

Debande, Olivier

Article

De-industrialisation

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ABSTRACT

This paper observes that de-industrialisation has been mostly relative in Europe, with industrial value added and employment shrinking in relative terms, but industrial value added growing in absolute terms – at least until recently. Qualitatively, this relative de-industrialisation has been the result of a number of supply-side factors, including improving labour productivity; changing comparative advantage of countries; and trade liberalisation. Demand-side factors have played a role, too, as rising income levels and population ageing in developed countries have led to changing consumption patterns. Quantitatively, factors internal to advanced economies, such as productivity growth and changing consumption patterns, explain 70 percent of the downtrend in European industrial employment. External trade, including with low-wage economies, is less important, although its role has shown some signs of strengthening in the past decade. All in all, the causes of de-industrialisation do not reflect market failures, and the process should not be resisted. However, it may have transitory economic and social pain as a consequence, which may well warrant public intervention.

Olivier Debande (debandeo@eib.org) is Senior Economist in the Projects Directorate of the European Investment Bank. He would like to thank, without implicating, Constantin Christofidis, Eric Perée, Armin Riess, and Timo Väilä for their helpful comments and suggestions on preliminary versions of this text. This contribution has also benefited from comments of participants at the 2006 EIB Conference on Economics & Finance. The opinions expressed in this paper are solely those of the author and do not necessarily reflect the views of the European Investment Bank.

De-industrialisation

1. Introduction

The transition towards a service-dominated economic structure in high-income countries has, by implication, involved a retreat of their industrial sectors. Industrial employment and output have been losing ground, as service sectors have become increasingly dominant in employing workforce and driving national income growth. The transition from an industrial to a service-dominated economy has been very gradual, stretching over decades in countries of the European Union, Japan, the United States, and elsewhere.

At the same time, especially labour-intensive manufacturing production has increasingly been moved away from high-income countries to middle- and low-income countries. This relocation of industrial production has accelerated in the last decade or two, alongside greater liberalisation of trade and capital flows, as well as rapid growth and development in emerging market economies.

These two developments have been associated with the concept of 'de-industrialisation' in high-income countries, often taken loosely to imply a wholesale demise of industry. The roots of de-industrialisation may vary from country to country, with the 'pull' from services more important in some countries and the 'push' by more profitable production in low-income countries more important in others. Nevertheless, the end result in either case is the retreat of the industrial sector.

The aim of this paper is to document the character and extent of de-industrialisation in the EU, Japan, and the United States, to examine the driving forces behind it, and to discuss possible future developments and the scope for policy intervention. Section 2 details the characteristics of the de-industrialisation process in Europe, Japan, and the United States. Section 3 identifies the factors driving de-industrialisation and examines their relative importance. To give the analysis a forward looking spin, Section 4 discusses the comparative advantage of European industry and expected changes therein. Section 5 concludes and draws policy lessons.

2. Characteristics of de-industrialisation

It is customary to distinguish between two different types of de-industrialisation: relative and absolute. Relative de-industrialisation refers to the reallocation of productive resources among economic sectors, with the share of industry in economic activity declining relative to other sectors, notably services. Absolute de-industrialisation, in turn, refers to industrial decline in absolute terms, characterised by a downtrend in real industrial activity over time.

Output and employment are the most common indicators of industrial activity used to assess de-industrialisation. Thus, relative de-industrialisation would be characterised by a declining share of industrial output, or value added, in total value added and a declining share of industrial employment in total employment. Absolute de-industrialisation would mean that industrial output and employment trend down in absolute terms. Note that relative de-industrialisation can well be associated with an absolute increase in industrial output and employment; it is just that their growth rates are lower than the growth rates of output and employment in other sectors, which lowers the share of industry in the economy.

Against this background, the aim of this section is to examine whether the de-industrialisation process in Europe has been relative or absolute in character in the past three to four decades and whether the European experience is similar to or different from that in Japan and the United States.

So let us start by considering the evolution of industrial output and employment in relative terms. As shown in Figure 1, industrial value added as a share of total value added has declined from

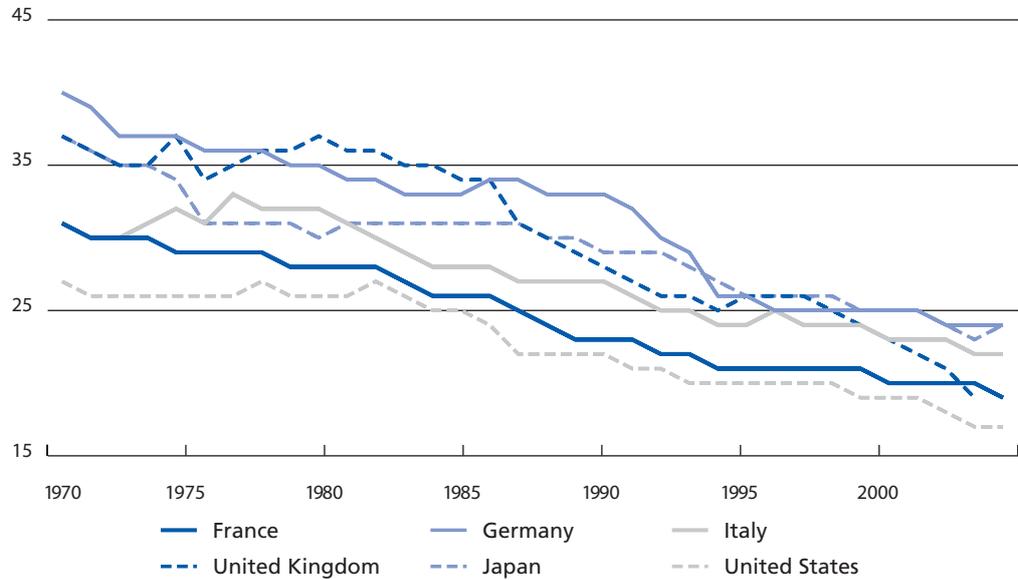


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The share of industry in total value added has declined by almost half in Europe since the early 1970s.

30-40 percent in the early 1970s to 20-25 percent now in European countries and in Japan. The share of industrial value added in the United States was at this level already in the 1970s, and it has declined further since then, to below 20 percent now.

