI inflows still has room to increase.

Table 1.1. China's share in major markets (% of total imports)

Partner	1990	2000	2001	2002	2003	2004
Japan	5.2	14.5	16.6	18.3	19.7	20.8
United States	3.1	8.6	9.3	11.1	12.5	13.8
Korea	2.1	8.1	9.5	11.6	12.4	13.4
Australia	2.7	7.9	9.0	10.3	11.3	13.0
EU-15	2.5	6.2	6.8	7.7	9.1	10.7
New Zealand	1.2	6.3	7.0	8.0	9.0	10.2
Canada	1.0	3.2	3.7	4.6	5.5	6.8
Russia*	1.6	2.1	3.9	5.7	5.7	6.3
Mexico	0.8	1.7	2.4	3.7	5.5	na
Turkey	1.1	2.4	2.3	2.7	3.9	4.8

*For Russia, 1990 refers to 1996.

Source: UN Commodity Trade Statistics Database (COMTRADE); EU data derived from OECD International Trade Statistics in OECD (2006b).

Although emerging countries are of growing importance, trade and FDI of OECD countries are still largely concentrated within the group of developed countries, suggesting that the globalisation of value chains is not primarily a north-south issue. In 2004, almost 78% of all OECD exports of manufactures went to other OECD countries, while 75% of the manufacturing imports in OECD countries came from within the OECD area. At the same time, globalisation is a two-way process with trade and FDI between OECD and non-OECD countries giving rise to flows in both directions. While manufactured exports of emerging countries have risen rapidly, so have the corresponding imports in these countries, as their domestic markets expand and demand for intermediate products increases. FDI data show that developing countries are starting to invest abroad, although the level of outward investment remains small.

Impacts of globalisation on employment: a complex discussion

Concerns about the employment impacts of globalisation abound in many OECD countries and have almost exclusively focused on the possible consequences of out-sourcing and offshoring. In the public mind, offshoring and especially relocation is often perceived as the 'exporting of jobs' abroad, directly resulting in a loss to the country and its workers. The globalisation of value chains has, however, several impacts on economic performance, affecting employment, productivity growth, prices and wages, and these impacts may vary across activities, regions and different social groups. In general, the process of globalisation has a variety of effects with different directions: positive (*i.e.* benefits) as well as negative (*i.e.* costs), dispersed as well as concentrated, short term as well as long term. But the visible, short term costs often gain most attention, as these are more easily measured, while the long term direct and indirect benefits may be much harder to calculate.

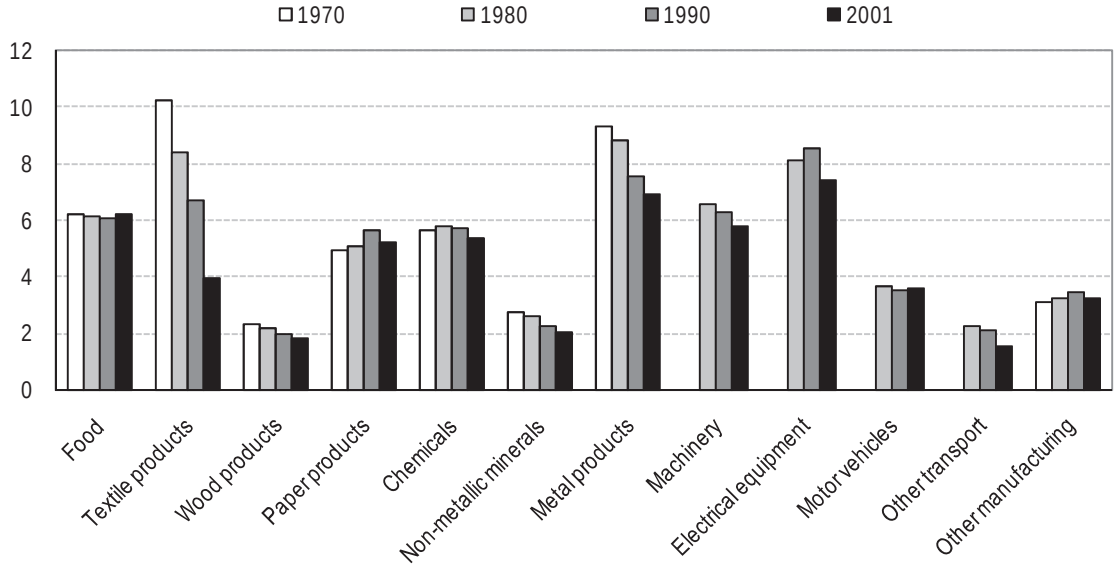
The concerns about employment losses go beyond manufacturing, as the offshoring of services may also affect jobs in the services sector, which has thus far often been relatively sheltered from international competition (see Chapter 5). India, in particular, is specialising in ICT- and ICT-enabled services. Moreover, the offshoring of services implies that not only typical low-skilled manufacturing jobs are affected, but also high-skilled service jobs. Several studies have provided estimates of the jobs (potentially) lost due to offshoring and international production sharing. Several of these studies find a large absolute number of jobs lost due to offshoring, but a relatively small impact when compared with overall churning in the labour market.

Furthermore, some of jobs might have been lost due to productivity enhancements and technological change, which are not necessarily linked to offshoring. Offshoring may actually help preserve jobs, as it allows firms to focus on their core activities. By transferring the more labour intensive part of the production process abroad, some firms are able to expand higher value-added activities and skill-intensive employment at home.

Recent empirical work shows that aggregate employment performance in the long term is not any worse in OECD countries that are the most open to trade or where trade openness has increased most rapidly than in the countries that are less open. The long-term effect of globalisation primarily seems to affect the composition of employment, rather than its level. Trade integration leads to changes in the international division of labour, causing employment losses in certain industries (*e.g.* manufacturing) through the exit and downsizing of less efficient firms and sectors.

Figure 1.7. Manufacturing employment by key activity

G7 countries, 1970-2001, millions of workers



Source: OECD STAN Indicators Database in OECD (2006a).

Certain regions, sectors and groups of workers may lose out in this process, *e.g.* those working in industries heavily exposed to international competition that have not been able to adjust to the competition (Figure 1.7). Globalisation is found to have a disproportionate impact on certain types of workers, notably low-skilled workers that may be concentrated in certain regions. Increased specialisation gives rise to higher imports of low-skilled intensive products from lower-wage countries, resulting in pressure on wages and/or jobs for lower-skilled groups in higher-wage countries. Indeed, many of the workers most affected by trade tend to be older, with lower qualifications and characterised by long job tenures. These workers are often more difficult to re-integrate into the labour market than other workers experiencing job loss, also since they may be highly specialised. The policy challenge in many countries is thus not so much how to support overall employment, as this is typically not affected by globalisation, but how to reintegrate specific groups of workers into the labour market.

Globalisation has positive impacts on productivity

While globalisation has certain negative consequences for particular groups, especially in the short term, it also has important positive effects. The impact on productivity is important, as openness is found to raise productivity and hence average incomes and wages. A number of studies have shown that more open countries typically grow faster than less open countries and have higher income levels. At the economy-wide level, the OECD Growth Study estimated that an increase in openness by 10 percentage points translates over time into an increase of 4% in per capita income in the OECD area.

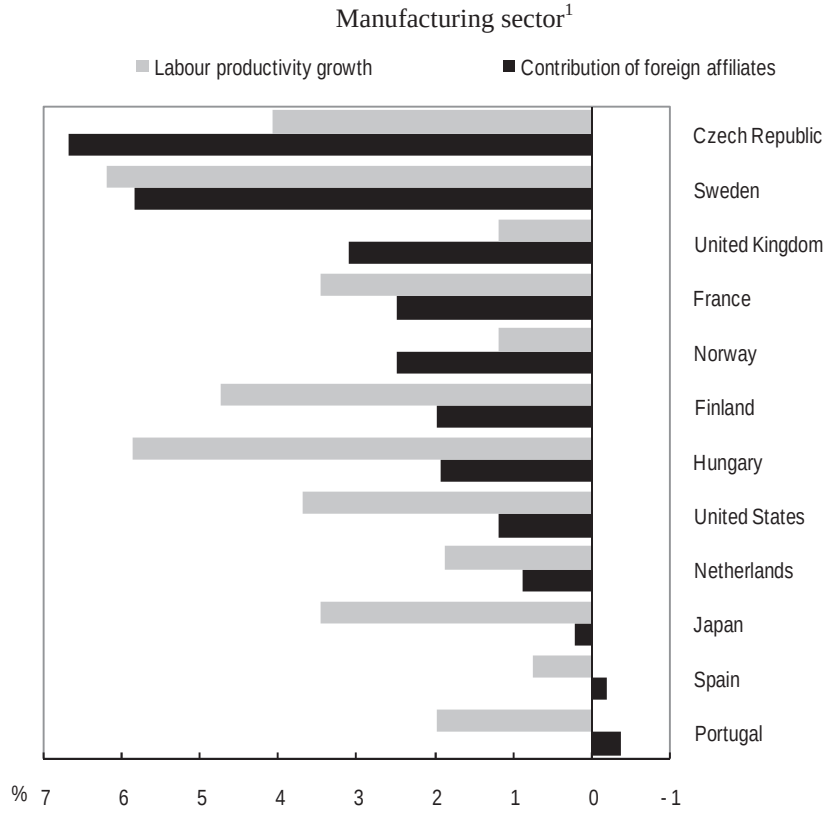
Gains from trade typically arise from the exploitation of comparative advantages and economies of scale. Instead of producing a particular good or service, a country can obtain more of it, indirectly, by exporting goods and services in which it has a comparative advantage. Trade opens foreign markets for goods and services that can be most efficiently produced in the home country. Furthermore, larger markets due to international trade may enable firms to take advantage of economies of scale not available when sales are limited to the domestic market, helping to lower costs. At the same time, trade generally results in lower prices for imported goods and services (final and intermediate) and increases product variety and quality in the home country. Larger markets through trade also allow a deeper division of labour across borders and can accommodate a greater variety of specialised firms. Access to better, cheaper and a wider variety of inputs helps improve the productivity of firms that incorporate these inputs into their products and services.

Apart from these standard static gains, globalisation may also lead to dynamic gains, *i.e.* not only in the level but also on the long-term growth of productivity. These dynamic gains typically materialise over a longer time period and are hard to measure. Nevertheless, recent analysis shows that they may be far more important than the static gains of trade. For example, the outsourcing and offshoring of less efficient activities to other, more efficient producers can increases firms' productivity. Furthermore, operating in a globally competitive market may force firms to become more engaged in innovative activities. Such pressure may arise from engaging in exporting, by operating in a market exposed to imports, or by being exposed to foreign affiliates of multinational firms. Moreover, globalisation offers an important channel for flows of foreign technology that embody significant innovations. Indeed, foreign technology accounts for the bulk of productivity growth in most countries, in particular in small countries.

These gains also depend on the speed and extent to which resources are re-allocated to industries and activities in which countries have a comparative advantage. As firms reallocate resources towards higher value-added activities and move out of lower value-added activities (or move them abroad), a country will increase productivity growth. The resulting productivity effects will not only increase real incomes and wealth, but may also contribute to job creation in other parts of the economy as they help businesses to remain profitable and preserve or expand jobs in the home country. Firms may also use the efficiency gains from offshoring to lower prices, to offer better products and services and/or to invest in new technologies.

The key role of multinational firms in the current globalisation process may generate additional positive effects on host countries' economies because of their typically superior performance. Their strong performance is linked to their use of more advanced production methods, their network of international suppliers, customers and contracting firms and their intangible assets that are the source of value creation. Since foreign affiliates are on average more labour productive than the average domestic firm, productivity in host countries is positively influenced by the presence of subsidiaries of foreign MNEs. Foreign affiliates also seem to be more successful than domestic firms in increasing their level of productivity (Figure 1.8). Moreover, they generally possess a higher level of technology than domestic firms and thus have the potential to generate technology spillovers (see Chapter 6).

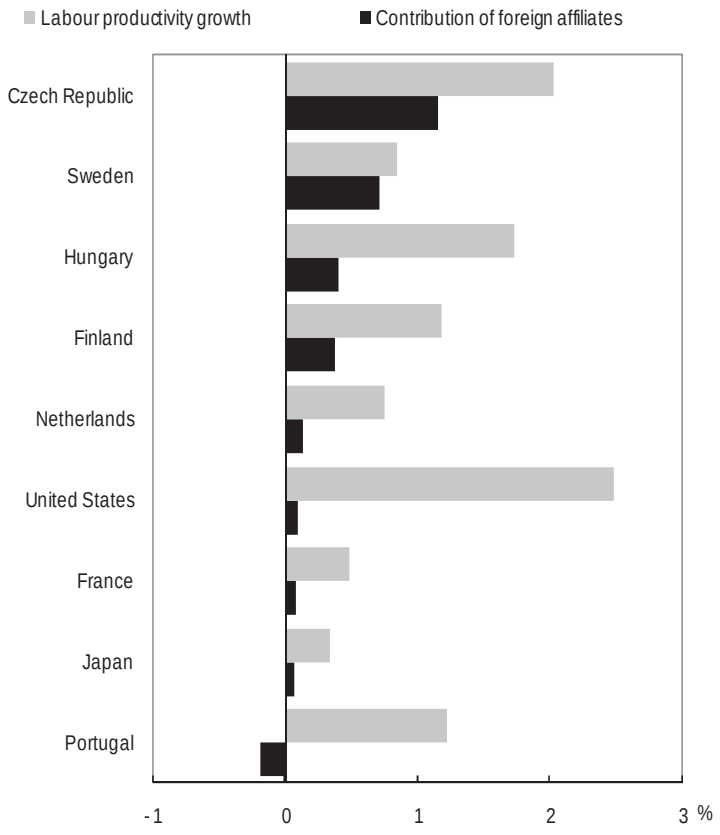
Figure 1.8. Average contribution of foreign affiliates to annual productivity growth, 1995-2001



1. Or nearest available year: Czech Republic 1997-2002; United Kingdom 1995-1999; Finland 1995-2002; Hungary 1996-2002; Spain 1999-2001 and Portugal 1996-2002.

Figure 1.8. Average contribution of foreign affiliates to annual productivity growth, 1995-2001 *(continued)*

Service sector[2]



2. Or nearest available year: Czech Republic 1995-2002; Sweden 1997-2000; Hungary 1998-2002; Netherlands 1997-2001; Japan 1997-2000 and Portugal 1996-2002.

Source: OECD (2005b).

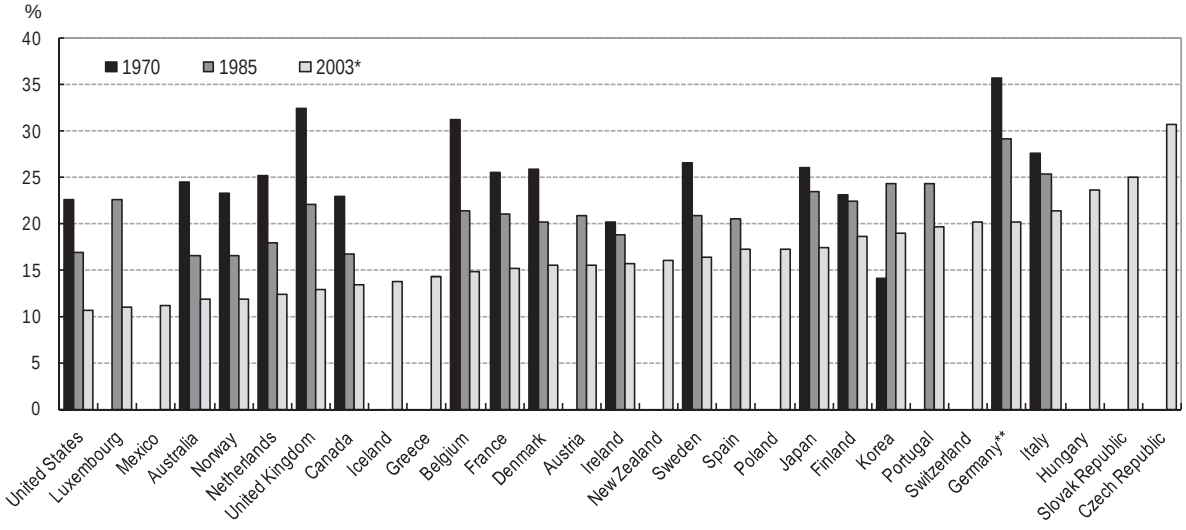
The presence of multinational firms also affects the productivity of host countries in indirect ways. The inflow of FDI may spur domestic competition resulting eventually in higher productivity, lower prices and a more efficient resource allocation in host countries. Technology transfers are perhaps the most important channel through which foreign corporate presence may produce positive externalities on aggregate productivity in host countries. Technology and knowledge may also spill over from foreign affiliates to domestic firms in host countries through the many interactions between them. Also MNEs may positively affect productivity in host countries to the extent that they are more likely to offer training and on-the-job learning.

Multinational firms are not the only firms to benefit from internationalisation. Numerous studies have documented that any internationally engaged firms, *e.g.* through exporting or importing and/or having affiliates abroad, tend to have higher productivity. Exports and direct investment abroad may provide useful feedback to firms which can help them to improve productivity. Offshoring is one specific form of global engagement and is also found to have positive effects on firm productivity (see Chapter 7).

Moving up the value chain by OECD countries: the response to globalisation?

Globalisation has important impacts on the industrial structure and dynamics of countries as it results in a changing allocation of production over a growing number of countries. The integration of new players in the global economy challenges existing comparative advantages and the competitiveness of countries, forcing them to search for new activities in which they can excel and confront the competition. The main drive is for countries to move up the value chain and become more specialised in knowledge-intensive, high value-added activities. Specialisation in more traditional cost-based industries and activities is no longer a viable option for most developed countries.

Figure 1.9. Share of manufacturing in total employment, 1970, 1985 and 2003



*Data refer to 2001 for Australia, 2002 for France, Poland and Switzerland.

**Germany before 1991 refers to West Germany.

Source: OECD STAN Indicators Database in OECD (2006a).

This process affects the manufacturing sector most strongly and has been accompanied by de-industrialisation in most OECD countries (Figure 1.9). The de-industrialisation process is driven by rapid productivity change in the manufacturing sector and a shift in demand to services. Globalisation has only played a limited role for some countries and some industries, as it has increased competition and thus stimulated technological improvements and productivity growth, while at the same time rendering certain (labour intensive) activities unprofitable in higher-wage countries. Evidence shows that only about a quarter of the recent de-industrialisation in the United States and the EU can be explained by increasing openness.

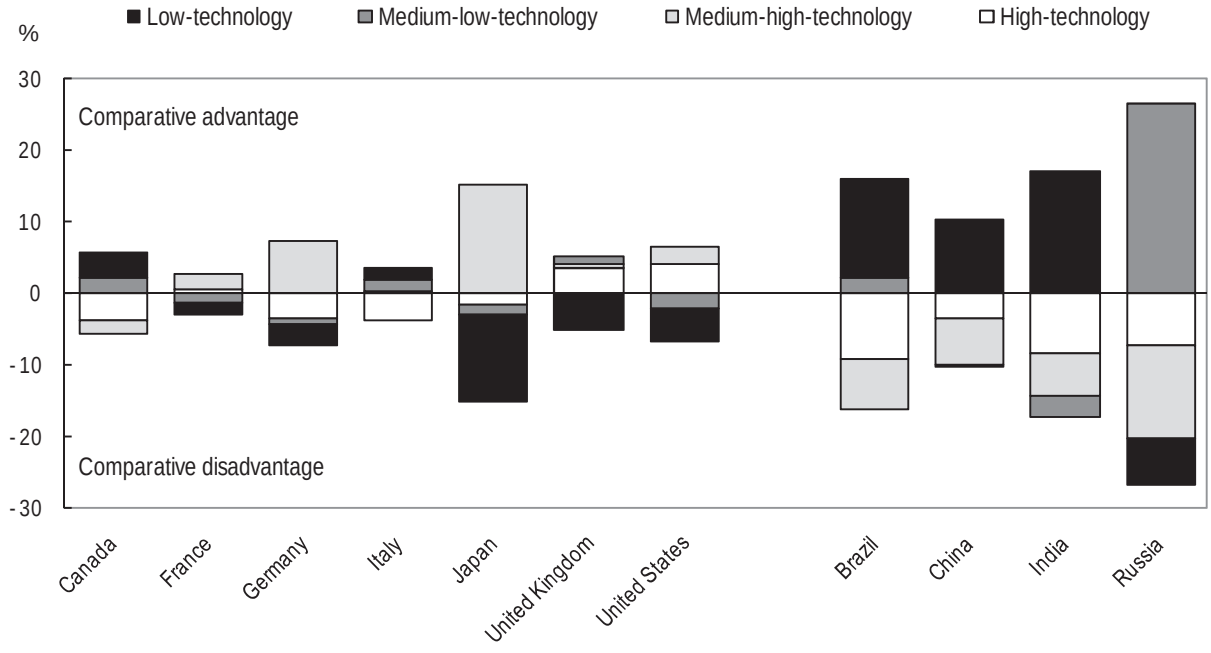
The current de-industrialisation process is also accompanied by a blurring of the distinction between manufacturing and services, as the interaction between the two sectors is growing and services are becoming increasingly tradable. For instance, a growing share of manufacturing firms' revenues comes from the provision of services.

If developed countries are to remain competitive in the global economy, they will have to rely more on knowledge, technology and intangible assets. Investment in knowledge is therefore a crucial factor for sustained economic growth, job creation and improved living standards. Indeed, investment in knowledge has increased in all OECD countries in recent years. At the same time, most OECD countries are shifting into higher technology-intensive manufacturing industries and into knowledge-intensive market services. This shift is also observed within lower technology industries, as shown in the high rates of productivity growth and the increasing R&D intensity within these industries.

The evolution towards a more knowledge intensive economy is also reflected in trade flows; trade in high- and medium-high technology industries has grown faster than total manufacturing trade in the OECD area. High-technology industries are the most dynamic manufacturing industries, representing about one-quarter of total OECD trade. Indicators on the contribution of different industries to countries' trade balances show, however, that only a few OECD countries are specialised in high-technology manufacturing industries. A considerable number of OECD countries still have a strong comparative advantage in medium-low-technology and low-technology industries (Figure 1.10).

Figure 1.10. Contribution to the manufacturing trade balance, G7 and BRICs, 2005

As % of total manufacturing trade



Note: The "contribution to the trade balance" is the difference between:

$$\left(X_i - M_i\right) - \left(X - M\right)\frac{\left(X_i + M_i\right)}{\left(X + M\right)}$$

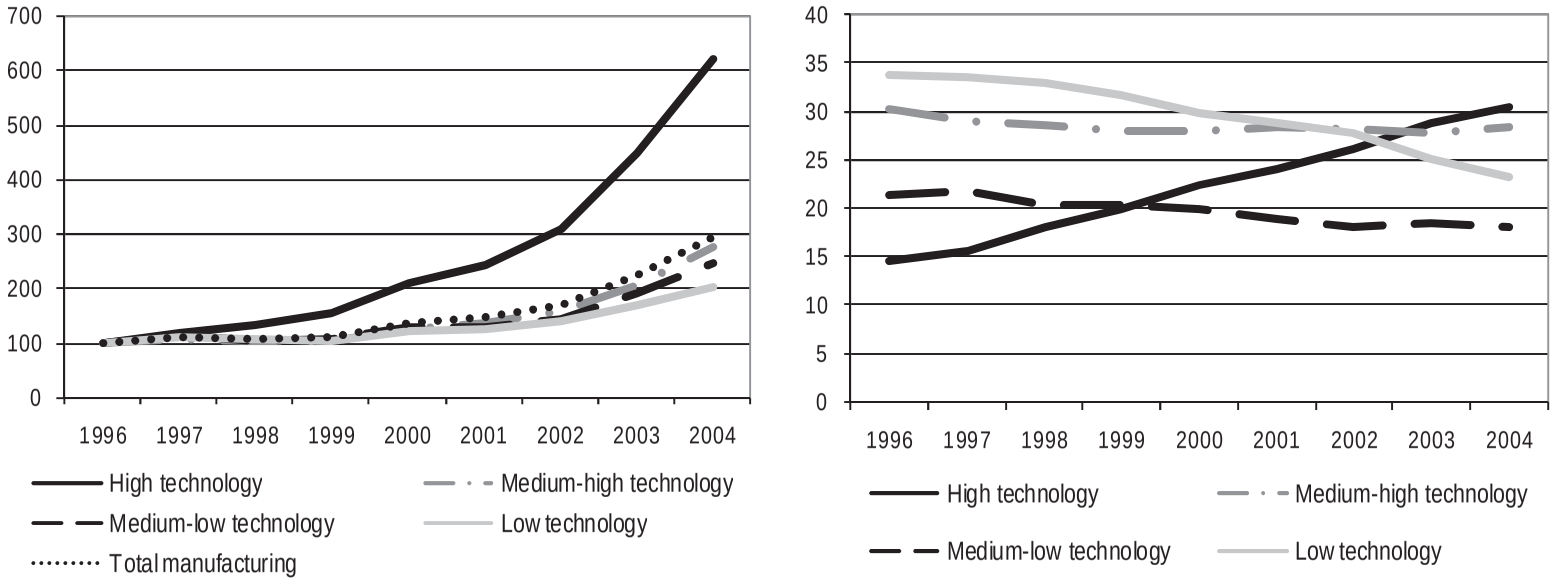
where $\left(X_i - M_i\right)$ = observed industry trade balance,

and $\left(X - M\right)\frac{\left(X_i + M_i\right)}{\left(X + M\right)}$ = theoretical trade balance.

If there were no comparative advantage or disadvantage for any industry *i*, a country's total trade balance (surplus or deficit) should be distributed across industries according to their share in total trade. A positive value for an industry indicates a structural surplus and a negative one a structural deficit.

Source: OECD (2007b).

Figure 1.11. Growth and structure of BRICs manufacturing trade by technological intensity, 1996-2004

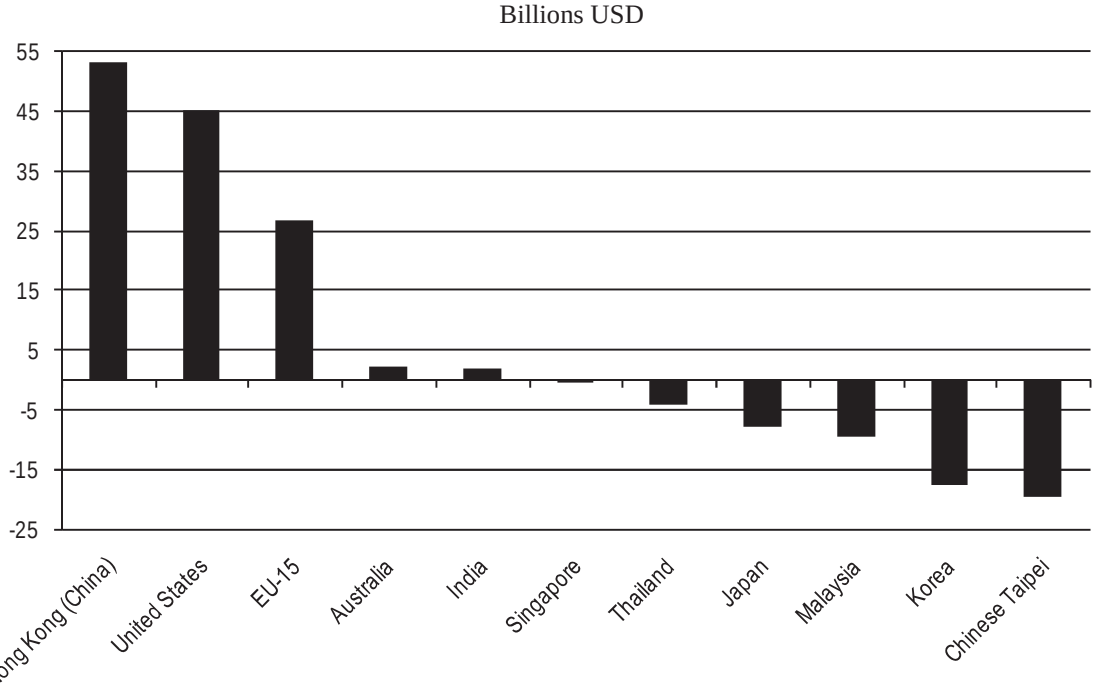


Source: OECD (2007).

The increased activity of non-OECD economies in high-technology industries poses additional challenges for OECD countries (Figure 1.11). China in particular is moving up the value chain and thus seems to compete directly with OECD countries. The imported technology embodied in FDI has changed China's trade over the past decade as the commodity composition has been diversified from traditional industries into higher technology-intensive industries. China's trade surplus, however, is not due to high-technology exports, but still to lower-technology industries such as toys, textiles and footwear. The strong growth of Chinese exports in more sophisticated electronics, furniture and transport goods is closely linked to the growing imports of parts and components by China.

Trade liberalisation has facilitated greater participation of China in international production networks and deeper integration with its trading partners, especially in Asia. Firms from Hong Kong (China), Chinese Taipei, Japan, South Korea and other Asian economies have relocated their labour-intensive industries to the mainland, while firms from the United States and Europe operating in Asian Newly Industrialised Economies have moved operations to China. Consequently, a triangular trade pattern has emerged with Japan and other NIEs exporting capital and sophisticated intermediate goods such as parts and components to less developed countries like China, which then process them for exports destined to the United States, Europe and back to Asian NIEs. This process has facilitated these more developed Asian economies to move further up the value chain and specialise in higher value added activities. Trade balances of China in ICT illustrate this triangular pattern very well: China reports trade surpluses with the United States and the EU-15 and trade deficits with most ASEAN countries (Figure 1.12). An important question then is whether China is merely assembling component parts or whether there are indications that the country has added increased value in industries like ICT.

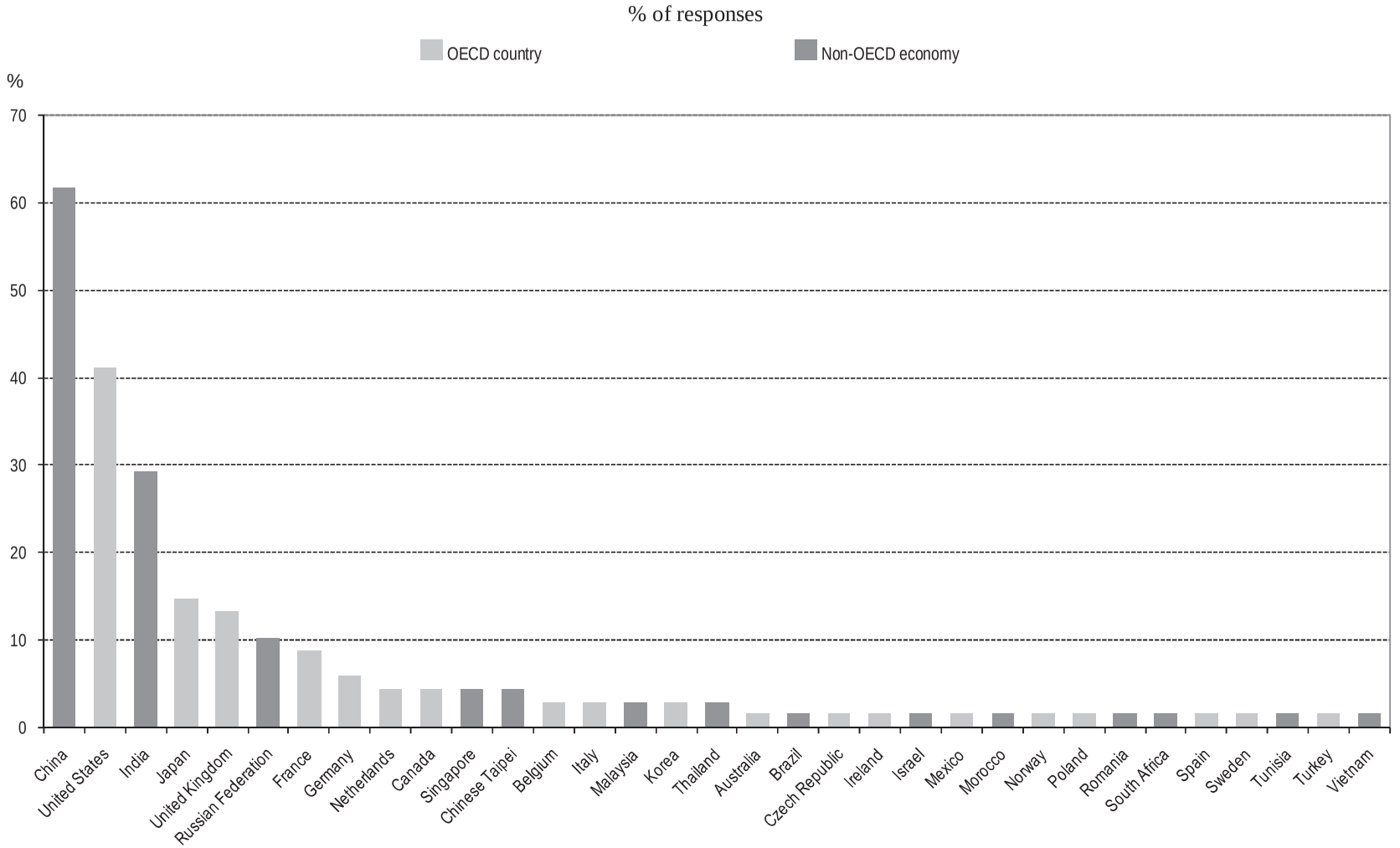
Figure 1.12. China's trade balance in ICT goods, 2005*



*Data for EU-15 and Chinese Taipei are for 2004.

Source: OECD ITS Database.

Figure 1.13. Most attractive foreign R&D locations: UNCTAD survey



Source: UNCTAD (2005) in OECD (2006d).

Another important question is how long this specialisation in labour-intensive activities will last and whether China will develop its own technological capabilities. Until the end of the 1990s, China relied heavily on the support of foreign capital and foreign technology embodied in high-tech imports, which seems to have resulted in only limited knowledge spillovers and benefits to the local Chinese economy. Furthermore, given the remaining large number (over 100 million) of low-skilled agricultural workers that could move into the manufacturing sector over the coming decades, it is likely that China's comparative advantage may remain in labour intensive activities and products for years to come. However, China has recently implemented a new policy which emphasises the development of domestic innovative capability. This has led to increased spending on R&D and a growing researcher base, but is not yet translating into stronger performance in many technological indicators.

Following the offshoring of manufacturing and services, high-skilled business functions like R&D also seem no longer immune to being outsourced and offshored (see Chapter 8). This has contributed to concerns about the future of the domestic knowledge base and resulting impacts on competitiveness, notwithstanding the fact that increased international R&D links can promote faster technological change and broader diffusion of technological advances worldwide. R&D investment abroad by multinational firms has grown strongly as MNEs' strategies focus on global technology sourcing. This involves building networks of distributed R&D globally in order to tap into local knowledge and develop sources for new technology development. While most R&D internationalisation still takes place within the OECD area, developing countries are increasingly attracting R&D centres, although these remain relatively small in a global perspective (Figure 1.13). Large increases in foreign R&D investment in Asia, in particular in China and India, have attracted much attention in recent years. It can be expected that this shift will continue to some extent as these countries offer a combination of relatively low wages with a good education system, resulting in a large pool of well-trained researchers.

Moving up the value chain: developing a strategy for innovation

The globalisation of value chains raises major policy challenges for OECD countries, as globalisation confronts OECD economies with new opportunities and challenges. One challenge for OECD countries is how to continue moving economic activity further up the value chain to ensure that OECD economies can continue to compete and prosper in the global environment. It is evident that certain areas of activity, *e.g.* low-technology manufacturing, will decline in importance in OECD countries, as lower-income economies such as China and India consolidate their position as effective competitors. Some of these activities are also characterised by rapid productivity growth and slow growth in demand, reducing the prospects for employment growth worldwide. Openness to trade and investment and well-functioning markets are key to the upgrading process, as this will help move resources from firms and industries that are no longer able to compete in the global market to firms that are successful.

Moving up the value chain implies a continuous process of change, innovation and productivity growth. Products and services that are currently regarded as among the most innovative and experimental ultimately end up as commodities that can be produced anywhere and by many producers. Developed economies can only grow by inventing new technology, by innovating products and processes and by designing new management methods. To foster and support the innovation process, several policy areas could be considered:

- *Innovation policies* can help increase the level of knowledge and technology embodied in production and exports, which would make competition from lower-income (lower-cost and lower-productivity) countries less likely in the relevant markets. Policies aimed at strengthening creativity in business, or at developing intangible assets as sources of value creation are closely related to these policies.

- *Policies to upgrade the human resource base of the economy.* A more innovative and productive economy sector may require more highly skilled workers or a different mix of skills. Standard production tasks can increasingly be carried out outside the OECD area where labour costs are often considerably lower. Upgrading the workforce can support a shift of economic activity towards more high value-added areas that might remain in OECD countries. Addressing this through education and training policy requires a growing focus on life-long learning.

- *Policies to foster entrepreneurship and new areas of economic activity.* Policies might also aim at creating new areas of economic activity, in stimulating new firm creation and entrepreneurship, or in stimulating innovation and technology in new areas, *e.g.* through public procurement. New firms are of great importance to innovation, particularly in areas where radical changes to existing markets and production processes are feasible.

- *Cluster policies and efforts at the local/regional level.* Local and regional strengths are also an important asset for economic policy. International and local firms may be attracted to very specific activities and skills that only exist in some regions and locations. These may be linked to scientific or educational institutions, historical heritages, natural resources, geographical location and so on. Policies aimed at the development of clusters, poles of excellence as well as regional policies may help capitalise on these strengths.

- *Policies to enhance attractiveness.* Making a country an attractive location for economic activities can help attract foreign direct investment and foster new areas of economic activities. Understanding what determines national attractiveness, building on national strengths and addressing weaknesses to the extent possible can help in drawing greater benefits from the globalisation process.

- *IPR-related policies.* In view of the changing environment for innovation, it is important to consider whether the current system of IPR rules and practices continues to stimulate innovation and provide access to knowledge, or if in certain cases the abuse of control with which IPR owners are sometimes endowed could hamper competition, fair use and the diffusion of technology. Complementing the IPR rules with practices, tools and networks that provide increased access to knowledge and enable more open forms of innovation may offer a way forward. Striking an appropriate balance between diffusion of technology and providing incentives to innovation remains an important consideration in this context. Moreover, more can be done to generate value from IPR, *e.g.* through licensing.

- *New approaches to moving up the value chain?* In recent years a discussion has emerged about the need and desirability of more government action, based on the success of some countries in strengthening comparative advantages in certain areas. Policies improving the functioning of labour, products and financial markets are necessary but may be no longer sufficient for successfully moving up the value chain, since market failures and externalities exist especially in new activities that are risky and require large-scale investments. However, experience in several countries with

old-style industrial (support) policies has not been positive. The current policy debate in several OECD countries is seeking to move beyond these types of policies, underscoring the need for well-functioning and competitive markets, but looking for actions that the government can undertake to strengthen the capacity of firms to compete in the global market. Such actions include innovation and entrepreneurship policy that has become the core of industrial policy in the 21st century.

Globalisation and technical change are both factors instigating structural change that requires countries to address adjustment costs, while benefiting from innovation, productivity growth and the creation of new jobs. One challenge is then the pressure on OECD countries to adjust. If countries are to realise the potential gains from openness, productive factors (including labour) must shift from economic activities where they are relatively less efficiently used towards activities where the economy enjoys a comparative advantage. The extent and speed of this structural change directly determines how much countries benefit from globalisation. However, it can be hard for individuals to move between jobs, industries and regions, and workers losing jobs in firms in import-competing industries sometimes bear large adjustment costs. Hence the need for complementary structural policies aimed at helping workers reallocate from lagging to more advanced industries and of policies aimed at compensating potential short-term losers from globalisation.

As globalisation increases the need for mobility, employment regulations should be reformed in cases when they inhibit change, wages should adapt to the new economic patterns, and geographic mobility should be stimulated in order to avoid adjustment difficulties concentrating in particular areas. In order to adequately compensate those who lose their jobs, some countries have succeeded in providing generous welfare benefits while at the same time promoting a more rapid return to employment through strong job-search obligations. Ensuring that all workers have adequate skills is also key to reducing adjustment costs.

Public perceptions as regards globalisation are not always positive, which may be due to the short-term job losses that may occur in specific regions and industries, and that often particularly affect low-skilled workers. The challenge is that although globalisation benefits economies as a whole, the gains are unevenly distributed and the costs in terms of employment loss and wage decline are often more visible than the wider benefits to consumers generally. Providing a balanced perspective on the benefits and costs of globalisation can help. However, the real problem is that globalisation may generate highly visible costs for a clearly identifiable group of people, while some benefits may only come later and are widely diffused across society. A promising avenue may be to address more directly the costs of globalisation, by compensating those who may suffer a short-tem decline in income.

Spreading the benefits of globalisation is necessary not only within OECD countries but also on a worldwide level between (developed and developing) countries. Concerns have risen that some world regions, notably Africa, seem in particular danger of being left behind in the globalisation process. Other concerns related to globalisation are linked to the potential environmental impacts of continued globalisation in developing countries. Further trade liberalisation in sectors where poorer countries have a comparative advantage (especially agriculture), complemented by capacity-building and development policies, may help to spread the benefits of globalisation to a wider range of countries, including those that are most at risk of being excluded. Addressing other global concerns,

notably global environmental challenges such as climate change, is also needed to make globalisation be regarded as an opportunity, rather than a threat.

The short-term employment losses that have emerged in some countries, and their possible link to globalisation, have led to demands for protection from competition in some OECD countries. These demands are varied and have resulted in a wide range of policy proposals. Some proposals are primarily aimed at insulating countries from the impacts of globalisation through import barriers, some seek to penalise firms that engage in offshoring, and some seem primarily aimed at slowing the exposure to international competition. Such protectionist measures are likely to raise costs for firms and reduce their efficiency. This will have detrimental impacts on the consumers buying products from these firms and will possibly also make the countries undertaking such policies a less attractive place to do business. Protectionist measures also have detrimental effects on other, often poorer, countries, denying them the chance to trade and increase living standards.

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Chapter 2

THE MEASUREMENT OF GLOBALISATION USING INTERNATIONAL INPUT-OUTPUT TABLES

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One of the distinctive characteristics of the current globalisation process is the emergence of global value chains. Within global value chains and international production networks, not only are final goods traded internationally, but intermediate goods (parts and components) and, in recent years, services also increasingly are. This trend significantly alters the economic relations between countries and increasingly casts doubt on empirical indicators such as trade and FDI that are traditionally used to measure globalisation. Input-output tables may provide much finer detail in describing current globalisation as they offer information on the use of goods instead of the rather arbitrary classification schemes that divide goods into intermediate and other categories. Moreover, input-output tables also incorporate information on the use of services, enabling measurement of the increasing offshoring of service activities in today's business activities. Based on the OECD Input-Output Database, which includes harmonised tables for 38 countries (of which 10 emerging non-OECD economies), this paper brings together empirical evidence on the growing importance of global value chains and the increasing interdependence between countries. Input-output indicators are presented for individual countries and individual industries, aiming to demonstrate the changing characteristics of current globalisation.

An earlier version of this chapter was published as STI Working Paper 2007/8 (OECD Directorate for Science, Technology and Industry).

Introduction

Input-output analysis has received renewed attention in recent years as input-output (I-O) tables are increasingly used in the empirical analyses of different topics, such as material flows, environmental issues, sustainable development, embodied technology, etc. This is partly due to the improved availability and quality of national input-output tables as well as modern IT capabilities that allow for more complex analyses to be undertaken. An area where input-output information has been used less is globalisation, largely due to the fact that published input-output tables do not have the same sector classification and price basis definitions, and therefore often lack international comparability.

Globalisation is high on policy and research agendas in many countries as the pace and scale of today's globalisation process is without precedent. Growth in world exports and imports has been accelerating since the 1980s, far exceeding the growth in world GDP. Since the second half of the 1990s, globalisation has been particularly boosted by the strong increase in foreign direct investment (FDI). Moreover, current economic integration is no longer restricted to the Triad – the United States, Europe and Japan – but now extends to new large global players like Brazil, Russia, India and China (BRICs).

Furthermore, current globalisation displays some distinctive features (OECD, 2007a; Grossman and Rossi-Hanberg, 2006; Baldwin, 2006) as production processes are increasingly fragmented geographically, resulting in the emergence of global value chains. Information and communication technologies (ICT) have made it possible to "slice up" the traditional value chain (Porter, 1985) and activities that previously had to be carried out in the same location in order to reduce costs (Box 2.1). Instead of total industries and their complete value chains, particular fragments of production are now increasingly clustering locally. Important restructuring has taken place within companies and industries, resulting in the outsourcing, offshoring and relocation activities. Final products and, increasingly, also production of intermediates are being offshored within these global value chains, giving rise to increased trade through exports and imports. Multinational firms play a prominent role in these global value and supply chains as they have a global reach that allows them to co-ordinate production and distribution across many countries and shift their activities according to changing demand and cost conditions.

Another key characteristic of current globalisation is that it increasingly extends to FDI and trade in services. Many service activities are becoming increasingly internationalised, especially as ICT enables services to be produced irrespective of location. Improvements in technology, standardisation, infrastructure growth and decreasing data transmission costs have all facilitated the sourcing of services from abroad. Rapid advances in ICT have also increased the tradability of many service activities and created new kinds of tradable services. In particular, "knowledge work" such as database and information processing services and research and consultancy services can easily be carried out via the Internet and through tele- and video-conferencing. Activities such as call centres have also begun to be offshored.

Box 2.1. The value chain

The value chain is a systematic approach to the analysis of the competitive advantage of companies, developed by M.E. Porter in his book *Competitive Advantage* (1985). The chain consists of a series of activities that create and build value, distinguishing between "primary" activities and "support" activities.

Primary activities

Inbound logistics: reception and storage of goods.

Operations: manufacturing and assembly of goods.

Outbound logistics: distribution to wholesalers, retailers or the final consumer.

Marketing and sales: marketing, communications and promotion.

Service: installation, customer service, handling complaints, training, etc.

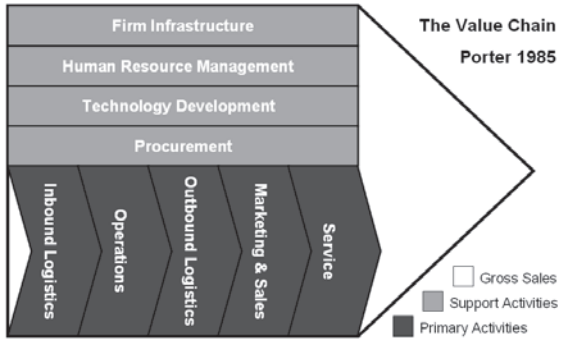
Support activities

Procurement: purchasing of goods, services and materials.

Technology development: production technology, lean manufacturing, customer relationship management (CRM), etc.

Human resource management: recruitment, training and development, remuneration.

Firm infrastructure: planning and control mechanisms (*e.g.* accounting).



As global value chains and the related offshoring may have important impacts on national economies and employment, more accurate empirical measures of globalisation have been called for. However, the new characteristics of globalisation make empirical measurement of current globalisation a difficult and challenging exercise. While trade and FDI data have traditionally been used to measure globalisation, both are too broad to measure the size of global value chains and the extent of offshoring. Due to the emergence of global value chains, trade has increased not only in finished goods and services but also, and especially, in intermediates such as primary goods, parts and components, and semi-finished goods. Exports of final goods are no longer an appropriate indicator of the (international) competitiveness of countries, as following the emergence of global value chains, final goods increasingly include a large proportion of intermediate goods that have been imported into the country.

Data on trade in intermediate goods and services may provide a more accurate indication, but such data are not readily available. Based on the broad economic categories developed by the United Nations, 54% of world manufacturing imports in 2003 could be classified as imports of intermediate goods. However, the drawback with these kinds of classifications is that they are based on some (arbitrary) assessment of which goods and products can be considered intermediate, and which ones as final. The

emergence of global value chains makes this distinction even less clear, as close-to-final products are often further processed in subsequent production and distribution stages within companies. The measurement problem is even greater for the offshoring of services, as data on trade in services are far less detailed than on trade in goods, while trade data do not typically identify if services are destined for final consumption or intermediate use.

In general, official data on employment, trade and FDI typically provide some insight into offshoring, but do not provide a complete picture (US Government Accountability Office, 2004). Firm-level data (often collected through surveys) may provide the most complete information on the globalisation of value chains and offshoring, but firms are often reluctant to furnish details on their outsourcing/offshoring and—especially—relocation decisions given the sensitivity surrounding these phenomena. Input-output tables, which are typically available for all industries albeit at an aggregated level, offer complementary insights into the globalisation of value chains as they provide information on the value of intermediate goods and services that have been imported from outside the country. A key advantage of I-O tables is that they classify goods according to their use (as an input into another sector's production or as final demand) instead of classification schemes that divide goods into intermediate and other categories based on their descriptive characteristics. Another key advantage of I-O tables is that they also include information on (domestic and international) inputs of/in services sectors, so that the fast-growing offshoring of services activities can be monitored.

This paper brings together empirical evidence on the growing importance of global value chains and the increasing interdependence between countries using the OECD Input-Output Tables Database. Input-output indicators are presented for individual countries and individual industries, with the aim to demonstrate the changing characteristics of current globalisation.

The OECD Input-Output Database

Coverage – country and time

Approximately every five years, the OECD produces estimated harmonised input-output tables. The first edition of the OECD Input-Output Database dates back to 1995 and covered 10 OECD countries, spanning the period from the early 1970s to 1990. A first update of this database (2002 edition) increased the country coverage to 18 OECD and two non-OECD countries (China and Brazil). The 2006 edition[1] has expanded coverage to 38 (28 OECD countries and 10 non-OECD economies), further strengthening the database's ability to tackle global questions. The effects of globalisation and increased foreign outsourcing of manufacturing goods and services, for example, cannot be properly analysed if some emerging non-member economies such as India, Indonesia and Russia are not included within the dataset. Table 2.1 gives an overview of the countries that have been included in the different versions of the OECD I-O database. For this paper, the most recent edition has been used, with data for 1995 and 2000 available for certain countries.

1. Including additional tables compiled after the first dissemination package.

Table 2.1. Country coverage of the previous and current versions of the OECD I-O database

Country	1995 edition (ISICr2)					2002 ed. (ISICr3)	2006 ed.* (ISICr3)		GDP (Billion US$)		Population (Million)
	1970	1975	1980	1985	1990	1995	1995	2000	2000	Rank	2000
OECD members											
1 Australia	68	74	-	86	89	94/95	-	98/99	388.0	<14>	19.2
2 Austria	-	-	-	-	-	-	95	00	190.7	<23>	8.1
3 Belgium	-	-	-	-	-	-	95	00	228.0	<21>	10.3
4 Canada	71	76	81	86	90	97	95	00	706.6	<8>	30.8
5 Czech Republic	-	-	-	-	-	95	-	00	51.4	<49>	10.3
6 Denmark	72	77	80	85	90	97	95	00	158.5	<27>	5.3
7 Finland	-	-	-	-	-	95	95	00	120.0	<32>	5.2
8 France	72	77	80	85	90	95	95	00	1,308.4	<5>	59.3
9 Germany	-	78	-	86,88	90	95	95	00	1,870.3	<3>	82.3
10 Greece	-	-	-	-	-	94	95	99	112.1	<34>	11.0
11 Hungary	-	-	-	-	-	98	98	00	46.7	<51>	10.0
12 Iceland	-	-	-	-	-	-	-	-	8.4	<92>	0.3
13 Ireland	-	-	-	-	-	-	98	00	94.8	<38>	3.8
14 Italy	-	-	-	85	-	92	95	00	1,074.8	<7>	57.5
15 Japan	70	75	80	85	90	95,96,97	95	00	4,763.8	<2>	127.0
16 Korea	-	-	-	-	-	95	-	00	511.9	<12>	46.8
17 Luxembourg	-	-	-	-	-	-	95	00	19.6	<62>	0.4
18 Mexico	-	-	-	-	-	-	-	-	581.3	<10>	98.9
19 Netherlands	72	77	81	86	-	95 to 98	95	00	370.9	<15>	15.9
20 New Zealand	-	-	-	-	-	-	95/96	02/03	51.7	<48>	3.8
21 Norway	-	-	-	-	-	97	95	00&01	166.9	<25>	4.5
22 Poland	-	-	-	-	-	95	95	00	166.5	<26>	38.6
23 Portugal	-	-	-	-	-	-	95	00	106.5	<35>	10.2
24 Slovak Republic	-	-	-	-	-	-	95	00	20.2	<59>	5.4
25 Spain	-	-	-	-	-	95	95	00	561.4	<11>	40.8
26 Sweden	-	-	-	-	-	-	95	00	239.8	<20>	8.9
27 Switzerland	-	-	-	-	-	-	-	01	240.1	<19>	7.2
28 Turkey	-	-	-	-	-	-	96	98	199.3	<22>	68.2
29 United Kingdom	68	79	-	84	90	98	95	00	1,438.0	<4>	58.7
30 United States	72	77	82	85	90	97	95	00	9,762.1	<1>	285.0
Non-OECD members											
31 Argentina	-	-	-	-	-	-	97	-	284.2	<17>	36.9
32 Brazil	-	-	-	-	-	96	95	00	601.7	<9>	171.8
33 China	-	-	-	-	-	97	95	00&02	1,252.3	<6>	1,275.2
34 Chinese Taipei	-	-	-	-	-	-	96	01	321.4	<16>	22.2
35 India	-	-	-	-	-	-	93/94	98/99	457.4	<13>	1,016.9
36 Indonesia	-	-	-	-	-	-	95	00	150.2	<28>	209.2
37 Israel	-	-	-	-	-	-	95	-	259.7	<18>	6.1
38 Russia	-	-	-	-	-	-	95	00	114.8	<33>	145.6
39 Singapore	-	-	-	-	-	-	95	00	91.5	<39>	4.0
40 South Africa	-	-	-	-	-	-	93	00	128.0	<29>	44.0
# of Countries	8	9	6	10	8	20	32	35			

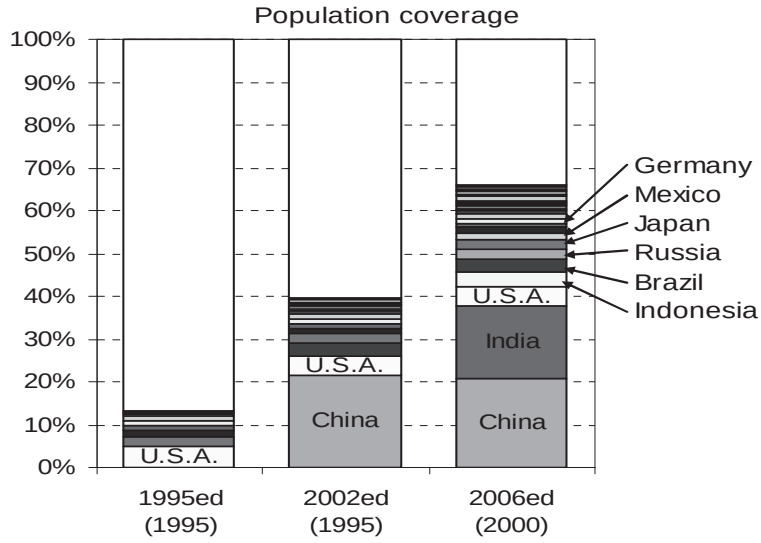
- : not available. YY/YY: Fiscal year.

Sources: OECD IO 1995, OECD IO 2002, OECD IO 2006, World Bank, United Nations.

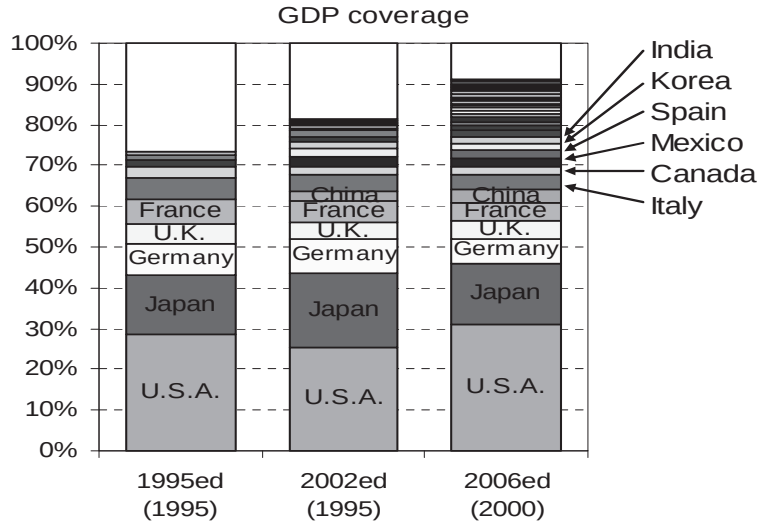
Representativeness of the database: coverage – GDP and population

The high representativeness of the OECD I-O database is clearly illustrated by its growing coverage over time (Figure 2.1). Population coverage rose from just over 10% in the 1995 edition to 40% in the 2002 edition and 67% in the 2006 edition. The coverage in terms of nominal USD based GDP has also increased from just over 70% (1995) to 80% (2002), and over 90% in the 2006 edition, which in turn reflects 99.9% of total OECD GDP.

Figure 2.1. Population and GDP coverage



Source: United Nations.



Source: World Bank WDI, OECD.

Industry classification

The industry classification of the database is based on the ISIC Rev. 3 system, meaning that it is compatible with the OECD's Structural Analysis (STAN) industry database and Bilateral Trade Database (BTD). The number of industries in the 2006 edition was expanded to 48. A full listing of the 48 industries is provided in Table 2.2. Unfortunately, information on all 48 industry sectors could not be obtained for every country due to disclosure restrictions and lack of detailed statistical sources.

Table 2.2. Industry classification

ISIC Rev.3 code		Description
1+2+5	1	Agriculture, hunting, forestry and fishing
10+11+12	2	Mining and quarrying (energy)
13+14	3	Mining and quarrying (non-energy)
15+16	4	Food products, beverages and tobacco
17+18+19	5	Textiles, textile products, leather and footwear
20	6	Wood and products of wood and cork
21+22	7	Pulp, paper, paper products, printing and publishing
23	8	Coke, refined petroleum products and nuclear fuel
24ex2423	9	Chemicals exluding pharmaceuticals
2423	10	Pharmaceuticals
25	11	Rubber and plastics products
26	12	Other non-metallic mineral products
271+2731	13	Iron & steel
272+2732	14	Non-ferrous metals
28	15	Fabricated metal products, except machinery and equipment
29	16	Machinery and equipment, nec
30	17	Office, accounting and computing machinery
31	18	Electrical machinery and apparatus, nec
32	19	Radio, television and communication equipment
33	20	Medical, precision and optical instruments
34	21	Motor vehicles, trailers and semi-trailers
351	22	Building & repairing of ships and boats
353	23	Aircraft and spacecraft
352+359	24	Railroad equipment and transport equipment n.e.c.
36+37	25	Manufacturing nec; recycling (include Furniture)
401	26	Production, collection and distribution of electricity
402	27	Manufacture of gas; distribution of gaseous fuels through mains
403	28	Steam and hot water supply
41	29	Collection, purification and distribution of water
45	30	Construction
50+51+52	31	Wholesale and retail trade; repairs
55	32	Hotels and restaurants
60	33	Land transport; transport via pipelines
61	34	Water transport
62	35	Air transport
63	36	Supporting & auxiliary transport activities; activities of travel agencies
64	37	Post and telecommunications
65+66+67	38	Finance and insurance
70	39	Real estate activities
71	40	Renting of machinery and equipment
72	41	Computer and related activities
73	42	Research and development
74	43	Other Business Activities
75	44	Public administration and defence; compulsory social security
80	45	Education
85	46	Health and social work
90-93	47	Other community, social and personal services
95+99	48	Private households and extra-territorial organisations

Price basis

In line with the 1993 System of National Accounts, the OECD Input-Output Database shows transactions, wherever possible, in industry-by-industry symmetric tables at basic prices. Eurostat member countries follow the basic price valuation system in producing the symmetric input-output tables. Some countries have not provided the tables at basic price in the published input-output tables. The basic price tables in the OECD format are submitted by the following economies[2]: Japan, Korea, India, Indonesia and Chinese Taipei. Ideally, for many applications, temporal comparisons of economic indicators should be made using constant price figures. However, constant price tables are only available in a very limited number of countries and so the 2006 edition, like the 2002 edition, reflects current price tables only.

Format

The 2006 edition of the input-output tables follows the format of earlier editions. As seen in the example below (Netherlands in 2000) domestic and import components are shown industry-by-industry at ISIC Rev. 3 classification.

Table 2.3. Format of the OECD I-O database

Country: Netherlands Valuation: Basic price
Year : 2000 Currency: Mill. Euros

Total

Industry \ Industry	Agriculture	Mining / Manuf.	Services	Final consumption expenditure	Gross capital formation	Exports	Imports
Agriculture	3,381	12,970	974	2,066	659	11,633	9,820
Mining / Manuf.	4,219	105,583	53,157	42,969	25,271	197,255	205,262
Services	4,224	37,226	169,126	221,249	52,356	57,430	27,165
Other adjustment	0	0	0	2,890	0	5,665	0
Net taxes on products	129	564	9,606	22,756	10,233	-15	0
TOTAL use	11,953	156,343	232,863	291,930	88,519	271,968	242,247
Gross Operating Surplus	7,309	31,359	112,810				
Compensation of Employees	2,336	35,603	167,752				
Net taxes on production	265	-113	1,021				
Industry Output	21,863	223,192	514,446				

Domestic

Industry \ Industry	Agriculture	Mining / Manuf.	Services	Final consumption expenditure	Gross capital formation	Exports
Agriculture	2,731	8,263	710	1,024	567	8,568
Mining / Manuf.	3,326	42,804	29,710	19,264	8,783	119,305
Services	3,988	32,566	149,423	220,722	51,165	56,582
Other adjustment	0	0	0	2,890	0	5,665
Imports	1,779	72,146	43,414	25,274	17,771	81,863
Net taxes on products	129	564	9,606	22,756	10,233	-15
TOTAL use	11,953	156,343	232,863	291,930	88,519	271,968
Value Added	9,910	66,849	281,583			
Industry Output	21,863	223,192	514,446			

Import

Product \ Industry	Agriculture	Mining / Manuf.	Services	Final consumption expenditure	Gross capital formation	Exports	Imports
Agriculture	650	4,707	264	1,042	92	3,065	9,820
Mining / Manuf.	893	62,779	23,447	23,705	16,488	77,950	205,262
Services	236	4,660	19,703	527	1,191	848	27,165
TOTAL	1,779	72,146	43,414	25,274	17,771	81,863	242,247

2. Available from the 2006 edition.

Indicators on global linkages

Traditional indicators using I-O information to measure the international orientation and dependency of countries are the import penetration and the export share of countries. While the former measures to what extent the total demand for goods and services in a country is served by imports, the latter shows the percentage of the total production of goods and services that is exported:

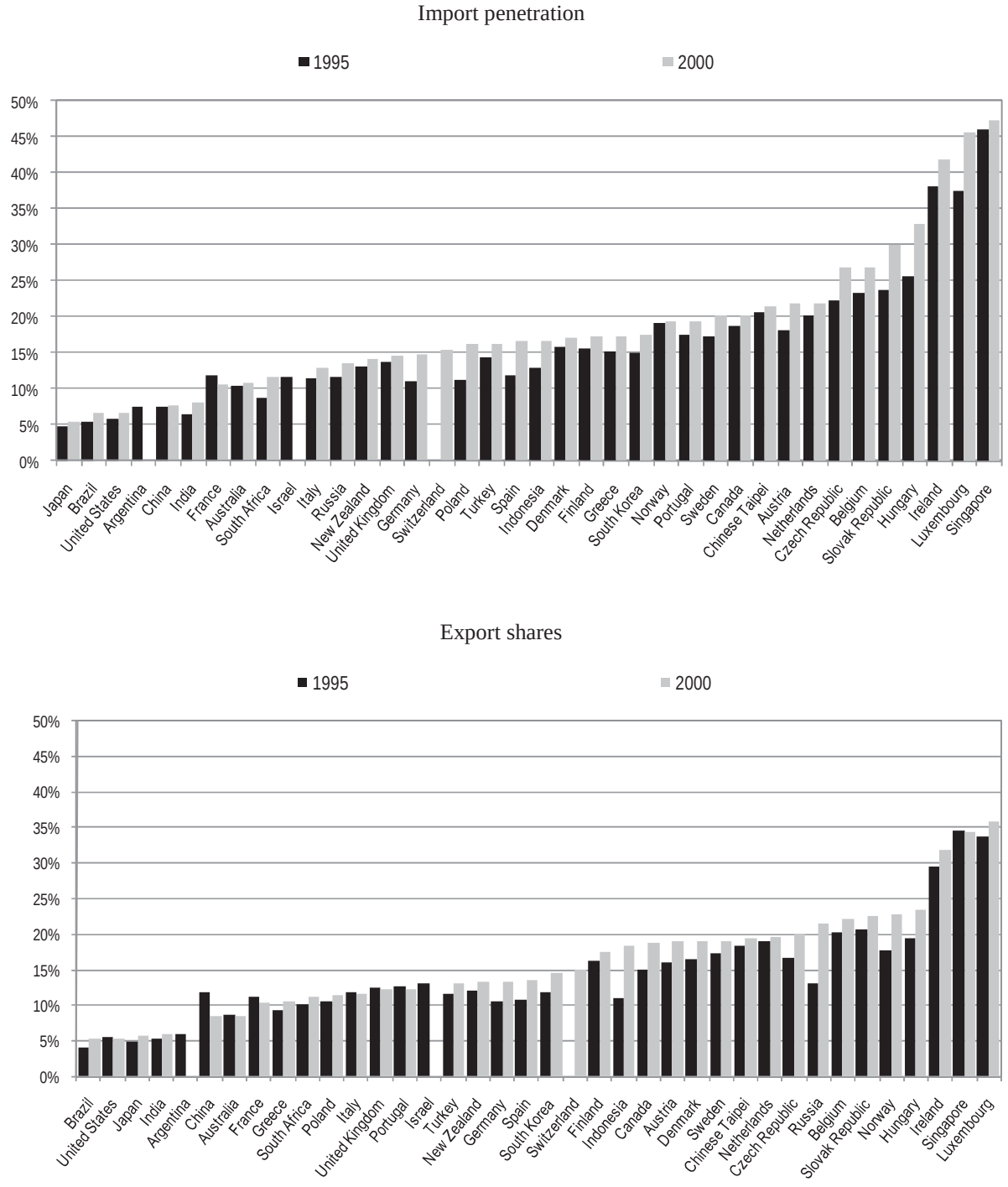
$$\textit{Import penetration} = \frac{\textit{total imports of goods and services } (M_k)}{\textit{total demand for goods and services } (D_k)}$$

$$\textit{Export share} = \frac{\textit{total exports of goods and services } (X_k)}{\textit{total supply for goods and services } (O_k)}$$

Figure 2.2 indicates that the import penetration has increased in 32 out of the 34 countries (for four countries only a one-year observation is available) and the export shares increased in 28 countries, reflecting the increase in foreign dependency of OECD economies and major non-OECD countries in the late 1990s. A typical observation that comes out of these international comparisons is that smaller countries have a larger international orientation than larger countries. Smaller countries such as Belgium, Hungary, Ireland, the Slovak Republic and Singapore are clear examples of this, while their higher international dependency is also partially due to the large presence of multinational enterprises (MNEs) in these countries.

Affiliates under foreign control are engaged not only in serving the local market in the host country, but have become essential links in global value chains as they serve other (neighbouring) markets and produce inputs for other affiliates in the multinational network. Data for US multinational firms show that 65% of the total output of US firms' foreign affiliates goes to the local market, while 11% goes to the United States and another 24% goes to third countries. In consequence, export and import intensities of foreign affiliates are in many cases higher than those of the average domestic firm, especially in manufacturing (OECD, 2007a). In Ireland, for example, over 90% of the manufacturing output of foreign affiliates is exported, and in Austria and Finland the proportion is over half.

Figure 2.2. Import penetration and export share, 1995[1] and 2000[2]



1. 1995 data is 1994/95 for Australia, 1995/96 for New Zealand, 1996 for Turkey, 1997 for Argentina, 1996 for Chinese Taipei, and 1993/94 for India; no data for Iceland, Mexico and Switzerland.

2. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

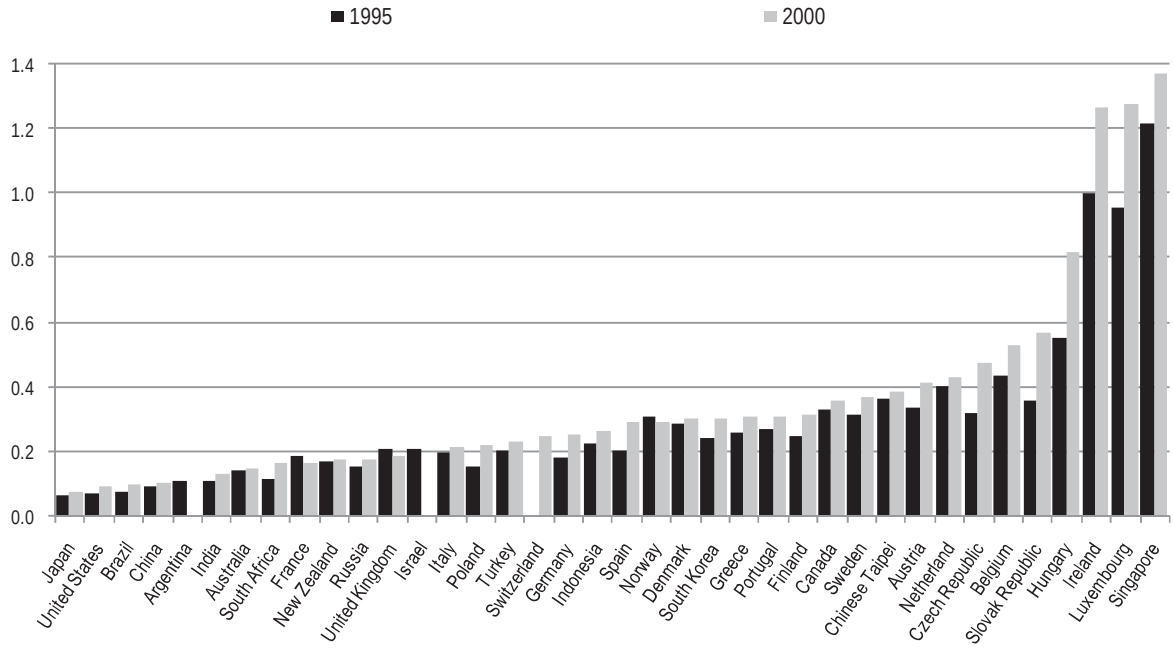
Source: OECD Input-Output Database.

The import penetration and the export share indicators include final as well as intermediate goods and services, and describe the global linkages and interdependencies between countries in overall terms. In order to better assess the position of countries in global value chains, the foreign dependency of countries can be better described only in terms of intermediates. Specifically looking at intermediate inputs defined in the I-O tables by the use made of goods and services, the ratio of imported to domestic sourcing of inputs is given by:

$$\textit{Imported intermediates/domestic intermediates} = \left(\sum_i \sum_j x_m^{ij}\right) / \left(\sum_i \sum_j x_d^{ij}\right)$$

where x_d^{ij} and x_m^{ij} are, respectively, the domestic and imported transactions of intermediates from sector *i* to sector *j*[3].

Figure 2.3. Imported/domestic intermediates, 1995[1] and 2000[2]



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2. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

Source: OECD Input-Output Database.

3. It may be clear that these indicators are dependent on the use of the statistical units in producing national accounts and input-output tables; *e.g.* differences between countries in using establishment and enterprise as statistical reporting unit may bias the results.

Figure 2.3 shows the average ratios (for the entire economy) of imported to domestic sourcing of inputs for the mid-1990s and early 2000s, based on information in the I-O tables. These figures provide a direct indication of the extent of economies' integration into global supply chains. The ratio of imported to domestic input increased in almost all countries from 1995 to 2000, demonstrating the growing importance of intermediate inputs in international trade and the increasing importance of international outsourcing. Consistent with their typically greater international orientation because of their limited size, smaller countries are found to import more intermediates from abroad. In Ireland, for example, domestic and international sourcing is reported to be equally important, meaning that the same amount of intermediates is sourced internationally as nationally (*i.e.* within the Irish economy).

MNEs are again considered to play a major role as the sourcing of intermediates within multinational networks has become especially important in recent years (OECD, 2007a; Grossman and Rossi-Hanberg, 2006; Baldwin, 2006). The share of intra-firm exports in total exports of manufacturing affiliates under foreign control has been reported to range between 15% and 60% in OECD countries (OECD, 2007a). This intra-firm trade involves the export and import of nearly finished goods destined for affiliate firms that are mainly involved in marketing and distribution with little additional manufacturing processing taking place. But another and growing part of intra-firm trade concerns the exports and imports by foreign affiliates that manufacture intermediate products destined for other affiliates. This last form is directly related to the globalisation of value chains and has been increasing in host economies like China, Korea, Mexico, Chinese Taipei and some Eastern European countries.

Indicators on offshoring

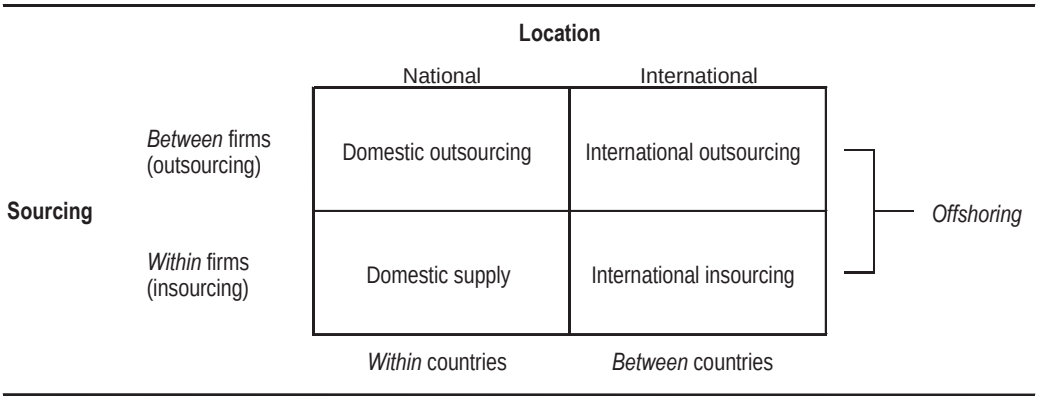
The offshoring of business activities including services has recently gained much attention, not least because of the supposed adverse effects on domestic employment. However, the link between offshoring and employment is not that obvious as different impacts have to be taken into account: direct and indirect effects, short- and long-term effects, and employment and productivity effects. Offshoring (including relocation) may lead in a first phase to short-term employment losses if certain activities are moved offshore or decline in importance. But globalisation has also positive impacts on productivity and may thus reduce costs and prices, both in the activity being directly affected and in other activities that use the products of this activity downstream. Bhagwati *et al*. (2004) emphasise that even if offshoring lowers employment and wages in certain occupations, in other cases it probably helps to create new jobs in the home country.

A major problem surrounding these discussions is that the empirical measurement of offshoring is difficult because of data availability (OECD, 2007b; GAO, 2004). A measure that has been widely used in empirical work is the "outsourcing" indicator suggested by Feenstra and Hanson (1996, 1999), calculated as the share of imported intermediate inputs in the total purchase of non-energy materials of individual industries. Typically, the information in I-O tables and more specifically the information in the imported transactions matrix has been used for this.

However, it should first be noted that while Feenstra and Hanson call this outsourcing, it is in fact offshoring, which is generally defined as companies' purchases of intermediate goods and services from foreign providers at arm's length, or the transfer of particular tasks from within the firm to a foreign location, *i.e.* to foreign affiliates

(Kirkegaard, 2004). Outsourcing refers to the purchasing of intermediate goods and services from outside specialist providers at arm's length, be it nationally or internationally (Figure 2.4). The cross-border aspect is the distinguishing feature in defining offshoring, *i.e.* whether goods and services are sourced from within the domestic economy or abroad – not whether they are sourced from within the same firm or external suppliers (OECD, 2007a).

Figure 2.4. Outsourcing and offshoring



Source: Van Welsum and Vickery (2004).

Secondly, while Feenstra and Hanson's measure has often been used, there is no consensus that it is the most appropriate. Girma and Gorg (2004) argue that this measure is too wide, especially for analyses at the firm level[4]; instead they prefer a measure originally developed by Abraham and Taylor (1996), which includes only the contracting out of machine maintenance services, engineering and drafting services, accounting services and computer services. Egger and Egger (2001) and Helg and Tajoli (2004) also use a narrower measure restricting outsourcing to outward processing. Others like Gorg *et al*. (2004) and Criscuolo and Leaver (2005) have more direct data on intermediate inputs, including *e.g.* raw materials and components, and services inputs as well as the proportion of these sources abroad. A discussion of the measurement issues associated with offshoring is given in OECD (2007b), with a focus on related labour relations.

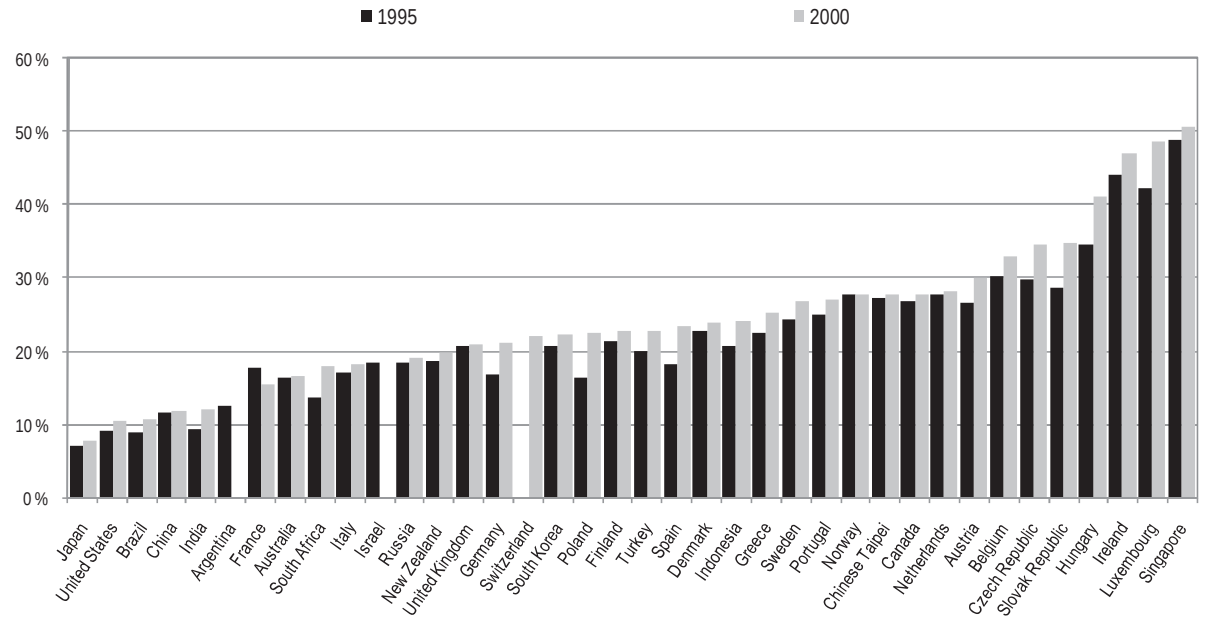
Notwithstanding these limitations, we have opted to build further on the work of Feenstra and Hanson and used the OECD I-O database to compute the level of offshoring (OFFSH) as the share of non-energy imported intermediate inputs in total non-energy intermediate inputs defined as:

$$OFFSH = \sum_j \sum_i x_m^{ij} \Big/ \left(\sum_j \sum_i x_d^{ij} + \sum_j \sum_i x_m^{ij} \right)$$

where x_d^{ij} and x_m^{ij} are the domestic and imported transactions of intermediates from sector *i* to sector *j* respectively and the *i* excludes the energy sectors (mining and utility).

