Study on the relation between industry and services in terms of productivity and value creation

Final report

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Changing patterns of specialisation in manufacturing and business service activities across Europe

Despite positive growth rates of industrial output in absolute terms, the share of manufacturing value added in overall GDP declined from 20% in 1995 to 16% in 2011 (following a long term trend), whereas the share of business services increased from about 14% to 18% over the same period for the whole economy. However, despite this increase in business services, an overall 'deindustrialisation' trend is still observed for the EU as a whole, when including only the services that are used in manufacturing activities for the provision of final manufactured goods. This 'value chain approach' –shows a decline of the combined manufacturing and related services share of GDP from 25.7% in 1995 to 22% in 2011. A number of reasons have driven this trend, including overall shifts in demand, significant improvements in productivity, companies externalising business services to outside Europe, off-shoring of core manufacturing activities (notably to Asian countries) and changes in relative prices in favour of services (Baumol's cost disease[1]).

These changing patterns of specialisation are however not uniform across the EU Member States; the geographical patterns of specialisation have become more pronounced. While some countries remain relatively specialised in manufacturing (e.g. Germany, Austria, Central and Eastern European countries), a second group is specialising more in business services (e.g. UK, the Netherlands, Belgium and France). Consequently, specialisation and agglomeration trends are observed for both manufacturing and services activities.

A third group of countries, comprising the Baltic States, Greece, Malta, Spain and Portugal, have faced a decline in their manufacturing shares but have not succeeded in increasing their specialisation in business services either. This may be owing to these countries' starting from a lower level and, with respect to initial specialisation patterns, from a less favourable manufacturing base. These conditions, together with the creation of bubbles in their economies and the ensuing difficulties, resulted in a loss of manufacturing competitiveness and an unfavourable economic development following the economic and financial crisis.

A mutually dependent and dynamic relationship between manufacturing and services

The production of manufactured output involves many activities along the value chain, from predominantly pre-production stage activities such as R&D and design, through the production (or assembly) stage, to predominantly post-production activities such as logistics, distribution, maintenance and marketing[2]. As physical inputs, services can either be provided in-house or sourced from services providers. In terms of direct cost shares in manufacturing, on average about 25% are services inputs; but there are large differences across countries with shares ranging from more than 30% to less than 15%. In terms of direct cost shares, distribution services account for about 12%, transport and communication for about 5% and business services for about 9% of total manufacturing costs. The service content of manufacturing production has increased by about 3 percentage points on average across countries between 1995 and 2011.

When taking account of both direct and indirect linkages, the average service content of manufactured goods produced in the EU reaches close to 40% of the total value of final manufacturing goods produced. The bulk of these services are distribution services (15%), transport and communication (8%) as well as business services which ranges between less than 10 to even 20% and more across EU member states. This latter category includes services such as legal and accounting services, R&D, advertising and market research, engineering activities and ICT services. The remaining service activities, which represent a negligible share of the total, are

[1] Baumol's cost disease states that due to larger productivity growth in manufacturing activities as compared to services, relative prices of manufactured products are declining, which consequently implies that the share of manufacturing is declining in nominal terms.

[2] Some services, such as marketing or logistics, play a role throughout the entire value chain.

non-market services. These numbers reflect a trend towards increased use of outsourcing of services by manufacturing firms.[3]

Additionally, there is a trend towards services being increasingly supplied together with physical products, a phenomenon sometimes described as 'servitisation of manufacturing'. The amount of services provided by manufacturers is not completely represented in officially available statistics and hence not part of the cost shares presented above. The servitisation share of total manufacturing revenues varies strongly. Shares between zero and 30% have been mentioned in interviews. Servitisation is to a large extent dependent on product programme and market environment with, generally speaking, final goods markets providing better opportunities to offer services over the whole product life cycle. Servitisation contributes to EU manufacturers' international competitiveness through comparative advantages in the field of know-how driven services, in particular engineering, and thus opens up growth opportunities for manufacturers who tap into new business areas, such as BOT[4], life-cycle services etc.

Finally, of course, services also use manufacturing inputs for the provision of services. However, these channels operate primarily via the supply of capital goods rather than intermediate inputs. The direct cost shares of manufacturing in services are therefore rather low at only about 2% of services gross output, and does not give an accurate quantification of the relationship between services and manufacturing.

Services-manufacturing interaction is growing across industries for different reasons

Expert interviews amongst four industries (machinery, transport equipment, textiles and clothing, and food and beverages) and six countries (France, Germany, Denmark, Sweden, the Czech Republic and Poland) showed that, for an in-depth understanding of the use of services in manufacturing, country and industry characteristics have to be taken into account. The industries considered differed strongly in terms of their structure, production technology, rate of innovation and their exposure to globalisation. For the four industries, these four features explain to a large extent the differences in the relationship between manufacturers and service providers, the critical fields of interaction and the economic impact of services on manufacturing companies' performance.

In the machinery and transport equipment industries – as examples of medium-high- to high-tech industries – the cost share of services for high- to medium-tech industries has been growing and is expected to increase further, mostly through outsourcing of R&D and engineering services, in particular by the spin-off of R&D and engineering units and because of the need to set up more efficient and effective development processes. The most important drivers behind this trend are the growing complexity of products and the integration of different technologies. The findings indicate that the success of R&D and engineering projects depends on the interaction of the different players involved and on the objectives of the outsourcing strategies pursued. For example, outsourcing of R&D and engineering services can be motivated both by cost saving as well as by the need for access to specific expertise.

By contrast, in both so-called 'low- to medium-tech' industries considered – food and beverages and textiles and clothing – efforts to increase the efficiency and effectiveness of the value chain management is the most important driver of growing business services inputs. A second explanation for the growing cost share of business services is related to downstream strategies. Manufacturers try to be better placed in their sales markets through services such as market research and advertising, as well as offering additional services to their clients, such as logistics and product placement. These activities comprise the provision of external and own services (i.e. servitisation as discussed above). These 'low-tech' industries also show higher cost shares of industrial output

[3] Note that these data provide a conservative estimate concerning the service content of manufactured products, as they do not account for services produced 'in-house' as services.

[4] Build-Operate-Transfer: A form of project finance which traditionally has been applied to large investment projects where manufacturers are reimbursed by revenues earned through the operation of the delivered establishments. Finally ownership is transferred to the client.

caused by transport and distribution services, which is due to the fact that these two industries are to a higher extent producers of consumer products.

The ability to exploit services – in particular business services – has contributed a great deal to the success of manufacturers of these 'low-tech' industries. Above all, companies from the textiles and clothing industry have been investing heavily in value chain management and the related upstream and downstream services. As such, these companies have been able to meet the challenges of globalisation through the management of international supply chains. In terms of value added and jobs, this has partly been able to compensate the reduction of domestic production capacities by tapping new business areas. The success of these industries has therefore driven the growing integration of services and manufacturing. Although the growth of related services might not be sufficient to fully compensate for losses of manufacturing activities, they increase EU companies' competitiveness and reduce any negative impact resulting from the structural changes taking place in the low-tech industries as a result of globalisation.

The differences in the interaction of services and manufacturing between the industries under consideration suggest that sectoral specificities have to be taken into account when formulating public policies and schemes.

Services-manufacturing inter-relations also determined by country specifics

The interrelation of services and manufacturing further shows quite different patterns between the Member States under consideration. The predominant strategies pursued by manufacturers in the individual countries impact not only on the overall use of services but also the kind of services sourced from outside. This is particularly the case with regard to the use of R&D and engineering services in high- to medium-tech industries, which are well suited to contribute to manufacturers' economic performance and their supply of technologically leading, high-performance products.

For example, there are remarkable differences in the amount of external services used by French and German companies. French companies have been more inclined to outsource whereas German firms have, to a larger extent, relied on internal service provision. Outsourcing is not only driven by the sophistication of products and the integration of numerous different technologies, but also by the manufacturers' need to improve their economic performance through cost saving. French companies in this industry have been struggling more than their German competitors and this may explain why they have outsourced more. There are indications that the German companies are also moving towards a greater use of outsourcing in the future.

For the smaller countries, the fieldwork revealed that the Danish manufacturing sector, for example, is struggling with a loss of competitiveness. Since the cost shares of services in manufacturing are well below those of the other long-term EU Member States under consideration, this indicates that Danish manufacturers may not exploit the possibilities for increasing their competitiveness through outsourcing to the same extent as manufacturing firms in other comparable countries.

The Swedish manufacturing industry provides a good example for maintaining a viable sector through comprehensive exploitation of services. Traditionally, Swedish firms successfully have commanded global value chains and only few capacities are left in the country; however, these have stayed competitive with the use of services. Most impressive is the Swedish textiles and clothing industry: Although only marginal manufacturing capacities are left in Sweden, the textiles and clothing industry is viable, provides attractive workplaces, is strong in R&D and design and keeps its position in the global production network through value chain management.

Since the fall of the Iron Curtain, Poland and the Czech Republic have become market-oriented economies. During the transition phase companies were privatised, with FDI playing an important role in this process and affecting the structure of the respective manufacturing industries. Foreign-owned and domestically-owned production sites which are integrated upstream in international supply chains are typical for both countries.

Independent, domestically owned companies which successfully command their own international distribution and sales networks exist as well, but are less frequent. Due to this specificity the exploitation of services does not yet play the same role for Polish and Czech manufacturers as for most companies from long-standing EU Member States. As many companies are struggling to meet the challenges emerging from production sites located in non-EU low-wage countries, in the longer run their survival will probably depend on process and product innovations and upgrading of product programmes for which services are pivotal. However, the Central and Eastern European manufacturing sector is expected to undergo structural changes similar to those in the long-standing Member States. These losses of production capacities, in particular of labour-intensive activities, will however only be partly alleviated through the use of services by increasingly know-how driven manufacturers.

Summarising, these results indicate that improved access to services and increases in the quality of services have the potential to strengthen the competitiveness of the EU manufacturing sector. However, even improved services and an improved integration of services and manufacturing will not stop changes in the international division of labour and relocation of manufacturing capacities.

Manufacturing firms in smaller countries source a higher proportion of business services from abroad compared to manufacturing firms in larger countries

The proportion of business services sourced from abroad tends to be small in all countries. In most countries the share of imported business services in manufacturing gross output is less than 1% (compared to about 5-10% in terms of direct cost shares of total business services used in manufacturing) with only a few countries showing higher shares. However, it should be borne in mind that this does not include services provided domestically via the commercial presence of foreign-owned affiliates (Mode 3[5]) or through long-term presence of foreign-national persons (Mode 4). For the cross-border provision of services (Mode 1) measured here, there is a distinct pattern of manufacturers in smaller countries sourcing a relatively larger share of their business services from foreign, mostly intra-EU, suppliers. This is in particular the case for the Central and Eastern European countries.

The differences in the intensity of use of imported business services suggest that manufacturers in larger countries have access to a more substantial base of domestically supplied services, whereas manufacturers in smaller countries have to rely more strongly on foreign-sourced business services in order to get access to the services they need. These different patterns also become apparent when considering the relation between manufacturing performance and business services: for the set of large EU countries, econometric evidence reveals a positive impact of use of domestic (and – to a smaller and less robust extent – foreign) business services inputs on manufacturing performance measured in terms of productivity or value added growth, whereas for smaller countries the econometric results suggest that in particular foreign business services linkages are important for improved manufacturing performance. However, this does not mean that large EU Member States would not profit from more open services markets. In particular the service providers in larger countries would also benefit from enlarged markets, and the manufacturing sector in larger countries would in turn benefit from increased competition and specialisation of business service providers.

Given the increasingly pronounced patterns of specialisation across Europe and the relative importance of foreign-sourced business services – particularly for smaller countries – potential barriers to cross-border trade in services and international manufacturing-services linkages are an important policy issue. However, the issue is not straightforward and goes beyond the issue of regulatory barriers. An analysis of the correlation between the patterns of use of imported services by manufacturing industries and the number of regulatory barriers to services trade present in a country did not reveal a significant relationship between the two. Furthermore, interviews with EU service providers and an analysis of regulatory barriers to services trade using data from the OECD STRI and

[5] The four modes of supply (as defined by GATS) are: Cross-border trade (Mode 1); Consumption abroad (Mode 2); Commercial presence/establishment (Mode 3); Presence of natural persons (Mode 4).

PMR indices suggest that legislation at the EU level is not significantly hampering cross-border trade in services. Nevertheless, from the interviews it is also clear that in practice significant regulatory barriers at lower levels still exist. These barriers relate for example to differences in Member States' internal legislation or the concrete implementation of EU regulations in individual countries.

Moreover, given the lower tradability of services compared to goods, entry modes other than cross-border provision of services are often more important. For example, for most performance-enhancing services, tradability of services is rather low and local presence is required for a large part of the service offering, because factors such as 'trust', the performance of domestic services markets, language and the knowledge of local regulations and culture play an important role. Consequently, for many types of services the policy issue for stimulating the use of foreign-sourced services in EU manufacturing industries relates more to the entry and the right of establishment of firms as well as the recognition of professional qualifications across borders. It should however be noted that the increasing digitalisation of performance-enhancing services is likely to increase their tradability in the future. This in turn will affect the policy intervention needed to support them.

Main policy messages

Summarising, there is evidence of a positive relationship between the performance of business services and the performance of manufacturing: notably, manufacturing sectors that buy-in a relatively higher proportion of business services have a better productivity performance than sectors with a relatively lower buy-in of business services. This indicates that the performance of manufacturing could be improved through policies that support the development of business services activities and their quality. Furthermore, the access to foreign suppliers of business services seems particularly important for smaller countries, since they usually do not have a full range of high-quality domestically supplied business services. However, also for larger countries, in view of the ongoing trend towards further specialisation and agglomeration of both business services and manufacturing across Europe, there is an increasing potential from improved competition and increased trade in business services. The 'manufacturing core' countries would for example benefit from improved access to foreign services suppliers from countries becoming more specialised in business services. In turn, the 'business services' specialist countries also profit from the increased cross-border demand for business services.