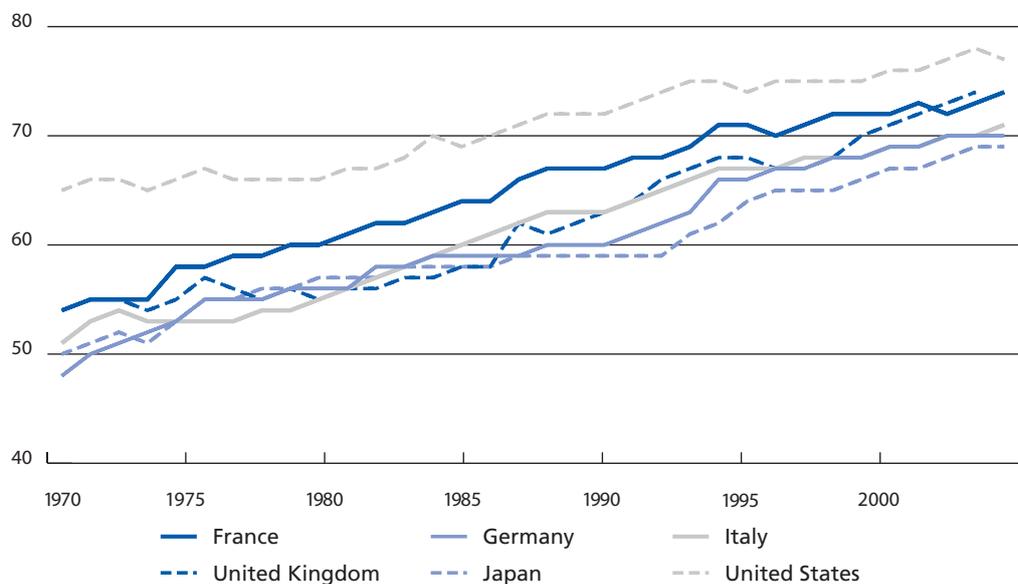
Figure 1. Industrial value added relative to total value added (%), 1970-2003



Source: OECD STAN database.

At the same time, as shown in Figure 2, the share of services in Europe and Japan has increased from 50-55 percent of total value added to around 70 percent now, thus occupying the ground lost by industry. Again, the United States is somewhat different, with services at 65 percent of total value added already three decades ago, reaching more than 75 percent now.

Figure 2. Value added in services relative to total value added (%), 1970-2003

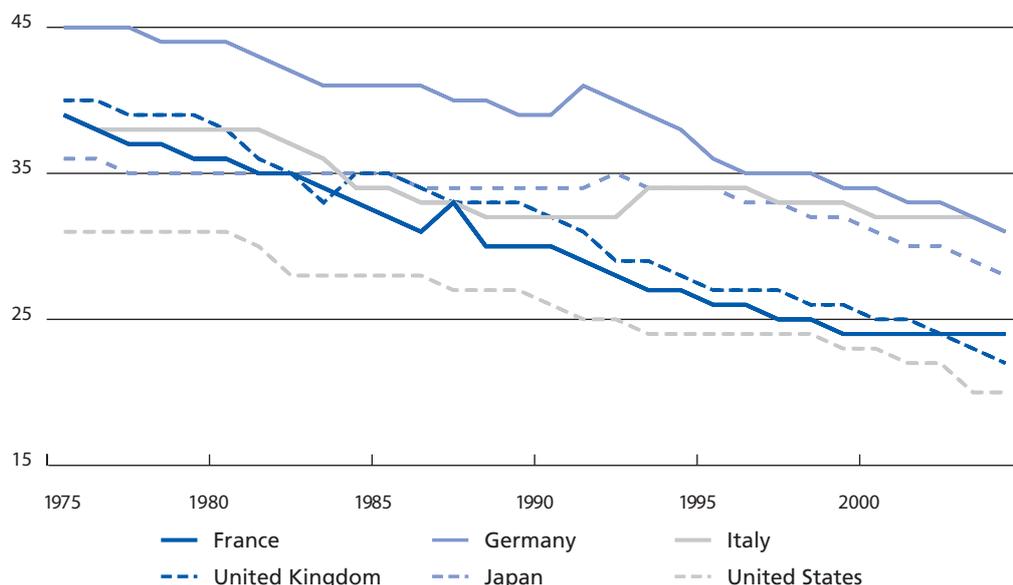


Source: OECD STAN database.

Turning then to the relative employment shares, Figures 3 and 4 demonstrate that the share of industrial employment in total employment in Europe and Japan has declined from around 40 percent in 1975 to just over 25 percent. In the United States, the decline has been from 30 to 20 percent. Meanwhile, the employment share of services has increased in Europe and Japan from 40-60 percent three decades ago to around 70 percent now, and in the United States it has grown from 65 to almost 80 percent.

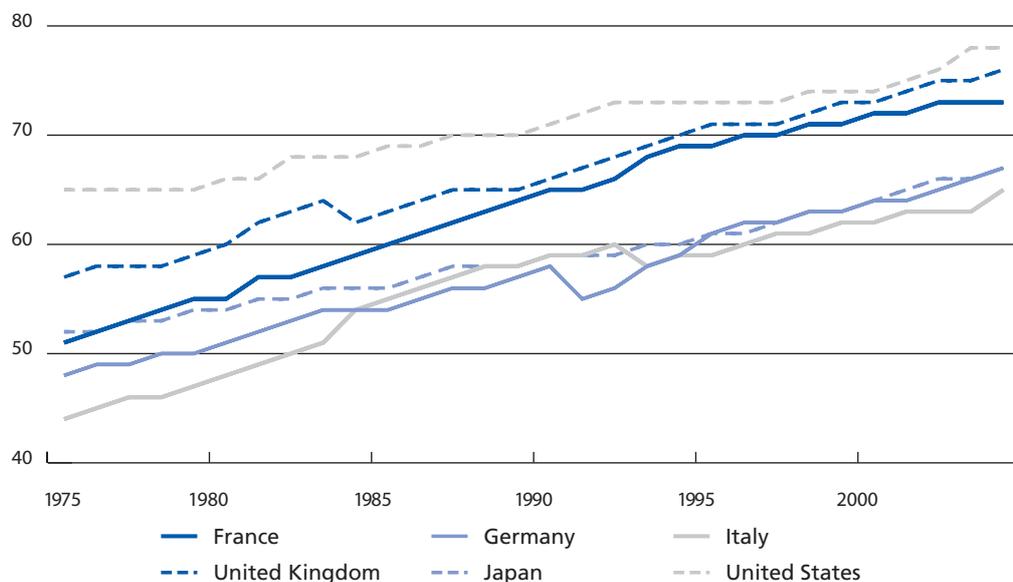
Industry employs 25 percent of workforce, in contrast to 40 percent three decades ago.

Figure 3. Manufacturing relative to total employment (%), 1975-2004



Source: Labour force statistics OECD.

Figure 4. Employment in services relative to total employment (%), 1975-2004



Source: Labour force statistics OECD.

All in all, it is clear that Europe, Japan and the United States have all experienced relative de-industrialisation in terms of both output and employment. In all cases, industrial output and employment have lost between one-third and one-half of their share in total output and employment. This loss has been accompanied by an equivalent increase in the relative share of services.