4. Feenstra and Hanson have also proposed a narrower measure of outsourcing by restricting attention to only those inputs that are purchased from the same industry as that in which the good is being produced.

Figure 2.5. Offshoring, total industry, 1995[1] and 2000[2]



1. 1995 data is 1994/95 for Australia, 1995/96 for New Zealand, 1996 for Turkey, 1997 for Argentina, 1996 for Chinese Taipei, and 1993/94 for India; no data for Iceland, Mexico and Switzerland.

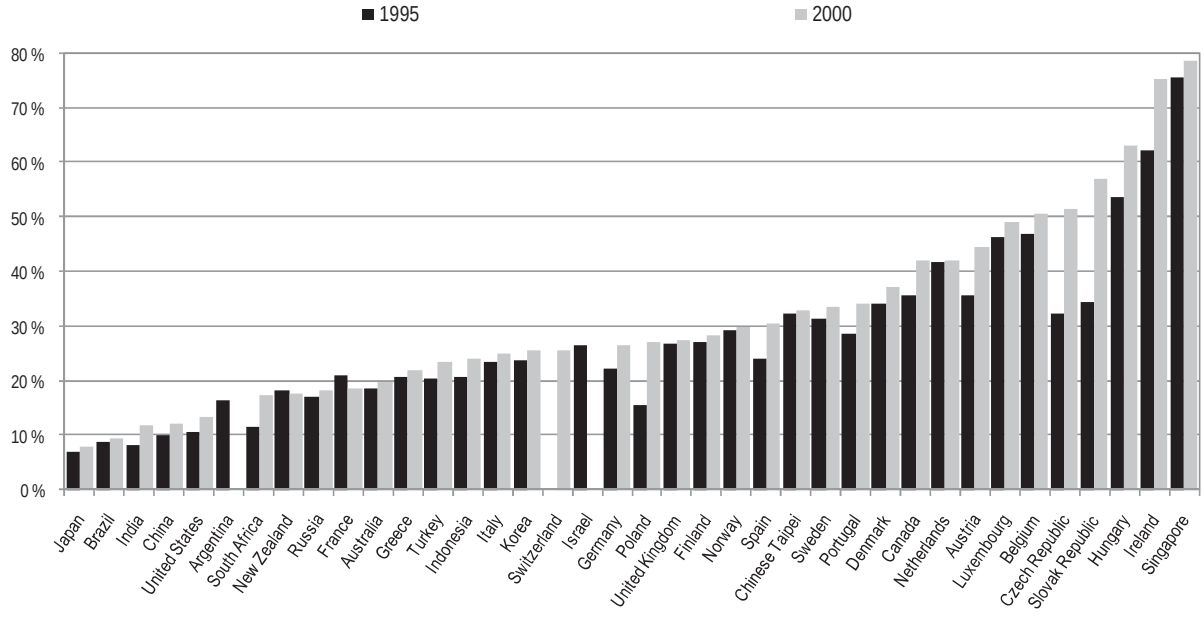
2. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

Source: OECD Input-Output Database.

In line with the increasing importance of imported intermediates, Figure 2.5 indicates that offshoring has grown in almost all countries, with, in some countries, very significant increases of the sourcing of intermediates abroad. Not surprisingly, smaller countries typically report higher offshoring indicators, notably Singapore, Luxembourg, Ireland and Hungary. Two large OECD countries, Japan (7.6%) and the United States (10.3%) are found to offshore relatively little compared with other OECD countries. Although the level in the large non-member countries such as Brazil, India, Argentina and China remains lower than the OECD average, the offshoring of intermediates also gained importance in these countries during the late 1990s.

The information in the OECD I-O Database also allows to analyse trends in offshoring taking the manufacturing and services sectors separately. This allows to illustrate the increased offshoring of business services in recent years. Figures 2.6 and 2.7 indicate that just like in manufacturing, the sourcing of intermediates abroad in market services has increased in almost all countries. While offshoring of intermediates just like the trade of final products has traditionally been occurring in manufacturing industries, the emergence of global value chains increasingly stretches out to services sectors. Notwithstanding this increase, the level of offshoring is still much lower in market services than in the total group of manufacturing industries.

Figure 2.6. Offshoring, manufacturing industries, 1995[1] and 2000[2]

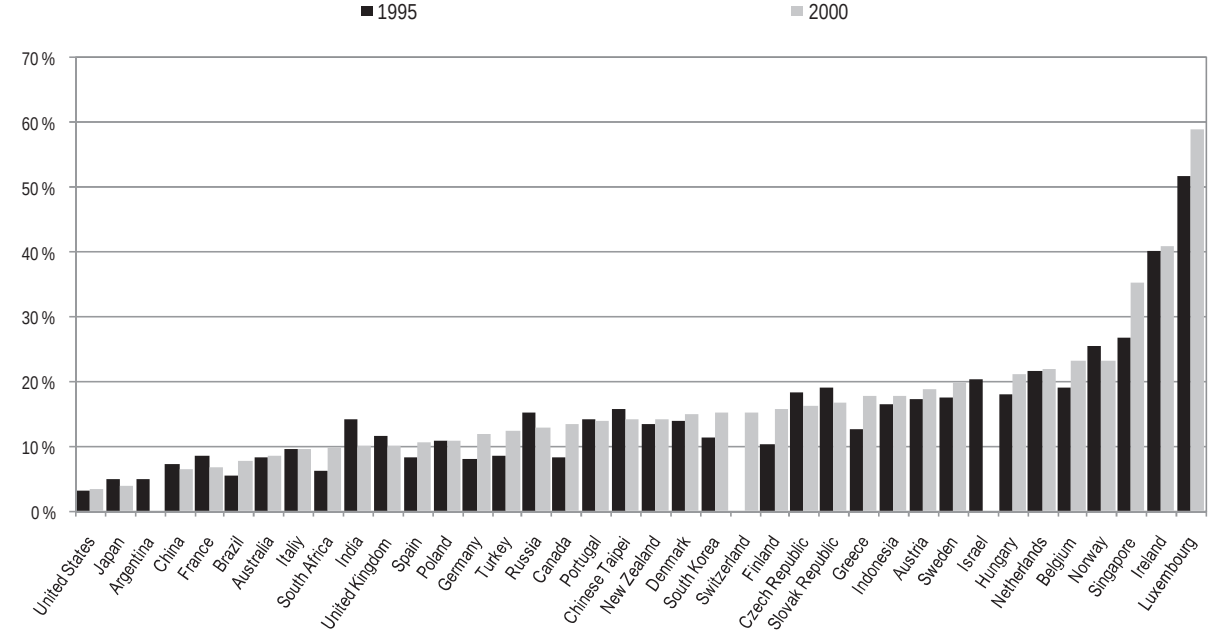


1. 1995 data is 1994/95 for Australia, 1995/96 for New Zealand, 1996 for Turkey, 1997 for Argentina, 1996 for Chinese Taipei, and 1993/94 for India; no data for Iceland, Mexico and Switzerland.

2. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

Source: OECD Input-Output Database.

Figure 2.7. Offshoring, market services[1], 1995[2] and 2000[3]



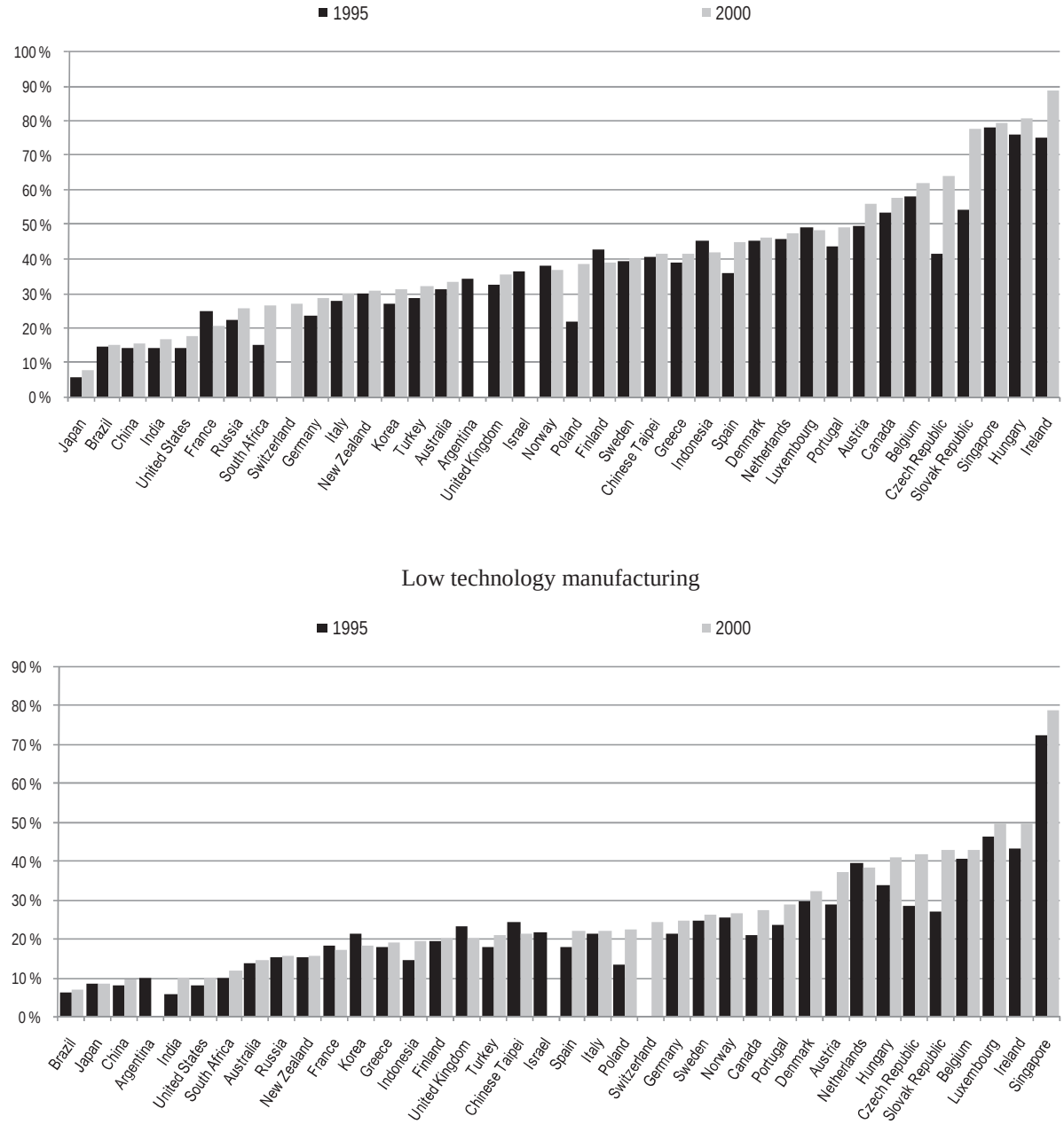
1. Market services ISIC rev 3: 50-74.

2. 1995 data is 1994/95 for Australia, 1995/96 for New Zealand, 1996 for Turkey, 1997 for Argentina, 1996 for Chinese Taipei, and 1993/94 for India; no data for Iceland, Mexico and Switzerland.

3. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

Source: OECD Input-Output Database.

Figure 2.8. Offshoring, higher and lower technology intensive industries, manufacturing, 1995[1] and 2000[2]



Note: Higher technology manufacturing ISIC rev 3 24, 29-35; Lower technology manufacturing ISIC rev 3 15-23,25-28,36-37.

1. 1995 data is 1994/95 for Australia, 1995/96 for New Zealand, 1996 for Turkey, 1997 for Argentina, 1996 for Chinese Taipei, and 1993/94 for India; no data for Iceland, Mexico and Switzerland.

2. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

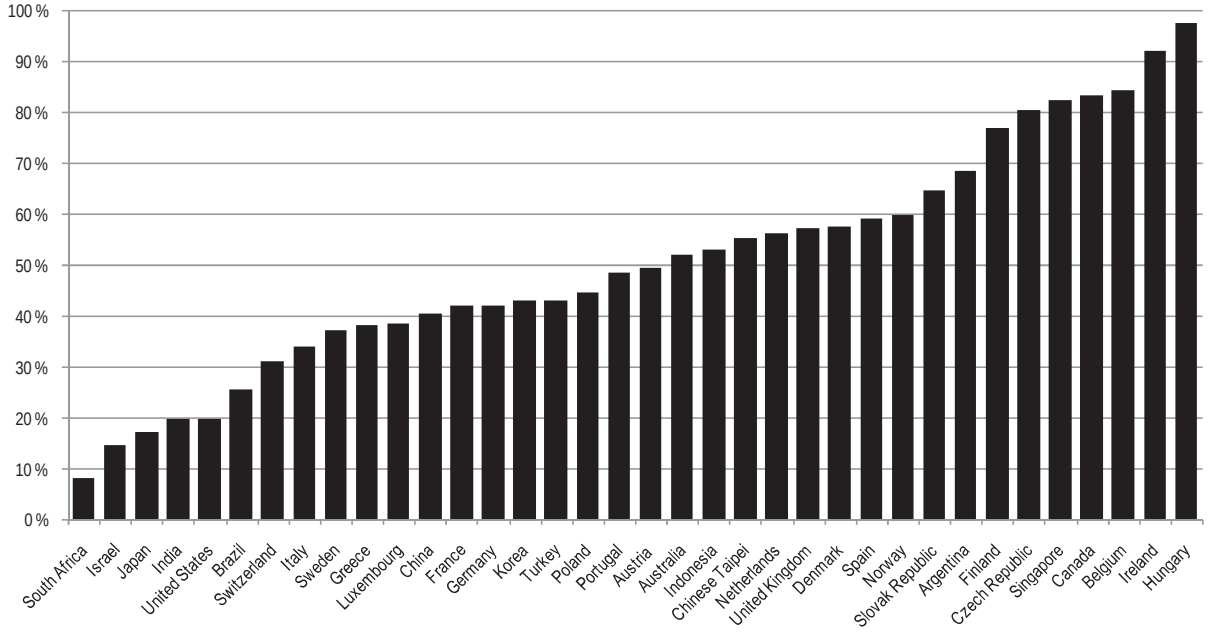
Source: OECD Input-Output Database.

The same offshoring indicator can also be constructed for groups of industries and/or individual industries, providing more detailed insights into the phenomenon of offshoring in today's global economy. Figure 2.8 shows that the sourcing of intermediates abroad is more prominent in higher technology industries than in lower technology industries (higher technology industries are defined as high and medium-high technology industries, ISICrev3: 24,29-35; while lower technology industries are defined as medium-low and low technology industries, ISICrev3: 15-23,25-28,36-37). In most countries the offshoring indicator is higher in the group of higher technology industries than in the group of lower technology industries, reflecting the generally higher complexity of technology-intensive goods as they typically require a broad range of inputs. The level of offshoring has increased in almost all countries in the higher technology as well as the lower technology-intensive manufacturing industries, but sourcing of intermediates abroad seems to have grown stronger in higher technology industries in most OECD countries.

Figure 2.9 presents the offshoring indicators with some internationally open industries as examples: computers, radio/TV/communications equipment and textiles. The offshoring of activities is somewhat higher in the high technology industries, computers and TV/radio/communications equipment, than in the low technology textiles sector. Again, smaller countries are found to source relatively more internationally, especially those countries that have a high presence of multinational firms, an observation that is consistent with evidence reported earlier in this paper.

Figure 2.9. Offshoring, individual industries, manufacturing, 2000[1]

Office, accounting and computing machinery



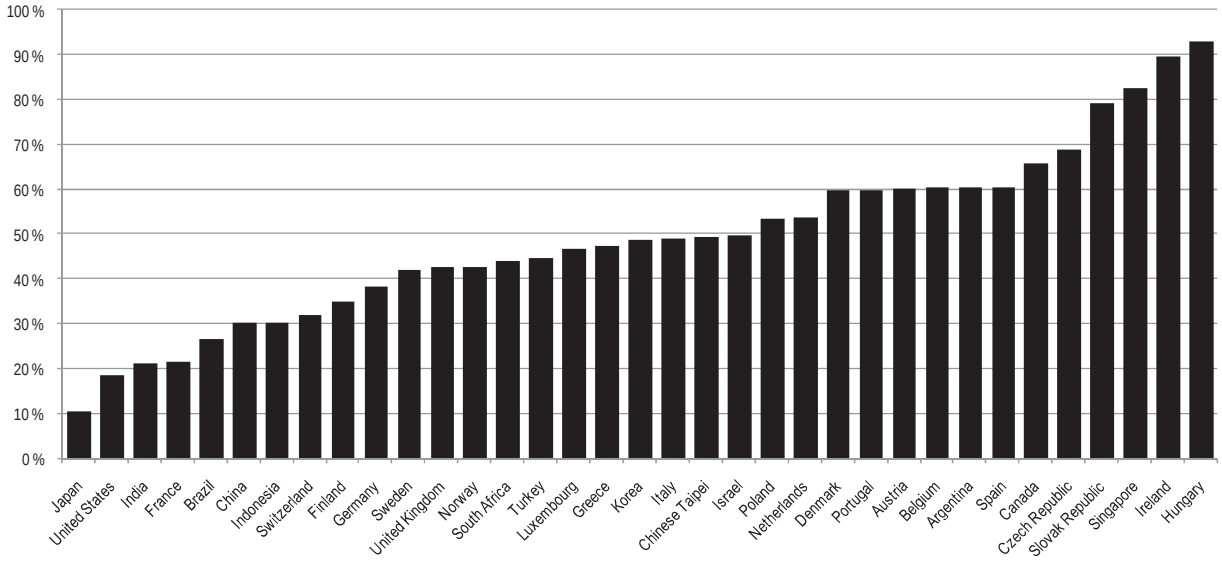
(Figure continues on next page)

1. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; Corresponding industries are not available for some countries.

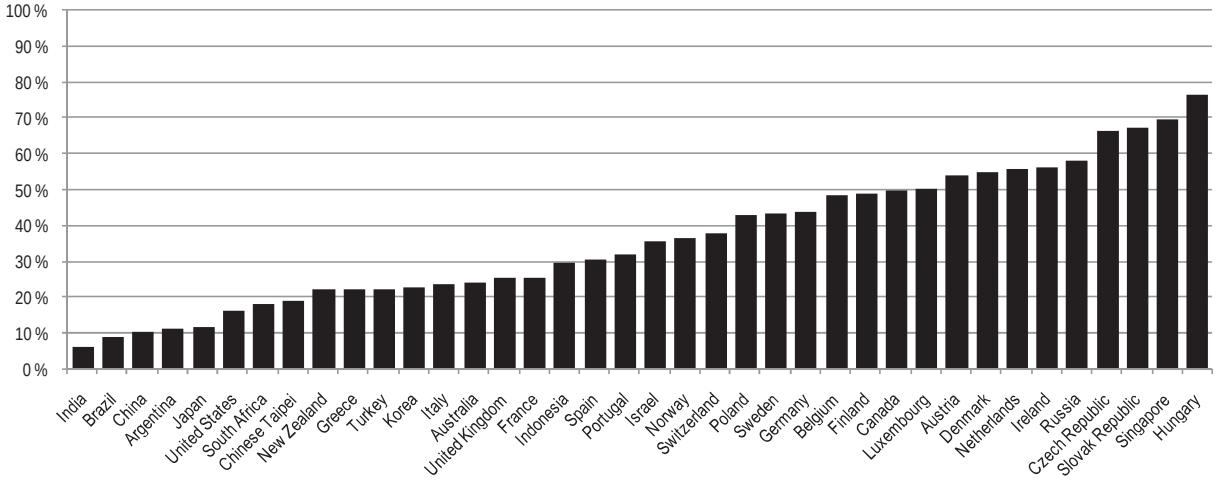
Source: OECD Input-Output Database.

Figure 2.9. Offshoring, individual industries, manufacturing, 2000[1] *(continued)*

Radio, television and communication equipment



Textiles, leather and footwear



1. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; Corresponding industries are not available for some countries.

Source: OECD Input-Output Database.

Calculating higher-order effects: embodied imports and the foreign content of exports

Input-output tables also allow for the computation of indirect effects on national economies in addition to the more direct effects discussed thus far. Instead of looking only at direct imports, it is important to compute the so-called induced indirect imports when analysing the foreign dependency of countries' economies (Ahmad and Wyckoff, 2003). The underlying idea is that direct imports indicate the direct contribution of foreign industries to the national production process, but this gives only a part of the whole story. For example, if a computer manufacturer imports certain components (*e.g.* computer chips) the direct import contribution will be the ratio of the value of these computer chips to the total value of the computer. If the computer manufacturer purchases other components from domestic manufacturers, who in turn use imports in their production process, those imports should also be included in the computer's value in order to have an idea of the foreign dependency of a country's economy.[5]

A (large) part of the intermediates locally produced by suppliers incorporate foreign raw materials, intermediaries such as parts and components, and semi-finished products produced abroad. In order to calculate the total import content, *e.g.* of nationally produced computers, one has to complement the direct imports bought and used directly by the computer fabricants, with the indirect imports, *i.e.* the imports bought and used by suppliers of these computer fabricants. These total direct and indirect imports are known as "embodied imports" and are calculated as:

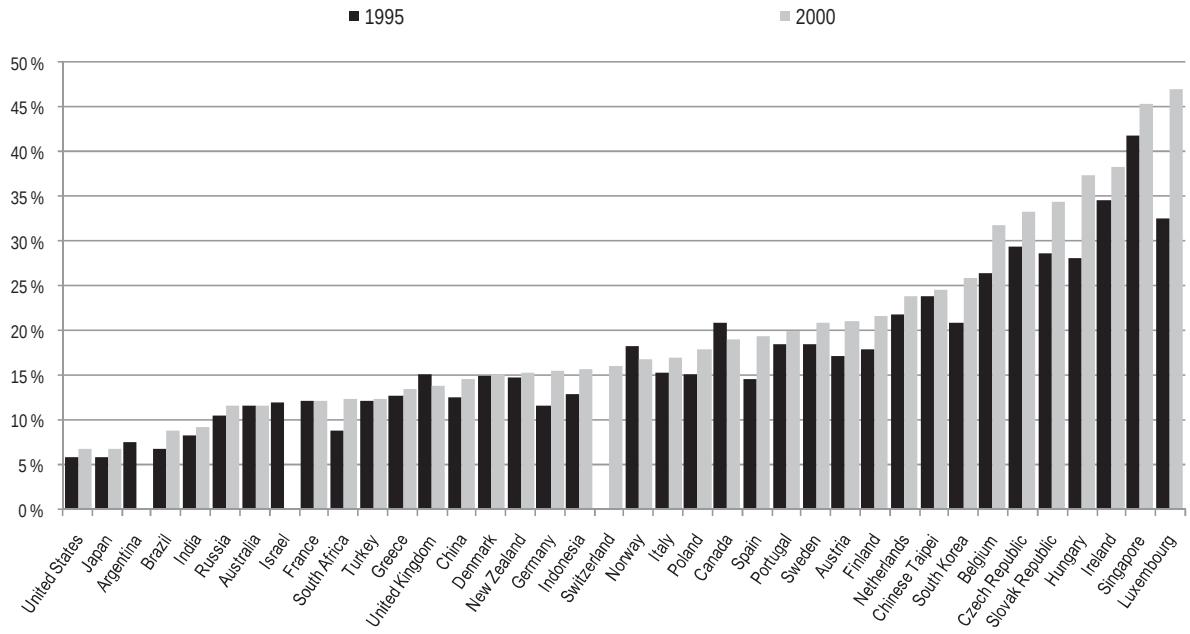
$$IMP.\ CONT. = u * Am * (I-Ad)^{-1} * O/O_k$$

where *Am* and *Ad* are the input-output coefficients for imported and domestic transactions respectively; *u* denotes an 1 x n vector each of whose components is unity, the matrix *O* is an n x 1 vector of outputs, and O_k is total country output.

Figure 2.10 shows that the embodied imports have increased in 33 of the 34 countries, clearly illustrating growing interdependence. Again, there are important differences between countries with relatively low levels of embodied imports, which did not rise strongly between 1995 and 2000 (*e.g.* larger countries like Australia, Japan and the United States). Smaller countries present relatively higher figures than larger countries because of their limited size, while at the same time the inflow of FDI has also contributed to this higher import dependency in these countries. The typical examples re-appear, *e.g.* Luxembourg, Singapore, Ireland and Hungary.

5. Re-exports defined as exports of foreign goods or foreign goods exported in the same state as previously imported, have been excluded from the analysis.

Figure 2.10. Embodied imports, 1995[1] and 2000[2]



1. 1995 data is 1994/95 for Australia, 1995/96 for New Zealand, 1996 for Turkey, 1997 for Argentina, 1996 for Chinese Taipei, and 1993/94 for India; no data for Iceland, Mexico and Switzerland.

2. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

Source: OECD Input-Output Database.

Based on these calculations of embodied imports, the foreign or import content of countries' exports can be constructed using national I-O tables. Input-output tables measure the interrelationships between the producers of goods and services (including imports) within an economy and the users of the same goods and services (including exports). As such, they can be used to estimate the contribution that imports make in the production of any good and service for export. The emergence of global value chains means that imports and exports increasingly move together since the production process of companies is increasingly characterised by sequential production and back-and-forth aspects. As such, exports are based to a large or small extent on intermediate inputs that are imported from abroad, hence the need to qualifythe export performance of countries.

Hummels *et al*. (1998, 2001) have introduced the term "vertical specialisation" in calculating the direct and indirect imported inputs that are included in a country's exports. As a result of global value chains and the corresponding geographical fragmentation of activities, countries become vertically specialised within the production process for some goods or services as companies tend to concentrate different production stages for a single good in each country. The vertical specialisation measures try to reflect this process by which different countries become part of a single production chain, linking the imported inputs required by one country with its exports. Since then several papers have computed the import content of exports for different countries, *e.g.* Yi (2003), Bergoing *et al*. (2004) and Cardoso *et al*. (2007); all found that vertical specialisation has increased over the years, illustrating not only increasing integration but also--and especially--the increasing importance of global value chains.

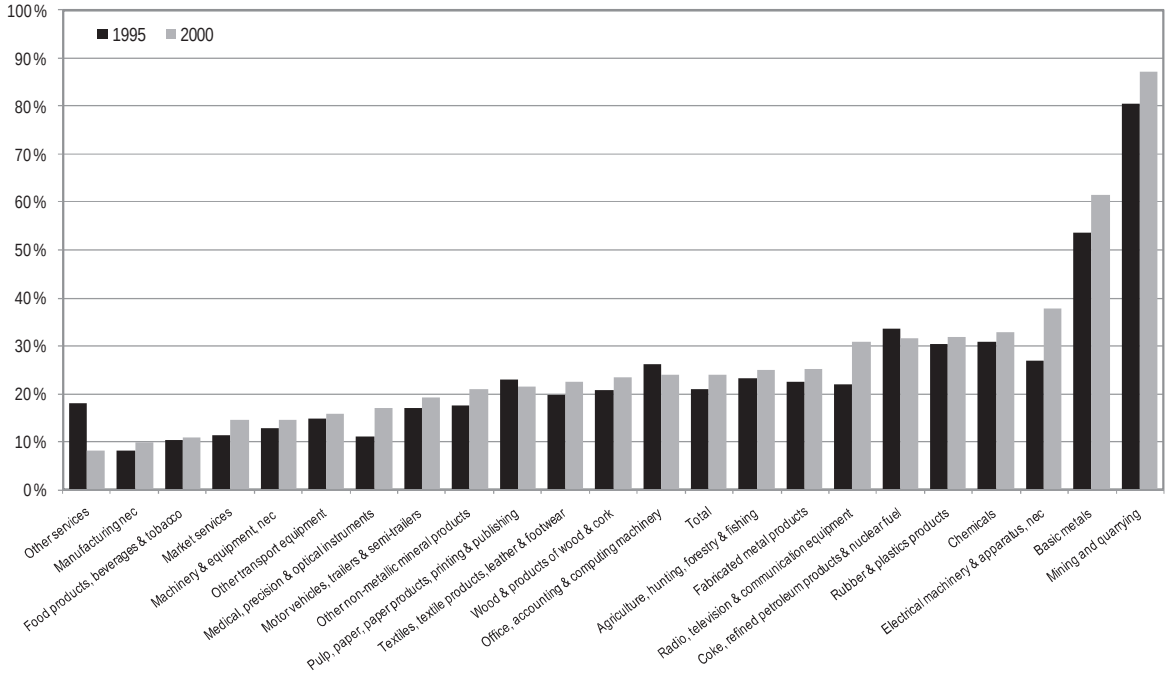
The calculation of the import content of exports using I-O information draws on some implicit assumptions as extensively discussed by the US National Research Council of the National Academy of Science (2006). It is typically assumed, for example, that the same input-output requirements apply for the goods and services that are exported and those that are destined for final demand. Further on, calculations are also based on the assumption that countries' imports originate 100% from foreign sources, which is not necessarily the case and may thus be a source of inaccuracy. However, measuring the domestic content of countries' imports is much more difficult as there is no input-output table that applies to the rest of the world. Notwithstanding these limitations and assumptions, the study concludes that I-O data are the most readily available source of information to gain insight into the increasing dependency of countries' export performance on imports.

The foreign content of countries' exports (FOR.CONT. EXP.) is calculated as:

$$FOR.\ CONT.\ EXP. = u * Am * (I-Ad)^{-1} * X/X_k$$

where *Am* and *Ad* contain the input-output coefficient for imported and domestic transaction, respectively; *u* denotes an 1 x n vector, each of whose components is unity, the matrix *X* is an nx1 vector of exports and X_k is total country exports. An import content of exports of 20%, for example, means that 20% of the exports are directly and indirectly based on imported intermediates.

Figure 2.11. Import content of exports, individual industries, OECD[1], 1995[2] and 2000[3]



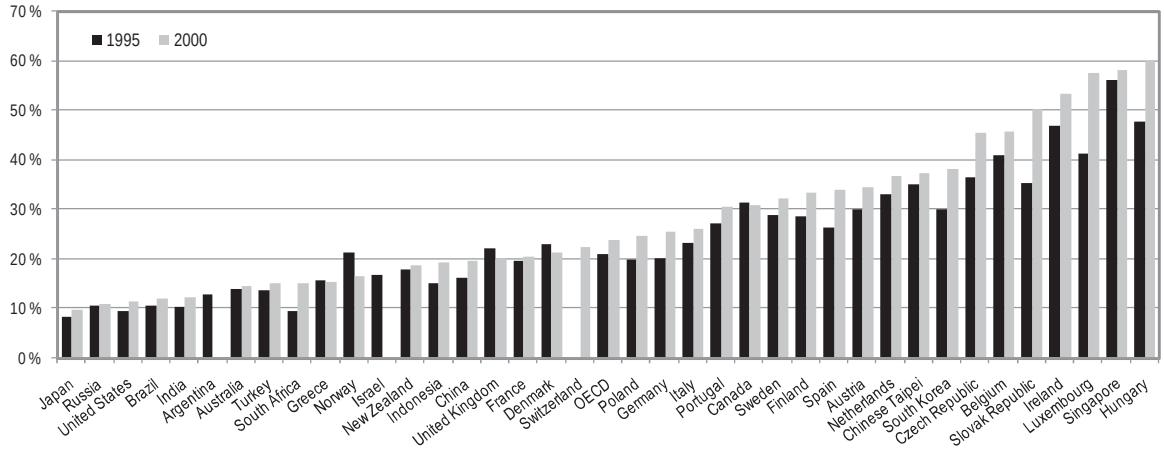
1. OECD excludes Iceland, Mexico and Switzerland for 1995 and Iceland and Mexico for 2000.

2. 1995 data is 1994/95 for Australia, 1995/96 for New Zealand, 1996 for Turkey, 1997 for Argentina, 1996 for Chinese Taipei, and 1993/94 for India; no data for Iceland, Mexico and Switzerland.

3. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

Source: OECD Input-Output Database.

Figure 2.12. Import content of exports, individual countries, 1995[1] and 2000[2]



1. 1995 data is 1994/95 for Australia, 1995/96 for New Zealand, 1996 for Turkey, 1997 for Argentina, 1996 for Chinese Taipei, and 1993/94 for India; no data for Iceland, Mexico and Switzerland.

2. 2000 data is 1998/99 for Australia, 1999 for Greece, 2002/03 for New Zealand, 1998 for Turkey, 2001 for Chinese Taipei, and 1998/99 for India; no data for Iceland, Mexico, Argentina and Israel.

Source: OECD Input-Output Database.

The import content of exports is found to be highest in more basic industries that make heavy use of primary goods (Figure 2.11). Examples are mining and basic metals, but also chemicals and rubber and plastics. A second group of industries that displays a rather high import content of exports includes higher technology-intensive industries that produce modular products. Parts and components are often produced in one country before they are exported to another where assembly takes place. This international division of labour is found in industries such as electrical machinery, radio/television and communication equipment, and office, accounting and computing machinery.

The indicators for the individual countries show that between the mid-1990s and the early 2000s, the import content of exports has increased in almost all countries (Figure 2.12). In larger countries like the United States, Japan and the United Kingdom, exports depend relatively less on the imports of intermediates sourced abroad. The increase in vertical specialisation becomes clearest in countries with a high multinational presence like Ireland, Hungary, the Czech Republic and Belgium, as the international sourcing of intermediates within multinational networks drives the development of global value chains. Foreign affiliates in different host countries produce intermediates that are then exported to final consumers, but also to other affiliates and the headquarters of the multinational company.

Within the group of emerging countries, China and Indonesia demonstrate a larger dependence on imported intermediates. The results for China illustrate the increasing international production sharing within ICT industries, in which the more labour-intensive manufacturing activities are carried out in emerging countries while the more skill-intensive activities remain clustered in developed countries (Srholec, 2007). A triangular trade pattern in the ASEAN region has emerged in which parts and components are produced by more developed economies like Japan, Chinese Taipei and Korea, and then exported to emerging countries like China where the assembly of the different

intermediates into finished products takes place. This restructuring process has particularly accelerated over the last years, suggesting that more recent data would show a higher import content of exports for China (Bolhoul *et al*., 2005; OECD, 2007a).

While the indicator on the import/foreign content of exports is of interest and illustrates important trends, one should refrain from using this indicator without knowledge of policy discussions. The underlying presumption that an increase in the foreign content of exports is problematic, and indicates that a country is losing out in the global competition (US National Research Council, 2006). However, this indicator does not necessarily say anything about the competitiveness of countries, and a growing import content of exports does not necessarily signal shrinking competitiveness. It may even be the opposite if a country successfully integrates the global value chains of high-growth industries. But the import content of exports is above all a descriptive indicator about the (changing) structure and dynamics of countries, that together with other appropriate indicators could be used in discussing countries' competitiveness.

Employment effects – Job embodiment of trade

The OECD I-O database has also been used in a thought experiment similar to the work by Groshen *et al*. (2005) who, on the basis of trade data and input-output tables, calculate the net effect of trade on total US employment. The Groshen study is among the few that not only focuses on the potentially negative consequences of offshoring and the resulting raise in imports, but also on the potentially positive effects of inshoring or exports. Both the jobs that may be lost through imports and the jobs that are created through exports are considered. This approach measures both the number of workers that are needed to produce the goods and services imported into the United States at current wages, prices and productivity levels, and the number of workers that are needed to produce US exports of goods and services. Moreover, by using input-output tables the study also accounts for indirect effects that are associated with impacts on other sectors.

However, it should be stressed that this approach has some major weaknesses because of assumptions relating to constant-factor input shares, no differences in quality between goods, etc. Furthermore, because in calculating the jobs embodied in imports as well as exports we use the industry technologies of the country, it is implicitly assumed that the technologies for import and export goods and services are identical. In addition, the figures are clearly the result of a thought experiment as imports and national production are assumed to be perfectly interchangeable with no costs (*e.g.* in production technology). Lastly and more importantly, because of its static nature, dynamic gains of trade which are typically very important, are not taken into account. As such, the results only give a partial view of trade, and should be interpreted accordingly.

In order to calculate the jobs embodied in trade for individual countries, the analysis firstly computes the number of jobs that would be needed to produce the goods and services imported in each country. This provides a sort of international trade "employment loss", hypothetically assuming that all imports would be replaced by domestic production. Secondly, the "employment gain" of international trade is computed as the number of jobs that are needed to produce the goods and services that are exported from each individual country. By subtracting the number of jobs needed to produce the goods and services imported by each country from the number of jobs needed to produce goods and services exported by that country, a net measure of the employment effect of trade is obtained.

The calculation of jobs embodied in trade makes use of the employment multipliers that are computed on the basis of the national input-output tables for individual countries. These employment impacts are then related to the value of gross imports and exports of individual countries. The employment multipliers provide the estimates of how much employment in the total economy (taking into account direct and indirect effects) will increase if the final demand increases by one unit. The employment multiplier for each industry *i* is calculated as:

$$F_i \, x \, (I\text{-}A)^{-1} \, x \, (O/LC)_{IO}(LC/E)_{STAN}$$

where F_i is a row matrix representing the change in final demand for industry *i* with one unit, $(I\text{-}A)^{-1}$ is the (square) inverse Leontief matrix and $(O/LC)_{IO}(LC/)_{STAN}$ is a column matrix representing the inverse of labour productivity in each industry. LC is labour compensation of employment and IO and STAN refer to the OECD I-O database and OECD STAN database. These employment multipliers are then multiplied by the amounts of exports and imports, thereby assuming that the imports flows to final users in each country are now produced in that country.

The results are presented in Table 2.4; in order to easily interpret the absolute figures, the results are also expressed relative to the total employment in each country. The jobs embodied in trade are on average larger (in relative terms) for smaller countries, given their smaller size and consequently their stronger international orientation. The size of countries, however, is not a prediction of whether countries "win or lose" from international trade; smaller as well as larger countries show positive/negative net impacts of trade on employment. Countries with a positive net employment impact are "winning" from international trade as calculated here: the jobs embodied in their exports (the employment "gain" of trade) exceeds the number of jobs embodied in their imports (the employment "loss").

Overall, the rather small numbers of jobs embodied in net imports relative to total employment clearly suggest that globalisation is not the main explanation for worsening employment performance in some countries. Globalisation is clearly a two-way process where offshoring and imports are compensated by insourcing and exports. Only in countries like Ireland, Portugal and the Slovak Republic does the "employment loss" of international trade seem rather large. Several factors explain these results, such as the rather large trade deficits some East European countries have run as their economic development has accelerated. Ireland, however, reports a positive trade balance; the negative net impact of trade-embodied jobs is explained by the fact that the trade surplus is accumulated especially in non-labour-intensive industries while sector trade deficits appear in low-productive, labour-intensive industries. Once again, it should be stressed that this approach only takes into account static (direct and indirect) effects, and that longer-term, dynamic effects are not included.

Table 2.4. Job embodiment of international trade

	Jobs embodied in imports (thousands)	%	Jobs embodied in exports (thousands)	%	Net (thousands)	%
Australia (1998)	1 382	15.5	1 236	13.9	-145	-1.6
Austria	1 142	27.7	1 057	25.6	-85	-2.1
Belgium	1 219	29.8	1 357	33.2	138	3.4
Canada	3 040	19.9	4 007	26.3	967	6.3
Czech Republic	1 725	35.8	1 772	36.8	47	1.0
Denmark	530	19.4	756	27.7	226	8.3
Finland	515	22.4	597	25.9	81	3.5
France	3 519	14.5	3 754	15.4	235	1.0
Germany	7 703	19.9	8 245	21.3	542	1.4
Greece (1999)	1 092	27.7	786	19.9	-307	-7.8
Hungary	1 390	36.3	1 136	29.7	-254	-6.7
Ireland	837	49.3	619	36.5	-218	-12.9
Italy	4 359	18.8	4 624	20.0	265	1.1
Japan	10 319	15.5	6 359	9.5	-3 961	-5.9
Korea	4 909	23.2	4 994	23.6	85	0.4
Luxembourg	165	62.3	115	43.6	-50	-18.8
Netherlands	1 941	23.9	2 368	29.1	427	5.3
New Zealand	240	18.6	296	23.0	56	4.3
Norway	605	26.3	555	24.1	-50	-2.2
Poland	372	24.7	320	21.3	-52	-3.5
Portugal	1 341	27.7	919	19.0	-421	-8.7
Slovak Republic	857	41.9	753	36.9	-104	-5.1
Spain	3 484	22.1	2 873	18.3	-611	-3.9
Sweden	1 016	23.8	1 219	28.6	203	4.8
Switzerland (2001)	723	22.0	753	23.0	30	0.9
United Kingdom	5 967	20.3	5 793	19.7	-174	-0.6
United States	13 731	9.2	11 463	7.7	-2 268	-1.5

Conclusions and future directions for research

Despite the typical disadvantages of published I-O tables (such as timeliness, sector classifications, etc.), this paper has shown that I-O may be a complementary source of information for measuring and analysing globalisation. Using the OECD I-O database, containing harmonised I-O tables for 38 economies (OECD and non-OECD), different indicators are being developed to allow analysis of some distinctive characteristics of current globalisation. The proposed indicators specifically measure the emergence of global value chains with their corresponding import and export flows of intermediate inputs, and the increasing offshoring of services can be discussed in more detail.

Of course the quality of the indicators presented directly depends on the information gathered within national I-O tables and their international comparability. While I-O tables have been harmonised as much as possible, reporting differences between countries (*e.g.* consolidated accounts, establishment vs. enterprise) may to some extent bias the results.

The OECD I-O database may also be an important instrument for future research on globalisation. Linking the OECD I-O database with bilateral trade data would extend the scope of the analysis; as such the effects of the increasing integration of emerging countries like in the global economy could be studied in more detail. While I-O tables typically allow for the calculation of direct and indirect effects through the total economy, these kinds of analyses are confronted with the traditional limitations of I-O tables (lack of dynamic effects and constant productivity).

The OECD I-O database represents a major input not only for descriptive statistics as I-O indicators could be used in more applied analysis. The impact of the increasing integration of countries on national employment, productivity levels and growth could be discussed in more detail.

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Chapter 3

ENHANCING THE ROLE OF SMEs IN GLOBAL VALUE CHAINS

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This study investigated the transformation that the relation between large and smaller firms in undergoing in the context of the globalisation of value chains. It collected data through more than 20 country/industry and country/enterprise case studies in five representative industrial sectors, which were selected to illustrate emerging patterns in manufacturing and service sectors where the value chains show a significant presence of SMEs as suppliers and subcontractors. These included the automotive, scientific and precision instruments, software, tourism and cinema industries. The study findings show that, across sectors, successful participation in global value chains brings stability and growth opportunities to SMEs. This is often achieved by the upgrading of technological and human capital as a result of the greater exposure and facilitated access to information, business practices and technologies that SMEs in global value chains experience. However, many of the SMEs surveyed revealed a lack of awareness about the complexity of the issues at stake, which unfortunately plays against their ability to respond to the challenges of globalisation in a timely and effective manner. Other problems include their limited managerial and financial resources, and insufficient ability to upgrade their technology and protect in-house innovation. Governments could facilitate SMEs' gainful participation in global value chains through policy initiatives in specific areas.

This chapter is a summary of the report "Enhancing the Role of SMEs in Global Value Chains", which was presented to the OECD Working Party for SMEs and Entrepreneurship in 2006.

Introduction

While underway for decades, the globalisation process has recently taken an accelerated pace, as shown by the substantial growth of world imports and exports since the 1980s and, more recently, of FDI. The way production of goods and services is organised has also changed. Most notably, the set of productive activities that leads a product from conception to the market is increasingly spread across several enterprises and countries. While the reasons are known why such a complex organisation of production emerged, less evident are the effects that the globalisation of value chains has on small and medium-sized enterprises, which are more followers than leaders in this process. This study is concerned with the issue of how globalisation of value chains and of large enterprises affects the role of SMEs as traditional partners, suppliers or distributors for larger firms. It aims to explore the benefits of SME participation in global value chains and the advantages this brings to SMEs, and to propose policy actions when appropriate.

The phenomenon of globalisation of production can be analysed through the notion of the industry value chain. The value chain model has been extensively used by researchers to map the linkages and networks at the firm and industry level, and to analyse where value resides at these two levels. At the firm level, the basic model of Porter (1985) helps determine which specific activities give organisations a competitive advantage and build their value. The activities are divided into *primary activities* (those that enable the firm to fulfil its role in the industry value chain and hence satisfy its customers) and *support activities* (those which are necessary to control and develop the business over time and thereby add value indirectly). The effective management of primary and support activities generates margins for the firm. In other words, the organisation is able to deliver a product/service for which the customer is willing to pay more than the sum of the costs of all activities in the value chain.

The analysis of the value chain at the firm level is meant to investigate the creation of value within the firm, and to identify the points in the internal chain where the value can be more successfully created. An enterprise's value chain for competing in a particular industry is embedded in a larger stream of activities that are referred to in the literature as the industry value chain. Upward, this includes suppliers, and distribution channels downward: a company able to manage effectively the entire industry value chain can gain a competitive advantage over its competitors. In light of this, one central issue in the value chain approach is that of value chain 'governance'. This term is used to describe all efforts aiming to systematically reduce any source of uncertainty in supply and demand through the active co-operation of the key actors in the value chain. By reducing uncertainty, information and trade flows are improved and overall costs reduced. However, this also means that some firms in the chain determine and impose the parameters under which others in the chain operate.

The representation of value creation as a chain, *i.e.* a sequence of activities performed one after the other, was essentially based on a manufacturing/retail view of industry. However, the chain model is less appropriate for representing an enterprise's activity and its relationships with customers and suppliers in many business sectors, particularly in service industries. Alternative models of value creation, called 'value configurations',

have therefore been developed to describe and analyse firm-level value creation across a broad range of industries.[6]

While it is important to understand the purpose of value creation analysis at the firm level, this study mostly deals with the notion of the value chain at the industry level and uses the term "chain" in a broad sense, integrating the idea that the creation of value in some business sectors may be portrayed by configurations other than a chain, *i.e.* as a network of activities and not a sequence. In this meaning, the notion of a value chain allows for analysis of several critical aspects of the phenomenon of globalisation of production: the production process as a set of value-adding activities performed by separate entities; the fragmentation of activities across multiple enterprises and countries; the distribution of productive tasks along the chain; and the type of co-ordination between firms in the chain, often involving asymmetry of power and information.

Also, the notion of a value chain highlights one specific aspect of the links between firms, which is the economic linkage of value addition in the full range of activities that is required to bring a product from its conception to its end use. Indeed, value addition is key. It is mainly the pursuit of those productive activities with the highest return that make lead firms in the value chain decide on which activities to keep in-house and which to outsource. The distribution of tasks and the positioning of firms along the chain at stages corresponding to low or high-value activities are largely determined by lead firms. Small firms rarely act as the lead firms of the chain.

Methodology of the study

A sectoral approach was adopted taking into account that globalisation affects different sectors in different ways and that the role of SMEs across sectors varies. In the perspective of conducting field work, the project identified five representative industrial sectors to be analysed through country/industry and enterprise/country case studies. The five industries, which were selected to illustrate emerging patterns in manufacturing and service sectors where the value chains show a significant presence of independent or affiliate SMEs acting as subcontractors or suppliers, included:

Two manufacturing industries:

- *The automotive industry:* this industry has changed dramatically over the past 20 years, in particular as concerns the supply and distribution networks, where many SMEs used to play a relevant role.
- *Precision and scientific instruments industry:* medium-sized enterprises in this industry still play a rather important role. However, as the markets are becoming more and more global, the industry is moving toward the provision of "service and product" packages and the strategic role of large global players seems to increase.

Two services industries:

- *The tourism industry:* this industry has become global, with its major players extending their co-operation to reach small or medium sized local players (franchising, management contracts, global reservation systems, branding). The study covered

6. Stabell and Fjelstad (1998) developed two alternative value *configuration* models as an addition to Porter's value chain model: value workshop and value network, describing, respectively, problem-solving activities (for example, advertising agencies and professional services organisations) and establishing contact, intermediary and dissemination activities (such as insurance companies, banks, telecommunications companies and airlines).

several segments, namely the hotel industry, the tour operator industry, and the travel agency industry.

- *The software industry:* this is a recent industry and yet one of the most globalised, subject to rapid and fundamental changes in production and distribution. Along with large and multinational firms, SMEs have an important role in the market, including providing support tools and a constant flow of independent ideas and concepts.

One creative/entertainment industry:

- *The film production and distribution industry:* in this industry the complementarity between the content providers and the distribution channels is crucial. The methods of collaboration of these two sets of enterprises, their relative size and strategic strengths changed dramatically with the generalisation of digital and telecommunications technologies in the 1990s.

Data for this project were gathered from two main sources: structured interviews with a limited number of large enterprises and their upstream and downstream partners for each of the selected industries; and country studies conducted through semi-structured interviews based on a questionnaire with a representative group of SMEs in the selected industries that explicitly or implicitly act as suppliers and/or distributors in global value chains. Overall, *the project undertook 17 country/industry case studies and seven in-depth enterprise case studies.* The latter were co-ordinated by UNCTAD and involved Colombia, Egypt, India, Mexico, Nigeria and South Africa. Table 3.1 shows the distribution of case studies by country and industry.

Table 3.1. Breakdown of case studies by industry and country

Manufacturing		Services		Creative industries	
Automotive	Australia Chinese Taipei Japan Spain Turkey India – Tata Motor Mexico - VolksWagen South Africa - Toyota	*Tourism*	Australia Austria German/Jordan Korea Poland Spain (Andalusia) Spain (Balearic Islands) Switzerland	*Film production and distribution*	Korea United States Colombia- RCN and Caracol Nigeria – Nu Metro
Precision and scientific instruments	Australia	*Software*	Turkey Egypt - Microsoft		

A reasonable level of homogeneity in the case studies was ensured through the predisposition of a questionnaire used during the semi-structured interviews. In particular, the following core set of questions was covered by questions put to the interviewees: *the awareness and understanding of the global value chains and its participants*; *the co-operation with the global value chains and the sort of links*; *the relevance of technological skill, standards and intellectual property rights*; and *the role expected from the public government*. As an additional precaution, the analysis of the field work findings has taken into account the following aspects:

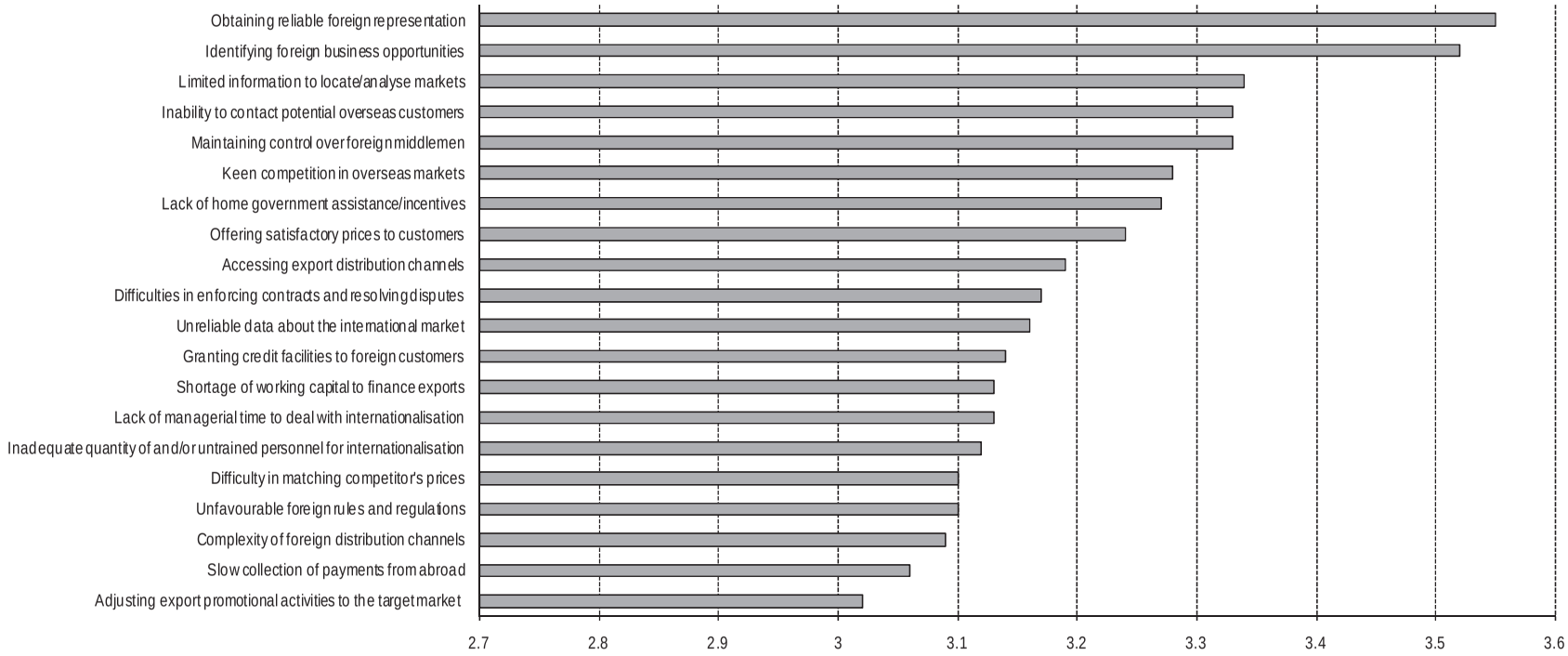
- Research team: The case studies have been carried out by researchers belonging to different types of institutions, namely ministries, universities, research institutes and consultancies.
- Country and sector: The background context of each case study is determined by the specific conditions in the country and sector of reference.
- Coverage/sample: The number of firms interviewed for each case study varies from a dozen to a few hundred, although the average is around 20. The selection criteria for the sample of enterprises, however, were always based on representativeness of the selected firms in the sector of reference.
- Period of time: The case studies were completed over different time periods between July 2005 and April 2007.

Production in global value chains

Opportunities for SMEs

SME participation in global value chains has to be placed in the broader context of SME internationalisation. The re-organisation of production at the international level and the development of global value chains are having significant effects on SMEs, in particular by expanding their business opportunities. In general, reaching international markets is a problematic step for SMEs. A recent OECD-APEC survey, carried out in the context of the study "Removing Barriers to SME Access to International Markets", investigated the type and intensity of barriers in accessing international markets perceived by SMEs. The survey found that these firms feel that their full participation in the globalisation process is hampered by numerous internal and external obstacles (Figure 3.1). It seems that SMEs consider their internal capabilities and resources as inadequate, and suffer from insufficient self-confidence in approaching international markets, expressed by the perception of obstacles such as difficulty in identifying foreign business opportunities, maintaining control over foreign middlemen or accessing export distribution channels.

Figure 3.1. Obstacles to internationalisation as perceived by SMEs



Note: SME Survey carried out between January and July 2006. Responses received from a total of 978 SMEs in OECD and APEC economies, with a high degree of concentration within just seven OECD member countries: Canada, Greece, Switzerland, Turkey, Japan, Spain and New Zealand. Barriers are ranked using the Likert-Scale ranking method, from 5 (very significant) to 1 (not significant).

Source: OECD WPSMEE, Removing Barriers to SME Access to International Markets, 2006.

In particular, in developing countries, only a limited number of SMEs are well prepared for the new conditions and increased competition encountered in global markets, thus limiting those who benefit from the opportunities opened up by globalisation (UNCTAD, 2005). On the contrary, trade liberalisation increases the ability of well-established foreign manufacturers and retailers to penetrate remote and underdeveloped markets, and makes it increasingly difficult for SMEs in developing countries to survive or at least maintain their business position in the local and, if applicable, global market. An emerging opportunity to reap the potential benefits of global trade is represented by the integration of SMEs into international chains of production at various stages of added value, through the establishment of linkages with larger firms and foreign affiliates. These linkages may represent the way for the SME sector, or at least for its segment with highest growth potential, to access a series of critical missing resources, the most important of which are access to international markets, finance, technology, management skills and knowledge, and to engage in a mutually beneficial relationship. In this respect, it is worthwhile noting that in the past developing countries have succeeded in complex industrial exports without going through MNE networks, by building the necessary indigenous base of technological capabilities. However, the changing international context and the growing role of MNEs in the work production and trade suggests that much of the growth of exports in the future will be situated in or around MNE production systems (UNCTAD, 2004).

Accessing new markets, entering new product and service niches

In both industrialised and developing countries, two phenomena have characterised the past decades and contrasted the impact of actual or perceived barriers to SME access to international markets. First, the use of ICT technologies and related services and improved transport facilities have importantly contributed to overcoming SME isolation and eased small firms' access to markets well beyond national boundaries. Previous OECD work, which analysed the extent of diffusion and uptake of ICT technologies among SMEs, highlighted the benefits of ICT use for these firms in terms of extending their network of business partners and reaching new customers with greater ease and at lower costs (OECD, 2000).

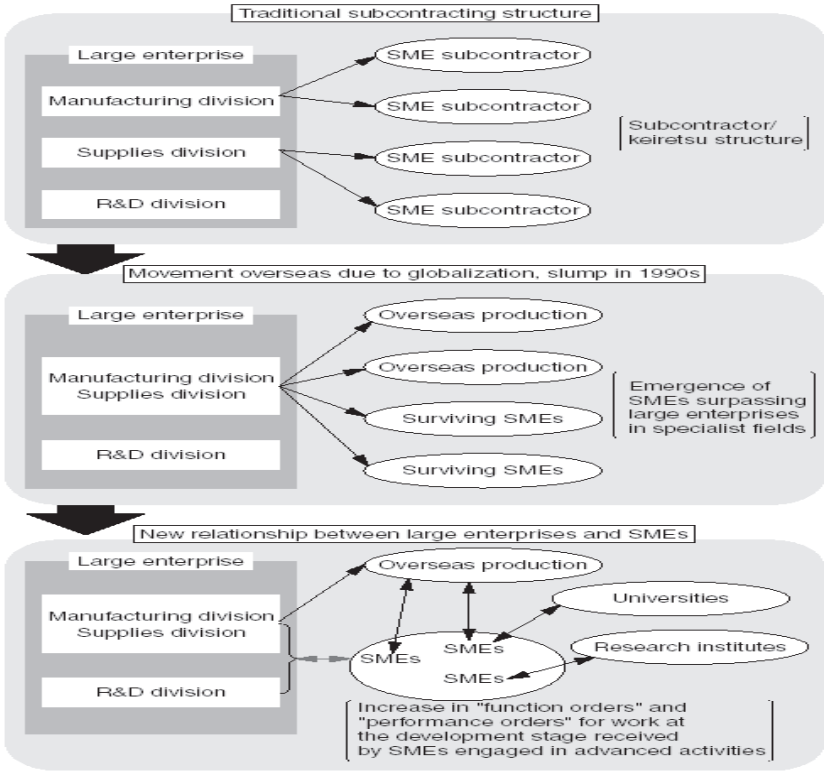
Second, the fragmentation of production together with the development of ICT technologies creates new entrepreneurial possibilities for SMEs. New niches for the supply of novel products and services continuously emerge where the small firms can position themselves, exploiting their flexibility and their ability to move quickly. Small firms with quality tangible and intangible assets, such as niche products and advanced technologies, are becoming partners in international strategic alliances, targets of cross-border mergers and acquisitions, specialised suppliers to MNEs, and participants in actual and virtual business networks on a global level (Sakai, 2002). In manufacturing sectors such as automotive and precision and scientific instruments, small firms that focus on multipurpose technologies have secured their position in the market by becoming specialised suppliers serving different global value chains.

The considerable spreading of subcontracting has benefited SMEs. It has opened business opportunities and brought more stability in the volume of work. Participating in global value chains as subcontractors also provides indirect access to global markets at lower costs than those faced by individual small-scale producers, due to the intermediary role assured by the contractor. Another advantage is exposure to learning processes among partners in global production networks (for instance, from the dissemination of business concepts) and this offers possibilities for human and technological capital

upgrading. Although subcontracting *per se* does not necessarily imply much co-operation between the two parties, some tasks do demand a significant amount of co-operation in order to be fulfilled.

There are different subcontractor profiles[7], with an important phenomenon being the increasing complexity of tasks required from subcontractors in several industrial sectors. The evolution in subcontracting relationships between large firms and their smaller counterparts in recent decades is illustrated in Figure 3.2, with reference to Japanese firms.

Figure 3.2. Changes in subcontracting structure, Japan



Source: Japan's 2005 White Paper of SMEs, SME Agency, Japan.

Electronic marketplaces

Electronic B2B marketplaces are a tool used by large and multinational firms to manage orders to suppliers and subcontractors and the flow of information with them. They can be vertically focused on particular industries, or they can be horizontally focused to provide goods and support services across a wide variety of industries. Over the past decade, many large companies have set up their own electronic trading platforms to procure goods and services, while others are using third-party e-marketplaces. For all of these firms, the objective is to better control their supply chain and rationalise cost and information at each stage of the chain.

7. See *OECD Handbook of Economic Globalisation Indicators*, 2005.

The use of e-marketplaces seems to be predominantly buyer-driven. SMEs are under inreasing pressure to use e-marketplaces as a condition to continue supplying their traditional customers. SMEs have to partake in reverse auctions[8] using their customers' e-marketplace, but they find it difficult to assess whether buyers' priority is reducing the price level or gaining efficiency in terms of improved process time. Evidence on the outcomes from participation in auctions and SMEs' perception of this tool is mixed. Some suppliers consider e-marketplaces as tools for buyers to limit prices by looking for new suppliers (Kjølseth, 2005). This is consistent with another finding of recent research in this area, namely that buyers are often not willing to invite suppliers with whom they already have a long-term relationship to e-marketplaces. However, there is also evidence that a very large share of online auctions is awarded to the existing supplier. Also on the positive side, some SMEs recognise that participation in e-marketplaces has allowed them to increase their global exposure and to secure contracts that they otherwise may not had received.

Overall, SMEs are still reluctant towards e-marketplaces, partly due to a lack of awareness, although many real barriers may also prevent them from fuller participation. According to recent research, SMEs find it difficult to judge which of the many e-marketplaces to trust and how one type of e-marketplace distinguishes itself from another (for instance, vertical versus horizontal e-marketplaces) (European Commission, 2002; Kjølseth, 2005). Different standard requirements for products and services are another obstacle since this raises the entry cost to participate in different e-marketplaces, which can be already relatively high for small firms. Finally, many small firms are worried about unfair practices, such as price fixing, in online auctions.

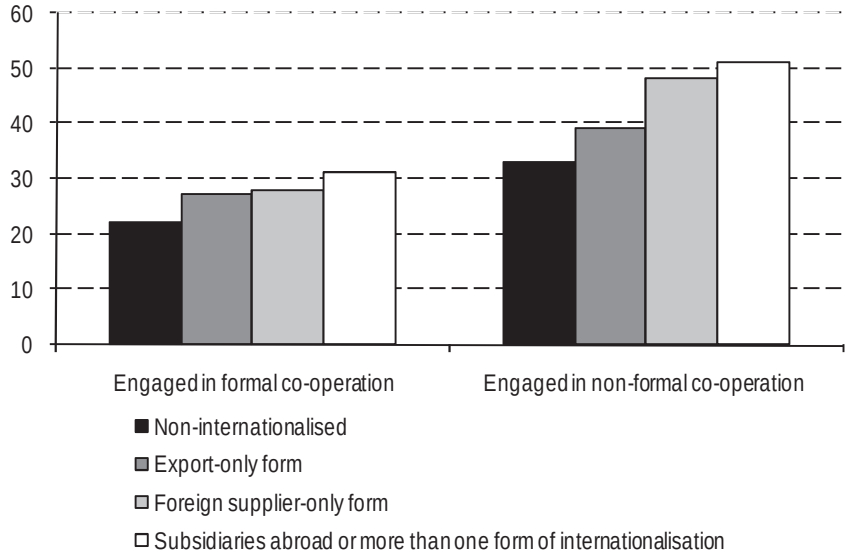
Rationalising production: offshore outsourcing and acquisition of strategic assets

With the development of ICT technologies and the emergence of a global supplier base, outsourcing -- including offshore outsourcing -- has become a viable option also for small firms. As is common with large firms, SMEs increasingly choose to outsource tasks when this allows them to gain competitiveness from rationalisation of production and optimisation of resource allocation. In many cases, it is the decision to follow the contractor abroad that determines the offshoring strategy. While difficult to measure, the increased recourse to outsourcing and offshoring by SMEs has been recorded in recent SME surveys (2003 Observatory on European SMEs; and Japan's 2004 and 2006 White Paper on SMEs). Recent studies from UNCTAD (2005) reveal that even SMEs in developing countries and economies in transition increasingly try to enhance their competitiveness through FDI that provides them with access to strategic assets, technology, skills, natural resources and international markets.

A European survey carried out in 2003 found that more than one-third of the surveyed SMEs with subsidiaries abroad had no exports (European Commission, ENRS Survey 2003). This suggests that the creation of foreign subsidiaries by SMEs is not always intended as a sales platform for the company's products, but can also be a platform for access to cheap labour (*e.g.* via sub-suppliers) or access to knowledge and technology. The survey findings also indicated that internationalised SMEs are more prone to co-operation whether by formal (such as agreement or contract) or informal terms with other firms, both domestically and abroad, as compared to other non-internationalised small firms (Figures 3.3 and 3.4).

8. A reverse auction is an electronic auction where suppliers bid online against each other for contracts against a published specification.

Figure 3.3. SMEs in formal and non-formal co-operation



Note: The ENRS survey groups the surveyed SMEs according to the following forms of internationalisation:

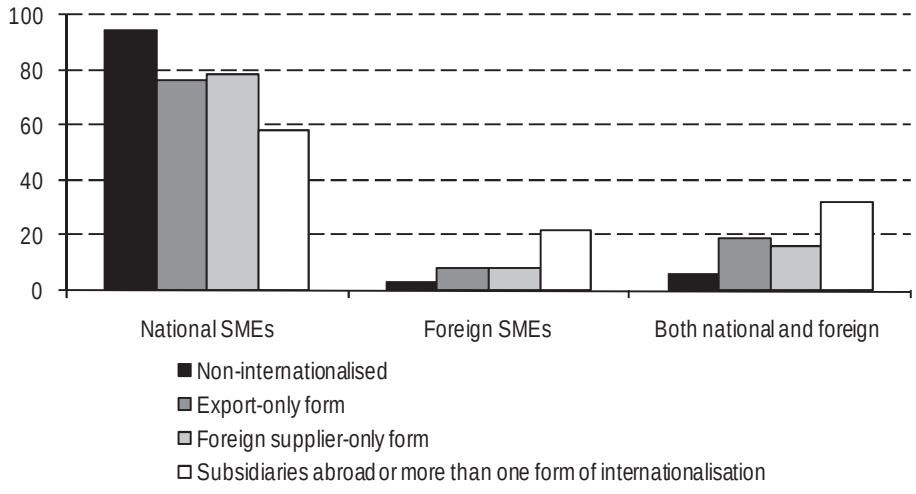
1. Foreign supplier (importing) as the only form of internationalisation.

2. Exporting as the only form of internationalisation.

3. Subsidiaries, branches and joint ventures abroad, or a combination of more than one form of internationalisation. The figure shows percentages for each typology.

Source: EC, ENRS Enterprise Survey 2003.

Figure 3.4. National or foreign SMEs as important partners in co-operation

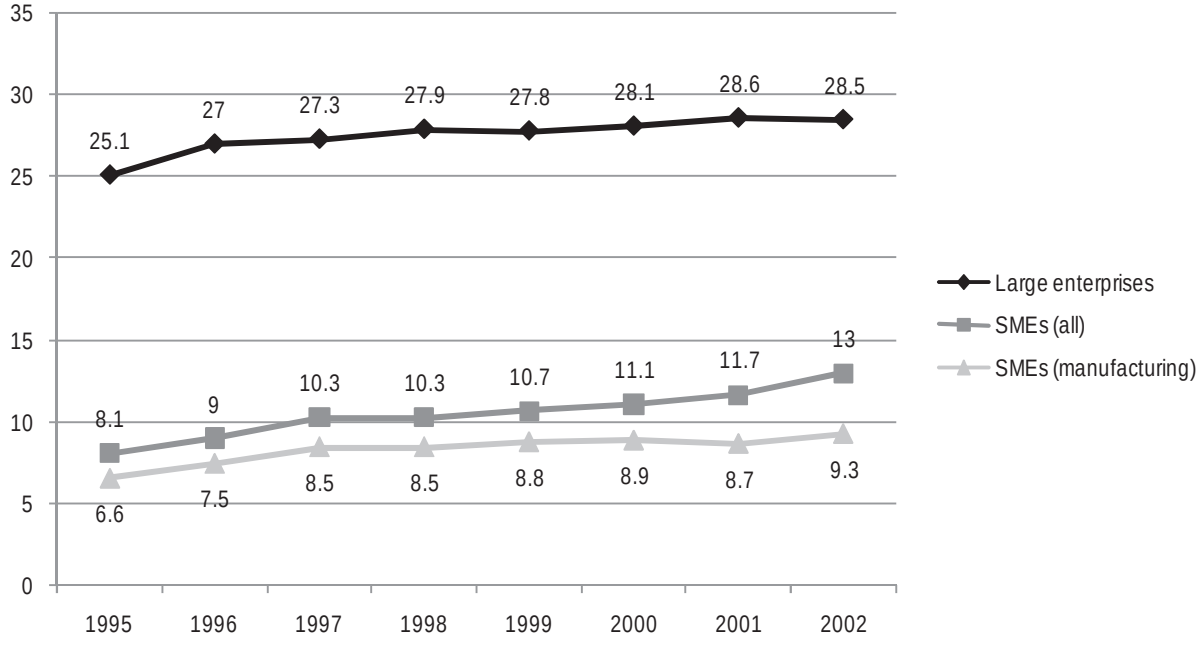


Note: See Figure 3.3.

Source: EC, ENRS Enterprise Survey 2003.

In Japan, the proportion of SMEs with overseas subsidiaries has increased constantly since the beginning of the 1990s, in particular in manufacturing (Figure 3.5). The purposes of establishing subsidiaries change according to region, with sourcing cheap products and cutting costs being the first reason in China and in newly industrialising economies (Hong Kong, China; Chinese Taipei and Korea). At the same time, the increase in overseas direct investment has also been accompanied by a rise in the number of withdrawn overseas subsidiaries of SMEs, with a higher share of withdrawal for joint ventures than for independent ventures. This is probably a sign of the difficulties SMEs encounter in managing operations outside their domestic market (OECD, 2005a).

Figure 3.5. Proportion of Japanese companies with overseas subsidiaries



Source: Japan's 2004 White Paper on SMEs.

Typically, small firms estimate that the savings associated with offshore sourcing are likely to be outweighed by the cost and risk of establishing an offshore operation. The difficulty of managing outsourcing of activities in countries with different languages and cultures may represent a relevant barrier to SMEs. Despite these problems, recent empirical evidence shows that SMEs can be successful in outsourcing abroad (Value Leadership Group, 2005). This depends on the fact that these SMEs have adopted an overall strategy with respect to outsourcing that goes beyond cost-cutting. Indeed, it is not easy to gain a competitive advantage based solely on a cost advantage, because sooner or later competitors are eventually forced to follow an offshore strategy. SMEs that have been successful are those that choose overseas partners with complementary competencies and a qualified labour force, thus adding to their comparative advantage at home and that of their partners. Among European IT SMEs, those successful in outsourcing offshore marked a step towards restructuring the firm's business model, allowing it to stay in the market and even remain competitive.

Challenges for SMEs

Overall, the globalisation of value chains constitutes a major challenge for small and medium-sized subcontractors that are used to serving local and national markets. Even when SMEs do not follow their contractors in international markets but rather stay at home, they still feel compelled to conform to those international standards for technology, quality, delivery and after-sales service that evolve in their industry. Also, small subcontractors have to adapt routines and practices developed at the local and/or cluster level to administrative managerial practices set by international buyers.

Also, network relationships have gained great importance in global value chains as a mechanism of co-ordination between firms, whereas co-ordination was once more polarised between a market-based relationship on one side and vertical integration (where a firm segments its activities along a number of domestic or foreign affiliate companies) on the other. The critical feature is that this type of relationship between a firm and its suppliers is not based on ownership, but nevertheless implies a degree of co-ordination which can be very high. Network relationships comprise a spectrum of possibilities going from low to high levels of co-ordination and power asymmetry between buyers and suppliers.[9] Relying on factors such as the ownership of brand names, proprietary technology, or the exclusive information about different product markets, lead firms act as governors of the chain by setting the conditions of the participation of the other agents in the chain. These would include, typically, process and product standards, quantity and terms of delivery (Humphrey and Schmitz, 2004).

For an increasing part of manufactured and semi-manufactured goods and services with a medium to low technological content, contractors now have a large base of suppliers available. For these products, the costs of changing suppliers are not high as compared with the situation for non-standard and high-tech products that are associated with a degree of specialisation and customisation that increases agency costs. Evidence suggests that many SMEs in OECD countries have registered a decrease in orders from their main buyers that choose to subcontract abroad where lower cost conditions can be found (see, for instance, Japan's 2005 White Paper on SMEs). For some small companies, this has implied the closure of their business.

The parallel phenomenon of increased outsourcing of customised inputs or services, for which agency costs are an issue, raises a different range of problems. In some cases, a supplier may need to make significant investment to develop relationship-specific assets necessary for the transaction. For instance, a part that a seller customises for a particular buyer is a specific commodity and any investment that the seller must undertake specifically as a result of the customisation is a relationship-specific asset. The need for relationship-specific investments in different global value chains might create a situation where some suppliers, especially small firms, become captive to the buyer. In France, 85% of the respondents to a survey of subcontractors in the automotive sector declared to be unsatisfied with the prevailing market prices, which they consider as too low (Usine Nouvelle, 2006). They reported that the cost reduction requested by contractors was between 10% over one year and 20% over three years.

9. Gereffi *et al.* (2005) observe the emergence of networks as a predominant form of co- ordination (or governance) between firms in value chains; they distinguish, in particular, three types of network relationships: modular, relational, and captive.

In other cases, a firm's participation in a global value chain might imply downgrading its functions in order to respond to the conditions imposed by the lead firm. For example, SMEs in one of the most reputed Italian shoe clusters have agreed to focus only on manufacturing and abandon conception and design tasks (Rabellotti, 2003). Although these firms succeeded in remaining competitive in the global market compared to other competitors, the effects of the functional downgrading in the medium and long term need to be evaluated, in particular if this is associated with loss of local skills.

This problem illustrates the difficult choices that SMEs may have to face when exposed to the international market. The market structure on the international stage may not necessarily be the same as at home. For example, at home, the SME may be a supplier to a market of many similarly sized buyers. However, with international exposure comes possible entrance into an oligopsonistic or monopsonistic market (*e.g.* Wal-Mart and its suppliers). While the decision to not sell to the dominant buyers in these markets may mean a substantial loss in potential sales and profits, the decision to deal with the dominant buyers can result in reduced profit margins due to asymmetries in contract negotiation and a loss of control in production decisions.

Supplier financing

The participation of small firms in global chains is also challenged by the fact that these firms may find it difficult to finance their production cycle, since after goods are delivered most buyers demand 30 to 90 days for payment. Specific financial tools (such as, for instance, "factoring" and "reverse factoring"[10]) have been created to provide financing of working capital to small suppliers. In Mexico, the Mexican Development Bank has promoted a supplier financing programme based on reverse factoring, which links large private and public companies and their SME suppliers.

Developing countries perspective

In developing countries, local component firms are finding it increasingly difficult to withstand the pressures of global sourcing. The pervasive pressure on MNEs to reduce their number of suppliers has increasingly the effect of removing many developing countries SMEs from the supply chain. In producer driven GVCs, in particular in the vehicle, capital goods and electronics industry, this is at the origin of continuously declining local ownership. For example, data show that the auto component sector is uniformly changing, from locally owned firms using local technology, to suppliers using proprietary technology from one of the global first-tier suppliers, preferably within an FDI relationship (Kaplinski, 2004). In this case, the challenge for an SME is typically how to engage with second-tier or third-tier suppliers, as first-tier suppliers are usually large multinationals in their own right.

10. Factoring is a type of supplier financing in which firms sell their credit-worthy accounts receivable at a discount (equal to interest plus service fees) and receive immediate cash. There is no debt repayment and no additional liabilities on the firm's balance sheet, although it provides working capital financing. Factoring is not a loan but a comprehensive financial service that includes credit protection, accounts receivable bookkeeping, collection services and financing. In reverse factoring, the lender purchases account only receivable from high-quality buyers (*i.e.* large internationally accredited firms) so that the credit risk is equal to the default risk of the buyer and not that of the SME (Kappler, World Bank, 2004).

The company case studies carried out in the automotive sector in India and South Africa show that large opportunities in second-tier sourcing have consistently emerged. To a large degree, independent local suppliers seem not to have managed to either link with global sourcing partners or build their own capabilities and resources to become global sourcing partner. On the other hand, however, developing countries SMEs are increasingly working with global sourcing intermediaries that operate as first tier suppliers of large MNEs. In this respect, there is a strong and urgent need to upgrade local suppliers and respond to the expectations of MNEs in terms of quality standards, supply standards and delivery times. Suppliers to Toyota in South Africa, for example, agreed that mere proximity to the local plant, the ability to produce a component according to a supplier specification and a history of relationship does not necessarily guarantee an ongoing relationship with Toyota (UNCTAD, 2006).