Since goods and services markets are becoming more closely linked and business services impact positively on the performance of manufacturing and vice versa, further steps towards integration should be undertaken, in particular in areas where barriers still exist. For example, a more ambitious implementation of the EU Services Directive would be a significant step forward in this direction, accompanied by the removal of remaining regulatory barriers also for goods markets, in particular at national level. Consequently, with the trends towards further specialisation and agglomeration in business services and manufacturing, reinforcing the internal market for both services and goods is likely to become even more important for EU competitiveness in the future.

Openness to trade will support further specialisation across countries and allow for the EU as a whole to reap the gains from specialisation. The study has shown that a group of countries, maybe in particular those at the periphery, have neither been able to keep a strong manufacturing base nor to develop strong business services industries. This indicates that there is a risk that some Member States may have difficulties in participating in EU (and globalised) manufacturing and business services value chains. These problems are to some extent caused by the loss of competitiveness due to the build-up of economic bubbles in these countries leading up to the economic and financial crisis. While they have to some extent managed to develop other sectors than business services and manufacturing, it would seem advisable for these countries to improve their overall competitiveness, in order to benefit more from the opportunities resulting from the globalisation of manufacturing and business services value chains.

1 Introduction

1.1 Manufacturing, services and their inter-relatedness

The services sector plays an important role in advanced economies, not only because of its high and growing share in total GDP of more than 70% in most advanced economies or its role for employment creation, but also as an important source of inputs in manufacturing. Of the services sectors, business services play a particularly important role as inputs in production, e.g. in terms of consultancy activities, design activities, marketing, cleaning, etc. As can be seen, business services are heterogeneous and matter to different degrees in the manufacturing process in both upstream and downstream activities along the manufacturing value chain.

In contrast, most developed economies have witnessed a declining share of the manufacturing sector for an extended period of time. However, the experience is mixed and while some countries experience an acceleration of this trend, others still successfully maintain their strong manufacturing bases (see Stöllinger et al., 2013). Therefore, on the one hand, policy-makers focus on reorienting their economies towards services to outweigh the losses of manufacturing jobs, but on the other hand, also strive to maintain a strong manufacturing base. This is referred to as 're-industrialisation', which is widely debated not only in the EU and amongst its Member States, but also in other major advanced economies, particularly the United States. However, given the strong linkages between manufacturing and services, the question is not just about promoting manufacturing *per se*, but promoting manufacturing and services sectors/activities for which the EU can be globally competitive.

There is an increasing awareness that manufacturing and services are strongly intertwined. First, manufacturing firms not only use various services as important inputs in their production process in a broad sense but also bundle their products and provide services along with their products. Second, a number of service activities are also carried out within manufacturing firms, which may be partly outsourced or offshored (e.g. business function offshoring). The other way round, also service industries use the output of manufacturing industries which allows them to provide their activities more efficiently (e.g. goods sold by service providers, e.g. for maintenance and repair, ICT system developer and integrator, capital goods used in service activities). Hence, given strong inter-sectoral linkages and interrelationships, changes or improvements in the services sectors and the conditions impacting on the interaction of services and industry, both within and across countries, are expected to have important effects on the performance of the manufacturing sector.

The Commission has emphasised in the European Industrial Policy Communication of 2012 the need to reverse the declining role of manufacturing in Europe from currently around 16% of GDP to as much as 20% by 2020 to address and counter prevailing and persistent economic ailments and guarantee sustainable growth, the creation of high-value jobs and to solve pressing societal challenges. This is even more relevant as the growth of manufacturing has been negatively affected by crisis-related low consumption, low investment levels and general policy uncertainty. On the positive side, the good export performance of European industry and its global competitiveness in high value-added goods points to important growth potentials of European manufacturing. This can however only become sustainable if European firms succeed in maintaining their competitive edge in global markets by further improving productivity, increasing the value added content of their products and innovating, for which the service sectors provides important inputs.

The emphasis on the inter-relatedness between these two sectors implies a shift in perspective. Baumol in 1967 warned of the danger the increasing services intensity poses to the global economy. He claimed that due to the low productivity of the 'stagnant' services sector, increases in the share of services in GDP causes overall

productivity growth to stagnate – the so-called 'Baumol disease'. However, the major critique of Baumol's theory lies in the fact that he considered services to be used for final consumption only and not as intermediate inputs, which can affect economy-wide productivity indirectly[6]: In particular, some services facilitate transactions through space (transport and telecommunications) and time (financial services). Also, many producer-related services are often found to be important vehicles for the transmission of knowledge spillovers and to initiate changes in production processes of client firms, which, in turn, improve overall productivity not captured by direct measurement. Empirically there is mounting evidence dismissing Baumol's concerns about the negative productivity effects emanating from the continuously expanding service sector. Instead, a positive productivity-effect is found to prevail; for example Maroto-Sanchez and Cuadrado-Roura (2008) show that between 1980 and 2005 the relationship between growth of services (in terms of percentage of total employment) and overall productivity growth is positive and statistically significant in 37 OECD countries.

The relevance of this critique may best be seen from the role of knowledge-intensive business services (defined as NACE Rev. 1 70 to 74), the so called KIBS.[7] The share of business services and that of the knowledge-intensive business services (KIBS) are generally increasing in the EU Member States as is their shares used as intermediate inputs in manufacturing as will be documented below.

These trends can imply two effects: on the one hand, manufacturing outsources or offshores low value-added activities to external suppliers, which raises measured productivity in manufacturing. On the other hand, manufacturing makes increased use of specialist service inputs (e.g. KIBS) which give rise to a positive (spill-over) effect on their productivity.

For a number of reasons, therefore, services have become increasingly intertwined with manufacturing activities. Consequently, developments in the services sector are not isolated but instead affect manufacturing too, so that productivity improvements or increases in growth in the service sector give rise to important productivity or output growth effects in the manufacturing sector, and vice versa. The service sector is found to be an important engine of innovative activities and spillovers for other sectors. For example, Kox (2004) shows that the Dutch business services industry, which has grown much faster than the market services sector as a whole but displayed stagnating productivity growth, plays a crucial role in the national innovation system and creates knowledge spillovers to other sectors. Similarly, Foster et al. (2012) use The World Input-Output Database (WIOD) to analyse the prevalence of technology spillovers between services and industry. They demonstrate that the service sector generates non-negligible productivity effects through R&D for manufacturing industries.

Thus, given the importance of industry-service-linkages, it is important to understand potential barriers and also enablers of these links. Previous studies have shown that framework conditions can be an important determinant of the productivity performance of the service sector which, in turn, affects the performance of other sectors. For example, PWC (2007) conducted a literature review and found that inappropriate labour or product market regulation can dampen innovation and inhibit the uptake of ICT. Moreover, in the retailing sector, restrictions on planning permission, flexible working, opening hours and other operational factors can put important limitations on retail sector efficiency. Also the role of the Internal Market was found to be an important determinant of service sector productivity. Ecorys (2011) showed that differences in regulatory regimes are significant determinants of relative performance in services between EU Member States. This study also found that, for example,

[6] Besides, misleading findings on productivity in services may arise from incorrect measurement (Maroto and Rubalcaba (2008). Wölfl (2003) identifies the following sources of measurement biases: difficulties in measuring output of certain services sectors (such as financial services); choice of deflators and disentangling effects of price changes from quality changes; aggregation bias when calculating aggregate productivity based on its components. There is substantial evidence that low or negative productivity rates in services are partly linked to inadequate measurement of service productivity growth (in particular the way constant prices are computed). Potential under-estimation of service productivity growth leads to an under-estimation of aggregate productivity growth.

[7] In the literature various definitions of the KIBS industries are used somewhat depending on data availability and the respective classifications to be used. These figures are therefore only indicative of the relative importance of the KIBS sector.

administrative burdens, barriers to trade and investment, price controls and costs for starting up a company have an important negative impact on the performance of services.

Next to these different perspectives, the impact of regulations on services-industry relations can be expected to differ depending on the type of relation between the two (see discussion below). For example, if services play an important role in innovations of manufacturing, as is the case for technical engineering and its relation to technical products (a situation of co-production), innovation policy may not only affect the technical engineering sector, but also the producer of technical products. By contrast, if a service is supplied as a support service and not as an input, such as security services, innovation policy may affect the performance of the security service sector but is unlikely to significantly contribute to an increase in productivity of the industry that uses these security services. It has to be stressed, however, that the effect of framework conditions can be positive or negative: they can act as a barrier hindering productivity improvements or help to promote productivity improvements of interrelated services and industries. Although previous studies have started to analyse some of these framework conditions, the analysis has been at a relatively general level. A deeper understanding of how framework conditions affect the service sector and its relation with industry is needed to develop appropriate policies.

Summarising, the strong and growing inter-sectoral linkages and the critical role of the service sector for the development and performance of industry, points at the importance of a policy framework that helps revitalise industry and keep industry internationally competitive by also fully exploiting the potentials of services. Moreover, industrial policy also needs to make sure that the service sector can fully profit from and exploit opportunities emanating from industry to optimise economic growth and employment generation. Concerning the EU, an important aspect is the role of the internal market and trade in services amongst EU Member States which might contribute to a thriving manufacturing industry in the EU economy.

1.2 General framework for exploring manufacturing-services interactions

1.2.1 Business services categorisation

There is a wide range of services activities which are directly and indirectly linked to the provision of a manufactured good. Kox and Rubalcaba (2007) provide a general taxonomy of producer services[8] (see Figure 1.1) that distinguishes between those services that may be categorised as network-type services (e.g. distribution, transport and logistics, financial services, telecommunications, and energy) and business services, which they define as '*a set of service activities that – through their use as intermediary inputs – affect the quality and efficiency of the production activities by complementing or substituting the in-house service functions*'. Within the category of business services, they further distinguish between operational services that supply relatively standardised business services, and knowledge-intensive business services (KIBS) that generally produce client-specific services with high knowledge content. In relative terms, operational services are mainly concerned with provision of manual skills, while KIBS are based on knowledge and information in the production and delivery of services. Viitamo (2007) considers that the taxonomy of Kox and Rubalcaba can be seen in terms of the generality of the service functions, with the highest generality (i.e. lack of client specific characteristics) associated with network-type services, while operational business services – although also relatively standardised – are more specialised in terms of supporting specific functions. Finally, knowledge-intensive business services have the highest degree of customer specificity.

[8] Based on the main client-base (customer segment) for the service provided, a distinction may be made between consumer services – i.e. services that are primarily consumed by private individuals – and producer services that are primarily used as intermediate inputs into the production processes of businesses.

Figure 1.1 - Overview of the categorisation of producer services

<table>
<tr><td rowspan="15">Producer services</td><td rowspan="14">Business-related services</td><td rowspan="12">Business services</td><td rowspan="7">Knowledge-intensive business services (KIBS)</td><td>Software and computer services</td></tr>
<tr><td>Strategy and management consulting</td></tr>
<tr><td>Accounting, tax and legal advice</td></tr>
<tr><td>Marketing services, opinion polling</td></tr>
<tr><td>Technical services, engineering</td></tr>
<tr><td>Research and development</td></tr>
<tr><td>Personnel training, headhunting</td></tr>
<tr><td rowspan="5">Operational business services</td><td>Security services</td></tr>
<tr><td>Facility management, cleaning</td></tr>
<tr><td>Administration, bookkeeping</td></tr>
<tr><td>Temporary labour recruitment</td></tr>
<tr><td>Other operational services (e.g. catering, photography, translation, call centres)</td></tr>
<tr><td rowspan="2"></td><td>Leasing and renting</td></tr>
<tr><td>Real estate</td></tr>
<tr><td rowspan="5">Network type services</td><td colspan="2">Distribution and trade services</td></tr>
<tr><td colspan="2">Transport and logistics</td></tr>
<tr><td colspan="2">Banking, insurance, stock exchange</td></tr>
<tr><td colspan="2">Telecommunication, courier</td></tr>
<tr><td colspan="2">Energy services</td></tr>
<tr><td colspan="4">Consumer services partly used by enterprises (business travel, company health service, social insurance services</td></tr>
</table>

Source: Adapted from Kox and Rubalacaba (2007).

From the above, it is evident that there is a large and diverse range of business-related services that interface with industry in different ways; for example by providing varying technological, operational, distributive and financial capabilities. Moreover, these services vary in terms of the degree to which they provide services that are tailored to the specific requirements of industry. They also vary in terms of the intensity of their interaction with industry, with some services providing specific capabilities that require a high degree of understanding and continuous interaction with industrial (manufacturing) production activities to deliver their services effectively. Other services, by contrast, require a much lower degree of specific knowledge of industrial (manufacturing) processes.

As noted in Ecorys (2008), typically the combination of the general nature (i.e. lack of client specificity) of network-type services and the associated economies of scale in their provision means that in-house production is usually neither a viable or cost-effective option. Moreover, the fact that such services are relatively standard means that a significant level of in-house complementary knowledge (to make effective use of the service) is not normally required. By contrast, though increasingly subject to outsourcing, knowledge-intensive business services typically require the retention of a complementary in-house knowledge base. Meanwhile, operational business services are situated in-between these two situations. In this context, the focus of this study is on knowledge-intensive business services which are characterised by a close relation to manufacturing production activities, the necessity of a complementary in-house knowledge base and the possibility for firms to decide whether to rely on in-house provision or whether these services inputs are outsourced or offshored.