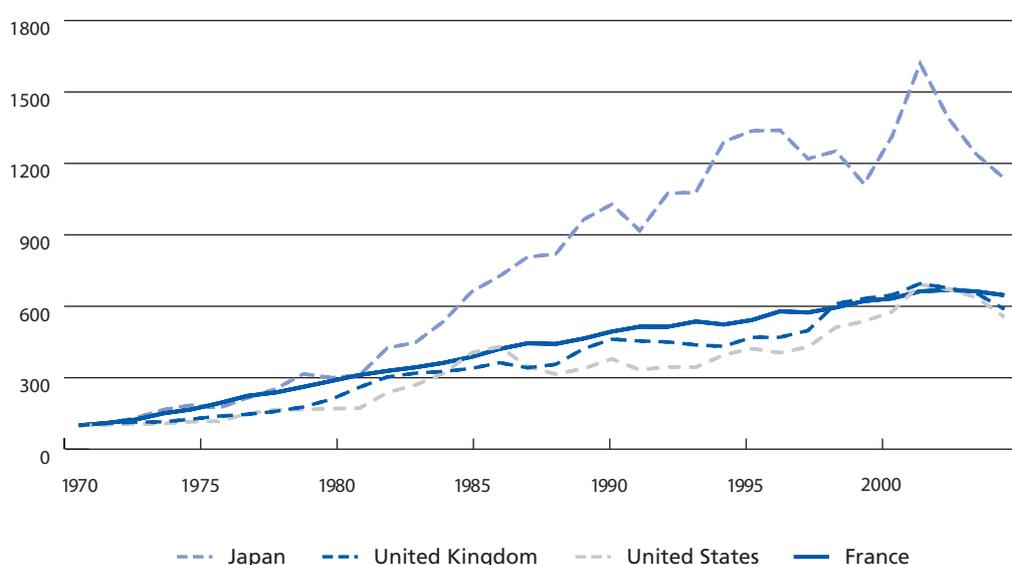
As a brief detour, let us put this relative de-industrialisation in a broader context and take a glimpse of even longer-term changes in the relative shares of agriculture, industry, and services. Historical data by Maddison (1991 and 2005) and the OECD (2003) covering the period from 1870 through 1999 show that the employment share of agriculture in the United States dropped from a half to just a few percent during that period, while the share of industry started off at around one-quarter, peaked at one-third in the early 1950s, only to decline to about 20 percent at the turn of the millennium. Consequently, the employment share of services rose from one-quarter in 1870 to three-quarters in 1998.

The evolution of employment shares was broadly similar in Europe, except in the United Kingdom, where industrialisation had started earlier and where the employment share of industry had reached 40 percent by 1870. In contrast, industrialisation started later in Japan, where agriculture employed as much as 70 percent of the workforce in 1870. Despite these differences, the employment shares of agriculture, industry, and services had converged to similar levels in Europe and Japan by 1999.

In absolute terms, industrial output has been growing rapidly.

Turning then back to developments in the past three to four decades, it remains to examine whether the relative de-industrialisation discovered earlier has been due to an absolute decline in industrial output and employment or just their slower growth relative to the rest of the economy. Figure 5 demonstrates that industrial value added has grown in absolute terms by as much as 5-6 percent per year on average since 1970 in Europe, Japan, and the United States.

Figure 5. Volume of industrial value added (1970=100), 1970-2003



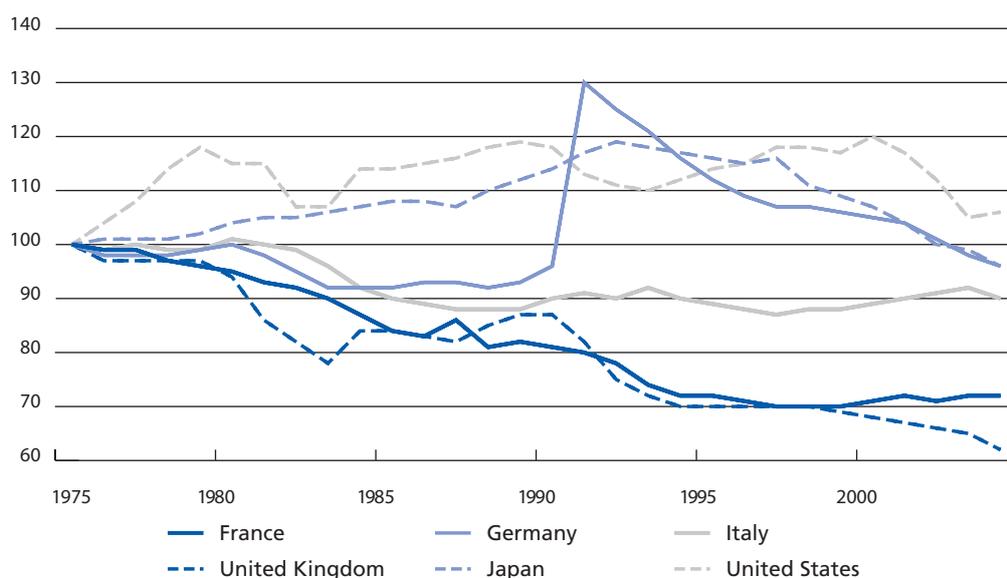
Source: AMECO.

However, it appears that the uptrend in industrial value added was broken simultaneously in Europe, Japan, and the United States around the year 2000.¹ While this downturn in industrial output coincided with a global cyclical downturn at that time, it appears unusually steep and persistent in many countries. It is obviously too early to judge whether the downturn is primarily cyclical or structural, but there is some evidence, to be reviewed in next section, to suggest that there is a structural element to it.

Industrial employment has been declining even in absolute terms in Europe, as shown in Figure 6. Over the past quarter-century, the number of industrial employees has declined by roughly one-third in the United Kingdom and France. In contrast, the number of industrial employees now is approximately the same as in the mid-1970s in Japan and the United States, although it has been declining for the past five to ten years in both countries, having peaked in the mid- to late 1990s.

There has been an absolute decline in industrial employment.

Figure 6. Volume of industrial employment (1975=100), 1975-2004



Source: AMECO.

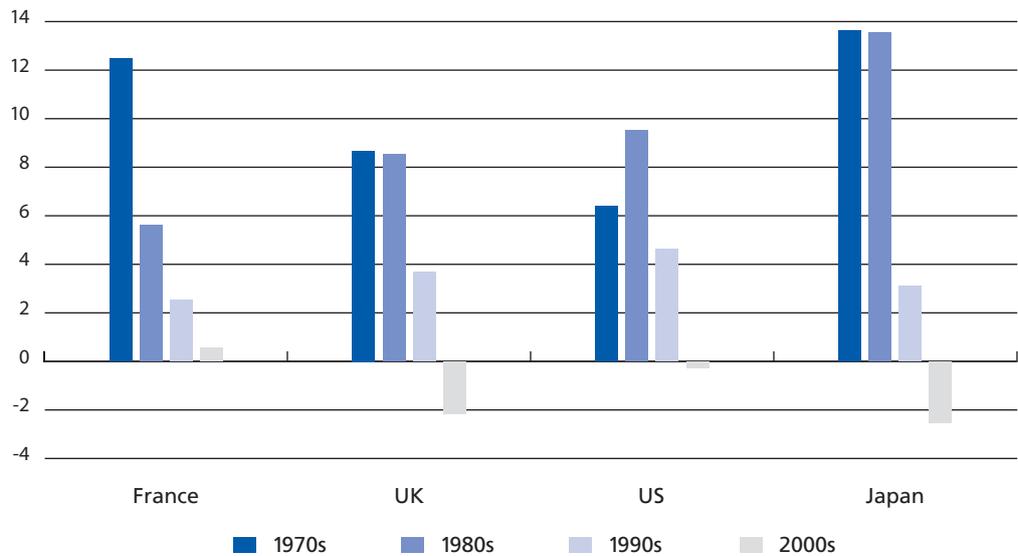
Note: The jump in the line for Germany is due to re-unification in 1990.