Today, in developed and developing countries it is critical that firms meet specifications in international standards and systems and provide their own technology offering or that of a strategic partner in meeting future production demand. The quality of the relationship between international contractors and their partners and suppliers is also crucial. In some developing countries, specific programmes have been set up to facilitate SME integration in global value chains, building on the linkages between MNEs and SMEs.

SMEs and global value chains: findings of the case studies

Awareness and understanding of global value chains

Awareness of the business environment and its evolution, and understanding of the critical characteristics of it, are the basic but necessary steps to build a firm's sustainable competitiveness. The case studies explored these issues by questioning SMEs on their knowledge of the market in which they operate and of the role that different actors play in it. The findings highlighted the following:

- There is *unequal understanding and appreciation of the global value chains by SMEs*. This seems to be a function of the sector and/or the position of the firm in the chain. Small firms in the automotive sector seem more apt to understand the structure of the value chain to which they contribute than the average SME in other sectors, for which the value chain concept itself is not always easy to grasp. This is likely related to the complexity of the configuration of the value chain (as in the tourism or cinema industries), the fact that the SME serves very different industries (as is the case of suppliers in the precision and scientific instrument industries) or that it occupies a low position in the chain and therefore there is limited knowledge beyond the surrounding environment (*e.g.* some SME suppliers in the automotive sector).
- *Many SMEs across different sectors are not able to identify their competitive advantage* through a value chain analysis nor do they fully understand the importance of doing so in order to optimise their participation in global value chains. Indeed, some of the interviewed firms explicitly raised this issue, by pointing to the lack of time and resources to devise a market strategy: specifically, the case studies on the tourism sector in Korea and the Toyota automotive enterprise in South Africa report that the interviewed SMEs mentioned their need for time and adequate human resources to understand the global context and analyse strategic issues; this, in turn, translates into an insufficient ability to define the adequate business model to gain or reinforce a firm's competitive advantage.

- *Specialised and niche market SMEs are more conscious of their competitive strengths*, which they associate in particular to the flexibility and quality of their offer (as in the precision and scientific instrument and software industries) or the personalised service (as in the tourism sector). Some of these firms have also succeeded in leveraging key assets from their lead partner, namely reputation. However, customisation of production is perceived as risky when it creates dependence on just one buyer.

Table 3.2 summarises the answers from the interviewed SMEs on the topic of awareness and understanding of global value chains.

Table 3.2. SMEs' awareness and understanding of the value chain

Case study / *Question*	*The structure of the value chain(s) of their sector, their market/ price structure/ competitors*	*Their key assets or weaknesses in the chain*
Automotive		
Australia	Due to long-term relationships and the flow of information through the GVC, automotive firms have a high level of awareness of the other players in the industry and the industry's overall structure.	SMEs see their competitive advantage in niche, medium to high-tech, high quality production, particularly for small volume runs.
Japan	SMEs at different points in the chain seem to have an unequal appreciation of the elements characterising their sector. Firms at lower tiers are less aware.	SMEs believe that the key factors for successful participation in GVCs are quality, cost and timeliness, which in turn are related to strong human resources and technology.
Spain	SMEs have a profound knowledge of the auto value chain and of the main players.	SMEs consider their flexibility, adaptability, and ability to produce short series as their strengths, but recognise that firms of large size have greater financial capacity and a stronger technology base.
Turkey	The firms interviewed have a good understanding of the value chain. More than half consider their level of transformation of goods and services high. They have to cope with a serious price pressure given the risk of loss of market share although their contracts are on confidence and long term basis.	Well trained human resources, patents and trademarks are considered as key assets.
India- Tata Motors	SMEs' level of awareness and understanding of the GVC is quite high; some of them have been practicing it for over ten years in various forms.	SMEs' identity as the original supplier of branded products has allowed to enter the GVC slowly but on a sustained basis. The use of latest technology, coupled with high precision, quality control and rejection rates within industry-specific permissible level have given them a competitive edge.
Mexico- VolksWagen	SMEs have a good or very good understanding of the value chain structure and are aware of the prevailing conditions in the market(s) they serve.	1st tier suppliers have become too specialised, producing only one product; 2nd tier suppliers have a broader competitive edge
South Africa- Toyota	SMEs supplying Toyota South-Africa have a good understanding of the concept of GVC and of their position in the chain. SMEs interviewed are aware that they supply componentry which would contribute to less than 1% of the final price of the motor vehicle.	SMEs consider critical the need to meet specifications in international standards and systems and provide their own technology offering or that of a strategic partner in meeting future production demand.
Scientific and precision instruments (PI)		
Australia	Difficult to generalise as the SMEs in the PIs industries supply a diverse range of industries. Typically, they find it difficult to conceptualise their position within GVCs.	SMEs believe that the strength of their position is related to quality, the range of products, operation within a niche market, service follow up, and in a few cases accreditation.

Case study / *Question*	*The structure of the value chain(s) of their sector, their market/ price structure/ competitors*	*Their key assets or weaknesses in the chain*
Software		
Turkey	Most of the interviewed companies believe that they play an important role in GVC by producing customised software, in co-operation with large MNEs, and packaged software solutions. This co-operation is beneficial to companies' production and distribution capability.	R&D is seen as being the key asset crucial for success. Many respondents indicated that competitiveness is the most important factor for successfully participating in GVC. To obtain a larger share of the global arena, Turkish SMEs have to develop their human resources, improve the quality of service and satisfy sector requirements.
Egypt - Microsoft	All the companies interviewed were clearly aware of the global value chain. On average, they have been part of the Microsoft GVC for 4.5 years. Most of them have international competitors mainly located in the Gulf Region or in India.	Most suppliers have a relatively low degree of transformation of their incoming Microsoft services. Although there is a high level of sophistication amongst firms, only one of the companies has reached the level of innovation required to develop its own products from scratch, and even then, this is still done only occasionally.
Tourism		
Australia	SMEs do not find the conceptual framework of GVC very pertinent to their activities.	Branding and well-trained staff are recognised assets. Strategic alliances, geographical clusters allow organisations to work together to increase their market share.
Austria	SME hotels participating in co-operation schemes have a good understanding of the service value chain.	For SMEs, professional co-operation management is key to create added value that is both measurable and sustainable. Only few SME alliances have launched an international co-operation.
Germany/Jordan	Jordanian SMEs recognise German tour operators – the producers of the package tours - as the main agents of the value chain.	High costs of internalisation (establishment of a branch office in the country of destination) are an obstacle for SME tour operators.
Korea	Most companies have low level of awareness of the GVC, although they try to establish new business paradigms to generate more revenues.	Lack of financial capital, knowledge and technical know-how, brand management and marketing skills are important barriers for the participation of SMEs in GVCs.
Poland	Many SMEs have a limited knowledge of their role in the global tourism value chain. They consider travel agents and tour operators, as well as large international or domestic hotel chains, as the key players of the value chain.	SMEs identify as key factors of competitiveness cost levels, service quality and coverage. Competition at the local, regional and international level pushes towards costs reduction and training of personnel.
Spain (Andalusia)	The SME hotels recognise the large tour operators as the main agents of the value chain. Travel agencies acknowledge their role of intermediation and identify the large vertical groups and transport companies as the main agents of the value chains.	Small independent hotels try to differentiate themselves from establishments belonging to the large hotel chains by dealing in a more direct and familiar manner compared to the more impersonal environment of those large chains.
Spain (Balearic Islands)	The Balearic enterprises see themselves as producers within the structure of the value chain, which they believe should always be focused on the customer.	The key assets are identified in brand, customer satisfaction, quality/ price ratio. Product diversification is seen as an important strategy to reduce dependence on a specific market and also to deseasonalise.
Switzerland	Travel agencies and tour operators have a better knowledge and understanding of the value chain in the sector than SME hotels.	For SMEs, personalised service and advice to their customers is a key asset.

Case study / *Question*	*The structure of the value chain(s) of their sector, their market/ price structure/ competitors*	*Their key assets or weaknesses in the chain*
Cinema		
Korea	The value chain is dominated by few major companies. Korean firms clearly understand that the domestic market itself is too small and they must expand their businesses into global markets. Given that global market is too large to approach by themselves, SMEs plan to collaborate with other firms in various activities. In particular, they would like to co-operate for global distributions.	The most competitive asset for the Korean firms is the digital content production skills and IT-related technologies. Since there is a strong trend of content convergence across related sectors, Korean SMEs believe they may be among the most advanced firms in the digital aspects. They also recognise human resources with high-talent and knowledge of global markets as critical success factors. SMEs think that production technologies and platform skills are quite advanced, while the contents need to be more adjusted to the global preference.
United States	The value chain is extremely complex, with complementary roles for large and small firms. The major studios depend greatly on many smaller entrepreneurial firms to carry out their missions. Although the major studios have a dominant position in Hollywood filmmaking, SMEs are essential to the industry's operation and occupy important niches in the filmmaking and distribution process.	Small firms are important sources of innovation, compared to the studios that are slower to react to technology and tend to follow the lead of the smaller companies who take the risk and show the reward of new systems. The ability to rapidly adapt to new business models is a critical asset. SMEs are also responsible for many higher-quality films.
Colombia - RCN and Caracol	Most 3D-animation companies interviewed are not familiar with the concept of global value chains, but are clearly aware of the immediate supplier-producer relationship. The two national TV channels have their own in-house production for 3D-animation to be used for TV shows/serials identity packages and promotion, and TV channel branding. When in-house capacity is insufficient to supply demand or if outside providers possess specialised technological equipment for specific productions, the TV channels outsource the production of 3D-animation either to specialised firms or to individuals working freelance.	SMEs benefit from the fact that Colombia serves as a "creative hub" for some transnational advertising agencies, operating in the Caribbean, Central- and South America.
Nigeria - Nu Metro	Nu Metro has a strategic partnership with Warner Bros, MGM and Disney. This makes Nu Metro part of a global value chain stretching from Hollywood to a flourishing in Nigerian movie industry known as Nollywood. The movies are supplied through Nu Metro Distribution. Nu Metro has been part of this global chain for about two years. Within this framework, Nu Metro belongs to tier 3. Nu metro has fourteen local suppliers and belongs to two GVCs, namely the movie/cinema industry and the optical disc production industry.	In the case of international movies destined for theatrical distribution, no value is added to the product. The prints are circulated and exhibited in a line-up that begins in South Africa then Nigeria and Kenya. However, Nu Metro, in line with government's vision of promoting quality, is partnering with government to: screen Nollywood movies in digital format (from March 2007); establish the Africa film festival (to be held in Nigeria commencing 2007); ensure that quality rather than quantity is the trademark of Nollywood; and follow attentively the international release trends.

Source: OECD country/industry case studies and UNCTAD enterprise/country case studies, 2005-2007.

Co-operation in global value chains

The case studies investigated the degree of co-operation between SMEs, their partners and competitors in the chains. As explained before, one important phenomenon in the globalisation of value chains is the disengagement of lead companies from several stages of production along the value chain, which has implied the transfer of greater responsibilities to subcontractors, who are presented with an increasingly demanding number of tasks. Contractors demand more of their partners not only to manufacture a product or provide a service, but also to contribute to its development, to organise and monitor a network of sub-suppliers, to implement internal systems of quality control and assure compliance to an increasing set of standards, and to ensure delivery and quality at

competitive costs. There are, therefore, pressures on SMEs to merge, in order to achieve the critical dimension necessary to support R&D costs, training of personnel, control of firms in lower tiers of the chains, and fulfilment of requirements in terms of standards and quality. Although problematic for the SMEs concerned, this pattern is not inherently bad, as it can bring a more efficient resource allocation in the economy.

The findings of the case studies highlighted the following points:

- As expected, *the degree of co-operation between firms is a function of the complexity of the product or service*: co-operation tends to be low in the case of manufacturing simple components, while it is high when products are more complex.
- *Trust and reputation* still represent two relevant dimension of long-term relationships between SMEs and their clients, and are vital to the success of the business (as in the auto industry and tourism). However, among SMEs at every tier of the chain there is a *widespread feeling of vulnerability* due to constant pressure to decrease costs.
- *Most SMEs that are below tier 1 suffer from poor or inefficient information flow, as they mostly rely on information transmitted from other suppliers working at levels between them and the contractor*. Some complain for not being properly recognised and appreciated for the high standard of technical contributions they make to the industry. On the contrary, there are cases of close co-operation where tier 1 firms assist their sub-suppliers in improving the quality of their offer, although this occurs as part of their contractual obligations vis-à-vis the main contractor.
- *SMEs see location in a cluster as a factor that boosts co-operation and facilitates technology upgrading to the benefit of internationalisation*. In recent years, a stream of research on business clusters has focused on the links between cluster analysis and value chain approach with a view to identify policies to improve international competitiveness of enterprises in clusters (Pietrobelli and Sverrisson, 2004; UNIDO, 2004a).[11] The argument is that also clustered firms are under the pressure of global competition and experience the erosion of their competitive advantage, and therefore they may find a new source of competitive advantage in linkages external to the cluster, notably when participation in global value chains improves upgrading capacity and market access. Recent research indicates, indeed, that clustered firms have increased their extra-regional sales and purchases (Altemburg, 2006).
- A variety of co-operation models exist in the tourism sector, where many small hotels have remained independent. SME hotels appear confident of the benefits of setting up alliances in case of horizontal co-operation, while the advantages of affiliation to large groups are not always clear to them. However, SMEs recognise that belonging to chains for commercialising provides them with more bargaining power when negotiating with other actors in the tourism industry and in related chains.

11. Traditionally, the analysis of industrial clusters is concerned with the role of local linkages in generating competitive advantages for firms in the cluster. Conversely, the global value chain literature emphasises cross-border linkages between firms in global production and distribution systems.

Table 3.3 summarises the answers from the interviewed SMEs on the topic of co-operation between SMEs and other partners in global value chains.

Table 3.3. Co-operation within the value chain

Case study / *Question*	*Level of co-operation with contractor(s), suppliers and/or partners*	*Level of dependence of SMEs from main contractor(s)*
Automotive		
Australia	Some SMEs have longstanding relationships developed over many years in the industry, and believe that the team-oriented dependent relationships built up within the supply chain were vital to the success of their business. These relationships are driven by trust and reputation. Some other SMEs indicate that due to the price pressures placed on them, their relationship with suppliers was based on price.	Many of the SMEs consulted, recognising that their reliance on the Australian OEMs is a weakness, were attempting to diversify their operations into other industries so as to achieve a more balanced income stream in the future.
Japan	SMEs at the 2nd tier and below benefit from little or no co-operation with the leading companies in the chain.	SMEs have so far adapted to the overseas strategy of their contractors (i.e., SMEs now serve the overseas markets).
Spain	Power asymmetry characterises the relation between SMEs and their clients. Co-operation tends to be unidirectional, from the supplier to the client, and entails no obligations for the latter.	Most of the SMEs sell more than 50% to contract clients, often on the basis of verbal agreements. The contract duration corresponds to the production life of the product to which suppliers contribute.
Turkey	The companies interviewed exhibited a high level of co-operation with their clients especially regarding product design and development. Co-operation with their competitors is limited to benchmarking (price, quality, production volume, etc.).	Many companies consider themselves completely independent in the selection of suppliers, but they carefully take into account the requirements of vehicle manufacturers they supply.
India- Tata Motors	There is a growing trend towards long term relationships with customers and suppliers of raw materials and services. Contracts are mostly settled through negotiations and personal contacts on a long-term basis.	Most of the SMEs interviewed are dependent on just one GVC. Enterprises have little or no freedom in selecting the market in which to operate.
Mexico- VolksWagen	The co-operation between tier 1 suppliers and contractors is very focused on production with little co-operation on process or product development. Tier 1 co-operate closely with tier 2 suppliers.	Most tier 1 suppliers are specialised in the auto industry and therefore have little independence. Tier 2 suppliers are more independent as they serve many clients.
South Africa- Toyota (TSA)	There is a high degree of co-operation between TSA and its suppliers. Supply relationships are based on trust and tend to be maintained for many years.	Only those SMEs suppliers that have built a close relationship with TSA are able to remain in TSA supply chain. They also tend to serve GVCs of other industries.
Scientific and precision instruments		
Australia	There is a low level of co-ordination between manufacturers and suppliers, and the supply base is large and highly competitive when the components are simple. However, high level co-ordination with a small number of suppliers occurs when the components are critical.	SMEs in the precision instruments industry are involved in many different GVCs.

Case study / *Question*	*Level of co-operation with contractor(s), suppliers and/or partners*	*Level of dependence of SMEs from main contractor(s)*
Software		
Turkey	Most of the companies produce under license from large MNEs. Agreements are mainly of two types: SMEs are sales agents for MNEs products; or they develop customised solutions (mostly frequently with 50:50 joint ventures). Some of small firms serve as liaisons for large local software developers.	SMEs that develop on-demand software solutions have a lower level of independency, despite their effort in order to develop open source code software and improve flexible solutions.
Egypt – Microsoft	A symbiotic and reciprocal relationship of co-operation exists between Microsoft and its Egyptian suppliers. For the Microsoft partners, the relationship with Microsoft Egypt is of extreme importance in terms of aiding them to develop their business and expand their scope. The existing eco-system of partners is of great help to them with regards to new market entry and credibility.	There is a general trend towards establishing long-term contracts with Microsoft. All of the firms interviewed are certified Microsoft Gold Partners and mentioned that a personal relationship with Microsoft accentuates the element of trust. Even if there is no exclusive relationship with Microsoft, over the years the Partner-Microsoft relationship grew stronger and allowed partners to experience the "lighthouse effect", credibility from serving a large well known company, and therefore expand geographically especially in the Gulf region where there is a lack of local skilled resources. This highlights the importance and prestige of the Microsoft-Partner certification program.
Tourism		
Australia	SMEs tend to be loyal to their traditional partners, with whom they have longstanding alliances. Relationships tend to be more prevalent at the domestic than at the international level. However, an increasing number of SMEs are affiliating themselves with MNEs, either as individual suppliers or as local franchisees.	Most tourism providers continue to see themselves as largely self-sufficient and independent entities. They develop their own strategies, identify and meet the needs of particular segments of the tourism market in their own unique ways, and generally rely on a finite set of partners to bring their products and services to market. However, even the most 'independent' travel agent now feels compelled to join a franchise in order to gain power.
Austria	Inter-firm co-operation includes co-operation between companies of the same sector (e.g. family hotels) or with partners of a different sector (e.g. hotels and cable car companies).	Local hotels choose to co-operate to maintain their independence but reach a critical mass. A co-operation venture in the tourism sector without a clear legal basis or a specific co-operation agreement just does not work.
Germany/Jordan	The co-operation between tour operators and incoming agencies is central to the operational management of the value chain from the market to the destination.	Incoming agencies (IAs) play a central role as co-ordinator and controller of package holidays in Jordan due to regulations which force every foreign tour operator (TO) to work in partnership with Jordanian IAs. However, for attracting foreign tourists, they are dependent on the foreign TO as they have no direct access to markets. IAs are highly fragmented and they have little scope to negotiate with foreign tour operators.
Korea	About half of the surveyed medium-sized hotels have a partnership with companies of other industries, most frequently credit card companies. Small hotels partner with travel agencies, to receive support on the reservation system.	Most SMEs hotels (less than four stars) are operated as independent hotels.

Case study / *Question*	*Level of co-operation with contractor(s), suppliers and/or partners*	*Level of dependence of SMEs from main contractor(s)*
Poland	Most SMEs are affiliated with trade organisations (i.e. tourism organisations, chambers of commerce). However, it is felt that affiliation does not bring clear benefits.	More than half of the SMEs interviewed are independent of any hotel chains, and they only envisage co-operation for joint advertising or, more rarely, to share reservation systems. Some SMEs have franchise contracts.
Spain (Andalusia)	The hotels consulted have signed a great number of individualised contracts with different tour operators, booking centres, and virtual or traditional agencies. Prices and quotas tend to be set, with strong pressure on prices. A high percentage of hotel establishments belong to commercialising chains which allows them to increase their negotiating power with the others in the tourism value chain.	All SME hotels and travel agencies interviewed are independent. However, both depend on tour operators for most of their reservations and turnover.
Spain (Balearic Islands)	Co-operation occurs within associations of enterprises in the sector at the local level and with employer organisations at a regional, national and international level, mainly for joint promotion. Associations with tour operators through guarantee contracts or co-operation agreements for joint promotion. The large hotel chains also establish joint venture agreements with suppliers and partners for the joint development of their activities or to benefit from the brand name of specific international enterprises.	Only big hotel groups are able to belong to several value chains, since their activities are both horizontally and vertically integrated.
Switzerland	Tour operators develop close partnerships with hoteliers and other partners with a view to strengthen the interconnection of the different products to quickly respond to the customer and to make economies of scale. Travel agencies tend to work with a limited number of tour operators to optimise their revenues. Hoteliers co-operate with colleagues for marketing purposes or to optimise their supply chain. Hoteliers also develop new forms of co-operation with ski lifts and cable car companies.	Some independent travel agencies choose to join the brand of a tour operator to increase their revenues. Many hotels do not work with tour operators because of their small size.
Cinema		
Korea	Co-operation between SMEs is not very active. Since major Korean firms in the film industry participate in funding, production, distribution, and screening, SMEs have relatively few opportunities to collaborate with other firms. Thus, a typical collaboration pattern of SMEs is the co-operation in the same sector, such as production or distribution, which is called as parallel co-operation systems.	Korean SMEs are quite independent in the cinema sector while very small firms usually rely on one or two clients. However, in the GVC perspective, most of them are less confident that they can expand their businesses into global markets by themselves.
United States	Although many of the companies providing services (transportation, insurance, food catering, set design, lighting, location scouting etc.) are relatively small, perhaps consisting of only a few people, it is not uncommon for such businesses to have been long-established and with significant historical ties to their counterparts at the production studios, theatre chains, and broadcast and cable television networks.	Many entry points are available to SMEs, but virtually all such firms are dependent on or require the co-operation of the large production and distribution entities for capital and other supporting input factors, the most critical of which, after capital, is distribution. Up to the point of consumption, every part of the value chain requires sophisticated legal contracts to be drawn, and expertise in accounting, finances, and taxes to be employed.

Case study / *Question*	*Level of co-operation with contractor(s), suppliers and/or partners*	*Level of dependence of SMEs from main contractor(s)*
Colombia - RCN and Caracol	The level of interaction between clients and 3D-animation producers varies according to the type of client. In general, it can be observed that 3D-animations for TV production show a higher level of freedom in creativity than for TV commercials. In the case of advertising agencies and post-production firms for TV commercials, the company submits the story-line, whereas in the case of TV production, the 3D-animation producer only receives the initial idea and needs to add value based on his own creativity. Due to such limitations in the creative process, many 3D-animation producers prefer working with TV-CN or film producers than with advertising agencies or postproduction firms for TV commercials. Co-operation between 3D animation producers is not very active.	The level of dependence on the main contractor varies according to the type of client. In the case of postproduction firms for TV commercials, film producers and TV-Channels, relationships are based on trust and even sometimes friendships, which favour a more long-term oriented business relation. Advertising agencies, however, do not stick to a preferred supplier. Contracts for a specific creative work are assigned based on tenders where usually the supplier with the lowest price-offer wins. Apart from the price, trust is an important factor for supplier selection and is based on both quality and delivery time. Price, however, is more important for national than international clients.
Nigeria – Nu Metro	The most important partners for Nu Metro are situated upstream and horizontally, that is, the parent company in South Africa and the co-distributors in Nigeria. The entertainment industry in Nigeria is a cluster of determined firms and individuals who against all odds have moved the industry from nothing to Nollywood. Nu Metro belongs to this geographic cluster and is working together with the others for the development of the entertainment industry.	As to international movies, Nu Metro in Nigeria is fully dependent on what is received from South Africa. In Nigeria, Nu Metro holds the monopoly for distributing Hollywood films. External linkages are quite limited as the Nu Metro group appears to have been designed to be self-supporting and self propelled.

Source: OECD country/industry case studies and UNCTAD enterprise/country case studies, 2005-2007.

Technology, innovation, standards and IPRs

The reconfiguration of production and division of labour along value chains has important consequences on the way knowledge and innovation are created and transferred. Since the knowledge base tends to expand as a function of the diversity of actors that take part in the production process, the globalisation of value chains is likely to create more opportunities for skill learning. However, complications can also arise for small suppliers and subcontractors because new competencies are generated and combined in a larger network of actors than they are used to handling.

The case studies findings pointed to the following matters:

- *Many SMEs see technological capabilities as critical and consider that continuous development of new technology is necessary to remain competitive,* in addition to the ability to respond to given standards (as illustrated in the case studies in the auto-motive and scientific and precision instrument industries). In the tourism sector, small and medium-sized hotels rely, in particular, on *organisational and marketing innovation* to raise their competitive edge. The introduction of new technology remains mainly the outcome of pressure by the governors of the chain. However, many SMEs at the bottom of the chain consider that they have *little or no transfer of information and technology* from their contractors, as already mentioned (see case studies in the auto industry).
- Some SMEs indicate that *the capacity to finance innovation* is a requirement to participate in the global value chains, which they find difficult.

- In the automotive industry, the issue of R&D capacity was raised by several interviewed firms across countries. Indeed, the modularity of production in this sector has brought important changes in the repartition of R&D functions. As in most assembly industries, where final assembly consists in putting together a relatively small amount of pre-assembled systems, system suppliers are responsible also for R&D functions. The cost savings for contractors can be very significant. In the automotive industry, more than one quarter of the total cost associated with a new model is accounted for as development costs and is incurred before a single car is assembled, because all the parts have to be designed, functionally related, checked for interactions, proofed for energy efficiency, noise, etc. The assembly methods based on modularity allows a contractor to transfer the cost of development on its system suppliers, who become responsible for developing the systems that they supply. This opens important opportunities of growth for those small suppliers that are able to afford the investment necessary for this functional upgrading.
- In the tourism industry, the diffusion of information technologies, in particular the Internet, represents both an opportunity and a threat for SMEs.
- *SMEs consider it relevant to better manage their intellectual assets, including through protection of intellectual property rights when appropriate*. Interviews with key players in the automotive and precision instruments industries confirmed cases reported in recent empirical literature, namely that today one form of control of the subcontractor consists in the request of complete transparency of information on virtually every relevant aspect of its business. Passing original designs to the contractor becomes a contractual obligation, and not just based on mutual trust. An additional element of pressure for the subcontractor is the fear that denying providing complete information could preclude future orders (White Paper on Small and Medium Enterprises in Japan, 2003). The risk of this is that original designs and plans submitted to the contractor can then be passed to lower-cost competitors, as reported in some case studies. However, the issue of intellectual property is not to be reduced to one of protection. For some SMEs, in fact, the realisation of value from their innovations comes from selling them to the market instead of keeping them in-house. For this reason, it is the overall management of intellectual assets that SMEs should target.
- *Most SMEs complain that standard requirements to be part of global value chains are very demanding*, and in some cases the cost and time invested to fulfil requirements do not necessarily provide a basis to obtain a premium in prices. Niche players seem better equipped to face these problems, because their higher level of technological knowledge (as in the precision and scientific instruments industry).

Product and process standards

The case studies findings are a good illustration of the role of standards in global value chains: in many industries, meeting specified product and process standards has become a necessary step to participate in the global value chain. Not only is entry in the chain conditioned to meet increasingly higher standards, but firms also need to be prepared to rapidly switch to new standards, should these evolve for technical or strategic reasons.

There are many benefits for a firm in the adoption of process and product standards, especially when they correspond to a higher level of technology than what is already used in the firm. Standards facilitate the transfer of knowledge and they support technological upgrading of firms. However, several issues emerge from actual patterns of standard enforcement in firms occupying lower tiers in the chain. First, there is a question of volume of standards. There is an increasing pressure on standard adoption in industry in order to respond to requirements in matter of security and protection of health and environment coming from public governments, and to satisfy an emerging demand for higher quality standards expressed by consumers and, more generally, the civil society. These add to the standards set at the level of enterprise to fulfil one or more of the many functions that standards serve (*i.e.* compatibility, information, quality, variety, etc.).

In addition, small volumes of orders may limit the scope to adapt to specific requirements and to afford the cost associated with investment in new equipment and systems, obtaining certification, and developing the capabilities required to meet new standards. For subcontractors that manage other subcontracting firms, there are additional costs in ensuring standard compliance at their sites and at those of their own suppliers. It is recognised that costs of certification are, on average, very high for small firms.

According to some researchers, lead firms tend today to externalise the control of compliance along the value chain of the whole set of standards necessary to meet the market requirements and for which default could harm the brand image (Gereffi and Sturgeon, 2004). These standards include also those related to matching civil society's concerns with respect to, for instance, processing and production methods for organic, fair trade, sweatshop-free, child labour-free products etc. Such controlling tasks are very demanding for SMEs.

Finally, standardisation may bring a type of homogenisation of offers that has both benefits and risks for SMEs. One example is the practice of franchise in tourism. Small hotels that can be associated with a well-known brand in the sector will benefit from visibility and reputation on the quality and delivery of the service. However, they will probably loose the main advantage of a personal service that distinguished them from competitors.

Table 3.4 summarises the answers from the interviewed SMEs on the topics of technology, standards, and IPR.

Table 3.4. Technology, standards and IPR within the value chain

Case study / *Question*	*Technology/Intellectual Property (IP)* *Ability to cope with required standards*
Automotive	
Australia	Technological capabilities were recognised as strength by Australian SMEs. This is reflected in their ability to create products featuring a high level of development and innovation, and to develop unique and competitive processes to create these products. **IPR:** SMEs denounce a lack of IP security within MNEs' global value chains, resulting in unauthorised use of SMEs' IP in low-cost manufacturing countries.
Japan	SMEs in tier 2 and lower have insufficient information concerning the industry's products and advanced technologies. SMEs are concerned about the lack of in-house technological capabilities.

Case study / *Question*	***Technology/Intellectual Property (IP)*** ***Ability to cope with required standards***
Spain	Half of the surveyed SMEs believe that the relationship with their client(s) is not transparent and that they do not have sufficient information. SMEs mainly introduce new technology at the urging of clients. Most of them participate in product development along with their clients, who have the last word. Larger firms in the sample co-operate with clients on more equal terms. SMEs had to develop new competencies to keep a stable pace in the chain, by investing in technology, process upgrades and R&D. **IPR:** SMEs engaged in R&D and innovation do not appropriately protect their intellectual assets.
Turkey	A large majority of the companies interviewed implement the manufacturing processes using international standards and technologies under license and the rest have their own trademarks and patents using high and innovative technologies. All companies are required by law and by the customers to fulfil necessary production standards. Use of ICT is common in all companies. **IPR**: Most of the companies use technologies, trademarks and patents under license. Companies recognise the importance of protecting IPRs.
India- Tata Motors	Most SMEs depend on the technical specifications given by the buyers. Overall, SMEs invest more on tangible than intangible assets. Only some of them have activities related to R&D, design and product development. Some SMEs have well developed in-house product development capabilities and could therefore capture the supplies to Fiat, Ford, Suzuki and Mercedes Benz.
Mexico- VolksWagen	First-tier firms exchange information with their suppliers. Tier 1 suppliers assist their suppliers to improve their quality.
South Africa- Toyota	SMEs feel many of the standards requirements are very onerous, complex and absorb much administrative time, but do not necessarily provide a basis to obtain a premium in prices within the automotive value chain.
Scientific and precision instruments	
Australia	SMEs consider that there is a high level of knowledge and transparency in the industry. **IPR:** There is concern over the lack of IP protection and its enforcement, particularly when designs are sent offshore and reverse-engineered.
Software	
Turkey	**IPR:** SMEs are well aware of the importance of IPRs; and believe it is important to protect IPRs in every field of software development.
Egypt - Microsoft	There is a lack of originality amongst domestic SMEs and a relatively low percentage of product transformation. Most IT firms tend to be service-oriented companies that offer add-ons on an already existing Microsoft product rather than come up with their proper innovative and creative solutions. **IPR:** All interviewed companies are aware of the importance of IPRs. In Egypt, IPRs are protected by newly passed laws specifically mentioning software, database designs and layouts of integrated circuits. The Egyptian government, in co-operation with multinational donors, has also started educating judges and district attorneys on the specific issues related to IPR violations.
Tourism	
Australia	Operators of small accommodation see the Internet as a complex opportunity which is currently being only partially utilised. Tour operators and travel agents are much more likely to view the Internet as a barrier to increasing their role within the GVC. The Internet boosts the power of consumers by allowing them to by-pass a step in the value chain.
Korea	ICT uptake by SMEs is gradual and is seen as a tool to strengthen competitiveness.
Poland	The majority of hotel SMEs make insufficient use of ICT tools, due to the high costs of implementing new IT solutions and buying licences. As a consequence, the companies tend to use only basic IT tools.
Spain (Andalusia)	The use of new technologies is imposed by the large touristic intermediaries or suppliers more in travel agencies than in hotel establishments. However, set-up costs are paid exclusively by the agencies, what means a considerable effort for them. They all work with Amadeus that pays the maintenance costs for its IT application.

Case study / *Question*	*Technology/Intellectual Property (IP)* *Ability to cope with required standards*
Spain (Balearic Islands)	The travel agency sector sees the Internet as a very serious competitor. Innovation is intended in the form of expanding and improving the offer. Information systems and the Internet are making this process easier
Switzerland	For tour operators and SME travel agencies, the use of ICT for connecting the various providers of services is primordial for giving the consumer accurate information and prices and for validating the reservations in real time. Many SME hotels are still not connected to networks and to reservation systems but would like to make progress in this area to increase their profitability.
Cinema	
Korea	Korean SMEs actively utilise new IT and digital platform technologies in the film and other content production. These trends make them very open to adopting various innovations. Considering the rapid progress of the digital convergence in Korea, SMEs will be among the earliest players to leverage new technologies and innovations.
United States	Due to the technological upheaval, traditional production and distribution business models have become dysfunctional and this has created myriad opportunities for SMEs. Much of their work will ultimately be applied to entertainment distribution and display devices and to production processes. Yet, given the great need for expansion capital and for marketing and distribution expertise, it is unlikely that many successful SMEs can or will remain independent for long.
Colombia - RCN and Caracol	The driving factor behind outsourcing of 3D-animations for the two national TV channels mainly lies in the degree of specialisation of many 3D-animation firms. In many cases suppliers possess more specialised technical equipment, as well as excellent talents in terms of human resources. The bulk of employees of 3D-animations firms either studied publicity or graphic design at Colombian higher-education institutes. Additionally, a software provider for 3D-animations opened recently a training centre in Colombia.
Nigeria - Nu Metro	In the case of DVD sales, Nu Metro faced strong competition from local pirates who had a more efficient distribution system and an advantage in pricing. Outright importation of DVDs made Nu Metro uncompetitive despite the superior quality. Thus, Nu Metro reappraised its policy and set up a DVD replicating plant in Lagos, and converted some of the erstwhile pirates into legitimate distributors.

Source: OECD country/industry case studies and UNCTAD enterprise/country case studies, 2005-2007.

Perceived benefits of SMEs' participation in global value chains

From a theoretical point of view, many factors suggest that the integration of SMEs in global value chains, under specific conditions, is for the benefit of these firms. During the interviews conducted for the case studies, SMEs were asked about their perception or experience of participation in global value chains. The main findings can be summarised as follows:

- Overall, the answers by the SMEs interviewed in all sectors support the argument that the *participation in global value chains brings benefits to SMEs or is expected to bring them*. Firms that have successfully integrated in one or more value chains have been able to gain stability or expand their business. Even those SMEs who have chosen to remain at the margins of the global value chain, recognise the potential for growth associated to participation to global value chains.
- One key factor of successful integration is co-operation with the network: co-ordination of work with partners upstream and downstream the chain increases the chances of success, due to substantial benefits in terms of information flow, access to superior technology and learning opportunities.

Table 3.5 summarises the answers from the interviewed SMEs as regards their perception of the benefits of participating in global value chains.

Table 3.5. Perceived benefits of SMEs' participation in global value chains

Case study / *Question*	*Benefits of being part of a supply/value chain*
Automotive	
Australia	Many of the SMEs consulted indicated that the GVC was critical to the future of their business and has allowed them to grow and achieve economies of scale. Australia has only a small automotive market and being a part of the GVC has enabled SMEs to form new alliances, to access more customers, to build more comprehensive networks and to source new suppliers.
Chinese Taipei	There are significant benefits from strengthening the role in the GVCs of small specialised suppliers of non-branded auto components used for maintenance.
Japan	The benefits of participating in GVCs depend on the capacity to contribute to activities with a high degree of value added.
Spain	SMEs estimate that the GVC offers them expansion opportunities, along with the acquisition of key knowledge. They also believe they can increase turnover and sales benefiting from growth at the worldwide level of the automotive sector.
Turkey	The large majority of the companies interviewed stated that involvement in GVCs provides new business and co-operation opportunities. In addition, involvement in GVCs also keeps them informed of state-of-the-art technologies, and of developments in their industry and market.
India - Tata Motors	All the respondents unanimously feel that the GVCs they serve bring opportunity for them to globalise and opens up both national and international outlets. Technical know-how also comes from the large companies seeking supplies from them. Opportunities are floating but it is entirely up to SMEs to capture them for their own advantage. Entering GVCs on a sustained basis, they feel, is only possible via latest technology route and proper supply-chain management system.
Mexico - VolksWagen	SMEs consider that being involved in the VW global value chain is quite profitable: they can reduce marketing costs because their sales are guaranteed by VW demand, and they receive the benefits of global demand expansion. As one SME interviewed said, "it is difficult to be outside the global value chain, because it is the only way for growth".
South Africa- Toyota	Linking to GVCs is perceived by suppliers as the ultimate condition to remain in business, although participation in GVCs is often associated with very strict requirements.
Scientific and precision instruments	
Australia	Although the PIs firms interviewed did not have a high appreciation of the GVC, most firms benefited from being involved. High-trust relationships established within the GVC allow firms to form temporary partnerships to increase services and attract 'problem solving' work which benefits original equipment and secondary manufacturers.
Software	
Turkey	The most important benefit of participating in global value chains for Turkish software developers is co-operation. Co-operation allows Turkish SMEs to improve their innovation and R&D abilities and to increase their export. Involvement in global value chains also keeps them informed of state-of-the-art technologies, developments in their industry and market.
Egypt- Microsoft	The Microsoft partnership has been instrumental in enabling local companies address regional growth opportunities and therefore become more integrated in the GVC, as opposed to being just a small local implementer. Many partners that have developed a successful relationship with Microsoft Egypt have used that network to implement Microsoft projects in other neighbouring countries. Microsoft has encouraged this expansion and has provided its trusted Egyptian partners with the necessary support (on technical and commercial fronts) to succeed in the regional markets. Microsoft benefits from this expansion in serving its customers in other Arab markets where resources are less available and technical know-how is less developed.

Case study / *Question*	*Benefits of being part of a supply/value chain*
Tourism	
Australia	The idea of greater participation in GVCs is not necessarily a high priority for most tourism operators in Australia. Although there is strong awareness of the immediate, first-hand interactions that connect particular businesses, there is little conception of the significance of the multiple linkages that occur along the entire length of these chains.
Germany/Jordan	Jordanian travel agencies can gain access to foreign markets.
Korea	In today's highly competitive business environment, SMEs are becoming aware of the importance of the value chain system for their competitiveness at both industry and company levels.
Poland	Lack of knowledge about the potential benefits hinders SME participation in value chains and also co-operation with large companies.
Spain (Andalusia)	To face competition pressure, travel agencies estimate that they should focus on offering a better quality product, with greater added value, in order to increase clients' fidelity.
Spain (Balearic Islands)	Enterprises believe they are in a leading position as a result of their specialisation, the quality of their service and their accumulated experience, and therefore do not intend to increase their role in the value chain in the sector. However, most of them admit that they are experiencing a loss in competitiveness due to the increased competition.
Switzerland	Travel agencies can increase their profitability through a more focused participation in GVCs. Hotels can reach a critical mass for marketing/branding, organise their reservation systems and streamline their purchases.
Cinema	
Korea	Participating in the GVC presents opportunities to the Korean SMEs, such as learning from advanced firms especially about content production and foreign market knowledge. SMEs believe that participating in the GVC is a necessary step to expand into global markets and gain value from their advanced knowledge about digital technologies.
United States	The opportunities for value chain participation by SMEs are substantial and expansive, but primarily in independent production and applications of new technology. While the decline of traditional production and distribution methods caused by rapid technological change leads to heightened volatility and uncertainty, it also leads to prospective gains by small, young, and restless enterprises as compared to the large legacy-bound companies.
Colombia - RCN and Caracol	Many companies consider international markets, especially the US and Canada, more attractive for animated products because of high demand and better price margins.
Nigeria - Nu Metro	Belonging to a GVC has created some advantages for the local subsidiary with such benefits of continental/global brand, capital, technology, and management. Nu Metro in turn is required to bring in standards of execution.

Source: OECD country/industry case studies and UNCTAD enterprise/country case studies, 2005 - 2007.

The role of government

As the globalisation of value chains presents both opportunities and challenges for SMEs, the case studies have tried to understand what SMEs' expectations are on the role, if any, governments could undertake to support them in the evolving environment. The following points emerged:

- Across countries, *many enterprises interviewed indicated that governments at the local or national level have provided them with little or no support for facilitating their participation in global value chains*. This answer mirrors the fact that many SMEs have a limited understanding of the global environment and therefore cannot easily identify policy initiatives facilitating their effective participation in global value chains. For instance, although the area of skill upgrading is certainly one of the most relevant for the successful integration of SMEs in global value chains, interviewed SMEs did not acknowledge programmes in the field of SME training,
- In most of the case studies, two themes dominate SMEs' concerns: *the need to improve technology and innovation capacity and the lack of adequate finance and human capital for this process*.
- Other important areas include: *the capacity to respond to standards and certification requirements*; *the ability to better manage intellectual assets, including the protection of IPRs when appropriate*; *the uneven bargaining power SMEs face with large contractors; and the support of diversification in activities to reduce dependence from one or few customers*.

Table 3.6 summarises the policy issues which emerged from the field work.

Table 3.6. Policy issues: Insights from the field work

Case study / *Question*	*Policy issues*
Automotive	
Australia	SMEs are concerned with increasing their innovation and R&D, flexibility and ability for just-in-time delivery, and marketing. They realise that their small firm size can inhibit their buying power, investment opportunities, and economies of scale. This is reflected in their heavy reliance on producing for the Australian auto industry due to undiversified operations. SMEs face difficulties due to a lack of IP enforcement in low-cost manufacturing countries and a lack of skilled and willing workers.
Chinese Taipei	SMEs are concerned with increasing their reach in the international market while maintaining the quality of their service. They realise the importance in decreasing their costs in order to enhance competitiveness, yet need to continue developing new products and new markets to increase diversity and add value to the products. SMEs seek assistance in acquiring certification from giant international automakers.

Case study / *Question*	*Policy issues*
Japan	SMEs need easier access to an information infrastructure, namely for the collection of accurate information about the global business environment. Also, the strengthening of in-house processing and production technology is one of the major difficulties confronting them. Policy recommendations for increasing SME participation in global value chains include: i) building an information infrastructure for the collection of accurate information about the business environment; ii) supporting SMEs through improving their technological capabilities; and iii) supporting cluster development (matching between SMEs in different fields, encouraging the provision of technical and management support from regional facilities such as universities and SME support organisations).
Spain	SMEs acknowledge investment in R&D and innovation to boost competitiveness and internationalisation as key to their growth. Among the central concerns of SMEs are rising cost of production and their reduced access to finance for new business projects compared to their larger competitors. This translates to low investment in R&D, marketing and internationalisation. Also, SMEs have little interaction with universities and a low patenting rate.
Turkey	SMEs are concerned with increasing their investments, research and development and innovation efforts. They consider increasing production costs as a significant threat for them.
India - Tata Motors	SMEs need to improve their in-house technical capabilities, while maintaining the highest technical precision with efforts to reach a zero rate of rejection and honouring the delivery schedule. SMEs need access to the latest technical information and venture-type financial support for R&D and new product development.
Mexico - VolksWagen	Local SME suppliers need greater support to undertake the learning process which allows them to meet global quality standards. They realise the importance of R&D; however, at present first tier firms do not have R&D departments in Mexico. SMEs would like to be represented in the bargaining process with VW and to have the rights of the subcontracted businesses preserved.
South Africa - Toyota	SMEs are concerned with their ability to upgrade and respond quickly in order to deliver products and production systems that are in line with expectations of Toyota in terms of quality standards, supply standards, and delivery times. SMEs draw attention to their need for increased skills development, investment, and technology development, as well as an increase in safety and security and improved infrastructure.
Scientific and precision industry	
Australia	SMEs risk a shortage of skilled labour as well as competition from emerging low-cost producers. This problem is linked with the lack of IP protection in low wage countries. SME would like to see an increase in capital access for investments, research and development, and marketing as well as a harmonisation of requirements for technical standards and regulation compliance.
Software	
Turkey	The most compelling problem for SMEs is the availability and cost of qualified personnel. Other concerns point to insufficient infrastructure, difficulties of reaching global market and financing R&D, capacity to stand competition with giant firms, and piracy.
Egypt - Microsoft	To expand their market and growth SMEs underline the need for a larger pool of qualified and skilled human resources, requiring a focused effort by the government in higher education. Capacity building activities for local companies to strengthen their management and technical capabilities would help equip them to compete more effectively. SMEs consider that the general business environment needs to be improved through faster and more efficient governmental service delivery and the enforcement of stringent piracy regulations.
Tourism	
Austria	When clear market failures occur, it might be worthwhile for national/local public authorities to accompany SMEs in planning their co-operation strategies with a view to optimise the service chain both on supply and on demand sides or to upgrade the co-operation ventures at international level.

Case study / *Question*	*Policy issues*
Germany/Jordan	Recommendations include: *i)* to protect the established value chain relationships between Jordanian and German SMEs from unexpected structural changes and political shocks; *ii)* to help SMEs diversify their offer in international markets; *iii)* to develop a policy in Jordan for upgrading the tourism destination to attract new investors (*e.g.* vocational training, investment regulation, infrastructure development, quality and standards); *iv)* to increase the coherence of tourism with other policies.
Korea	SMEs need support to: modernise their professional management techniques in line with modern hotel management; upgrade information system and facilities and equipments; improve the levels of service quality and standards; develop nation-wide and world-wide marketing networks; and strengthen the financial structure.
Poland	SMEs need support for modernising, including improvement of service quality, adoption of ICT, and innovation of business strategies (such as new incentive-based personnel management systems and new marketing techniques). Companies should be encouraged to participate in networks and industry associations and strengthen their competitive position through joint actions.
Spain (Andalusia)	SMEs would like to see simplified administrative procedures. Requests are for direct public support for ICT development, renewing of infrastructure or promotion of co-operation, although some SMEs see the role of public authorities more in designing the appropriate policy framework (standards and certification, infrastructure) or in creating an industry advisory board.
Spain (Balearic Islands)	SMEs consider it critical to pursue continual improvement and innovation to face the fierce competition with international offer and compete with enterprises that have very different costs structure and that are able to set lower prices for products. The request in terms of public aid focuses on the promotion and improvement of the tourism environment and the infrastructures, although many enterprises acknowledge that they have the financial means to afford certain actions aimed at improving their role in the value chain in their sector.
Switzerland	Tour operators consider that airport taxes are too high while at the same time recognising that this is the "price to pay" for good infrastructure and security. Travel agents are in need of support for vocational training. Hoteliers point out the necessity to increase their added value through innovation and infrastructure development but have difficulty to undertake action due to lack of financing.
Film production and distribution industry	
Korea	SMEs' concerns focus on short term development and lack of infrastructure. They would like to see public investment used wisely and not just for major firms since that could undermine the balance of development and growth essential for global competitiveness. The IT cluster should play an important role; for example it could be used as a testing field for new value-adding businesses.
United States	In order to remain independent, SMEs should continue developing new innovative technology. For this they need access to expansion capital and improve marketing and distribution expertise. Funding may become a real problem due to long-run uptrend in costs of production and rising costs of capital.
Colombia - RCN and Caracol	SMEs would like to have a more business friendly environment, including: tax benefits for technology acquisition; an ease of travel restrictions for business purposes; an ease of restrictions for foreigners working in Colombian that hinders a firm's business development; greater promotion of local talent; and promotion of English language communication skills that facilitate companies' linkages with international TV channel and networks.
Nigeria - Nu Metro	SMEs suffer from the lack of basic infrastructures which has led to high costs of doing business. Promotion of FDI, local investments and tax breaks would improve these financing difficulties. SMEs would like to see greater efforts to improve the regulatory environment ex: IP infringements and piracy; in addition to enforcement as prosecution is to date slow and cumbersome.

Source: OECD country/industry case studies and UNCTAD enterprise/country case studies, 2005-2007.

Conclusions and policy recommendations

Although it is difficult to establish common trends in the diversified universe of SMEs, the case studies conducted in several OECD members and non-members provided some new insights on the performance of SMEs in global value chains. One result that stands out from the different findings across sectors is that successful participation in global value chains brings stability: small firms that are able to remain in value chain(s) despite keen global competition, or SMEs that succeed in 'jumping on board' normally gain stability and even expand their business. This is often accomplished by the upgrading of technological and human capital, as a result of the greater exposure and facilitated access to information, business practices and technologies that SMEs in global value chains experience. Indeed, co-operation with the network appears a key factor. Case studies in the automotive and tourism sectors indicated that co-ordination of work with upstream and downstream partners increases the chances of success of small firms in the value chain. This seems related to substantial benefits in terms of status, information flows and learning possibilities. Successful SMEs in global value chains acquire more autonomy from their larger counterparts and increase opportunities to grow further by leveraging on access to an extended network of partners and to superior technology, and on improvement of staff skills.

The increased opportunities for SMEs come along with serious challenges in terms of managerial and financial resources, and ability to upgrade and protect in-house technology and to innovate. When questioned on these issues, SMEs point to their lack of critical dimension necessary to support adequate R&D costs, training of personnel, and fulfilment of strict requirements of product standards and quality. Insufficient working capital is also indicated as a barrier to the participation in global value chains, in particular to face delayed payments from international partners. Moreover, if upgrading a small firm's position in the value chain is possible, it is typically linked to the take-up of a larger and more complex set of tasks. In the case of a small supplier, this would include the manufacturing of a product or the provision of a service, but also contributions to product development and organisation and monitoring of a network of sub-suppliers to ensure delivery and quality at competitive costs. The lack of awareness on the complexity of the issues at stake, which unfortunately many SMEs surveyed revealed, plays against their possibility of responding timely and effectively to the challenges of globalisation.

Governments could facilitate SME gainful participation in global value chains through policy initiatives in specific areas:

- *Raising awareness of the potential of participation in global value chains.* Many SMEs that are used to serving local markets may find it difficult to gain a good understanding of the advantages and potential of subcontracting for foreign customers. This also applies to the potential for SMEs to subcontract abroad part of their production, in order to improve their competitiveness through rationalisation of resources. Although the diffusion of ICT has made market intelligence easier also for SMEs, their limited resources and lack of managerial capacities still hamper accurate information and analysis on the opportunities inherent in foreign markets.
- *Increasing participation in global value chains* through initiatives such as the facilitation of SME consortia for joint marketing or for entering joint bids, particularly in government procurement, or promotion schemes for potential suppliers.

- *Supplier financing.* Gainful participation in value chains often requires substantial investments to acquire or develop superior production technologies and logistics systems, invest in human capital, or certify newly required standards. Moreover, suppliers normally receive incoming payments from their customers several weeks or even months after the delivery of orders and contract enforcement and collection of payments may be a significant challenge for an SME. Policies aimed at ensuring confidence in SMEs' accounts receivables and facilitating SME financing can help small subcontractors overcoming liquidity problems, *e.g.* by contributing to the development of financial schemes such as factoring.

- *Promotion of technological upgrading* is critical in order to encourage SMEs to capture more value added from participation in global value chains. Policy in this area should aim to support training and capacity building via skill development programmes; promote partnerships between SMEs and organisations overseas that can develop or transfer technology, products, processes or management practices; and to facilitate the technological upgrading through various financial schemes, such as credit lines for upgrading.

- *Protection of intellectual property*. The protection of intellectual property rights is of high relevance to SMEs. As discussed, the insufficient protection of SMEs' intellectual property rights in international markets is already having harmful effects on those small subcontractors that experience unfair behaviour by their customers. The negative impact is twofold. In addition to the direct damage created by deceptive business practices, small firms' incentives to innovation may well be reduced if appropriation of economic benefits is threatened. Governments should consider including provisions for technology transfer from small subcontractors to MNEs within the OECD Guidelines for Multinational Enterprises (MNEs). At present, these Guidelines only evoke the transfer of technology, and the need for protection of intellectual property rights, from multinational enterprises to other partners, as it is considered that MNEs are the main conduit of technology transfer across borders (Section VIII, Science and Technology, OECD Guidelines for MNEs, Revision 2000).

- *Facilitation of compliance procedures.* The adoption of product and process standards has several well-known benefits for firms. It enables them to introduce new technology and integrate business practices that ameliorate their overall performance. However, different and concurrent standards can become barriers to transmission of information and to trade. Also, the costs of compliance to required standards are proportionally too high for small firms. The problem is aggravated when these firms have to cope with an increasing number of private standards set by customers in addition to mandatory ones. Governments should ensure that national certification systems do not impose an excessive burden on small firms and encourage SME participation in the standard-setting process. Initiatives such as group certification for small firms in local regions might also prove effective, if trust in the control mechanisms can be gained.

- *Promotion of skills development.* Effectiveness of aforementioned policy measures, to a certain degree, is contingent on having skilled human resources in SMEs. Participation in global value chains can accelerate SMEs' upgrading of human and technological resources, through technology and knowledge transfer and implementation of new business practices. Conversely, participation may be demanding as well, to the extent that a threshold of capabilities could be necessary to successfully enter value

chains. Policies that aim at raising technical and managerial skills in SMEs can booster integration of these firms into global chains.

- *Promoting the development of industrial clusters.* Cluster initiatives allow for economies of scale and agglomeration and also help developing an experienced local pool of skilled labour and a network of firms co-operating in complementary areas of specialisation. By doing so, they strengthen their comparative advantages in a sustainable manner and become attractive sites for quality FDI. In many cases, the presence of MNEs becomes crucial to integrate clusters into GVCs, and to strengthen their export capacity both from the production and distribution point of view.
- *Attracting foreign direct investment.* FDI promotion policies may facilitate the integration of firms in global supply chains. Some policies can explicitly be designed to attract MNEs that would promote technology and knowledge transfer to local suppliers and subcontractors, whereas others may aim at helping established foreign affiliates to enter and/or upgrade into higher-value activities. After-care services offered to foreign investors are very important to influence investors' decision on linkages development.
- *Promoting the development of industrial clusters.* Cluster initiatives allow for economies of scale and agglomeration and also help developing an experienced local pool of skilled labour and a network of firms co-operating in complementary areas of specialisation. By doing so, they strengthen their comparative advantages in a sustainable manner and become attractive sites for quality FDI. In many cases, the presence of MNEs becomes crucial to integrate clusters into GVCs, and to strengthen their export capacity both from the production and distribution point of view.
- *Promoting in developing countries the development of domestic industries and service networks* able to link effectively with international production networks, by promoting entrepreneurship and enhancing competitiveness at firm level through technology and business linkages. This calls for using official development assistance (ODA) more effectively to support developing countries efforts to undertake a wide range of proactive measures to support an integrated approach to promoting trade and investment for development. To address these challenges at the multilateral level, besides the building of appropriate support for trade policy formulation for WTO accession and the negotiation of bilateral and regional agreements, there is need to enlarge the scope of the Aid for Trade to include support for productive capacities development.

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Chapter 4

THE CHANGING NATURE OF MANUFACTURING IN OECD ECONOMIES

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This paper provides empirical evidence on the changing nature of manufacturing in OECD countries, including the continued loss of employment in the manufacturing. It examines the extent to which manufacturing output and employment are declining in OECD countries and explores possible causes, including increased productivity, slow growth in demand for manufacturing products, loss of markets to imports, statistical and classification issues, and so on. The paper finds that the share of manufacturing in OECD economies is declining and argues that this is likely to continue. It also presents evidence pointing to an increased blurring of the distinction between manufacturing and services. Furthermore, it notes that manufacturing is becoming more and more integrated at the global level. Finally, it noted that although manufacturing production is declining in OECD countries, innovation in this sector continues to be dominated by OECD countries. The paper is a contribution to an OECD project on global value chains, and will also contribute to OECD work on globalisation and structural change.

This chapter was originally published as STI Working Paper 2006/9 (OECD Directorate for Science, Technology and Industry).

Introduction

De-industrialisation of OECD economies is back on the policy agenda in many OECD countries. Recent policy studies in several OECD countries, including the United States, the United Kingdom, Belgium and the Netherlands, point to the ongoing loss of manufacturing employment in OECD economies and raise questions about the future of manufacturing in OECD economies (US Department of Commerce, 2004; Department of Trade and Industry, 2004; *Bureau Fédéral du Plan*, 2004; Ministry of Economic Affairs, 2004). Questions that are raised include: Will the current decline of manufacturing employment continue in OECD economies? Is off-shoring of manufacturing production a threat or an opportunity for OECD economies? To what extent is the loss of manufacturing threatening future innovation and technological progress in OECD economies? Can future prosperity in OECD economies be ensured without a vibrant manufacturing sector (Conference Board, 2004*a*)? These questions, and others, are raised against the background of a growing role of certain non-OECD economies, notably China, in global manufacturing.

This paper provides empirical evidence to help develop a response to these questions. It examines the extent to which manufacturing output and employment are declining in OECD countries and explores possible causes, including increased productivity, slow growth in demand for manufacturing products, loss of markets to imports, statistical and classification issues, and so on. The paper also provides empirical material to help increase understanding of the evolving global business models of manufacturing enterprises, especially multinational enterprises (MNES), which feature global supply chains comprised of many smaller services and manufacturing companies. The paper is a contribution to an OECD project on global value chains, and also contributes to OECD work on globalisation and structural change. It will be complemented with other studies, including work examining input-output relationships between countries and work with firm level data.

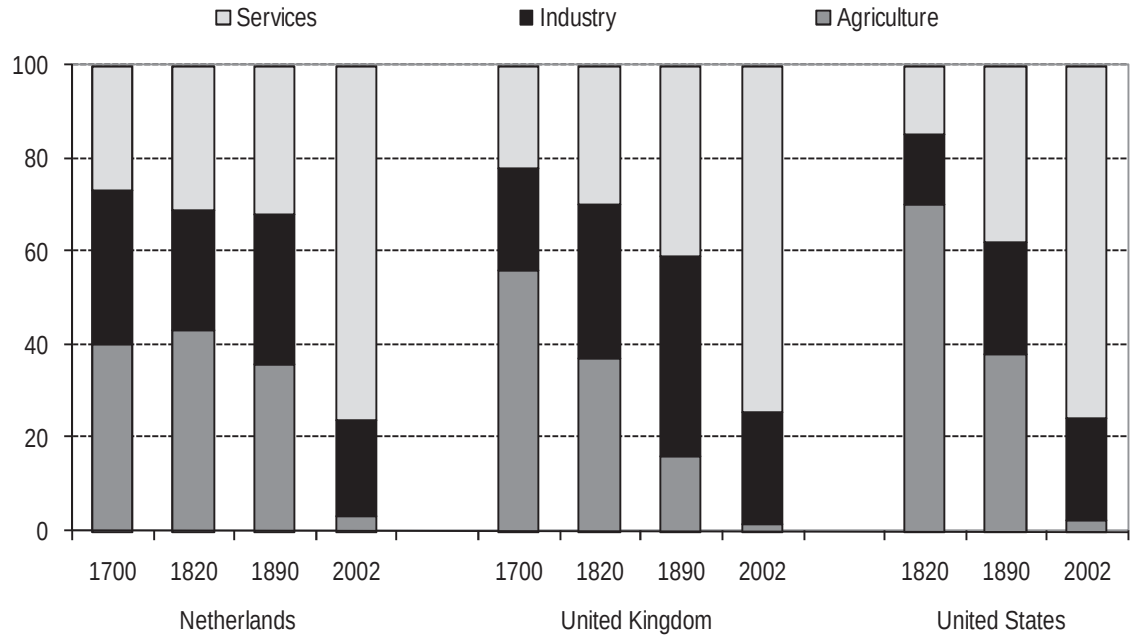
The paper includes four substantive sections: section 2 examines trends in employment and output; section 3 looks at trends in the internationalisation of manufacturing; while section 4 examines trends in the key drivers of manufacturing performance. Section 5 concludes and briefly discusses some issues that will require further examination in developing policies that may help address these trends.

Trends in manufacturing employment and output

Manufacturing employment has declined steadily in most OECD countries

Economic development in OECD economies has long been characterised by a gradual process of structural change. In the initial stages of economic development, agriculture typically accounts for the bulk of GDP and employment, as is still the case in many developing countries. In later stages, its share in total value added and employment declines and the manufacturing sector grows as economies industrialise. In recent years, many OECD economies have experienced a decline in the share of manufacturing in overall employment, with a concurrent rise in the share of services (Figure 4.1).

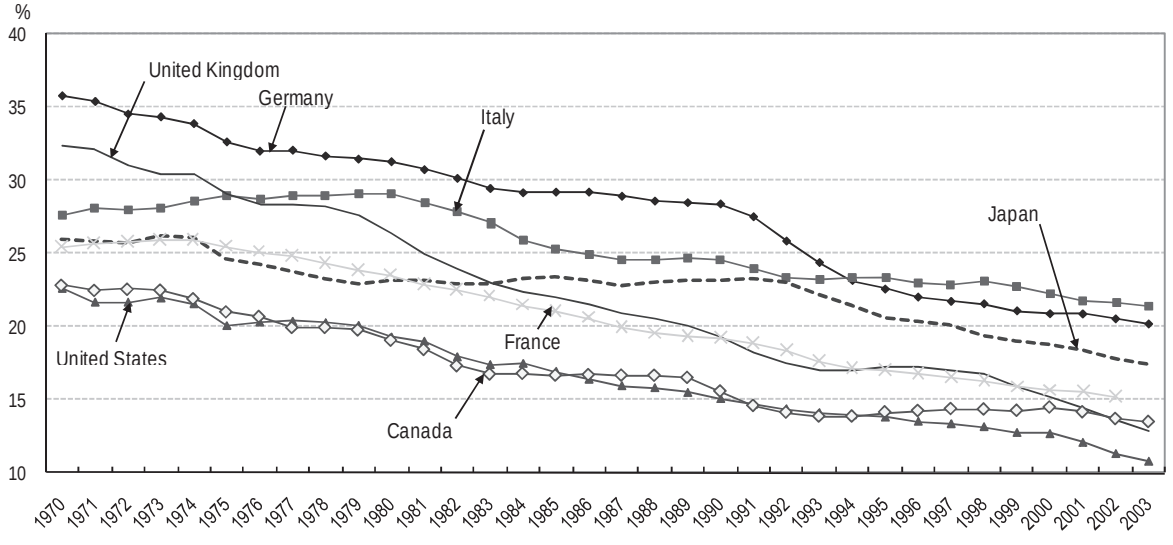
Figure 4.1. Share of main activities in employment, selected OECD economies, 1700-2002, in %



Source: Maddison (2001) and OECD Labour Force Statistics.

Much of the recent debate about de-industrialisation and the potential decline of the manufacturing base has focused on the loss of manufacturing employment in OECD countries. Cross-country evidence on manufacturing employment shows that most OECD countries have indeed experienced a steady decline in the share of manufacturing in total employment (Figure 4.2).

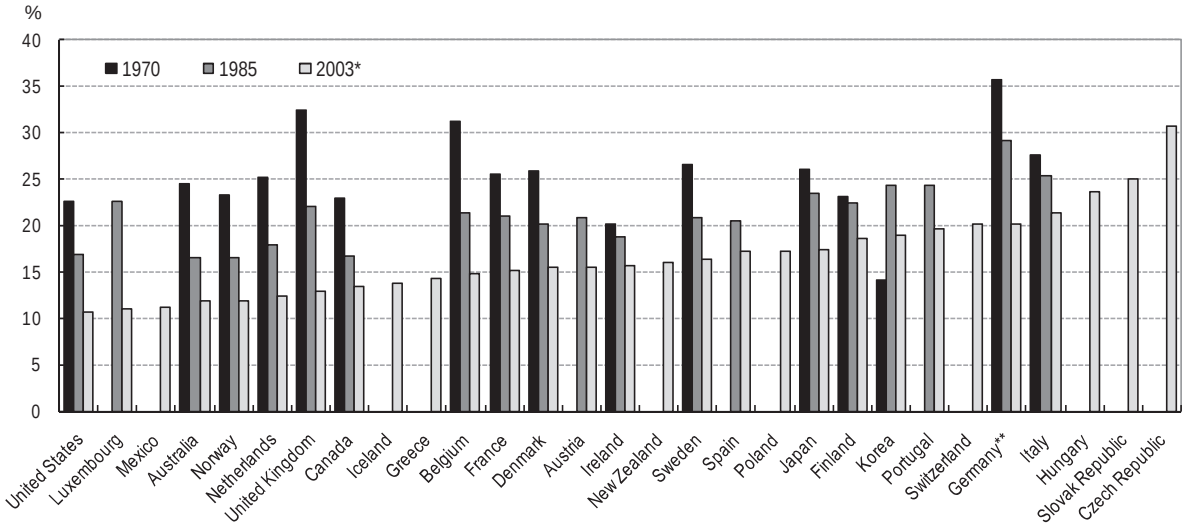
Figure 4.2. Share of manufacturing in total employment, G7 countries, 1970-2003, in %



Source: OECD, STAN Indicators database, December 2005.

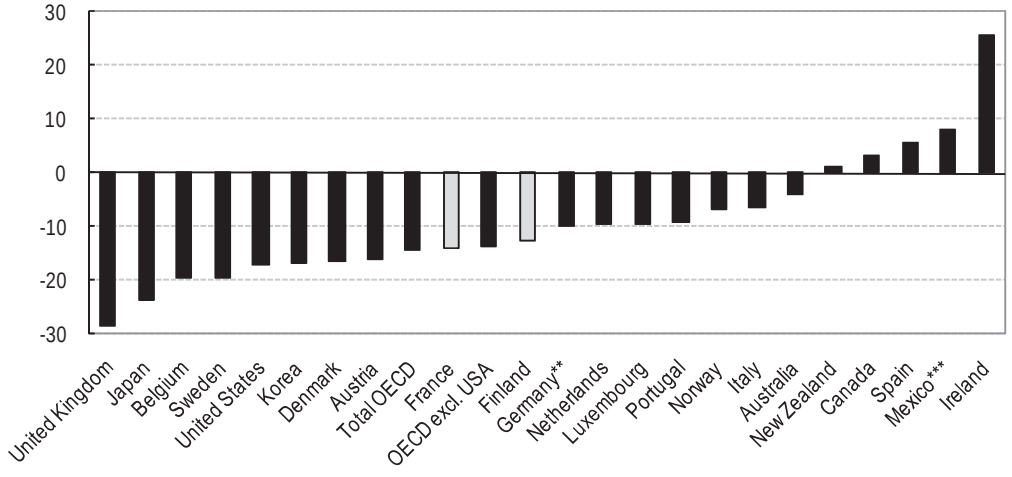
This pattern is broadly confirmed for other OECD countries (Figure 4.3). In most, the share of manufacturing has declined substantially since the 1970s, with Germany, the United Kingdom and Luxembourg showing the largest drop in employment shares from 1985 to 2002. In Canada, Ireland, Italy and Spain, the absolute share of manufacturing has declined the least over the past two decades. Underlying the declining share are two factors; an absolute decline in the number of manufacturing workers in virtually all OECD countries, with the exceptions of Canada, Ireland, Mexico, New Zealand and Spain (Figure 4.4), as well as rapid employment growth in the services sector (Wölfl, 2005).

Figure 4.3. Share of manufacturing in total employment, 1970, 1985 and 2003



*Data refer to 2001 for Australia, 2002 for France, Poland and Switzerland. **Germany before 1991 refers to West Germany.
Source: OECD STAN Indicators Database in OECD (2006a).

Figure 4.4. Percentage change in manufacturing employment, 1990-2003*



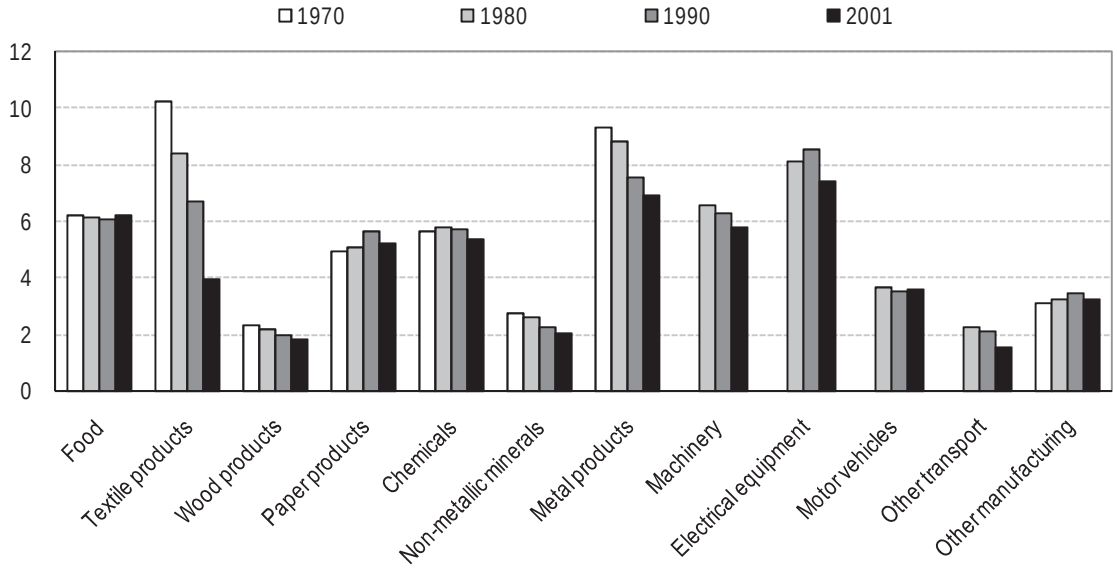
*Or latest available year. **Germany before 1991 refers to West Germany. ***Data for Mexico refer to employees.
Source: OECD, STAN Indicators database, December 2005.

Not all manufacturing sectors have declined equally

While overall manufacturing employment has declined, not all sectors have fared equally. Figure 4.5 shows manufacturing employment for key manufacturing sectors for the G7 countries, countries that account for approximately 70% of manufacturing employment in OECD countries. The graph shows that most of the decline in manufacturing employment over the past three decades has occurred in only two activities, textiles products and metal products. In several activities, notably food products, paper products, chemicals, motor vehicles and other manufacturing, manufacturing employment in the G7 countries has been relatively stable. In some others, such as wood products and machinery, it has only declined a little.

Figure 4.5. Manufacturing employment by key activity

G7 countries, 1970-2001, millions of workers



Source: OECD STAN Indicators Database in OECD (2006a).

There are several reasons why there is such large variation in the experience of different manufacturing activities. First, OECD countries maintain a comparative advantage in certain sectors of manufacturing activity and have been faced with strong demand for products of certain manufacturing sectors, *e.g.* pharmaceuticals and motor vehicles. This has helped to maintain employment in these sectors; in certain OECD countries, employment in these industries has grown. Second, in certain industries, such as food products, manufacturing production is often located close to the market, and international competition is typically not an important source of job loss. Indeed, some industry analysts suggest that off-shoring of production in such industries may make little sense, since the benefits of having a short, responsive local supply chain may outweigh the costs of higher wages (Ritter and Sternfels, 2004). In other industries, notably textiles, international competition of low-cost countries has played an important role in reducing manufacturing employment in OECD countries and will likely become even more important with the recent change in the trade regime for this sector (OECD, 2004).

At the same time, there is considerable variation across OECD countries in the development of employment in key manufacturing industries. For example, while overall OECD employment in the computer industry in OECD countries has declined substantially over the past decade, Ireland, Mexico and Korea experienced an increase over the 1990s. In radio, TV and communications equipment, employment grew substantially during the 1990s in Ireland, Mexico, Finland and Sweden, while it declined in most other OECD countries. Similar patterns of specialisation are apparent in other industries; for example, while employment in shipbuilding declined in virtually all OECD countries over the 1990s, it increased in Korea and Norway. Some OECD countries thus continue to have a strong comparative advantage in manufacturing industries that may be considered susceptible to off-shoring.

High-technology manufacturing is also being affected by employment losses

The recent changes in OECD manufacturing employment do not reflect a shift from low- to high-technology industries, as was the case in the 1980s (Figure 4.6). While OECD production and trade patterns in manufacturing clearly demonstrate the growing importance of high-technology manufacturing, employment data show that only one high-technology industry, pharmaceuticals, has experienced employment growth over the past decade (Figure 4.6). Other high-technology industries have all experienced a considerable decline, with computers and aircraft and spacecraft having the most rapid declines in employment of all manufacturing industries, with the exception of textile products.

Manufacturing employment in non-OECD countries has not grown

If manufacturing employment has fallen in OECD countries, the question can be raised what has happened in non-OECD countries? Have jobs been shipped off-shore? Although the available data are not readily comparable, ILO and UNIDO statistics suggest that the absolute number of manufacturing workers in non-OECD countries is considerably higher than in the OECD area. China alone had over 80 million manufacturing workers in 2002, which is similar to total manufacturing employment in the OECD area as a whole. On the one hand, this reflects the size and population of China, which outstrips that of the OECD. More importantly, however, the average level of productivity in Chinese manufacturing remains at a very low level (see below). Despite the large numbers of workers engaged in Chinese manufacturing, China (and many other non-OECD countries) still account for a (relatively) modest, through rapidly growing share, of global manufacturing production (see below).

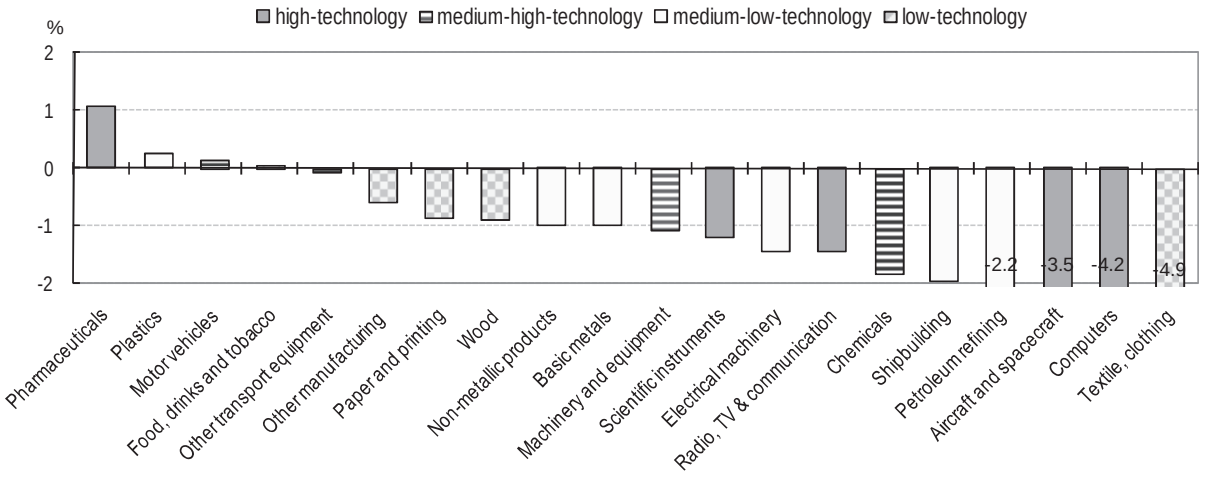
The limited evidence on trends in manufacturing employment in non-OECD countries suggests that the decline in manufacturing employment in OECD countries has not been accompanied by an increase in non-OECD countries. ILO and UNIDO employment estimates for key non-OECD countries such as Brazil, China and Russia show that manufacturing employment has also declined in these countries, and very substantially in some of them. For example, a recent study (Conference Board, 2004*b*) cites a net job loss of more than 4 million jobs between 1995 and 2002 in China's manufacturing sector, while a recent BLS report suggests that manufacturing employment in China fell from 98 million workers in 1995 to 83 million in 2002 (Banister, 2005*a*). At the same time, manufacturing employment has remained relatively stable in other large countries such as India and Indonesia. The key factor responsible for the decline in manufacturing employment in these countries is therefore rapid productivity growth, notably in countries such as China and Russia, where economic restructuring has been accompanied by the closing of many inefficient state-owned plants (Conference Board, 2004*b*). This suggests

also that the decline in manufacturing employment in OECD countries has not only been due to a shift of production from OECD to non-OECD countries. While this has certainly played a role for some countries and some industries, the key factor driving the decline in manufacturing employment is productivity growth.

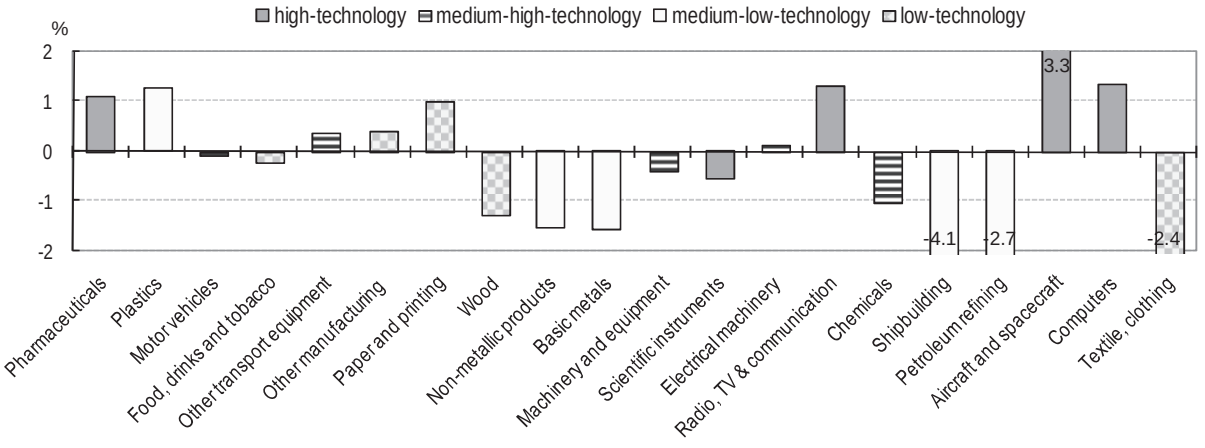
Figure 4.6. Growth of OECD* manufacturing employment by technology intensity

Average annual growth rates, in %

1990-2003**



1980-1990



Note: *) OECD aggregate includes Austria, Canada, Denmark, Finland, France, Germany, Italy, Japan, Norway, Spain, Sweden, United Kingdom and United States. Data for United Kingdom refer to number of employees. **) Or latest available year.