1.2.2 Broad categorisation of service-industry interactions and productivity impacts

In general terms, the growth and productivity potential of interactions between services activities and manufacturing production activities – specifically in terms of the contribution of services, in particular KIBS, to the performance of manufacturing – can be considered to be influenced by conditions at three levels:

- **Within manufacturing sectors:** In general, empirical evidence – both comparing across countries and between sectors – points to a positive impact of increased use of (external) service inputs on productivity

performance in manufacturing industries. Equally, services – whether externally or internally supplied – are regarded as a means for industry (manufacturing) to extract higher levels of value added within the value chain. On the one hand, services may contribute to raising efficiency of industrial (manufacturing) activities; on the other hand, specific attention has focused on the role of services – in particular knowledge-intensive services – as vehicles to increase value added in industrial (manufacturing) activities through the generation of non-physical or intangible capital. Many services used in industries act as a vector for the diffusion of technology and a catalyst for innovation activities that contribute to productivity improvements in industrial (manufacturing) activities.

- **Within service sectors:** Factors that enhance access to service inputs, reduce their cost or raise their quality are likely to have an incremental effect on value creation within a value chain. In this respect productivity gains within service sectors can be expected to create benefits for industrial (manufacturing) users of service inputs. This suggests a potential importance of the openness and overall functioning of service markets (e.g. in terms of their regulatory environment, competition conditions, the extent of integration in international markets, and the level of innovation) as factors influencing the growth and productivity potential of manufacturing production activities.
- **Interface between services and industry:** Beyond conditions at the level of service and industry sectors *per se*, the growth and productivity potential of interrelations between services activities and manufacturing production activities depend on the combined ability of service providers and service users within value chains to generate effective service outcomes. In this respect, significant attention in the literature on services covers discussion of issues such as information asymmetries between service providers and users and the role of users in the coproduction of service outcomes. For example, the former may reflect the difficulty that users have in evaluating service quality (both pre-acquisition and during and after service delivery) or for providers to clearly establish the service requirements of their clients. The latter reflects the fact that effective delivery of many services requires interaction ('co-production') between service providers and clients; the level of interaction is likely to be more pronounced when services are more customised to the specific requirements of clients and where a high degree of mutual understanding is required. These attributes of the service-industry interface indicate the potential importance of factors that increase market transparency (i.e. facilitation of search and matching processes) and enhance the respective capabilities of service providers and users to effectively engage in co-production processes (e.g. 'learning processes' through which mutual understanding can be developed, both with regard to the nature of services to be provided and the requirements of client organisations).

1.2.3 Manufacturing-service interaction along the value chain

Industry-services interactions occur throughout industrial value chains, from 'upstream' functions such as R&D and design, through to downstream functions such as 'marketing' and 'after-sales' services. The increasing importance of more upstream ('pre-production intangibles') and downstream ('post-production intangibles') functions is associated with the production phase occupying a less pivotal position in the value chain of manufactured goods relative to more service orientated components (see e.g. Veugelers, 2013, for a recent discussion). The diminution of value creation in the core production phase (e.g. fabrication and assembly activities) reflects a combination of factors including productivity gains and technology developments that have lowered costs and displaced employment in production activities, together with growing (international) competition that has further contributed to driving down prices and reducing margins for physical production outputs. In particular, the pressure on value creation in core production activities has gone hand-in-hand with them being outsourced and offshored to low-cost suppliers/locations.

At the same time, as a consequence of the pressure on core production processes, many firms have sought to increase value creation and profit margins by focusing on the development of intangible service-related assets in 'upstream' and 'downstream' value chain activities. In general terms, services can be categorised relative to their position in the value chain:

- **Upstream (development) services in the value chain:** product conception and innovation activities (e.g. R&D, design and branding), together with the technical development of high value-adding production processes, are increasingly important as a source of competitive advantage. The focus on upstream functions links in with trends towards raising the technological level of products (e.g. high-tech products), increased specialisation of production processes and higher-end market positioning. In this context, services play a key role in providing specific scientific, technical and design capabilities necessary to support upstream functions that contribute to raising the value added 'embedded' in manufactured products through better product conception and specialised production processing. These include services dedicated to product innovations such as R&D and engineering and design. For example, Europe is a global leader in independent engineering services providers (ESP) which strengthen the comparative advantages of related industries. Particularly, the services provided by ESPs and their technological expertise are pivotal for the success of the EU automotive industry in global markets.
- **Core (production) services in the value chain:** these concern services which are associated most closely and directly to production activities such as supply management, production and process engineering and other technical services. These include:
    - **Services that contribute to improved linkages along the supply chain**; for example through a better functioning of input markets through increasing transparency, shortened response times and reduction of transaction costs. These services increase manufacturing companies' opportunities for the exploitation of comparative advantages, even in remote areas which might lead to a relocation of manufacturing activities from EU to non-EU locations. One striking example is the production of clothing, one of the most globalised industries. Some of the more successful EU companies have become international supply (and value) chain managers with only a remainder of own production if at all. Their competitiveness depends strongly on the set-up of efficient, globally co-ordinated processes supported by the application of adequate IT-tools and agreements on common standards, at least proprietary ones.
    - **Services for process innovation within companies:** Generally services in this area contribute to the competitiveness of European production locations. Disadvantages such as high input costs can be to a certain extent compensated by increased efficiency, resource-saving, and faster or more flexible processes. As an example, the set-up of highly integrated and sophisticated business operations supported by IT systems requires a qualified staff and experienced consultants. The EU offers a favourable environment for the set-up of efficient, IT-supported processes as compared to emerging economies. Service providers therefore can improve manufacturing companies' opportunities to exploit comparative advantages for EU production locations. However, the relocation of non-core, low value added manufacturing processes to non-EU locations remains on the agenda.
- **Downstream (market) services in the value chain:** Firms are increasingly using downstream services (e.g. distribution, marketing, pre- and after-sales services) as a means to generate value added through better differentiating their products, enabling greater customisation and more broadly deepening their relationships with customers. The focus on downstream functions is part of the manifestation of the 'servitisation' of manufacturing through which firms increasingly tend to supply hybrid goods and service combinations or

services solutions rather than just supplying goods. Often manufacturing firms derive an increasing proportion of their revenues not from the sale of goods *per se* but from the service activities that accompany the goods and which may generate longer lasting revenue streams with higher margins than the goods themselves. In this context, a range of different service functions related to bringing products to market (e.g. logistics, distribution, marketing and pre-sales services) and that 'support' and 'accompany' goods in the market (e.g. customer support, maintenance) and even after use (e.g. recovery and recycling) play an increasingly important role in value generation within manufacturing value chains.

Thus, 'servitisation' has the potential to contribute to comparative advantages for EU based production of complex, sophisticated products for specific applications and customised solutions. As such demand for comprehensive services packages related, for example, to the supply of machinery and equipment is strongly growing globally with new business areas, such as contracting and BOT[9], gaining importance. The EU machinery industry is a prototype for an industry with a noteworthy and growing share of services in output with its competitiveness being driven by the combination of physical goods and services. This supply meets growing client demand for a comprehensive supply of machinery and equipment together with product lifecycle services.

- **Transversal (management & coordination) services:** e.g. management and strategy consulting, management related ICT. In this context, services – ICT-related services, in particular – can play an important role in enabling firms to maintain their competitive position in core production activities through supporting improved production efficiency, lowering production costs and facilitating the coordination within complex supply-chains and across multiple production locations.

The general point is that industry-service interactions occur throughout the value-chain and that at each stage potential choices exist both in terms of (i) whether to provide services 'in-house' or to 'buy-in' services from an external service provider and (ii) and whether to source services locally or from a 'foreign' supplier. Decisions on the choice of service provision may be influenced by overall framework conditions at all levels which furthermore should not be seen as independent from each other (see next sub-section).

1.2.4 Industry-service interactions and framework conditions

Despite increasing recognition of the importance of industry-service interactions for the (productivity and growth) performance of manufacturing industry, there has to date been very little analysis of the factors (cf. framework conditions) that influence the efficiency and effectiveness of the interactions between these two branches of the economy. To some extent this reflects the difficulty of providing an overarching framework capable of encompassing very heterogeneous service functions that interact with the industry in many diverse ways.

Even if the analysis is limited to the knowledge-intensive business services (KIBS) which are deemed to be performance enhancing, there is an absence of analyses that focus specifically on their interaction with manufacturing. On the whole, the understanding of the role played by KIBS in terms of their contribution to their clients' innovation behaviour has developed significantly. Initially seen as adopters of technology developed in manufacturing, the role of KIBS as catalysts for innovation in their clients' has been recognised. This has subsequently been followed by increasing acknowledgement that KIBS are important as innovators in their own right, both for themselves and on behalf of their clients (Muller and Doloreux, 2007).

More problematic, is the spatial dimension of KIBS. To date, relatively little analysis exists concerning the factors determining the location of KIBS with most existing analysis focused on the tendency for KIBS suppliers to

[9] Build-Operate-Transfer: A form of project finance which traditionally has been applied to large investment projects where manufacturers are reimbursed by revenues earned through the operation of the delivered establishments. Finally ownership is transferred to the client.

concentrate in major metropolitan areas. In particular, it appears that service providers in major urban areas take advantage of the access that such locations offer to national and (increasing) international networks and information exchanges. It appears, moreover, that service providers in major urban areas tend to be both more internationalised – indicating *a priori* a stronger market position – and more innovative. As a consequence, there is a self-reinforcing tendency for KIBS to become more spatially concentrated.

At first view, the tendency for KIBS to become more spatially concentrated is somewhat counter-intuitive. In particular, the development of ICT technologies that support codification of knowledge and its delivery at distance would a priori be expected to weaken the incentives for KIBS to concentrate in specific locations. However, there appears to remain an important component of tacit knowledge that is required to use and interface with flows of knowledge supported through ICT technologies. In this respect, the effective delivery of KIBS may nonetheless require proximity between service provider and (manufacturing) user in order to develop the necessary mutual understanding (i.e. common tacit knowledge). Accordingly, it is understandable for KIBS to cluster in locations providing accessibility to a high concentration of (actual and potential) clients.

Recently, a number of authors have attempted to analyse the relationship between FDI in services and manufacturing, either in terms of the presence and size of manufacturing activities as a factor influencing service location decisions or in terms of the complementarity between services FDI and manufacturing FDI. For example, Nefussi and Schwellnus (2010) find complementarity between the location of business services and manufacturing activities of French affiliates abroad, and Meliciani and Savona (2011) find that intermediate demand from the manufacturing sector positively affects domestic specialisation in business services at a regional level. Similarly, Castellani and Mirra (2013) find that the localisation of FDI investments in business services is positively related to the presence of manufacturing activities, particularly for manufacturing sectors that are intensive users of business services, as is the case for high and medium-high technology industries. That would suggest that business services providing services to manufacturing industries tend to locate close to major manufacturing production locations. This finding might have implications in the context of the 'off-shoring' of manufacturing production and the location of business services which can either relocate accordingly or remain in the respective countries specialising in the service intensive parts of the value chain. For example, the textiles industry provides an example of a highly internationalised industry which uses services to a large extent whereas most production occurs outside Europe (see Section 5 for a detailed assessment of the organisation of production in selected industries and countries).

Unfortunately, there appears to be relatively little analysis that has examined the spatial dimension of specific categories of knowledge-intensive services and in relation to location of manufacturing activities; although there is somewhat more analysis of locations patterns for R&D functions. In general, it appears that the main factors influencing the location of business services are typical location determinants such as general demand, cost advantages, human capital and agglomeration economies. What is missing in this respect is any assessment of whether other framework conditions – specifically regulatory and other restrictions – may impact on FDI (and trade) in business services.

1.3 Overview of study

The purpose of the study is to shed light on prevailing services-industry inter-linkages, with the EU as focal area. It will take a quantitative comparative approach and compare trends and developments in the EU with a focus on analysing and describing differences in the evolution of services-industry inter-linkages across EU countries (and partly with trends of its major competitors).

In particular, it aims to quantify the relationship between business services and manufacturing sectors and to which extent this relates to productivity and growth in manufacturing industries which will be the subject of Sections 2 and 3 of this report. Section 2 furthermore provides an overview of general trends concerning the specialisation patterns in manufacturing and business services over the period 1995-2011 and potentially underlying explanations based on performance indicators such as productivity and unit labour costs. Section 3 takes an econometric approach investigating the role of business services and the respective inter-linkages with manufacturing performance. In both sections the role of domestic and foreign-sourced business services will be highlighted.

This is followed by Section 4 which provides a novel approach for exploring the value added associated with manufacturing by taking into account all value added creating activities along the value chain in a specific country that contribute to the production of a specific manufactured product – or more general – the production of final products worldwide of a specific industry. Thus a specific service activity (e.g. R&D, advertising) of a country can directly and indirectly contribute to the production of the final manufacturing product (e.g. a car) which would be considered as part of the manufacturing value chain.

However, as indicated above, the interaction of manufacturing and services is a rather complex issue for which not all aspects can be covered when using a purely quantitative approach. The quantitative analysis is complemented, therefore, with a more qualitative interview-based approach for a selection of six countries and four industries characterised by differences with respect to past developments, their use of domestically and foreign-sourced business services and framework conditions. Specifically, Section 5 highlights cross-country differences in the use and provision of business services in the manufacturing process in a comparative manner. Subsequently, Section 6 focuses on the differences in cross-border flows of business services and potential hindrances and barriers to these flows.