To sum up, the evidence concerning absolute de-industrialisation is mixed. While industrial employment has been on a downtrend in Europe and started declining more recently also in Japan and the United States, industrial value added has been rising – except in the last few years.

Having described the broad trends in industrial employment and value added, let us now consider how stable the process of de-industrialisation has been over the past decades. To this end, Figures 7 and 8 depict the average annual percentage changes in industrial value added and employment over the past few decades. They suggest that while there is a downtrend in the growth rate of value added, with the exception of the United States, there is no unambiguous trend across countries as regards the rate of decline in industrial employment. In other words, growth in industrial production has been steadily decelerating, but this has not translated into a parallel accelerating decline in industrial employment since the early 1980s in all countries. However, with the notable exception of France, the decline in industrial employment seems to be accelerating.

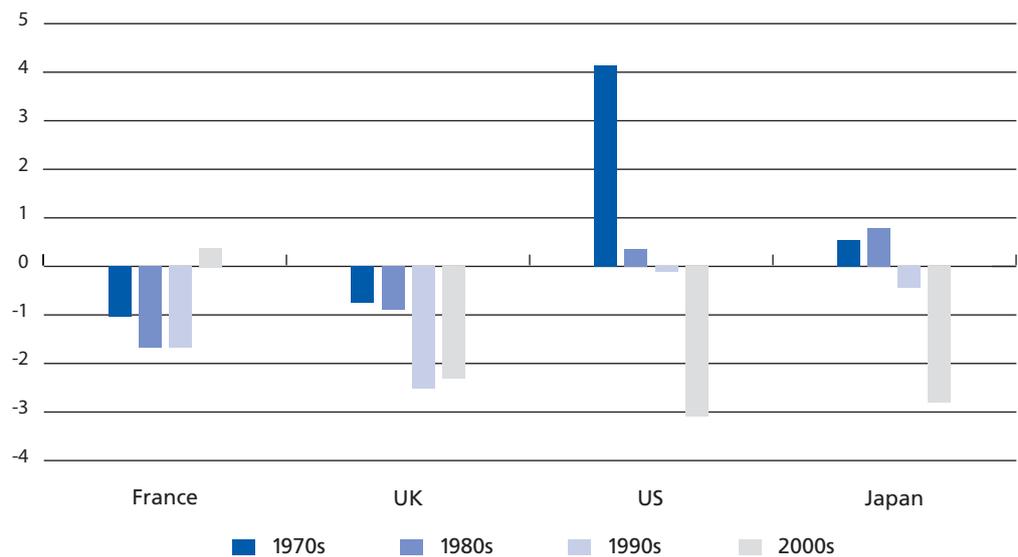
¹ At the level of individual sectors in Europe, output has been on a longer-term downtrend in textiles, clothing, leather and shoes, shipbuilding and repair, oil refining, coal and nuclear fuel.

Figure 7. Average annual rates of change in industrial value added (%)



Source: AMECO.

Figure 8. Average annual rates of change in industrial employment (%)



Source: OECD labour force statistics.

Long-term de-industrialisation in Europe, Japan, and the United States has been relative, but it may have turned into absolute in recent years.

Putting then all the pieces from this section together, we can conclude that Europe, Japan, and the United States have all experienced relative de-industrialisation, which may have turned into absolute de-industrialisation in recent years. Industry has been losing its share of total economic activity to services for many decades already. While industrial value added grew steadily and rapidly during all these decades, suggesting that the relative de-industrialisation did not translate into a fullblown absolute de-industrialisation, both industrial value added and

employment have been on a simultaneous downtrend since the late 1990s in Europe, Japan, and the United States.

The information presented above is clearly insufficient to pass judgement about the permanence of the recent episode of absolute de-industrialisation. What is more, it is insufficient to judge whether de-industrialisation is 'good' or 'bad', that is, whether or not it warrants public intervention by means of economic policy measures. To better understand the nature and recent changes in the de-industrialisation process, let us now turn to examining its root causes.

3. Factors explaining de-industrialisation

This section reviews empirical studies that try to disentangle the factors driving the de-industrialisation process. After an overview of the various factors and their relative importance in explaining de-industrialisation, special attention is paid to the impact of outsourcing, which is frequently associated with de-industrialisation.

3.1 Overview of empirical studies

A small number of studies, to be reviewed below, have sought to determine the driving factors behind de-industrialisation. They have, in general, focussed on the decline in the share of industrial employment in total employment as the measure of de-industrialisation to be explained. As explanatory variables the studies have used a number of supply-side and demand-side factors. Let us first just list them, before considering their relative importance.

On the supply-side, productivity gains achieved in the manufacturing sector have reduced the demand for labour. The productivity gains are obvious from Figures 5 and 6 above: industrial output has grown steadily, although industrial employment has trended down. Indeed, the growth of labour productivity in industry has been much faster than in services.

Increased exposure to international trade as a result on trade liberalisation has contributed to the increase in productivity by stimulating competition and productive efficiency. In addition, trade with low-wage economies has induced relocation of industrial activities so as to better reflect comparative advantages.

The fragmentation and segmentation of the production process have also had an impact on industrial employment. Outsourced activities previously performed in-house by manufacturing industries (transport, logistics, information technology) are increasingly provided by specialised service firms, as discussed in detail below. The resulting de-industrialisation is a mere statistical artefact to the extent that it only involves a re-classification of industrial employment as service sector employment. However, to the extent that outsourcing is done outside the home country's borders, it has a visible impact on employment.

Turning to the demand-side factors responsible for de-industrialisation, changes in consumer demand are related to population ageing and a shift of demand towards services. The falling share of income devoted to the purchase of manufactured goods is not related to any 'saturation effect', but to a rapid fall in the relative prices of these goods. With higher income the demand for service products is increasing, for instance through higher spending on tourism and health care.

De-industrialisation has been driven by both supply-side and demand-side factors.

Some studies have attempted to rank the relative importance of the factors discussed above for de-industrialisation. Using a different taxonomy, Rowthorn and Ramaswamy (1998) as well as Rowthorn and Coutts (2004) conclude that supply- and demand-side factors internal to advanced economies, such as productivity gains and changing consumption patterns, have been more important in explaining de-industrialisation than external factors, notably trade. Their results are summarised in Table 1 below.