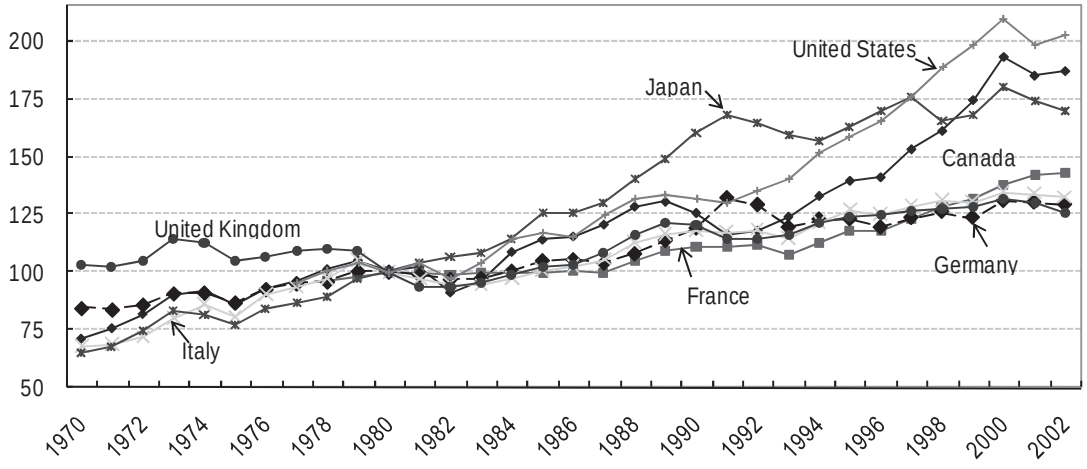
Source: OECD, STAN Indicators database, December 2005.

Manufacturing production and value added have continued to experience strong growth

One possible source for the decline in manufacturing employment in OECD countries could be slow growth in the demand for manufacturing products, which could lead to slow growth in manufacturing production and value added. However, the available data point to strong growth in manufacturing production and value added, in particular in certain key OECD countries, such as Canada and the United States (Figure 4.7). In European countries, in particular in Germany, Italy and the United Kingdom, manufacturing value added has grown only little in recent years, which is also the case for Japan since the early 1990s. Outside the G7 countries, manufacturing value added in OECD countries increased particularly quickly in recent years in Finland, Hungary, Korea, Mexico, Poland and Sweden.

Figure 4.7. Index of manufacturing value added, G7 countries, 1970-2003

Volume index (based on constant prices), 1980=100[1]



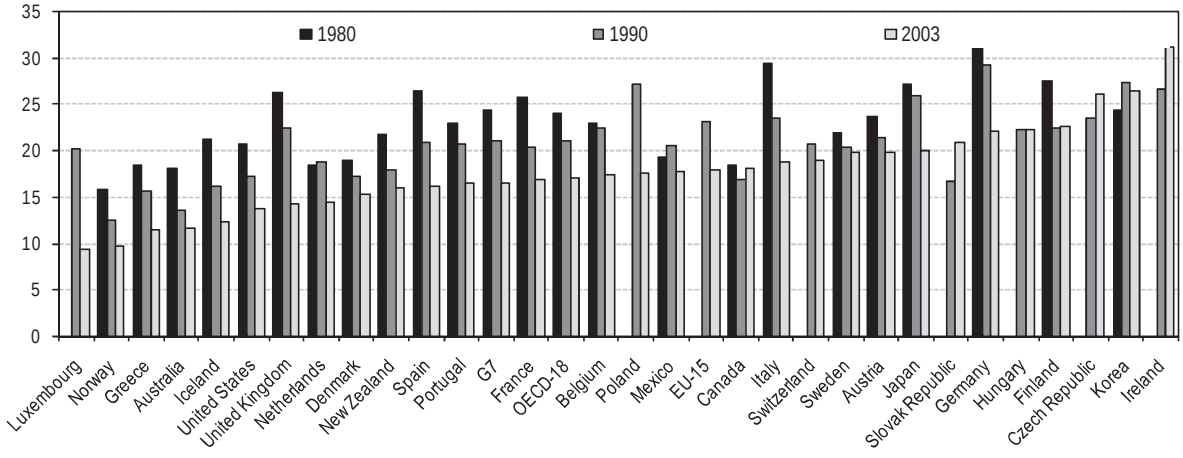
1. Data on value added is available for more countries in the OECD STAN database than data for production. For countries where both indicators are available, the trends are fairly similar.

Source: OECD, STAN database, December 2005.

While the volume of manufacturing production and value added has continued to rise over the past decades, the share of manufacturing in value added at current prices has slowly declined (Wölfl, 2005; Figure 4.8). From 1980 to 2003, the largest declines in shares occurred in the United Kingdom, Italy, Spain, Germany and France. From 1990 to 2003, the largest declines occurred in Luxembourg and Poland. Despite these declines, the manufacturing sector still accounted for 20% or more of value added in 2003 in several OECD countries, including Japan, Germany, Finland, the Czech Republic, Korea and Ireland. On the other hand, it had declined to less than 15% of total value added in Luxembourg, Norway, Greece, Australia, Iceland, the United Kingdom, the United States and the Netherlands.

To some extent, the declining share of manufacturing in value added is due to price effects. Since much of the manufacturing sector is characterised by relatively high productivity growth, prices of manufacturing products tend to increase only little over time and may even fall. This contrasts with the experience of the many parts of the services sector, where productivity growth has been slower and prices tend to go up more strongly over time. This price effect contributes to the declining share of manufacturing in value added; while manufacturing production has continued to increase, manufacturing products have become relatively cheap and therefore account for a smaller proportion of the economy than they did before.

Figure 4.8. Share of manufacturing value added in total economy, 1980-2003*

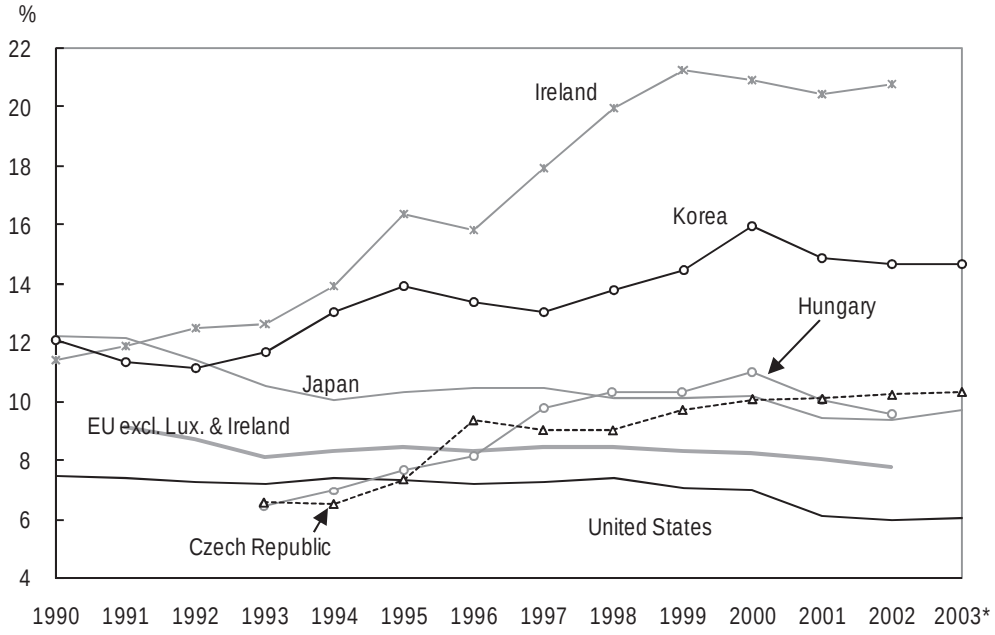


*Or latest available year.

Source: OECD, STAN Indicators database, April 2006.

The decline in value-added shares is also reflected in the share of high and medium-high technology manufacturing industries (Figure 4.9). In 2002, high and medium-high technology manufacturing accounted only for about 7.5% of total OECD value added, compared to about 8.5% in 2000 (OECD, 2005). In the United States, the share fell from 7.5% in 1990 to 6.0% in 2003. In Japan, it fell over the same period from 12.2% to 9.7%, and in the EU-15 (excluding Ireland and Luxembourg), it fell from 9.2% to 7.8%. Some countries experienced increases in the importance of these sectors, however. In Ireland, the importance of high and medium-high technology manufacturing rose from 11.4% in 1990 to 20.8% in 2002. In Korea, the rise was from 12.1 in 1990 to 14.7 in 2003; in Hungary, from 6.4% in 1994 to 9.6% in 2002; and in the Czech Republic, from 6.6% in 1994 to 10.3% in 2003.

Figure 4.9. Share of high and medium-high technology in total gross value added, 1990-2003*



*Or latest available year.

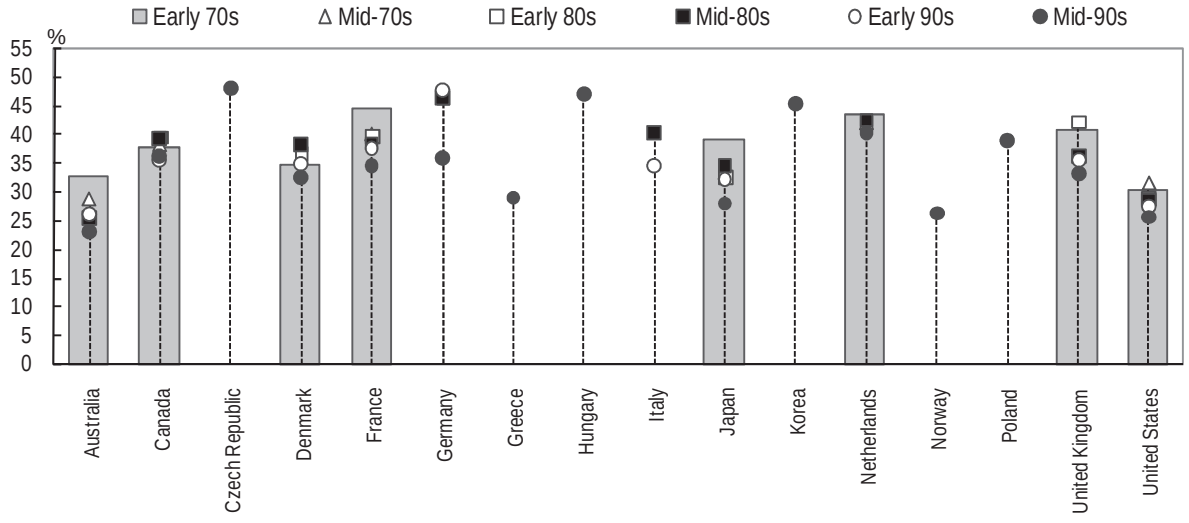
Source: OECD, STAN Indicators database, December 2005.

Demand for manufacturing goods remains high

Manufacturing is also important for the economy since it provides important inputs to other sectors of the economy and since it satisfies a broad range of final and intermediate demands. Evidence on the importance of manufacturing in this respect can be derived from input-output tables. Figure 4.10 shows that final demand for manufacturing products in the mid-1990s accounted for between 45% and 50% of total final demand in the Czech Republic, Hungary and Korea. In Australia, Norway and the United States, this share had declined to about 22%-26% of total final demand by 1995. For countries for which input-output tables are available over a long time period, the data suggest a gradual decline of the share of manufacturing demand in total final demand. At the same time, these shares are considerably higher than the shares of manufacturing in value and employment, and show that manufacturing still accounts for a considerable share of overall economic activity.[12]

12. Work is currently underway at the OECD to update its Input-Output Tables to 2000 or a later available year. Once this work is complete, the estimates in Figures 4.10 and 4.11 can be updated to a more recent period. See Yamano and Ahmad (2006) for further details on this work.

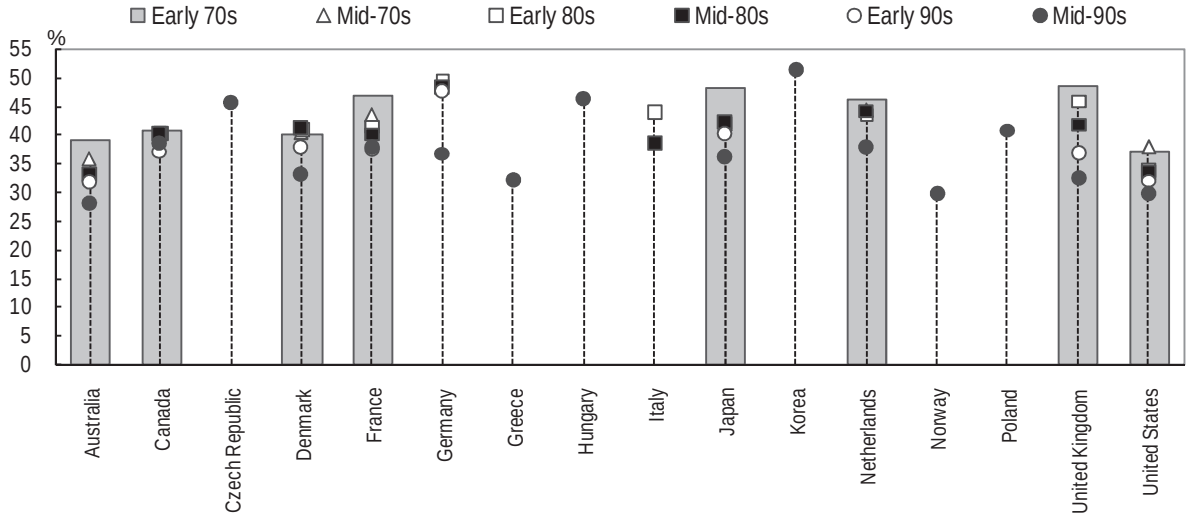
Figure 4.10. Share of final demand for manufacturing goods as a share of total final demand, 1970-1995[1]



Source: OECD, Input-Output Tables database.

Another way of illustrating the role of manufacturing in demand is by examining the share of demand for manufacturing in total demand (intermediate and final demand). These shares are shown in Figure 4.11, which points to very high shares for the Czech Republic, Hungary and Korea (over 50% in Korea), with the lowest shares (28%-30%) for Australia, Norway and the United States. This illustrates once more that manufacturing remains considerably more important to total economic activity than suggested by other indicators, such as value added shares.

Figure 4.11. Share of total demand for manufacturing goods as a share of total demand, 1970-1995[1]

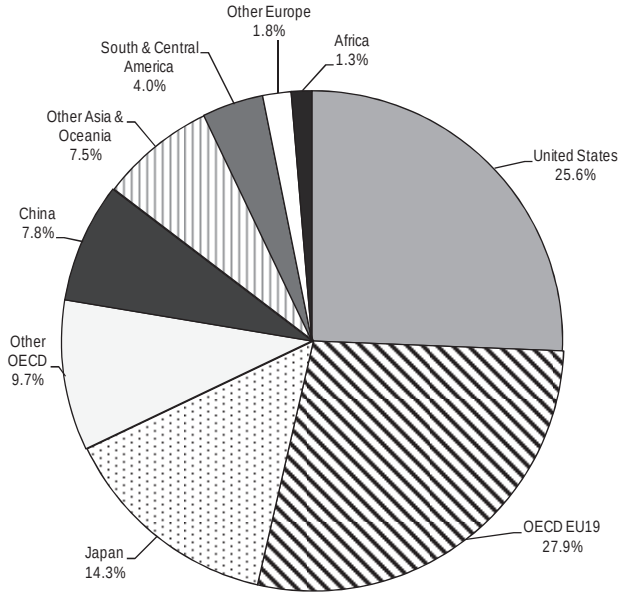


Source: OECD, Input-Output Tables database.

Global production continues to rise

Output growth of manufacturing products in certain non-OECD countries, such as China, has been particularly rapid in recent years. In terms of the importance of different countries in global manufacturing, OECD countries still dominated global manufacturing in 2002, however, accounting for just below 80% of world-wide manufacturing (Figure 4.12). China accounted for about 8%, however, which is similar to Germany's share in that year. The share of other Asian countries was about the same as that of China in 2002, while South America accounted for about 4% of global manufacturing, a share comparable to that of the United Kingdom or France. Africa accounted for only 1.3% of manufacturing value added in 2002, a share comparable to that of Chinese Taipei.

Figure 4.12. Share in world manufacturing value added, 2002, in %[1]

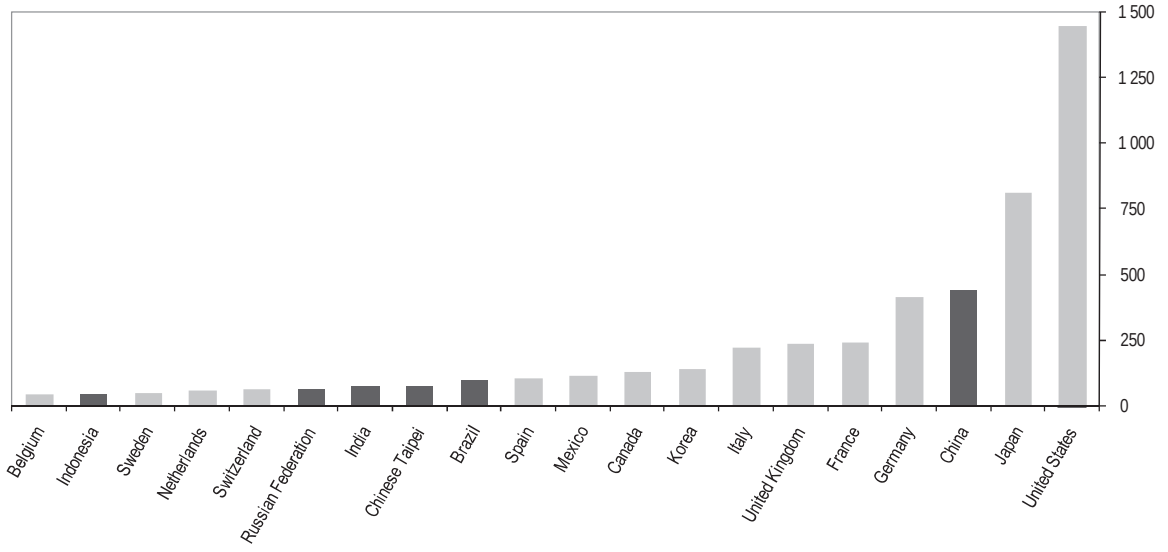


1. Data on value added are converted at exchange rates. The estimates should be interpreted with caution.

Source: OECD, STAN database and UN Statistics Division.

Figure 4.13 shows that out of the 10 top global manufacturing countries in 2002, nine belonged to the OECD, with US and Japanese manufacturing being the largest. In 2002, China's manufacturing value added was about the same as that of Germany. Given recent trends, China has now clearly become the third-largest manufacturing country in the world. Other non-OECD countries, including Brazil, India and the Russian Federation, only accounted for a small share of global manufacturing in 2002.

Figure 4.13. Top 20 manufacturing countries, 2002, in million USD[1]

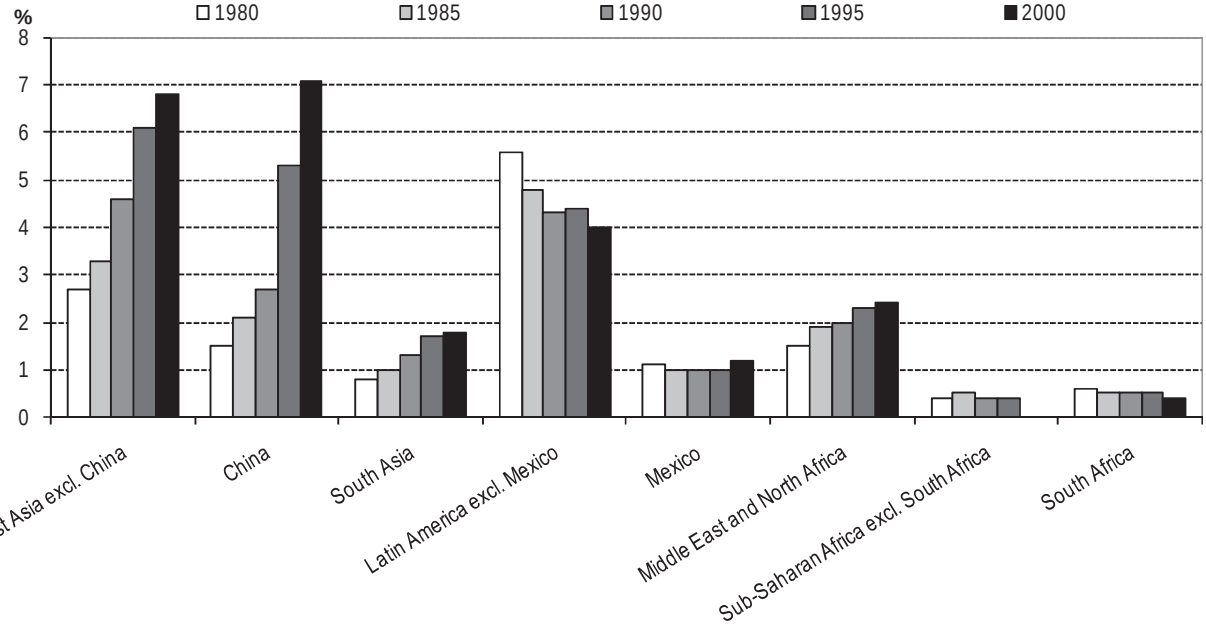


1. Data on value added are converted at exchange rates. The estimates should be interpreted with caution.

Source: OECD, STAN database and UN Statistics Division.

The share of China in global manufacturing has risen rapidly over the past few decades, as is shown in Figure 4.14. Strong growth has also occurred in East Asia, whereas South Asia and the Middle East have also experienced a growing share in world manufacturing. At the same time, the share of Latin America has declined whereas that of Africa has remained at a very low level.

Figure 4.14. Share of major developing regions in global manufacturing value added



Source: UNIDO (2004).

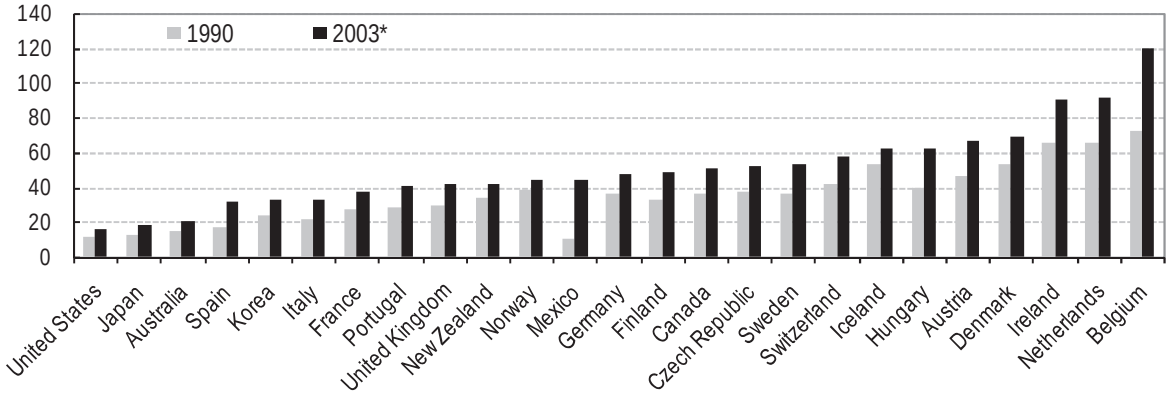
Trends in the internationalisation of manufacturing

Manufacturing trade is increasing more rapidly than global production

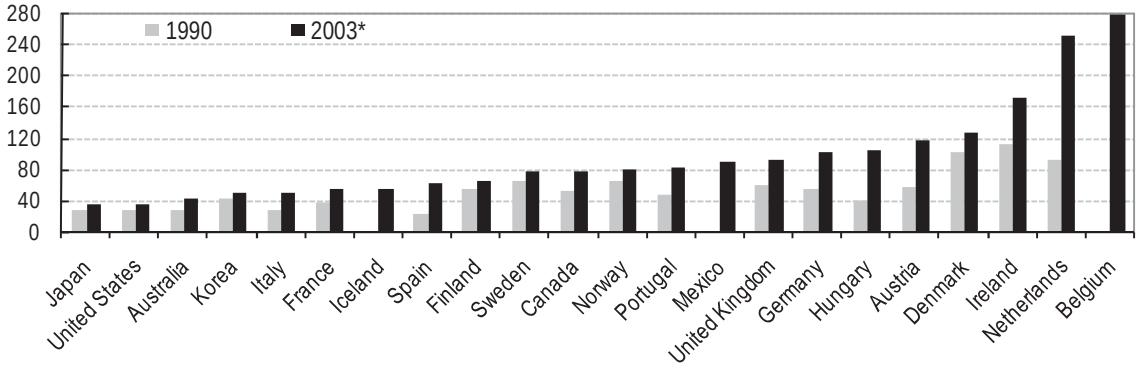
The growth of manufacturing production is accompanied by an even faster growth of manufacturing trade, in particular of high-technology goods. This is visible in the growing export intensity of manufacturing production; for total manufacturing, this has increased considerably for all OECD countries from 1990 to 2003 (Figure 4.15a). A similar increase can be observed for high-technology industries, where the level of export intensity is even higher (Figure 4.15b). Similar increases in the trade intensity of manufacturing can be observed for imports. Both indicators point to a growing integration of manufacturing production at the global level.[13]

Figure 4.15. Share of exports in production, 1990-2003[1]

a) Total manufacturing



b) High-technology industries



1. Or latest available year.

Source: OECD, STAN Indicators database, December 2005.

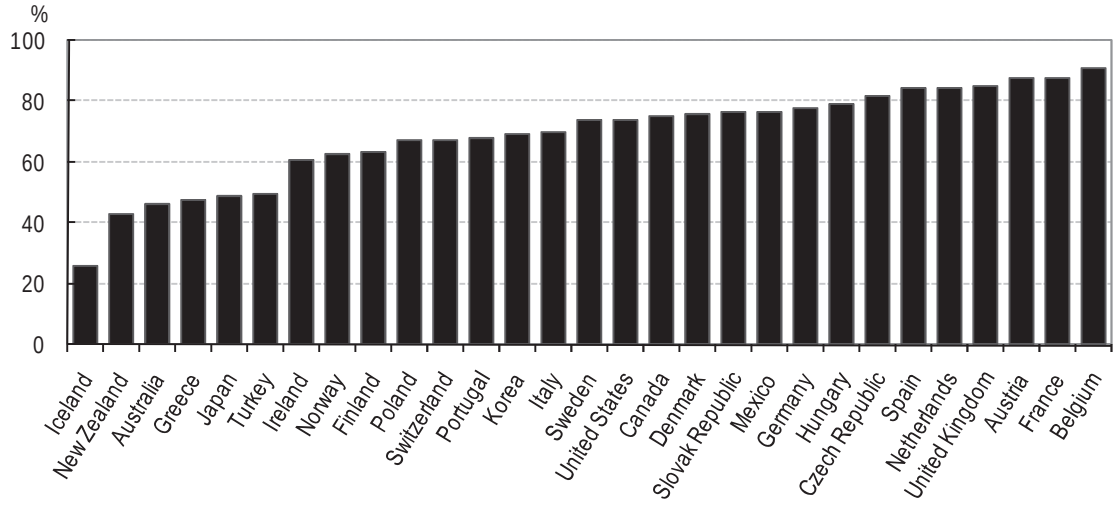
13. Note that the high shares of exports in production for Belgium and the Netherlands are linked to re-exports. Recent research indicates that 40% of total exports in the Netherlands should be considered as re-exports (*i.e.* the re-export of imported goods without being significantly processed).

Inter-industry trade is important, pointing to the integration of value chains

Much manufacturing trade occurs within the same industry or even within a firm, resulting from the integration of manufacturing production throughout the value chain. Such simultaneous exports and imports within the same industry are generally labelled as intra-industry trade (see OECD, 2005*b*). 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. Countries in which intra-industry trade is high in relation to aggregate manufacturing trade (over 70%) and where it has increased in recent years are the Czech Republic, Hungary and Portugal (Figure 4.16). In some other countries, such trade remains fairly important, although it has not increased significantly. These countries include France, Canada, Austria and Switzerland.

Figure 4.16. Manufacturing intra-industry trade as a percentage of total manufacturing trade

Average 1996-2003



Source: OECD, STAN Indicators database, June 2005.

The high level and fast growth of intra-industry trade in some Central and Eastern European countries may stem from the large volume of direct investment in those countries, from Germany in particular. The shift to these countries of numerous activities of foreign multinationals was conducive to a relatively swift rise in intra-industry trade over the course of the 1990s. The low level of intra-industry trade in Japan may be due to the fact that Japanese exports are concentrated in a number of high-technology sectors that generate substantial trade surpluses.

There are winners and losers in the global marketplace

The growth of global manufacturing trade has boosted trade in most OECD countries, but does not benefit all countries equally. Some countries have gained market share, while others have lost market share. Over the period 1995 to 2003, among the G7 countries, Japan, the United States, the United Kingdom, France and Italy lost export market shares in goods, while Germany and Canada increased theirs (Figure 4.17a). The highest growth of export market shares in goods is observed for Hungary, Ireland, Greece, the Slovak Republic, Poland, the Czech Republic, Mexico and Turkey. Despite these increases, these countries still account for only a small share of world export market shares (Figure 4.17b).

Figure 4.17. Trends in export market shares in goods

a) Growth of OECD countries export market shares in goods between 1995 and 2003

Current prices

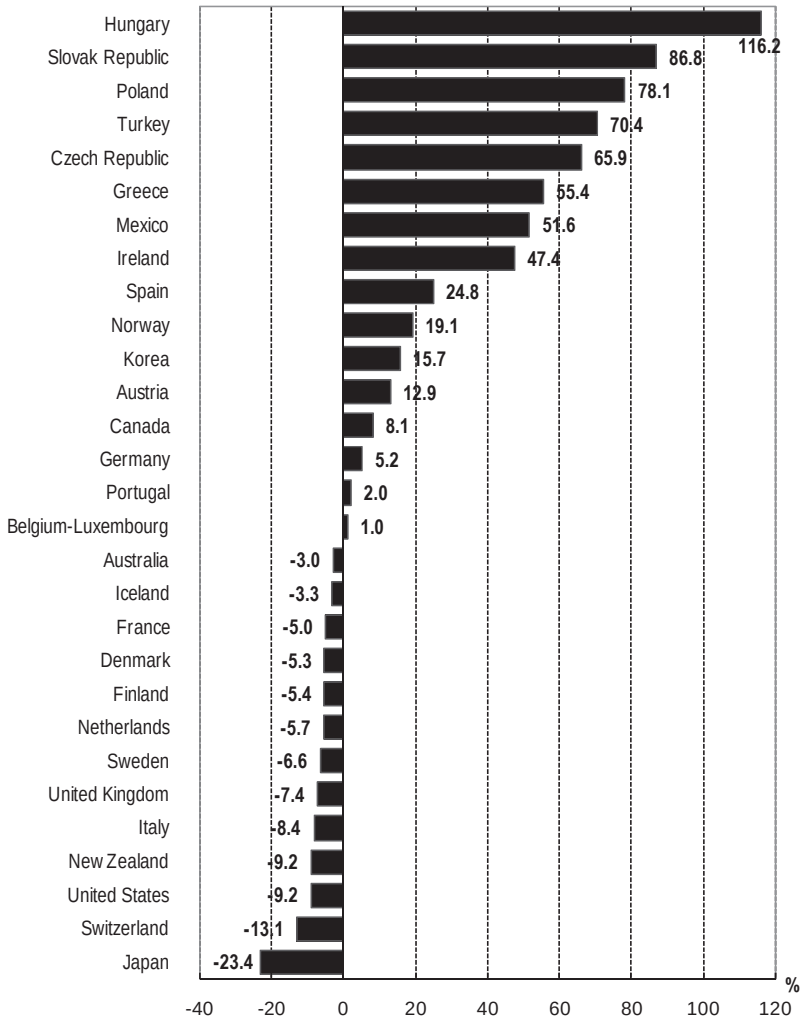
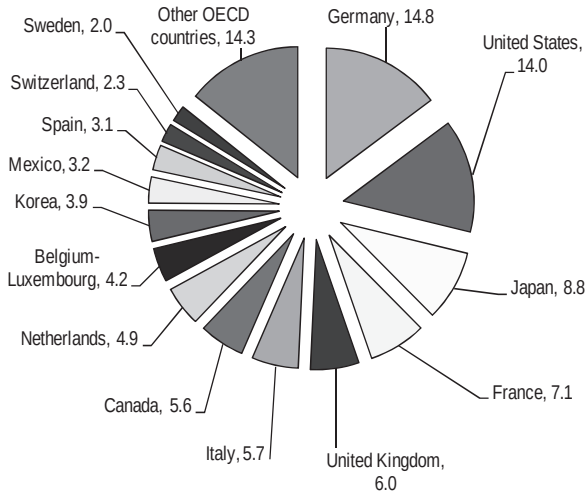


Figure 4.17. Trends in export market shares in goods *(continued)*

b) World export market shares in goods of OECD countries, 2003

Current prices



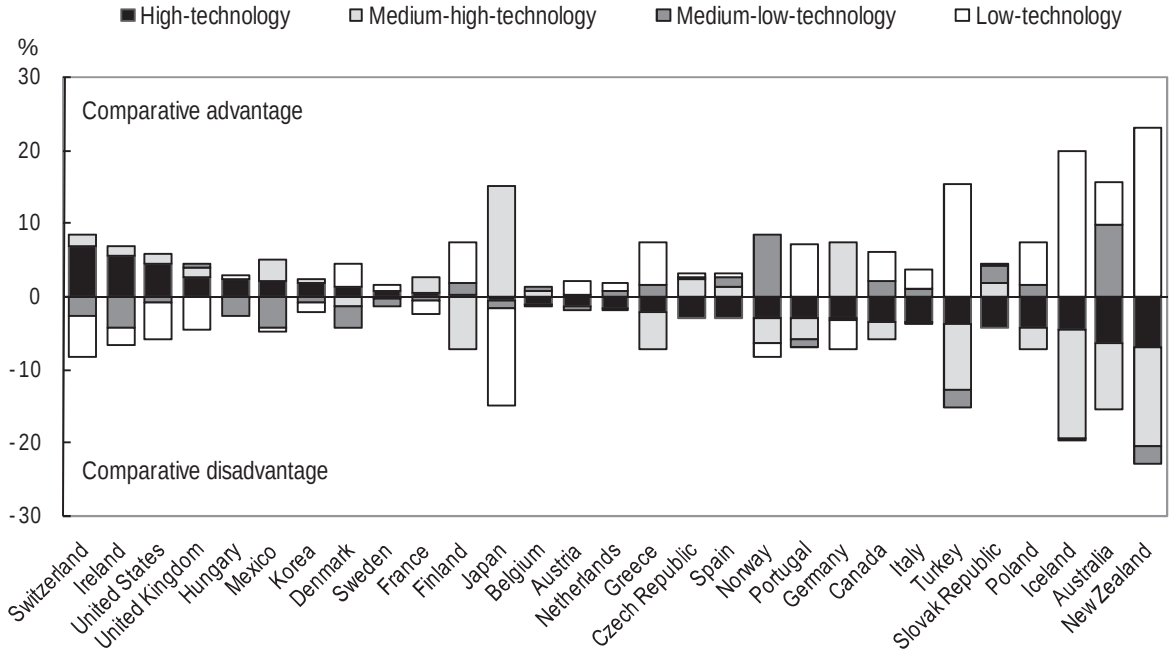
Source: IMF, Balance of Payments Statistics, April 2005; OECD, Economic Globalisation Indicators, 2005.

The comparative advantage of OECD countries differs considerably

OECD countries differ considerably in the composition of manufacturing trade and in their relative comparative advantage. This is illustrated in Figure 4.18, which shows the relative strengths of different OECD countries in terms of their trade package, classified according to the technology intensity of their trade package (see OECD, 2005*c*). Only a few OECD countries, notably Switzerland, Ireland, the United States and the United Kingdom have a strong comparative advantage in high-technology manufacturing. Several others, notably Japan and Germany, are particularly strong in medium-high technology industries, such as machinery, electrical equipment and cars. Yet another group of countries, including Portugal, Turkey, Iceland and New Zealand have a particularly strong comparative advantage in low-technology manufacturing.

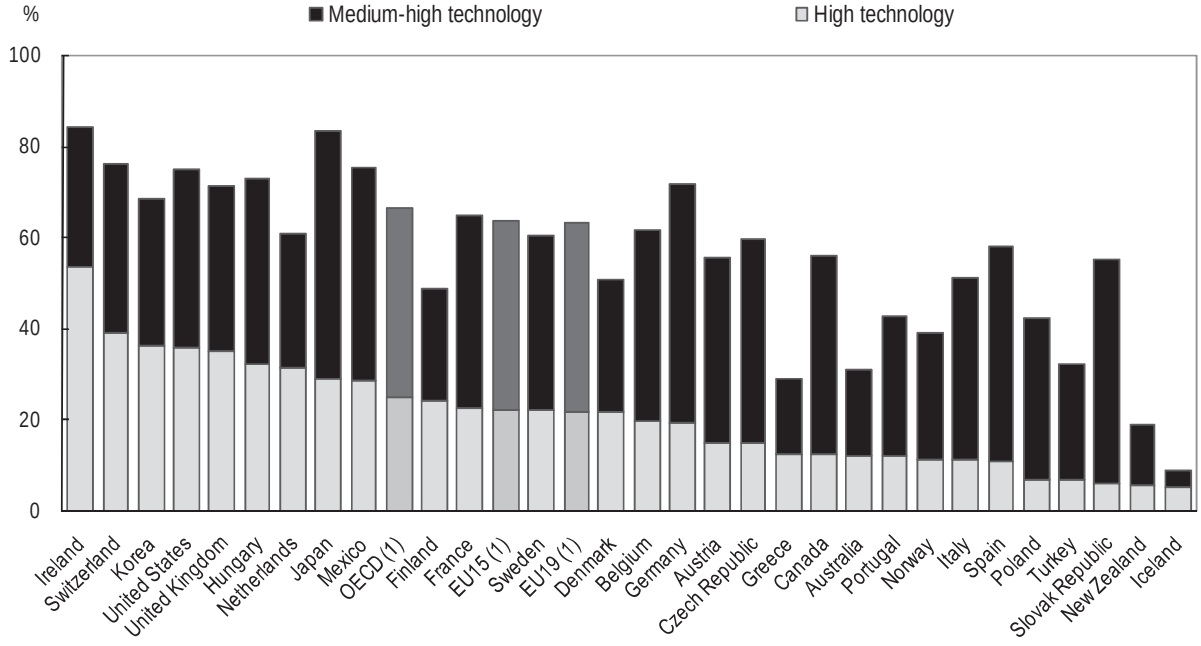
Another way of illustrating the relative strengths of different OECD countries is the share of different industries in manufacturing exports (Figure 4.19). This shows very high shares of high-technology industries in Ireland (58% of total manufacturing exports), Switzerland, the United States, the United Kingdom and Korea. Japan, Germany, Mexico and Spain have particularly high shares of medium-high technology industries in total manufacturing exports.

Figure 4.18. Contribution to the manufacturing trade balance, 2003
As a percentage of total manufacturing trade



Source: OECD, STAN Indicators database, June 2005.

Figure 4.19. Share of high and medium-high technology industries in manufacturing exports, 2003
As a percentage of total manufacturing exports



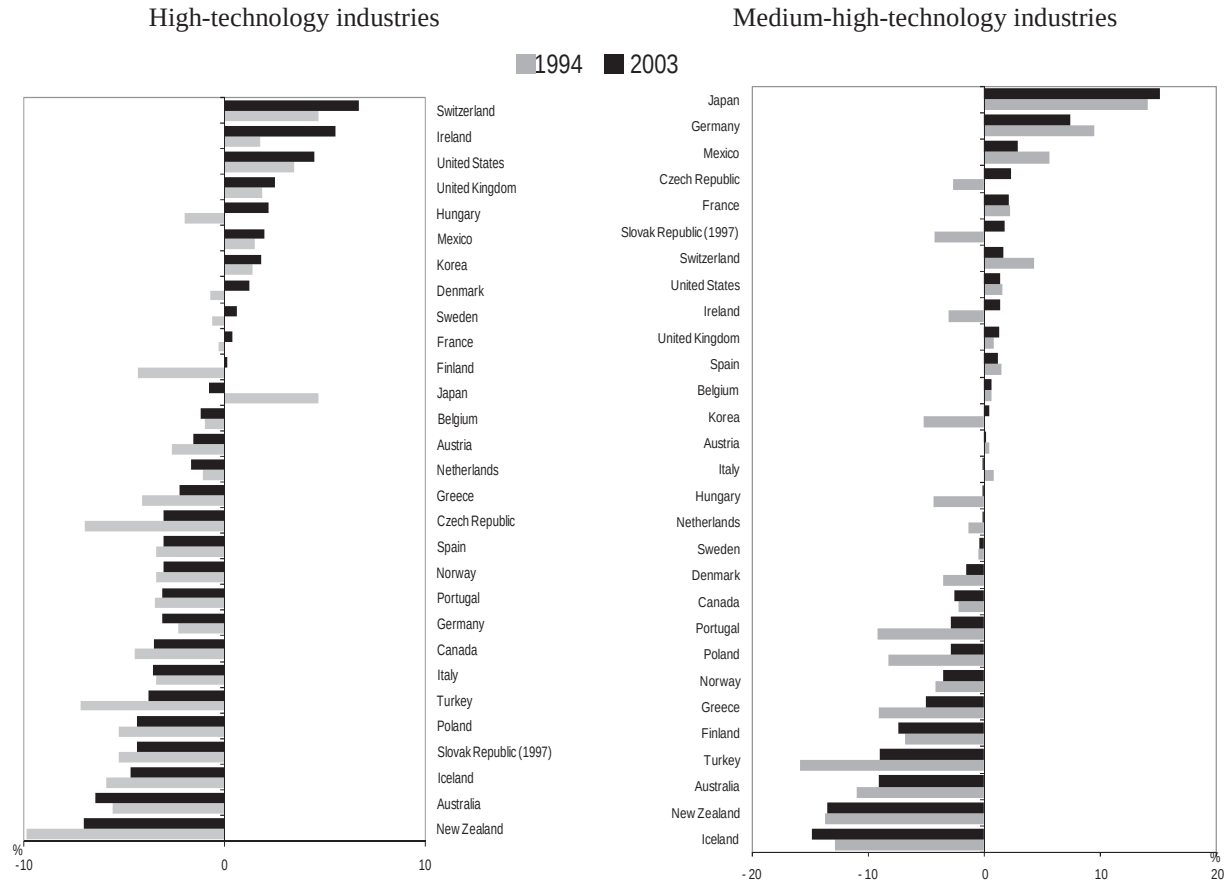
1. Excluding Luxembourg.

Source: OECD, STAN Indicators database, June 2005.

These patterns of comparative advantage are not static, but are slowly changing over time, as the structure of OECD economies adjusts and firms engage in new activities. Some evidence for the changing pattern of comparative advantage from 1994 to 2003 is presented in Figure 4.20. For the high-technology industries, it shows large shifts for Finland, Hungary and Japan, where the first two countries strengthened their position in these industries, whereas Japan lost some of its edge in this part of the market. For medium-high technology industries, large shifts can be observed for Greece, the Czech Republic, Hungary, the Slovak Republic, Ireland, Korea, Portugal and Turkey, with all these countries reducing their comparative disadvantage in this part of the global market.

Figure 4.20. Changes in the contribution to the manufacturing trade balance, 1994-2003

As a percentage of total manufacturing trade



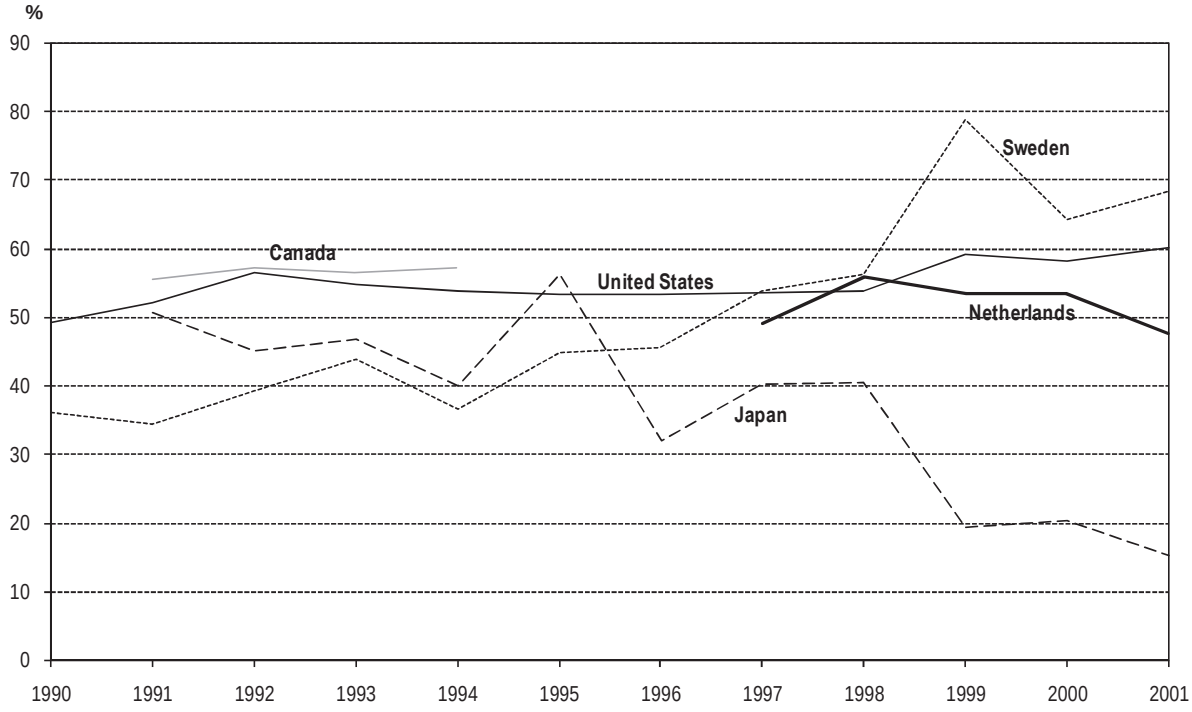
Note: No data are available for Luxembourg.

Source: OECD, STAN Indicators database, September 2005.

Foreign affiliates are of growing importance

Much of global trade is carried out by MNEs and much trade takes place between MNEs and their foreign affiliates, in the form of intra-firm trade. Data on such intra-firm trade is only available for some OECD countries (Figure 4.21). The share of intra-firm exports in total exports of manufacturing affiliates under foreign control ranges between 15% and 60% in the OECD countries for which such data are available. Throughout the 1990s and the beginning of the present decade, this proportion held steady at around 50% in the United States, Canada and the Netherlands, but rose sharply in Sweden (from 35% to 75%) and declined in Japan (from 35% to 15%). In other words, in 2001, only 30% of the exports of affiliates under foreign control in Sweden were destined for non-affiliates, while in Japan the corresponding proportion was 85%. This once more points to the growing integration of production in value chains, where parts of production are being relocated to other countries.

Figure 4.21. Share of intra-firm exports in total exports of affiliates under foreign control, 1990-2001



Source: OECD (2005), Economic Globalisation Indicators, Paris.

Factors driving manufacturing performance

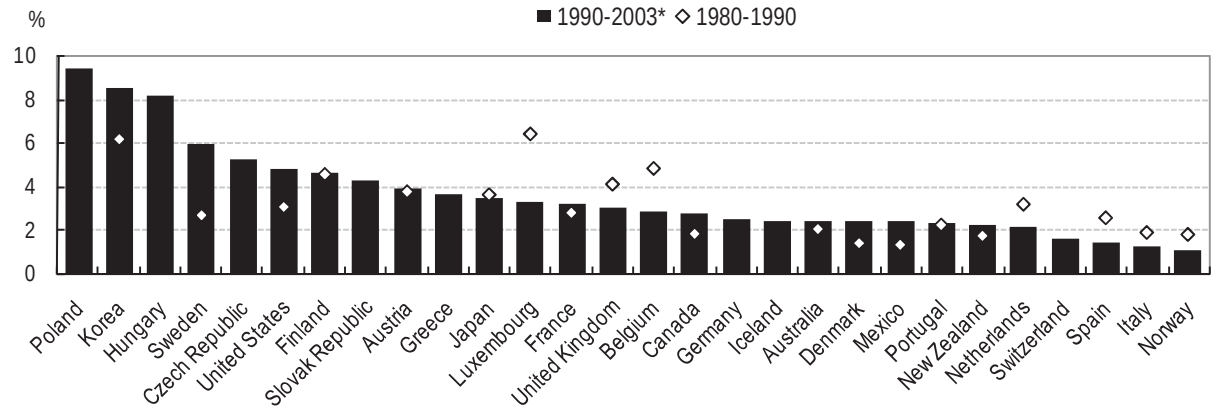
The previous two sections of this paper have pointed to continued growth of manufacturing output, rapid growth in manufacturing trade, including a growing share of certain non-member economies, a declining share of manufacturing in OECD demand, GDP and employment, as well as an absolute decline in the number of manufacturing workers. This section examines some of the factors that underpin these trends. This includes productivity and labour costs, innovation and technology, and the interaction between services and manufacturing.

Productivity growth in manufacturing remains high in many OECD countries

One of the key drivers of manufacturing output and employment is rapid growth in productivity, in particular in certain countries and industries. Average productivity growth rates in certain countries, notably Hungary, Korea, Poland and Sweden have been over 6% annually (Figure 4.22). Combined with somewhat slow growth in manufacturing demand, high rates of productivity growth can contribute to a decline in manufacturing employment. In most OECD countries, average rates of productivity growth in manufacturing have been more modest, ranging between 2%-4% annually. This is still substantially higher than economy-wide growth in productivity, however (Wölfl, 2005).

Figure 4.22. Productivity growth in manufacturing, 1980-90 and 1990-2003*

Annual average growth of value added per person employed, in %



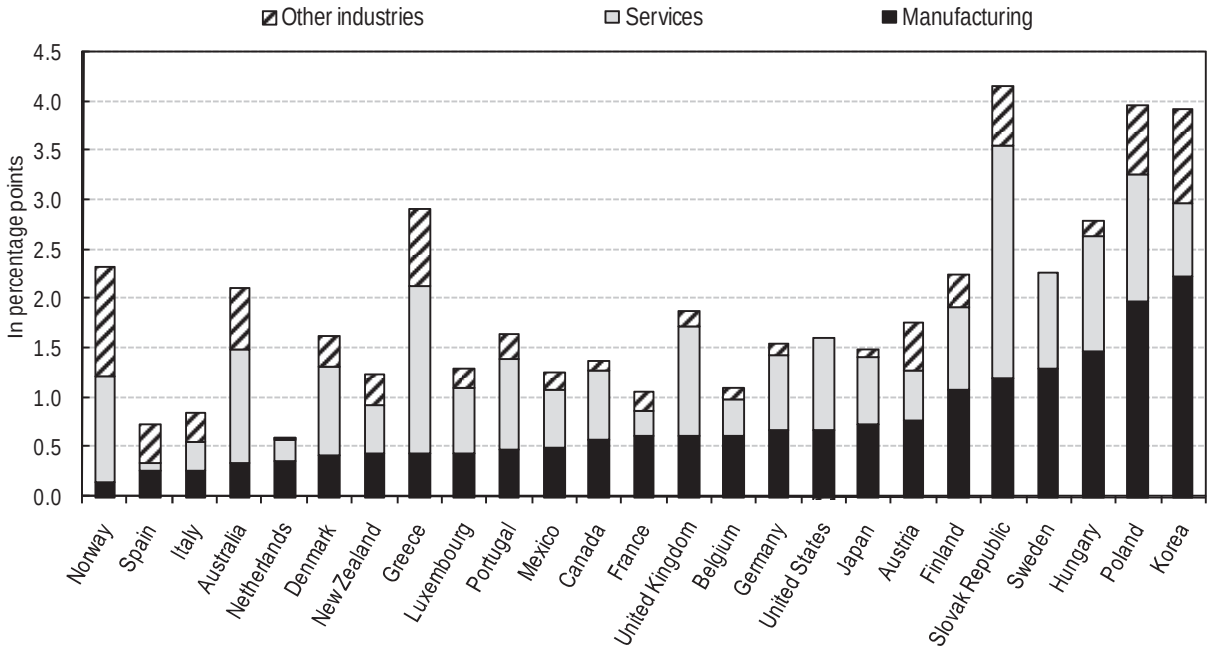
*Or latest available year.

Source: OECD, STAN and STAN Indicators databases, December 2005.

Due to its high rates of productivity growth, the manufacturing sector continues to make a significant contribution to aggregate productivity performance, despite is relatively small share in total value added and employment. This is particularly the case in Finland, Hungary, Korea, Poland, the Slovak Republic and Sweden, where manufacturing made a large contribution to the high productivity growth rates characterising these countries over the past decade (Figure 4.23). However, manufacturing also accounted for the bulk of aggregate productivity growth in several other countries, including France, Japan and the Netherlands. In several other OECD countries, including Australia, Denmark, Greece, Norway, Portugal and the United Kingdom, however, manufacturing accounted for only a small share of aggregate productivity growth over the past decade.

Figure 4.23. Contribution of manufacturing to aggregate productivity growth, 1990-2003*

Contribution to annual average growth of value added per person employed, in %



*Or latest available year.

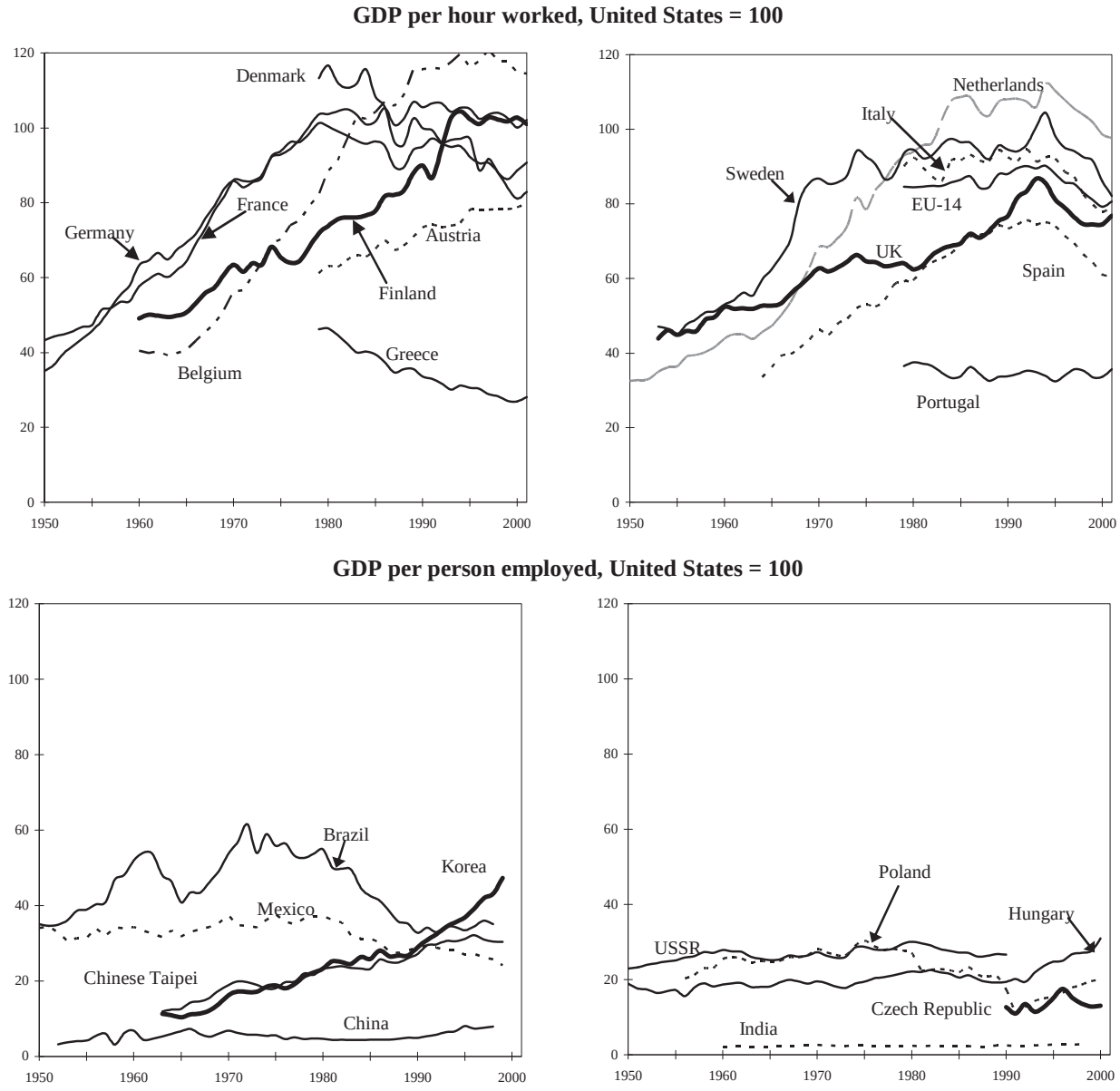
Source: OECD, STAN and STAN Indicators databases, December 2005.

A closer look at the detailed industries underlying strong manufacturing productivity growth points to a diversity of experiences, reflecting relative strengths and weaknesses of different countries. In certain OECD countries, notably Finland, Hungary, Ireland, Japan, Korea, Sweden and the United States, ICT-producing industries have made a large contribution to aggregate productivity growth over the past decade (Pilat and Wölfl, 2004; Pilat, 2005).

Gaps in productivity levels across countries are large and persistent

While manufacturing productivity has grown quickly in many OECD countries, the available evidence points to large and persistent gaps in productivity levels across OECD and non-OECD countries (Figure 4.24). Some countries, such as Finland and Korea, have made sizeable progress in catching up in productivity levels over the past decades. In others, little progress has been made and in some, notably in Europe, productivity levels compared with the United States have fallen over the recent period. The available evidence points to relatively low productivity levels for some non-OECD countries, notably China and India.

Figure 4.24. Relative labour productivity in manufacturing, 1950-2000



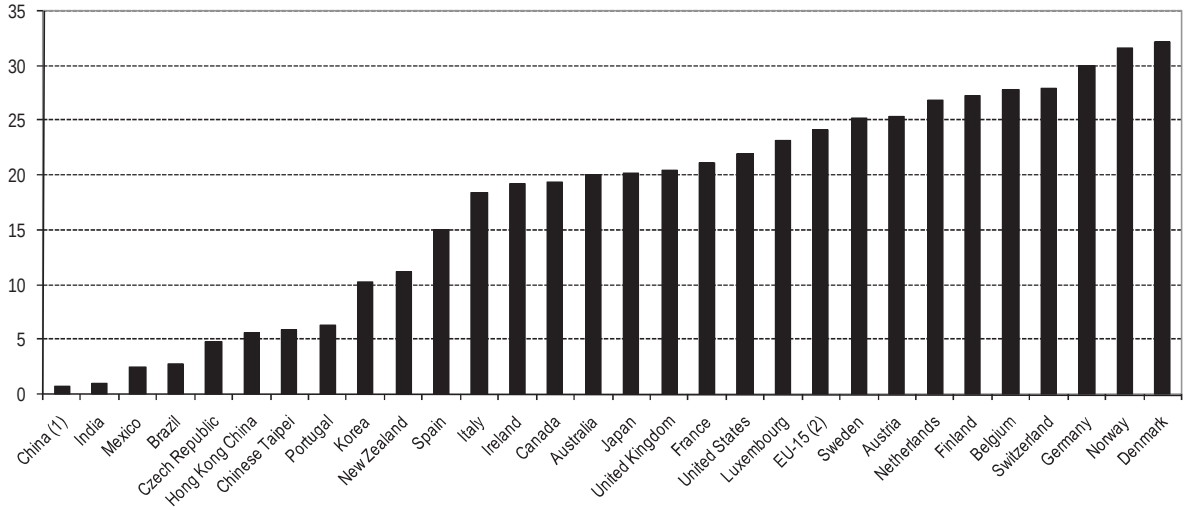
Source: Groningen Growth and Development Centre.

Labour costs differ enormously across countries, but also reflect productivity gaps

Labour costs are another key factor in determining the location of manufacturing production in different countries. Although labour costs account for only a fraction of total manufacturing costs (with considerable differences across industries), it is one of the factors that is most linked to location, as it is influenced by domestic labour market conditions. Comparisons of manufacturing labour costs are published on a frequent basis by the US Bureau of Labor Statistics. These comparisons cover 25 OECD countries and six non-OECD economies (Brazil; Chinese Taipei; Hong Kong, China; Israel; Singapore and Sri Lanka). China and India are not included in these estimates and were added to the figures below based on estimates by Oxford Economic Forecasting. The resulting comparison of hourly labour costs is shown in Figure 4.25.

Figure 4.25 shows a wide diversity in labour costs, ranging from just over 0.6 USD per hour in China and 1 USD an hour in India,[14] to over 30 USD an hour in Norway and Denmark. Major OECD countries such as the United States, Japan, Canada, France and the United Kingdom all have hourly labour costs around 20 USD an hour. Germany had the highest level of hourly labour costs among major OECD countries, with 30 USD an hour. Since the estimates are converted by exchange rates to a common currency, exchange rates have a considerable influence on these estimates. For example, hourly labour costs in the Euro-area have risen considerably relative to the United States as the Euro has appreciated. The low position of China in Figure 4.25 is also influenced by the relatively low value of the Chinese Yuan.

Figure 4.25. Hourly labour costs in manufacturing, 2003, in USD



1. Estimates of Chinese labour compensation may be underestimated as many Chinese workers may benefit from various types of non-monetary compensation, including subsidised accommodation.

2. Trade-weighted estimates, as shown in BLS (2004).

Source: Estimates from BLS (2004); China and India from Oxford Economic Forecasting.

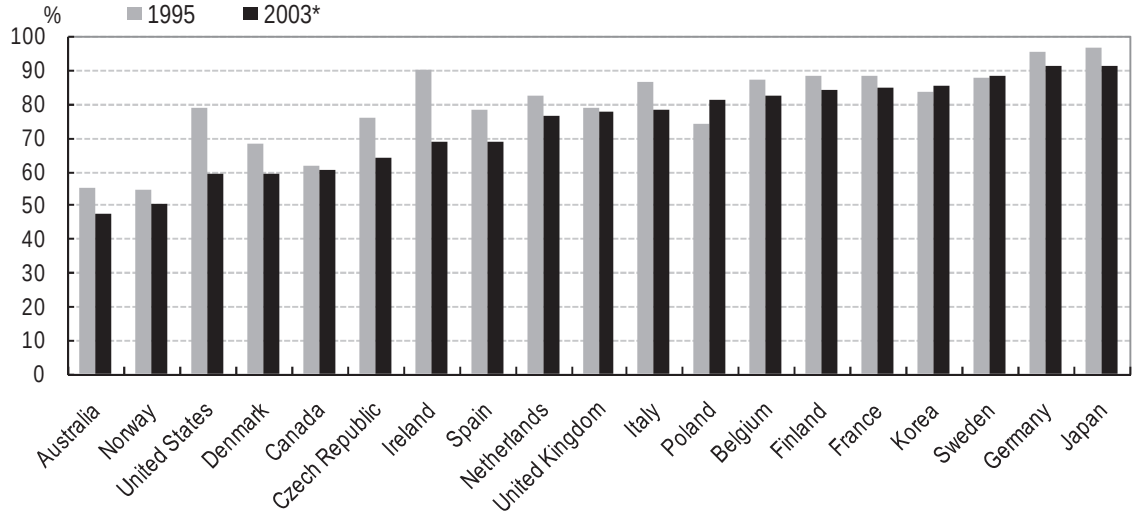
14. The estimates for China are confirmed by a recent BLS study on manufacturing compensation in China, that finds hourly compensation of about 0.57 USD in 2002 (Banister, 2005*b*).

Labour costs should be examined relative to a country's level of productivity in the manufacturing sector. High labour costs can only be supported if they coincide with a high level of labour productivity; conversely, countries with low levels of labour costs typically have low levels of labour productivity. The combination of the estimates of productivity levels presented in Figure 4.24 and the estimates of labour costs presented in Figure 4.25 suggest that China has a relatively low level of unit labour costs. However, the figures shown in Figures 4.24 and 4.25 are averages; more detailed estimates are required to compare unit labour costs in individual industries. For example, labour costs in high-technology industries may be relatively high in low-income economies if these industries require highly skilled workers that might be more scarce.

The manufacturing sector still accounts for the bulk of spending on research and development

Of great importance to the role of the manufacturing sector in overall economic activity is its role as a driver of innovation and technological change. While manufacturing's share in employment and value added has declined, the manufacturing sector still accounts for the bulk of business expenditure on R&D (Figure 4.26). Its share has declined, however, due to a variety of factors, such as growing R&D in certain services sectors, the outsourcing of R&D to specialised R&D labs that are classified in the services sector, as well as better measurement of R&D in services.

Figure 4.26. Share of manufacturing in total business R&D, 1995 and 2003*, in %



*Or latest available year.

Sources : OECD, ANBERD and STAN Indicators databases, December 2005.

With the end of the "new economy" bubble in 2000, R&D in manufacturing has declined in many high-technology sectors, as the markets for these industries retracted and profits diminished.

In several OECD countries, manufacturing R&D is highly concentrated in a few industries and firms. For example, in Canada, Finland, Ireland, the United States and the United Kingdom, over 60% of all manufacturing R&D is accounted for by high-technology industries. In other countries, such as Germany, Japan and the Czech Republic, medium-high technology industries account for a large share of the total. Combined, these two technology groups account for 80%-90% of total manufacturing R&D in most OECD countries, with the exceptions of Australia and Norway (Figure 4.27).

Figure 4.27. Share of technology industries R&D in % of total manufacturing R&D, 2003 *

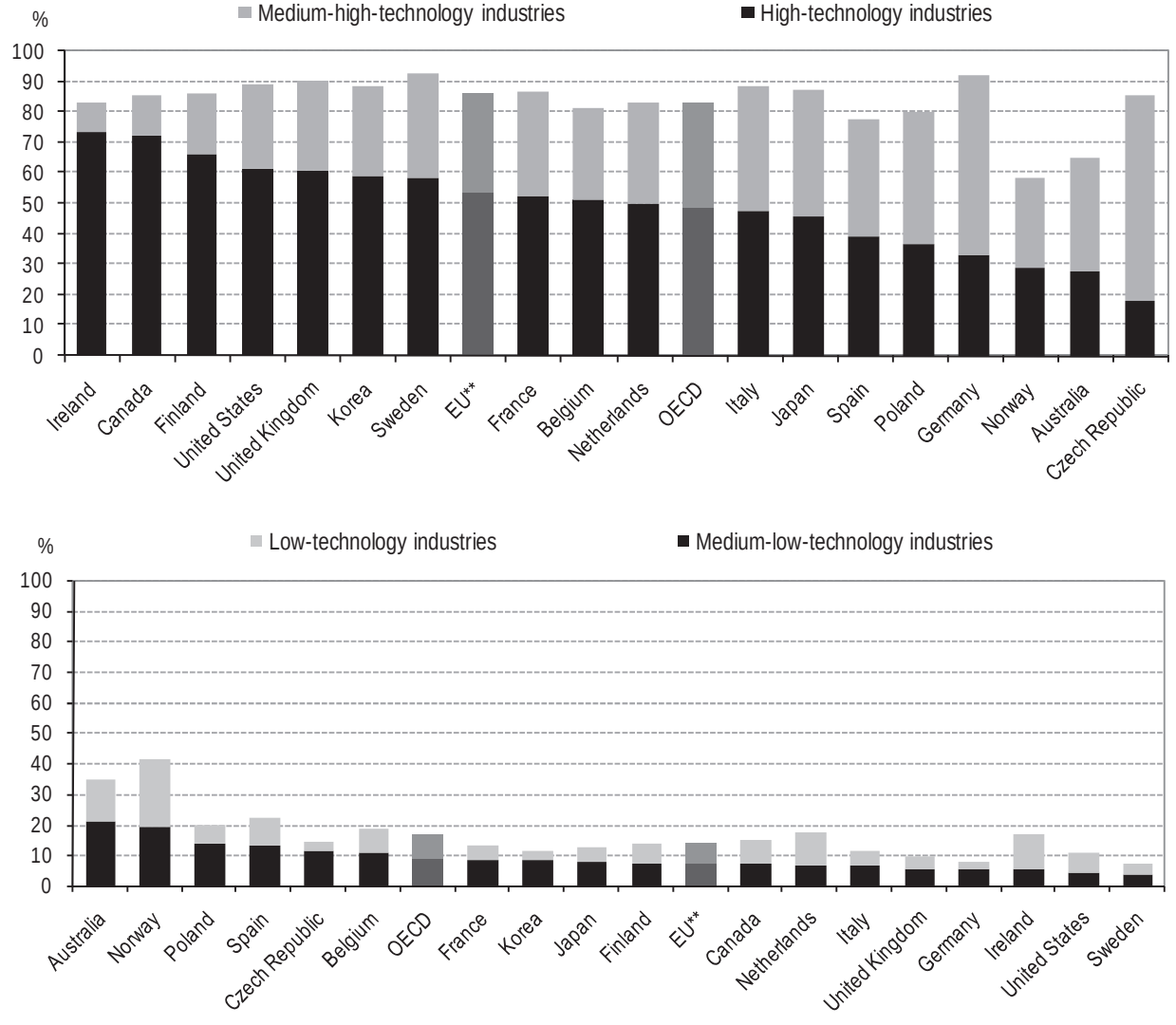
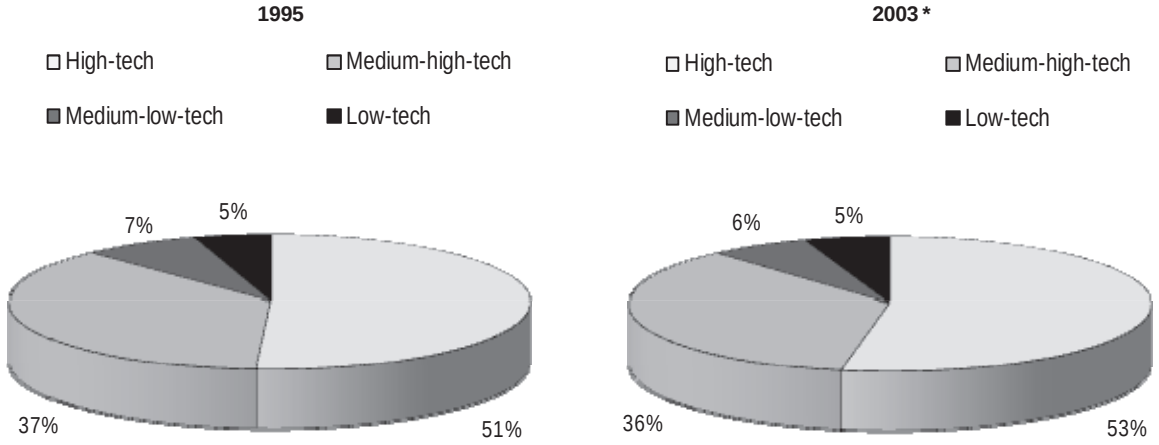


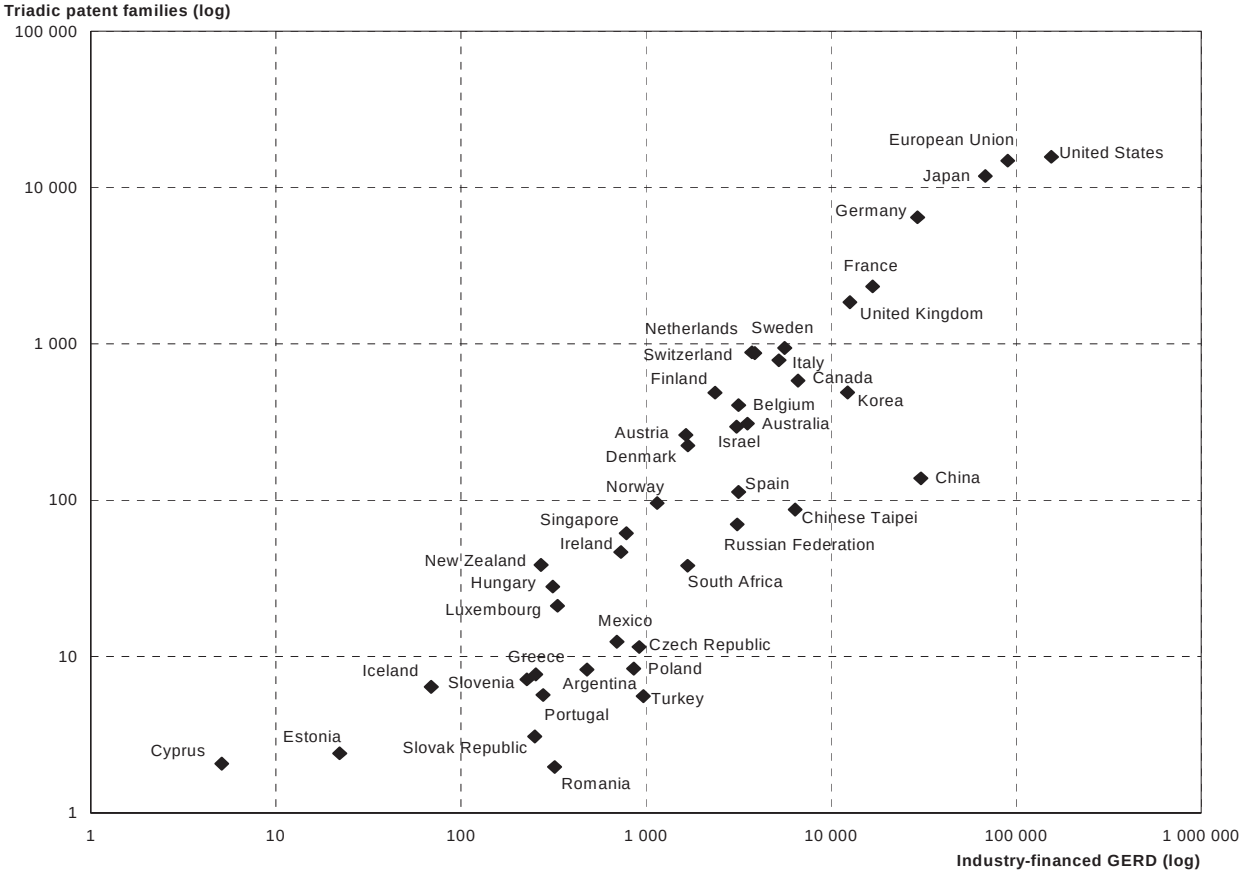
Figure 4.27. Share of technology industries R&D in % of total manufacturing R&D, 2003* *(continued)*



*Or latest available year. **Excluding the Czech Republic and Poland.

Source : OECD, ANBERD and STAN Indicators databases, December 2005.

Figure 4.28. Triadic patent families[1] and industry-financed R&D[2], 1996-2002



Note: Patent counts are based on the inventor's country of residence, the earliest priority date and fractional counts.

1. Patents all applied for at the EPO, USPTO and JPO. Figures for 2000 to 2002 are estimates.

2. Gross domestic expenditure on R&D financed by industry, million 2000 USD using purchasing power parities, lagged by one year.

Source: OECD, Patent and R&D databases, December 2005.

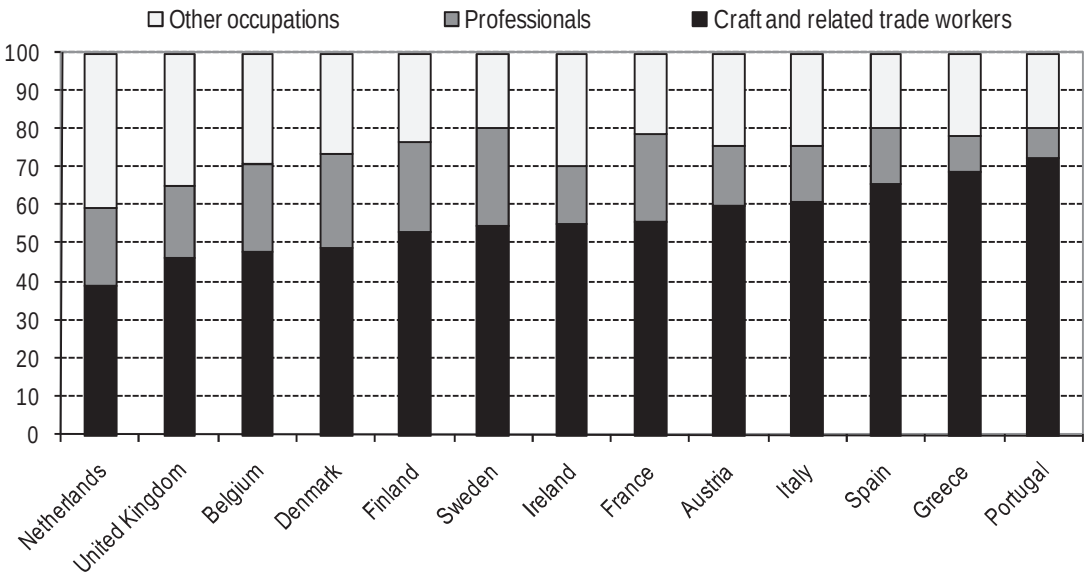
OECD countries continue to dominate global innovation

The R&D undertaken by manufacturing firms can be turned into patentable innovations. OECD indicators of triadic patents capture major innovations, as they only count those patents that have been filed at all the three major patent offices, the US Patent and Trademark Office, the Japan Patent Office and the European Patent Office. Figure 4.28 shows the position of different OECD and non-OECD countries on this indicator. It shows that some countries, such as China, Korea and the Russian Federation, have considerable spending on R&D, but so far make a relatively small contribution to triadic patents. These countries are still primarily oriented towards imitation. Others, such as Japan, Germany, Switzerland, Sweden and the Netherlands make a relatively larger contribution to triadic patents than to R&D. These countries are primarily oriented towards innovation.