2 Performance and interdependence of industries and services

2.1 Manufacturing and services performance

2.1.1 The importance of (business) services in the economies

Though the focus of this study is the interaction between manufacturing and services sectors – and business services in particular – this section starts with an overview of the developments of these two sectors in the total economy in a comparative manner across countries (for classification issues see Box 2.1). It is a well-known fact that the share of manufacturing is declining worldwide (with a few exceptions such as China and Korea) whereas the share of services industries is increasing. With respect to the advanced nations the manufacturing shares decreased whereas the shares of business services increased as reported in Table 2.1. The shares of the other services sectors remained more or less stable.

Table 2.1 – Shares of manufacturing and services in total GDP, in %

	Manufacturing		Distribution		Transport and communication		Business services		Non-market services	
	1995	2011	1995	2011	1995	2011	1995	2011	1995	2011
EU-27	20.1	15.8	28.3	29.7	6.7	6.8	14.3	17.9	18.0	18.8
USA	15.5	12.3	32.3	30.3	6.1	5.2	17.8	23.1	19.6	20.8
Japan	22.6	18.6	32.7	33.8	6.6	6.5	11.7	13.2	13.7	18.3
Austria	19.6	18.5	28.9	31.8	7.6	6.0	11.8	14.8	18.4	17.2
Belgium	20.3	14.5	26.4	26.5	8.2	7.7	15.7	20.5	19.8	22.3
Bulgaria	22.0	17.6	25.3	27.7	6.6	11.5	10.4	9.1	9.9	13.5
Cyprus	11.8	6.8	37.6	37.5	8.0	7.4	9.9	14.7	16.9	20.7
Czech Republic	24.3	25.8	23.7	21.2	10.4	10.2	9.6	14.0	13.0	14.3
Denmark	17.1	11.5	29.7	28.9	7.6	7.4	11.8	15.7	22.4	24.3
Estonia	21.0	14.3	28.2	28.6	11.2	11.0	7.0	14.0	14.8	17.4
Finland	25.4	18.6	24.6	28.2	9.1	7.8	9.4	12.7	19.2	20.2
France	14.2	10.1	28.1	31.3	6.3	6.6	16.9	19.6	20.7	22.4
Germany	22.6	22.4	28.4	28.3	5.7	5.5	15.2	17.8	17.3	17.8
Greece	12.0	10.3	38.7	39.7	5.9	9.5	7.8	8.9	17.1	21.0
Hungary	21.3	25.3	24.6	24.6	7.6	7.2	11.6	14.0	18.7	16.3
Ireland	30.2	26.8	18.9	19.3	5.5	5.3	13.6	21.8	17.0	19.1
Italy	22.2	16.6	31.9	33.6	7.0	7.3	11.7	14.9	15.8	17.4
Latvia	20.7	9.9	20.3	32.7	14.5	11.4	8.8	14.9	16.9	17.1
Lithuania	19.1	16.4	28.6	29.8	8.4	13.8	3.7	8.2	16.8	18.0
Luxembourg	13.7	6.5	26.8	25.0	8.2	8.7	28.7	38.6	13.5	14.3
Malta	21.7	13.3	32.9	34.0	9.2	9.2	9.8	15.8	16.8	19.4
Netherlands	17.4	14.1	25.5	24.8	6.9	6.0	16.7	20.7	20.0	22.0
Poland	21.1	18.1	29.6	31.8	6.3	7.2	6.4	11.0	14.5	14.4
Portugal	18.4	13.4	27.7	29.8	6.5	6.9	12.4	15.3	19.3	22.8
Romania	25.6	23.6	19.8	24.5	6.7	10.5	9.8	7.7	6.1	11.9
Slovak Republic	26.8	19.6	24.4	27.3	10.5	7.1	9.3	12.7	12.1	13.9
Slovenia	25.7	19.6	25.8	26.3	6.8	7.2	11.9	15.3	16.0	17.7
Spain	19.2	13.2	30.8	33.6	7.1	7.2	10.5	13.0	16.4	18.3
Sweden	22.4	16.7	26.6	26.1	7.9	7.0	11.8	16.8	20.2	21.1
United Kingdom	20.9	11.7	25.7	28.1	7.7	6.8	16.6	25.5	17.5	16.6

Note: These figures are based on value added at basic prices as provided in the WIOT.

Source: WIOD; wiiw calculations.

Box 2.1 – Business services in NACE Rev. 1 and NACE Rev. 2

Many definitions of 'business services' and 'knowledge-intensive business services (KIBS)' in terms of official classifications are defined using industry classifications. As this study is mostly concerned with the inter-linkages between manufacturing and services industries and heavily relies on information from supply and use and input-output tables. For a large sample of countries these are so far only available at the NACE Rev. 1 2-digit level or even more aggregate as e.g. in the WIOD database. Therefore a pragmatic approach has to be taken in this study concerning the definition of business services. Based on NACE classification Revision 1 the following industries are classified as 'business services' (with a particular focus on the bold marked activities):

NACE aggregate	NACE Rev. 1	Description
J	65	Financial intermediation services, except insurance and pension funding services
J	66	Insurance and pension funding services, except compulsory social security services
J	67	Services auxiliary to financial intermediation
71t74	**71**	**Renting services of machinery and equipment without operator etc.**
71t74	**72**	**Computer and related services**
71t74	**73**	**Research and development services**
71t74	**74**	**Other business services**

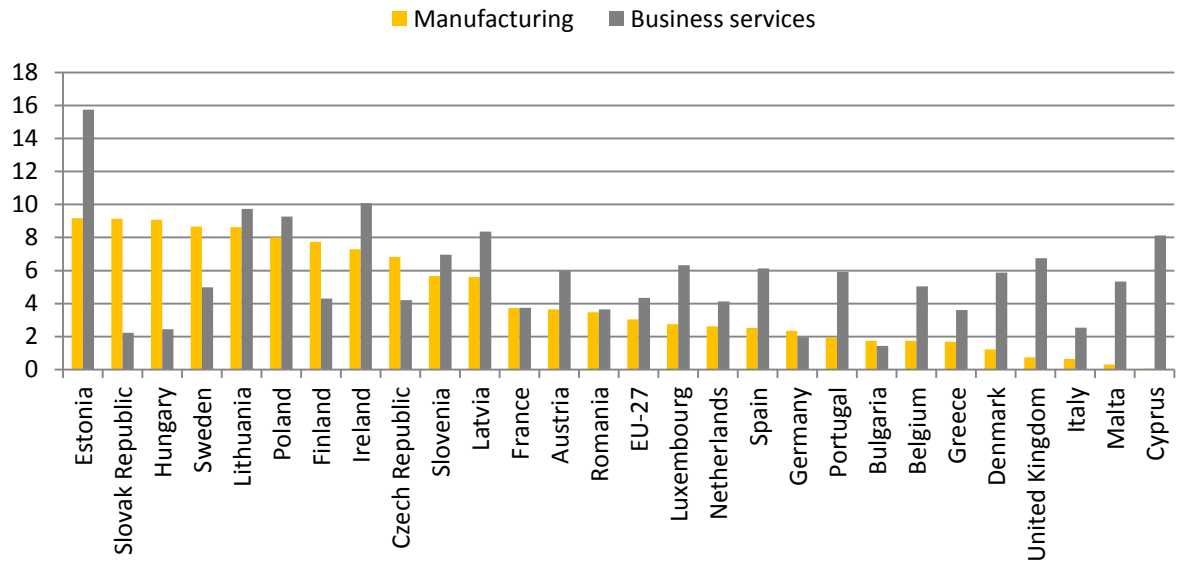
This includes financial activities together with renting activities, computer and related services, R&D and the category 'other business services' which unfortunately includes a diverse range of service activities. Lumping together renting services (NACE Rev. 1 71) with services such as R&D and computer services is dictated by the WIOD database which – at the industry dimension – reports only aggregate 71t74. Information relying on supply and use tables will however split this group into the four activities as listed above.

As mentioned above, for studying the role of knowledge-intensive business services or its sub-group such as R&D services, engineering services, computer services, etc. further details at the 3 or 4-digit levels of the NACE Rev. 1 would be necessary which would however not allow to study interactions between manufacturing and services due to lack of detailed supply and use or input-output tables for a broader range of countries. Fortunately, however, the recently adopted revised classification, NACE Revision 2, splits the services sectors into more detailed activities as listed in the following table (the activities marked in bold are particularly focused on in this study).

CPA	Description
J58	Publishing activities
J59-J60	Motion picture, video, television programme production; programming and broadcasting
J61	Telecommunications
J62-J63	**Computer programming, consultancy, and information service activities**
K64	Financial service activities, except insurance and pension funding
K65	Insurance, reinsurance and pension funding, except compulsory social security
K66	Activities auxiliary to financial services and insurance activities
M69-M70	Legal and accounting activities; activities of head offices; management consultancy activities
M71	**Architectural and engineering activities; technical testing and analysis**
M72	**Scientific research and development**
M73	**Advertising and market research**
M74-M75	**Other professional, scientific and technical activities; veterinary activities**
N77	Rental and leasing activities
N78	Employment activities
N79	Travel agency, tour operator reservation service and related activities
N80-N82	Security and investigation, service and landscape, office administrative and support activities

It should be stressed, however, that – despite the declining manufacturing share – most countries experienced overall positive real growth rates of manufacturing activities at least up to the crisis, thus one should not see it as a 'declining sector'. In most countries both the manufacturing and (business) services experience positive growth rates of value added in real terms with the latter ones in most cases being larger indicating the shift towards services.

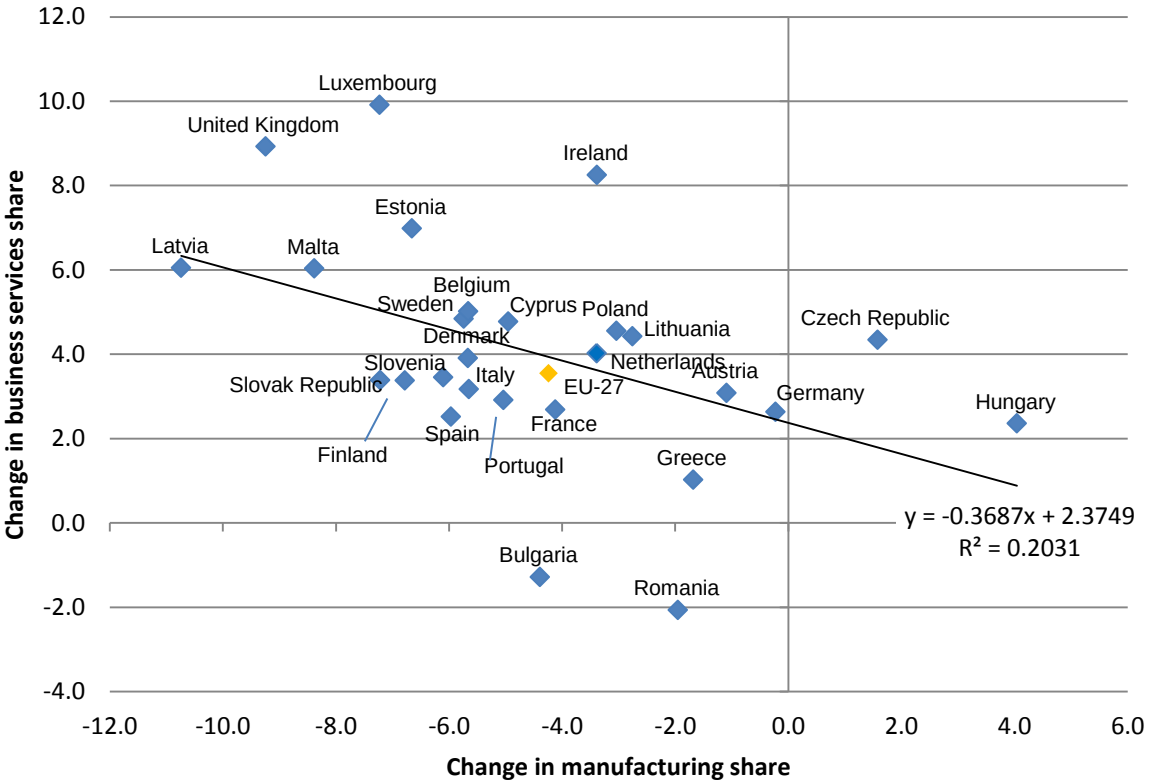
Figure 2-1 – Real growth rates of manufacturing and business services in %, 1995-2007



Source: WIOD; wiiw calculations.

However, within Europe these differentiated growth rates indicate quite divergent patterns and trends across Member States as presented in Table 2.1. In 2011 the manufacturing shares range from slightly above 10% (or even less in some small countries) to more than 25%, as e.g. in some of the New Member States. But also the trends have been rather different across countries with strong declines in some countries (e.g. UK) and rather stable shares in others (e.g. Germany). On the other hand, the shares of business services sectors in most countries have increased and now range from 25.5% in the UK (and even almost 40% in Luxembourg) to less than 10% in Bulgaria, Greece, Lithuania, and Romania. From this perspective it is interesting to note that on average the manufacturing shares declined (though with some exceptions) whereas the share of services in the economy increased, mostly due to an increase in the share of business services, whereas the shares of the other services categories are rather stable. This holds particularly when considering the larger economies such as the EU-27, the United States and Japan as shown in Table 2.1. However, at the level of individual EU Member States these trends have been more diverse as shown in Figure 2.2 which plots the changes in the share of manufacturing and business services in total GDP in percentage points over the period 1995-2011.

Figure 2.2 – Percentage point changes in manufacturing and business services shares, 1995-2011



Source: WIOD; wiiw calculations.