Table 1. Importance of internal and external factors in explaining falling industrial employment

	1970-1994		1992-2002	
	Internal factors	External factors	Internal factors	External factors
EU	84%	15%	72%	25%
US	81%	12%	90%	10%
Japan	90%	-20%	60%	30%

Source: Rowthorn and Ramaswamy (1998), Rowthorn and Coutts (2004).

In the EU, internal factors, such as productivity gains and changing consumption patterns, explain 70 percent of the decline in the share of industrial employment.

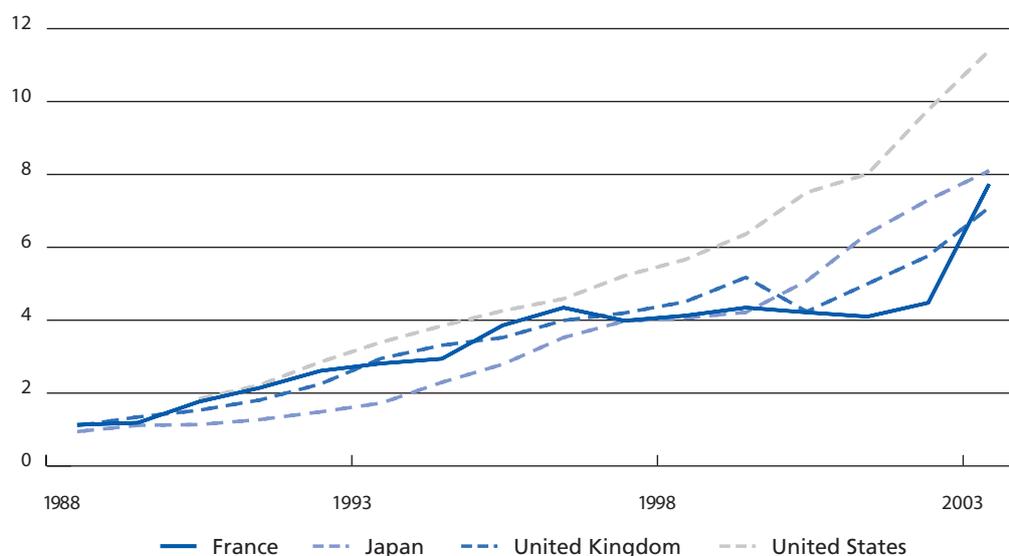
In the EU, internal factors explain over 70 percent of the decline in the share of industry in total employment during 1992-2002, down from over 80 percent during 1970-94. External trade explains a quarter of the decline in industrial employment during 1992-2002, up from 15 percent over the period 1970-94. This increase in the importance of trade in explaining de-industrialisation is associated with trade with low-wage economies. Nevertheless, its impact on industrial employment in the EU (EU-15) remains rather small, especially considering that the estimated impact of external trade includes not only the direct employment impact of competition, but also its indirect impact due to increased productivity.

Internal factors explain the bulk of the decline in industrial employment also in the United States and in Japan. During the 1990s, internal factors accounted for 90 percent of industrial job losses in the United States and 60 percent in Japan. In the United States, trade with low-wage economies has grown in importance, while in Japan the opposite is true.

Applying the same methodology to a sample of OECD countries between 1970 and 2002, Boulhol (2004) estimated that the competitive pressure from emerging countries accounts for 15 percent of the de-industrialisation process – defined again as the reduction of relative manufacturing employment – between 1970 and 2002, with an acceleration of this process between 1987 and 2002 affecting especially countries like Belgium, Finland, Spain and the Netherlands within the EU. Hence, structural changes observed in the manufacturing sector mainly result from the internal restructuring process, although the impact of the competitive pressure from emerging countries is increasing.

To better gauge the impact of import competition, consider manufacturing imports from China and India since the late 1980s, shown in Figure 9 below in relation to industrial value added. While manufacturing imports from these two countries only amounted to some 2 percent of manufacturing value added two decades ago, they now amount to 11 percent in the United States and 8 percent in France, Japan, and the United Kingdom. Manufacturing imports from China and India alone have thus grown 4-6 times faster than manufacturing value added. As concluded earlier, this increasing competition has reduced industrial employment in developed countries both directly and indirectly through higher productivity.

Figure 9. Manufacturing imports from China and India (% of manufacturing value added), 1988-2003.



Source: OECD.

All in all, it is obvious that import competition from low-wage countries such as China and India is an increasingly important factor in de-industrialisation.² To what extent import competition is responsible for the steep and persistent decline in industrial output and employment in the past few years is, however, too early to judge – especially as the simultaneous cyclical downturn in developed economies has taken its toll, too. But one should not dismiss the possibility that import competition may be accelerating the pace of de-industrialisation.

Import competition from low-wage countries is increasingly important in explaining de-industrialisation.

3.2 Focus on outsourcing

The empirical results presented above suggest that factors internal to advanced economies remain more important than external ones, such as import competition from low-income countries, in explaining de-industrialisation. One internal factor often mentioned in this context is outsourcing.³ It was alluded to earlier that outsourcing is related to the fragmentation and segmentation of production processes and, moreover, that the resulting de-industrialisation is a mere statistical artefact to the extent that it only involves a re-classification of industrial employment as service sector employment.

However, if activities previously performed in-house by industrial firms are outsourced to specialised service firms located in other countries, the loss of industrial employment, all other things equal, translates into a loss of total employment in the home country. Such international outsourcing is also referred to as offshoring.

Note that offshoring of service activities supporting industrial production is distinctly different from the relocation of production. Offshoring is a means to rationalise production that remains in the home country. Relocation involves the move of entire production processes and facilities from home to other countries and can give rise to direct import competition, as reviewed earlier.

² For further details, see for instance Amiti and Wei (2004) and Bhagwati *et al.* (2004). Specifically for the United Kingdom, see Abramowsky *et al.* (2004).

³ For a general discussion about the link between manufacturing and service industries, see Kalmbach *et al.* (2003), Pilat and Wölfel (2005), and Wölfel (2003, 2005).

Data on individual cases of firm restructuring compiled by the European Monitoring Centre on Change (EMCC)⁴, give an indication of the employment impact of outsourcing, offshoring, and relocation in the EU. Since the beginning of 2002, out of the total number of planned job reductions, only about 1½ percent were attributed to outsourcing, while some 6½ percent were due to offshoring or relocation of production.

Marin (2004) examines the impact of offshoring and relocation within the enlarged EU by assessing the impact of outward investment to Eastern Europe by German and Austrian firms. Based on a large sample of direct investment projects undertaken by 2,200 German and Austrian firms during the period 1990-2001, relocation of production led to a direct loss of around 91,000 jobs in Germany and 24,000 jobs in Austria. However, the opening of subsidiaries in Eastern Europe had also an indirect employment impact through intra-firm exports from the parent to the subsidiaries and imports the other way around. All in all, the net destruction of jobs in Germany and Austria is estimated at 90,000 jobs and 22,000 jobs, respectively, representing 0.3 percent and 0.7 percent of total employment.