The character of work in the manufacturing sector is changing

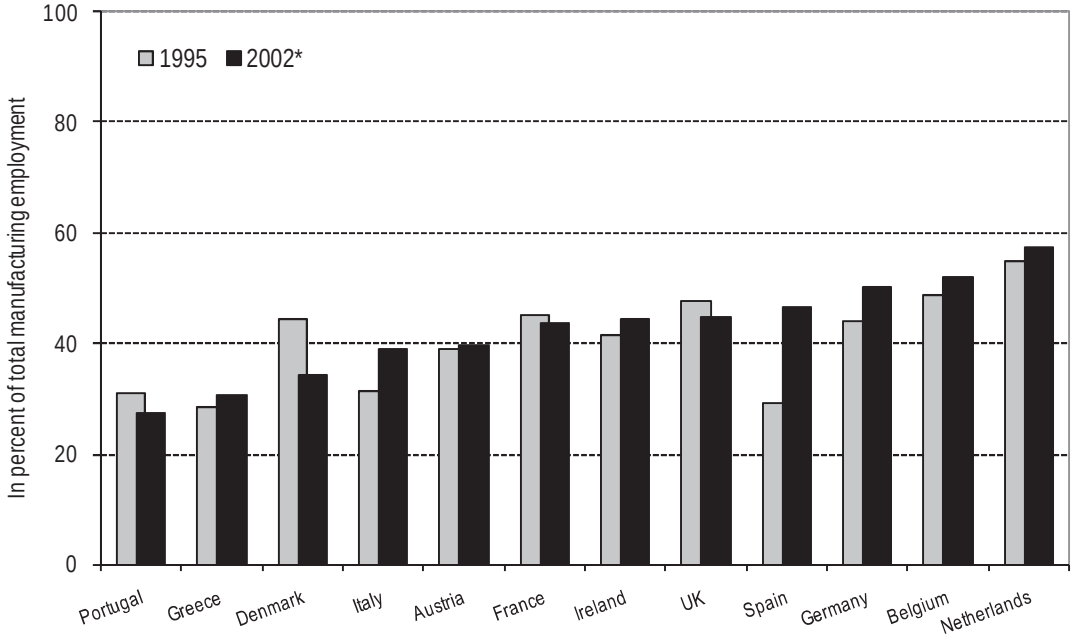
The character of work in the manufacturing sector has changed too, as employment has declined and the manufacturing sector has become more productive and moved up the value chain in many OECD countries. The clearest indication for this change is the growing share of workers in the manufacturing sector engaged in services-related occupations. In some OECD countries, such as the Netherlands, more than 50% of workers in the manufacturing sector were already engaged in a services-related occupation in 2002. Figure 4.29 shows that in 2002 on average about 40% of all persons employed in the manufacturing sector were employed in occupations that can be considered as services-related, *e.g.* scientific professionals, accountants, lawyers, managers, clerks or other services occupations. Only about 60% of all manufacturing workers can still be considered as "production" workers. The share of service-related occupations is particularly high in the Netherlands and the United Kingdom. It remains relatively low in Portugal and Greece.

Figure 4.29. Share of production and services workers in the manufacturing sector
In percent of total employment of manufacturing, 2002



Source: EULFS, 2002.

Figure 4.30. Share of employment in service-related occupations in the manufacturing sector
In percent of total employment of manufacturing, 1995 and 2002



*Data for Germany are from 2001.

Note: Services-related occupations cover ISCO classes 100-500, 830, 910, 933. These occupations are: legislators, senior officials and managers, professionals and associate professionals, clerks, service workers and shop and market sales workers, as well as drivers, sales and services elementary occupations and transport workers.

Source: EULFS, 1995, 2002.

The share of service-related occupations in the manufacturing sector has declined since 1995 in the United Kingdom, Denmark and France; it has increased in the other European countries, notably Spain, Italy and Germany (Pilat and Wölfl, 2005; Figure 4.30). The trend towards a growing share of services workers is consistent with evidence over a longer period. A recent study for the United States, for example, finds a consistent move from labourers to services workers over the 20th century (Wyatt and Hecker, 2006).

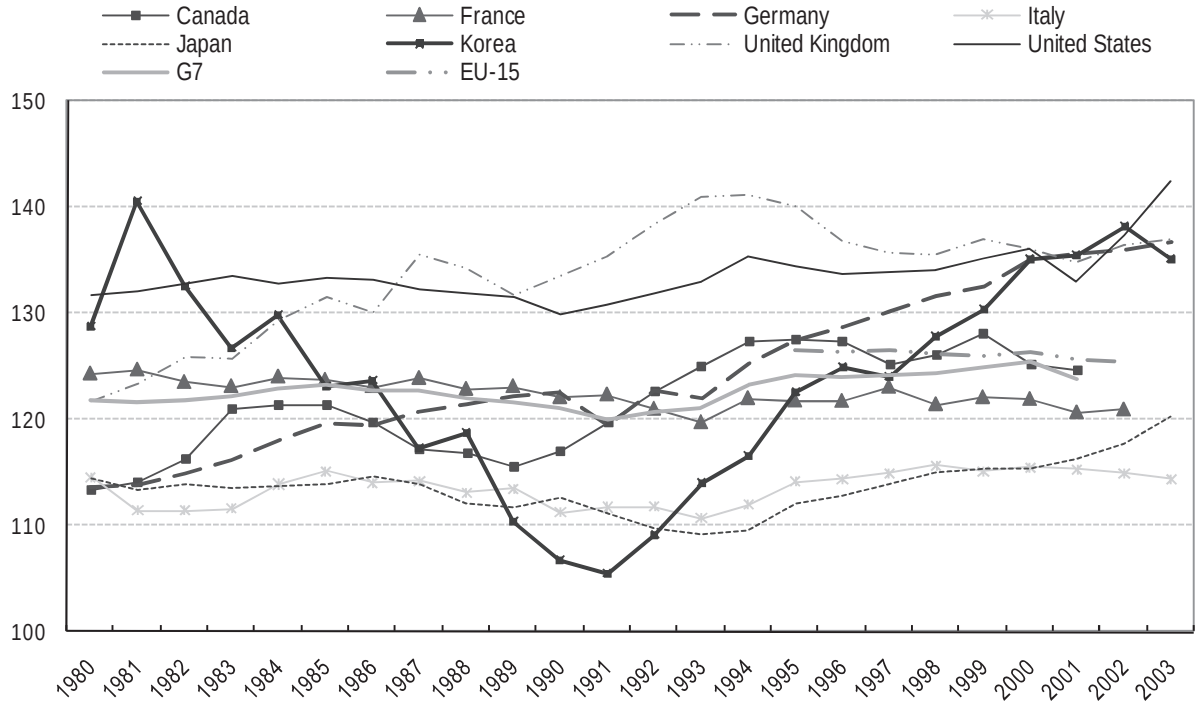
A second way to examine the role of workers in the manufacturing sector is to look at the development of their relative wages, *e.g.* as compared to the economy as a whole, or the business sector. These trends are shown in Figure 4.31 and suggest that average compensation in the manufacturing sector has not fallen behind that of the economy as a whole and has grown somewhat in several countries. Manufacturing workers have therefore not become less well off compared to other workers. These trends are influenced by several factors, including: *a)* more rapid productivity growth in the manufacturing sector than in services in most OECD countries, which is likely to contribute to more rapid wage growth; *b)* changes in the composition of manufacturing work, as discussed above, with possible impacts on the average wage as the share of some highly paid services workers increases[15]; *c)* changes in the structure of the manufacturing sector, with certain low-technology industries and low-wage industries such as textiles and wood products

15. Although services workers may also be less well paid than manufacturing production workers, depending on their occupation.

declining in importance, and other industries such as ICT manufacturing and machinery and equipment remaining important.

Figure 4.31. Labour compensation per employee relative to the total economy, manufacturing

Total economy = 100, 1980-2003

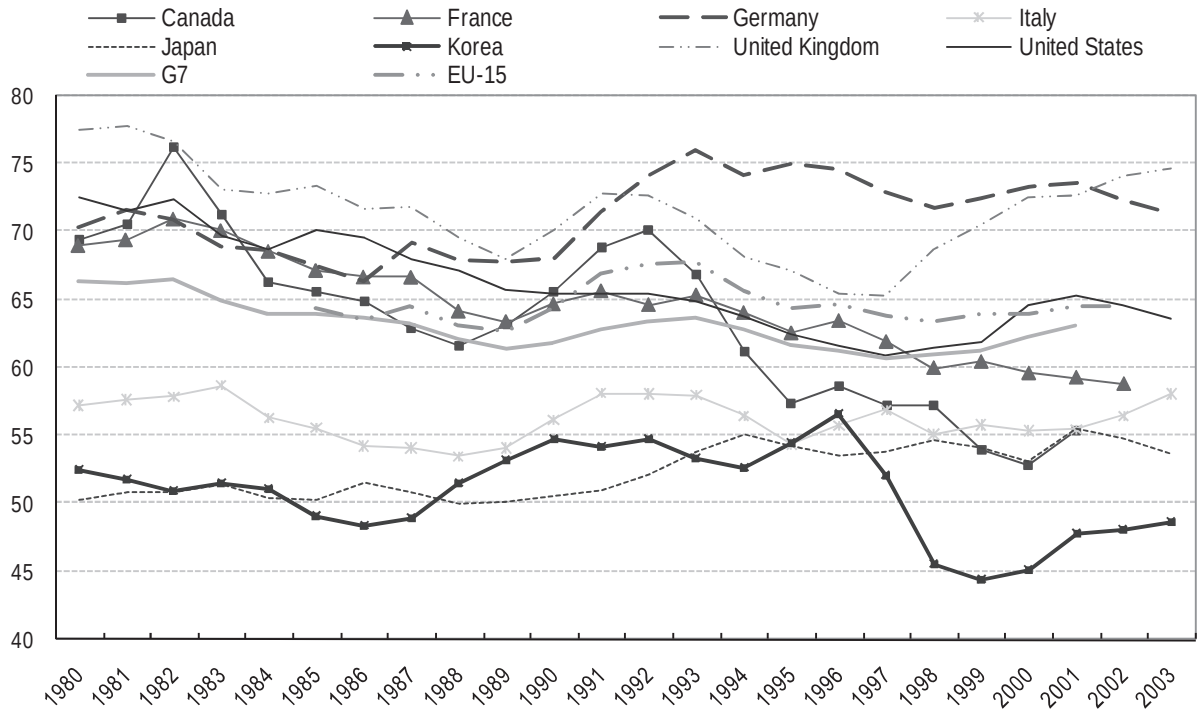


Source: OECD, STAN Indicators database, February 2006.

A third way to examine the role of labour in the manufacturing sector is to look at the labour share in value added. A first glance at these data points to considerable fluctuations in the share of labour in value added, but no clear trend for OECD countries as a whole (Figure 4.32). As with the previous chart, several factors are likely to be at work here and no simple conclusion can be reached without further analysis. Likely factors that play a role are: *a)* the occupational shift discussed above, with possibly a higher share of high-skilled workers employed in the manufacturing sector, thus contributing to higher labour shares; *b)* structural shifts, as discussed above, that may contribute to a higher share of high-skilled workers and thus higher labour shares, but that may also contribute to higher capital shares if the structural shift is towards more capital-intensive industries; *c)* changes in the relative bargaining power of manufacturing workers. More detailed analysis, as conducted in other OECD work (De Serres *et al.*, 2002) would be required to disentangle these, and other factors.

Figure 4.32. Share of labour compensation in value added in the manufacturing sector

In percentage, 1980-2003



Note: Labour shares are not adjusted for the labour income associated with self-employed workers.

Source: OECD, STAN Indicators database, February 2006.

The distinction between services and manufacturing is blurring

The interaction between manufacturing and services is increasingly complex and comprises several forms of interaction, including outsourcing of services activities from manufacturing firms to services firms as well as the use of intermediate inputs from an independent service provider that has not been previously integrated in the final good producing firm or industry. The evidence presented in a recent OECD paper (Pilat and Wölfl, 2005) demonstrates that the distinction between manufacturing and services is blurring. Moreover, interactions between services and manufacturing now take on many forms. The main results from the cross-country analysis can be summarised as follows:

- Input-output tables demonstrate that services make important contributions to production, both through their direct contribution to total output and final demand, as well as through their indirect contribution through deliveries of intermediate inputs. The amount of services sector value added that is embodied in manufacturing goods has slowly risen over time and amounted to up to 25%-30% of total output in some countries in the mid-1990s.

- Despite anecdotal evidence on a growing share of services turnover within the manufacturing sector, firm-level evidence suggests that manufacturing enterprises in most countries are not very diversified, *i.e.* they do not have many separate establishments that are engaged in services production. Canada is a notable exception in this respect. In other countries, the diversification of manufacturing firms may primarily

occur at the level of the enterprise group, *i.e.* enterprises in an enterprise group may be engaged in different activities.

- At the same time, data on turnover by product suggest that manufacturing firms and establishments do derive a greater share of turnover from services activities, notably in countries such as Finland and Sweden. Most of these sales refer to wholesale and retail trade activities carried out by manufacturing firms.

In addition to these three points, the growing role of services occupations in the manufacturing sector also points to the blurring of services and manufacturing. The work also suggests that while the distinction between manufacturing and services is becoming increasingly blurred, the two sectors still differ in their role in the economy. The services sector is more independent from other industries than the manufacturing sector. Most inputs that are necessary to produce demand for services derive from the services sector itself. Manufacturing industries interact much more strongly with other industries, both as providers and as users of intermediate inputs. Even though services now contribute as providers of intermediate input to the performance of other industries, their role remains more limited than that of the manufacturing sector. The evidence presented in the paper also shows that both services and manufacturing are changing; the manufacturing sector is taking on characteristics of the services sector, with a growing share of services occupations and more revenues being derived from services, whereas services are becoming more like manufacturing as they have growing impacts on other sectors of the economy.

Concluding remarks

So what is happening to manufacturing in OECD countries and what does this imply for the future? These are the questions that can be raised after the brief review of empirical evidence in the previous sections. A few findings should be highlighted:

- The *share of the manufacturing sector* in total economic activity continues to decline in OECD countries and is likely to do so in the future. The relative decline in the share of manufacturing in production and value added results primarily from relatively slow growth in demand for manufacturing products, as demand for services is growing more rapidly. The relative and absolute decline in manufacturing employment is primarily due to strong productivity growth, but is also affected by the growth of manufacturing capacity in non-OECD countries. At the same time, the loss of manufacturing employment in OECD countries cannot simply be characterised as a transfer of manufacturing production to non-OECD countries, as manufacturing employment in non-OECD countries has not grown significantly. Work is currently underway at the OECD to estimate the employment effects associated with off-shoring.
- The *character of manufacturing production* in OECD countries is changing. The distinction between high-technology and low-technology sectors is becoming less relevant, as certain components of high-technology production can also be carried out in non-OECD countries. Manufacturing activity in OECD countries increasingly incorporates high-value added services. This change seems due to business models that increasingly emphasise intellectual assets and high-value added activities (OECD, 2006), such as research and development, financial and after-sales services, instead of manufacturing production as such. The distinction between manufacturing and services is blurring, complicating empirical analysis with data by economic activity.

- *Manufacturing production has become more and more integrated at the global level.* Manufacturing companies increasingly explore which part of production can be carried out at arm's length, either within their own country or abroad, or by their foreign affiliates. This leads to a growing fragmentation of production, notably in those industries where production can be fragmented (*e.g.* electronics) and to growing inter-industry and inter-firm trade. Due to these changes, trade patterns and patterns of comparative advantage across countries are increasingly complex as they are heavily influenced by location choices of multinational enterprises.
- *Innovation in manufacturing remains dominated by OECD countries.* The emphasis on high value-added activities translates in a growing importance of innovation. Research and development in non-OECD countries is growing, notably in China. Thus far, growth of R&D in non-OECD countries has not translated into much new innovation, as measured by triadic patents. OECD countries continue to account for the bulk of global patenting activity. That being said, the R&D intensity of OECD countries has not grown significantly in recent years, even if there appears to be a growing emphasis on innovation in national policies.[16]

These trends raise two major challenges for OECD countries. The first challenge concerns the structural shift from manufacturing to services and the implications this has for the labour market in OECD countries. Governments will need to facilitate this shift and help displaced workers find alternative employment. Two recent OECD reports (OECD, 2005*a*, 2005*d*) have set out a range of policies that can support such structural change, including policies to improve the functioning of labour and products markets, to open markets to international trade and investment, to strengthen education and training, to enhance innovation and technology policies, as well as tax policies.

The second challenge is how to ensure the continued presence of a viable manufacturing sector in OECD countries. Maintaining such a presence may be particularly important if manufacturing activity remains the main source of technological progress. Several policies could be considered in this context and will be discussed in more detail in further work in the context of this project.

16. Available measures of R&D intensity do not account for the possibility that the productivity of R&D could have increased, implying that less R&D expenditure might be required to lead to growing output. Improved measurement of R&D in real terms will be required to investigate this issue.

ANNEX 4.A: SOURCES

STAN – Industry

The STAN database for **Industrial Analysis** includes annual measures of output, labour input, investment and international trade by economic activity which allow users to construct a wide range of indicators focused on areas such as productivity growth, competitiveness and general structural change. The industry list based on the International Standard Industrial Classification (ISIC) Rev. 3, provides sufficient details to enable users to highlight high-technology sectors and is compatible with those lists used in related OECD databases in the 'STAN' family (see below). STAN-Industry is primarily based on member countries' annual National Accounts by activity tables and uses data from other sources, such as national industrial surveys/censuses, to estimate any missing detail. Since many of the data points in STAN are estimated, they do not represent the official member country submissions. See: *www.oecd.org/sti/stan*

Publication: STAN-Industry is available on line via SourceOECD (*www.sourceoecd.org)* where it is regularly updated (new tables are posted as soon as they are ready). A "snapshot" of STAN-Industry is also available on CDROM together with the latest versions of STAN – R&D (ANBERD), STAN – Bilateral Trade and a set of derived STAN Indicators. See *www.oecd.org/sti/stan/indicators*.

STAN – R&D (ANBERD)

The **Analytical Business Enterprise Research and Development** database is an estimated database constructed with a view to 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 1987-2003, by industry (ISIC Rev. 3), for 19 OECD countries. See: *www.oecd.org/sti/anberd*.

Publication: OECD (2004), *Research and Development Expenditure in Industry 2004*. Annual. ANBERD is also available on line via SourceOECD (under the STAN heading) as well as on the STAN family CDROM.

STAN – Bilateral Trade (BTD)

This database presents 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 USD at current prices and have been derived from the OECD database *International Trade by Commodities Statistics* (ITCS - formerly *Foreign Trade Statistics* or FTS). Imports and exports are grouped according to the country of origin and the country of destination of the goods. The data have been converted from product classification schemes to an activity classification scheme based on ISIC Rev.3, compatible with those of the OECD's STAN-Industry, Input-Output Tables and ANBERD databases. See: *www.oecd.org/sti/btd*.

Publication: OECD, *Bilateral Trade Database*. BTD is available on line via SourceOECD (under the STAN heading) as well as on the STAN family CD-ROM.

STAN – I-O

The set of OECD **Input-Output** Tables used in this paper consists of matrices of inter-industrial transaction flows of goods and services (domestically produced and imported) in current prices for 18 OECD countries and two non-member OECD economies (Brazil and China) covering one or more years around the mid-1990s. The tables are based on ISIC Rev. 3 and are available for free in zipped Excel format. See: *www.oecd.org/std/io-tables/data*. A new set of IO tables, covering a year around 2000, is currently being prepared by OECD and will be released by the end of 2006, or early 2007. See Yamano and Ahmad (2006).

R&D

The **R&D** database contains the full results of the OECD surveys on **R&D expenditure and personnel.** This database serves, *inter alia*, as raw material for both the ANBERD and MSTI databases.

Publication: OECD (2005), *Research and Development Statistics: 2004 Edition* (formerly *Basic Science and Technology Statistics)* Updated annually on CD-ROM as *OECD Science and Technology Statistics* (a printed edition is also available every two years).

MSTI

The **Main Science and Technology Indicators** database provides a selection of the most frequently used annual data on the scientific and technological performance of OECD member countries and nine non-member economies (Argentina, China, Israel, Romania, Russian Federation, Singapore, Slovenia, South Africa, Chinese Taipei). The indicators, expressed in the form of ratios, percentages, growth rates, cover resources devoted to R&D, patent families, technology balance of payments and international trade in highly R&D-intensive industries.

Publication: OECD (2005), *Main Science and Technology Indicators 2005/2*. Biannual. Also available on CD-ROM as *OECD Science and Technology Statistics*.

Patent database

This database contains patents filed at the largest national patent offices – European Patent Office (EPO); US Patent and Trademark Office (USPTO); Japanese Patent Office (JPO) – and other national or regional offices. Each patent is referenced by: patent numbers and dates (publication, application and priority); names and countries of residence of the applicants and of the inventors; and technological categories, using the national patent classification as well as the International Patent Classification (IPC). The compiled indicators mainly refer to single patent counts in a selected patent office, as well as counts of triadic patent families (patents filed at the EPO, the USPTO and the JPO to protect a single invention). See: *www.oecd.org/sti/ipr-statistics*

The series are published on a regular basis in OECD, *Main Science and Technology Indicators.*

AFA

The **Activities of Foreign Affiliates** database presents detailed data on the performance of foreign affiliates in the **manufacturing** industry of OECD countries (inward and outward 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 (based on ISIC Rev. 3) for 23 OECD countries.

Publication: OECD, *Measuring Globalisation: Economic Globalisation Indicators*. 2005. Also available annually on line on SourceOECD (*www.sourceoecd.org*).

FATS

This database gives detailed data on the **activities of foreign affiliates** in the **services** sector of OECD countries (inward and outward investment). The data indicate the increasing importance of foreign affiliates in the economies of host countries and of affiliates of national firms implanted abroad. FATS contains five variables (production, employment, value added, imports and exports) broken down by country of origin (inward investments) or implantation (outward investments) and by industrial sector (based on ISIC Rev. 3) for 21 OECD countries.

Publication: OECD, *Measuring Globalisation: Economic Globalisation Indicators*. 2005.

Other OECD databases

ITCS (International Trade by Commodity Statistics) (Statistics Directorate).

Productivity (Statistics Directorate; Directorate for Employment, Labour and Social Affairs; Directorate for Science, Technology and Industry).

Further details on OECD statistics are available at: *www.oecd.org/statistics*

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Chapter 5

POTENTIAL IMPACTS OF INTERNATIONAL SOURCING ON DIFFERENT OCCUPATIONS

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This paper uses trade and employment data to examine the relationship between the share of employment potentially affected by offshoring and economic and structural factors, including trade in business services and foreign direct investment, using simple descriptive regressions for a panel of OECD economies between 1996 and 2003. It extends an earlier model to test whether there are differences in the factors driving the shares of potentially offshorable "non-clerical" occupations, or professionals such as managers, consultants and engineers, and clerical occupations in total employment. Separate indicators for manufacturing and services foreign direct investment are included.

The results show a positive statistical association between the share of both "non-clerical" and clerical occupations potentially affected by offshoring and exports of business services, and a negative association with imports of business services. However, the results also show important differences between different types of occupations as they behave differently over time (the share of professionals, or "non-clerical" generally growing over time and the share of clerical declining), and are affected differently by the economic and structural variables included in the model. In particular, net outward manufacturing FDI, ICT investment, and the relative size of the services sector all have a positive association with the share of employment in potentially offshorable professionals ("non-clerical" occupations), but are negative with clerical occupations. On the other hand, union density has a positive statistical association with clerical occupations but negative with professionals, or "non-clerical" occupations. These results have important implications for policy, as they clearly suggest that different factors are driving the performance of different occupational groups.

A revised version of this chapter was published as NBER Working Paper No. 12799, entitled "We Can Work It Out – The Globalisation of ICT-Enabled Services", December 2006.

Introduction[17]

Services now account for around two-thirds of output and foreign direct investment in most developed countries, and for up to 20-25% of total international trade. The importance of services in international trade remains comparatively modest because many services have only recently become tradable, and many others remain non-tradable. Rapid advances in information and communication technologies (ICTs) and the ongoing global liberalisation of trade and investment in services have increased the tradability of many service activities and created new kinds of tradable services. Many service sector activities are thus becoming increasingly internationalised, especially since ICTs enable the production of services to be increasingly location independent. This has led to the globalisation of services activities and facilitated the ICT-enabled offshoring[18] of services, with associated changes in trade and cross-border investment in service activities and employment patterns.

This paper builds on earlier work quantifying the share of employment potentially affected by the ICT-enabled offshoring of services (van Welsum and Vickery, 2005a, van Welsum and Reif, 2006a,b). At present there are no official data measuring the extent of offshoring of services. So it is necessary to use indirect measures such as data on trade in services, employment data, input-output tables, and trade in intermediate products. Evidence from company surveys can also be a useful complement. This paper combines the information from both trade and employment data to examine the relationship between the share of employment potentially affected by offshoring and other economic and structural factors using some simple descriptive regressions for a panel of OECD economies between 1996 and 2003. Initial estimates of the statistical association between the share of employment potentially affected by service sector offshoring, trade in business services and foreign direct investment are provided by van Welsum and Reif (2006a,b). In this paper the model is extended to test whether there are differences in the factors driving the shares of potentially offshorable clerical and "non-clerical" occupations (professionals) in total employment. Separate indicators for manufacturing and services foreign direct investment are now also included.

It is important to take care with the interpretation of the results, as they are not drawn from the empirical testing of a formal theoretical model of the underlying structural relationships. Thus, it is not possible to separate out completely the effects from demand and supply side developments. However, the results provide guidance on the statistical associations that are found to exist between the variables included in these descriptive regressions.

17. We thank Nigel Pain from the OECD Economics Department for his help and advice in preparing this paper. Comments from participants at the CRIW-NBER Conference on International Services Flows (28-29 April 2006, Bethesda, Maryland, United States), and in particular Marshall Reinsdorf and our discussant Lori Kletzer, are also gratefully acknowledged. We are also grateful to our colleagues in the Directorate for Science, Technology and Industry, in particular Graham Vickery, for their guidance and support. This paper was prepared while Xavier Reif was visiting the OECD.

18. Under the definition of offshoring adopted in this paper, offshoring includes both international outsourcing (where activities are contracted out to independent third parties abroad) and international insourcing (to foreign affiliates). The cross-border aspect is the distinguishing feature of offshoring, *i.e.* whether services are sourced within the domestic economy or abroad – not whether they are sourced from within the same company or from external suppliers (outsourcing).

The structure of the rest of this paper is as follows. A number of different measures of the extent to which services activities have become globalised are discussed in the second section. The third then summarises the work undertaken at the OECD to obtain estimates of potentially offshorable ICT-using occupations in a number of OECD economies. The fourth section contains the new empirical analysis of the factors associated with the evolution over time of the share of these potentially offshorable occupations in total employment, for the total but also broken down into clerical and "non-clerical" types of occupations. Indicators of international trade and investment, national economic structure and economy-wide framework factors are all found to be important influences.

The globalisation of ICT-enabled services

Trade in ICT-enabled services

The extent of international trade in ICT-related services and business services can be approximated by summing the IMF Balance of Payments categories "computer and information services" and "other business services" (see Annex Table 5.A.1 for details on which services are included in these categories). Data on computer and information services are not available for all countries. For some, such as India, they are included under "other business services", along with other services.[19] The "other business services" category may have variable shares of IT and ICT-enabled services in different countries. Moreover, the data are reported in current USD and can be affected by currency movements.

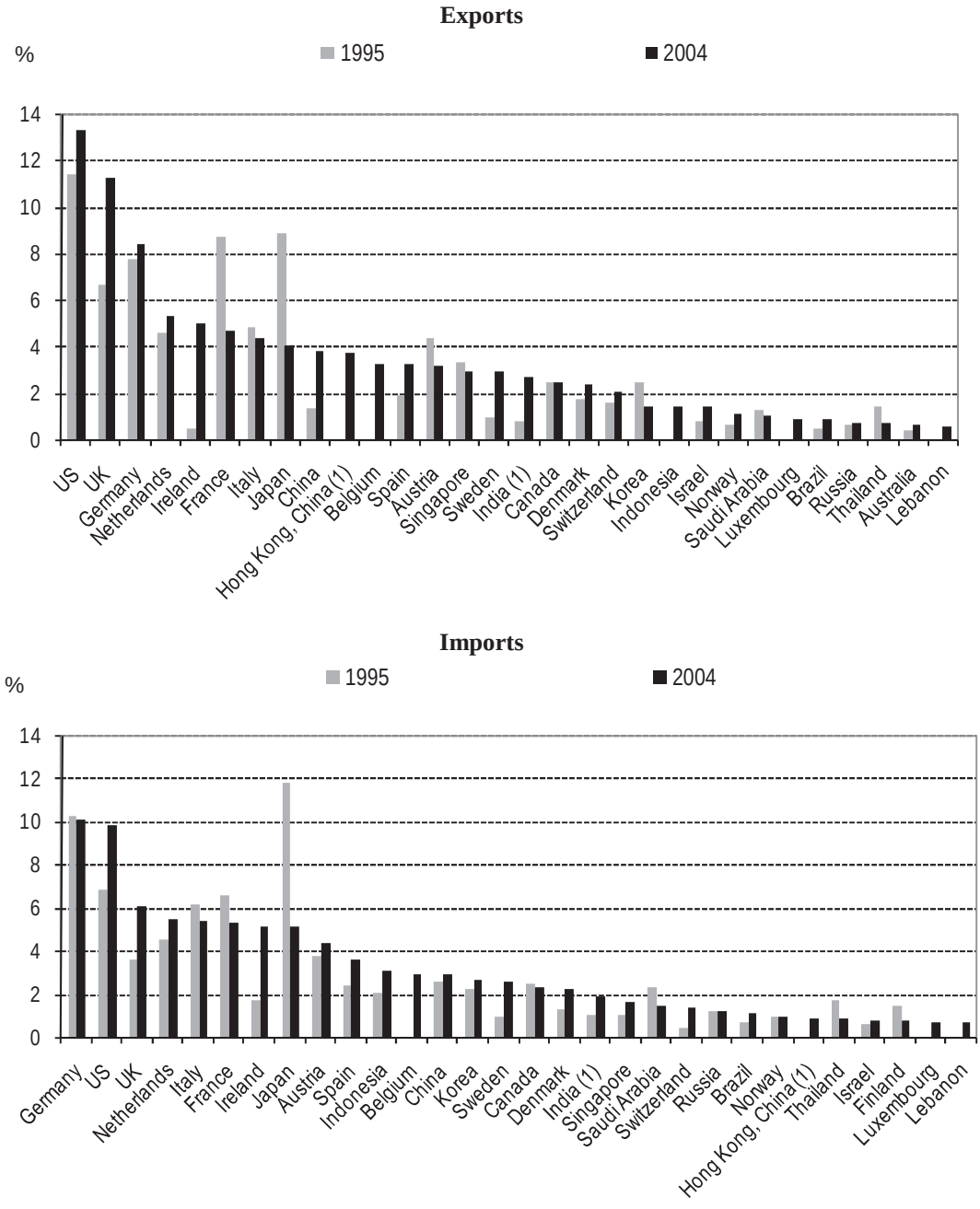
Most exports and imports (over 80%) of other business services and computer and information services are still accounted for by OECD countries. The 30 countries that accounted for the largest value shares in 2004 are shown in Figure 5.1. There are many OECD countries among those with the largest value shares, but some non-OECD members are also present (including some of the BRICS[20] – China, India, Russia and Brazil, but also Hong Kong, China and Israel for example). Nevertheless, Eastern European and Baltic countries, as well as some developing economies, are experiencing rapid growth in exports and imports (Figure 5.2), although most are starting from very low levels. Ireland is the highest ranked OECD country for growth of both exports and imports. Average annual growth of the total reported export values between 1995 and 2004 is around 9.6%, and around 7.6% for imports.

19. For India, the category "other business services" includes all services except travel, transport and government services. However, Indian firms are now extensively exporting ICT-enabled services and business process services and the remaining services included in the category are likely to be small in comparison. Furthermore, data on overseas revenues from annual reports of top Indian export firms show patterns similar to the IMF data.

20. BRICS: Brazil, Russia, India, China and South Africa.

Figure 5.1. Share of the value of reported total[1] imports and exports of other business services and computer and information services, 30 selected other countries, 1995 and 2004[1]

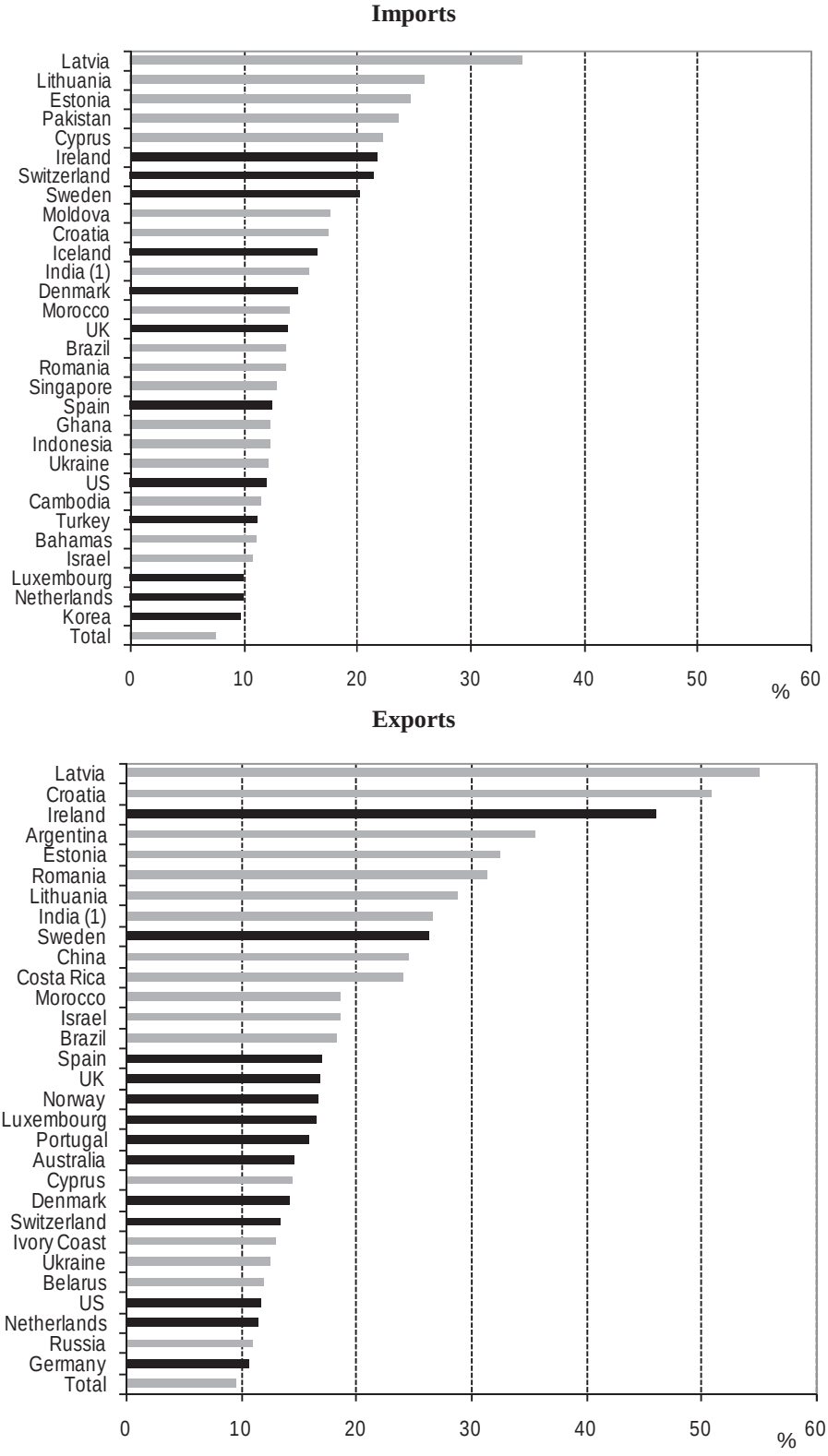
Decreasing order of the total reported value share in 2004, percentages



1. The reported total for all countries does not necessarily correspond to a world total. For some countries, such as India, it is not possible to isolate other business services and computer and information services. As a consequence, for India, the category includes total services, minus travel, transport and government services (*i.e.* including construction, insurance and financial services as well as other business services and computer and information services). The data are in current USD and may therefore be affected by currency movements. Data for Hong Kong, China and India are for 2003.

Source: OECD calculations based on IMF Balance of Payments Database (March 2006).

Figure 5.2. Thirty selected countries with rapid average annual growth of imports and exports of computer and information and other business services (CAGR 1995-2004[1])



1. Except India (1995-2003).

Source: OECD calculations based on IMF Balance of Payments Database (March 2006).

The increasing importance of trade in services, and of trade in business services and computer and information services in particular, for most countries is also illustrated in Table 5.1 below. In most countries the share of services trade in total trade increased between 1995 and 2003. Business services and computer and information services also tend to account for a relatively large and increasing share of services trade.

Table 5.1. Relative importance of trade in services and trade in the sum of "other business services" and "computer and information services", selected countries, 1995 and 2003

Percentages

	Exports						*Imports*					
	S in T		BCIS in T		BCIS in S		S in T		BCIS in T		BCIS in S	
	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003
Australia	23.3	23.1	1.7	3.3	7.3	14.3	23.0	20.0	2.8	2.8	12.3	14.2
Austria	35.8	32.5	13.3	12.2	37.0	37.5	30.1	31.9	11.1	15.0	36.9	47.1
Canada	11.9	13.0	3.1	4.1	26.3	31.8	16.7	17.2	3.3	3.9	20.0	22.5
China	13.0	9.6	2.5	3.8	19.6	39.6	18.6	12.3	5.1	2.5	27.5	20.6
Denmark	23.3	32.9	7.2	12.9	30.8	39.1	24.3	34.0	5.8	11.5	24.0	33.9
Finland	15.5	13.0	6.2	4.4	40.1	34.0	25.4	20.2	10.3	6.8	40.4	33.8
France	23.2	21.4	6.6	5.5	28.6	25.7	19.8	18.8	5.4	5.6	27.1	29.8
Germany	13.3	14.1	3.5	4.5	26.7	32.2	22.4	22.2	4.7	6.1	20.9	27.3
India	17.8	28.3	5.6	16.9	31.3	59.7	21.3	27.4	5.6	9.3	26.4	34.0
Ireland	10.1	29.8	2.8	16.6	27.7	55.6	26.8	50.3	10.8	21.8	40.2	43.3
Italy	20.8	19.4	4.5	5.8	21.6	30.0	22.0	20.6	6.7	7.1	30.3	34.6
Sweden	16.4	23.1	2.7	9.9	16.4	42.9	21.2	25.7	3.1	10.6	14.8	41.1
UK	24.5	33.2	5.7	11.5	23.4	34.8	20.0	24.5	3.0	4.6	14.8	18.8
US	27.4	29.8	4.0	6.8	14.5	22.9	15.9	16.9	2.1	3.0	13.0	17.8

Where: S in T = services trade in total trade, BCIS in T = other business services and computer and information services in total trade, and BCIS in S = other business services and computer and information services in services trade.

Source: OECD calculations based on IMF Balance of Payments Database (August 2005).

Table 5.2. Exports and imports of "other business" and "computer and information" services as a share of GDP, selected countries, 1995 and 2003

Percentages

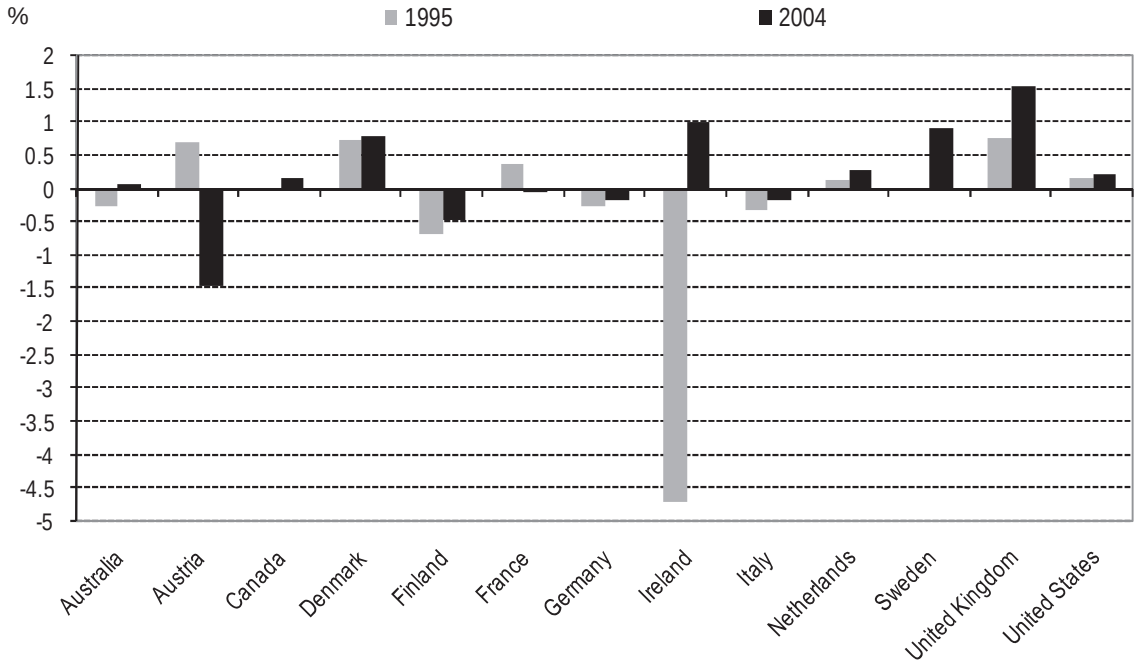
	Exports		*Imports*	
	1995	2003	1995	2003
Australia	0.32	0.57	0.57	0.58
Austria	4.97	6.32	4.27	7.64
Canada	1.18	1.58	1.15	1.34
Denmark	2.61	5.84	1.87	4.51
Finland	2.29	1.66	2.99	2.10
France	1.55	1.44	1.15	1.46
Germany	0.87	1.60	1.13	1.96
Ireland	2.09	13.88	6.85	14.88
Italy	1.21	1.46	1.52	1.75
Netherlands	3.08	4.70	2.94	5.10
Sweden	1.03	4.36	1.02	3.92
UK	1.63	2.96	0.86	1.31
US	0.43	0.63	0.25	0.42

Source: OECD calculations based on IMF Balance of Payments Database (August 2005).

Trade in business and computer and information services accounts for a relatively modest, but increasing, share of GDP in most countries (Table 5.2). The share tends to be somewhat larger in smaller countries than in larger countries. There was a particularly large increase in the share in Ireland between 1995 and 2003, reflecting Ireland's rapid shift into service activities over that period (Barry and van Welsum, 2005).

The trade balance (in current USD) in the sum of the IMF categories "other business services" and "computer and information services" as a percentage of GDP for selected countries in 1995 and 2004 is shown in Figure 5.3. The United States have a relatively large and still increasing surplus in trade in these categories, although it is relatively small as a percent of GDP. The United Kingdom also has a large and growing surplus, and the share in GDP is also increasing, in spite of the impression that may be given by the many (media) reports on the extent of offshoring and related imports. Ireland registered a surplus in the sum of these categories for the first time in 2004. Previously it had registered a large surplus in the category "computer and information services" alone, but a deficit for the sum of the two categories.

Figure 5.3. Trade balance in the sum of the categories "other business services" and "computer and information services" as a percentage of GDP (all in current USD), selected countries, 1995 and 2004



Source: OECD calculations based on IMF Balance of Payments World Economic Outlook Databases (March 2006).

FDI in services[21]

The stock share of services in total FDI is another indicator of the extent of globalisation of services (Table 5.3). In most countries, the share of services has increased between 1995 and 2003, and the stock of services tends to account for more than half of the total stock, and up to 88% in Germany for inward investment, and up to 82% in outward investment in France in 2003.

Table 5.3. The share of FDI in services in total FDI, 1995 and 2003

	inward		outward	
	1995	2003	1995	2003
Australia	47.0	52.7	35.1	34.2
Austria	65.2	76.8	69.9	79.1
Canada	30.7	29.2	40.0	55.1
Denmark	73.4	77.1	64.5	69.6
Finland	39.5	64.9	9.7	13.2
France	67.4	80.5	80.0	81.8
Germany	76.1	88.1	67.6	81.1
Italy	55.8	54.5	63.6	59.1
Netherlands	55.2	63.1	49.5	58.1
Sweden	33.0	38.8	31.7	42.5
United Kingdom	46.6	66.1	40.1	61.7
United States	51.0	62.6	55.2	74.1

Source: OECD calculations based on OECD Direct Investment Statistics Database.

A further indicator of globalisation of services is given by the share of this type of FDI in GDP. In all countries, both the total share of FDI (inward and outward) and the share of services FDI in GDP have increased between 1995 and 2003 (Table 5.4).

However, most of this FDI in services is not in services that can necessarily be traded with the help of ICTs. The sectors distinguished in the OECD FDI data base are listed in Annex Table 5.A.2. It is difficult to know which category would be most suitable to match the categories used as proxies for ICT-enabled trade in services,[22] but probably the best approximation is given by "business activities", which can be obtained by subtracting "real estate" from "real estate and business activities". Unfortunately, this breakdown is

21. FDI data as currently collected may not be an ideal proxy for the activities of multinationals abroad because of a variety of ownership and measurement problems (*e.g.* differences across countries and data sets as to the definition of minority-held overseas investments included in FDI statistics), but it is the only widely available measure of the scale of cross-border investment for many countries. As multinationals can be very large enterprises with multiple establishments that span a large number of industries, assigning their investments to their "primary" industry can be problematic as their activities in other industries can be relatively high in receiving countries and attributing investment based on the "primary" industry of the investor may be misleading. In many small open countries the size of the inward and outward FDI stocks relative to GDP may also be affected by large investments in holding companies. Furthermore, enterprise-level FDI data may not be comparable with establishment-level performance data. This section uses data from the OECD Direct Investment Statistics Database. Not all OECD countries record FDI in the same way, however. See the *OECD Direct Investment Statistics Yearbook* for methodological details.

22. "Real estate and business activities" represents section K of ISIC 3 (minus if available "of which real estate"), but the connection is loose between service products and service activities determined for large enterprises. Business services can be provided internally within multinationals with main activities elsewhere, *e.g.* in manufacturing.

not widely available (eight countries in the sample, and not necessarily for all years considered), but "real estate" tends to account for a relatively small share of that category.

Table 5.4. Share of FDI in GDP, 1995 and 2003

	Total inward		Services inward		Total outward		Services outward	
	1995	2003	1995	2003	1995	2003	1995	2003
Australia	25.8	37.9	12.1	20.0	14.2	28.6	5.0	9.8
Austria	7.3	21.0	4.8	16.1	4.9	21.8	3.4	17.3
Canada	21.2	32.1	6.5	9.4	20.3	36.5	8.1	20.1
Denmark	12.1	41.3	8.9	31.8	12.5	42.6	8.0	29.7
Finland	6.5	31.0	2.6	20.1	11.5	46.9	1.1	6.2
France	12.2	29.1	8.2	23.4	13.0	40.3	10.4	32.9
Germany	7.6	27.5	5.8	24.2	10.2	30.4	6.9	24.7
Italy	5.8	12.3	3.2	6.7	8.8	16.3	5.6	9.6
Netherlands	29.4	89.3	16.2	56.4	43.0	103.6	21.3	60.1
Sweden	12.3	39.9	4.1	15.5	29.0	53.3	9.2	22.7
United Kingdom	17.6	33.7	8.2	22.3	26.9	68.4	10.8	42.3
United States	7.3	12.9	3.7	8.1	9.5	16.4	5.3	12.2

Source: OECD calculations based on OECD Direct Investment Statistics Database.

Employment potentially affected by offshoring

To get an idea of the "outer limits" of employment potentially affected by offshoring, van Welsum and Vickery (2005a) calculate the share of people employed who are mainly performing the type of functions that could potentially be carried out anywhere, using data on employment by occupation by industry. This analysis, using occupational data for several OECD countries, suggests that around 20% of total employment carries out the kinds of functions that are potentially geographically footloose as a result of rapid technological advances in ICTs and the increased tradability of services, and could therefore potentially be affected by international sourcing of IT and ICT-enabled services.

The classifications were not harmonised internationally, but the same methodology and rationale were applied to the individual country data sources.[23] As this analysis was carried out in order to obtain an order of magnitude on the share of people employed performing tasks that could potentially be carried out anywhere, no additional assumptions were made as to what proportion of each occupational group was actually likely to be affected by offshoring in practice. Thus, the whole of each selected occupation was then included in the calculations.

23. The European data are Labour Force Survey data provided by Eurostat. The occupational classification system in those data is the ISCO – International Standard Classification of Occupations, and NACE – the industrial classification system of the European Union – is used for sectoral classification. For the United States, data from the Current Population Survey were used. The Current Population Survey collects information on both the industry and the occupation of the employed and unemployed. However, beginning with data from January 2003, the 1990 Census Industrial Classification System was replaced by one based on the North American Industry Classification (NAICS), and the 1990 Census Occupational Classification was replaced by one derived from the US Standard Occupational Classification (SOC). Further information is available on the web site of the US Bureau of Labor Statistics at: www.bls.gov/opub/hom/pdf/homch1.pdf (accessed November 2004): Chapter 1: Labor Force Data derived from the Current Population Survey. For Canada Labour Force Data provided by Statistics Canada were used. The occupational classification is in SOC91. For Australia data from the Labour Force Survey provided by the Australian Bureau of Statistics were used. The occupational classification is in Australian Standard Classification of Occupations (ASCO) second edition.

Occupations were selected by examining detailed occupational and task descriptions on the basis of the following four criteria, or "offshorability attributes": *i*) intensive use of ICTs, *ii*) an output that can be traded/transmitted enabled by ICTs, *iii*) high codifiable knowledge content, and *iv*) no face-to-face contact requirements. The occupational selections that resulted from this exercise are reported in Annex Tables 5.A3-5.A6. For further details on the methodological background see van Welsum and Vickery (2005a,b), and OECD (2004a).

Other studies have taken a similar approach. Blinder (2005), and as quoted in Mankiw and Swagel, (2005), finds a similar estimate of around 20% of total employment potentially affected by offshoring in the United States in 2004. He uses the concept of "personally deliverable services" and "impersonally deliverable services". However, the estimates of employment potentially affected by offshoring vary widely. For example, Bardhan and Kroll (2003) produced estimates of 11% of total employment in the United States in 2001 as potentially affected by offshoring, and Forrester Research, as reported by Kirkegaard (2004) up to 44% of total employment. The differences in these estimates can be explained by the selection criteria that are applied to the occupational data. Thus, Bardhan and Kroll (2003) only included occupations in which at least some offshoring was already known to have taken place or being planned, yielding a more conservative estimate of the share of employment potentially affected, whereas the Forrester study used less detailed occupational categories resulting in a larger estimate of jobs potentially affected. A different but related approach was taken by Jensen and Kletzer (2005) looking at tradable versus non-tradable occupations based on Gini coefficients, where they make the assumption that an industry or occupation that is highly geographically concentrated is tradable. The list of tradable occupations they find for the United States overlaps with the list in van Welsum and Vickery (2005a) and used in this paper, but the methodology of Jensen and Kletzer (2005) identifies a larger set of tradable occupations. According to their methodology, around 30% of employment in the United States can be considered as "tradable". They find little evidence of slower employment growth in tradable occupations (and activities).

The evolution over time of the share of employment potentially affected by offshoring is illustrated in Figure 5.4. Even though the levels of these shares are not directly comparable, the evolution of the trends is interesting. The share of occupations potentially affected by offshoring in the EU15 increased from 17.1% in 1995 to 19.2% in 2003. For Canada it was more or less flat around 19.5% until 2001, after which it declined to 18.6% by 2003. For the United States the share declined by more than a percentage point from 19.2% in 1995 to 18.1% in 2002.[24] In Australia, the share increased between 1996 and 2001 (except in 1999) but started to decline in 2001.

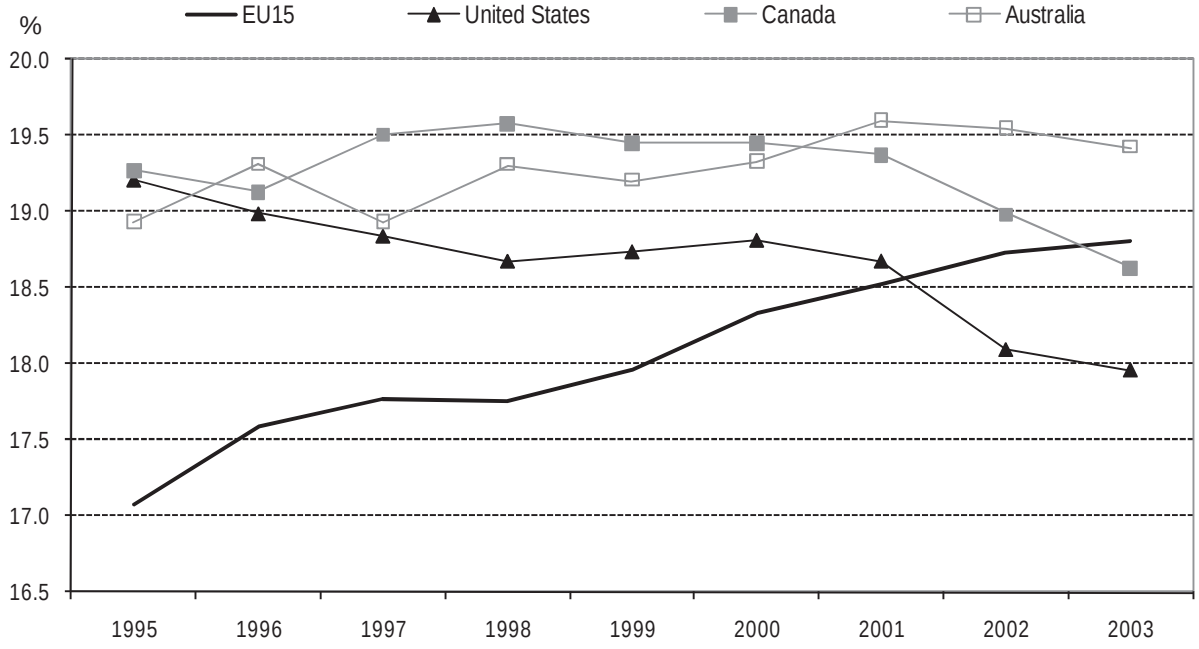
While it is difficult to draw inferences from these trends without further analysis, since the trends are affected by a multitude of factors, the evolutions shown are consistent with anecdotal observations on the ICT-enabled offshoring that is taking place. For example, Canada serves as an offshoring location, mainly from the United States, but may have become comparatively less important a location recently as other countries such as India have started to emerge. Similarly, Australia possibly also experienced competition for attracting, or keeping, activities that can be sourced internationally from India and other emerging locations in the region. Thus, the declining share in the United States, Canada and Australia towards the end of the period could be consistent with the

24. The number for 2003 (just under 18%) is an estimate as both the occupational and industrial classification systems were changed in 2003 in the United States.

offshoring of IT-related and back-office activities (with some "potential offshoring" having become "actual offshoring"), for example, even though this is unlikely to account for all of the decline. Another possible explanation could be a differential pace of technological change with a relatively more rapid adoption and integration of new technologies, leading to relatively more jobs disappearing sooner as they become automated and/or digitised.[25] These countries have also benefited from relatively stronger ICT-related productivity growth which may be changing the distribution of occupations. The increasing share for Europe is compatible with an overall increase in services employment as well as the finding from surveys that European firms tend to offshore within Europe (see Millar, 2002, and Marin, 2004, for example). At least one EU country, Ireland, is also a major destination country of offshoring activities from the United States (IT-related activities in particular). Other factors could also be important, *e.g.* cyclical developments and changes in labour supply and labour quality. Finally, the coming and going of Y2K preparations as well as the ICT boom and bust could have had some influence on shifts in ICT-related occupations.

Figure 5.4. The share of ICT-intensive using occupations potentially affected by offshoring in total employment: EU15, US, Canada, and Australia 1995-2003[1]

Percentages



1. Includes estimates where a full data set was not available. Because of classification changes, the number for the United States for 2003 is also an estimate. There is a break in the data for Australia, with data for 1995 and 1996 in ASCO first edition and subsequent data in ASCO second edition. Due to differences in classifications the levels are not directly comparable.

Source: OECD calculations and van Welsum and Vickery (2005a), based on EULFS, US Current Population Survey, Statistics Canada and Australian Bureau of Statistics (2004/5).

25 A parallel can be drawn here with some of the work undertaken by Autor *et. al.* (2003) and Levy and Murnane (2004). These authors argue that the tasks most vulnerable to being substituted by technology are those where information processing can be described in rules. If a significant part of a task can be described by rules, this increases the likelihood of the task being offshored, since the task can then be assigned to offshore producers with less risk and greater ease of supervision.

However, the offshoring phenomenon does not necessarily have to result in a decline in services employment. Many existing services sectors have expanded, new services have emerged, and with ongoing technological developments and services trade liberalisation it is likely yet more are to be created. Furthermore, with the elasticity of demand of internationally traded services greater than one (*e.g.* Pain and van Welsum, 2004; van Welsum, 2004; Mann, 2004), rapid growth in countries such as India and China should also lead to reinforced exports from OECD countries. The offshoring phenomenon itself will also create new jobs in the domestic economy. However, it could be that certain types of occupations will experience slower growth than they otherwise might have done, and others more rapid growth.

As the trends in Figure 5.4 are expressed as shares, there are several possibilities to explain changes in these trends. For example, a decline in the share could be explained by an absolute decline in the number of people employed in the categories identified as potentially affected by offshoring. Alternatively, it could be that this selection of occupations is growing at a slower pace than total employment. The relatively slower growth of employment potentially affected by offshoring is in fact what explains most of the declines observed in the trends, except for the United States where the absolute number of people employed in the categories identified as potentially affected by offshoring has declined (see Box 5.A.1 in Annex). These observations would therefore tend to support the idea that offshoring may lead to slower growth of employment in occupations potentially affected by offshoring and not necessarily to actual declines in employment.

Disaggregating employment potentially affected by offshoring

As offshoring and technology may have a different effect on workers with different types of skills (*e.g.* Autor *et al*, 2003), the share of employment potentially affected by offshoring is broken down into two sub-categories: clerical and "non-clerical" professional occupations potentially affected by offshoring (Figures 5.5 and 5.6). This is important as the clerical group includes the types of jobs that can be substituted for by ICTs (through the digitisation and/or automation of certain tasks and types of codifiable knowledge) so a differential pace of adoption and integration of technology can have a different effect across countries.

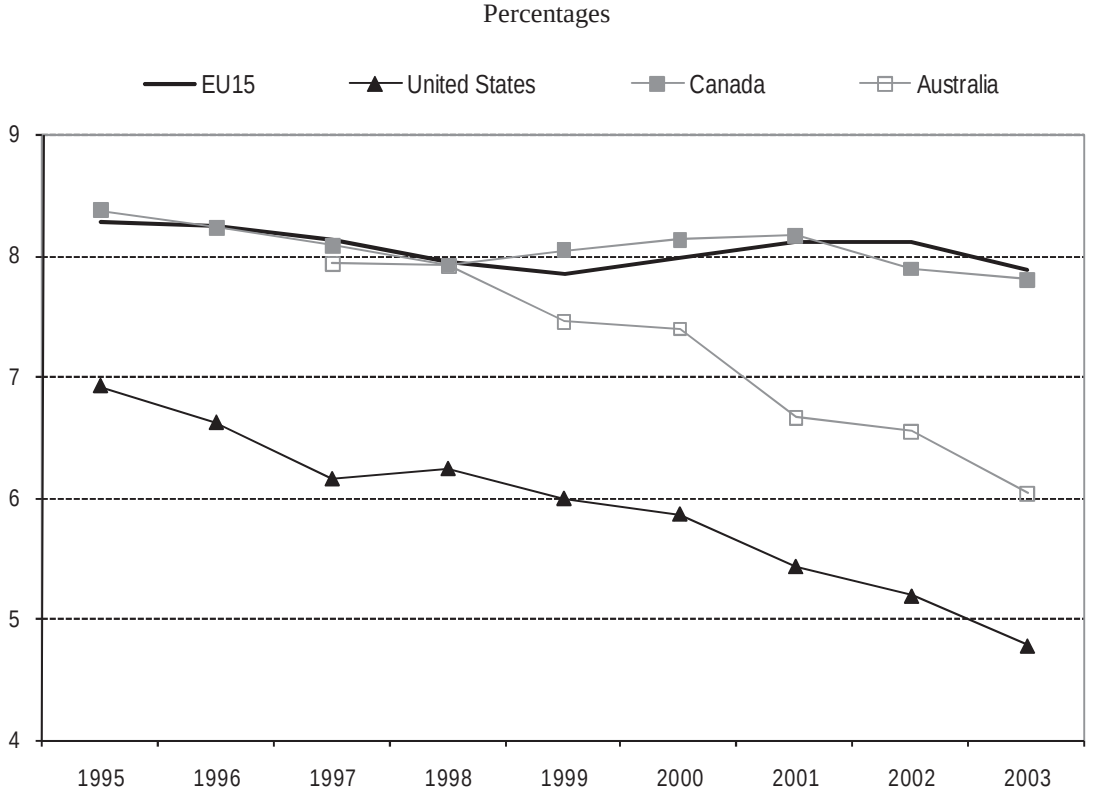
Looking at the share of clerical occupations for each country at the beginning and end of the respective available data periods it can be seen that for the United States and Australia, and Canada to a lesser extent, there is an obvious decline. This is consistent both with the destruction of these types of jobs as a result of technological advances and with the offshoring of back-office activities. For the EU15 countries the evidence is more mixed. In some countries a decline in the share can be observed (Austria, Belgium, Germany, Finland, France, Ireland, Netherlands, Portugal), but in other countries there is an increase (Denmark, Spain, Greece, Italy, Luxembourg, Sweden and the United Kingdom). It is likely that there are different explanations underlying these evolutions, for example the varying importance of the size of the services sector and the public sector in the economy, and the differential pace of technology adoption and integration. However, it also means that while there are many reports about clerical-type occupations being offshored, in some countries at least more still are being created at home. For example, in the United Kingdom employment growth in IT and call centre occupations potentially affected by offshoring over the period 2001-2005 was 8.8% compared to 3.2% for total employment, in spite of many media reports of these kinds of jobs being offshored. Nevertheless, *Computer Weekly* (February 2006 issue) reports that the effects

of offshoring are now being felt in the IT job market in the United Kingdom with more and more IT employers offshoring and outsourcing basic development and programming work.

Even though technology may account for at least some of the relative decline in the occupations potentially affected by offshoring, the possibility that some of these jobs have been offshored cannot be ruled out. For example, Baily and Lawrence (2005) argue that at least some of the declines in low-wage ICT-enabled occupations in the United States, a concept close but not equivalent to the group of clerical workers identified above, took place as a result of activities being shifted overseas. Looking at IT specialist occupations, they also find that the net loss of computer programmers in the United States was most likely the result of offshoring. Nevertheless, even the largest projections of jobs to be offshored, as often reported in the media, are in fact relatively small compared to annual job churning in OECD labour markets (OECD, 2004b).

Annex Tables 5.A.3-5.A.6 illustrate the occupations which have been included as "potentially affected by offshoring", and which of those are considered as "clerical" occupations. The following two graphs illustrate the evolution over time of the share of these clerical occupations and "non-clerical" occupations, or professionals (*e.g.* managers, professionals and engineers), in total employment.

Figure 5.5. The share of clerical occupations potentially affected by offshoring in total employment: EU15[1], US, Canada, and Australia 1995-2003[2]

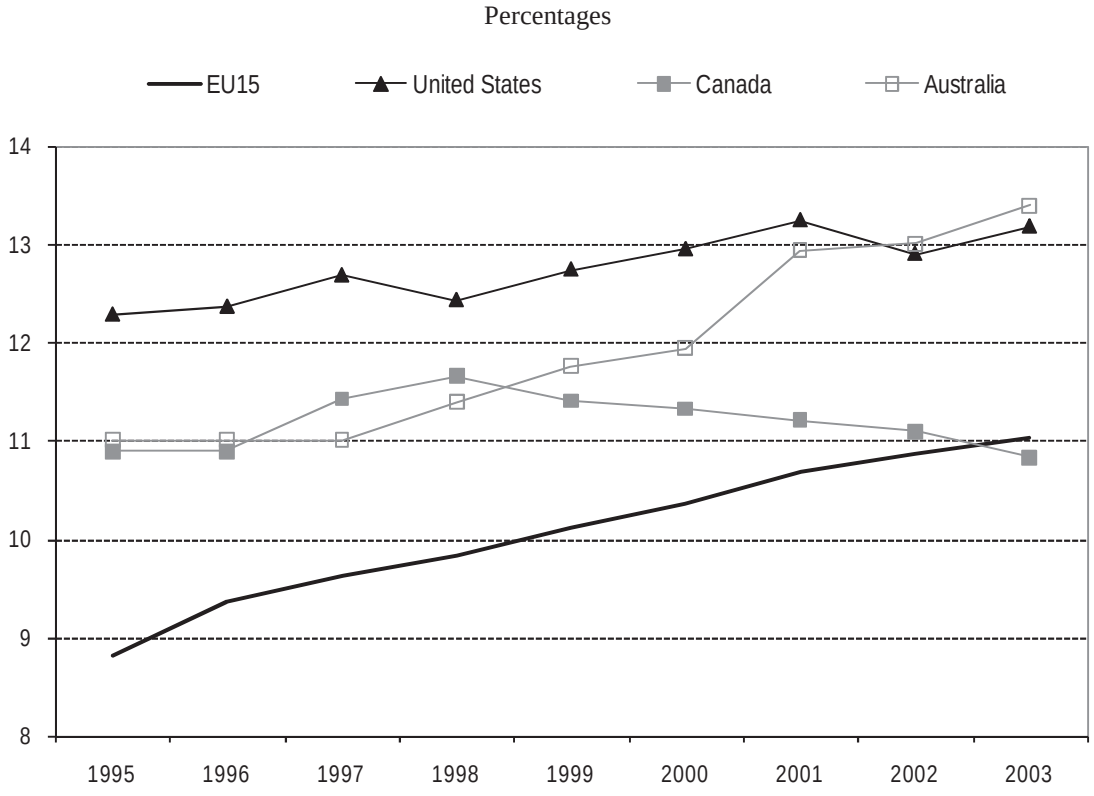


1. 1995 and 1996 exclude Finland and Sweden; 1998 excludes Ireland, and 2003 excludes Denmark, Luxembourg and the Netherlands.

2. Because of classification changes, the number for the United States for 2003 is an estimate. Due to differences in classifications the levels are not directly comparable.

Source: OECD calculations, based on EULFS, US Current Population Survey, Statistics Canada and Australian Bureau of Statistics (2004/5).

Figure 5.6. The share of "non-clerical" occupations (professionals) potentially affected by offshoring in total employment: EU15[1], US, Canada, and Australia 1995-2003[2]



1. 1995 and 1996 exclude Finland and Sweden; 1998 excludes Ireland, and 2003 excludes Denmark, Luxembourg and the Netherlands.

2. Because of classification changes, the number for the United States for 2003 is an estimate. Due to differences in classifications the levels are not directly comparable.

Source: OECD calculations, based on EULFS, US Current Population Survey, Statistics Canada and Australian Bureau of Statistics (2004/5).

The three-year averages for the share of clerical occupations in the occupations potentially affected by offshoring are shown in Table 5.5. Again, the levels of the shares are not directly comparable as the classifications were not harmonised internationally, but the direction of the trends over time is. The share of potentially offshorable employment accounted for by clerical occupations varies widely across countries, being over 60% in Italy and Portugal compared to around 30% in Australia, Ireland, Sweden the United Kingdom and the United States.

The distribution by industry of the total share of employment potentially affected by offshoring, as well as the clerical and "non-clerical" (professionals) breakdown, is shown for Europe for 2003 and 1995 in Annex Table 5.A.7. Services industries tend to account for large shares of these types of employment and the "non-clerical" share tends to be higher than the clerical share, except in hotels and restaurants, and some of the manufacturing and agricultural sectors. Similar observations can also be made for the United States, as illustrated by a selection of industries shown in Annex Table 5.A.8.

Table 5.5. The share of clerical occupations in employment potentially affected by offshoring, three-year averages[1], 1995-2003

Percentages

	Clerical in offshoring		
	1995-1997	1998-2000	2001-2003
Australia	41.9	39.3	32.8
Canada	42.6	41.2	41.8
United States	34.5	32.2	28.1
Austria	44.6	42.5	39.7
Belgium	38.0	36.7	33.2
Germany	49.1	44.8	42.3
Denmark	38.9	38.3	37.6
Spain	55.7	53.3	51.3
Finland	31.6	30.6	26.6
France	42.0	39.9	36.2
Greece	46.6	51.4	51.5
Ireland	22.0	33.0	30.8
Italy	65.8	62.8	61.9
Luxembourg	57.9	51.9	48.6
Netherlands	42.8	39.4	39.7
Portugal	63.8	67.8	62.9
Sweden	30.3	28.8	28.0
United Kingdom	33.8	31.7	32.9

1. Three years or as many as available. Includes estimates where a full data set was not available. Due to differences in classifications the levels of the shares are not directly comparable between the European and non-European countries.

Source: OECD calculations based on EULFS, US Current Population Survey, Statistics Canada and Australian Bureau of Statistics (2004/5).

Empirical analysis

The empirical work in this paper extends and refines the models estimated by van Welsum and Reif (2006a,b), in an attempt to identify the key factors associated with the share of economy-wide employment that is potentially offshorable in the United States, Canada, Australia and nine European Union member states[26] over the period 1996-2003.

In the empirical model the share of employment that is potentially offshorable is related to a set of factors controlling for international openness, the national economic structure, and economy wide framework influences. The controls for openness include indicators of exports and imports of business services and a number of different measures of foreign direct investment (FDI) stocks. The controls for economic structures are the shares of services and high-tech industries in GDP, and the share of ICT investments in total gross fixed capital formation. Finally, economy-wide framework factors are controlled for by the inclusion of the OECD product market regulation indicator, trade union density and an indicator of human capital. Each of these series is described in greater detail below.[27] The choice of variables is motivated by findings from a vast

26. The EU15 countries excluding Belgium, Greece, Ireland, Luxembourg, Spain and Portugal. The choice of countries is determined by the availability of the necessary data.

27. Even though GDP per capita was found to be associated with the share of services sector employment (Messina, 2004) it is not included in the regressions in this paper. In a time series context it does not make sense to include the level of GDP per capita in a regression of an ultimately bounded variable. The first difference of GDP per capita was tested at an early stage of the empirical analysis, but was found to be insignificant and is thus dropped from the model reported in this paper. This is not necessarily surprising as the countries in sample all have relatively high levels of GDP per capita. Nevertheless, with the exception of

background literature, including studies of the factors determining the overall share of the service sector in the economy, studies of services sector employment, and studies of the effect of trade and technology on employment.

The empirical work in this paper extends and improves the model used in previous analysis in two ways. First, the dependent variable is disaggregated into potentially offshorable clerical and "non-clerical" (professionals) occupations (see Figures 5.5 and 5.6 above), permitting a test of whether there are common influences on both. Secondly, there is an improved treatment of the FDI data used in the regression analysis. In the earlier papers use was made of only the aggregate stocks of inward and outward FDI. In this paper more disaggregated data are used for FDI, allowing tests to be undertaken of whether FDI in manufacturing has similar effects to FDI in market services.

Ideally, it would be appropriate to begin with a simple structural model of the factors affecting the relative demand for all potentially offshorable ICT-using occupations. Using the first order marginal productivity conditions from an (unknown) production function with two types of labour (ICT and non-ICT using labour), such a model might be expected to include measures of the relative output and relative wages of ICT-using occupations. Control variables might also be included to pick up possible differences in the extent of (labour-augmenting) technical progress in the two broad types of occupations. As in the literature on the demand for skilled and unskilled labour, possible controls are indicators for both trade and technology.

Unfortunately, while it is possible to control for output and technology effects directly, data on occupational wages are not readily available in most countries at the level of detail required. Their effect can be captured only indirectly by including a number of variables that can be expected to have an influence on real wages. It should be noted that although it is not possible to estimate a full structural model, the estimates we show are not a pure reduced form model either, since potentially endogenous current dated terms in output and/or trade and technology remain in the model.

Description of the data

Trade effects are approximated by including both imports and exports of other business and computer and information services as a share of GDP.[28] The literature on trade-related displacement suggests that imports can be expected to have a negative association with the share of potentially offshorable occupations, while exports should have a positive relationship. The FDI measures used in this paper are the net outward stock of FDI in manufacturing and in services as a share of national GDP.[29] The predictions from the literature are ambiguous about the overall direction of the relationship between FDI and the share of employment potentially affected by offshoring, and it is quite possible that the effects may vary according to the characteristics of

Austria, the countries with a relatively low share of potentially offshorable employment are also those with a comparatively lower level of GDP per capita. Time dummies pick up common cyclical effects.

28. The trade data are from IMF Balance of Payments statistics and GDP is taken from the OECD ANA (Annual National Accounts) database.

29. The foreign direct investment data are taken from the OECD Direct Investment Statistics Database. However, as multinationals can be very large enterprises with multiple establishments that span a large number of industries, assigning their investments to their "primary" industry can be problematic. Thus, it is possible that some manufacturing FDI contains services activities and vice versa. For Denmark and Sweden it was necessary to interpolate missing stock data using the available information on the composition of investment flows.

particular types of potentially offshorable employment and the sectors in which FDI takes place, just as the relationship between trade and FDI depends on the level of aggregation (Pain and van Welsum, 2004; van Welsum, 2004).

The share of services sector[30] value added in total value added and the share of high-tech industries[31] value added in total value added are included as indicators of the industrial structure of the economy.[32] Other things being equal, the larger the share of the services sector in the economy, the larger the aggregate demand for ICT-using occupations can be expected to be. The share of ICT investment[33] in total national gross fixed capital formation is also included in order to approximate technology adoption and integration. The ICT investment data are from an unpublished OECD database based on national account sources.

It is possible that the intensity of product market competition may influence the speed at which new technologies are adopted and the subsequent use made of them to adjust employment and labour tasks. An OECD indicator of anti-competitive product market regulations is thus included as a control in the regressions. This measure is an average of separate indicators of regulation in selected non-manufacturing industries.[34] A lower value of the aggregate indicator suggests that regulations are less restrictive and that there is a higher degree of competitive pressures in the economy. Other things being equal, there should be a negative relationship between this variable and the share of potentially offshorable employment. Messina (2004) includes a measure of entry-barriers to the creation of new firms in the economy as an indicator of product market regulations and finds a significant and negative effect on the share of services sector employment.

Two additional economy-wide structural variables are included to capture institutional and supply-side influences on (unobserved) real wages – union density and human capital. Trade union density indicators may of course provide information about the degree of flexibility in national labour markets, as well as the relative strength of workers in wage bargaining.[35] A number of existing papers suggest that union density rates are related to the growth of service sector occupations. For example, Messina (2004) finds that a fall in union density rates is associated with an increase in services sector

30. ISIC Rev.3 categories 50-99: 50-55: Wholesale and retail trade; repairs; hotels and restaurants; 60-64: Transport, storage and communications; 65-74: Finance, insurance, real estate and business services; 75-99: Community, social and personal services.

31. ISIC Rev.3 categories: 2423: chemicals excluding pharmaceuticals; 30: office, accounting and computing machinery; 32: radio, television and communication equipment; 33: medical, precision and optical instruments; 353: aircraft and spacecraft.

32. These are taken from the OECD STAN database; missing values have been estimated using the "60-Industry Database" from the Groningen Growth and Development Centre of the University of Groningen (Netherlands), available at: http://www.ggdc.net/dseries/60-industry.html (last accessed 28 April 2005).

33. ISIC Rev.3 categories: 30: office, accounting and computing machinery; 3130: Insulated wire and cable; 3210: Electronic valves and tubes and other electronic components; 3220: Television and radio transmitters and apparatus for line telephony and line telegraphy; 3230: Television and radio receivers, sound or video recording or reproducing apparatus, and associated goods; 3312: Instruments and appliances for measuring, checking, testing, navigating and other purposes; 3313: Industrial process control equipment; 5150: Wholesale of machinery, equipment and supplies; 6420: Telecommunications; 7123: Renting of office machinery and equipment (including computers); 72: computer and related activities.

34. The original version of these data is described in Nicoletti and Scarpetta (2003), with subsequently updated series available at: www.oecd.org/document/1/0,2340,en_2649_34117_2367297_1_1_1_1,00.html.

35. The data on trade union density rates come from OECD Labour Force Statistics Indicators and OECD 2004c (Table 3.3). Factors other than union density rates, including union coverage and hiring and firing restrictions, may also be important but are not included here.

employment. Similarly, Nickell *et al.* (2004) find evidence that countries with higher levels of employment protection were slower in reallocating resources from declining sectors (agriculture, manufacturing, and other production) into the services sector, possibly because stronger employment protection makes labour shedding in declining sectors more costly. The analysis in the present paper does not consider employment at the sectoral level, but an analogy can be drawn as labour market inflexibilities are likely to affect occupational shifts as well as sectoral changes. The *a priori* effect of this variable is ambiguous though, as it can both prevent a reallocation of resources into ICT-intensive using occupations, and hinder the speed at which existing ICT-intensive using jobs can be transferred abroad. In the latter case, the share of potentially offshorable occupations in total employment will be at a higher level than it would otherwise have been.

Human capital is approximated by the average years of education per person (de la Fuente and Doménech, 2002a,b, and OECD, 2003). It is expected that this variable should be positively related to the share of potentially offshorable occupations, since higher levels of human capital are positively correlated with the supply of ICT-literate people in the workforce. Such increases in supply should help to restrain the growth of real wages of workers in ICT occupations and hence support demand. Nickell *et al* (2004) find a strong positive effect of increases in educational attainment on the output share of the "other services" sector in the economy in Australia, Canada, France, Italy, Japan, Netherlands, Sweden, Germany, the United Kingdom and the United States.[36]

Thus the final specification used in the empirical work has the basic form:

$$\left[\frac{OFF\ j}{EMP}\right]_{it} = \alpha_i + \beta_1\left[\frac{X}{GDP}\right]_{it} + \beta_2\left[\frac{M}{GDP}\right]_{it} + \beta_3\left[\frac{NETMFDI}{GDP}\right]_{i,t-1} + \beta_4\left[\frac{NETSFDI}{GDP}\right]_{i,t-1}$$
$$+ \beta_5\, ICTIRAT_{i,t-1} + \beta_6\, SERVICES_{i,t-1} + \beta_7\, HITECH_{i,t-1} + \beta_9\, PMR_{i,t} + \beta_{10}\, UNIONS_{t-1}$$
$$+ \beta_{11}\, HK_{i,t-1} + \varepsilon_{it} \qquad [1]$$

where the dependent variable is the share of potentially offshorable employment of type *j* in total employment in country *i*, X and M are exports and imports of business and computer information services, NETMFDI and NETSFDI are the net outward stocks of manufacturing and services FDI, ICTRAT is the share of ICT investments in total investment, SERVICES and HITECH are the share of service sector output and hi-tech sector output in GDP, PMR is the product market regulation indicator, UNIONS denotes union density and HK denotes human capital. All the GDP share variables use data at current prices. The reported regressions also include country-specific fixed effects, capturing otherwise unobserved factors specific to each country that do not vary over time, and annual time dummies, capturing otherwise unobserved effects that are common to all countries in each year.