In all countries with the exceptions of Czech Republic and Hungary the share of manufacturing declined whereas the share of business services increased (with the exceptions of Bulgaria and Romania). However, these changes are differentiated across countries. Two contrasting patterns of development can be observed for the UK and Germany which started from very similar shares of about 20% in 1995: The UK, for example, lost about 10 percentage points of the share of manufacturing in GDP, but it gained about almost 10% in terms of business services. In Germany the share of business services increases by about 3 percentage points but it kept its share of manufacturing in GDP more or less constant. However, in general these changes are not one to one. A simple regression suggests that a one percentage point decline in manufacturing goes in hand with less than a 0.5 percentage point increase in business services. Though the negative relationship is to be expected (as this is expressed in terms of shares) it highlights the different specialisation patterns across EU Member States.

This can even be better seen from Figure 2.3 which shows the dynamics of specialisation of European countries between 1995 and 2011. More precisely, the figure plots the deviation of each country's shares of manufacturing and business services in per cent of GDP from the shares for the EU-27 in 1995 (indicated by green dots) and 2011 (indicated by red dots), respectively.

In 1995 the share of manufacturing in GDP in the EU-27 was about 20%. A number of countries have been above this level with some smaller countries (particularly Eastern European countries) showing much larger levels. A few countries, Greece, Cyprus Denmark but also France, shows levels much below the EU average. With respect to business services the average was about 14% in GDP for the EU-27 with most countries being below that level, exceptions being France, Netherlands, Belgium and United Kingdom. Thus, apart from a few exceptions, shares have clustered around the EU-27 average. This situation has changed significantly in 2011 as indicated by the red dots in Figure 2.3. For the EU-27, the share of manufacturing declined from 20 to about 16%, whereas the share

of business services increased from about 14 to 18%. But, more importantly, country shares have become much more differentiated – or, stated differently, specialisation patterns are more pronounced – where three groups of countries can be identified:

Manufacturing core countries: Some countries have been on a trajectory showing a strengthening of their relative orientation to manufacturing which includes Germany, Austria, Poland, Hungary and the Czech Republic and – to a lesser extent – Ireland. A group of other countries still maintain a relatively high share of manufacturing but nonetheless show a relative weakening of their orientation towards manufacturing. This group includes Finland, Slovak Republic, Slovenia but also Italy and Sweden.

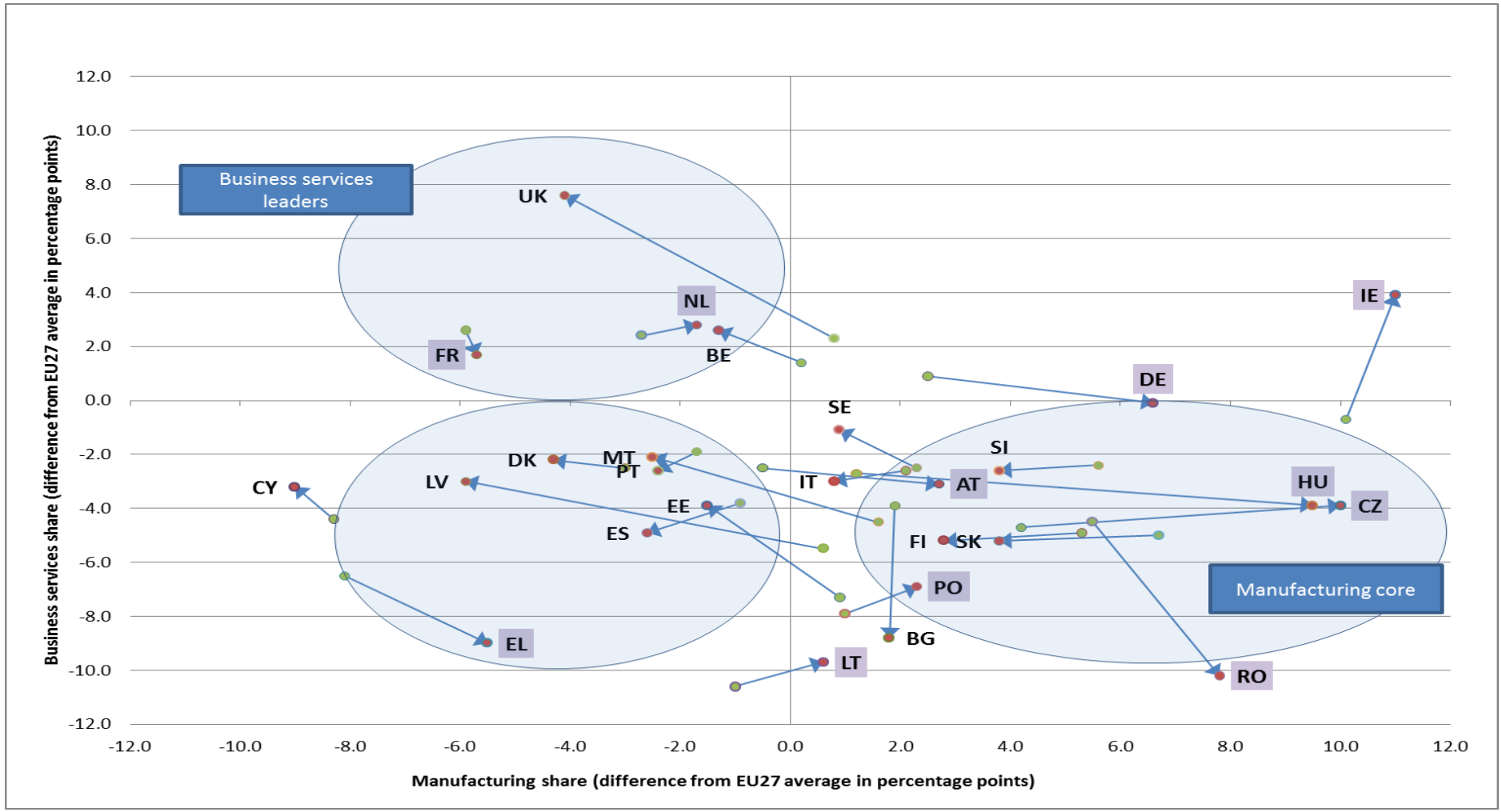
Business services leaders: Some countries which have maintained their relative position of specialisation in business services (such as France or the Netherlands) though both have a minor increase in their manufacturing share. Great Britain and Luxembourg[10] show the most important shifts towards business services and away from manufacturing.

Low manufacturing and low business services: The third group consists of countries which have neither been able to maintain a manufacturing share (even above the anyway declining EU average) nor been able to develop a large share of business services in their economies. This group comprises a number of small and peripheral countries such as the Baltic countries (with the possible exception of Estonia and Lithuania), Cyprus, Malta and Portugal but also Spain, Denmark, Greece, Portugal, Slovenia, and Finland. From a policy perspective this could imply a need for different and specific approaches towards business services for these countries if they cannot develop a stronger manufacturing sector.

This section so far highlighted the relative importance of the manufacturing and business services sector in the EU Member States highlighting the differentiated specialisation dynamics across countries. Some countries have been able to maintain an above EU-average share of manufacturing in their GDP as Germany and Sweden together with relative stable or increasing share of business services in their economies which are close to the EU-average. Other countries – like Czech Republic and Poland - also maintained or increased their share of manufacturing in GDP above EU-average but with a much lower and – relative to EU-average rather constant - share of business services in GDP. Finally, the manufacturing share decreased partly strongly in other countries or remained well below EU-average with only some of these countries (e.g. France) however having managed to specialise in business service activities or at least preserve an above EU-average specialisation in business services, whereas other countries have specialised less in business services (like Denmark). As such, one finds more pronounced patterns of specialisation in manufacturing and business services than about a decade and a half ago. The manufacturing sectors' performance of these countries just mentioned and the specific relations to service activities will be discussed in more detailed in Section 5 shedding light on the patterns of interaction between manufacturing and (business) services.

[10] Luxembourg is not shown in the figure.

Figure 2.3 – European manufacturing and business services specialisation dynamics, 1995-2011



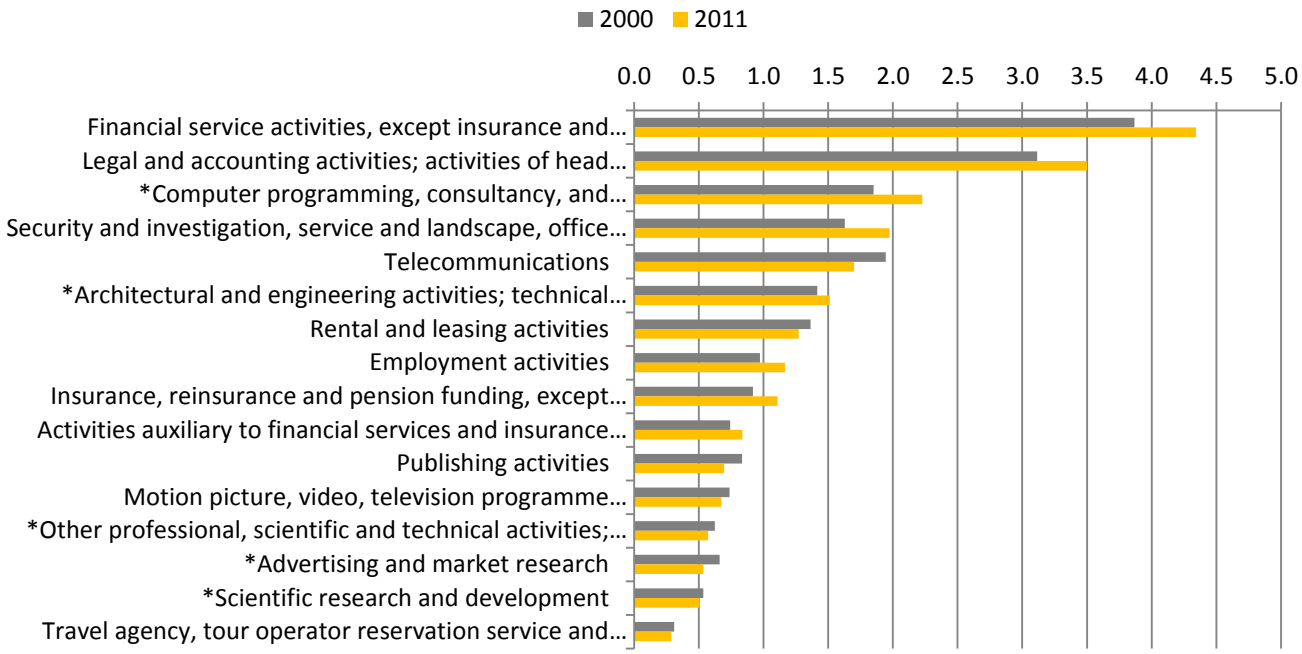
Note: Green dots indicate the deviation of the shares of manufacturing and business services in GDP to the EU-27 shares in 1995, whereas red dots indicate these deviations in 2011. Countries characterised by increasing manufacturing shares are highlighted in grey.

Source: WIOD; own calculations.

2.1.2 *Differentiated developments of the business services categories*

From the viewpoint of this study it is interesting to look at the evolution of the business services sector in more detail. Therefore, Figure 2.4 presents the respective shares in total GDP for the EU-28 countries and years 2000 and 2011 (the latest year for which data are available) according to NACE Rev. 2 classification.[11] In total, business services account for slightly more than 20% in overall GDP with only a slight increase over time (from 21.5 to slightly less than 23% between 2000 and 2011). The most important business services are financial service activities (NACE Rev. 2 K64) and legal and accounting activities, etc. (NACE Rev. 2 M69-M70). This is followed by computer programming consultancy, etc. (NACE Rev. 2 J62-J63). These three categories also show the largest increases in terms of shares. Focusing on performance related business services which make about 5% of GDP, the most important ones are computer programming computer, programming consultancy, etc. (NACE Rev. 2 J62-J63) with a share of 2.2% in 2011 and architectural and engineering activities, etc. (NACE Rev. 2 M71) with about 1.4%. The other categories: other professional, scientific and technical activities, etc. (NACE Rev. 2 M74-M75), advertising and market research (NACE Rev. 2 M73) and scientific research and development (NACE Rev. 2 M72) account each for about 0.5% of total GDP with slight declines over time.

Figure 2.4 – Shares of business services according to NACE Rev. 2 in GDP for EU-28, in % of GDP

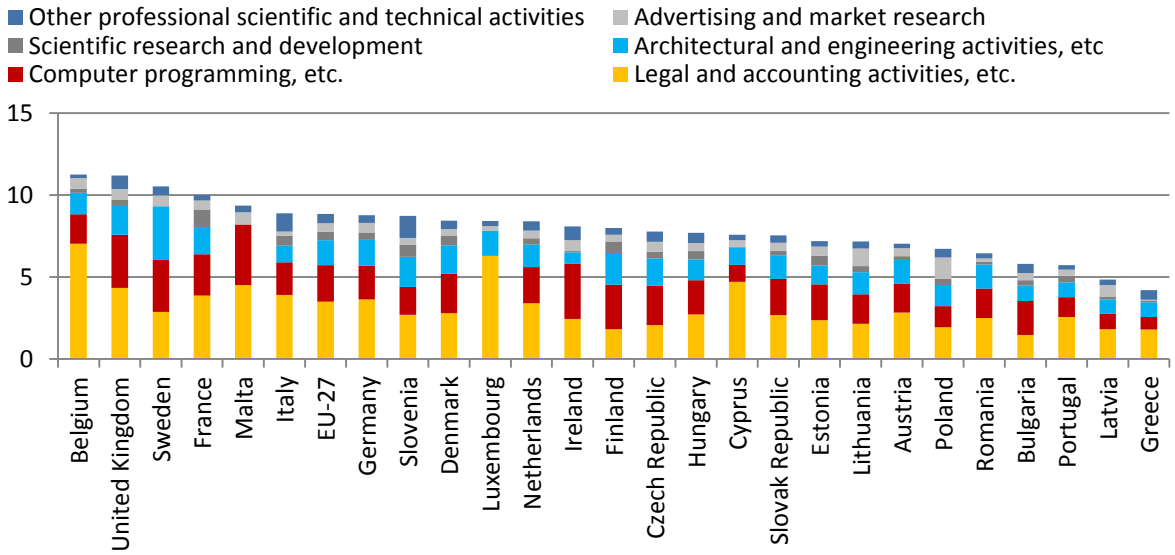


Note: * Denotes the set of knowledge-intensive business services which is focused on.
Source: Eurostat; wiiw calculations.