Trade with low-income countries, offshoring, and relocation remain much less important than internal factors in explaining de-industrialisation.

Falk and Wolfmayer (2005) suggest that 'international outsourcing' (offshoring) has had some negative impact on manufacturing employment in Europe. Based on data on intra-industry imports of intermediate goods from low-wage countries, they estimate that outsourcing of business services reduced manufacturing employment by 0.3 percent per year in the seven EU countries in their sample during 1995-2000. There is, however, significant variation across industries, with more rapidly growing industries experiencing no employment reduction due to international outsourcing.

To sum up, while the importance of external factors, notably trade with low-income countries such as China and India is gaining in importance as a determinant of de-industrialisation in advanced economies, internal factors – such as productivity gains and changing demand patterns – remain much more important. Offshoring and relocation of production to other countries has only had a negligible impact on industrial employment in Europe.

4. European industrial structure and specialisation

We have so far considered the character and determinants of de-industrialisation at the aggregate level, without paying any attention to the sectoral composition of industry. Let us now turn to a more detailed examination of European industry, with a view to assessing what kind of production constitutes European comparative advantage in the international division of labour and how de-industrialisation may be changing Europe's comparative advantage.⁵

As a first step to that end, let us consider the characteristics of European manufacturing exports in terms of their labour and technology input. A useful indicator for characterising the export intensity of different types of goods is the Revealed Comparative Advantage (RCA) index. It measures the share of a good in, say, total European exports in relation to the share of that good in exports worldwide. Thus, if a good's share in European exports is 40 percent and in worldwide exports 30 percent, the index assumes the value 1.33 (=0.4/0.3). Values above 1 indicate that Europe exports that good relatively more intensively than the world on average, thus suggesting that Europe has a 'revealed' comparative advantage in producing and exporting the good.

4 The EMCC compiles the European Restructuring Monitor, for which the data are collected from leading European daily newspapers and business press and present planned job reductions by economic sector, country and the type of firm restructuring. For details, see www.emcc.eurofound.eu.int/erm/index.php?template=help3.

5 For an extensive discussion on EU productivity and competitiveness, see European Commission (2003), O'Mahony and van Ark (2003) or Gordon (2004).

Using the RCA index to characterise European manufacturing exports, Table 2 shows that Europe's revealed comparative advantage lies in exports with intermediate labour skill content. In contrast, Europe's revealed comparative advantage is less prominent in products with either high or low labour skills. This is in contrast to high-income countries outside the EU (including Japan and the United States), whose comparative advantage is in goods with high or high-intermediate labour skill content.

Table 2. Revealed Comparative Advantage (RCA) index by labour skills categories (2002)

Regions by income level	Products by labour skills categories			
	High	High-intermediate	Low-intermediate	Low
EU-15	0.92	1.14	1.21	0.91
High non EU-15	1.05	1.33	0.98	0.90
Upper-medium	1.11	0.47	0.98	1.05
Low-medium	0.96	0.47	0.79	1.26
Low	0.68	0.25	0.62	1.61

Source: European Commission (2005), Table VI.9.

Using the RCA index to characterise the technology content of EU exports, Table 3 shows that Europe's revealed comparative advantage is in medium-high technology goods. Again, high-income countries outside the EU are more clearly oriented towards high technology goods. Indeed, high-technology industries accounted for only about 20 percent of total EU manufacturing exports in 2003, compared with some 29 percent in the United States and 27 percent in Japan (European Commission 2005).

Table 3. Revealed Comparative Advantage (RCA) index in products by technology categories (2002)

Regions by income level	Products by technology skills categories			
	High	High-intermediate	Low-intermediate	Low
EU-15	0.86	1.17	0.95	0.88
High non EU-15	1.12	1.13	0.93	0.68
Upper-medium	1.12	0.92	1.06	0.97
Low-medium	0.92	0.57	1.21	1.72
Low	0.47	0.36	1.03	2.67

Source: European Commission (2005), Table VI.11.

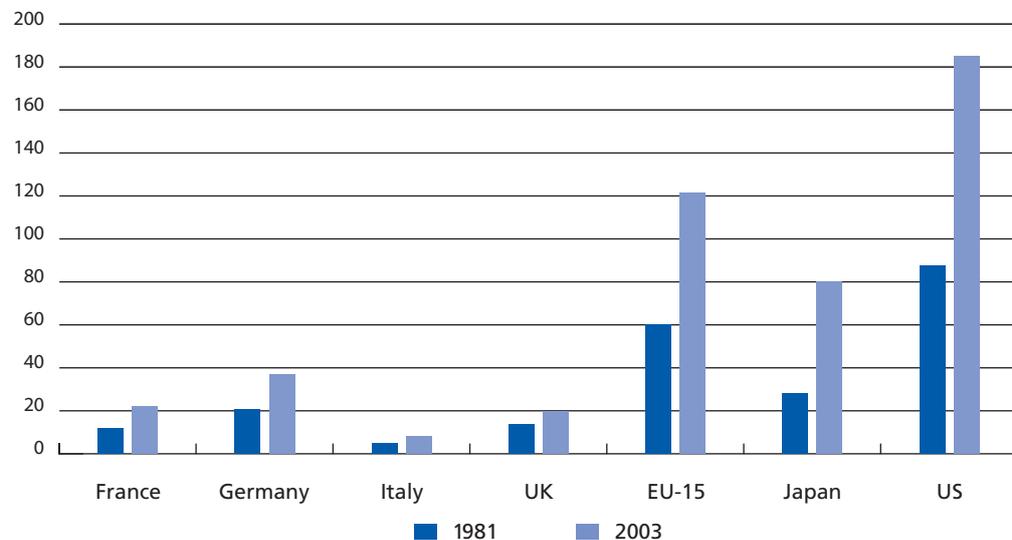
That European producers are more oriented towards goods with intermediate human capital and technology intensity makes them possibly more vulnerable to competition from emerging economies. As discussed in Section 3, manufacturing imports from countries like China and India have exploded during the past decade. It is reasonable to expect emerging economies to move gradually towards producing and exporting goods with ever higher human capital and technology intensity, thus increasing competitive pressure in, first, markets where European producers currently have their comparative advantage and, later on, markets for products based on high-skilled labour and high technology.

European producers are oriented towards goods with intermediate human capital and technology intensity.

It is worth pointing out that the relatively speaking lower human capital and technology content in European exports is not due to inferior innovation and product development effort. To see this, consider the research and development (R&D) effort of European manufacturing firms in international comparison. Figure 10 shows the evolution of business enterprise expenditure on R&D (BERD) between 1981 and 2003, expressed in constant (year 2000) US dollars and corrected for real exchange rate differentials. As is obvious from the figure, the absolute level of BERD in Europe falls between that

in the United States and Japan. However, the average annual growth in BERD during 1981-2003 was only 3.2 percent in Europe, which contrasts with 3.5 percent in the United States and almost 5 percent in Japan.