This model is estimated using three different measures of the dependent variable – total potentially offshorable employment, potentially offshorable clerical employment and potentially offshorable non-clerical employment ("professionals"). The equations for the two sub-categories are estimated jointly to improve the efficiency of the estimates by allowing for potential correlations in the respective equation variances. Joint estimation also allows tests to be undertaken for common parameters in both equations.

36. But in the sector "business services" they found a greater role for changes in relative prices.

As the two sub-categories sum to total potentially offshorable employment, and the same explanatory factors are used in all three equations, the coefficients in the jointly-estimated clerical and "non-clerical" equations will sum to those in the equation for the aggregate measure. The main advantage of estimating the equations for the individual categories is thus to establish whether different factors affect the different types of occupations. It does not provide an alternative picture of the factors driving the evolution of total potentially offshorable employment.

Results

The stylised preliminary results are shown in Table 5.6. The results show it is important to differentiate between different types of occupations as the results differ for four of the explanatory variables (net outward manufacturing FDI, ICT investment, relative size of the services sector and union density). In particular, these variables have a positive statistical association with the share of "non-clerical" occupations (professionals), but a negative association with the share of clerical occupations. They show that it is important to allow for different types of occupations as the disaggregation matters to the results. Furthermore, contrary to what was found in previous analysis (van Welsum and Reif, 2006a,b), a negative association between the share of employment potentially affected by offshoring and imports of business and computer and information services is now found, which could point to some sign of displacement. This difference in the results could be related to the use of some different and more disaggregated data that were not used in the previous analysis.

Table 5.6. Stylised regression results for "non-clerical" (professionals) and clerical occupations

	Total offshoring	"Non-clerical"	Clerical
Exports computer and business services/GDP	+	+	+
Imports computer and business services/GDP	-	-	-
Net outward manufacturing FDI	-	+	-
Net outward services FDI	+	+	+
ICT investment	+	+	-
Services sector	+	+	-
High-tech sector	+	+	+
Product market regulation	-	-	-
Union density	-	-	+
Human capital	+	+	+

A + indicates a positive statistical association between the share of employment potentially affected by offshoring and the variable in question, a – a negative statistical association. Details of significance and confidence levels are given in Table 5.7.

Table 5.7 contains the detailed results from using fixed effects, simultaneous equation and instrumental variables estimation techniques. Estimation for the basic fixed effect single and multivariate regression models is for a sample of 12 countries over 1996-2003. The multivariate instrumental variables estimates (by 3SLS) are for the same countries, but over 1997-2003.

An initial set of results using total potentially offshorable employment as the dependent variable is shown in column [1]. The results from joint estimation of equations for the clerical and "non-clerical" (professional) components are reported in column [2]. Although a joint test for common parameters in both equations is strongly rejected [p-value = 0.00], the imposition of common parameters on four explanatory factors – product market regulation, imports of business and computer services, human capital and the share of hi-tech industries in GDP cannot be rejected [p-value=0.42]. The results from imposing these restrictions and discarding one highly insignificant variable are shown in column [3].

The final column of Table 5.7 shows the results obtained from estimating the simultaneous equation model in [3] by three-stage least squares (3SLS). This combines an instrumental variable approach to produce consistent estimates and generalised least squares to account for the correlation structure in the disturbances across equations. A year is dropped from the estimation period to allow higher order lagged variables to be used as instruments. All current dated terms, with the exception of the product market regulation indicator, are instrumented in column [4], as is the lagged ICT investment ratio, to allow for the possibility that it is acting as a proxy lagged dependent variable. The 3SLS model results have a similar pattern to those from the simultaneous equation models, though there are some differences in the magnitude and significance of the coefficients.

The following subsections discuss the estimation results for the international openness variables, the economic structure variables and the economy-wide framework variables in turn.

Table 5.7. Factors associated with the share of employment (total, non-clerical ("professionals") and clerical occupations) that is potentially offshorable

	[1]	[2]		[3]		[4]	
Dependent variable	**Total**	**Non-Clerical**	**Clerical**	**Non-Clerical**	**Clerical**	**Non-Clerical**	**Clerical**
$(X/GDP)_t$	1.1504 (7.6)*	0.7310 (7.0)*	0.4194 (4.6)*	0.6776 (8.4)*	0.4586 (6.5)*	1.0390 (4.4)*	0.7891 (3.4)*
$(M/GDP)_t$	-0.4457 (2.8)*	-0.2763 (2.5)*	-0.1693 (1.8)†	-0.2108 (2.8)*	-0.2108 (2.8)*	-0.5278 (2.0)*	-0.5278 (2.0)*
$(NETMFDI/GDP)_{t-1}$	-0.0012 (0.1)	0.0395 (1.9)†	-0.0408 (3.2)*	0.0498 (2.5)*	-0.0457 (3.8)*	0.0352 (1.4)	-0.0518 (3.3)*
$(NETSFDI/GDP)_{t-1}$	0.0543 (3.8)*	0.0422 (3.1)*	0.0121 (1.3)	0.0386 (3.0)*	0.0137 (1.5)	0.0380 (2.7)*	0.0153 (1.7)†
$(ICTIRAT)_{t-1}$	0.1876 (3.5)*	0.1918 (4.7)*	-0.0042 (0.1)	0.2036 (6.2)*		0.3079 (4.7)*	
$SERVICES_{t-1}$	0.0994 (1.8)†	0.1590 (3.4)*	-0.0596 (2.1)*	0.1540 (3.7)*	-0.0578 (2.0)*	0.1621 (3.2)*	-0.0330 (0.9)
$HTECH_{t-1}$	0.4833 (2.3)*	0.3315 (2.1)*	0.1518 (1.3)	0.2063 (2.2)*	0.2063 (2.2)*	0.2232 (1.7)†	0.2232 (1.7)†
PMR_t	-0.5642 (2.9)*	-0.3206 (2.0)*	-0.2436 (2.0)*	-0.2803 (2.9)*	-0.2803 (2.9)*	-0.4208 (2.8)*	-0.4208 (2.8)*
$UNIONS_{t-1}$	-0.0472 (1.1)	-0.0978 (2.4)*	0.0506 (1.9)†	-0.0936 (2.4)*	0.0495 (1.8)†	-0.1114 (2.3)*	0.0363 (1.1)
HK_{t-1}	2.0099 (3.8)*	0.8028 (2.3)*	1.2072 (4.7)*	1.0833 (4.4)*	1.0833 (4.4)*	1.0210 (3.4)*	1.0210 (3.4)*
$\overline{R}^2$	0.966	0.984	0.987	0.983	0.987	0.981	0.987
Standard error	0.502	0.319	0.238	0.321	0.238	0.342	0.243
Mean of dependent variables	18.61	11.39	7.23	11.39	7.23	11.39	7.23
Estimation method	OLS	MVR		MVR		3SLS	

Notes: (X/GDP) is the share of exports of other business and computer and information services in GDP, (M/GDP) is the share of imports of other business and computer and information services in GDP, (NET FDI/GDP) is the net stock of outward foreign investment as a share of GDP, (ICTI/INV) is the share of ICT investment in total fixed investment, SERVICES is the share of the services sector in total value added, HTECH is the share of high-tech industries in total value added, PMR is a product market regulations indicator, UNIONS denotes the trade union density rate, and HK is the average years of education per person.

Country fixed effects and annual time dummies are included in all regressions. Heteroscedastic-consistent t-statistics are in parentheses.

* Denotes a coefficient significant at the 5% level.

† Denotes a coefficient significant at the 10% level.

International openness

International trade and the FDI measures are both found to be significant. Exports of business and computer information services are found to have a positive and significant association with the share of employment potentially affected by offshoring – as expected. The impact on potentially offshorable professionals, or "non-clerical", employment is significantly larger than that for potentially offshorable clerical employment, as can be seen from the results in columns [2] to [4] of Table 5.7. In contrast, the coefficient on imports of business and computer information services is negatively signed, implying that increasing imports are associated with a reduction in the share of potentially offshorable occupations at the aggregate level, with similar sized effects on both types of potentially offshorable employment. Although the trade variables may be endogenous, especially if companies' decisions about international sourcing and employment are made simultaneously, the basic findings remain even in the 3SLS estimates in which the trade variables are treated as endogenous.

The results for the two net outward FDI measures vary across the different occupational categories and the different econometric techniques. In the single equation for total potentially offshorable employment (column [1]) only the net services FDI variable is significant, with a higher net outward stock of services FDI being positively associated with the share of potentially offshorable employment. The simultaneous equation estimates show that this effect largely arises from a positive association with potentially offshorable professionals, or "non-clerical" occupations. The impact on clerical occupations is significant only in the 3SLS estimates, and even then the coefficient is significant only at the 10% level. This result is consistent with a scenario where skill intensive headquarter services (*e.g.* management, R&D, marketing, design) continue to be provided from the home country, at least initially, while there is a reduced need for administrative support functions when relatively more of the activity is located abroad.

The net outward manufacturing FDI stock does not have a significant overall impact on the aggregate share of potentially offshorable employment. The simultaneous equation estimates show that this arises because there are offsetting effects on clerical and "non-clerical" occupations (professionals). In particular, an increase in the net outward manufacturing FDI stock is associated with a decline in the employment share of potentially offshorable clerical occupations. In contrast, such a change in the manufacturing FDI stock is associated with an increase in the employment share of potentially offshorable professionals ("non-clerical occupations"). This latter effect is significant in the simultaneous equation estimates in [2] and [3], but not in the 3SLS estimates. The same type of scenario of a relative increase in the need for highly skilled headquarter services combined with a reduced need for clerical type occupations could again explain this result, with the negative effect on the latter stronger in this case.

A common element of the findings for both FDI variables is that they are associated with a rise in the share of professionals, or "non-clerical" occupations relative to the share of clerical occupations. This is consistent with other studies that have found that outward FDI is positively associated with a rise in the relative demand for skilled labour in the home economy (see, for example, Head and Ries, 2002).

There are many different factors that might be reflected in the coefficients on the FDI variables. It is also the case that FDI data can, at times, be a poor measure of the actual scale of activities that multinational companies undertake. However, as shown in van Welsum and Reif (2006a,b), the inclusion of FDI variables does not significantly bias the coefficients on the other explanatory factors.

Economic structure

The share of ICT investment in gross fixed capital formation, the share of services in GDP and the share of high-tech industries in GDP are all significantly positively associated with the share of employment potentially affected by offshoring (column [1]), as might be expected. However, there are noticeable differences in their effects on clerical and "non-clerical" ICT-using occupations (professionals).

The ICT investment term has a significant positive association only with "non-clerical" occupations (professionals) – as shown in [2] the coefficient on this term in the clerical occupations terms is not significant and is thus discarded in [3] and [4]. This means the share of "non-clerical" to clerical is rising. However, there is no sign that, overall, ICTs are having a destructive effect on ICT-using clerical occupations.

The service sector share has a significant positive association with "non-clerical" occupations (professionals), but a small negative association with ICT-using clerical occupations. The latter effect is statistically significant in the simultaneous equation models shown in columns [2] and [3], but not in the 3SLS estimates. The initial estimates also suggest that the share of high-tech output in GDP matters mainly for the "non-clerical" employment share (see [2]), but it is not possible to reject the imposition of a common coefficient in the clerical and "non-clerical", or professionals, employment equations, with the resulting estimate being statistically significant, as shown in [3].

Economy-wide framework factors

A reduced level of anti-competitive product market regulations and a higher level of human capital are both found to be positively associated with the aggregate share of potentially offshorable occupations in total employment. Both of these factors encourage the adoption and usage of ICT technologies. Subsequent tests indicated that both also have similar effects on the two types of ICT-using occupations, with common coefficients being imposed on these terms in the estimates shown in column [3] and column [4].

Union density is not found to be significantly related to the aggregate share of potentially offshorable occupations in total employment. However, it does appear to affect the composition of this share, having a negative association with the share of "non-clerical" occupations (professionals) and a positive association with the share of clerical occupations, although the latter effect is not significant in the 3SLS estimates. These results suggest that higher levels of union density act to slow the general adjustment that is taking place from clerical to "non-clerical" occupations (professionals) in all the economies included in the sample used in this paper.

Conclusions

This paper summarises analysis of the factors affecting the share of potentially offshorable professionals or "non-clerical" (*e.g.* managers, professionals and engineers) and clerical occupations in total employment. The analysis suggests that the share of exports of business services in GDP, the share of ICT investment in total investment, the share of the service sector in GDP and improvements in human capital have all been especially important factors behind the general upward tendency in the share of employment in potentially offshorable professionals (non-clerical occupations). The remaining variables considered also help to raise the employment share, with the exception of the share of imports of business services in GDP.

The exports to GDP ratio and human capital also help to raise the share of employment in potentially offshorable clerical occupations, as does the share of hi-tech output in GDP and reductions in product market regulations. However, these factors have been offset by rising imports of business services, the decline in trade union densities and the rising share of services in GDP.

Overall, the principal findings appear to be robust to changes in estimation techniques and specifications of the model. Indicators of international trade and investment, the structure of national economies and economy-wide framework factors are all important for understanding the cross-country pattern of the share of potentially offshorable occupations in total employment. Although the development of corresponding data sources for the relative wages of the various types of occupations would help to separate out demand and supply-side influences more clearly, the results from the descriptive regressions in this paper provide useful guidance for both policy development and for further work in this area.

Further work in this area could follow a number of paths to improve understanding of the effects of international sourcing. A major area would be to strive to improve the occupational selections, for example by co-ordinating with work undertaken in the United States (*e.g.* Blinder, 2005 and Jensen and Kletzer, 2005) and by generating occupational lists through repeated independent occupational choice exercises. Controlling for differences in ICT-content of occupations, over time and across countries, would be another extension. Finally, further separating out the effects of technology on occupations from those of offshoring should also be explored.

International harmonisation of the definition of offshoring and the data classifications, as well as data collection itself, would greatly enhance the scope for the formulation of consistent and sound policy recommendations and would enhance the scope for comparison of the various studies on the effects of offshoring.

ANNEX 5.A

Table 5.A.1. IMF balance of payments categories

7.	Computer and information services
7.1	Computer services
7.2	Information services
7.2.1	News agency services
7.2.2	Other information provision services
9.	Other business services
9.1	Merchanting and other trade-related services
9.1.1	Merchanting
9.1.2	Other trade-related services
9.2	Operational leasing services
9.3	Miscellaneous business, professional, and technical services
9.3.1	Legal, accounting, management consulting, and public relations
9.3.1.1	Legal services
9.3.1.2	Accounting, auditing, bookkeeping, and tax consulting services
9.3.1.3	Business and management consulting, and public relations
9.3.2	Advertising, market research, and public opinion polling
9.3.3	Research and development
9.3.4	Architectural, engineering, and other technical services
9.3.5	Agricultural, mining, and on-site processing services
9.3.5.1	Waste treatment and depollution
9.3.5.2	Agricultural, mining and other on-site processing services
9.3.6	Other business services
9.3.7	Services between related enterprises, n.*i.e.*

Source: OECD (2002).

Table 5.A.2. Sectors distinguished in the OECD Direct Investment Statistics Database

PRIMARY SECTOR
- Agriculture and Fishing
- Mining and Quarrying
  - of which: Extraction of petroleum and gas

MANUFACTURING
- of which: Food products
- Total textile and wood activities
- Total petroleum, chemical, rubber, plastic products
- Total metal and mechanical products
- Total machinery, computers, RTV, communication
- Total vehicles and other transport equipments

SERVICE SECTOR
- Electricity, Gas and Water
- Construction
- Trade and Repairs
- Hotels and Restaurants
- Transports, Communication
  - of which: Total land, sea and air transport
  - Telecommunications
- Financial Intermediation
  - of which: Monetary intermediation
  - Other financial intermediation
    - of which: Financial holding companies
  - Insurance and activities auxiliary to insurance
  - Total other financial intermediation and insurance activities
- Real Estate and Business Activities
  - of which: Real estate
- Other Services

UNALLOCATED

TOTAL

Table 5.A.3. Europe: Occupations potentially affected by offshoring

3 Digit ISCO-88
123: Other specialist managers
211: Physicists, chemists, and related professionals
212: Mathematicians, statisticians and related professionals
213: Computing professionals
214: Architects, engineers, and related professionals
241: Business professionals
242: Legal professionals
243: Archivists, librarians, and related information professionals
312: Computer associate professionals
341: Finance and sales associate professionals
342: Business services agents and trade brokers
343: Administrative associate professionals
411: Secretaries and keyboard-operating clerks
412: Numerical clerks
422: Client information clerks

Note: Occupations in shading have been classified as clerical.

Source: van Welsum and Vickery (2005a), based on EULFS (2004).

Table 5.A.4. United States: Occupations potentially affected by offshoring

CPS categories			
accountants and auditors	23	Archivists and curators	165
underwriters	24	Economists	166
other financial officers	25	Urban planners	173
management analysts	26	Authors	183
architects	43	Technical writers	184
aerospace engineer	44	Editors and reporters	195
metallurgical and materials engineers	45	Air traffic controllers	227
mining engineers	46	Computer programmers	229
petroleum engineers	47	Tool programmers, numerical control	233
chemical engineers	48	Supervisors and Proprietors, Sales Occupations	243
nuclear engineers	49	Insurance sales occupations	253
civil engineers	53	Real estate sales occupations	254
agricultural engineers	54	Securities and financial services sales occupations	255
Engineers, electrical and electronic	55	Sales occupations, other business services	257
Engineers, industrial	56	Supervisors, computer equipment operators	304
Engineers, mechanical	57	Supervisors, financial records processing	305
marine and naval architects	58	Chief communications operators	306
engineers, n.e.c.	59	Computer operators	308
surveyors and mapping scientists	63	Peripheral equipment operators	309
computer systems analysts and scientists	64	Secretaries	313
operations and systems researchers and analysts	65	Typists	315
Actuaries	66	Transportation ticket and reservation agents	318
Statisticians	67	File clerks	335
Mathematical scientists, n.e.c.	68	Records clerks	336
Physicists and astronomers	69	Bookkeepers, accounting, and auditing clerks	337
Chemists, except biochemists	73	Payroll and timekeeping clerks	338
Atmospheric and space scientists	74	Billing clerks	339
Geologists and geodesists	75	Cost and rate clerks	343
Physical scientists, n.e.c.	76	Billing, posting, and calculating machine operators	344
Agricultural and food scientists	77	Telephone operators	348
Biological and life scientists	78	Bank tellers	383
Forestry and conservation scientists	79	Data-entry keyers	385
Medical scientists	83	Statistical clerks	386
Librarians	164		

Note: Occupations in shading have been classified as clerical.

Source: van Welsum and Vickery (2005a), based on US Current Population Survey.

Table 5.A.5. Canada: Occupations potentially affected by offshoring

SOC91 Canada	
A121	Engineering, Science and Architecture Managers
A122	Information Systems and Data Processing Managers
A131	Sales, Marketing and Advertising Managers
A301	Insurance, Real Estate and Financial Brokerage Managers
A302	Banking, Credit and Other Investment Managers
A303	Other Business Services Managers
A311	Telecommunication Carriers Managers
A312	Postal and Courier Services Managers
A392	Utilities Managers
B011	Financial Auditors and Accountants
B012	Financial and Investment Analysts
B013	Securities Agents, Investment Dealers and Traders
B014	Other Financial Officers
B022	Professional Occupations in Business Services to Management
B111	Bookkeepers
B112	Loan Officers
B114	Insurance Underwriters
B211	Secretaries (except Legal and Medical)
B212	Legal Secretaries
B213	Medical Secretaries
B214	Court Recorders and Medical Transcriptionists
B311	Administrative Officers
B312	Executive Assistants
B412	Supervisors, Finance and Insurance Clerks
B512	Typists and Word Processing Operators
B513	Records and File Clerks
B514	Receptionists and Switchboard Operators
B521	Computer Operators
B522	Data Entry Clerks
B523	Typesetters and Related Occupations
B524	Telephone Operators
B531	Accounting and Related Clerks
B532	Payroll Clerks
B533	Tellers, Financial Services
B534	Banking, Insurance and Other Financial Clerks
B553	Customer Service, Information and Related Clerks
B554	Survey Interviewers and Statistical Clerks
C011	Physicists and Astronomers
C012	Chemists
C013	Geologists, Geochemists and Geophysicists
C014	Meteorologists
C015	Other Professional Occupations in Physical Sciences
C021	Biologists and Related Scientists
C031	Civil Engineers
C032	Mechanical Engineers
C033	Electrical and Electronics Engineers
C034	Chemical Engineers
C041	Industrial and Manufacturing Engineers
C042	Metallurgical and Materials Engineers
C043	Mining Engineers
C044	Geological Engineers
C045	Petroleum Engineers
C046	Aerospace Engineers
C047	Computer Engineers
C048	Other Professional Engineers, n.e.c.
C051	Architects
C052	Landscape Architects
C053	Urban and Land Use Planners
C054	Land Surveyors
C061	Mathematicians, Statisticians and Actuaries
C062	Computer Systems Analysts
C063	Computer Programmers
C152	Industrial Designers
C172	Air Traffic Control Occupations
E012	Lawyers and Quebec Notaries
E031	Natural and Applied Science Policy Researchers, Consultants and Program Officers
E032	Economists and Economic Policy Researchers and Analysts
E033	Economic Development Officers and Marketing Researchers and Consultants
F011	Librarians
F013	Archivists
F021	Writers
F022	Editors
F023	Journalists
F025	Translators, Terminologists and Interpreters
G131	Insurance Agents and Brokers

Note: Occupations in shading have been classified as clerical.

Source: van Welsum and Vickery (2005a), based on Statistics Canada.

Table 5.A.6. Australia: Occupations potentially affected by offshoring

ASCO 4-digit	
1221 Engineering Managers	2521 Legal Professionals
1224 Information Technology Managers	2522 Economists
1231 Sales and Marketing Managers	2523 Urban and Regional Planners
1291 Policy and Planning Managers	2534 Journalists and Related Professionals
2111 Chemists	2535 Authors and Related Professionals
2112 Geologists and Geophysicists	3211 Branch Accountants and Managers (Financial Institution)
2113 Life Scientists	3212 Financial Dealers and Brokers
2114 Environmental and Agricultural Science Professionals	3213 Financial Investment Advisers
2115 Medical Scientists	3294 Computing Support Technicians
2119 Other Natural and Physical Science Professionals	3392 Customer Service Managers
2121 Architects and Landscape Architects	3399 Other Managing Supervisors (Sales and Service)
2122 Quantity Surveyors	5111 Secretaries and Personal Assistants
2123 Cartographers and Surveyors	5911 Bookkeepers
2124 Civil Engineers	5912 Credit and Loans Officers
2125 Electrical and Electronics Engineers	5991 Advanced Legal and Related Clerks
2126 Mechanical, Production and Plant Engineers	5993 Insurance Agents
2127 Mining and Materials Engineers	5995 Desktop Publishing Operators
2211 Accountants	6121 Keyboard Operators
2212 Auditors	6141 Accounting Clerks
2221 Marketing and Advertising Professionals	6142 Payroll Clerks
2231 Computing Professionals	6143 Bank Workers
2292 Librarians	6144 Insurance Clerks
2293 Mathematicians, Statisticians and Actuaries	6145 Money Market and Statistical Clerks
2294 Business and Organisation Analysts	8113 Switchboard Operators
2299 Other Business and Information Professionals	8294 Telemarketers
2391 Medical Imaging Professionals	

Note: Occupations in shading have been classified as clerical.

Source: van Welsum and Vickery (2005a), based on Australian Bureau of Statistics.

Box 5.A.1. Detailed analysis of the US occupational data

Looking at the year-on-year change in the occupational data for the US (1995-2002) at the level of the individual occupations shows:

All of the occupations selected as potentially affected by offshoring experienced at least one year-on-year decline.

45 out of the 67 occupations included in the US selection experienced an absolute decline between 2001 and 2002, as did the overall selection of occupations potentially affected by offshoring and total employment.

The overall selection of occupations potentially affected by offshoring experienced 3 absolute declines between 1995-2002; to compare the individual occupations against the overall selection, the following 47 occupations experienced **at least** three absolute declines:

Accountants and auditors	23	Urban planners	1
Architects	43	Authors	1
Metallurgical and materials engineers	45	Technical writers	1
Mining engineers	46	Editors and reporters	1
Petroleum engineers	47	Air traffic controllers	2
Engineers, electrical and electronic	55	Computer programmers	2
Engineers, industrial	56	Supervisors and Proprietors, Sales Occupations	2
Engineers, mechanical	57	Insurance sales occupations	2
Marine and naval architects	58	Real estate sales occupations	2
Engineers, n.e.c.	59	Supervisors, computer equipment operators	3
Operations and systems researchers and analysts	65	Computer operators	3
Actuaries	66	Peripheral equipment operators	3
Statisticians	67	Secretaries	3
Physicists and astronomers	69	Typists	3
Chemists, except biochemists	73	Transportation ticket and reservation agents	3
Atmospheric and space scientists	74	File clerks	3
Geologists and geodesists	75	Payroll and timekeeping clerks	3
Physical scientists, n.e.c.	76	Billing clerks	3
Biological and life scientists	78	Cost and rate clerks	3
Forestry and conservation scientists	79	Telephone operators	3
Medical scientists	83	Bank tellers	3
Librarians	164	Data-entry keyers	3
Archivists and curators	165	Statistical clerks	3
Economists	166		

The estimates for 2003 show a further absolute decline in the selection of occupations potentially affected by offshoring.

Table 5.A.7. Share of employment potentially affected by offshoring for Europe[1], by industry, 2003 and 1995

NACE	Industry	2003			1995		
		Total Offshoring	Clerical	Non-clerical	Total Offshoring	Clerical	Non-clerical
1	Agriculture, hunting and related service activities	1.8	1.0	0.8	2.5	1.9	0.6
2	Forestry, logging and related activities	4.3	2.1	2.2	6.2	4.3	1.8
5	Fishing; service activities incidental to fishing	2.0	1.2	0.9	2.5	1.7	0.8
10	Mining of coal and lignite; extraction of peat	10.5	2.4	8.1	6.6	3.2	3.4
11	Extraction of crude petroleum and natural gas;	43.5	10.7	32.8	31.5	10.7	20.8
12	Mining of uranium and thorium ores	19.2	11.7	7.5	13.4	6.8	6.6
13	Mining of metal ores	19.1	8.0	11.0	10.7	4.0	6.7
14	Other mining and quarrying	10.5	5.4	5.1	8.1	4.2	3.8
15	Manufacture of food products and beverages	11.6	4.5	7.1	10.9	4.9	6.0
16	Manufacture of tobacco products	22.6	8.4	14.2	15.1	5.7	9.4
17	Manufacture of textiles	13.2	7.0	6.2	11.2	6.6	4.6
18	Manufacture of wearing apparel; dressing and dyeing of fur	9.5	4.8	4.7	5.6	3.0	2.6
19	Tanning and dressing of leather; manufacture of leatherwear	9.5	6.1	3.5	7.8	5.9	1.9
20	Manufacture of wood	7.9	4.0	3.9	6.9	3.8	3.1
21	Manufacture of pulp, paper and paper products	14.7	5.1	9.7	13.6	5.6	8.1
22	Publishing, printing and reproduction of recorded media	23.3	8.8	14.5	21.0	9.9	11.1
23	Manufacture of coke, refined petroleum products and nuclear fuel	35.6	9.3	26.3	33.0	11.4	21.6
24	Manufacture of chemicals and chemical products	31.2	7.9	23.3	26.7	8.7	18.0
25	Manufacture of rubber and plastic products	14.9	6.0	8.9	14.6	5.9	8.7
26	Manufacture of other non-metallic mineral products	14.1	5.6	8.4	11.2	5.7	5.6
27	Manufacture of basic metals	13.7	6.1	7.5	11.6	4.5	7.1
28	Manufacture of fabricated metal products	12.8	5.4	7.4	11.8	6.0	5.7
29	Manufacture of machinery and equipment, n.e.c.	20.6	6.5	14.1	19.2	7.2	12.0
30	Manufacture of office machinery and computers	52.0	7.7	44.3	49.5	9.4	40.1
31	Manufacture of electrical machinery and apparatus, n.e.c.	23.6	6.4	17.2	21.3	6.5	14.7
32	Manufacture of radio, television and communication equipment	32.2	6.2	26.1	27.3	6.8	20.5
33	Manufacture of medical, precision and optical instruments	26.9	7.7	19.3	22.1	6.8	15.3
34	Manufacture of motor vehicles, trailers and semi-trailers	17.1	4.3	12.8	12.7	4.5	8.2
35	Manufacture of other transport equipment	25.2	4.8	20.4	19.0	5.5	13.5
36	Manufacture of furniture; manufacturing n.e.c.	12.1	6.2	6.0	9.7	5.6	4.1
37	Recycling	11.8	6.3	5.4	11.4	6.0	5.4
40	Electricity, gas, steam and hot water supply	32.7	13.6	19.2	26.8	12.2	14.6
41	Collection, purification and distribution of water	28.3	12.4	16.0	24.3	13.0	11.3
45	Construction	9.4	3.8	5.6	9.2	4.2	5.0
50	Sale, maintenance and repair of motor vehicles and motorcycles	15.2	7.0	8.1	13.6	6.6	7.0
51	Wholesale trade and commission trade	38.1	10.1	28.0	35.7	11.0	24.7
52	Retail trade	11.7	3.7	8.0	9.6	3.6	6.0
55	Hotels and restaurants	4.5	3.0	1.5	4.0	2.8	1.2
60	Land transport; transport via pipelines	9.4	4.7	4.7	8.4	4.7	3.7
61	Water transport	19.7	9.8	9.9	13.9	6.9	7.0
62	Air transport	23.8	11.8	11.9	20.5	9.3	11.3
63	Supporting and auxiliary transport activities; activities of travel agencies	25.3	14.8	10.5	23.0	13.3	9.6
64	Post and telecommunications	28.5	12.6	15.9	16.1	9.2	6.9
65	Financial intermediation, except insurance and pension funding	62.1	38.2	24.0	55.4	37.1	18.3
66	Insurance and pension funding, except compulsary social security	71.1	33.8	37.3	73.5	35.2	38.2
67	Activities auxiliary to financial intermediation	67.7	25.1	42.6	74.5	30.5	44.0
70	Real estate activities	44.0	14.9	29.1	43.9	16.3	27.6
71	Renting of machinery and equipment	27.3	12.5	14.7	26.1	11.8	14.4
72	Computer and related activities	79.4	9.0	70.5	73.9	12.8	61.1
73	Research and development	41.1	6.1	35.1	36.3	7.9	28.4
74	Other business activities	47.7	17.3	30.3	49.1	20.3	28.8
75	Public administration and defence; compulsary social security	22.0	14.1	7.9	23.0	16.0	7.0
80	Education	7.6	4.2	3.3	6.3	3.7	2.5
85	Health and social work	7.5	5.6	1.9	8.2	6.3	1.8
90	Sewage and refuse disposal, sanitation and similar activities	9.1	5.2	3.9	8.0	4.2	3.8
91	Activities of membership organisation, n.e.c.	26.5	16.9	9.6	24.7	17.2	7.5
92	Recreational, cultural and sporting activities	15.0	6.5	8.5	14.5	6.4	8.0
93	Other service activities	8.5	5.1	3.4	8.6	5.0	3.6
95	Private households with employed persons	1.6	1.3	0.3	0.8	0.5	0.2
99	Extra-territorial organisations and bodies	30.1	15.8	14.4	28.3	18.2	10.1

1. EU15 except Luxembourg in 2003, and EU15 except Finland and Sweden in 1995. The total share for the top ten ranked industries in the total offshoring category in 2003 and 1995 are in shading.

Source: OECD calculations based on EULFS.

Table 5.A.8. Share of employment potentially affected by offshoring for the US, 20 industries with a high total share, 2002[1] and 1995

Industry	2002			1995		
	Total offshoring	Clerical	Non-clerical	Total offshoring	Clerical	Non-clerical
890 Accounting, auditing, and bookkeeping services	81.2	25.5	55.7	84.7	26.7	58.0
710 Security, commodity brokerage, and investment companies	62.3	5.4	56.8	70.6	11.2	59.4
732 Computer and data processing services	60.6	3.6	57.0	62.6	5.6	57.0
882 Engineering, architectural, and surveying services	58.9	3.7	55.2	62.2	8.6	53.6
711 Insurance	57.3	10.5	46.8	64.7	16.4	48.3
892 Management and public relations services	57.1	5.9	51.1	56.6	8.5	48.2
701 Savings institutions, including credit unions	55.3	29.3	26.1	48.1	31.4	16.7
442 Telegraph and miscellaneous communications services	49.6	12.6	36.9	25.6	12.1	13.5
700 Banking	48.0	28.6	19.4	53.8	32.6	21.2
362 Guided missiles, space vehicles, and parts	45.9	2.7	43.1	36.6	6.4	30.2
852 Libraries	45.5	8.0	37.6	56.2	12.6	43.6
432 Services incidental to transportation	45.2	35.1	10.1	57.3	51.6	5.8
930 Environmental quality and housing programs administration	44.6	9.8	34.9	38.6	11.2	27.4
702 Credit agencies, n.e.c.	44.2	6.5	37.7	48.5	12.7	35.7
712 Real estate, including real estate-insurance offices	43.5	5.8	37.8	44.3	6.4	37.9
472 Not specified utilities	43.0	0.0	43.0	26.8	0.0	26.8
663 Catalog and mail order houses	40.6	6.2	34.4	34.3	6.4	27.9
921 Public finance, taxation, and monetary policy	40.5	10.7	29.8	45.3	11.4	33.9
891 Research, development, and testing services	38.5	4.6	33.9	43.6	8.6	35.0
511 Metals and minerals, except petroleum	36.4	10.1	26.3	32.7	6.7	25.9

1. Data for 2002 were used here as the 2003 data are not directly comparable with the 1995 data because of classification changes.

Source: OECD calculations based on US CPS.

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Chapter 6

FOREIGN AFFILIATES IN OECD ECONOMIES: PRESENCE, PERFORMANCE AND CONTRIBUTION TO HOST COUNTRIES' GROWTH

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This study uses new information to determine the role of foreign affiliates in productivity growth. The study has three aims. Firstly, the study quantifies the contribution of foreign affiliates to productivity growth in OECD countries using a growth accounting approach. Secondly, the analysis shows how much of this contribution derives from an increase in the employment share of foreign affiliates in the host country relative to an increase in the productivity of existing foreign affiliates. Thirdly, the study compares the presence of foreign affiliates across OECD countries. The information is derived by matching three OECD data sources: the STAN database for industrial analysis, the AFA (Activities of Foreign Affiliates) and FATS (Foreign Affiliates in Trade and Services) databases. Despite its limitations, this combined database provides longitudinal industry level information on both the presence and the productivity of foreign affiliates in OECD countries. The analysis confirms that foreign affiliates can make an important contribution to productivity growth. The contribution is larger in the manufacturing sector. In the services sector and in low-tech manufacturing sectors, the largest component of the contribution of foreign affiliates is due to the increased employment share of foreign affiliates. In medium- and high-tech sectors, the contribution is mainly driven by stronger productivity growth of existing foreign affiliates. In the United States the contribution is consistently driven by stronger productivity growth of existing foreign affiliates in both the manufacturing and the services sectors.

This chapter has previously been published in OECD Economic Studies No. 41, 2005/2. The paper was prepared while Chiara Criscuolo was at the OECD Directorate for Science, Technology and Industry.

Introduction[37]

In recent decades, foreign direct investment (FDI) has steadily increased so that foreign owned multinational enterprises (MNEs) now play an important role in the economy of many developed and developing economies. Countries compete with each other to attract FDI because they expect affiliates of foreign MNEs to contribute to the welfare of the host economy through multiple channels. But what precisely is the impact of foreign affiliates on the host country economy?

International trade models assume that MNEs must have inherent advantages that allow them to compete with domestic firms despite the higher costs of operating in a foreign country with a different cultural and legal environment, where they often have less knowledge of demand conditions and of local business networks involving suppliers and customers (see for example Helpman, Melitz and Yeaple, 2004 and references therein; Hymer, 1976; Helpman 1984; Dunning, 1993 and Markusen, 1995). The literature suggests that these inherent advantages derive from firm-specific assets, such as better management techniques and better production technology and employees' technical knowledge, which MNEs can share with their affiliates, as well as brand names and product innovations from which the affiliates benefit.

MNEs' affiliates benefit from being part of a global group and from the advantages of vertical and/or horizontal integration. They can gain not only from the knowledge transfers from parent companies and flows among subsidiaries but also from factor price differentials, global economies of scale and outsourcing. This makes them more productive than firms that are not part of an MNE (see for example Doms and Jensen, 1998 for evidence on the United States; Griffith, 1999 and Criscuolo and Martin, 2004 for evidence on the United Kingdom). Since there is a paucity of data identifying firms that are part of domestic MNEs, and since only a small fraction of all domestic firms are part of domestic multinationals, this MNE advantage is mainly reflected in an advantage of foreign affiliates.

Empirical evidence has shown that foreign affiliates are larger, and more capital and skill intensive; they invest more in both physical and knowledge capital and pay higher wages[38] than domestic firms within the same industry. Also, as shown by previous OECD work, foreign affiliates are often concentrated in more capital and skill intensive sectors and are more R&D intensive and more innovative than domestic firms. Therefore, they are likely to grow more than domestic firms and thus contribute *directly* to productivity growth of the host economy.

Foreign affiliates may also contribute *indirectly* to productivity growth of the host economy, by raising the productivity of domestic firms. Host countries hope to benefit from the presence of foreign affiliates by appropriating some of the productivity and knowledge advantages that foreign affiliates cannot fully internalise. These externalities take place through "knowledge spillovers" such as international technology transfer,

37. The author would like to thank Agnes Cimper, Paul Conway, Jørgen Elmeskov, Nicholas Oulton, Dirk Pilat, Colin Webb, Andrew Wyckoff, Norihiko Yamano, Paul Swaim and David Turner for valuable comments and suggestions. Many thanks go to Thomas Hatzichronoglou, Isabelle Desnoyers-James and Laurent Moussiegt for providing the AFA/FATS data and details on its sources. Responsibility for any errors is the author's alone. The paper reflects the views of the author and should not be attributed to the OECD or its member countries.

38. See Lipsey, 2003 for a survey of empirical evidence.

diffusion of best practices and demonstration effects (see Keller, 2004 for a survey).[39] The presence of foreign affiliates affects the productivity of domestic firms also through the increased competitive pressure on domestic firms. This effect is, however, ambiguous. Increased competitive pressure on domestic firms in the same industry might force them to introduce new technology and improve efficiency (see Blomström and Kokko, 1997). However, the entry of foreign firms could also result in lower productivity or exit of domestic firms because of lower market shares, through a "market stealing" effect (Aitken and Harrison, 1999). This study does not attempt to assess and quantify the "knowledge spillovers" and "market stealing" effects (*i.e.* the *indirect* contribution) from foreign affiliates to domestic firms.

Instead, this study quantifies the *direct* contribution of foreign affiliates to labour productivity growth across OECD countries using a growth accounting approach and investigates how much of the contribution is derived from an increase in the size of foreign affiliates' presence in the host country and how much is derived from their higher labour productivity growth. The data on which the analysis is based comes from matching three sources: the OECD STAN database for industrial analysis, the AFA (Activities of Foreign Affiliates) and FATS (Foreign Affiliates' Trade in Services) databases. Despite some limitations, this combined database provides longitudinal information at the industry level on the productivity of the host country and the presence and the productivity of foreign affiliates.

Only the study by Corrado, Lengermann and Slifman (2003) has previously used a growth accounting approach to quantify the contribution of the (foreign and domestic) multinational sector to labour productivity growth using, in this case, aggregated plant-level data from the United States for the period 1977 to 2000.

The present study assesses the contribution of the foreign multinational sector across several OECD countries and extends their analysis by decomposing the contribution of foreign affiliates to labour productivity growth into two components: the *within* effect, *i.e.* the contribution from labour productivity growth of existing foreign affiliates, and the *between* or *compositional* effect, *i.e.* the contribution from the increase in the share of foreign affiliates' employment in the host economy.

The rest of the paper is organised as follows: Section two describes the data; Section three reports the presence of foreign affiliates and Section four analyses their relative labour productivity across OECD countries. Section five outlines the methodology used for decomposing labour productivity growth and describes the results of the labour productivity growth decomposition. Finally section six concludes. The Annexes include more details regarding the data and additional results at a more disaggregated level.

39. Domestic firms can imitate foreign affiliates; workers trained in foreign firms might leave foreign firms and move to domestic firms. In the case of backward and forward linkages, foreign firms are also likely to improve the knowledge of domestic suppliers and/or distributors (see evidence in Smarzynska, 2004).

The data

The data used for the analysis are derived from three OECD databases: the STAN productivity database; the AFA (Activity of Foreign Affiliates) database, which contains information on activity of foreign affiliates in the manufacturing sector and the FATS (Foreign Affiliates' Trade in Services) database, which contains information on the activity of foreign affiliates in the services sector. A brief description of each dataset and a short discussion of the issues that arise when matching the three datasets follow below. Annex 1 reports further detail on the measurement of output and labour input in STAN, discusses the characteristics of the AFA/FATS data that are relevant for our cross-country longitudinal analysis and outlines some issues related to deflation of the matched data.

The Structural Analysis (STAN) database is provided and maintained by the Economic Analysis and Statistics Division of the OECD[40] and contains information on annual measures of output, measured as gross output and/or value added, labour input, investment, import and exports at the industry level,[41] both in the manufacturing and the services sector for 29 OECD countries. The analysis reported in this paper uses only measures of output and labour input to construct measures of labour productivity growth. STAN is mostly based on member countries' annual National Accounts, which are primarily derived from data collected at the establishment level, but also uses other sources (*e.g.* national industrial surveys/censuses; short term indicators of industrial activity; labour force surveys; business registers; income surveys and input-output tables) to estimate missing information. The output measures available in STAN are value added and/or gross output measured in nominal terms, *i.e.* at current prices, and in real terms, *i.e.* as volumes, so it is possible to calculate implicit deflators for gross output and/or for value added.

AFA and FATS are both survey-based databases. OECD member countries report on the basis of their own surveys or their own business registers sectoral level information on the outputs, inputs and importing/exporting activity of foreign affiliates in the host country. The output measures available in AFA/FATS are value added and/or turnover measured in nominal terms, *i.e.* at current prices, only.[42] To overcome this limitation, this study uses the implicit deflators calculated from STAN to deflate value added and turnover in AFA/FATS. The only measure of labour input available in AFA and FATS is the number of employees of foreign affiliates.

In interpreting the results of the analysis that follows it is important to bear in mind a number of limitations with the data:

40. STAN has been widely used and comprehensively documented. Thus, this section only briefly describes the variables used and the main issues of interest. See Webb (2005) for a thorough user guide and www.oecd.org/sti/stan for an overview of the sources.

41. The STAN list of industries is based on ISIC Rev. 3.

42. For some countries AFA and FATS also contain information on national totals, i.e. the combined activities of domestic and foreign firms. Data for national totals are missing for the United States. For most countries the figures are only available at an aggregate level and only for some years. For example, data for the manufacturing sector in Japan are only available between 1992 and 1996; in Italy only for 1999 and 2001.

- The time series of foreign affiliate activity in AFA and FATS are affected by several structural breaks, as discussed in detail in Annex 1. To prevent the results of this study being biased by these breaks, the analysis of the contribution of foreign affiliates to labour productivity growth is carried out for 1995-2001, a period which is virtually unaffected by these breaks.

- AFA/FATS report information at the enterprise rather than at the establishment level. This implies that the statistics on foreign affiliates' activity reported might incorporate secondary activity. This point is particularly relevant in this study because measures of foreign affiliates' activity are calculated relative to national totals primarily based on establishment level data from STAN. Since the two aggregates are not based on the same statistical unit, some measurement problems arise (see also the *OECD Handbook on Economic Globalisation Indicators*, Section 3.3.7).

- In STAN the industry allocation is mostly based on the main activity of each plant that is part of an enterprise. In AFA/FATS, the industry classification is based on the primary activities of the consolidated enterprise. This might cause the relative presence of foreign affiliates in certain sectors to be under- or overestimated, depending on whether the industry concerned is the secondary or primary activity of the foreign enterprise.[43] Contrary to the study by Corrado, Lengermann and Slifman (2004), where an adjustment was made by using the underlying micro level data, the data underlying this analysis do not provide a straightforward solution to this problem. A similar adjustment, based on use of the underlying micro level data, could be part of future research.[44]

- A final set of issues that arise in merging production data from AFA/FATS and STAN concerns definitions of the main variables used in the datasets. Firstly, STAN contains information on total employment. AFA and FATS only contain information on the total number of employees. However, the difference between total number of employees and total employment, which corresponds mostly to the "self-employed", is likely to be negligible for foreign affiliates. Therefore, the statistics reported should reflect very closely the foreign affiliates' share of total employment in the host economy. Secondly, STAN contains information on value added and gross output, while AFA and FATS have information on value added and turnover. Since turnover equals the value of goods and/or services sold in a year, while gross output is defined as the value of goods or services produced in a year whether sold or stocked, the direction of the biases that may arise from this difference is not always clear.[45] This study therefore will concentrate on measures of labour productivity based on value added rather than gross output (or turnover) to avoid incurring these biases.

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43. In a few cases, the ratio of foreign presence relative to the national total is greater than one. In the service sector, the employment share is always within the 0-1 range; but for turnover the ratio is greater than 1 in 30 cases, 27 of which are in the wholesale and retail trade sector. The high turnover ratio for these sectors is easily explained by the difference in definition of output in FATS (sales) and STAN (margins).

44. A related concern might arise because of the conversion of national industrial classifications to international classifications. This issue occurs when the conversion to an international classification is based on aggregated published data. This particularly affects data from the United States and Canada. Therefore, the sectoral analysis will be conducted mainly at the subsection level, rather than at the 2-digit level.

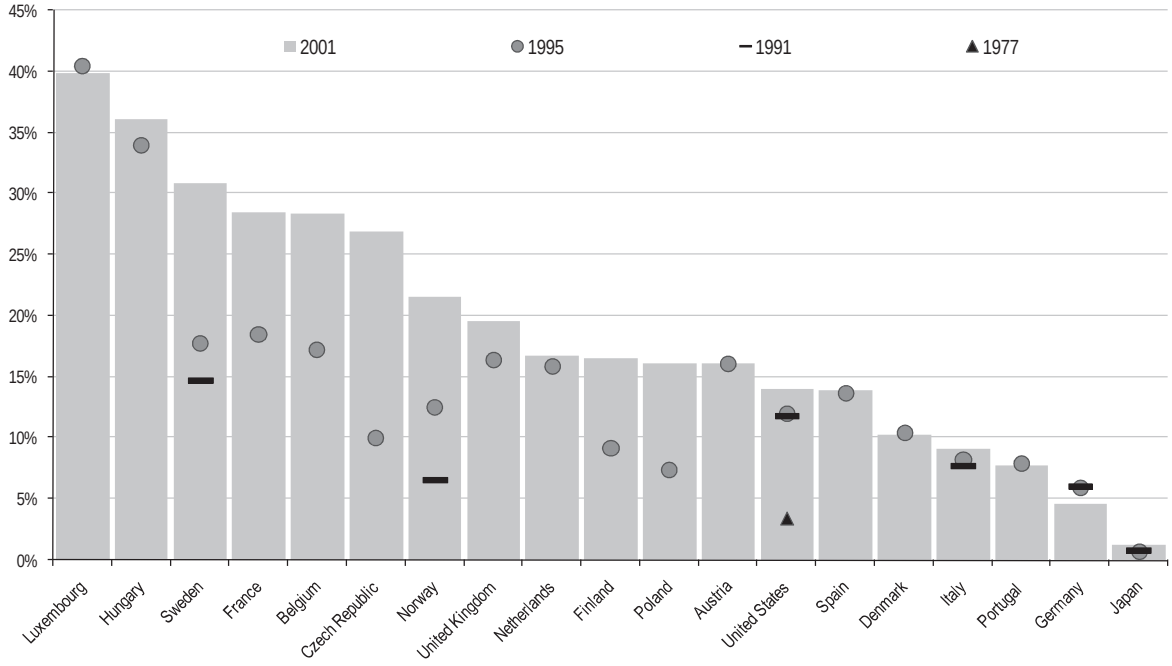
45. However, in the services sector, sizeable biases, especially in the wholesale and retail sectors, might derive from differences in the definition of gross output. As noted by Triplett and Bosworth (2004) and Timmer and Inklaar (2005), the system of national accounts, which constitutes the basis for STAN, measures trade output as margins rather than sales, where margins are defined as sales minus the value of the goods that would need to be purchased to replace the ones sold.

The study compares labour productivity of foreign affiliates to labour productivity of domestic firms and measures the contribution of foreign affiliates to labour productivity growth. The choice to focus on labour productivity (LP) rather than multifactor productivity (MFP) is mainly dictated by data availability, since AFA and FATS do not contain information on enterprises' capital stocks. Although labour productivity only measures the efficiency of one of the inputs to production, labour, and thus cannot distinguish whether an increase in productivity is due to an improvement in efficiency or an increase in capital stock, labour productivity measures are less data intensive, impose very few theoretical restrictions and do not rely on measures of capital stock that are likely to be affected by measurement error.

The presence of foreign affiliates in OECD countries

The employment share of foreign affiliates in the manufacturing sector in the 19 OECD countries considered here varies widely (Figure 6.1).[46] However, for virtually all countries the share of employment of foreign affiliates has increased over time, the sole exception being Germany (where there has been a slight fall).

Figure 6.1. Employment share of foreign affiliates in the manufacturing sector of 19 OECD countries



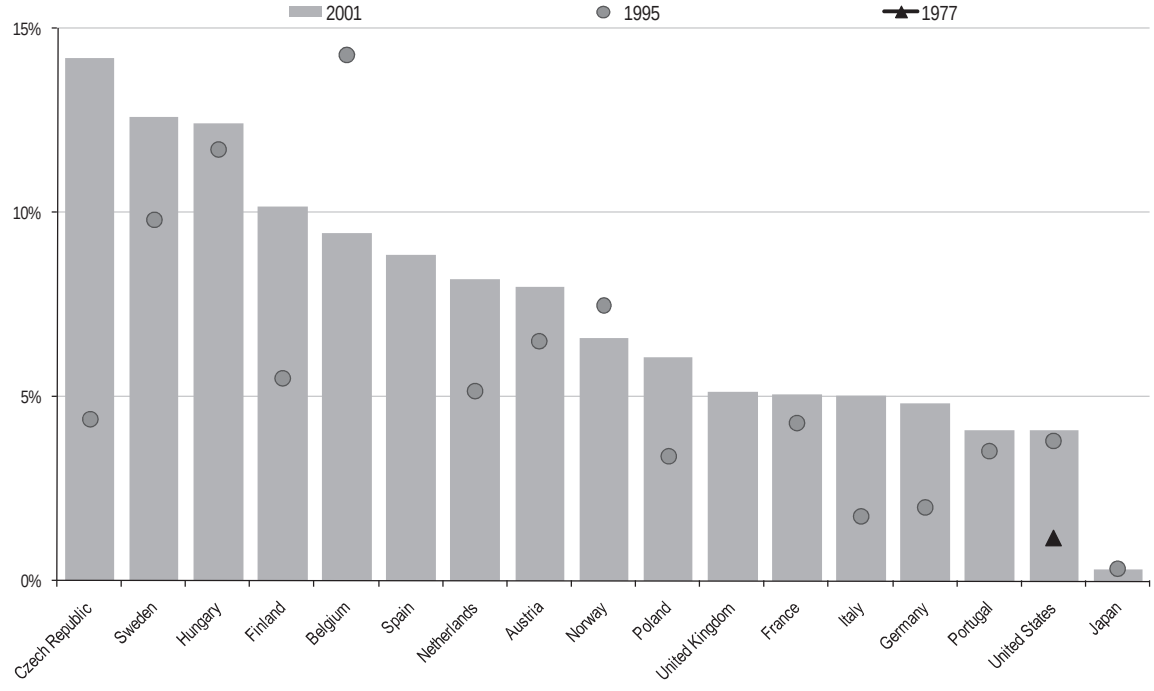
Source: OECD AFA database.

46. Data on employment in foreign affiliates is not available in the AFA/FATS databases for Canada.

However, care needs to be taken in interpreting these changes as they are sometimes partly attributable to changes in definition of the foreign affiliates' group or in the coverage of the data.[47] Most of changes in definitions and coverage took place before 1995, so the analysis of labour productivity growth will concentrate on the period 1995 to 2001.

The presence of foreign affiliates is much lower in the service sector[48] relative to the manufacturing sector (Figure 6.2). This might be due to higher barriers to entry in the services sectors. As for the manufacturing sector, there is a general trend increase in the presence of foreign affiliates (although as for the manufacturing sector there are some data inconsistencies which affect the data for some countries, mainly prior to 1995).[49] The presence of foreign affiliates is lowest in Japan and highest in Central European countries, notably Hungary and the Czech Republic; and in Nordic countries, notably Sweden and Finland. Note, however, that relative to the manufacturing sector the time period covered is much shorter and the data much more sparse over time.

Figure 6.2. Employment share of foreign affiliates in the private services sector of 17 OECD countries



Note: Japan: data excludes ISIC Rev 3 sectors 60 to 64; 65 to 67 and in 1995 also 70 to 74. United States: data for sectors 70 to 74 are only available from 1987. Finland: data for sector 55 are missing in 1995.

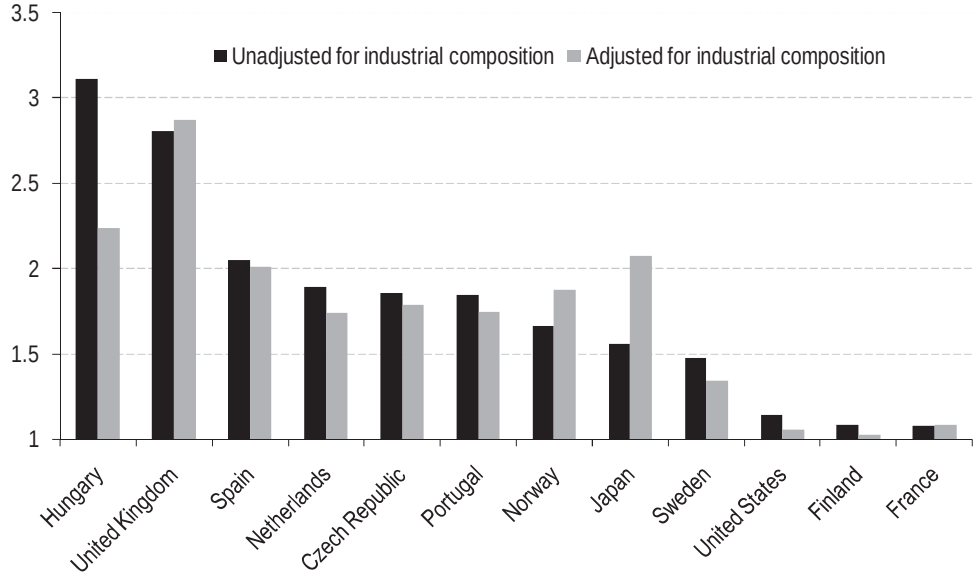
Source: OECD FATS database.

47. Such inconsistencies are a particular feature of the data for France; Sweden; Norway and Finland. See Annex 6A.1 for full details.

48. The private services sector is defined as ISIC Rev 3 sectors 50 to 74. For those countries for which data on foreign affiliates for the financial services are not available, we report data on 50 to 64 and 70 to 74, as described in the notes to Figure 6.2.

49. Such inconsistencies are a particular feature of the data for Italy, and the United States. See Annex 6Â.1 for full details.

Figure 6.3. Relative labour productivity of foreign affiliates in the manufacturing sector, 2001

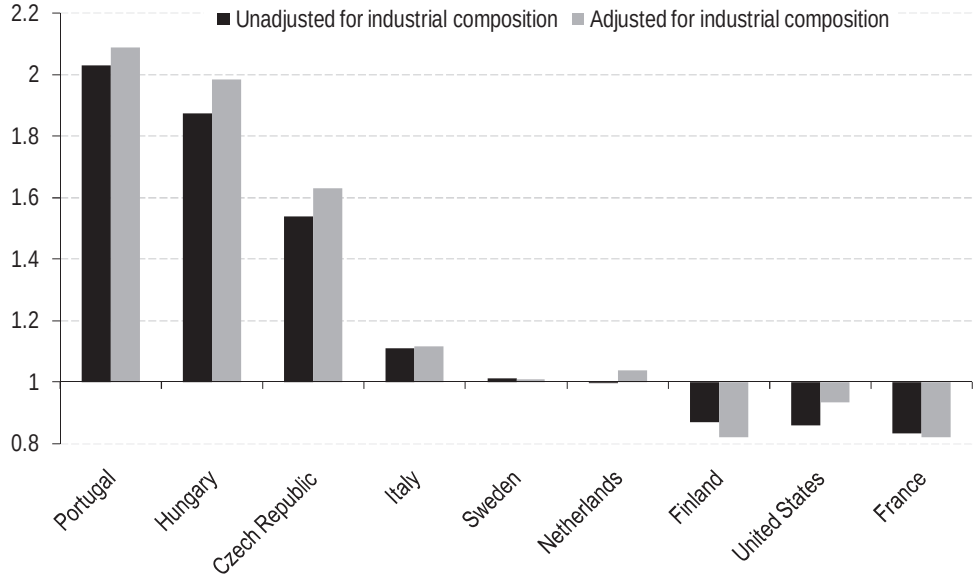


Note: Figures reported are for 2001, except for the Czech Republic (2002), Japan (2000), Hungary and the United Kingdom (1999) and Portugal (1998).

Source: OECD AFA database.

Figure 6.4. Relative labour productivity of foreign affiliates in the services sector, 2001

LP of domestic firms = 18



Note: Figures reported are for 2001, except for Czech Republic, Hungary and Portugal (2002) and Sweden (2000). Hungary: data for ISIC Rev 3. 65 to 67 are missing.

Source: OECD FATS database.

The relative labour productivity of foreign affiliates in OECD countries

In the manufacturing sector foreign affiliates have a higher level of labour productivity than domestic firms[50] in 2001 (Figure 6.3). In the services sector this is not always the case (Figure 6.4): in Finland, France and the United States domestic firms appear to be more productive than foreign affiliates.

The labour productivity differential between foreign affiliates and domestic firms might be driven by differences in industrial composition since foreign affiliates are likely to be in high technology, high value added industries. The importance of this compositional effect can be judged by comparing the "unadjusted" data with a series which corrects for the industrial composition of the foreign affiliates group (Figures 6.3 and 6.4). This adjustment consists of calculating the productivity differential between foreign and domestic firms keeping the distribution across industries for foreign affiliates equal to the distribution of domestic firms. In nearly all cases, the adjustment does not have a large impact on the relative labour productivity differential between foreign and domestic firms. Two exceptions are Hungary and Japan. In Hungary, the decrease in the foreign affiliates' productivity advantage in the adjusted figure is driven by the strong LP advantage of foreign affiliates in chemical, rubber, plastic and fuel products (sectors 23 to 25), non-metallic mineral products (26), electrical and optical equipment (30 to 33) and transport equipment (34 and 35). These are medium-high technology sectors where foreign affiliates are also more present. In the aggregate "adjusted" figure, the weight of these medium-high technology sectors decreases and so does the labour productivity advantage of foreign firms. For Japan, the food products, beverages, and tobacco sectors (15 and 16) drive the increase in the labour productivity advantage of foreign firms in the adjusted results. In these sectors the presence of foreign affiliates is very small and the labour productivity advantage of foreign affiliates is very large. Since the adjustment uses the domestic distribution across sectors, the weight of these sectors in the adjusted relative productivity figure increases nine fold and so does the labour productivity advantage of foreign affiliates.

The figures also show great cross-country heterogeneity in foreign affiliates' relative labour productivity. In the United States, France and Sweden, labour productivity of foreign and domestic firms is very similar, while in Spain, Hungary and the United Kingdom foreign affiliates are twice as productive as domestic manufacturing firms.

One way to investigate the source of this heterogeneity is to analyse the labour productivity differentials between foreign and domestic firms at a more disaggregated level,[51] as reported in Tables 6.A2.5 and 6.A2.6 in Annex 6.A2. These results are summarised here using box and whiskers diagrams[52] to describe the distribution of labour

50. Relative labour productivity is defined as the ratio of value added per employee of foreign affiliates over the value added per employee of domestic firms. The data for the group of domestic firms are derived as the difference between data for national totals and foreign affiliates.

51. An additional way to investigate the relative country's performance is to look at the relative labour productivity by country of origin. AFA contains some detail on the country of origin of foreign affiliates. This information is only available for some countries and mostly at the aggregate manufacturing level. Criscuolo (2005) shows the ratio of labour productivity of foreign affiliates by country of origin relative to national labour productivity in the manufacturing sector in 2001 (or the latest available year) in nine OECD countries. The analysis does not suggest any clear cut general insight.

52. In the box and whiskers diagrams reported the middle of the box is the median relative LP. The edges of the box are the 25th and 75th percentile (first and third quartile) of the distribution. The two whiskers identify the minimum and the maximum value of the distribution.

productivity differentials between foreign and domestic firms within industries and within countries (Figure 6.5). The first panel in the figure reports the distribution of relative labour productivity in the manufacturing sectors. In high tech and medium-high sectors (such as 23 to 25, chemical, rubber, plastics and fuel products; and 30 to 33, machinery and equipment) both the productivity advantage of foreign affiliates and the spread of the distribution -- measured as the interquartile range -- are on average smaller than in low-tech sectors (such as 15 and 16, food products, beverages and tobacco; 17 to 19, textiles, textile products, leather and footwear; and 36 and 37 manufacturing NEC and recycling). This might be due to the tougher competition in these medium-high and high technology sectors, which have already been opened to global competition through imports and large FDI flows.

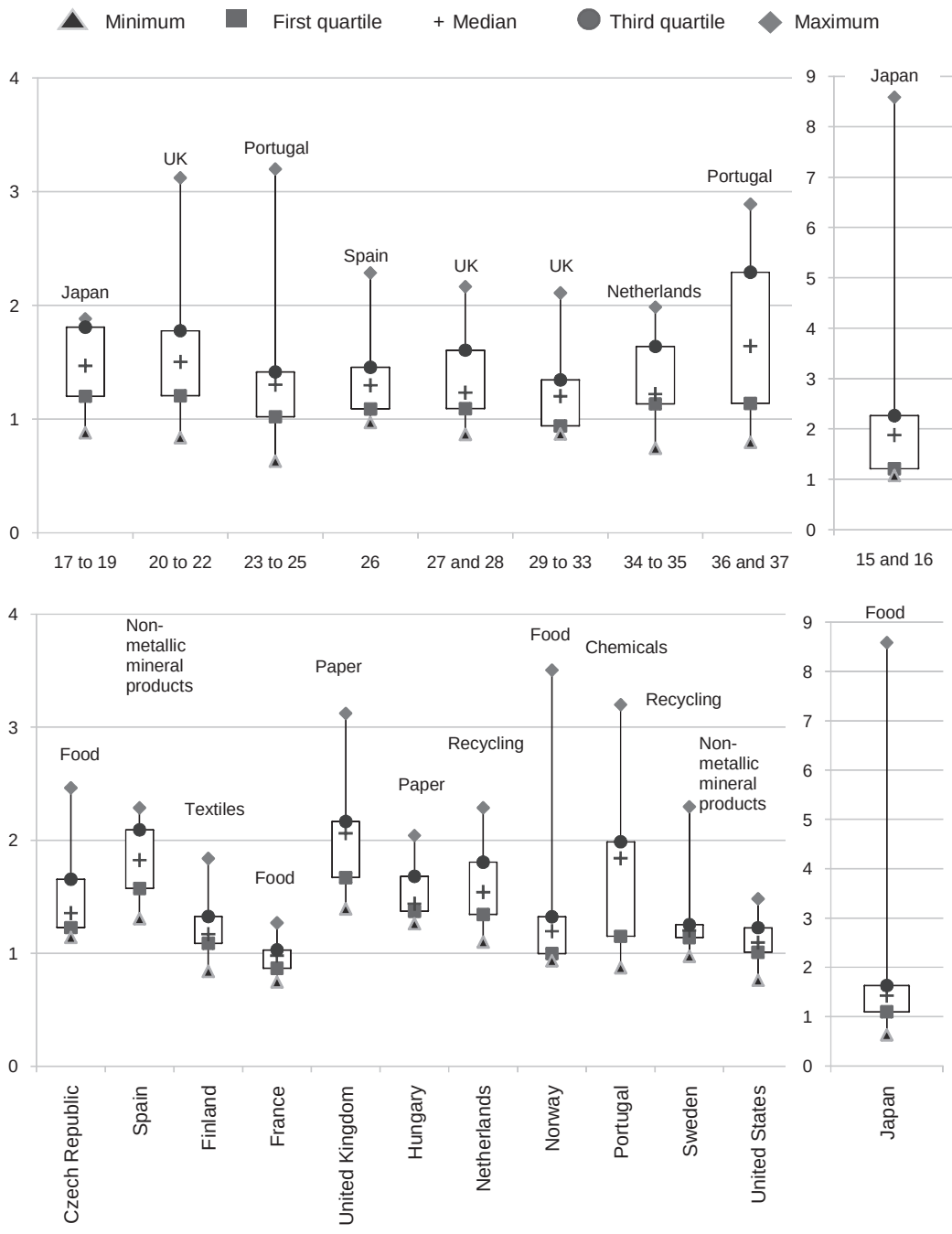
The lower panel of Figure 6.5 compares the distribution of the LP differential between foreign affiliates and domestic firms across sectors within countries. Countries where the foreign LP advantage is smallest (France, Finland, Sweden and the United States) are also countries where the spread of the distribution of the LP advantage is smallest. This might again be due to tougher competition in these countries, but also to the fact that these countries are at the technology frontier (see for example Caselli and Coleman, 2005) in most sectors and therefore the gap with foreign affiliates is very small across all sectors.

Table 6.A2.6 in Annex 6.A.2 shows similar figures for the services sector. The table shows that the strong labour productivity performance of domestic firms relative to foreign affiliates in Finland, France and the United States is mainly driven by the transport, storage and communication and the real estate, renting and business activity sectors. The communication and business activity sectors are considered knowledge-intensive high technology sectors. The retail and wholesale; and the hotel and restaurant sectors are considered less knowledge-intensive. In these sectors, with the exception of France, Italy and the United States in the hotel and restaurants sector, foreign affiliates' labour productivity is always higher than that of domestic firms.

The results from both the manufacturing and services sectors seem to suggest that in sectors with high knowledge intensity the labour productivity differential between foreign and domestic firms is smallest. Secondly, in countries that are at the technology frontier, such as Finland, France and the United States, not only is the labour productivity advantage of foreign affiliates very small and in some cases negative, but also the within country heterogeneity of the LP differential is smallest. A possible explanation for these results could be differences in the level of competition and regulation across sectors, with high technology sectors being more open to global competitors, and across countries, where differences in the level of regulations and barriers to entry persist.

Figure 6.5. Relative labour productivity of foreign affiliates in the manufacturing sector, 2001

(Relative to domestic firms = 1) by sector and country



Note: Figures reported are for 2001. Except for the Czech Republic (2002); Japan (2000); Hungary and the United Kingdom (1999) and Portugal (1998). Sectors 23 to 25 exclude sector 23 for the Czech Republic, Finland and Spain. Data for Spain do not include sectors 29 to 33. In both panels the country and sector with the maximum values are reported.

Source: OECD AFA database.

Finally, it is important to note that this section has compared the labour productivity of foreign affiliates to that of all domestic firms. However, one might question whether all domestic firms in the host country constitute the sole reference group for comparison. The group most directly comparable with affiliates of foreign MNEs is likely to consist of the affiliates of domestic MNEs. Firms that are part of domestic MNEs are similar in size; enjoy economies of scale and the benefits of being part of global groups to the same level as foreign affiliates. When such comparisons have been made at the micro level (*e.g.* Doms and Jensen, 1998 for the United States and Criscuolo and Martin, 2004 for the United Kingdom) the results show that in general the nationality of the owner does not affect the productivity outcome. The exception seems to be the United States; in both studies affiliates of American MNEs are consistently the most productive. However, data on domestic MNEs are currently only available for very few countries and contain only information on the domestic activity of the consolidated group rather than at the enterprise level, thus hampering the comparison between foreign controlled affiliates and affiliates of domestic multinationals.

Measuring the contribution of foreign affiliates to labour productivity growth

The study has already shown that foreign affiliates are on average more labour productive than domestic firms, but is their labour productivity also growing more quickly than that of domestic firms? What is their contribution to the (labour productivity) growth of the host economy?

Methodology

Total annualised labour productivity growth is defined as the weighted sum of the domestic firms' and foreign affiliates' labour productivity growth, where the weights used are the shares of domestic firms' and foreign affiliates' total employment, as shown in the formula below:

$$\frac{1}{k} * \frac{\Delta LP_t}{LP_{t-k}} = \sum_{i=DOM,FOR} \frac{w_{it} LP_{i\,t} - w_{it-k} LP_{i\,t-k}}{LP_{t-k}} * \frac{1}{k}$$

where LP is labour productivity calculated as the ratio of output at constant prices to labour input (EMP), Δ indicates change; k indicates the number of years between observations, so that the left hand side is the aggregate annualised labour productivity growth and $w_{it} = \frac{EMP_{it}}{EMP_t}$, is the employment share.

For each sector the contribution to labour productivity growth of foreign affiliates can be calculated as: $1/k * \left(\left(\frac{EMP_{FOR,t}}{EMP_t} * LP_{FOR,t} - \frac{EMP_{FOR,t-k}}{EMP_{t-k}} * LP_{FOR,t-k} \right) \Big/ LP_{t-k} \right)$. This contribution is calculated for the aggregate manufacturing and services sectors, but also at a more detailed sectoral level.

The paper also shows how much of the contribution to labour productivity growth by foreign affiliates derives from the increase in the labour resources employed by foreign affiliates, (the "between effect") and how much is due to the labour productivity growth within the group of foreign affiliates (the "within effect").

$$\frac{1}{k}*\left(\left(\frac{EMP_{FOR,t}}{EMP_t}*LP_{FOR,t}-\frac{EMP_{FOR,t-k}}{EMP_{t-k}}*LP_{FOR,t-k}\right)\Big/LP_{t-k}\right)=\underbrace{\frac{1}{k}*\frac{\Delta LP_{FOR,t}}{LP_{t-k}}*\overline{w}_{FOR}}_{within}+\underbrace{\Delta w_{FOR,t}*\frac{1}{k}*\frac{\overline{LP}_{FOR}}{LP_{t-k}}}_{between}$$

The first term on the right hand side is the "within" or "productivity growth" effect and the second is the "between" or "compositional" effect term. Thus, for example, the contribution of foreign affiliates to labour productivity growth might be larger than the domestic firms' contribution if their increase in their labour productivity growth and/or in their employment share is larger; and/or if their average employment share and/or their labour productivity level is higher relative to those of domestic firms.[53] The next section reports the results for the manufacturing and services sector. Criscuolo (2005) reports results of a more detailed industry level analysis.

The results of this growth accounting decomposition reported below, describe the absolute "contribution" to labour productivity growth of foreign affiliates rather than their contribution "relative" to domestic firms.

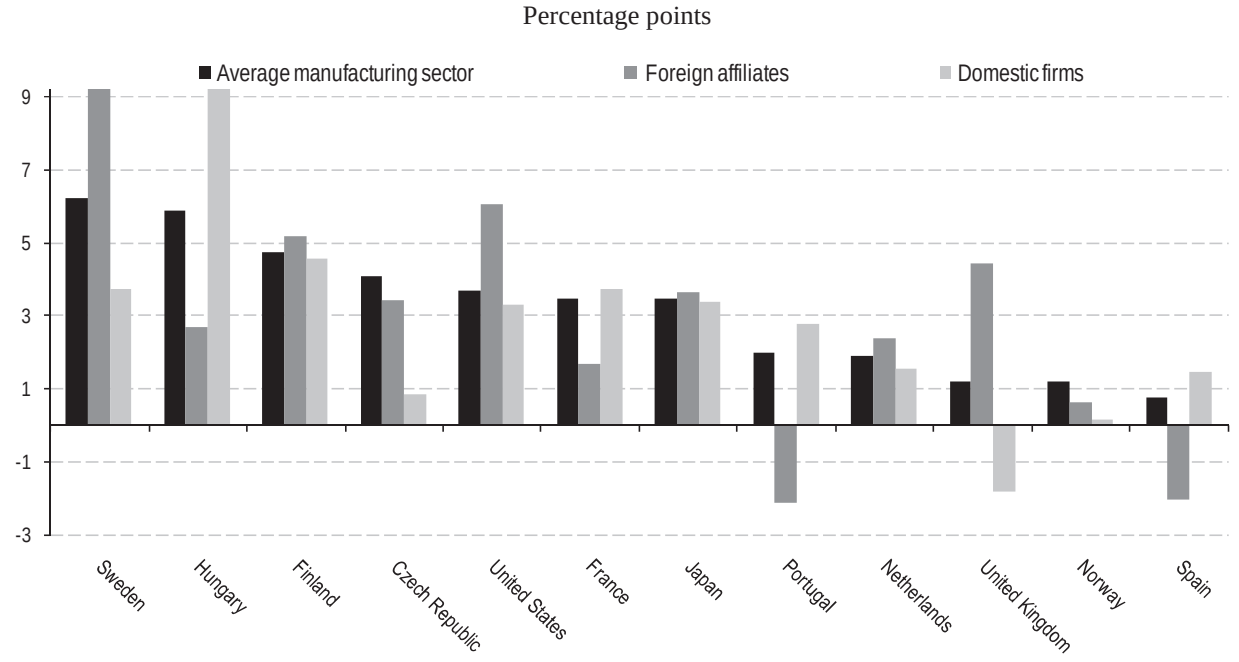
Therefore, the reader should be cautious in interpreting positive contributions of foreign affiliates as showing that foreign affiliates contribute to labour productivity growth more than domestic firms. According to the definition used, if both the labour productivity level and growth of foreign affiliates and domestic firms were exactly the same, and foreign affiliates represented an unchanging positive share of employment then their contribution to productivity growth would also be positive and would derive completely from the "within effect". The positive "within effect" and the positive contribution do not capture the fact that for the host economy's labour productivity growth the presence of foreign affiliates in the economy would not matter, since they are equally productive and grow at the same rate.[54] The paper, therefore, also reports the components of the "within effect" term, *i.e.* the labour productivity growth and the average foreign employment share. Similarly, according to the decomposition formula, if over the period considered the presence of foreign affiliates increases and foreign affiliates' average LP is positive, the "between effect" component for foreign affiliates will be positive. If the average labour productivity of foreign affiliates over the period is positive but lower than that of domestic firms the decomposition will not capture the fact that labour productivity in the host country might have been higher if the presence of foreign affiliates had decreased over the period (and the share of domestic firms increased).[55]

53. The contribution can be negative if either or both "within" and "between" terms are negative, or if either of the components of the right hand side terms is negative and larger in absolute value than the positive components. The first term on the right hand side can be negative if productivity growth is negative; the second term can be negative if there is a negative change in the employment shares of foreign affiliates or if foreign affiliates have, on average, negative labour productivity levels during the period. A similar expression can be derived for domestic firms.

54. This argument holds only if one assumes that domestic firms could employ the share of employees that are working in foreign affiliates. If this were not the case, the sheer presence of foreign affiliates in the economy would represent an absolute and relative contribution to the labour productivity growth of the host economy.

55. Criscuolo (2005) discusses these issues in more detail.

Figure 6.6. Average annual labour productivity growth in the manufacturing sector, 1995-2001[1]

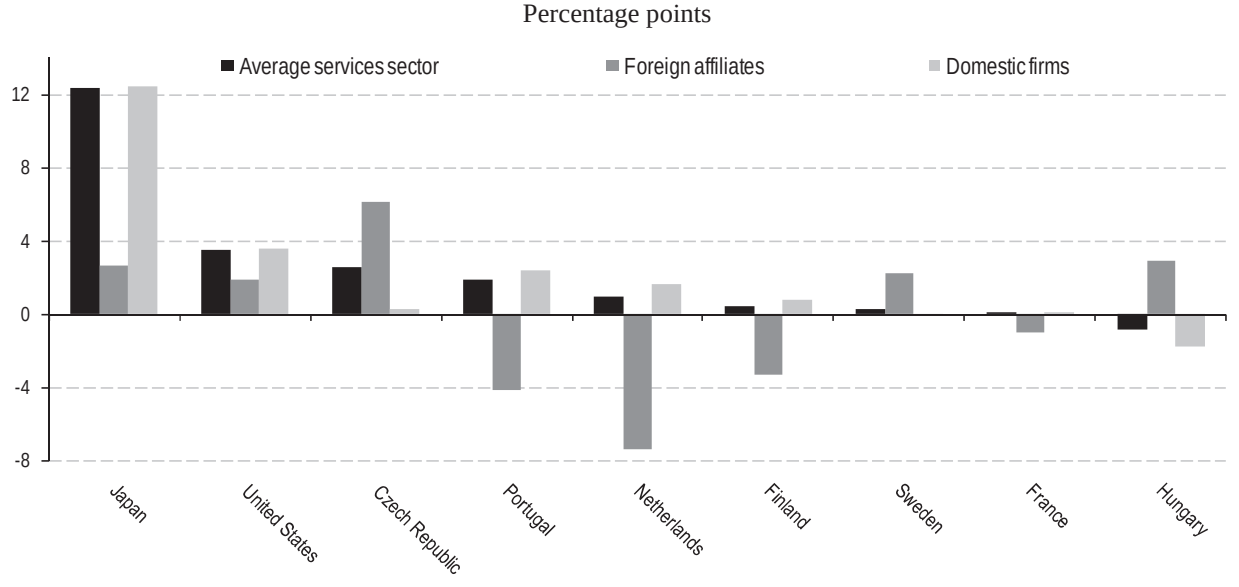


1. Or nearest available years: Czech Republic 1996-2002; United Kingdom 1995-1999; Finland 1995-2002; Hungary 1996-2002; Spain 1999-2001 and Portugal 1996-2002.

Note: Labour productivity is measured as value added in constant prices over employment.

Source: OECD AFA database.