Figure 2.5 shows the structure of the performance enhancing business services (including legal and accounting services) in the respective EU Member States. Legal and accounting services make the bulk of business services in terms of GDP in most countries with the shares being notably large in Belgium, Luxembourg and Cyprus. Computer programming follows second on average with shares ranging from less than 1% to more than 3%. Architectural and engineering services are particularly important in Sweden (with more than 3%) with the share in the other countries ranging from 1% to 2% per cent. The other service categories considered in Figure 2.5 are less important with shares below one per cent in general.

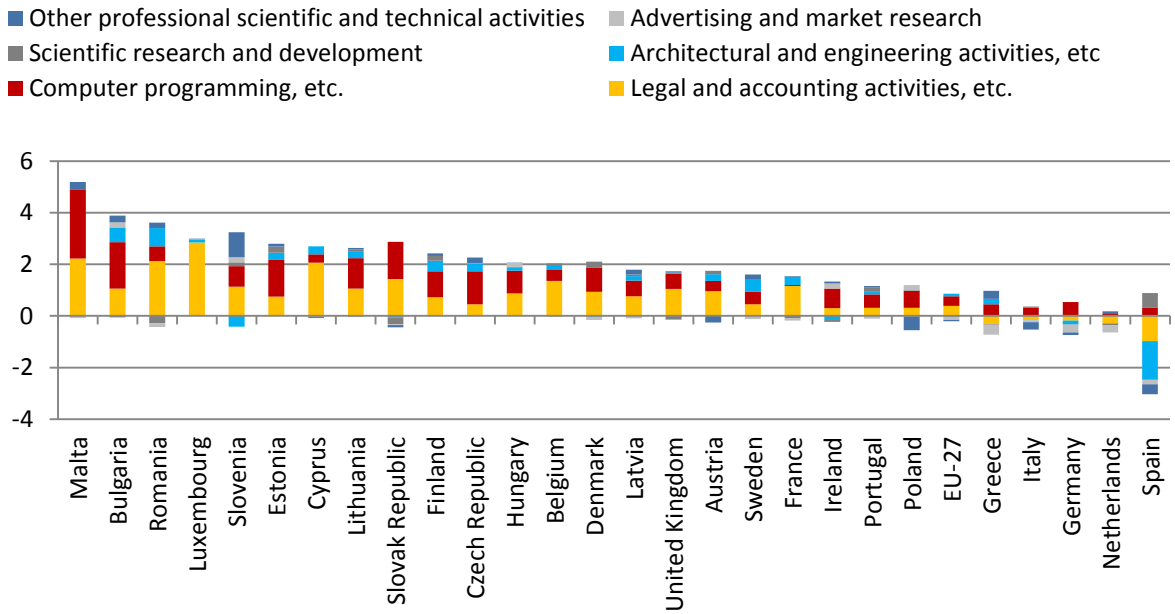
[11] As indicated in Box 2.1 the new NACE classification (NACE Rev. 2) allows one to provide interesting details concerning the evolution of business services as compared to NACE Revision 1.

Figure 2.5 - Shares of selected business services according to NACE Rev. 2, in % of GDP, 2011



Note: Lithuania (2010); Spain (2009).
Source: Eurostat; wiiw calculations.

Figure 2.6 – Percentage point changes in shares of selected business services, 2000-2011



Note: Lithuania (2000-2010); Spain (2000-2009).
Source: Eurostat; wiiw calculations.

Figure 2.6 presents the percentage point changes of these shares of business services in overall GDP. It is easy to detect that in most countries the increase in business services was due to an increase in legal and accounting services and computer programming and related activities. The latter was particularly important in Malta and a number of Eastern European countries together with Finland and Denmark whereas shares have been stable or even slightly declined for some sectors in Italy, Germany or Netherlands (and more significantly in Spain). The rise of legal and accounting services which was particularly significant in the accession countries could be due to

EU legal requirements, whereas in the old Member States the above mentioned specialisation patterns across countries play a role.[12]

2.1.3 Performance of manufacturing and services sectors

Having considered the differentiated developments of the manufacturing and business services sector across countries the next step is to analyse the performance of these industries over time and in particular to which extent performance of the business services sectors correlate with the developments in terms of specialisation discussed above.

Performance indicators of manufacturing and services in large economies

Though the focus lies on developments across EU Member States as a starting point performance indicators are compared across large economies, the EU-27, USA and Japan. Table 2.2 presents the developments of labour productivity based on value added and gross output, growth rates of employment and value added, developments of wage rates, resulting developments of unit labour costs and the price indexes of both value added and gross output based on the WIOD-SEA data. This table includes measures based on gross output as when focusing on total costs the role of intermediates have to be considered.[13] The period considered is 1995-2007, i.e. not including the crisis period.[14] The results are based on constant prices 1995, and presented for the total economy, the manufacturing industries, and three broad services sectors.

Table 2.2 – Performance indicators for large economies, growth rates in % over period 1995-2007

		Value added	Employ-ment	Labour productivity (VA)	Labour productivity (GO)
Total	EU-27	3.5	1.0	1.7	2.3
	USA	3.6	1.1	2.5	2.1
	Japan	1.6	-0.3	1.9	1.4
Manufacturing	EU-27	6.2	-0.6	3.6	4.4
	USA	4.4	-1.8	6.2	3.8
	Japan	2.7	-1.8	4.5	3.2
Distribution etc.	EU-27	2.9	1.9	0.7	0.8
	USA	4.5	1.2	3.2	2.4
	Japan	0.3	-0.4	0.7	0.7
Transport and communication	EU-27	4.2	0.7	3.7	4.4
	USA	4.3	0.4	3.8	3.2
	Japan	1.9	-0.4	2.3	2.2
Business services	EU-27	3.8	3.7	0.4	1.2
	USA	4.5	2.1	2.4	3.6
	Japan	3.5	2.0	1.4	1.2

Source: WIOD; wiiw calculations.

Starting with value added growth it can be seen that there is a unanimous ranking in the sense that the US was growing faster (in real terms) in all distribution and business services. The growth rates in the EU-27 have been

[12] The decline of respective shares in Romania and Bulgaria as visible in Figure 2.2 is driven by the period 1995-2000.

[13] In the econometric analysis in Section 3 results will also be provided for gross output based performance measures.

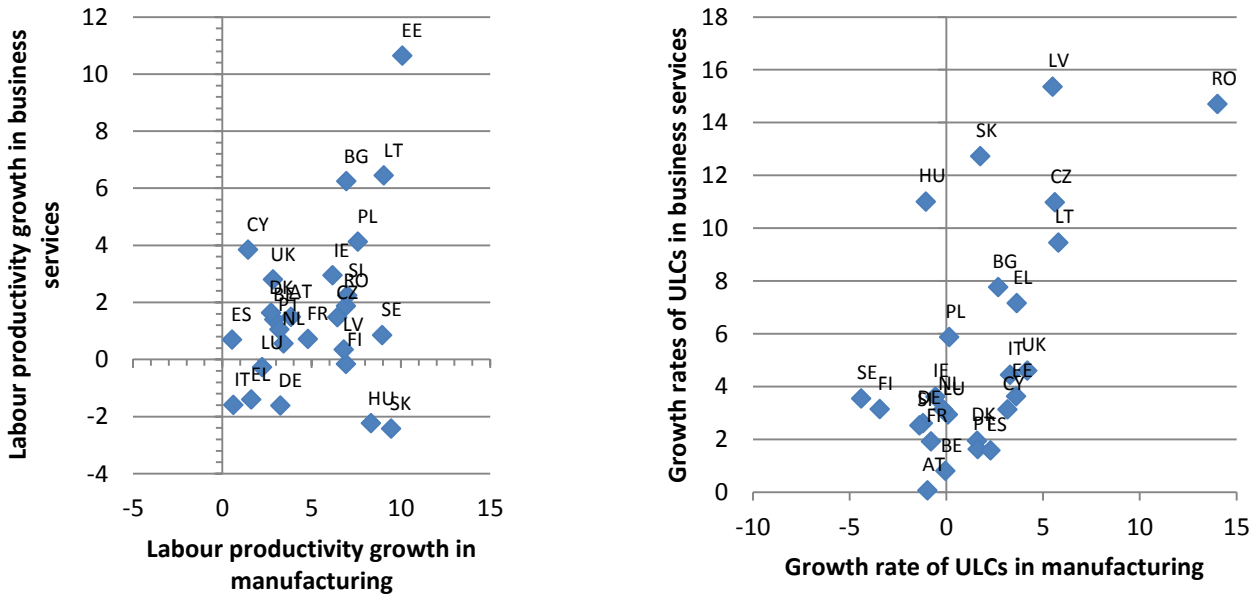
[14] Results are however qualitatively similar when considering the full period or a shorter period such as 2000-2007. An analysis up to a more recent year is hindered by lacking data availability and the break in the NACE classification.

higher in manufacturing. In all cases these two economies performed better than Japan, though the growth differential in business services to the EU-27 is small. In terms of employment growth the performance of the EU-27 is in most cases better than that of the US. With respect to labour productivity growth, the US reports larger productivity growth rates in value added terms in manufacturing, distribution and business services. In manufacturing the EU-27 has been doing however better when considering productivity based on gross output.

Performance indicators of manufacturing and services across EU member countries

Figure 2.3 highlighted the differentiated specialisation patterns of manufacturing and services activities across Europe. Figure 2.7 presents growth rates of labour productivity and unit labour costs in the manufacturing and the business services sectors.

Figure 2.7 – Productivity and unit labour costs developments, growth rates 1995-2007 in %



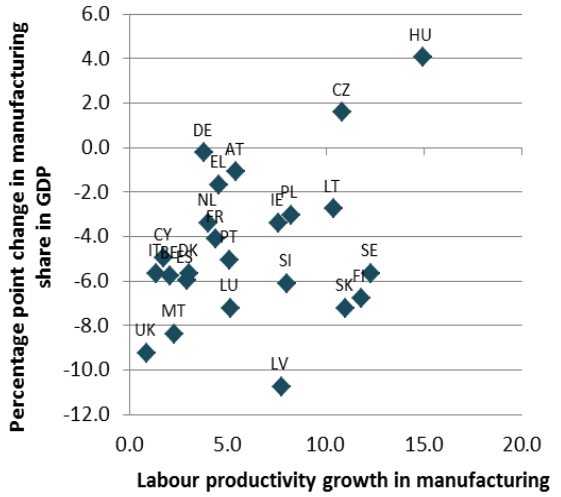
Source: WIOD; wiiw calculations.

First, when comparing labour productivity performance of these two sectors it turns out that labour productivity growth rates range from almost zero up to about 10%; the Eastern European countries but also Finland and Sweden have particularly high growth rates in manufacturing. When not considering Bulgaria, Lithuania and Estonia the growth rates of labour productivity in the business services sector are less differentiated ranging from -2 to 4%. These growth rates are even negative for some large economies such as Italy, Greece, Germany, Hungary and the Slovak Republic, which, in fact, explains the low EU growth rate. The UK, Denmark, Belgium and Netherlands have above-EU average growth rates. Concerning unit labour costs growth a differentiated pattern is observed as these have a much larger spread in business services as compared to manufacturing (when not considering Romania). Again, this is particularly driven by the performance of the Eastern European countries. A simple explanation behind that differentiated patterns in terms of labour productivity and unit labour costs growth is that wage rates tend to grow at similar rates across sectors. Particularly, in the Eastern European

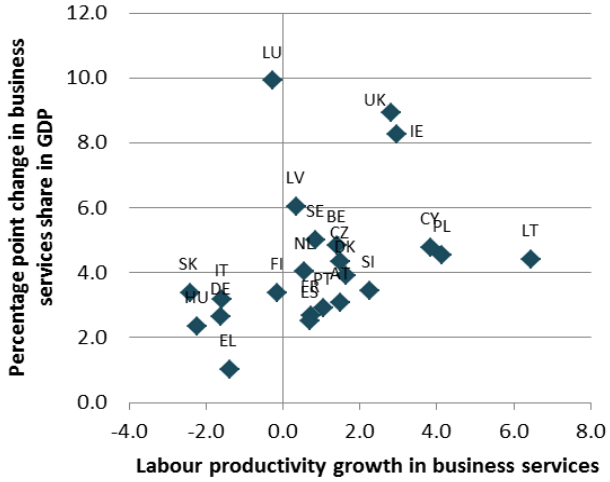
countries manufacturing productivity growth incited wage increases also in services which are not accompanied by similar productivity gains. A similar pattern is observed when considering EU-15 only: Italy, UK but also Denmark, Portugal and Spain experience much larger unit labour costs growth rates in manufacturing, i.e. the tradable sectors, compared to the other countries, whereas UK and Italy experience higher growth rates in business services, which is less tradable directly. Greece experienced high unit labour costs growth in both sectors considered here.