Figure 10. Business enterprise expenditure on R&D (in billions of year-2000 US dollars at PPP), 1981-2003.

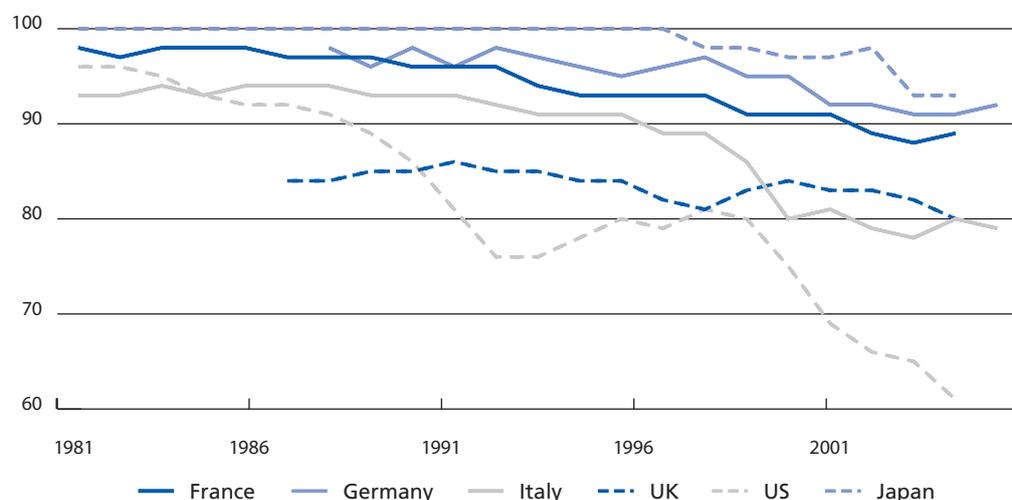


Source: OECD Main Science and Technology Database

The relatively low human capital and technology content of European exports is not due to inferior R&D spending.

Considering the share of the manufacturing sector in total BERD, Figure 11 suggests that the manufacturing sector remains the dominant R&D investor, albeit decreasingly so. In the United States, the share of manufacturing in total BERD has dropped to around 60 percent as a result of a rapidly increasing (and ever better measured) R&D spending in services sectors. In Japan, manufacturing still accounts for over 90 percent of BERD, while European countries lie in the middle of these two extremes.

Figure 11. Share of manufacturing industries in total business enterprise expenditure on R&D (%), 1981-2003.

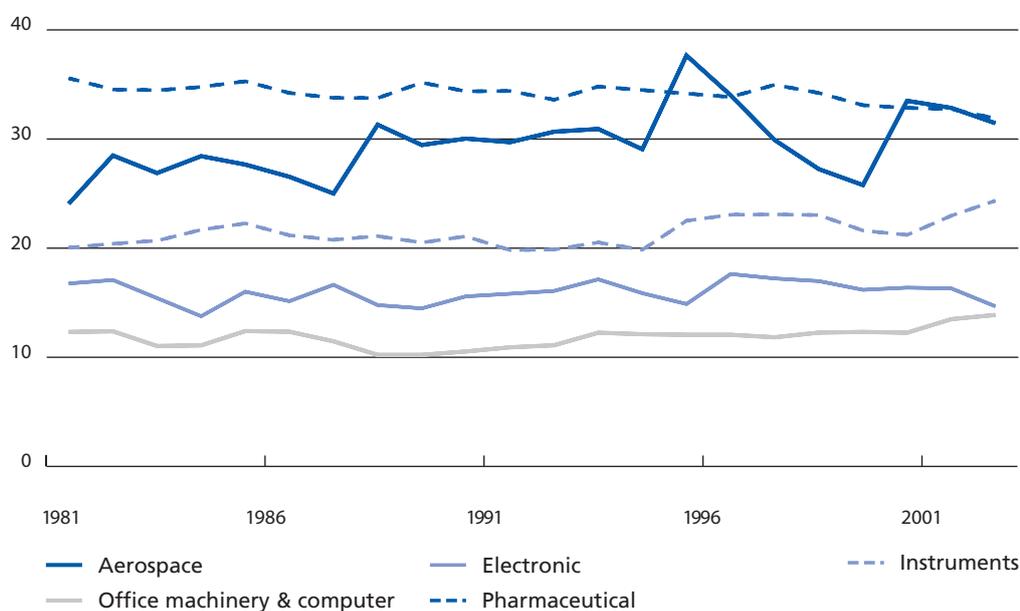


Source: OECD Main Science and Technology Database

Overall, European industry is placed somewhere between its US and Japanese counterparts in terms of R&D spending, so innovation and product development do not seem to explain why Europe's revealed comparative advantage in high-tech, skilled-labour intensive products is not as strong as in other high-income countries. In any case, we will now turn to some evidence suggesting that Europe's competitive position in producing and exporting high-tech, skilled-labour intensive products in selected high-technology industries remains strong.

Based on a classification by the OECD, high-technology industries include aerospace, pharmaceuticals, computers and office machinery, communication equipment and scientific (medical, precision and optical) instruments. Figure 12 shows the global market shares of European producers in these five industries. In all these industries, European producers have maintained relatively stable market shares. Pharmaceuticals and aerospace are clearly ahead of other high-technology sectors in terms of European market dominance, but European competitive advantage is less clear in the high-tech sector related to information and communication technologies.

Figure 12. EU export market share (%) in high-technology industries, 1981-2002.