Figure 6.7. Average annual labour productivity growth in the services sector, 1995-2001



Note: Japan: data for sectors 60 to 64 and 70 to 74 are only available in 1997 and 2000. Data for sectors 65 to 67 are not available in any year. United States: data for sector 55 are only available from 1992; data for 60 to 64 are missing in 1999; data for sectors 70 to 74 are available from 1992 and missing in 1999. Czech Republic: data for sectors 65 to 67 are missing in 1999. Finland: data for sector 55 are missing in 1995. Hungary: data for 65 to 67 are missing in 2000, 2001 and 2002.

Source: OECD FATS database.

Labour productivity growth and the contribution of foreign affiliates to labour productivity growth

Figures 6.6 and 6.7 describe annualised labour productivity growth over the period 1995-2001 for the total sector, foreign affiliates and domestic firms in the manufacturing and services sectors respectively. The figures show a (sizeable) variation across countries and across domestic and foreign firms. Figure 6.6 shows that in the manufacturing sector of eight out of the twelve OECD countries considered, foreign affiliates have higher labour productivity growth than domestic firms. However, this is not the case in France, Hungary, Spain and Portugal where foreign affiliates have experienced lower labour productivity growth than domestic firms.[56]

Figure 6.7 illustrates labour productivity growth for the services sector as a whole (ISIC Rev 3. 50 to 74), foreign affiliates and domestic firms for nine OECD countries. The picture here differs from the manufacturing sector: except for the Czech Republic, Sweden and Hungary foreign firms have experienced less rapid labour productivity growth than domestic firms. In four countries (Portugal; Finland; France and the Netherlands), they have experienced negative labour productivity growth.

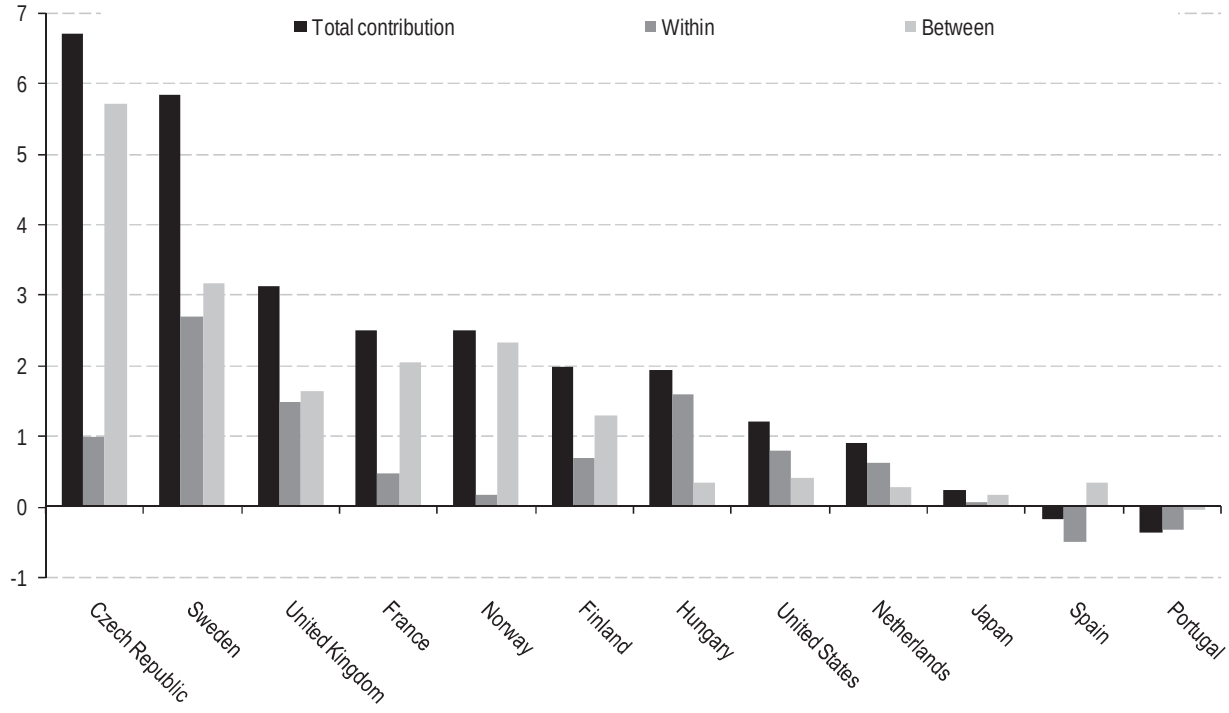
Figures 6.8 and 6.9 show the contribution of foreign affiliates and the breakdown in "within" and "between" effects in the manufacturing and services sectors respectively. Reading this figure together with Figure 6.6 and Figure 6.1 helps interpret the source of the sign and magnitude of the within and between components. For example, the contribution of foreign affiliates to the LP growth of the Spanish and Portuguese manufacturing sectors is negative, where, as shown by Figure 6.6, the labour productivity growth of foreign affiliates is negative and, in line with this result, the "within" effect is also negative. The contribution is very small and positive in Japan (where it only accounts for 5% of aggregate labour productivity growth), this is in line with the small share of employment of foreign affiliates shown in Figure 6.1. The "between effect" accounts for two thirds of this contribution, in line with the large increase in the share of foreign employment over the period.

The results show that the contribution of foreign affiliates accounts for about 32% of total labour productivity growth of the US manufacturing sector. Across European countries, there is wide variation in the contribution of foreign affiliates to labour productivity growth, ranging from Hungary (33%); Finland (42%), France (72%), Netherlands (47%) to Sweden (94%). In few cases [the Czech Republic (164%), the United Kingdom (158%) and Norway (251%)], the contribution of foreign affiliates is larger than total national labour productivity growth. This result, which seems counter-intuitive, can be driven by a sharp increase in the presence of foreign affiliates with a higher LP (*e.g.* for the Czech Republic and Norway) or by negative labour productivity growth of domestic firms over the period analysed (as in the case of the United Kingdom). Only in few countries is the contribution of foreign affiliates driven by the "within" effect (Hungary, the United States and the Netherlands; and in the negative contributions in Spain and Portugal). In all other cases, as shown in Figure 6.8, the "between" effect is the main component of the contribution of foreign affiliates.

56. The sectoral analysis in Criscuolo (2005) shows that these results are associated with great heterogeneity across sectors in the same country. Contrary to the analysis of the labour productivity level, however, these figures do not suggest the presence of any particular pattern across countries and/or sectors. The only clear trend is that in the United States, foreign affiliates in the services sector have had lower labour productivity growth than domestic firms in all but the retail and wholesale sector.

The sectoral level analysis (Criscuolo, 2005) shows that the relevance of the within and the between effects in the contributions of foreign affiliates seems to be related to the technology intensity of the sector considered. In the medium-high and high-tech sectors, such as machinery and equipment and chemical, rubber, plastics and fuel products, the "within" effect is as important as and in some cases more sizeable than the "between" effect. This result seems in line with previous evidence that foreign affiliates have higher labour productivity growth than domestic firms in high-tech sectors. Also, the results for the United States are in agreement with the evidence in Corrado, Lengermann and Slifman (2004).

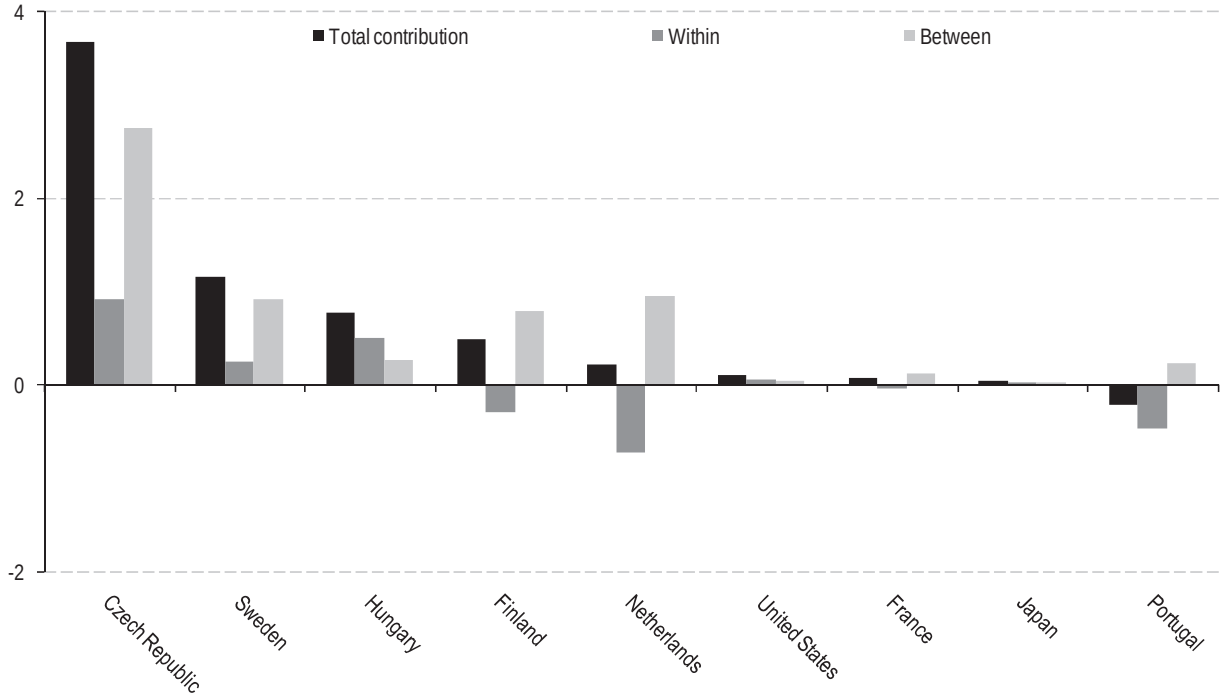
Figure 6.8. Contribution of foreign affiliates to average annual labour productivity growth and breakdown in "within" and "between effect" in the manufacturing sector, 1995-2001, percentage points



Source: OECD AFA database.

Figure 6.9 presents the contribution of foreign affiliates and its breakdown for the services sector: except for the United States, Hungary and Portugal, the "between effect" accounts for most of the contribution of foreign affiliates to labour productivity growth. For Finland, the Netherlands, France and Portugal the "within effect" represents a negative component of the contribution, in line with the negative labour productivity growth of foreign affiliates shown in Figure 6.7.

Figure 6.9. Contribution of foreign affiliates to average annual labour productivity growth and break down in "within" and "between effect" in the services sector, 1995-2001, percentage points



Source: OECD FATS database.

Conclusions

This paper represents a first attempt to investigate the contribution of foreign affiliates to labour productivity growth in OECD countries using a growth accounting approach.

The study describes the general trend of increased presence of foreign affiliates in OECD countries over the nineties, with all of the countries presented in the study, except for Germany, showing an increase in the aggregate presence of foreign affiliates. The study also highlights differences in the presence of foreign affiliates across countries: Japan has the smallest presence of foreign affiliates in both the manufacturing and services sectors, while Sweden, Belgium and two Central European countries analysed -- the Czech Republic and Hungary -- have in both the manufacturing and services sectors the largest presence of foreign affiliates.

Secondly, the study analyses the labour productivity differential between foreign affiliates and domestic firms. The results show that the difference in labour productivity between foreign and domestic firms persists after controlling for differences in industrial distribution of foreign and domestic firms. The results show that in all manufacturing industries foreign affiliates are on average more labour productive than domestic firms and that this advantage is smallest and its distribution less spread in countries at the technology frontier (Finland, France and the United States) and in medium-high and high technology sectors. In the services sector, Finnish, French, and American domestic firms are on average more labour productive than foreign affiliates. The sectoral analysis for

services confirms a negative correlation between the level of knowledge intensity of the sector and the magnitude of the labour productivity gap between foreign and domestic firms. These results might suggest that the tougher competition in high technology sectors and in countries at the technology frontier push the average domestic firm to be at least as efficient as its foreign competitors.

The study confirms that foreign affiliates can make an important absolute contribution to labour productivity growth. In the manufacturing sector, the average contribution of foreign affiliates to annual labour productivity growth ranges from 6.7% in the Czech Republic to -0.1% in Portugal. For three countries, the Czech Republic, the United Kingdom and Norway, the contribution of foreign affiliates is larger than labour productivity growth in the total manufacturing sector. This is due to sharp growth in the foreign affiliates' share of employment in the Czech Republic and Norway and to negative labour productivity growth of domestic firms in the United Kingdom. Across countries, the contribution of foreign affiliates is determined mainly by the "between" effect, *i.e.* the growth in the share of foreign affiliates' employment. However in the United States, the within effect is the most important component of the contribution to LP of foreign affiliates both in the manufacturing and services sectors. Sectoral level evidence suggests that despite great heterogeneity across sectors and countries in the medium-high and high technology manufacturing sectors the contribution reflects mainly "within" effects.

In the services sector, the contribution of foreign affiliates to productivity growth is much smaller than in the manufacturing sector ranging from 3.7% in the Czech Republic to -0.2% in Portugal. As in the manufacturing sector, the "between effect", with the exception of Hungary and the United States, accounts for most of the contribution of foreign affiliates to labour productivity growth in the services sector.

In line with previous evidence, the results for the United States show that the significant contribution to US labour productivity growth of foreign affiliates derives mainly from the higher labour productivity growth of foreign affiliates, especially in high technology sectors.

The work conducted in this study is intended as a first attempt to analyse the contribution to labour productivity of foreign affiliates using information from AFA, FATS and STAN and can be extended along several dimensions. The empirical analysis has highlighted some limitations in the data and future efforts should be directed towards improving the data. The analysis focused on labour productivity growth rather than multi-factor productivity; the main reason being that measures of capital stock are only available for a few countries in STAN and not available at all in AFA/FATS. Efforts aimed at constructing a measure of capital stock would make it possible to calculate multifactor productivity (MFP) growth. This would allow investigating the sources of the productivity advantage of foreign affiliates, such as higher technical efficiency and greater use of information and communications technology (ICT). Finally, an interesting policy question is the differences in the presence of foreign affiliates in and the contribution to OECD economies. Current research in the OECD Economics Department is studying the impact of institutions and regulation on the presence of foreign affiliates in the OECD.

ANNEX 6.A1. DETAILS OF THE DATABASES USED

STAN: Measures of output and labour inputs

In STAN, gross output is defined as the value of goods and/or services produced in a year whether sold or stocked.

The definition of value added in STAN is at the valuation most commonly presented in national publications; however this definition differs across countries. Indeed, value added is not measured directly, but calculated as the difference between production and intermediate inputs, or as the sum of labour costs, consumption of fixed capital, taxes less subsidies and net operating surplus and mixed income. Table 6.A1.1 (from Webb, 2005) describes the different definitions.

Table 6.A1.1. Valuation of value added[1]

	Value added at **factor costs**
+	*Other* taxes, less subsidies, *on production*[2]
=	Value added at **basic prices**
+	Taxes less subsidies, *on products*[3] *(not including imports and VAT)*
=	Value added at **producer's prices**
+	Taxes, less subsidies, *on imports*
+	Trade and transport costs
+	Non-deductible VAT
=	Value added at **market prices**[4]

1. This table draws on concepts outlined in both the 1968 and 1993 version of a *System of National Accounts* (SNA68 and SNA93). Until the late 1990s, most countries adhered to recommendations in SNA68 (where the notions of factor costs, producer's prices and market prices were predominant). However, many OECD Member countries have now implemented SNA93 (or the EU equivalent, ESA95) which recommends the use of basic prices and producer's prices (as well as purchaser's prices for Input-Output tables).

2. These consist mostly of current taxes (and subsidies) on the labour or capital employed, such as payroll taxes or current taxes on vehicles and buildings.

3. These consist of taxes (and subsidies) payable per unit of some good or service produced, such as turnover taxes and excise duties.

4. Market prices are those which purchasers pay for the goods and services they acquire or use, excluding deductible VAT. The term is usually used in the context of aggregates such as GDP, whereas purchaser prices refer to the individual transactions.

Source: Webb, 2005.

Table 6.A1.2 describes the difference in definitions across countries used in the current analysis; as the table shows, most countries present value added at basic prices, in line with SNA93 (or in Europe, ESA95) recommendations. Japan and the United States use valuations at producer's prices.

Table 6.A1.2. Differences in valuation of value added across countries[1]

Definition	Countries
Value added at **basic prices**	Austria; Belgium; Czech Republic; Germany; Finland; France; Hungary; Italy; Netherlands; Norway; Poland; Portugal; Spain; Sweden
Value added at **producer's prices**	Japan; United States

Source: OECD, STAN country notes, 2005.

STAN includes information on total employment and on the number of employees. The preferred measure of labour input in this study is employment. For many countries the measure of employment provided is headcounts, *i.e.* the actual number engaged full- and part-time. However, some countries such as Austria, Japan and the United Kingdom provide the number of jobs, as recommended in SNA93, so that those with more than one job are counted more than once. For measuring productivity, a measure of hours worked or comparable measures of full-time equivalent employment would be preferable.[57] However, hours worked by detailed activity are only available for some countries. Moreover, there are still concerns related to the measurement of hours actually worked and their degree of international comparability (see Chapter 4 of the OECD Manual *Measuring Productivity*), consequently this study prefers the headcounts measure.

AFA and FATS

The definition of a "foreign affiliate" in both AFA and FATS is based on the concept of controlling interest. As outlined in Chapter 3 of the OECD *Handbook on Economic Globalisation Indicators* data covering the operations of affiliates and parent companies should be compiled, if possible, "for affiliates in which the direct investor has an unambiguous control and should be attributed to the country of the investor of ultimate control".

The criterion recommended for a firm to be classified as under unambiguous control of a foreign owner is that a single foreign investor (or a group of foreign investors acting in concert) holds the majority (more than 50% of the capital) of ordinary shares or voting power. Some countries, however, define foreign-controlled affiliates as those firms where a foreign owner holds more than 10% of the capital, based on the assumption that foreign owners can still influence management decisions. As outlined in Tables 6.A1.3 and 6.A1.4 this is the case for Hungary and the United States in both AFA and FATS.

57. A related issue concerns also the composition of labour, which is much more difficult to compare across countries. While some efforts have been made, the statistical basis remains rather limited. The OECD has, therefore, not yet estimated levels of labour input adjusted for its composition in the context of its work on international comparisons of productivity levels, see www.oecd.org/statistics/productivity

To identify the "investor of ultimate control", *i.e.* the parent firm at the end of a chain of domestic and/or foreign directly and indirectly controlled companies, it is necessary to have information not only on the foreign firms that directly control the firm but also on the indirect owners of the firm. However, this information is not available for all countries. As shown in Tables 6.A1.3 and 6.A1.4, some countries include indirectly foreign-owned establishments, *i.e.* owned by foreigners through foreign majority-owned resident enterprises.

Table 6.A1.3. Definition of foreign-owned companies in AFA

		Ownership	
		Majority (>50%)	**Minority (>10%)**
Control	**Direct**	Czech Republic; Finland (until 1995); Germany (until 2001); Ireland; Japan; Netherlands; Poland; Canada; Norway (until 1995); Turkey	Hungary (>10%)
	Indirect	Finland (from 1996); Norway (from 1996); France; Germany (from 2001);Italy; United States (from 1997); Luxembourg	United States (until 1997)

Table 6.A1.4. Definition of foreign-owned companies in FATS

		Ownership	
		Majority (>50%)	**Minority (>10%)**
Control	**Direct**	Austria; Belgium; Poland; France; Japan; Luxembourg; Germany (until 2001);Portugal; Greece; Netherlands	Hungary (>10%)
	Indirect	Finland; Sweden; Ireland; Italy; Norway; Germany (from 2002); United States from 1997 partially indirect)	United States until 1996 (partially indirect)

The definition of foreign owned firms within countries has sometimes changed over time. For example, in Germany the data available up to 2001 comprise enterprises directly owned by foreigners, but after 2001 the figures provided also include enterprises indirectly owned by foreigners through foreign majority-owned resident enterprises. In Norway and Finland, data from 1995 include indirectly foreign-owned establishments and are not comparable with those for previous years, which only include enterprises directly owned by foreigners. In the services sector data for the United States the definition of foreign affiliates include until 1996 all firms where foreigners had an interest of at least 10%; after 1996 the definition of foreign ownership only covers majority owned foreign affiliates.

Thirdly, statistics on foreign presence in some sectors are only available for more recent years (*e.g.* for France, data for the food and beverages and energy sectors were added in 1999) or are missing in the database for some years due to confidentiality issues.

Fourthly, the coverage of the sources used has sometimes changed over time (*e.g.* in the Czech Republic the Business Register used as a source by the Czech Statistical Office covered units employing at least 20 employees in 1997 and 1998; and all units from 1999; in Norway the data sources used by Statistics Norway covered all establishments with five or more persons up to 1991; those employing more than ten persons for the period

1992-95 and all manufacturing establishments from 1996; in Sweden the coverage of the data on foreign affiliates has improved over time.[58])

Finally, there are differences in the sources of information on the presence of foreign affiliates both within countries over time and across countries (*e.g.* for Italy the sources of information on the services sectors have changed over time. Information for 1997 comes from the Reprint database developed at the Department of Management, Economics and Industrial Engineering of the "Politecnico di Milano" with the support of the Italian National Council for Economy and Labour (CNEL). Information for 2001 comes from ISTAT.) Some countries use business register information; others use specific surveys. In the latter case a related issue relates to sampling frames: *e.g.* if the stratification by size excludes smaller firms below different thresholds. Since foreign affiliates are likely to be larger firms, this issue might be less of a concern as regards differences between both register data and surveys and across surveys with different sampling stratification.

Deflators

AFA/FATS only contain value added and turnover in nominal values, but STAN contains measures of output at current and constant prices, so that deflators can be derived. When comparing labour productivity growth of foreign owned and domestic firms at the aggregate manufacturing and/or services sector level, the same deflators calculated from STAN are used for both groups. However, the industry distribution of foreign affiliates likely differs from the national average. For example, foreign affiliates might be mainly concentrated in high-tech sectors characterised by low inflation, while domestic firms might be more evenly distributed across sectors, including sectors with higher inflation. Applying the same deflators to foreign affiliates and domestic firms assumes that foreign and domestic firms have the same industry distribution. For the countries for which the complete sectoral distribution of foreign affiliates across different industries is available, separate deflators for foreign affiliates can be derived, so that it is possible to construct a deflator which accounts for the sectoral distribution of foreign affiliates.[59]

58. These improvements, however, only partly explain the increase in measured foreign presence between 1991 and 1995, which reflects sharp changes in the paper, printing and publishing, pharmaceutical and motor vehicles industries. In the 1990s, some major mergers with and acquisitions of foreign firms took place in Sweden: for example, General Motor's 50% ownership of Saab Automobile (1990); the merger between Asea and Swiss Brown Boveri (1988) (ABB); the merger between Pharmacia and Upjohn (1996); Tetra Pak's acquisition of Alfa Laval (1991) and Dutch Akzo's acquisition of Nobel Industries (1994). In 1999, a year that corresponds to a big increase in foreign presence in the data, Ford acquired the automobile operations of Volvo.

59. The first step derives weights that reflect the presence of foreign affiliates in each sector relative to the total manufacturing level, calculated as the share of foreign value added in the sector relative to foreign value added in total manufacturing, and uses these weights to aggregate sectoral-level deflators to the whole manufacturing level. This is possible for only some countries and for few years. The formula of the new deflators will differ across countries according to whether the deflators are fixed weight or annually re-weighted chained Laspeyres. The limitations of this approach are related to the fact that sudden and/or spurious changes in the presence of foreign affiliates within a particular sector of the economy might affect the deflators for that particular sector, for reasons unrelated to inflation.

ANNEX 6.A2. RESULTS AT THE SECTORAL LEVEL

Table 6.A2.1. Relative LP of foreign affiliates in the manufacturing sectors in 2001 or latest available year

(LP of domestic firms = 1)

	Czech Republic	Spain	Finland	France	United Kingdom	Hungary	Japan	Netherlands	Norway	Portugal	Sweden	United States
Sectors **15 and 16**: Food Products, Beverages and Tobacco	2.46	2.06	1.15	1.27	2.06	1.68	8.59	1.81	3.50	1.95	1.07	1.10
Sectors **17 to 19**: Textiles, Textile Products, Leather and Footwear	1.14	1.81	1.84	0.98	1.81	1.47	1.88	1.54	1.32	0.88	1.46	1.26
Sectors **20 to 22**: Wood and Products of Wood and Cork; Pulp, Paper, Paper Products, Printing and Publishing	1.50	1.76	0.84	1.22	3.12	2.04	1.41	1.80	1.52	1.75	1.14	1.20
Sectors **23 to 25**: Chemical, Rubber, Plastics and Fuel Products	1.36	1.39	1.36	1.01	1.67	1.44	0.63	1.13	0.97	3.20	1.25	1.03
Sector **26**: Other non-metallic mineral products	1.79	2.29	1.32	1.03	1.39	1.28	1.43	1.10	1.08	1.15	0.97	1.48
Sectors **27 and 28**: Basic metals and fabricated mineral products	1.24	2.13	1.09	0.87	2.17	1.37	1.10	1.36	1.00	1.84	1.16	1.22
Sectors **29 to 33**: Machinery and equipment	1.22		0.94	0.97	2.11	1.26	1.47	1.34	1.19	0.87	1.20	0.93
Sectors **34 and 35**: Transport Equipment	1.23	1.30	1.17	0.74	1.53	1.75	1.10	1.99	1.20	1.99	1.22	0.76
Sectors **36 and 37**: Manufacturing NEC; Recycling	1.65	1.84	1.27	0.80	2.85	1.38	1.63	2.29	0.93	2.89	2.30	1.01

Note: Figures reported are for 2001, except for the Czech Republic (2002), Japan (2000); Hungary and the United Kingdom (1999) and Portugal (1998). Sectors 23 to 25 exclude sector 23 for the Czech Republic, Finland and Spain. Data for Spain do not include sectors 29 to 33.

Source: STAN and AFA databases, OECD.

Table 6.A2.2. Relative LP of foreign affiliates in the services sectors in 2001 or latest available year

(LP of domestic firms = 1)

	Czech Republic	Finland	France	Hungary	Italy	Japan	Netherlands	Portugal	Sweden	United States
Sectors **50 to 52**: Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	2.13	1.83	1.94	2.38	1.86	n/a	2.04	3.33	2.09	1.87
Sector **55**: Hotels and restaurants	1.40	1.16	0.77	2.05	0.85	n/a	1.34	1.34	1.29	0.69
Sectors **60 to 64**: Transport, storage and communications	1.65	0.53	0.73	4.26	1.79	1.62	0.63	2.66	0.92	0.23
Sectors **65 to 67**: Financial intermediation	2.14	n/a	1.51	2.71	n/a	n/a	n/a	1.29	n/a	0.46
Sectors **70 to 74**: Real estate, renting and business activities	1.30	0.47	0.43	0.87	0.48	0.35	0.57	0.73	0.56	0.44

Note: Figures are for 2001, except for the Czech Republic, Hungary and Portugal (2002) and Japan and Sweden (2000). The figures for sectors 65 to 67 in Hungary refer to 1998.

Source: STAN and AFA databases, OECD.

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Chapter 7

OFFSHORING AND PRODUCTIVITY: THE CASE OF IRELAND, SWEDEN AND THE UNITED KINGDOM

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This paper analyses the relationship between offshoring of services and total factor productivity across three different OECD countries: Ireland, Sweden and the United Kingdom. Offshoring activity is widely believed to play an important role for firm productivity due to the fragmentation of the production process across countries when there are differences in the relative endowments of skilled and unskilled labour and of technology. The paper firstly shows that offshoring firms tend to be more labour productive, are larger, pay higher wages and are more likely to be multinational and foreign-owned. Secondly, there appears to be some suggestive evidence of a positive relationship between offshoring and firm productivity although the statistical and/or economic significance of this relationship is not very strong across the three countries. One possible explanation is the small time horizon over which our analysis span.

This chapter is a revised version of a paper presented at the Statistical Working Party of the OECD Industry Committee at its November 2006 meeting.

Introduction

In recent years, thanks to trade liberalisation and progress in information and communication technology (ICT), an increasing number of firms are trading a wide variety of services with both developed and emerging economies. Before the ICT revolution most services (call-centres, IT consultancy, accounting services, etc.) were non–tradable. This makes services trade, in particular the importing or "offshoring" of services (from low wage countries), a relatively new phenomenon, whose consequences are the subject of much debate among policy makers and the public opinion.

Attention has focused on the possibility that offshoring of services might lead to the migration of jobs to countries, such as India, where firms can pay qualified workers much less than in their home countries. In general, the discussion has concentrated on the negative effects of offshoring. However, offshoring is likely to bring benefits to developed economies through lower costs of services, restructuring and increased specialisation. Moreover, the largest exporters of services in absolute terms remain developed countries, such as the United States and United Kingdom. An increase in services trade implies for these countries not only an increase in imports but also a potential increase in exports and therefore a larger market where domestic firms can offer their services. This may also yield gains to firms in developed economies.

This paper aims to describe these trends and compare the experience of three OECD countries that are quite different in terms of industrial structures and labour market regulations -- Ireland, Sweden and the UK -- using previously unavailable detailed official data.

Most of the existing evidence reports the experience of single countries as it cannot compare responses across different countries because of confidentiality constraints associated with the use of official firm-level data. Given these constraints our approach is to conduct a similar type of analysis over the same time frame across the three countries using similar detailed micro-level data so that the results are as comparable as possible and differences are not driven by methodology or the time frame considered.

In each of the three countries analysed, Ireland, Sweden and the UK, the available data gives information on firm performance, domestically and internationally outsourced services and foreign ownership. With these datasets we document a series of facts about offshoring and related measures (characteristics of firms that offshore; amount of trade; differences in patterns between manufacturing and services sectors; association of services offshoring with productivity).

The paper is organised as follows. In the next section we give a brief overview of the data in the three countries and we describe broad patterns related to offshoring in the data. In Section 3 we move on to describe the empirical approach used in the analysis; we then present the results of this analysis in Section 4. Section 5 concludes. In Annex 7.A we describe in more detail each of the data sources used.

Data description

We are using firm level data that cover manufacturing and services. The data comes from the Statistical offices in Sweden (Statistics Sweden); the UK (Office for National Statistics, ONS) and from Forfás, Ireland's national policy and advisory board for enterprise, trade, science, technology and innovation. Table 7.1 summarises the characteristics of the data used; such as the sampling frame and the variables available in each countries. The data covers the period 2000-2003 for the UK; 2000 to 2002 for Sweden and 1999 to 2002 for Ireland. To make the analysis comparable in all three countries we use data for the period 2000 to 2002. In all three countries the data contains information on output (gross output and value added); inputs; foreign ownership. Most importantly we have data on imports and exports of intermediate services (UK; Sweden and Ireland) and intermediate goods (Sweden and Ireland) at the firm level. The table also reports information on other variables available in the data such as skills and R&D in Sweden; or training expenditure in Ireland. A detailed description of the data sources can be found in the Annex 7.A.

Table 7.1. Description of data across countries

	Ireland	Sweden	United Kingdom
Source	Forfás	Statistics Sweden	Office for National Statistics
Sample	Census 60- 80% response rate of targeted plant population	Census of firms with at least 20 employees	Stratified sample: selects all the largest businesses (>249) with a reducing fraction of smaller businesses
Sectors covered	Manufacturing (and services)	Manufacturing and services	Manufacturing and services
Time period covered	1999- 2002	2000- 2002	2000-2003
Output variables	Gross output; value added; net value added and gross value added	Gross output and value added	Gross output and value added
Input variables	Materials and services	Materials and services*	Materials and services
Import of intermediate goods	Yes	Yes	No
Export of goods	Yes	Yes	No
Imports of intermediate services	Yes	Yes	Yes
Export of services	No	Yes	Yes
Other relevant variables	Wages; capital R&D; training	Wages; capital; R&D; skills	Wages; capital
Ownership variables	Domestic and foreign;	Domestic single firm; part of a group; domestic MNE; foreign owned	Domestic single firm; part of a group UK MNE; foreign owned

*The data for Sweden have time series break in 2002 that prevents the construction of a continuous time series.

Note: Data on total purchases of services are imputed from sector level data. For Ireland, coverage of service sector is very limited.

Descriptive evidence

The aim of this section is to present some initial evidence on how firms that do offshore differ from firms who don't. The question we want to answer is who the firms are that offshore in each of the countries analysed. Are these firms similar or do we observe stark differences across countries?

The first figures we are going to present look at the overall presence of offshoring firms in the three economies in a particular year (2000). As the UK is not a census but is a stratified sample, we present for this country both weighted[60] and unweighted figures. This has two aims: we want to make the UK sample representative of the population of UK businesses; and we present unweighted figures to look for differences in the samples analysed. Also we present the figures separately for manufacturing and services. This highlights that for Ireland data for services is very limited (*i.e.* only 172 firms).

Table 7.2. Offshoring intensity in each country, 2000

	Actual number of firms in the sample		Share offshorers (%)[a]		
Year 2000	Non-offshorers	Offshorers	Firms	Employment	Value added
			Manufacturing		
Ireland	361	721	67	84	68
Sweden	4096	1177	22	58	68
UK	8824	1874	17	29	33
UK weighted				22	27
			Services sector		
Ireland	62	110	64	79	66
Sweden	5332	1580	23	54	57
UK	24011	1725	7	19	20.5
UK weighted				13	15

Notes:

Numbers and shares reported refer to 2000 and only relate to outsourcing of international service intermediates.

For the UK, shares reported are weighted using probability weights.

As is evident from the statistics reported, Ireland is the country where offshoring is most widespread: more than half of the sample offshore international services. This might reflect the higher reliance of Ireland on foreign intermediate trade relative to Sweden and the UK, but also differences in the industrial structure and in the presence of foreign multinationals. About a fifth of Swedish firms offshore, while their activities in terms of value added is at least twice the size (even more than so for manufacturers), indicating that the group of offshorers consist of many large firms. We also note for Ireland that although service offshorers contribute proportionally more to employment, their contribution to value added is in line with that of their non-offshoring counterparts. We will investigate this below. To help compare values for the three countries, we report only the

60. To weight the figures presented we use inverse probability weights provided by the Office for National Statistics.

international outsourced service intermediates although data is also available for materials intermediates for Sweden and Ireland.

How much do differences in the presence of offshorers reflect differences in industrial composition across the three countries? Table 7.3 answers this question. We find that across all of the sectors analysed and independently of measure used (number of firms, share of value added or employment) Ireland has a much larger presence of offshorers and the UK a smaller one, with Sweden somewhere in between. This is especially so when we look at the weighted figures for the UK in which we account for the fact that large firms that are more likely to offshore are over-sampled in the ARD data.

Table 7.3. Distribution of offshoring firms by sector (2000)

	Ireland		Sweden		UK		Ireland	Sweden	UK	UK weighted
Sector	Non-OFF	OFF	Non-OFF	OFF	Non-OFF	OFF	Percentage offshorers			
15-16	65	115	240	66	967	128	64%	22	12%	6%
17-19	17	47	78	35	716	126	73%	31	15%	4%
20	11	20	260	69	265	19	65%	21	7%	1%
21-22	36	36	365	132	1230	184	50%	27	13%	4%
23-25	40	136	265	134	960	349	77%	34	27%	11%
26	14	16	65	28	350	93	53%	30	20.9%	21.3%
27-28	52	85	717	144	1509	240	62%	17	14%	4%
29-33	82	191	715	363	1765	516	70%	34	23%	8%
34-35	15	26	187	75	471	126	63%	29	21%	9%
36-37	29	49	192	33	591	93	63%	15	14%	5%
50-52	9	2	2372	463	11619	775	18%	16	6%	3%
55	0	1	557	48	2563	71	100%	8	3%	1%
60-63	n/a	n/a	721	207	1822	211	n/a	22	10%	5%
64	1	4	40	60	225	25	80%	60	10%	2%
70-74	51	97	1642	802	7782	643	66%	33	8%	3%

Note: Authors' calculation from ARD; Forfás and SBS data. The sectors considered are: 15-16 Food and beverages and tobacco; 17-19 Textile; Wearing apparel and Leather; 20 Wood and wood products; 21-22 Pulp, paper and paper products; Publishing, printing and reproduction of recorded media; 23-25 fuel Chemicals and chemical products; Rubber and plastic products; 26 Other non-metallic mineral products; 27-28 Basic and fabricated metals; 29-33 Machinery and equipment not elsewhere classified (nec); Office machinery and computers; Electrical machinery and apparatus nec; Radio, television and communication equipment and apparatus; Medical, precision and optical instruments, watches and clocks; 34-35 Motor vehicles, trailers and semi-trailers; Other transport equipment; 36-37 Furniture, manufacturing nec and Recycling. 50-52 wholesale and retail trade; repair of motor vehicle, motorcycles and personal and household goods; 55 Hotels and Restaurants; 60-63 transport and storage; 64 post and telecommunications; 70-74 real estate; renting and business activities.

We know from the existing literature that within industry heterogeneity exists. Table 7.3 looks at the characteristics of firms that offshore relative to those who do not. One issue that arises when conducting cross-country analysis is how to overcome the fact that these countries use different currencies. The way we have solved the issue here is to express all of the variables considered as log deviation from the average non-offshoring firm in the three-digit industry of firm *i* at time *t*. Therefore in the table we present for each country the following mean:

$$\Sigma_{i \in OFF}(\ln X_i - E(\ln X)^{NON\text{-}OFF})/N^{OFF}$$

For example, column 1, row 1 shows that in Ireland offshorers are on average 35% more labour productive than the average non-offshoring firm in the same industry; where we define labour productivity as value added per employee. In the UK and Sweden the difference in labour productivity is smaller at 21% for both countries.

Table 7.4. Characteristics of offshoring firms relative to non offshorers (year 2000)

	Advantage of offshorers vs. non-offshorers	Ireland	Sweden	UK
(1)	Value added per employee	0.35***	*0.21***	0.21***
		(0.89)	*(0.01)*	*(0.77)*
(2)	Gross output per employee	0.32***	*0.35***	0.35***
		(0.94)	*(0.01)*	*(0.78)* ***
(3)	Employment	0.73***	*0.74***	1.02***
		(1.21)	*(0.02)*	*(1.67)*
(4	Purchased materials per employee	0.24**	*0.48***	0.42***
		(1.36)	*(0.02)*	*(1.23)*
(5)	Purchased services per employee	0.24***		0.65***
		(1.05)		*(1.04)*
(6)	Capital per employee	0.30***	*0.25***	0.50***
		(1.29)	*(0.02)*	*(1.01)*
(7)	Average wages	0.14***	*0.51***	0.30***
		(0.49)	*(0.02)*	*(0.61)*
	Observations	1,259	*12,185*	36,434

Note: Figures reported are log deviation from the average non-offshoring firm and represent differences in means for services offshorers and non-services offshorers respectively. Standard deviations in brackets.

One clear pattern emerges from this table. In all three countries we observe that offshoring firms are more labour productive; larger; more intermediates- and capital-intensive and pay higher wages than the average non-offshoring firm.

From previous country level evidence we know that offshoring firms are mainly globally engaged firms and that this helped explain at least partly the observed differences between offshoring and non-offshoring firms. Is this the case in all three countries? Table 7.5 attempts to answer this question. We do find that in all three countries the proportion of foreign multinationals is larger among offshorers. In the UK and Sweden where the data is available this is true also for the proportion of domestic multinationals. Concerning differences across countries note that the proportion of foreign owned affiliates is much higher in Ireland and that they make up about two-fifths of offshorers in Ireland, while only a third in Sweden and a quarter in the UK.

Table 7.5. Offshoring and other dimensions of global engagement (% of sample)

	Ireland		Sweden		UK	
	Non-offshorers	Offshorers	Non-offshorers	Offshorers	Non-offshorers	Offshorers
Proportion of domestic firms (%)	83	59	73	31	90	65
Proportion of domestic MNEs (%)	n/a	n/a	17	34	4.5	11
Proportion of foreign MNEs (%)	17	41	10	35	5.5	24

Note: For the Irish data we cannot distinguish for domestic multinationals.

The econometric framework

To estimate the importance of offshoring for firms' productivity, we estimate a production function augmented by measures of import intensities and a set of control variables assumed to affect total factor productivity.

Assuming that firms produce according to a linear homogenous general differentiable production function:

$$Y_{it} = A_{it} F(X_{it}) \qquad (1)$$

where Y_{it} is gross output, A_{it} is the firm specific productivity factor, and X_{it} is a vector of inputs (labour, capital, intermediate goods and intermediate services), in the *i:*th firm in period *t*. Following Klette (1999), we express the production function in terms of logarithmic deviations from the median firm in the industry of firm *i* at time t, which we use as our point of reference so that we can rewrite equation (1) as:

$$\tilde{y}_{it} = \tilde{a}_{it} + \alpha_K \tilde{k}_{it} + \alpha_M \tilde{m}_{it} + \alpha_s \tilde{s}_{it} + \alpha_L \tilde{l}_{it} \qquad (2)$$

where the small letters with tildes denote the transformed variable and we now write each of the inputs separately.

We assume that the TFP of the *i:*th firm relative to the "representative firm" in the industry at period t ($\tilde{a}_{it}$) might be affected by offshoring of services. Finally, we allow for the fact that multinational firms (MNE) -- both foreign and domestic -- have higher TFP than non-MNEs, as suggested by existing evidence.[61]

One question we will investigate is whether MNEs may be better able to gain from offshoring since they are already active within an international network or whether for firms with a history of high levels of exposure to international markets the possibilities for positive effects may have been exhausted in a way that they have not for other firms. Another indicator of being active within an international network that we use is whether the firm is exporting or not. We also control for firm age and age squared in order to control for heterogeneity among firms. Substituting out $\tilde{a}_{it}$ and adding industry, λ_i, time,

61. Criscuolo and Martin (2004) for the UK and Karpaty (2006) for Sweden show that multinational firms, both domestic and foreign are more productive than domestic firms.

λ_t, and region λ_r, gives:

$$\tilde{y}_{it} = \beta_O + \beta_1 Off_{it} + \beta_2 DomMNE + \beta_3 USMNE + \beta_4 ForeignMNE + \beta_5 Exporter + \beta_6 \tilde{k}_{it} + \beta_7 \tilde{m}_{it} + \beta_8 \tilde{s}_{it} + \beta_9 \tilde{l} + \beta_{10} age + \beta_{11} age^2 + \lambda_i + \lambda_t + \lambda_r + \varepsilon_{it} \quad (3)$$

We start by estimating equation 3 using OLS. This approach presents several limitations.

Firstly, we impose the same production function across all firms; in particular we have imposed that the offshoring effects on productivity are the same. It is, however, possible that offshoring effects on productivity may be different depending on the characteristics of the firm, its nationality and whether it has previous experience of international trade through export, (Görg *et al.*, 2005). We will investigate these differences in the three countries.

Secondly, OLS regressions report correlations. However, if we are in search of a causal relationship between offshoring and productivity, OLS estimates are not likely to give us the right answer as the error term and the explanatory variables, in particular choices on the production inputs and on offshoring, are likely to be correlated. We assume that we can divide the productivity shocks in two components: a firm specific time invariant component and an idiosyncratic time varying productivity shock. If inputs choices were only correlated with the time invariant establishment specific effect, taking first differences or estimating a fixed effect model would solve the endogeneity problem.[62]

Finally, we choose a static specification. This choice is driven by the loss of observations that we would incur if we were to have a dynamic specification for the UK data and by the short time period available to us for the comparative study (just three years from 2000 to 2003). In country level studies for Sweden and Ireland for which where there is a census of firms for every year, the authors have relaxed this assumption and controlled for the possible correlation between production inputs and offshoring intensity with the time varying productivity shock using the GMM estimator suggested by Blundell and Bond (1998).[63] We will discuss the results obtained at the country level in more detail below.

62. We prefer fixed effects to first differences estimation not only because of the structure of the data, but also because first differencing can exacerbate measurement error problems (Griliches and Hausman, 1986). For the UK, given the nature of the data, the difference between fixed effects and first differences over the three year period is very marginal. The fixed effect estimator (FE) is more efficient than the first differencing (FD) under the assumption of no serial correlation in the idiosyncratic errors μit. However if μit follow a random walk the FD estimator is more efficient (Woolridge, 2002, p.284).

63. The differenced GMM estimator uses time differenced variables in order to remove permanent unobserved heterogeneity, Arellano & Bond (1991). When there is relatively little persistence in the series the lagged levels may be valid instruments for endogenous variables. However, when time series are short or when there is persistence in the time series over time, the Arellano and Bond GMM estimator suffers from poor precision (Blundell et al 2000). Blundell and Bond (2000) propose an improved GMM for shorter panels and when there is persistence in the series. The model suggests that lagged time differenced regressors should be used as instruments for the endogenous variables.

Results

We now answer the question: are the offshoring firms more productive, even after controlling for differences in capital intensity; intermediate usage; multinationality and industry distribution shown above in Tables 7.3, 7.4 and 7.5?

Table 7.6 shows the regression parameters, estimated by OLS, of equation 3. The estimations have been performed for both manufacturing and service sectors together, and for manufacturing and services separately. Note that in all regressions, a polynomial in age and industry, time and region dummy variables are included, as specified in equation 4 but not reported in the tables.[64]

The offshoring variable is defined as the ratio of imported services over total services purchased. We start by looking at both the manufacturing and services sector: the first two rows of panel 1 report the coefficients and the robust standard errors of the OLS estimates. When comparing the coefficient across the three countries we observe that in Ireland the coefficient is not significant; in Sweden it is strongly significant but economically small at a level similar to that of the UK, which in turn is significant at the 10% level.

If we look separately at manufacturing and services sector we find that the order of magnitude of the coefficient looks much more similar across the three countries, with Sweden having the largest and most significant estimate of 0.076[65] for the manufacturers. The coefficient for Ireland remains insignificant and the one for the UK significant only at the 10% level. The last panel reports estimates for the services sector, we could not estimate this for Ireland as the number of observations is too small. Now the offshoring coefficient becomes insignificant for the UK and economically smaller for Sweden.

The rest of the table confirms existing evidence; the MNE variables are positive and strongly significant in all three countries. For Ireland we can only identify Foreign MNEs, *i.e.* we cannot identify domestic Irish MNEs, but we separate out British Multinationals by including a dummy for UK MNEs but report it in the table in the domestic MNE column. The association of global engagement in terms of exporting activity with productivity differ between sectors, with the exporters' advantage being stronger in the services sector for both the UK and Sweden. For the UK, one note of caution here relates to the fact that "exporters" both in the manufacturing and services sectors are firms that export services; this implies that in the manufacturing sector we cannot identify firms that export goods but not services. This might imply that we are identifying a very specific group of manufacturing firms who actually export both manufacturing and services (*e.g.* machinery and equipment manufacturers who also export the engineering and maintenance services) and might therefore be a lower bound estimate of the actual exporters' advantage for the UK.

The above regressions found some suggestive evidence of a positive relation between offshoring intensity and productivity mainly in the UK and Swedish manufacturing sectors. It is however important to address a number of econometric problems. We expect that the presence of unobserved influences, *e.g.* firm-specific fixed effects such as different quality of labour and capital between firms may affect the results. The fixed

64. Note that in the UK we also included a dummy to account for the fact that the age of the firm is only known if the firm is established after 1980 in the manufacturing sector and after 1997 in the services sector.

65. Note that this coefficient is a semi-elasticity.

effects estimates reported in Table 7.7 try to get at this. However, given the short time period available for the analysis, the results must be taken with some caution.

Table 7.6. Effects of offshoring on productivity performance in manufacturing and service, 2000-2002, OLS estimations

	Both sectors			Manufacturing			Services	
	Ireland	Sweden	UK	Ireland	Sweden	UK	Ireland	UK
Offshoring	0.074	0.025	0.027	0.062	0.076	0.030	0.022	0.021
	(0.060)	(0.003)***	(0.016)*	(0.057)	(0.011)***	(0.018)*	(0.003)***	(0.024)
Ln(EMP)	0.406	0.005	-0.009	0.433	0.015	0.008	-0.001	-0.015
	(0.020)**	(0.003)*	(0.001)***	(0.020)**	(0.004)***	(0.002)***	(0.004)	(0.001)***
Ln(K/EMP)	0.065	0.083	0.211	0.049	0.072	0.136	0.089	0.229
	(0.010)**	(0.002)***	(0.004)***	(0.010)**	(0.003)***	(0.006)***	(0.003)***	(0.004)***
Ln(M/EMP)	0.369	0.178	0.228	0.402	0.177	0.270	0.176	0.218
	(0.011)**	(0.003)***	(0.003)***	(0.011)**	(0.005)***	(0.008) ***	(0.004)***	(0.003)***
Ln(S/EMP)	0.226		0.198	0.181		0.258		0.184
	(0.013)**		(0.003)***	(0.013)**		(0.007)***		(0.003)***
Domestic MNEs	0.112	0.053	0.077	0.144	0.025	0.028	0.075	0.130
	(0.062)	(0.007)***	(0.008)***	(0.058)*	(0.009)***	(0.007)***	(0.01)***	(0.014)***
Foreign US MNEs		0.117	0.145		0.04	0.092	0.15	0.184
		(0.014)***	(0.011)***		(0.022)*	(0.011)***	(0.018)***	(0.021)***
Foreign other MNEs	0.219	0.055	0.120	0.154	0.035	0.048	0.065	0.169
	(0.03)**	(0.008)***	(0.008)***	(0.028)**	(0.011)***	(0.008)***	(0.011)***	(0.013)***
Exporter	0.032	0.021	0.040	0.025	-0.016	0.013	0.037	0.054
	(0.034)	(0.006)***	(0.006)***	(0.032)	(0.009)*	(0.007)*	(0.009)***	(0.008) ***
Observations	2526	36367	95143	2179	15602	22856	20751	72287

Note: For Ireland ,domestic MNEs are UK MNEs. OLS estimations heteroskedasticity-consistent standard errors in parenthesis, ***, **, *, significant at the 1%, 5% and 10% level respectively. Unreported time, region and four-digit industry dummies are always included. The estimations consist of an unbalanced panel including all firms with at least 20 employees. Offshoring defined as services offshored divided by total purchases of service intermediates.

Comparing Tables 7.6 and 7.7 we find some interesting features of the results: the loss of significance of the ownership and offshoring variables for the UK while the Swedish estimates remain significant and similar to those reported from the pure OLS estimation. The exception to this general similarity in the Swedish findings is with respect to the ownership variables which are now smaller than in Table 7.6. These results are partly at odds with those obtained in the single countries (*e.g.* Criscuolo and Leaver, 2004; Hagsten *et al.*, 2007). In fact, the results from the UK show that looking over the period 2000 to 2003, the positive association between offshoring and productivity is robust to controlling for fixed effects. We have investigated the source of this discrepancy in more detail. This analysis (unreported but available upon request) shows that the difference is due to the short time horizon analysed. For the UK, when the analysis is extended to include later years the significance of the services offshoring variables is resumed. In the Swedish case, the discrepancies in the results between the single country studies and this comparative one seem to be driven by differences in specification of the models and variables used.

Table 7.7. Effects of offshoring on productivity performance in manufacturing and service, 2000-2002, fixed effects estimations

	Both sectors			Manufacturing			Service	
	IRL	SWE	UK	IRL	SWE	UK	SWE	UK
Offshoring	0.032	0.025	0.012	0.125	0.074	-0.006	0.022	0.024
	(0.121)	(0.003)***	(0.017)	(0.120)	(0.011)***	(0.019)	(0.003)***	(0.030)
Ln(EMP)	0.302	0.012	-0.106***	0.277	0.018	-0.025**	0.01	-0.102***
	(0.038)**	(0.003)***	(0.008)	(0.039)**	(0.004)***	(0.010)	(0.004)**	(0.013)
Ln(K/EMP)	0.025	0.081	0.241***	0.014	0.069	0.244***	0.087	0.303***
	(0.031)	(0.002)***	(0.009)	(0.032)	(0.003)***	(0.017)	(0.003)***	(0.015)
Ln(M/EMP)	0.194	0.182	0.137***	0.240	0.176	0.222***	0.183	0.105***
	(0.022)**	(0.003)***	(0.006)	(0.022)**	(0.005)***	(0.013)	(0.004)***	(0.007)
Ln(S/EMP)	0.117		0.143***	0.117		0.169***		0.127***
	(0.021)**		(0.006)	(0.020)**		(0.008)		(0.008)
Domestic MNEs		0.03	-0.003		0.021	0.000	0.036	-0.001
		(0.006)***	(0.008)		(0.008)***	(0.008)	(0.009)***	(0.015)
Foreign US MNEs		0.081	-0.013		0.035	-0.008	0.1	-0.023
		(0.013)***	(0.014)		(0.02)*	(0.012)	(0.018)***	(0.032)
Foreign other MNEs		0.025	0.000		0.025	0.004	0.021	-0.000
		(0.007)***	(0.010)		(0.01)***	(0.010)	(0.01)**	(0.019)
Exporter		-0.002	-0.008	0.014	-0.016	0.004	-0.002	-0.010
		(0.005)	(0.006)	(0.064)	(0.007)**	(0.007)	(0.007)	(0.009)
Observations	2526	36733	73428	1104	11703	22856	12048	72287

Note: For Ireland Domestic MNEs are UK MNEs. OLS estimations heteroskedasticity-consistent standard errors in parenthesis, ***, **, * significant at the 1%, 5% and 10% level respectively. Unreported time, region and four-digit industry dummies are always included. The estimations consist of an unbalanced panel including all firms with at least 20 employees. Offshoring is defined as services offshored divided by total purchases of service intermediates.

Offshoring and international experience

Up to this point, we have dealt with the issue of offshoring assuming that the association between offshoring and productivity is the same across domestic and foreign firms and across exporters and non-exporters. It is, however, possible that potential effects from offshoring on productivity may be different depending on the global engagement of the firm. First, we ran a regression on domestic firms only; then on foreign-owned, and for Sweden and the UK we performed the same regression for domestic multinational firms. As argued the correlation between offshoring intensity might be either larger or smaller for firms with global engagement than pure local firms. However, the results shown in Table 7.8 and 7.10 for Sweden and the UK do not seem in line with the hypothesis that firms with global engagement having a more positive offshoring-productivity relationship (explained for example by smaller transaction cost and lower search costs): the offshoring coefficient estimates seem to suggest a weaker correlation for the globally engaged firms, exporters and MNEs (domestic and foreign).[66] One possible explanation is that this might be due to difficulties in measurement due to transfer pricing issues.

66. Column 2: the offshoring coefficient for the Swedish domestic exporters is not significant., while all 21 781 exporters, not included in the table above, are positively significant at the one per cent level with the estimate 0.022 and standard deviation 0.003.

Table 7.8. Offshoring and previous international experience: Sweden

Sweden	Domestic non-exporter	Domestic exporter	Domestic MNE	Foreign MNE	Domestic non-exporter Manufacturing sector
	(1)	(2)	(3)	(4)	(5)
Offshoring*	0.224	0.023	0.027	0.022	0.274
	(0.058)***	(0.016)	(0.005)***	(0.004)***	(0.076)***
Ln(EMP)	-0.001	0.006	0.007	0.019	-0.002
	(0.007)	(0.006)	(0.006)	(0.006)***	(0.008)
Ln(K/EMP)	0.083	0.073	0.097	0.071	0.094
	(0.003)***	(0.003)***	(0.005)***	(0.006)***	(0.003)***
Ln(M/EMP)	0.187	0.165	0.195	0.16	0.2
	(0.005)***	(0.006)***	(0.009)***	(0.008)***	(0.006)***
Observations	12350	9915	7191	6100	3855

Note: OLS estimations. Robust standard errors in parenthesis, ***, **, * significant at the 1%, 5% and 10% level respectively. Unreported time, region and four-digit industry dummies are included. The estimations consist of an unbalanced panel including all firms with at least 20 employees. Offshoring is defined as imports of services over total purchases of services intermediates.

Table 7.9. Offshoring and previous international experience: Irish manufacturing firms

Ireland	Domestic firms	Foreign MNEs	Exporters
Offshoring	-0.199	0.268	0.098
	(0.075)**	(0.096)**	(0.063)
Ln(EMP)	0.486	0.320	0.427
	(0.023)**	(0.035)**	(0.022)**
Ln(K/EMP)	0.039	0.068	0.056
	(0.011)**	(0.017)**	(0.011)**
Ln(M/EMP)	0.336	0.511	0.398
	(0.013)**	(0.021)**	(0.013)**
Ln(S/EMP)	0.174	0.175	0.188
	(0.016)**	(0.024)**	(0.015)**
Firm is an exporter	0.065	-0.066	
	(0.032)*	(0.098)	
UK MNE			0.140
			(0.066)*
Foreign			0.147
			(0.030)**
Observations	1452	727	1866

Note: OLS estimations heteroskedasticity-consistent standard errors in parenthesis, ***, **, * significant at the 1%, 5% and 10% level respectively. Unreported time, region and four-digit industry dummies are always included. The estimations consist of an unbalanced panel including all firms with at least 20 employees. Offshoring is defined as services imported divided by total purchases of service intermediates. For Ireland we cannot discriminate between domestic firms and domestic MNEs and so report results for all domestic firms.

Table 7.10. Offshoring and previous international experience: United Kingdom

UK	Domestic non-exporter	Domestic exporter	Domestic MNE	Foreign MNE	Domestic non-exporter Manufacturing sector
	(1)	(2)	(3)	(4)	(5)
Offshoring	0.035	-0.002	0.036	0.040	**0.076***
	(0.029)	(0.027)	(0.053)	(0.036)	**(0.039)**
Ln(EMP)	-0.010***	0.004	0.003	-0.012***	0.006**
	(0.001)	(0.004)	(0.006)	(0.004)	(0.003)
Ln(K/EMP)	0.200***	0.214***	0.234***	0.259***	0.129***
	(0.004)	(0.012)	(0.017)	(0.012)	(0.008)
Ln(M/EMP)	0.243***	0.140***	0.179***	0.241***	0.265***
	(0.003)	(0.008)	(0.010)	(0.009)	(0.010)
Ln(S/EMP)	0.183***	0.284***	0.284***	0.259***	0.249***
	(0.003)	(0.012)	(0.014)	(0.012)	(0.009)
Observations	75613	7006	5029	7495	13808

Note: OLS estimations heteroskedasticity-consistent standard errors in parenthesis, ***, **, * significant at the 1%, 5% and 10% level respectively. Unreported time, region and four-digit industry dummies are always included. Offshoring is defined as services imported divided by total purchases of service intermediates.

On the other hand, the results for Ireland, as shown in Table 7.9, show a negative offshoring coefficient for domestic firms; an insignificant one for exporters and a significant one in both economic and statistical terms, at 26.8%, for foreign owned firms based in Ireland.[67] In a nutshell, our Irish results show us that international services outsourcing and TFP are positively and significantly correlated only for globally engaged firms (foreign MNEs). How does this result fit in with previous evidence on Irish firms?

Our finding ties in with existing work for an earlier time period (1990-1998) by Görg *et al.* (2006) who use data from the Forfás Irish Economy Expenditure Survey. Görg *et al.* similarly find that foreign MNEs benefit most from international services outsourcing (as well as materials outsourcing), most likely through use of their extensive foreign distribution networks or pecuniary scale economies when dealing with suppliers.

67. In unreported results we have checked the robustness of the Irish and Swedish results to the presence of endogeneity of factor inputs and the offshoring decision allowing for an autoregressive error term using the system GMM first suggested by Blundell and Bond 1998. The results show that the offshoring coefficient remains significant in the overall sample for Sweden, but this significance is driven by the estimates in the services sector. In Ireland the estimates becomes strongly significant. However, we believe that given the very short time period of the analysis these results might not be reliable.

Conclusions

Offshoring activity is widely believed to play an important role for firms due to the fragmentation of the production process across countries when there are differences in the relative endowments of skilled and unskilled labour and of technology. The question is, however, if it is possible to prove empirically the existence of offshoring effects.

In this paper, we have looked at the relationship between offshoring of services and total factor productivity across three different OECD countries: Ireland, Sweden and the United Kingdom.

The three countries are similar in that all three are open economies, but they are very different in terms of industrial structures and labour regulation.

The first question the paper answer is which firms offshore in the three countries? Is there a clear pattern of characteristics across these countries? Are there striking differences?

The answer is that in all three countries offshoring firms are more labour productive, are larger, pay higher wages and are more likely to be multinational and foreign-owned. This latter feature is particularly evident in the Irish data.

Concerning the association between multifactor productivity and services offshoring we find some suggestive evidence of a positive relationship although the statistical and/or economic significance of this relationship is not very strong across the three countries. One possible explanation is the small time horizon over which our analysis span. Moreover, firms that already are globally engaged do not benefit more from offshoring than pure local firms in the UK, while foreign owned firms are the only ones to have a positive services offshoring coefficient in Ireland. In Sweden the domestic non-exporters benefit more from offshoring than globally engaged firms. This bonus is somewhat stronger than in Hagsten *et al.* (2007) but is considered to arise from differences in the specifications of the equations and the exclusion here of the smallest firms. However, the direction of the results is in line with the pure Swedish study.

ANNEX 7.A. DATA DESCRIPTION

Ireland

The data for Ireland comprises plant level data for manufacturing industries in the Republic of Ireland. The data are taken from the *Irish Economy Expenditure Survey*, undertaken annually since 1983 by Forfás, the government agency with responsibility for enterprise development, science and technology. This is an annual survey of larger plants in Irish manufacturing with at least 20 employees, although a plant, once it is included, is generally still surveyed even if its employment level falls below the 20 employee cut-off point. The response rate to this survey is generally estimated to be between 60 and 80 per cent of the targeted plant population. The survey provides plant level information on, inter alia, output, value added, exports, employment, capital employed, nationality of ownership, as well as details on plants' expenditure on labour, materials, and services inputs.

One should note, however, that information on the capital stock is only available from 1990 onwards. In this study we only use the period 2000-2002 for comparability with Sweden and the UK. A plant is defined as foreign owned in the data if at least 50 percent of its shares are held by foreign owners.

Sweden

The data used in this analysis originate from the International Trade Statistics, The Structural Business Statistics (SBS) and The Swedish Register of Education as well as from the National Accounts. The Riksbank (Sveriges Riksbank, Swedish Central Bank) is the authority responsible for the trade statistics, and did formerly even produce them. However, as from 2003, Statistics Sweden produces these series. When the responsibility for producing the import of services series changed, also the methods of data collections were altered. This led to irreparable breaks in the disaggregated series. For a more detailed description of the data sources we refer to Hertzman et al (2006) and Fors and Jansson (2006) or to Hagsten *et al.* (2007).

The SBS consists of information on profit and loss accounts, investments and employment and rely heavily on administrative data from the Tax Authority. All firms operating in Sweden are included in the register and are reported by their unique identification number.

Until the last quarter of 2002 the settlement system was used which registered collated bank transactions between Sweden and other countries when the transactions amounted to more than SEK 150 000. This threshold value meant that most firms were included, but many lesser transactions were lost. As from 2003, when Statistics Sweden started to produce the series on imports and exports of services, the representative sample amounts to slightly more than 10% of the population of international traders, which in turn corresponds to 41 000 firms.

The Swedish Register of Education consists of data on graduation and educational background from the 1990 and 1970 censuses, each year updated with graduation and examination data from regular educational institutions such as primary and secondary schools, universities et cetera. The register comprises the population 16-74 years old registered as residents in Sweden. Each person is registered by their unique identification number.

United Kingdom

The Office of National Statistics (ONS) Annual Respondents Database (ARD) is described in detail in Criscuolo, Haskel and Martin (2003), so only a brief description is included here. Since 1997 The ARD consists of the replies to the mandatory *Annual Business Inquiry* (ABI).

The ABI is the major source of establishment level data in the UK and underlies the construction of aggregate output and investment in the national accounts. The ABI forms request information on inputs and outputs: gross output,[68] value added, employment, investment, intermediates and wage costs. Information is also collected on establishments' industry, region, and nationality of ownership. Each unit that replies is assigned a unique identification number, which allows units to be linked over time. The ONS also assigns a second identification number corresponding to the entity that owns the unit so units under common ownership share the same firm identifier.

The ABI asks firms on their purchases of goods, materials and services. Since 2000 the ABI forms include a question which asks firms to report the amounts of services traded with other countries (imports and exports of services). The question explicitly excludes the value of imported and exported goods. The values reported should include, according to the notes of the surveys, "*all transactions with individuals, enterprises and other organisations domiciled in a country rather than the UK*". This definition includes subsidiaries and parents that are operating abroad. This means that the value of imported/exported services reported includes both inter- and intra-firm trade. These services include industrial and non-industrial services. Industrial services include repair of construction equipment and computers; non industrial services include among others: consultancy services (market research, advertising, accountancy and R&D); telecommunications services; computer services (excluding hardware).

The ARD provides information on investment but does not contain information on firms' capital stock. We use capital stock built using the information on investment from the ABI using a perpetual inventory method, details of which can be found in Martin (2000).

The Inter Departmental Business Register (IDBR), the register from which the ABI sample is drawn, identifies foreign owned firms. The main source of information is Dun and Bradstreet's Who owns Whom database. To obtain information on which UK firms are outward direct investors we need to match into the dataset information from the AFDI register. Details of the AFDI register data and the procedure followed to merge the AFDI and the ARD can be found in Criscuolo and Martin (2004).

This study uses ARD data from 2000 to 2002, and covers both manufacturing and services sectors.

68. The ABI contains gross output at current values. The ONS provides PPI deflators with base year 2000 for the manufacturing sector (MM17). For a limited number of service sector industries the ONS provides a set of experimental deflators. For all the other industries in the service sector a common service sector deflator is used.

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Chapter 8

THE INTERNATIONALISATION OF R&D

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This chapter provides an overview of the increasing internationalisation of R&D and innovation, and analyses the drivers behind the trend. It presents available indicators related to the globalisation of inputs, outputs and trade of R&D and examines the changing innovation strategies of the multinational enterprises. It also considers the policy challenges and opportunities posed by R&D internationalisation, and traces some policy initiatives that have been undertaken by governments in OECD countries.

This chapter was originally published as Chapter 4 of the OECD Science, Technology and Industry Outlook 2006. *Some data have been updated in this version.*

Introduction

The internationalisation of R&D is a key dimension of globalisation, with important implications for economic development and public policy. It is not a totally new phenomenon, since some R&D has been undertaken abroad for a long time. However, cross-border R&D has traditionally been the corollary of foreign direct investment (FDI) and until recently largely aimed at adapting technologies for sales in host countries.

Current R&D internationalisation has three distinguishing characteristics: it is taking place at a much faster pace, it is spreading to an increasing number of countries, including developing countries, and it involves R&D that extends beyond adapting technology to local conditions. This chapter suggests that the last of these phenomena may represent a distinctive new trend in the internationalisation of R&D. In the past, the evidence suggested that major global firms kept their key technology creation activities – as evidenced by R&D and patenting – close to their home bases. Now, however, they seem not only to seek to exploit knowledge generated at home in other countries, but also to tap into worldwide centres of knowledge. This implies genuinely international sourcing of knowledge.

Multinational enterprises (MNEs) play a major role in this process since they account for the major share of global business R&D. Until recently, R&D was among the least internationalised segments of MNEs' value chains. While production, marketing and other functions moved abroad quite quickly, R&D was considered one of the least "fragmentable" economic activities because it involves knowledge that is strategic to firms, and because it often has a tacit, non-transferable character. Consequently, firms by and large performed R&D and undertook patenting in their home bases.

While corporate R&D activities still maintain a home-country bias – in the sense that firms continue to carry out R&D predominately where their head offices are located – MNEs are increasingly changing how they innovate and this involves building global distributed R&D networks. Following the broader fragmentation of the value chain and the corresponding internationalisation of manufacturing, MNEs increasingly establish R&D facilities at many locations worldwide. This foreign technological activity increasingly aims to tap into local knowledge and to provide further sources of new technology.

This chapter largely focuses on MNEs in order to identify trends and analyse drivers behind the internationalisation of R&D. Multinationals are the leading players in the global R&D landscape as they are the largest R&D investors: firms account for almost 70% of total R&D expenditure in the OECD area and most is carried out by large firms. However, innovation nowadays also requires cross-functional co-operation and interaction not only within firms but also with external parties (customers, suppliers, universities and research institutes for example). The focus on business should not detract from other important aspects that complement the internationalisation of business R&D such as the internationalisation of science and the international mobility of researchers. Successful innovative firms are typically part of a system of formal and informal links with other firms, public research institutions, universities and other knowledge-creating bodies. Governments also play a role since policies for R&D, education and infrastructure affect the structure and functioning of innovation systems.

To identify major trends, this chapter first looks at a number of observations and indicators of the internationalisation of R&D and innovation (inputs, outputs and trade of

R&D); it should be noted however that countries' data on cross-border R&D flows are often incomplete and that it is difficult to compare and interpret them. There are also problems of timeliness. The chapter then analyses the major drivers of the increasing internationalisation of R&D and discusses factors relating to location of R&D centres abroad. The internationalisation of R&D poses new policy challenges and opportunities for governments, as foreign R&D has important impacts on countries' economies and their national innovation systems. These policy challenges range from attracting and retaining R&D activity, to encouraging domestic firms to internationalise R&D, to capturing the economic benefits from global R&D activities. Examples of how countries have tackled these challenges are discussed in a final section.

Major trends in the internationalisation of R&D

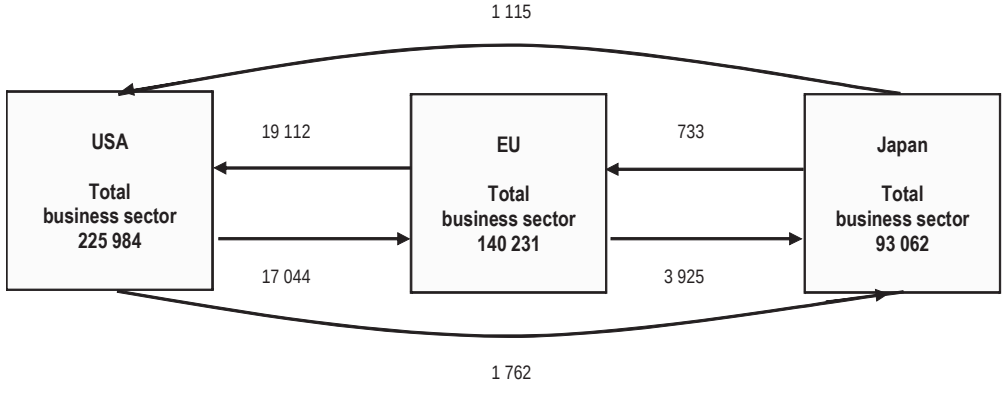
The growing role of foreign affiliates in host countries' R&D

The largest cross-border flows of R&D take place within the OECD area, mainly between the three main regions, the United States, the European Union (here EU15) and Japan. Figure 8.1 shows that in 2002 US multinationals placed over 61% of their foreign R&D investment in the European Union (USD 12.9 billion) and 7% in Japan (USD 1.5 billion) while the European Union invested USD 17.5 billion in the United States and USD 2.2 billion in Japan. Whereas the United States was a net exporter of R&D to the EU in the late 1990s, the situation changed in the early 2000s with more European firms establishing foreign R&D affiliates in the United States than *vice versa*. Japan invested only USD 1.4 billion in the United States and 0.7 billion in the EU.

These flows tend to be highly concentrated in sectoral terms. European R&D investments in the United States are mainly in the chemical and pharmaceutical industry (50%), computers and electronics (13%) and petroleum distribution (10 %). On the other hand, investment by US multinationals in the European Union essentially involves three sectors: automobile (33%), the pharmaceutical industry (26%) and computers and electronics (14%). Japanese R&D investments in the United States are concentrated in services (69%), especially in wholesale trade and professional/scientific services, rather than in manufacturing (31%). The United States' R&D investment in Japan is essentially in the pharmaceutical industry (63%) and computers (20 %).

Figure 8.1. R&D flows between EU15, the United States and Japan, 2005*

Millions of USD PPP

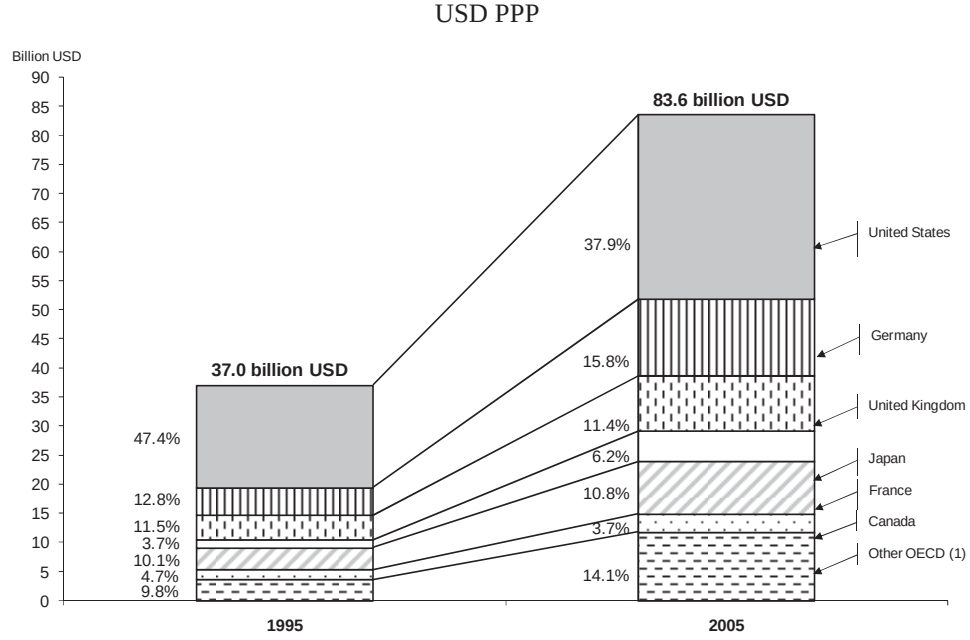


* Figures for Japan are for 2004.

Source: OECD, AFA database, January 2008.

Increasing R&D investments abroad by MNEs have resulted in the growing role of foreign affiliates in host countries' R&D. Between 1995 and 2003, R&D expenditure by foreign-controlled affiliates in OECD countries rose by USD 36.5 billion in purchasing power parity (PPP) dollars. Within the OECD, these flows are also geographically concentrated. Although its share slightly decreased over the period 1995-2003, the United States continues to attract the largest share of R&D expenditure by foreign affiliates in the OECD area (41.9%). Other countries that attract important R&D investments of foreign MNEs, are Germany, the United Kingdom and, to a lesser extent, Japan, France and Canada (Figure 8.2). The three largest EU R&D performers (Germany, the United Kingdom and France) together attract 37.4% of foreign R&D investments in the OECD area.

Figure 8.2. Trends in the share of R&D expenditure under foreign control in the business sector in selected OECD countries between 1995 and 2005*



* Figures for Japan are for 2004.

1. The Czech Republic, Finland, Hungary, Ireland, Poland, the Netherlands and Sweden.

Source: OECD, AFA database, January 2008.

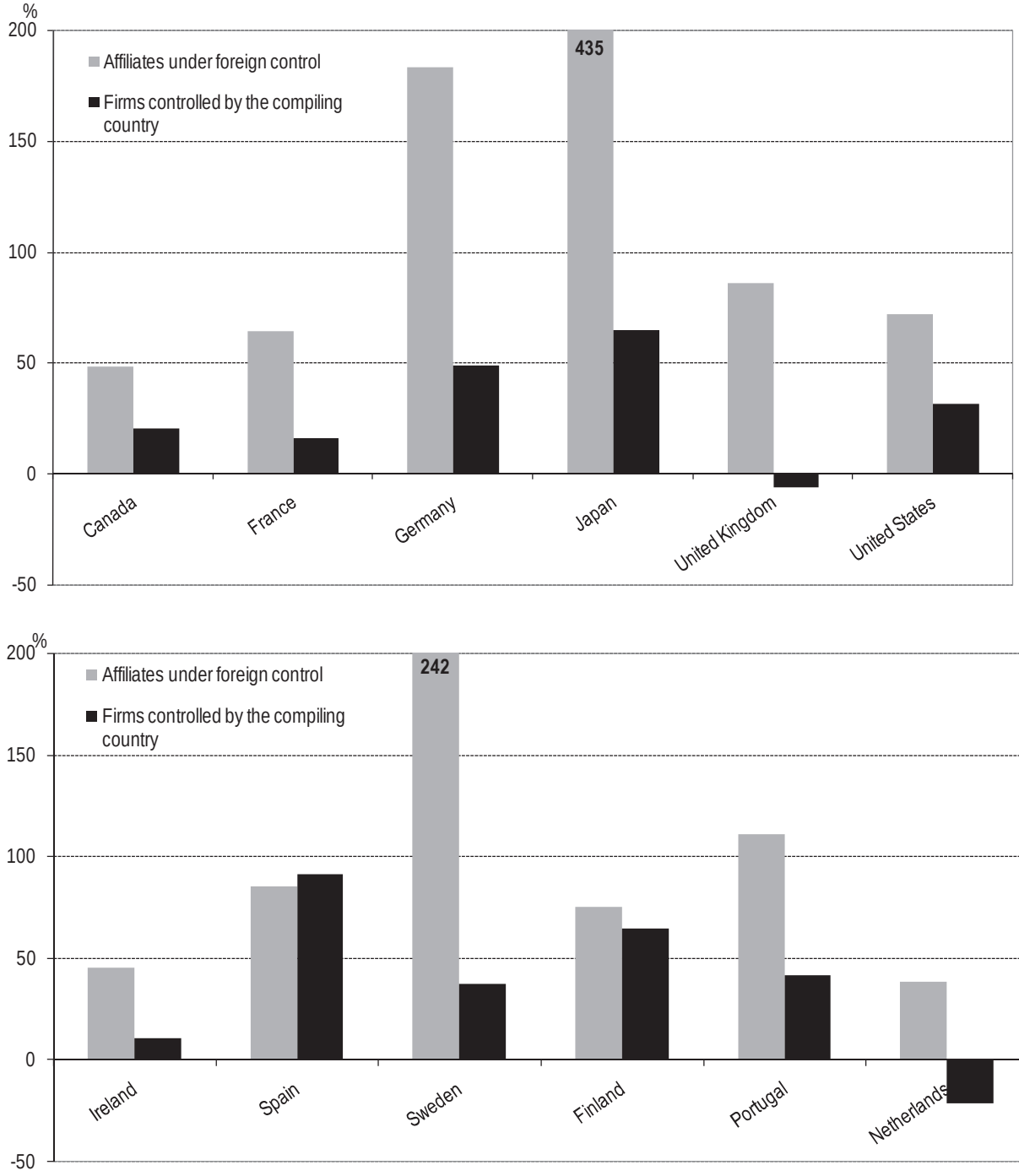
Box 8.1. International R & D collaboration and alliances

Firms are not only internationalising their R&D activities through foreign affiliates (whether greenfield investment or mergers/takeovers), but also by collaborating with other firms and research organisations. The increasing similarity of technologies across sectors and the cross-fertilisation of technology between sectors, coupled with the increasing costs and risks associated with innovation, has often led firms to consider international R&D alliances as a first-best option. Through R&D co-operation and strategic alliances, leading international technological enterprises have created new solutions that allow for rapid and flexible networking of institutionally or regionally scattered centres of competence. The formation of research joint ventures enables companies to pool resources and risk, exploit research synergies and reduce research duplication.