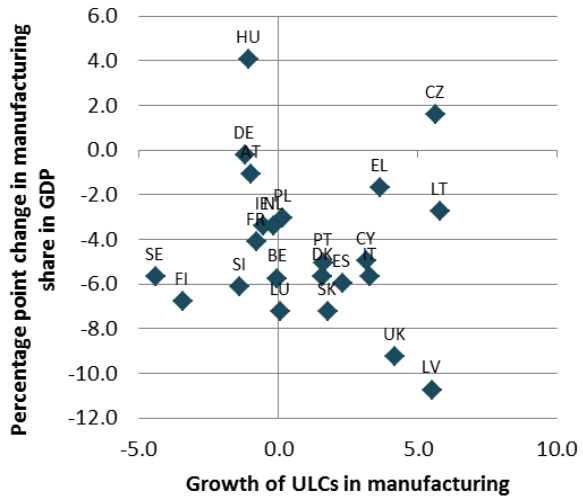
Figure 2.8 – Performance and specialisation dynamics 1995-2007

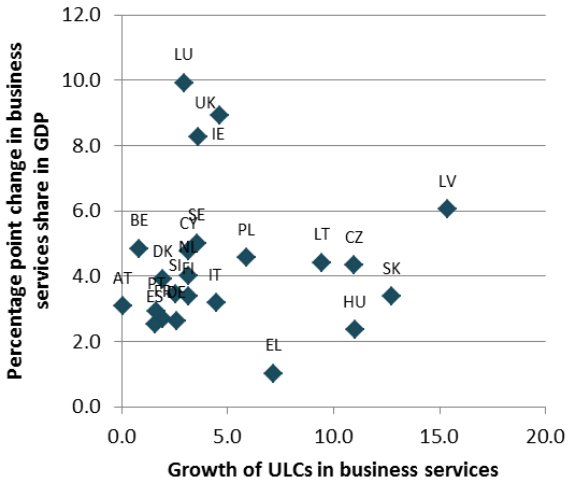
Manufacturing



Business services







Source: WIOD; wiiw calculations.

Finally, the question to which extent this differentiated productivity and unit labour costs dynamics has shaped the specialisation patterns as shown in Figure 2.3 above has to be addressed. Figure 2.8 presents the percentage point changes of the manufacturing and business services shares in GDP relative to the performance measures labour productivity growth (upper panels) and unit labour costs growth (lower panel). With the exception of a few outliers there seems to be a positive relation between the growth rates of labour productivity in both manufacturing and business services and the respective percentage point changes in their shares in GDP. A negative correlation can also be seen when considering unit labour costs growth and the share in GDP in manufacturing (with a few outlying cases) though this is less the case for business services. Thus in a broad sense, the countries in the manufacturing core have been characterised by *relatively* higher productivity growth rates and *relatively* lower growth rates of unit labour costs, which contributed – amongst other things such as the emergence of production networks in specific high-tech sectors, FDI flows and the exploitation of economies of scale – to the development of the European manufacturing core. Other countries have been more successful in specialising in (business) services partly because of their relatively better performance in the services industries. It should be noted here that also for (business) service activities factors such as integration via FDI, economies of scale, learning effects, etc. do play a role, thus indicating that a clustering of these activities is likely to occur. Taken all together this resulted in the differentiated specialisation dynamics across Europe as indicated in Figure 2.3.

2.2 Indicators capturing the inter-linkages between manufacturing and services industries

These aspects and the observed patterns of specialisation are particularly important when – as is the focus of this study – investigating the interaction of manufacturing and services activities. Questions arising are (i) about the role and relative importance of business services in manufacturing activities and (ii) the role of cross-border provision of business services in case of increased specialisation across countries. This section therefore sheds light on these interactions based on quantitative indicators concerning these inter-linkages which will subsequently be used in an econometric investigation studying its impact on manufacturing performance (Section 3). Sections 5 and 6 then investigates in more details the role of business services in manufacturing activities and the role of cross-border flows for a selection of countries and industries.

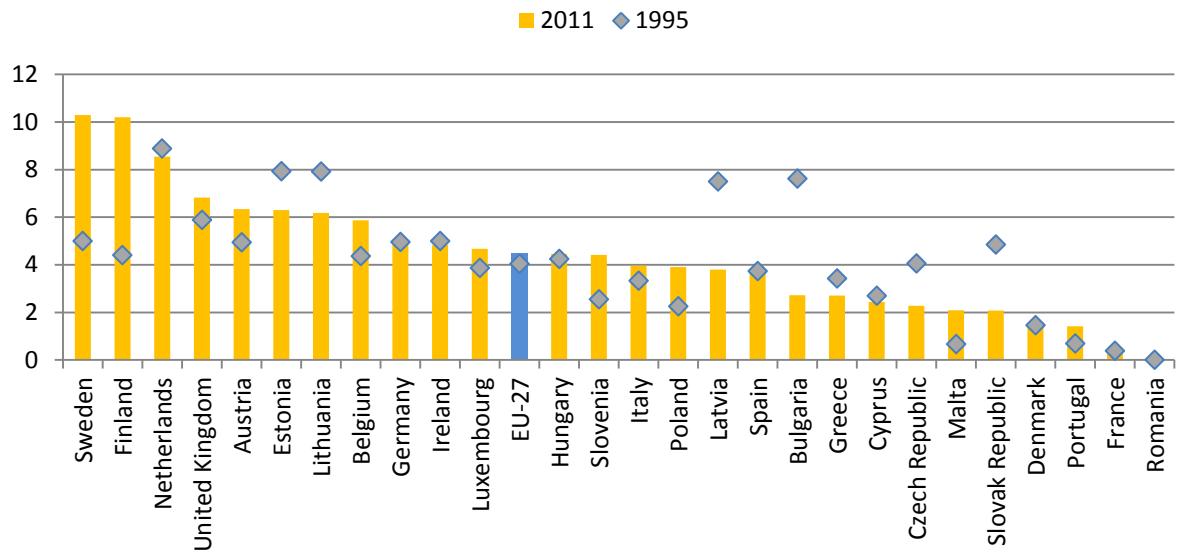
2.2.1 Secondary production

Manufacturing firms provide additional output in services as maintenance and repair services, business advisory services (e.g. accounting, legal, advertising, management consulting, software consultancy), presale services, sales services such as installation and training, automobile financing, procurement services, and after sales services (Magnusson et al., 2007). Such 'secondary production' can be calculated by using information from the supply tables which list output of firms classified as manufacturing or services by product (according to CPA classification). Secondary production in the input-output framework include subsidiary products (i.e. secondary products that are technologically unrelated to the primary product), by-products (products that are produced simultaneously with another product, but which can be regarded as secondary to that product) and joint products (i.e. products that are produced simultaneously with another product, but which cannot be said to be primary). The share of secondary production in Europe is generally low (see Eurostat, 2008, Chapter 11, for details) as shown in Figure 2.9.

The share of secondary production in the EU-27 manufacturing industries gross output is about 4.5% with only a slight increase observed since 1995. However, there exist large differences across EU Member States as shares

range from about 10% in Sweden and Finland to less than 1% in France and Romania. In most of the EU-15 countries this share has been slightly increasing whereas pronounced declines are reported for most of the EU-12 countries.[15] Remarkable increases are however observed for Sweden and Finland. These results support the findings by Falk and Jarocinska (2010), Stehrer et al. (2012) and Dachs et al. (2012). The latter contribution further argues that there is a strong positive relation between the share of secondary service production in manufacturing and R&D intensity measured as GERD relative to GDP. They further point towards a strong relationship between service output and innovation-intensive industries (defined according to Peneder, 2010) with the electrical and optical equipment industry being the most pronounced in this respect. The shares of products delivered as secondary products differ however.

Figure 2.9 - Secondary service production of manufacturing industries in % of gross output



Source: WIOD; wiiw calculations

In 2011, the share of non-tradable market services (comprising repair, wholesale and retail trade) in the EU-27 accounts for slightly less than two third and business services (Financial Intermediation, NACE Revision 1 J, and Renting of M&Eq and Other Business Activities, NACE Rev. 1 71t74) for about one third of the services[16] supplied by manufacturing industries whereas transport and communication and non-market services are only marginal.[17] This pattern is more or less the same or even more pronounced towards a relatively higher importance of non-tradable market services when considering individual EU Member States. Particularly, the secondary production of business services is relatively more important for Denmark, Finland and France, but also for Luxembourg, Sweden and Portugal (although for the latter country the overall share of secondary products is relatively low). The significant increase in the share of secondary service production in Finland and Sweden was mostly due to an increase in the non-tradable market services and even more so in business services. However, even though the share of business services increased in the majority of Member States, there is no common trend.

[15] These declines are observed in most, though not all countries between 1995 and 2000. Romania reports a secondary production of zero.
[16] For some of the EU-12 countries these shares are much larger, however. Falk and Jarocinska (2010) report an unweighted share of about 50% of business services in manufacturing services turnover.
[17] Dachs et al. (2012) report a larger share of KIBS in manufacturing output using a different definition as KIBS includes CPA 72-74) and non-KIBS comprises CPA 55 to 95 excluding KIBS.

These differences across countries and the changes over time lead to the question whether these patterns and changes differ across industries. Considering EU-27, secondary service production is largest in medium-high- and high-tech industries and lowest in the medium-low-tech industries. In the medium-high- and high-tech industries business services play a relatively larger role and changes have also been stronger, particularly so for Finland and Sweden

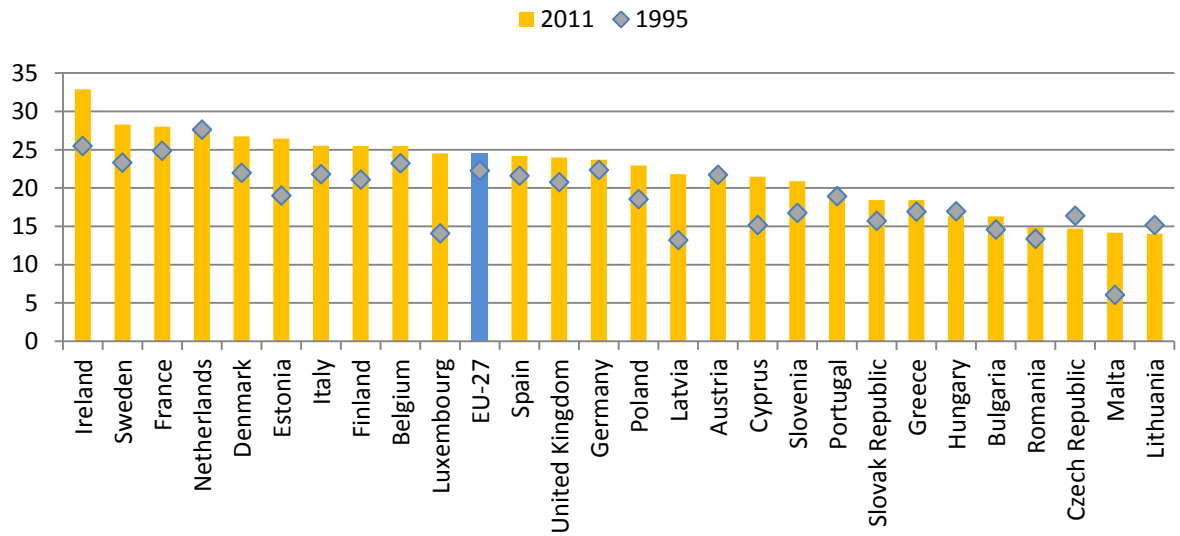
Concerning secondary manufacturing production of services industries, the data indicate that these shares are generally rather small with e.g. 0.8% for the EU-27 in 2011. With respect to individual Member States the share of secondary production of manufacturing products in services sectors account for less than 1% on average. For some countries, e.g. Belgium, Italy and a number of Eastern European economies, slightly larger shares are found with the largest share being 4.3% in the Slovak Republic. There is no common trend over time though the average is slightly decreasing since 1995.

Thus, generally the shares of secondary production are rather small with some country heterogeneity. However, it should be noted that this indicator – as defined in official statistics – does not at all fully capture the role of 'servitisation' of production which is highlighted in more detail in Section 5.

2.2.2 Direct cost shares

Manufacturing industries use services to a large extent as an important input in their production processes. The value of gross output produced by an industry (or firm) consists of inputs of primary factors such as labour and capital services (and the respective factor payments to them) and the use of intermediary inputs from other manufacturing industries and services, both from domestic and foreign sources. This is the information which is reported in the (columns of the) use or input-output tables which are closely related to the national accounts statistics. Figure 2.10 provides the results concerning the importance of services inputs in terms of (direct) cost shares, i.e. service inputs in per cent of gross output, in the manufacturing industry for the EU-27 countries.

Figure 2.10 – Cost shares of services in manufacturing in % of gross output



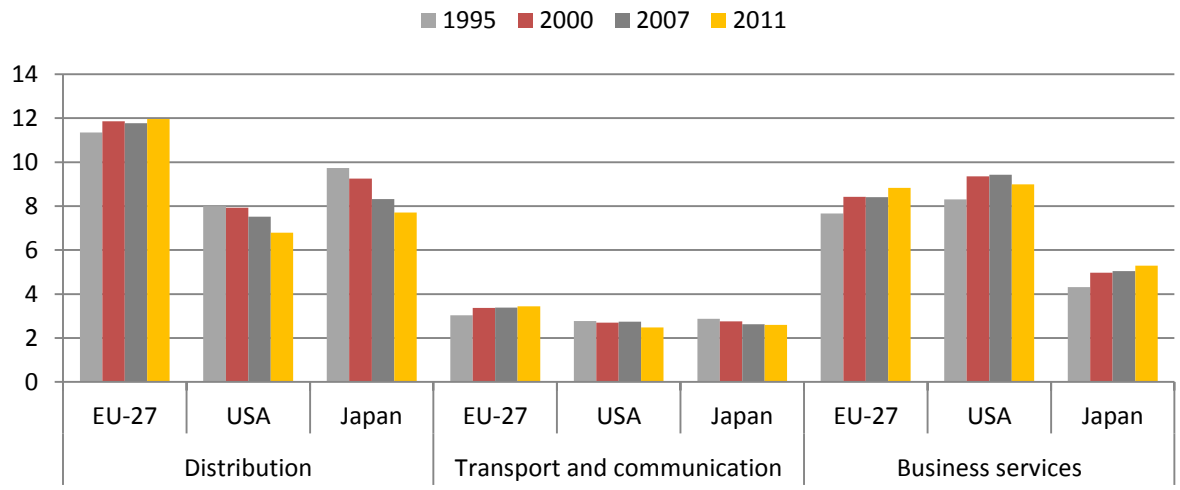
Source: WIOD; wiiw calculations.