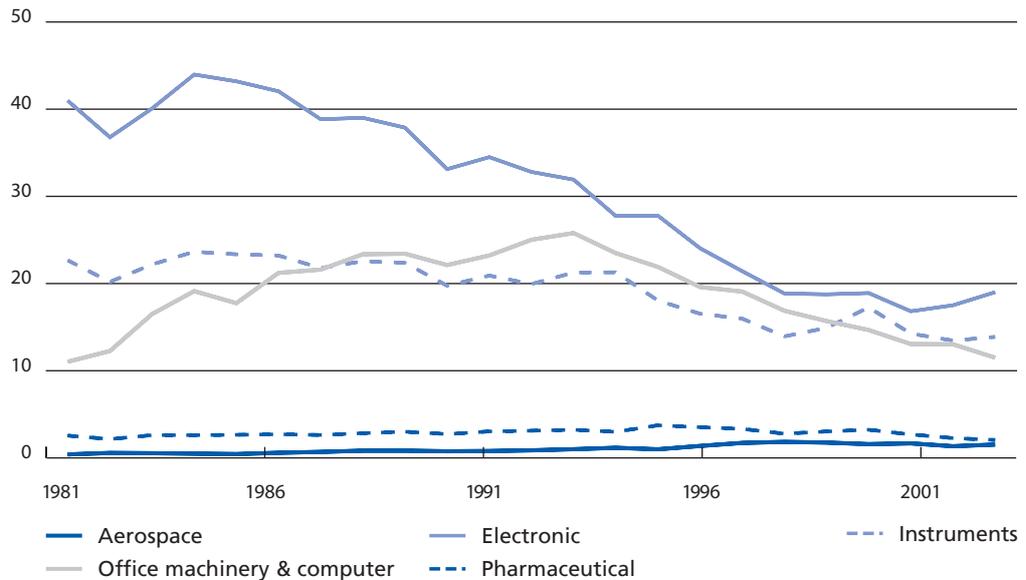


Source: OECD Main Science and Technology Database

Comparing European performance with that of Japan and the United States, shown in Figures 13 and 14 below, two observations stand out. First, as opposed to Europe, both Japan and the United States have been losing global market shares in at least some high-technology industries. In some cases, such as US aerospace or Japanese electronics, that loss has been quite dramatic. Second, the market shares of European high-technology industries are much closer to one another in the 15-30 percent range, while those in Japan and the United States show greater dispersion. This suggests that the European high-technology industry is more diversified than its Japanese and US counterparts. This higher diversification can be interpreted as a sign of lesser vulnerability to competition from emerging high-technology producers, such as China and India.

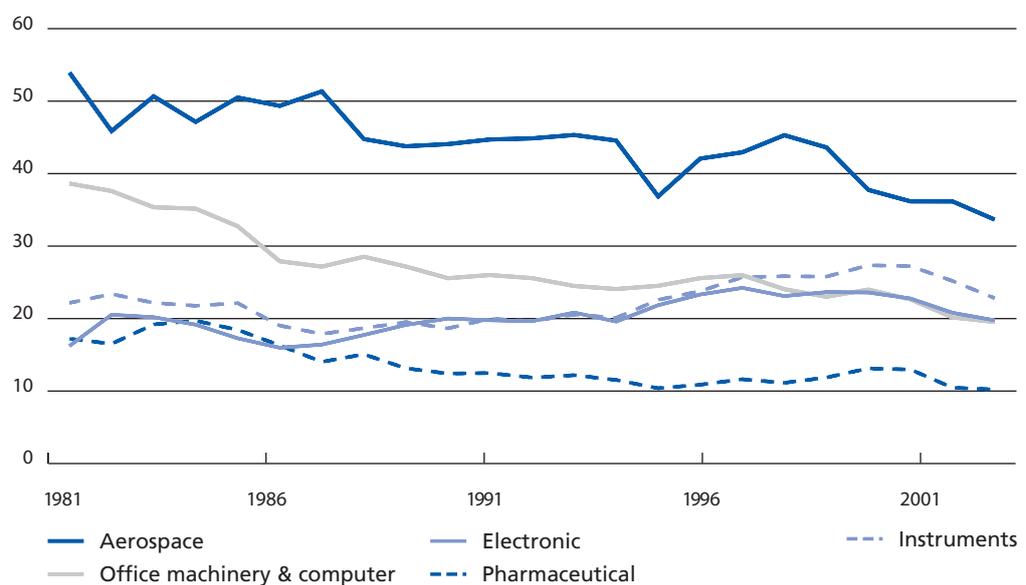
The market shares of European high-technology industries have been more stable than those of Japan and the United States.

Figure 13. Japanese export market shares (%) in high-technology industries, 1981-2002.



Source: OECD Main Science and Technology Database

Figure 14. US export market shares (%) in high-technology industries, 1981-2002.



Source: OECD Main Science and Technology Database

It is reasonable to expect increasing competition from emerging economies in the sectors where Europe has so far had a revealed comparative advantage.

To sum up, the revealed comparative advantage of European industry is in goods with intermediate human capital and technology intensity, where it is reasonable to expect gradually increasing competition from emerging economies. This contrasts with high-income countries outside the EU, including Japan and the United States, whose comparative advantage is more clearly in goods with high human capital and technology content. This difference cannot be traced back to particularly low investment in innovation and product development in Europe, at least in comparison with Japan and the United States. This being said, in high-technology industries, European producers have been able

to maintain relatively stable global market shares across the board, while Japanese and US producers have lost theirs in at least some industries. What is more, Japanese and US high-technology sectors appear less diversified and thus more vulnerable to competition from emerging markets.

The apparently robust position of the European high-technology industry suggests that the inevitable transition away from less human capital and technology intensive production and exports does not need to involve any deep and prolonged economic malaise, provided that European markets and economic institutions are flexible enough to facilitate the transition. That said, the transition will involve major changes in the structure of European economies; in the skills necessary for the labour force; and in the stock of productive capital. Such changes take a long time and can be disruptive, involving transitory economic and social pain.

5. Conclusions and policy implications

We have identified two types of changes in Europe's economic structure related to de-industrialisation. First, as in Japan and the United States, the industrial sector in Europe has been losing ground to services for a while already. This process has long been relative in character, with industrial value added and employment declining relative to the rest of the economy. While industrial employment has been on a downtrend in absolute terms for a while, industrial value added has been growing, and growing rapidly at that. However, industrial value added might also have entered an absolute downtrend in recent years, apparently as a result not only of cyclical but also structural factors, such as import competition from low-income countries.

Another structural change, more prospective than contemporary in character, is related to the composition of the industrial sector. Right now, the revealed comparative advantage of European industry is in goods characterised by intermediate human capital and technology content. This is in contrast to high-income countries outside the EU, including Japan and the United States, whose comparative advantage is more clearly in goods with high human capital and technology content. Given the gradually increasing competition from emerging economies, it is only a question of time before the comparative advantage of European industry will have moved more strongly towards goods with high human capital and technology content.

The fundamental factors underlying de-industrialisation include technological change and education (which boost productivity); higher income levels, population ageing and changing consumer preferences (which change consumption patterns); and changing comparative advantages between countries, coupled with external trade liberalisation (which foster an economically meaningful division of labour between countries). The changing composition of the industrial sector is related to the same factors, with changing comparative advantage and international trade liberalisation playing the pivotal role.

Importantly, all these factors – including trade with low-income countries – are benign in character in that they do not represent market or government failures. This being the case, economic efficiency and thereby the growth potential of the EU economy could not be improved by policy intervention addressing the root causes of de-industrialisation; in fact, public intervention could even hurt long-run growth.

The speed and easiness of these structural adjustment processes will depend on the flexibility of domestic factor markets in facilitating factor migration from shrinking to expanding sectors. As a consequence of well-documented rigidities in the European labour markets – and assuming that it

The factors behind de-industrialisation are benign in character, so public intervention should not seek to reverse the process.

is impossible to remove those rigidities at least in the short term – intervention by the public sector may be warranted to smooth the structural changes and to lessen the associated economic and social costs. The details of such industrial policy intervention is the subject matter of other contributions to this volume of the *EIB Papers*.

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