Companies increasingly carry out joint R&D projects with the best possible partners, either other firms or science partners. The search for best partners is carried out on a global scale. Since the 1980s a rising number of co-operation agreements or alliances have been concluded between partners residing in different countries (Hagedoorn, 2002). As for firms' R&D investments, R&D collaboration is dominated by companies from the world's most developed economies, paralleling the worldwide distribution of R&D resources and capabilities.

Figure 8.3. Growth of R&D expenditures of affiliates under foreign control and firms controlled by the compiling country between 1995 and 2003 in selected OECD countries

In constant PPP (2000)



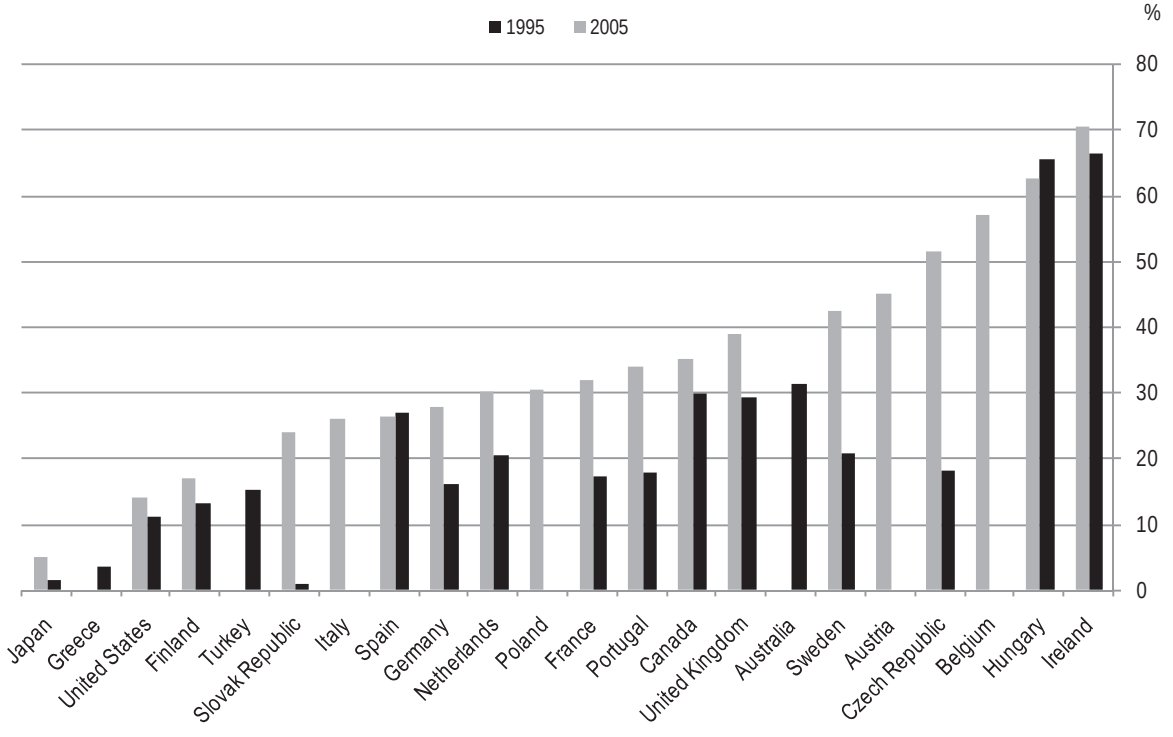
Note: Finland: 1997-2003; Netherlands: 1997-2002; Portugal: 1999-2003.

Source: OECD, AFA database.

The growth of R&D investments by foreign affiliates in the manufacturing sector was much higher than the corresponding growth by domestically controlled firms, except in Spain, (Figure 8.3). In the United Kingdom, Sweden and the Netherlands, only R&D expenditure of foreign-controlled affiliates grew rapidly, while that of domestically controlled firms declined. It is because of R&D investment by foreign affiliates that the overall growth of business R&D in these three countries has not been negative. The difference in trends may be due to choices between mergers and acquisitions and green-field investments when setting up R&D facilities abroad; however detailed data for analysing these trends empirically are not available (see also below). In addition, the figures do not include collaboration between firms, which has been increasing (see Box 8.1).

These different growth patterns have resulted in an increasing share of foreign affiliates in countries' business R&D expenditures. Except in Spain and Turkey, the "foreign" share of R&D investments increased substantially during the period 1995-2005 (Figure 8.4). In OECD countries such as Ireland, Belgium and Hungary, foreign affiliates now play a major role in national R&D investments. Smaller countries seem to report larger shares; this may be due to a combination of smaller domestic R&D bases and proactive measures and favourable conditions for the attraction of FDI and accompanying R&D. However, in some (larger) countries, the share of R&D conducted by foreign affiliates is also high; it exceeds 40% in the Czech Republic, Sweden, the United Kingdom and Australia.

Figure 8.4. Share of affiliates under foreign control in total business sector R&D expenditures, 1995 and 2005

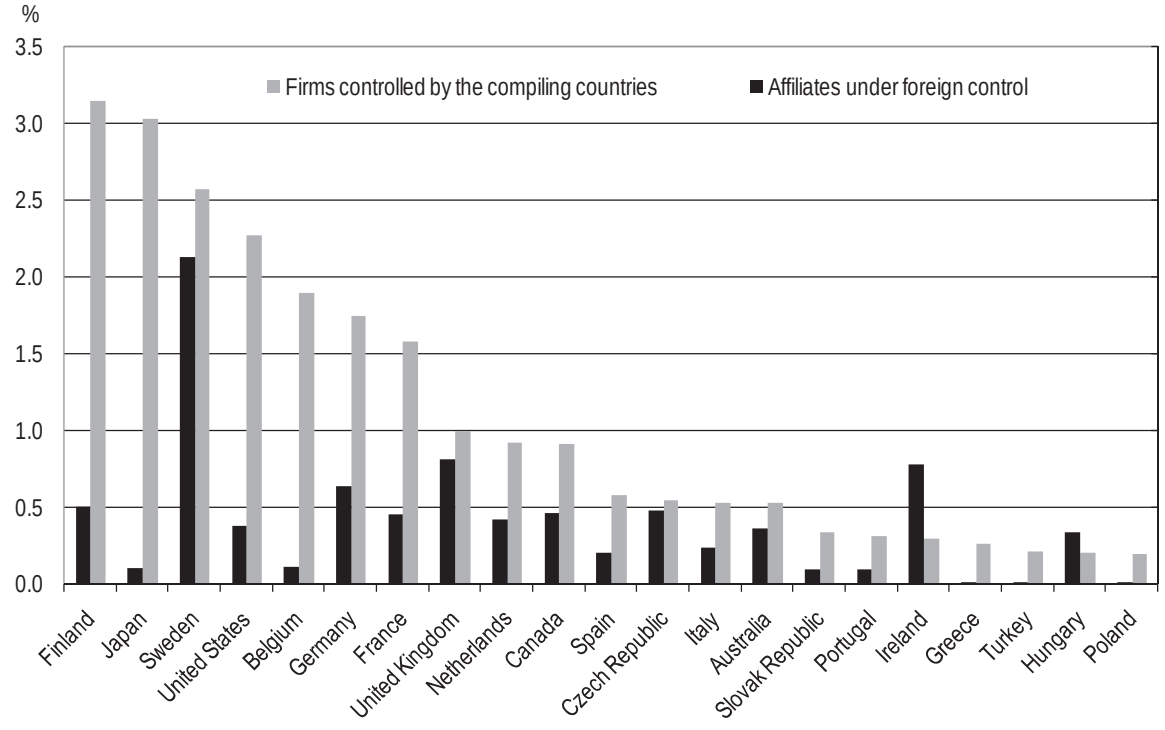


Note: Czech Republic: 1996; Finland, Hungary, Netherlands, Turkey: 1997; Portugal: 1999; Hungary: 2003; Austria, Canada, Italy, Japan, Netherlands: 2004.

Source: OECD, AFA database, January 2008.

The importance of foreign MNEs in host countries' R&D has raised concerns about the dependency and vulnerability of the local R&D base (OECD, 2005a). These concerns are greater in countries such as Ireland and Hungary where the ratios of R&D expenditure to turnover are higher in foreign affiliates than in domestically controlled firms (Figure 8.5), an indication of the latter's relative lack of investment in R&D. There is some evidence that firms in these countries tend to buy the bulk of their technology abroad rather than develop it at home. In both Hungary and Ireland, technological payments (licences, patents, know-how, technical assistance, studies, R&D, etc.) are far higher than the R&D expenditure of enterprises in general (see also below).

Figure 8.5. R&D intensity of affiliates under foreign control and firms controlled by the compiling countries, 2003



Source: OECD, AFA database.

Growing foreign activity not only in host countries' R&D but also in (broader) innovation

Patents

The internationalisation of R&D is demonstrated not only on the input side of the innovation process through R&D expenditures but also on the output side, as measured by patents. The increasing volume of R&D investments abroad is matched by the increasing importance of foreign affiliates in patenting. An increasing share of patents nowadays is owned by a firm's headquarters rather than by an entity in the inventor's country of residence.

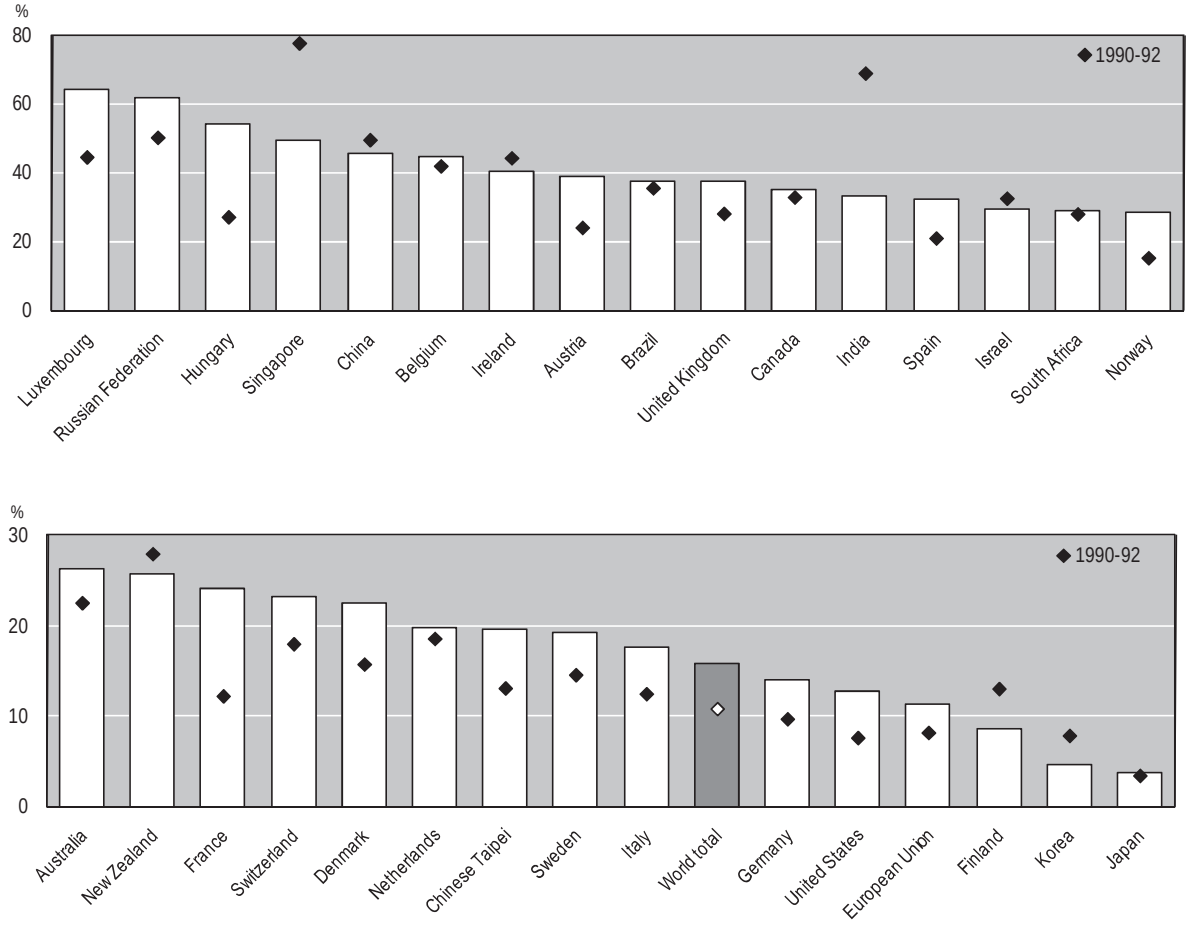
Patent data are considered a unique, broadly available and reliable source of statistical material (OECD, 2005b). Patents can be used to study internationalisation over a long period and a large sample of firms and sectors. The main disadvantage of patent statistics

is that they fail to capture all innovative activity as not all innovations are patented and not all patents lead to innovations.

On average, 15.8% of all patented inventions at the European Patent Office (EPO) were owned or co-owned by a foreign resident in 2000-02, a significant increase from 1990-92 (10.8%). For a majority of reported countries, the share of patents owned (or co-owned) by a foreign resident was higher in 2000-02 than in the early 1990s (Figure 8.6).

Foreign ownership of domestic inventions is particularly high in Luxembourg, the Russian Federation, Hungary and Singapore, where 50% or more of domestic inventions filed at the EPO are owned or co-owned by a foreign resident. Japan, Korea and Finland are much less internationalised; less than 10% of their patents filed at the EPO are foreign-owned. In the case of Japan and Korea, possible reasons for low foreign ownership include linguistic barriers and the low penetration of foreign affiliates.

Figure 8.6. Foreign ownership of domestic inventions[1]
2000-02[2]



Note: Patent counts are based on the inventor's country of residence, the priority date and simple counts. The EU is treated as one country; intra-EU co-operation is excluded.

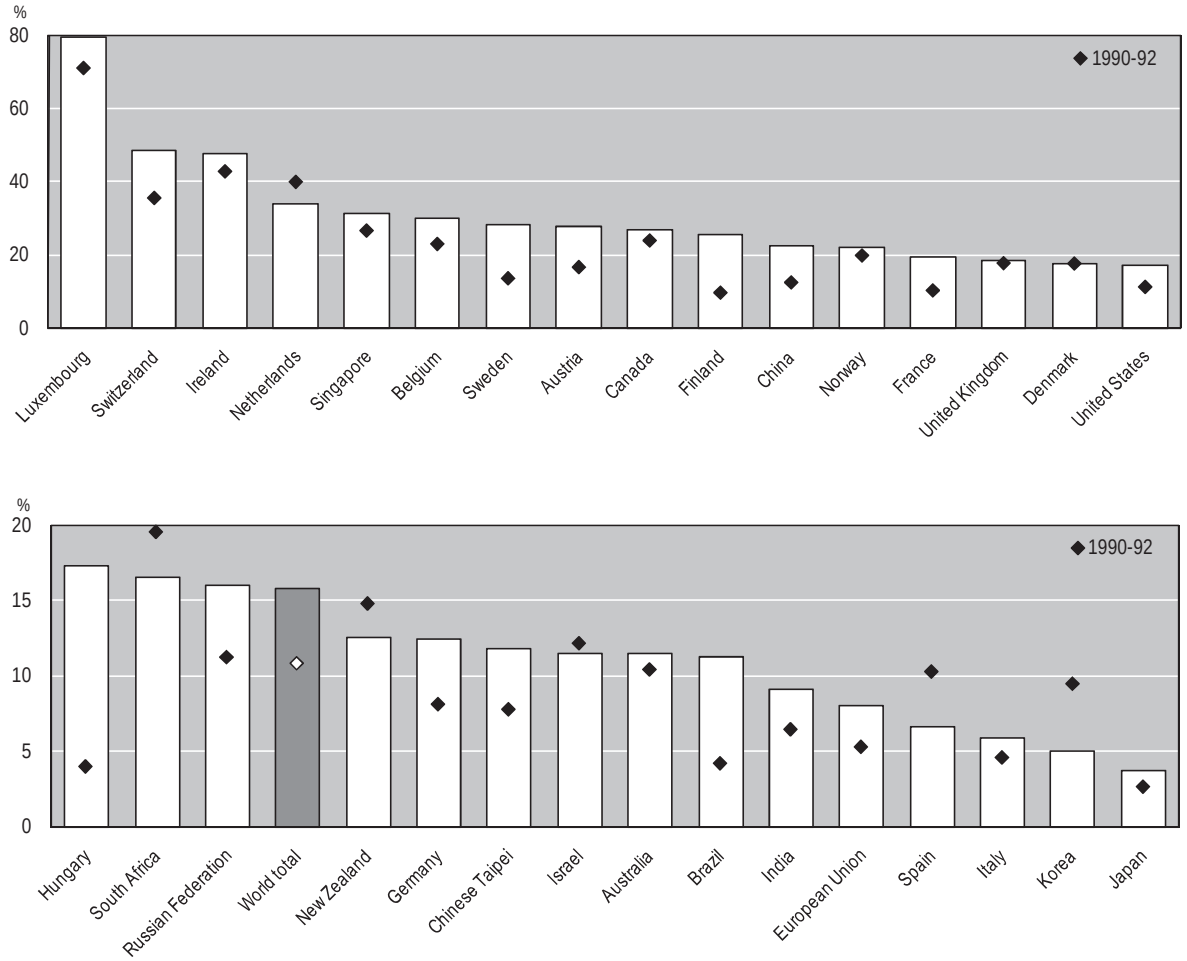
1. Share of patent applications to the EPO owned by foreign residents in total patents invented domestically.

2. The graph only covers countries/economies with more than 300 EPO applications over the period 2000-02.

Source: OECD Patent Compendium, www.oecd.org/sti/ipr-statistics.

During the 1990s, there was also been a considerable increase in the share of domestic ownership of inventions made abroad. This share increased from 10.8% of all EPO patents in 1990-92 to 15.8% in 2000-2002. Again, for the majority of reported countries, the share of domestic ownership of inventions made abroad is higher in 2000-02 than in 1990-92. Notable exceptions are Korea, the Netherlands, New Zealand, Spain and South Africa (Figure 8.7).

Figure 8.7. Domestic ownership of inventions made abroad[1]
2000-02[2]



Note: Patent counts are based on the applicant's country of residence, the priority date and simple counts. The EU is treated as one country; intra-EU co-operation is excluded.

1. Share of patent applications to the EPO invented abroad in total patents owned by country residents.

2. The graph only covers countries/economies with more than 200 [EPO applications over the period 2000-02.

Source: OECD Patent Compendium, www.oecd.org/sti/ipr-statistics.

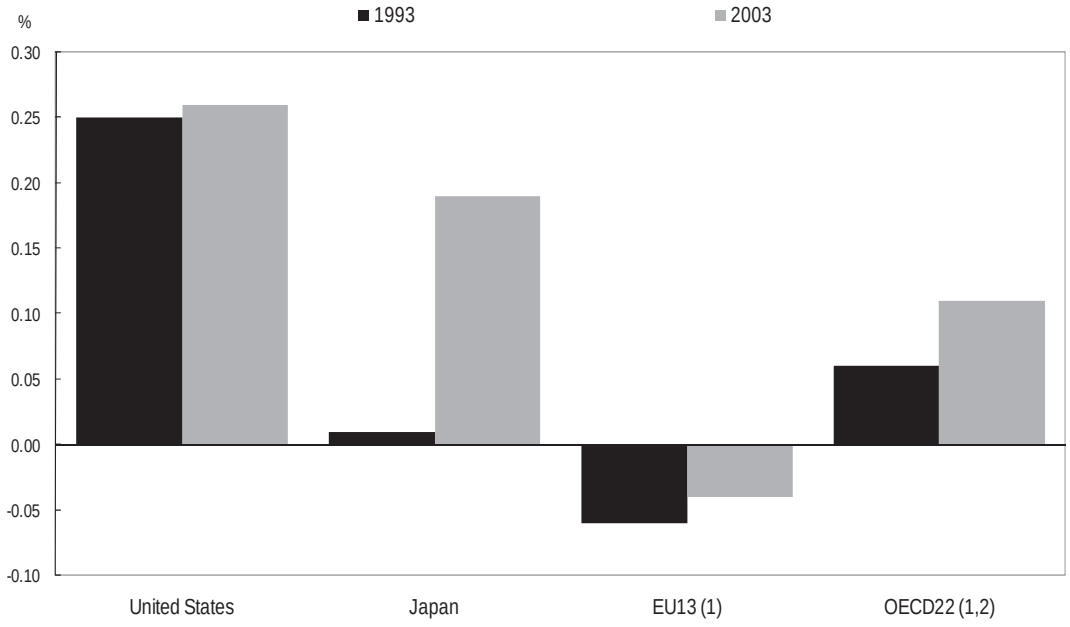
There is a high level of domestic ownership of inventions made abroad in small, open economies. For example, close to 80% of all inventions owned by residents of Luxembourg were made abroad. This share is also high in Switzerland (48.7%) and Ireland (48.0%). Japan, Korea, Italy and Spain are the least internationalised with respect to domestic ownership of inventions made abroad.

These results are largely confirmed in a study by Criscuolo and Patel (2003) analysing the patenting activities of the largest US, Japanese, and European MNEs between 1996 and 2000. This study shows that MNEs from small countries, such as Belgium, the Netherlands, Sweden and Switzerland, have the most internationalised R&D operations, while MNEs from large European countries (the exception being the United Kingdom) are less internationalised. There has been a modest increase in the last 15 years in the internationalisation of technological activities, with most of the growth realised by MNEs from small European countries. At the same time, the study suggests that home-based technological activities of large firms from large countries continue to have a significant influence on the R&D activities of their home countries.

Technology balance of payments

The internationalisation of R&D can also be gauged by the evolution of countries' technology balance of payments (TBP), because technology payments and receipts represent to some extent the trade in R&D outcomes across borders. The technology balance of payments measures disembodied international technology transfers: licences, patents, know-how, research and technology assistance. In most OECD countries, technological receipts and payments increased sharply during the 1990s.

Figure 8.8. Changes in the technology balance of payments as a percentage of GDP



1. Including intra-area flows. EU 15 excluding Demark and Greece.

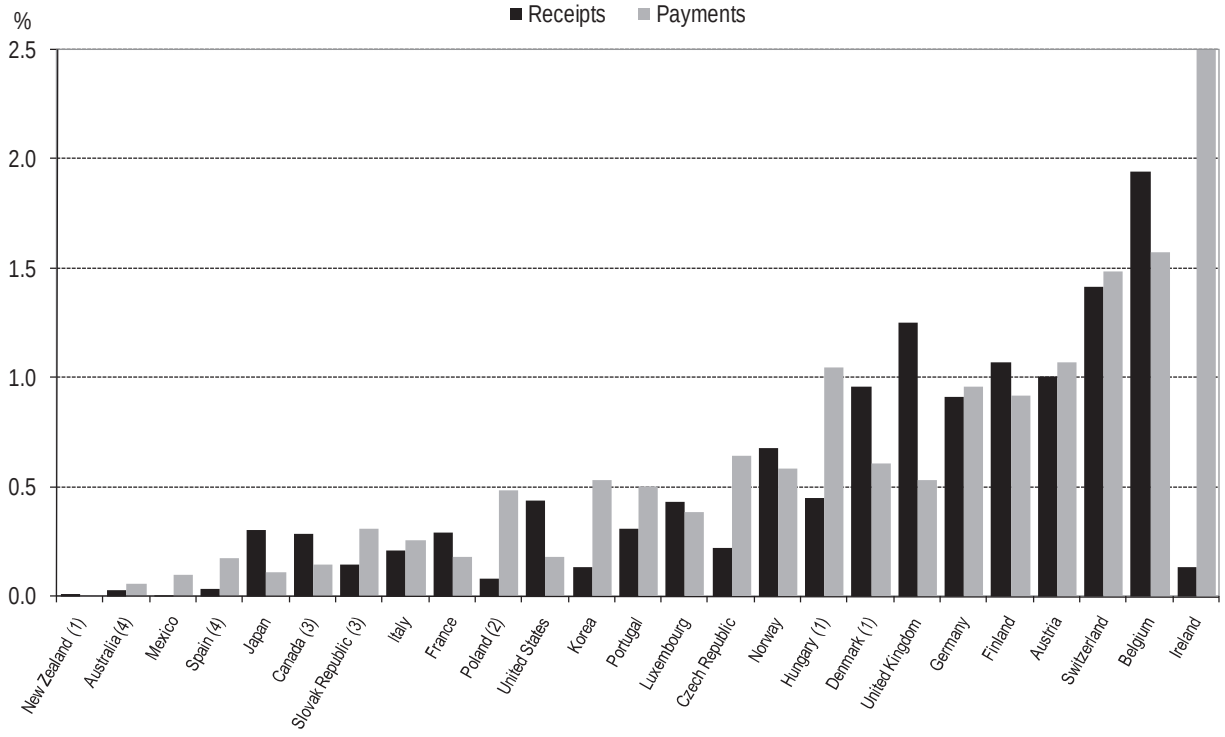
2. OECD excluding Czech Republic, Denmark, Greece, Hungary, Iceland Poland the Slovak Republic and Turkey. Data partially estimated

Source: OECD, Technology Balance of Payments.

Overall, the OECD area has maintained its position as a net exporter of technology (Figure 8.8). The European Union, however, has continued to run a deficit on its technology balance of payments. In Ireland, Hungary, the Czech Republic, Poland and Korea, the technology balance of payments shows a significant deficit (Figure 8.9).

Although the balance reflects a country's ability to sell its technology abroad and its use of foreign technologies, a growing deficit does not necessarily indicate low competitiveness in technology. In some cases, it results from increased imports of foreign technology; in others, it is due to declining receipts. Likewise, if the balance is in surplus, it may be due to a high degree of technological autonomy, a low level of technology imports or a lack of capacity to assimilate foreign technologies. In addition, since most transactions also correspond to operations between parent companies and affiliates, the valuation of the technology transfer may be distorted. Therefore, additional qualitative and quantitative information is needed to analyse correctly a country's deficit or surplus position.

Figure 8.9. Technology balance of payments (receipts/payments) as a percentage of GDP, 2003



Source: OECD, Technology Balance of Payments.

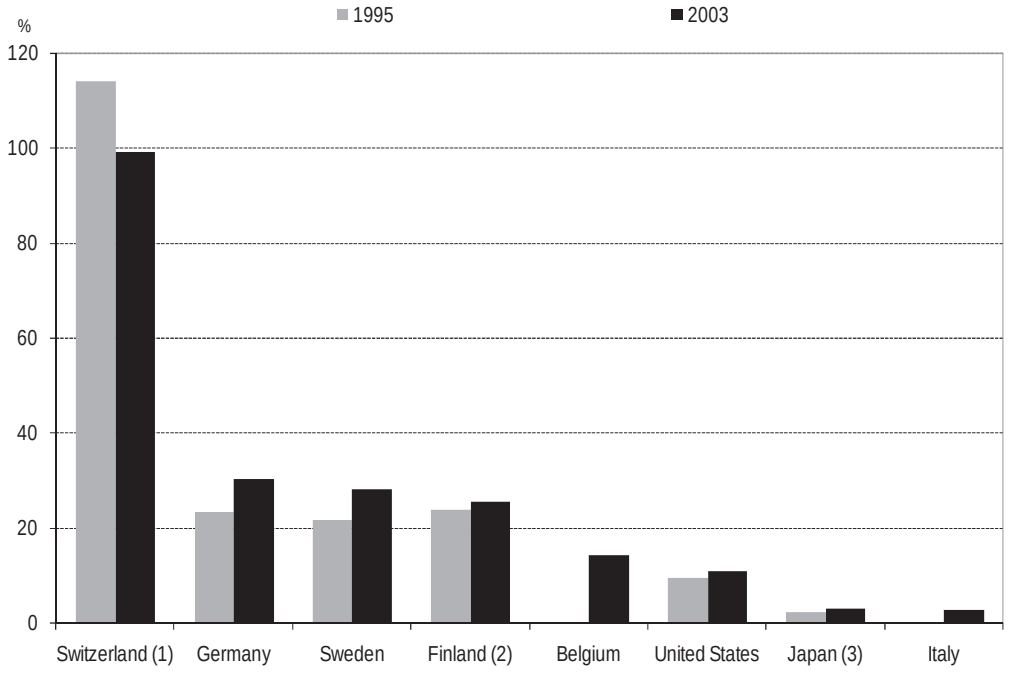
The financial transactions measured by TBP data encompass transactions between different firms as well as within MNEs. However, it is important to note that transactions within firms largely dominate. Hence TBP data mainly reflect international technology transfers within MNEs' R&D networks. The international R&D activities of MNEs not only significantly affect R&D investments and patent activities in host countries, they also influence to a large extent these countries' technology balance of payments. For example, Ireland's deficit in technology payments is due to the strong presence of foreign affiliates that import technology from their parent companies.

Increasing industrial R&D investments abroad by MNEs

The converse of the increase in inward R&D investment in host countries is the growth of R&D investments abroad by multinational firms. As noted above, MNEs' strategies until recently kept R&D at home while globalising other operations, but a newer strategy sees the world in terms of global technology sourcing. While data on outward R&D investment are less readily available than data on inward R&D investment because most countries do not undertake surveys relating to R&D activity by national firms' affiliates abroad, there is some direct and indirect evidence (see Box 8.2).

For countries for which data on outward investment are available in the AFA database, Figure 8.10 shows that R&D performed abroad has increased since 1995 relative to R&D performed at home. The only exception is Switzerland which has seen a slight reversal; nevertheless Swiss affiliates abroad do as much research as all firms inside Switzerland. Other countries show a smaller share of R&D investments abroad although the share is over 20% in Germany, Finland and Sweden.

Figure 8.10. Business sector R&D expenditure by affiliates abroad as a percentage of domestic R&D expenditure in selected OECD countries



1. 1996 and 2004.
2. 1993 and 1998.
3. 1997 and 2002.

Source: OECD, AFA database.

While these historical data may not allow for identifying the most recent trends, the internationalisation of R&D is confirmed by some recent surveys. A survey of the largest R&D investors, undertaken by UNCTAD from November 2004 to March 2005, suggests that the pace of internationalising R&D may be accelerating (UNCTAD, 2005): as many as 69% of responding firms stated that their share of foreign R&D is set to increase (only 2% indicated a decline and the remaining 29% expected the level of internationalisation to remain unchanged). Momentum appears to be particularly strong among companies in Japan and Korea, which have so far been less aggressive in terms of internationalisation of R&D: nine out of ten Japanese firms in the sample and about 80% of the Korean firms planned to increase their foreign R&D, while 61% of the European firms indicated similar intentions. The average firm in the UNCTAD survey spent 28% of its R&D budget abroad in 2003, including in-house expenditure by foreign affiliates and extra-mural spending on R&D contracted to other countries. Japanese and Korean MNEs displayed the lowest share of foreign R&D (15% and 2%, respectively).

Box 8.2. New initiative on the collection of data on R&D by foreign affiliates

It is widely agreed that various aspects of the data on the internationalisation of R&D need to be improved. The March 2005 OECD Forum on the internationalisation of R&D underlined the strong need to develop and improve indicators in this area. Many of the measurement issues related to cross-border flows have to do with how MNEs operate on a global basis and how they keep their books. For example, sales and purchases of R&D may include intra-company R&D (own account R&D) produced by separate entities on behalf of affiliated producers. MNEs may not be able, or rules on financial reporting might not require them, to distinguish all transactions undertaken by affiliates in different geographic locations. While MNEs have to produce a consolidated account, they may find it difficult to compile separate accounts for each affiliate.

A coherent and systematic framework is needed for analysing the internationalisation of R&D activities. Since R&D surveys are the vehicle commonly used to collect statistics international flows of on R&D funds, this seems a natural starting point. In the OECD working group of National Experts on Science and Technology Indicators (NESTI), new initiatives have been launched to analyse how countries apply the OECD's *Frascati Manual* to measure flows of R&D funds from and to abroad and how they use different sources to measure international transactions of R&D. An especially challenging area is measuring R&D performed outside the country by affiliate firms. In general, there is a need to understand the extent to which R&D surveys cover the target population of interest and capture R&D transactions within MNEs. There is also scope to leverage other surveys and administrative sources, to examine the extent to which they can be reconciled with R&D surveys, and to collaborate with national accountants on the issue of measuring international R&D transactions.

R&D investments abroad are largely located in OECD countries but also in emerging economies

As indicated, most internationalisation of R&D still takes place within the main OECD regions (with the United States the major location for foreign R&D). Developing countries are increasingly attracting R&D centres, however, although R&D investments remain relatively small from a global perspective. Large increases in foreign R&D investment in developing Asia, particularly in China and India, have attracted much attention in recent years. According to official Chinese statistics, some 750 foreign R&D centres had been established in China by the end of 2004, most of them after 2001. Over 100 multinational firms had established R&D facilities in India by 2004. Eight of the world's top ten R&D-spending MNEs have set up R&D centres in China or India (Microsoft, Pfizer, DaimlerChrysler, Genera Motors, Siemens, Matsushita Electric, IBM and Johnson & Johnson) (BAH, 2005).

This is confirmed by the location of R&D investments abroad for the United States, one of the few countries that publish recent detailed information. The main trends in the geographical distribution of US R&D investment abroad are set out in Table 8.1. The main change between 1995 and 2003 is the decline in the European Union's share as a destination and the increase in that of Asia-Pacific, especially China. The overall pattern of investment in other geographical zones has not changed significantly. In spite of the relative decline in its share, Europe continues to attract over 60% of US MNEs' R&D investment.

Latin America, eastern Europe, the Middle East and Australia together attract only 8.5% of total US R&D investment (Table 8.1). Among individual countries, the decline in US R&D investment in Europe mainly concerns Germany and France, while investment in the United Kingdom and Sweden doubled in value.

Table 8.1. R&D expenditures of affiliates of US parent companies abroad by country or zone of destination

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Canada	8.5	11.1	12.5	11.9	9.3	11.4	10.8	10.8	11.0
European Union (15)	70.4	66.9	66.4	68.6	65.6	61.0	58.8	61.4	61.5
Eastern Europe*	0.1	0.3	0.3	0.5	0.3	0.4	0.2	0.3	0.3
Latin America	3.1	3.9	4.5	5.1	3.4	3.2	2.9	3.7	3.1
of which Brazil	2.0	2.5	3.0	3.0	1.6	1.2	1.0	1.4	1.5
Africa	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Middle East	0.8	1.2	1.4	1.0	2.1	3.1	3.7	3.5	3.1
Asia-Pacific	14.8	14.8	12.8	10.9	17.8	19.2	21.3	18.0	18.2
of which Japan	10.2	9.5	7.5	6.6	8.4	8.0	7.6	7.3	7.4
China	0.1	0.2	0.2	0.4	1.8	2.5	..	3.1	2.5
Australia	2.3	2.9	2.5	2.0	1.6	1.7	1.5	1.5	1.9
Total	100	100	100	100	100	100	100	100	100
Total in billion USD	12582	14039	14593	14664	18144	20457	19702	21063	22328

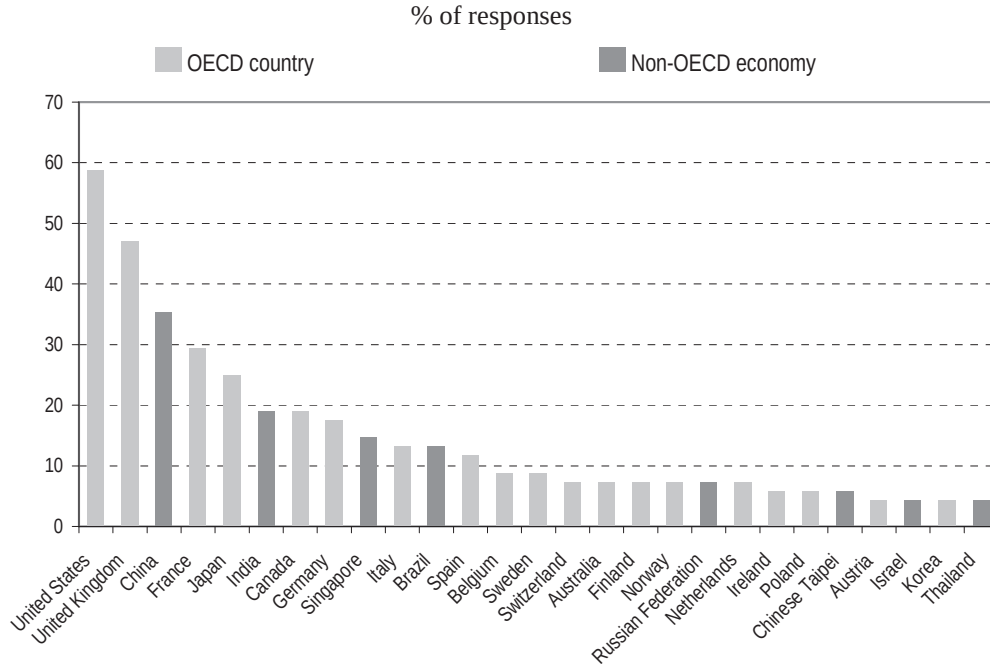
* From 1999 onwards, eastern Europe only includes the Czech Republic, Hungary, Poland and Russia.

Source: Moris (2005).

These emerging geographical patterns are confirmed by recent surveys on the location of R&D centres undertaken by different international organisations. In the UNCTAD survey of the largest R&D spenders worldwide, China (3rd) and India (6th) were among the top ranks as current locations for R&D (Figure 8.11). Other developing countries, including Singapore, Brazil and some eastern European countries, also appeared in the ranking. Likewise, recent information on new greenfield and expansion FDI projects involving R&D over the period 2002-04, reveals that of the 1 773 projects identified, 1 095 were undertaken in developing countries, eastern Europe and the Commonwealth of Independent States (CIS) (LOCO-monitor of OCO-consulting, cited in UNCTAD, 2005). More than 90% of these projects were undertaken by MNEs from developed countries; the United States was the top source country followed by the EU15 and Japan.

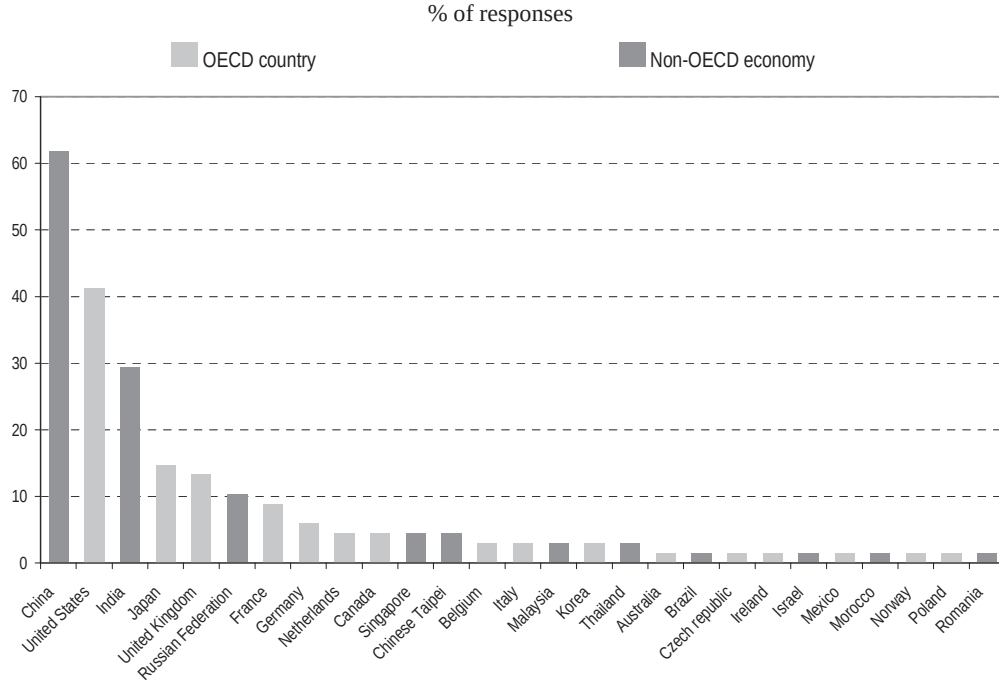
It is expected that this shift towards emerging countries will continue to some extent, as demonstrated by the findings on future R&D investments in the same UNCTAD survey (Figure 8.12). China was the R&D location mentioned most often, followed by the United States. India was in third place, and Russia was also among the top ten target locations. Other emerging economies named were Singapore, Chinese Taipei and Thailand.

Figure 8.11. Current foreign R&D locations



Source: UNCTAD (2005).

Figure 8.12. Most attractive foreign R&D locations



Source: UNCTAD (2005) in OECD (2006a).

Drivers of the internationalisation of R&D

MNEs' changing innovation strategies

The consensus among analysts has been that R&D is probably the least mobile of MNEs' activities because of its complex and tacit nature. Perhaps the most influential work in this respect was done by Pavitt and Patel (1999) in a series of studies from the early 1990s. They argued that the technological capabilities of firms were far less globalised than their other activities, such as marketing and investment in production facilities. Firms by and large performed R&D and undertook patenting at home for two main reasons. The first was the tacit, person-embodied non-transferable character of much technological knowledge, which led to locational "stickiness". Second, they argued that firms (even major MNEs) are strongly shaped by their home country's specialisations and national innovation systems (including for example, accumulated research skills and labour force skills). Therefore, R&D was only to a limited extent dispersed and the home market was the preferred location for performing R&D. Economies of scale in R&D and agglomeration effects, as well as the need for co-ordination and control of expensive and risky investments were also reasons for keeping R&D and the initial stage of production in the home location.

To exploit these intangible assets beyond the home market, firms preferred to set up or acquire affiliates in host markets through FDI rather than sell technology internationally through licensing. FDI allows the multinational to appropriate more benefits from its innovations, given the high transaction costs involved when transferring technology through market mechanisms. As firms increasingly locate production closer to their customers and suppliers they need R&D laboratories to adapt the technologies and products developed at home to local conditions. In this type of R&D facility technological knowledge tends to flow from the parent firm's laboratory to the foreign-based facility so that the technological advantages of the affiliate primarily reflect those of the home country (where the core of innovation activities continues to be concentrated) and foreign R&D units tend to exploit the existing parent-company technologies. This type of R&D site has been termed *"home-base exploiting"* (Kuemmerle, 1997), or *"asset-exploiting"* (Dunning and Narula, 1995).

Current evidence on flows of R&D suggests that the global business environment has changed. Because global competition has intensified, companies have been forced to innovate more quickly and develop commercially viable products and services more rapidly. Relevant knowledge has become increasingly multidisciplinary and global in scope, making innovation both more expensive and riskier. At the same time, some barriers to the dispersion of R&D have become less significant owing to rapid developments in information and communication technology. These trends imply changes in the governance of innovation in MNEs, with important implications for the role of subsidiaries in recognising and exploiting the potential for innovation.

This further implies that innovation strategies increasingly require global sourcing: they need to sense new market and technology trends worldwide and respond adequately by developing new ideas which are then implemented on a global scale. Technological spillovers from the local public knowledge base or from specific technological know-how present in the host locations and of benefit to the MNE at corporate level are absorbed as much as possible.

Such decentralised R&D activities have been defined as *"home-base augmenting"* (Kuemmerle, 1997) or *"asset-seeking"* R&D activity (Dunning and Narula, 1995). Pearce and Singh (1992) label these as "internationally interdependent labs", which play a role in the group's long-term basic research and will collaborate closely with similar labs. Through such investments, firms aim either to improve their existing assets or to acquire (and internalise) or create completely new technological assets by locating R&D facilities abroad. Knowledge relations between the foreign laboratory and the central home laboratory become far more interdependent (Archibugi and Michie, 1995, 1997; Cantwell, 1997; Pavitt and Patel, 1999). As a result of these changes, Cantwell (1997) has argued that while home bases remain very important:

> *"… technology leaders have altered the nature of international technology creation by pioneering the international integration of MNC facilities into regional or global networks. Globalisation in this sense involves the establishment of new international structures for technology creation. In the past, foreign technological activity exploited domestic strengths abroad … By contrast, today for companies of the leading centres, foreign technological activity now increasingly aims to tap into local fields of expertise, and to provide a further source of new technology that can be utilised internationally in the other operation of the MNC. In this respect, innovation in the leading MNCs is more genuinely international or, in the terminology used here, it has become 'globalised'."* (Cantwell, 1997, p. 236)

Location factors for different categories of R&D investment

From the perspective of home-based exploitation, motives for decentralising R&D are primarily demand-oriented and relate to market proximity when it is important to be close to "lead users" and to adapt products and processes to local conditions. Supply-related motives, *i.e.* those related to the creation and renewal of core capabilities by allowing access to a wider range of scientific and technological skills, are less important. The R&D undertaken in affiliates is merely adaptive, directed at customising technologies to local conditions. Such research is typically closely related to production and is determined by the size of the host market.

The shift towards subsidiaries that are actively engaged in R&D, not simply in incremental, adaptive innovations but also in radical innovations, points to supply-related location factors and the presence of scientific and technological skills. Location decisions for R&D facilities that augment those of the home base are typically supply-oriented, based not only on the host country's technological infrastructure, but also on the presence of other firms and institutions that may create spillover benefits that investing firms can absorb. Such externalities may result from spillovers of information from other R&D units, access to trained personnel, established links with universities or government institutions, and the existence of an appropriate infrastructure for specific kinds of research. The R&D undertaken in these affiliates is more innovative and/or technology-monitoring, and is largely determined by the quality of the individual components of the regional or national innovation systems. The precise features of a host country that are needed to attract innovative R&D depend on the industry and the activity involves.

A wide range of empirical studies have indicated that both demand- and supply-related motives are important for the location of R&D activities in host countries, but that technology-sourcing motives are on the rise (for an overview, see OECD and Belgian Science Policy, 2005). The distinction between adaptive and innovative R&D centres seems less clear in the real world. Knowledge flows from foreign units to the parent

company are more likely if the foreign affiliates undertake asset-augmenting R&D activities that generate knowledge that is valuable for the rest of the organisation. To be able to absorb localised sources of knowledge, foreign subsidiaries need to be embedded in the host country innovation system, but they also need to be embedded in the firms' organisational network. This explains why, according to most empirical studies, acquired units are less likely to contribute to the internal transfer of knowledge.

The role played by subsidiaries in the innovation process of MNEs depends on the technological capabilities and the strategic importance of the host market. At one extreme, subsidiaries can simply implement projects if they have low levels of technological expertise and if the market has little strategic importance. In this case the technology transfer is a pure import into the local market.

If the location has a high level of technological capability for a particular innovative project, it can be assigned a role in developing generic central know-how or even play a crucial leading role as a "centre of excellence" with a "global product mandate" (Rugman and Poynter, 1982). In such cases, the transfers of know-how are numerous, with the subsidiary responsible for sourcing know-how from other units of the MNE (including headquarters) but also for accessing external sources. For an effective global innovative strategy, know-how needs to flow across units and locations within the MNE. This requires effective linking of R&D units, mobility of staff, the existence of long-distance interpersonal communication and adequate reward systems and responsibilities (Westney, 1997; Bartlett and Ghoshal, 1997).

Choosing between mergers/takeovers and greenfield investment when internationalising R&D is to some extent determined by the firm's innovative strategy. Greenfield entry is the most common mode when setting up asset-exploiting R&D investment, as adaptive R&D has to be closely linked to production activities. In the case of technology-sourcing and asset-augmenting R&D facilities abroad, acquiring an existing R&D facility through a merger or takeover may be the preferred option in order to gain quick access to foreign knowledge. Overall, greenfield investment still tends to dominate in R&D investment abroad, with mergers and takeovers undertaken especially in more developed countries owing to their larger numbers of target R&D facilities.

Are location factors in emerging countries different?

Apart from the strong rise in the number of R&D centres in emerging countries, evidence also points to a qualitative shift in the activities of their R&D facilities. Asia appears to have taken the lead among developing countries in playing a more sophisticated role in MNEs' global R&D networks. Some R&D centres in these countries have evolved from performing adaptive R&D targeted at customising technologies to local markets into more innovative R&D for local markets but in some cases also for regional and global markets. This trend suggests that supply-oriented conditions, which are typical location factors for attracting foreign R&D, have become more important in some emerging countries.

Most emerging countries that have successfully attracted foreign R&D, motivated by the success of developed countries, have put in place policies to strengthen their national innovation system. Innovative R&D and technology sourcing are indeed still undertaken predominantly in developed countries, mainly because of the presence of world-class clusters of technological and industrial activity including centres of excellence and an effective national innovation system. In addition to proximity of manufacturing activities,

there are other reasons for the increasing attractiveness for foreign R&D of some emerging countries.

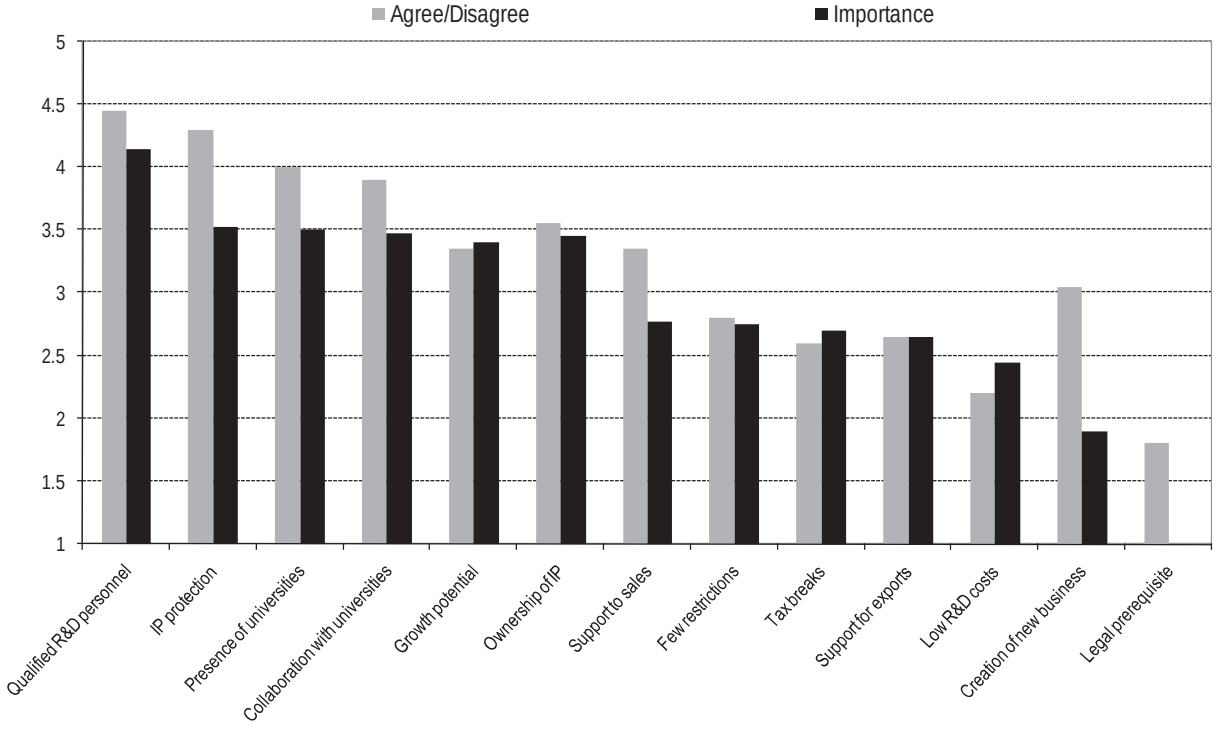
UNCTAD (2005) points to a new set of drivers for the internationalisation of R&D in the cost and availability of researchers. Intense global competition and rising R&D investments push MNEs to innovate quickly and efficiently to bring new products, services and processes more rapidly to market. Just as the internationalisation of manufacturing had important cost advantages, the internationalisation of R&D is also motivated to some extent by cost-cutting, resulting in outsourcing of activities and location of R&D in countries with low costs. However, the reason seems less to be lower wages *per se* than the available pool of skilled scientists and engineers. Schwaag (2006) identifies the presence of an increasingly strong and competitively priced human capital base next to markets and production facilities as the most important reason for locating R&D in China.

Some emerging countries seem to offer a combination of low wages and a good education system, that results in a large mass of well-trained researchers. In China, for example, only a small proportion, but a very large absolute number, of the population has a tertiary degree. Furthermore, absolute numbers of enrolments in, and graduates from, tertiary education in China match the numbers in the United States and the EU. However, China's level of enrolments in and graduations from advanced research programmes such as the PhD, is still low compared to other countries (Schaaper, 2005). Recently, however, some evidence has been presented on the suitability of new graduates from China and India for working in internationally active MNEs. Based on interviews with human resource managers, McKinsey (2005) concluded that on average only 13% of the potential talent supply in low-wage countries is suitable for employment by MNEs.

A recent survey by the Kauffman Foundation (Thursby and Thursby, 2006) on the reasons for locating multinational R&D in developed and emerging countries confirmed the lesser importance of (wage) costs (Figures 8.13 and 8.14). The survey found that emerging countries such as India and China will continue to be major beneficiaries of R&D expansion over the coming years. More than half of the respondents identifying the United States as their home country reported that they had either recently expanded or planned to locate R&D facilities in China and India; the percentage is somewhat lower for western European MNEs. R&D activities in emerging countries seem to build more on existing technology than those in developed countries. At the same time, however, the results indicate that firms increasingly move more basic and applied research to emerging countries than development and customisation work.

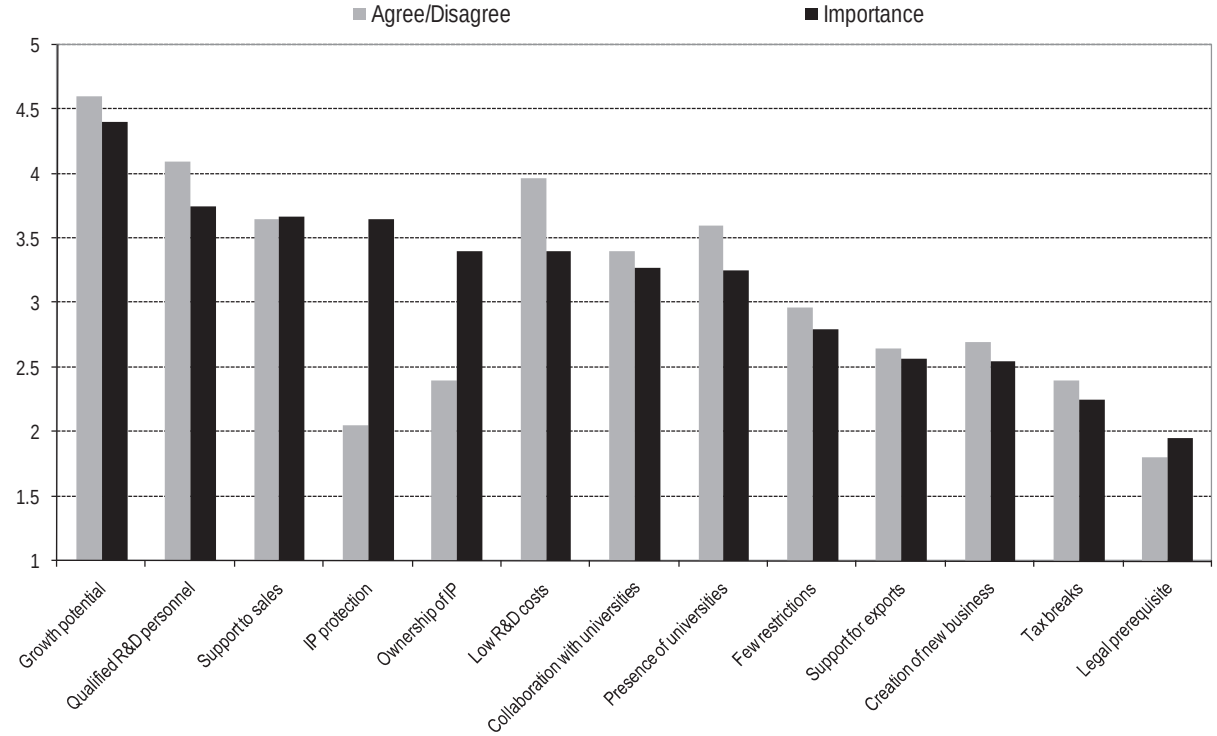
The results further indicate that growth potential, quality of R&D talent and collaboration with universities rather than low costs were crucial factors for locating R&D in developed countries. Surprisingly, the same three factors, not low costs, were found to be important for locating R&D in emerging countries. However, the lack of an effective IPR regime (especially its enforcement) as part of the national innovation system was an important deterrent for locating R&D in emerging countries.

Figure 8.13. Factors in locating R&D activities in developed countries



Note: A 5-point scale is used where 5 = strongly agree and 1 = strongly disagree; likewise 5 = extremely important and 1 = not important at all.
Source: Thursby and Thursby (2006).

Figure 8.14. Factors in locating R&D activities in developing or emerging countries



Note: A 5-point scale is used where 5 = strongly agree and 1 = strongly disagree; likewise 5 = extremely important and 1 = not important at all.
Source: Thursby and Thursby (2006).

Policy implications

Challenges and opportunities for the internationalisation of R&D

Until recently, R&D policy has largely been national in scope, often supporting the development of critical knowledge bases and technologies or particular national specialisations. The new forms of internationalisation of R&D, based on global sourcing and integration of complex knowledge bases, present challenges to national approaches. When innovation networks span national boundaries, how should national innovation systems relate to the global division of labour in knowledge production? A central problem is that many instruments of policy – R&D support, education and training policies and infrastructure policies – are predominantly national in scope.

A key policy problem, then, is how to integrate essentially national measures and instruments and companies' globalised knowledge strategies. Should policy measures themselves be more internationalised, and what is the future role for national instruments? In part, this is a matter, as suggested above, for major MNEs. But innovation and collaboration surveys have shown that smaller firms also engage in cross-border collaboration and international sourcing of knowledge. In fact, the internationalisation of R&D affects a large share of innovating firms and therefore all aspects of business-oriented R&D and innovation policies.

Some key policy issues are:

- What are the R&D benefits and costs of inward FDI, in terms of augmenting domestic capabilities?
- What national benefits might flow from the participation of national companies in global innovation networks or global supply chains and outward investment?
- How are changing strategies altering the cost and benefits of international R&D investments?
- How does internationalisation affect levels of domestically performed R&D, and hence national R&D intensities?
- How should national policy instruments be used to support integration with global R&D and innovation networks?
- What issues arise for host countries for creating absorptive capacity of global R&D flows?

These issues are discussed briefly in turn.

Attracting FDI in general and FDI in R&D specifically has traditionally been high on the policy agenda of many countries, based on arguments that inward flows of R&D provide net benefits for the host country. The prospect of acquiring modern technology, interpreted broadly to include product, process and distribution technology as well as management and marketing skills, is typically identified as the main component of this net benefit. Knowledge spillovers to the host country economy and its firms can have very positive effects, including an upgrading of domestic innovative capacity. In addition, there may follow important benefits for human capital: increased R&D employment, better training, support to education and formation, reverse brain drain effects. However, empirical evidence has largely shown that these spillover effects do not appear automatically. In order to maximise these positive effects, countries that receive FDI have to invest in networking and strengthen agglomeration effects in domestic clusters and the

absorptive capacity of the local economy. There then arise questions concerning the types of policy initiative that might support such effects.

On the other hand, it would be wrong to present attraction of foreign R&D solely in positive terms. There is a danger of loss of control over domestic innovative capacity, with potential damage to the technological competitiveness of domestic firms owing to intensified competition. Many empirical studies find that foreign presence lowers the average dispersion of a sector's productivity with firms with lower productivity exiting the market (see OECD and Belgian Science Policy, 2005). Some countries may become heavily dependent on FDI and on R&D performed by foreign affiliates, and minor changes in location decisions might have large impacts on the local R&D base in these countries.

There are also policy questions relating to the benefits of outward R&D flows. The key question is how to benefit not only from attracting and retaining R&D, but also from encouraging firms to engage in global innovation networks and capture economic benefits from global innovation activities. Such flows may generate positive effects for home countries, since the transfer of knowledge is not unidirectional. An MNE may benefit from establishing subsidiaries in foreign centres of excellence by drawing on the existing stock of technical knowledge and by learning from innovations of local firms. Smaller firms may benefit from greater involvement in global networks and significantly expand their innovative capabilities. Griffith *et al*. (2004) have recently cast interesting light on the benefits of the internationalisation of R&D by exploring the spillover effects of locating in the United States. They analysed UK firms that had located R&D facilities in the United States and showed that total factor productivity (TFP) growth was higher in these firms than in UK firms that had not located there. This suggests a specific spillover effect from internationalisation of R&D. Moreover the effect was stronger for firms whose productivity gap with the United States was greatest, that is, the benefits were greater for those with the "most to learn".

The shift towards asset-augmenting and technology-sourcing internationalisation of R&D has caused concern among policy makers of both net recipient and net source countries. Foreign subsidiaries increasingly try to tap into the knowledge generated in centres of excellence around the world. This has led to combined inward and outward learning and reverse and interactive technology transfer between different organisational and geographical locations. Governments of net recipient countries fear that foreign-owned firms may act as "Trojan horses" and both reduce the national technology and production base and keep the core of their innovative activities in their home countries. For the host economy, the trend towards technology-sourcing motives for internationalising R&D would predict more potential for diminishing than for increasing domestic innovative capacity. At the same time, however, it creates more scope for potential benefits since more technology transfers to the host locations are likely to take place. For their part, countries that are net sources of foreign R&D investment are worried that the internationalisation of R&D may erode ("hollow out") the domestic knowledge base, because foreign affiliates may export technology developed at home and because fewer R&D activities may be undertaken at home.

Some policy makers, especially in countries with R&D intensity targets, are concerned by the scale of inward and outward flows of R&D, because they affect levels of domestically performed R&D. While this may not be a major issue in terms of volumes of R&D, it can be a cause for concern in particular sectors. It can also be a problem for some small economies with large MNE R&D performers because relatively small

relocation decisions by key firms can substantially affect volumes of business expenditure on R&D (BERD).

It is claimed that individual countries cope with globalisation largely according to the characteristics of their national innovation systems. That is, success in the global economy depends on local capabilities. International R&D activities are currently driven by the need to interact with local systems of technological competence and end users. Many of these systems are affected by national policies. The core components of innovation systems are education provision at all levels (and related human resource policies), labour market institutions, provision of physical and knowledge infrastructures, corporate and public sector governance arrangements, and R&D support policies. To differing degrees, all of these elements of the system are – subject to budget constraints – developed through discretionary national policies. Two policy challenges stand out at present: education provision and knowledge infrastructures (such as universities, public-sector research organisations, standards organisations and government laboratories). Policies in these areas may be critical to accessing the benefits of internationalised R&D flows. As an example of how measures in these areas can affect flows, the funding of the infrastructure for biotechnology and biopharmaceutical research by the US National Institutes of Health appears to be linked to strong inward R&D flows. Global pharmaceutical companies clearly seek to locate close to the major US infrastructure in these fields.

Finally, there is an issue of absorptive capacity. With the growth of new world centres of excellence, the economic welfare of a country or region depends increasingly on its ability to assimilate and acquire knowledge developed elsewhere. In this respect, the absorptive capacities of both large and small enterprises, as well as R&D institutions, need to be strengthened. In addition, international mobility needs to be fostered. Local firms, institutions and researchers need to be encouraged to access international networks and to network in domestic clusters with foreign firms. At the same time, the foreign R&D activities of MNEs may provide access to foreign technologies and therefore be a channel for transferring knowledge back to the home country. There is some empirical analysis to suggest that to benefit from technology acquired abroad by their own MNEs, home countries should develop their absorptive capacity and networking to enable technology sourcing through multinational firms. In addition, to compensate for the internationalisation of R&D investment by its domestic firms and for institutions and R&D workers moving abroad, a country should be able to simultaneously attract innovative companies, R&D institutes and R&D workers from abroad. The following section traces some policy responses to these emerging issues in OECD countries.

Policies towards the internationalisation of R&D

In order to gain insight into how OECD countries are tackling increasing internationalisation of R&D, the OECD conducted in 2005 a policy survey analysing practices with respect to the internationalisation of R&D in OECD countries. Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Korea, the Netherlands, New Zealand, Norway and Poland were willing to share some features of their policies. The main conclusions are described in the following paragraphs.

While incentives to attract FDI in general are quite common, special incentives for FDI in R&D are relatively uncommon. This is in line with theoretical and empirical findings that show that R&D investment by MNEs is largely driven by fundamental economic factors (market size, tax rates, labour market conditions, etc.), the political environment (stability and an appropriate public infrastructure) and the scientific and

technological specialisation and capabilities of the country. Only one country reported offering direct financial support for FDI in R&D (Australia through its Invest Australia Strategic Investment Coordination).

Countries have a number of initiatives to attract foreign firms and link domestic firms to foreign knowledge. The measures are mostly non-monetary in nature and concentrate on administrative and managerial support, matchmaking between domestic and foreign firms willing to co-operate, provision of information services, consultancy services, etc. Several countries indicated that they offer some administrative support and/or infrastructure (Austria, Germany, France, Italy and the Netherlands). Investment agencies in almost all countries were especially active in recruitment and advertising (examples include Invest in Denmark, Invest in Finland, and the Netherlands Foreign Investment Agency).

Non-discrimination *vis-à-vis* domestic firms and free access to national funding for domiciled foreign-owned enterprises is the guiding principle for the treatment of foreign affiliates in most OECD countries. In Austria, for instance, the Kplus programme stimulates indigenous industry, on the one hand, and knowledge pools of technical expertise independently of their domestic base, on the other. In Finland Tekes has opened its technology programmes in order to gather sufficiently large clusters of competence able to attract international interest. In Germany, the federal government provides various instruments that promote research co-operation between foreign firms or research partners and German partners. In the Netherlands, foreign-owned affiliates and foreign research institutions domiciled in the country can participate in national research projects. However, New Zealand applies the criterion of "national benefits" for allowing foreign firms and institutes to access national R&D programmes.

An important determinant of a country's attractiveness is the quality and specialisation of the domestic knowledge base. Hence, all measures to improve the scientific and technological capabilities of an economy will also increase the country's attractiveness for R&D investment by MNEs. In this context, the most important measures relate to human resource development, intellectual property protection, a first-class knowledge infrastructure, excellent universities and research organisations, and co-operative partners in the business enterprise sector.

Promoting international collaboration in science and technology and helping to link domestic enterprises to knowledge abroad is high on the agenda of OECD countries. However, domestic enterprises must have a certain level of technological expertise to be able to absorb spillovers from foreign affiliates. Since these spillovers are regarded as one of the main benefits a country derives from the presence of MNEs, the technological capacities of the domestic economy also crucially affect the degree to which countries benefit from FDI in terms of technological effects (rather than the more usual benefits of employment, value added, etc.). The Australian government supports collaboration of domestic firms with foreign innovators via various programmes (Intelligent Manufacturing Systems, Commercial Ready, Invest Australia and Cooperative Research Centres). Denmark provides financial support for SMEs that want to submit an application for international research programmes (*e.g.* the EU Sixth Framework Programme). Germany provides through Pro InnoII (the major co-operation programme for SMEs) a specific promotion bonus for projects involving European partners.

Another key area for policy initiatives is the attraction of international talent. Countries make considerable efforts to remove barriers to the mobility of highly skilled personnel. This area can be expected to gain in importance in the coming years. Australia's migration programme for example strongly emphasises developing Australia's skills base. While Canada does not articulate a deliberate strategy to augment its S&T capacity through immigration, some measures greatly facilitate the immigration of highly qualified personnel. Denmark has a special 25% tax scheme which provides favourable conditions for foreign employees and researchers. Japan has widened the career path of foreign researchers. In Korea, the Brain-Pool programme and the exchange programme support the invitation of foreign scientist to Korea, while the Post-Doc programme provides foreign scientists with opportunities for research and training. Australia, Canada, Denmark, Finland, Germany, Italy, Korea, the Netherlands and Poland have all implemented incentive/supporting schemes for the return of expatriated scientists and engineers.

To date, policies have largely been *ad hoc* and aimed at specific problems, such as lack of inward investment, lack of mobility of human resources, and too much mobility, *i.e.* brain drain. However more holistic approaches are emerging in some countries. The examples in Box 8.3 show some interesting recent practices aimed at benefiting as much as possible from the internationalisation of R&D.

Box 8.3. Policy practices

Ireland: an integrative approach

In contrast to other European countries, Ireland's rapid economic development has been strongly based on industrial policy and substantial investments in innovation measures. Although business expenditure on R&D remains low, 80% is accounted for by foreign-owned MNEs. Ireland is therefore commonly regarded as a success in terms of inward investment owing to its proactive stance. Headed by the Industrial Development Authority (IDA), it has gained an international reputation for its emphasis on policy independence, continuity and consistency (Tekes, 2004).

With regard to the framework for taking decisions, grant concessions were tied to well-defined objectives (employment, R&D), and repayment was required in case of an MNE's failure to comply. Additionally, policy implementation was always on a project-company basis, and explicit sectoral targeting was a defining feature of Irish policy. In fact, MNEs were not attracted to sectors in which Ireland traditionally had an advantage but to high-technology industries; FDI therefore had a tangible impact on Irish industry, as it motivated a structural shift in sectoral and regional terms. As a result, Ireland had significant growth in FDI inflows over the last decade with the greatest part accounted for by greenfield investment or expansions rather than mergers and acquisitions (Molero and Alvarez, 2004; Tavares, 2004).

In order to attract new investments, Ireland has used from the end of the 1990s a very bold and expensive set of instruments, upgrading the physical infrastructure of the universities and making massive investments in strategic research in biotechnology and ICT. The Science Foundation Ireland (SFI), an agency of the industry ministry, offers very large grants to foreign-based researchers willing to move to Ireland and establish research groups, followed by smaller grants, open to nationals as well as those abroad. Other incentives include inward mobility schemes for individual researchers and those with key skills, and reduced fees for non-EU postgraduate students. Furthermore, there is an innovation support programme aimed especially at strengthening the capabilities of Irish plant, and corporation taxes are still low (Tavares, 2004; Tekes, 2004).

…/…

Box 8.3. Policy practices *(continued)*

Finland: The role of Tekes

In the 1980s Tekes' technology programmes were mainly focused on accessing and managing rapidly developing technologies for industrial purposes. In the 1990s, the scope of technology programmes broadened to address issues such as changes in the competitive environment of enterprises and regulatory issues. Today Tekes' technology programmes have a much wider scope, providing opportunities to participate in networking and to gain from spillovers from other projects.

Over half of Tekes' R&D funding for large enterprises is now directed through technology programmes with a strategy for the internationalisation of R&D based on four elements: selective project funding, national technology programmes, promotion of innovative activity and development of innovation environments. Tekes' technology programmes are in principle targeted or mission-oriented and are open to participation by foreign companies in four ways:

- *Joint projects* based on a common objective, shared resources and tasks. Each party covers its own costs and uses the results as agreed among the participants;
- *Subcontracting* gives participants the possibility to purchase services from a foreign entity to complement the project, provided no domestic source is available;
- *Technology transfer* enables project participants to purchase licensed or existing technology from a foreign entity to complement R&D project work.
- *Collaboration* for marketing and distributing the project results allows project participants to collaborate with foreign enterprises to bring products to the market.

In 2001, 36% of all technology programmes financed by Tekes involved international co-operation. Expenditures for these projects represented about 45% of the total volume of funding provided by Tekes; 56% of the foreign participants came from Europe, 28% from the United States and 5% from Japan (Tekes, 2004).

Austria: The Kplus programme

To face the challenge of improving the effectiveness and efficiency of its innovation system, Austria has chosen to create new structures for science-industry co-operation. To build up scientific capacities operating in thematically relevant and technological fields, temporary research institutions called Kplus Centres have been established. Kplus Centres are generally founded through formal partnerships between universities and enterprises, are focused on the creation of a new culture of collaboration and are based on the principle of non-discrimination. To support interdisciplinary and complementary co-operation in specific scientific fields, foreign-owned firms are encouraged to participate.

Today there are 18 active Kplus Centres that carry out R&D on an internationally competitive basis in networks with about 270 partners from industry and 150 from science and technology. The share of foreign companies participating is high; in 2003, 10% of total expenditures came from foreign-domiciled companies, *i.e.* companies which have not settled in Austria but participate in its Competence Centre Programme. According to the programme guidelines the cumulative share of foreign-domiciled companies must be less than 25% of the total volume of each competence centre. Furthermore, 13% of all participating companies are foreign-domiciled; a percentage that reaches 34% in individual Kplus Centres, *e.g.* in the Austrian Centre of Competence for Tribology (ACT). The percentage of foreign PhDs is 50% in centres such as the Competence Centre of Applied Electrochemistry (ECHEM).

The Netherlands: Twinning centres

Since the Netherlands is the home base of a number of significant MNEs, there have for some time been concerns that corporate R&D might migrate out of the country. Accordingly, a major policy challenge is to improve the climate for innovation and therefore enhance international networking. One approach that helps to make the Dutch economy more dynamic is the establishment of the twinning centres, a sophisticated cluster approach that combines a local competence centre and an incubator model with strategic networking with global lead markets. For this purpose, networks of local companies have been activated, and leading foreign companies and universities are integrated into these networks. Public incentives encourage an increase in new companies, especially in the ICT sector, through funding, coaching and networking (Edler and Mayer-Krahmer, 2003).

Policy summary

Policy recommendations for facing the challenges and opportunities raised by the internationalisation of R&D should take into account national policy objectives as well as the specific features of science and innovation systems. However, some general policy conclusions can be drawn:

- First, if countries want to attract foreign R&D, it is essential to look at the economic fundamentals. Inward R&D investment is closely related to policies that influence attractiveness for FDI in general. Factors such as political stability, public infrastructure, market size and development, tax rates and labour market conditions are decisive in decisions to locate R&D. Policy should provide and secure a "healthy business environment".
- Second, an adequate R&D policy for facing the challenge of internationalisation of R&D should not be designed in isolation from other policies. An effective R&D policy implies co-ordination among various policy makers, linking R&D with other policy areas, particularly research and technology development (RTD), innovation, education, economic affairs and foreign affairs. Close co-operation among decision-making instances or even integration should be explored to guide prioritisation processes and to better exploit synergies in order to optimise the national innovation system (OECD, 2005c).
- Third, measures to build an innovation-friendly environment and increase a country's scientific and technological capacities also help to attract foreign R&D. A strong and vibrant academic and industrial research base, effective protection of intellectual property rights and a well-trained workforce are major determinants of MNE investment in R&D but also promote the growth of domestic enterprises. Hence, these policy measures should be aimed simultaneously at domestic and foreign-owned or domiciled enterprises and should not discriminate against foreign firms.
- Fourth, the creation of a framework of local conditions that foster R&D is crucial. Increasing the local R&D force can create the necessary absorptive capacity to profit from the presence of FDI in R&D, to attract FDI in R&D and to foster international networking. The provision of a strong local infrastructure for business in general and for R&D in particular is very important. Prior building of technological capabilities within a country's firms is crucial for their ability to interact and absorb knowledge made available by inward and outward FDI. Technological upgrading can be ensured by setting up a local infrastructure for industrial research, technological development and innovation through science parks, business incubators and technology transfer centres. Policy should try to attract and support R&D by providing a consistent (location- and not ownership-based) grants and tax regime, adequate IP protection (*e.g.* the cost to patent in the EU is still far higher than in the United States).
- Fifth, human capital is a cornerstone of R&D. Provision of human resources is the primary task of universities but is also a task for firms. Therefore, inter-firm co-operation or co-operation between firms, universities and public research organisations focused on learning by local staff should be encouraged. An important element here is the mobility of highly skilled labour. Although policy has less influence on cultural and structural barriers, it can focus on reducing political and technical barriers such as immigration legislation, red tape, taxation and S&T-related legislation. This would allow firms to make use of foreign talent and thus import important knowledge.

Policies for attracting and retaining foreign highly skilled labour are a most important area of governmental policy with respect to the internationalisation of R&D. Policy and legislation do not drive the mobility of highly skilled labour but can facilitate or hinder it. Measures to be taken include grants, immigration legislation and tax issues. The presence of a critical mass in excellent research centres is vital for attracting experienced researchers. Ongoing work at the OECD is aimed at development of good policy practices in this context.

Conclusions

This chapter has argued that an important change is under way in the international dimensions of R&D performance. Increasing cross-border flows of R&D are a major trend and feature of the world economy. Gross flows are rising, and in many OECD economies significant shares of domestic R&D are performed by affiliates of foreign firms. The converse is that firms headquartered in particular OECD countries are performing increasing amounts of R&D outside their home base. The transition is not just in the changing scale of the internationalisation of R&D but also in its drivers. In the past, firms undertaking FDI tended to keep their major technology-creation activities in or close to their home bases. Now R&D is accompanying FDI, and firms appear to be relocating R&D to benefit from knowledge capabilities that are distributed across countries, either in partner companies or in public-sector knowledge infrastructures. This reflects the growing complexity of industrial and service sector knowledge bases which requires firms to build global strategies to access relevant R&D results and knowledge capabilities. It is well-known that MNEs are invariably multi-technology companies, but the sources of MNE technologies are now also more widely distributed geographically and require worldwide location strategies.

This development raises complex policy issues. For most OECD countries, S&T policies remain predominately national in scope, and few countries have fully recognised the implications of the current internationalisation of R&D. In part this is because the full implications are not yet clear, and this is certainly an area in which further research and analysis is required. The increasing mobility of R&D is accompanied by the increasing mobility of highly skilled scientists and engineers. This has implications not only for education and infrastructure policies, but also for a wide range of policy arenas – tax policies, regulatory frameworks and standards setting, among others. This suggests that measures that influence MNEs' location decisions are of increasing importance for policy makers who wish to maximise spillover and other benefits from R&D.

An important emerging dimension of these trends is a change in North-South relations in global R&D. R&D and innovation activity are moving to a number of rapidly developing economies where R&D, and particularly FDI-related R&D, is growing rapidly. The situation of the BRICS (Brazil, Russia, India, China and South Africa) is covered in other chapters of this volume, but it should be noted that their innovation capabilities are growing, and that these countries are increasingly considered as locations for R&D facilities by MNEs.

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OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(92 2008 06 1 P) ISBN 978-92-64-04630-6 – No. 56217 2008

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ISBN 978-92-64-04630-6
92 2008 06 1 P