For the EU-27 this share stood at about 25% in 2011, marking a slight increase from about 22% in 1995. However the shares range markedly across countries: from more than 30% in Ireland to less than 15% in the Czech Republic, Malta and Lithuania. With a few exceptions, these shares have been rising or at least remained stable for most countries. Particularly strong increases are observed for Luxembourg, Latvia, and Malta which, however, partly started from rather low levels. Generally, these service cost shares tend to be lower in the EU-12 countries together with Greece and Portugal.

Two questions might arise from this broad pattern: First, to which extent these cross-country differences are driven by the sectoral composition or the differences in the respective direct cost shares and, second, what explains the changes over time. Concerning the first question, it turns out that the differences across countries mostly result from differences in services use (as measured by cost shares) rather than industry composition. A similar result holds when considering the changes over time, i.e. the dominant effect concerning the changes in service intensities are changes in the direct cost shares rather than changes in the structure of manufacturing.

Whereas Figure 2.10 presented overall services cost shares in manufacturing, the next figures provide more detailed information on services cost shares split into distribution and other services, transport and communication services, business services (including financial services) and non-market services[18]. For a broad overview, Figure 2.11 first presents these shares for the EU-27, the US and Japan. The share of distribution services is the highest in the EU-27 with about 12% as compared to the US with about 7% and Japan with slightly less than 8%. The cost shares of transport and communication services are more similar though with 3.5% also slightly higher in the EU-27 (3.5%) as compared to the US or Japan with about 2.5%. Finally, the share of business services is about 9% both in the EU-27 and in the US and in the case of the EU-27 was slowly converging to the US. This share is rather low in Japan with about 5% though also slightly increasing.

Figure 2.11 – Cost shares of services in manufacturing, in % of gross output



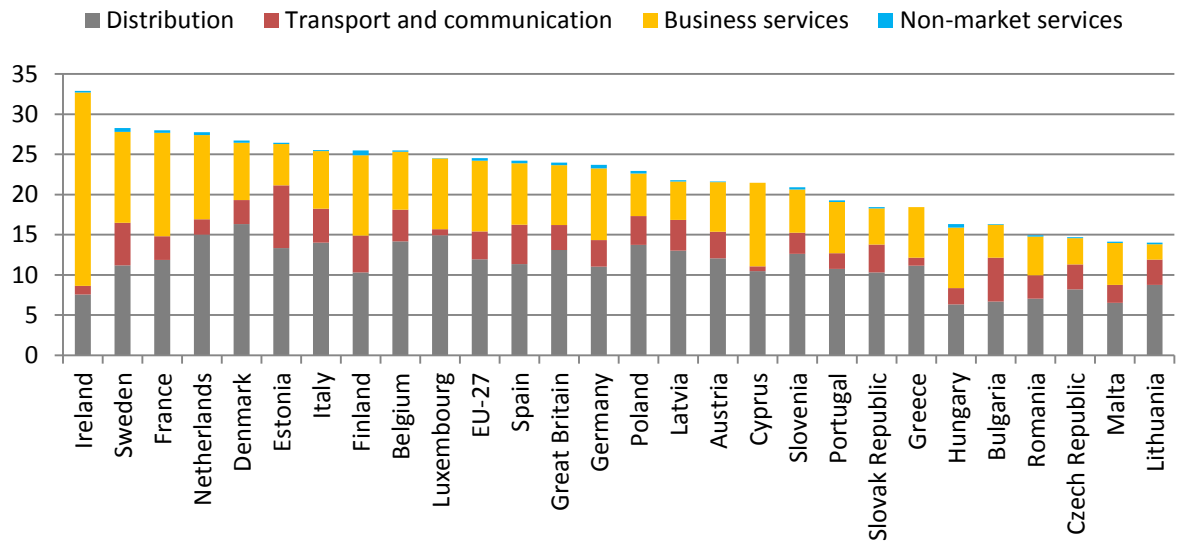
Source: WIOD; wiiw calculations.

[18] Distribution and other services include Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel (NACE Rev. 1 50), Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles (NACE Rev. 1 51), Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods (NACE Rev. 1 52), and Real Estate Activities (NACE Rev. 70) and Private Households with Employed Persons (NACE Rev. 1 P). Transport and communication services include Hotels and Restaurants (NACE Rev. 1 H), Inland, Water and Air transport and other supporting auxiliary transport services (NACE Rev. 1 60-63) and Post and Telecommunications (NACE Rev. 1 64). Business services include Financial intermediation services (NACE Rev. 1 70) and Renting of M&Eq and Other Business Activities (NACE Rev. 1 71t74). Non market services comprise the remaining categories Public Admin and Defence; Compulsory Social Security (NACE Rev. 1 L), Education (NACE Rev. 1 M) Health and Social Work (NACE Rev. 1 N), and Other Community, Social and Personal Services (NACE Rev. 1 O).

Cross-country differences in the structure of services cost shares in manufacturing are highlighted in Figure 2.12. Across EU Member States the shares of distribution services range in 2011 from slightly above 6% in Bulgaria, Hungary, and Malta to shares up to 16% as e.g. in Denmark (16.3%), Netherlands (15%), Luxembourg (14.9%) to list the countries with the highest shares. Cost shares of transportation and communication services are again more balanced, though these are relatively low in Cyprus, Greece and Luxembourg. Importantly, the direct cost shares of business services are much more diverse across countries. These range from 24% in Ireland, 12.9% in France, about 10% in Cyprus, Finland, Netherlands and Sweden to about 4-5% in the other countries. Shares are particularly low in Lithuania with only 2%. Generally, these shares have increased over time, particularly so with respect to business services and in some countries for transport and communication services as highlighted in Figure 2.13.

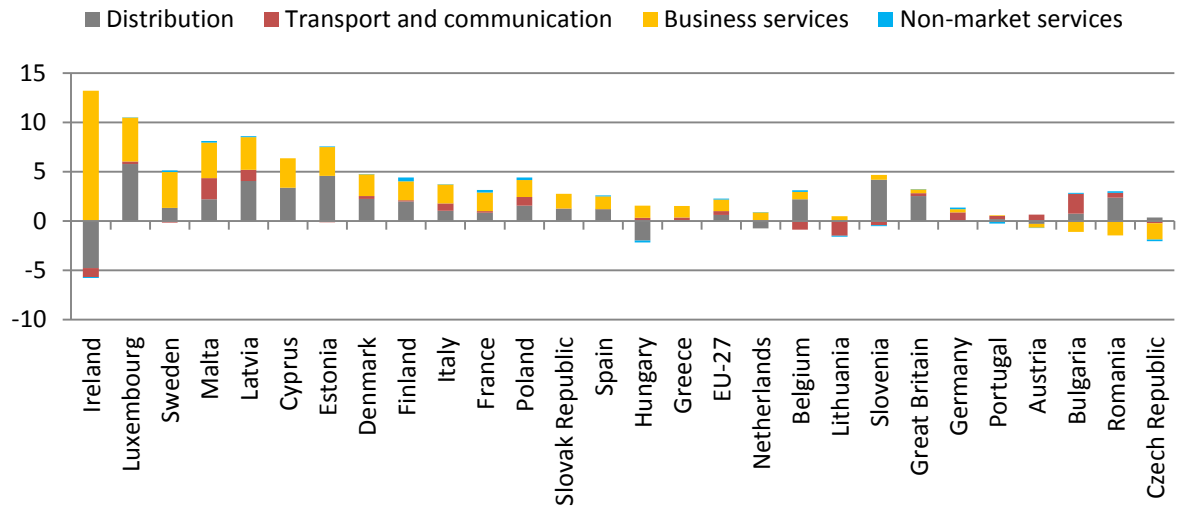
Unfortunately, the CPA category 'Other business services' (CPA 74) takes account of the major part of cost shares with in most cases more than 50% (or 5.6% in gross output). This category however includes a rather large range of different service activities (e.g. cleaning, advertising, consultancy, etc.). Differences across countries with respect to business service inputs are largely driven by differences in the shares of this category 'Other business services' (CPA 74). This is particularly the case for Ireland showing a share of other business services of 18% as compared to less than 6% for the EU-27.

Figure 2.12 – Structure of services cost shares in % of gross output, 2011



Source: WIOD; wiiw calculations.

Figure 2.13 – Percentage point changes in services cost shares in manufacturing, 1995-2011



Source: WIOD; wiiw calculations.

Performance related services: A detailed look based on revised CPA classification

However, as indicated in Box 2.1 the revised NACE classification allows for a better split within business services and a number of countries have already provided supply and use or input-output tables for 2010. This information can be used to shed a more detailed light on the structure of business services used in manufacturing industries. Table 2.3 therefore presents the shares of business services in gross output based on the new CPA categories which closely correspond to the business service activities as used above.

Table 2.3 – Share of business services according to CPA Rev. 2 in EU-27*, 2010

CPA	Description	in % of gross output	in % of business services
J58	Publishing activities	0.2	1.8
J59-J60	Motion picture, video, television programme production; programming and broadcasting	0.1	0.8
J61	Telecommunications	0.2	2.5
*J62-J63	Computer programming, consultancy, and information service activities	0.6	5.9
K64	Financial service activities, except insurance and pension funding	1.1	10.9
K65	Insurance, reinsurance and pension funding, except compulsory social security	0.2	2.3
K66	Activities auxiliary to financial services and insurance activities	0.1	1.0
M69-M70	Legal and accounting activities; activities of head offices; management consultancy activities	1.8	17.6
*M71	Architectural and engineering activities; technical testing and analysis	0.8	7.5
*M72	Scientific research and development	1.1	10.9
*M73	Advertising and market research	0.9	9.3
*M74-M75	Other professional, scientific and technical activities; veterinary activities	0.2	2.4
N77	Rental and leasing activities	1.0	10.3
N78	Employment activities	0.8	8.0
N79	Travel agency, tour operator reservation service and related activities	0.1	0.6
N80-N82	Security and investigation, service and landscape, office administrative and support activities	0.8	8.3
		10.1	100.0

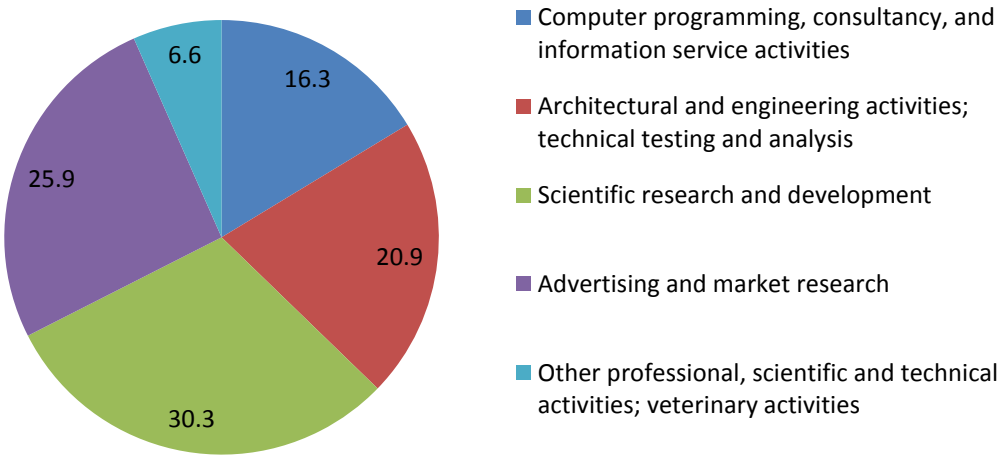
Note: EU-27 does not include Cyprus, Denmark, Malta, Poland and Spain.
Source: Eurostat; wiiw calculations

The total share in gross output accounts for about 10% (which is comparable to about 9% based on the old classification). When those activities which are also captured in the old CPA categories (i.e. CPA categories J62-J63, K, M72, N77) are not taken into account, the remaining categories account for about 6% of gross output which is relatively close to the share of 'other business services' as is observed when using the old classification.

Assuming now that these categories (highlighted in light grey in Table 2.3) account for the category 'other business services' the structure of this category would be as presented in Figure 2.14. Important categories which are probably related to industry performance would however be only a subset of these: Computer programming (CPA J62-J63), Architectural and engineering activities, etc. (CPA M71), Scientific research and development (M72), Advertising and market research (M73) and other professional etc. activities (M74-M75), which together account for a share of 3,6% in terms of gross output. The relative importance of these activities is plotted in Figure 2.14. Scientific research and development (M72) accounts for about 30%, followed by Advertising and market research (M73) with 25.9%, and Architectural and engineering activities, etc. (CPA M71) with 20.9%. Computer programming (CPA J62-J63) accounts for about 16% and category other professional etc. activities (M74-M75) for slightly above 6%.

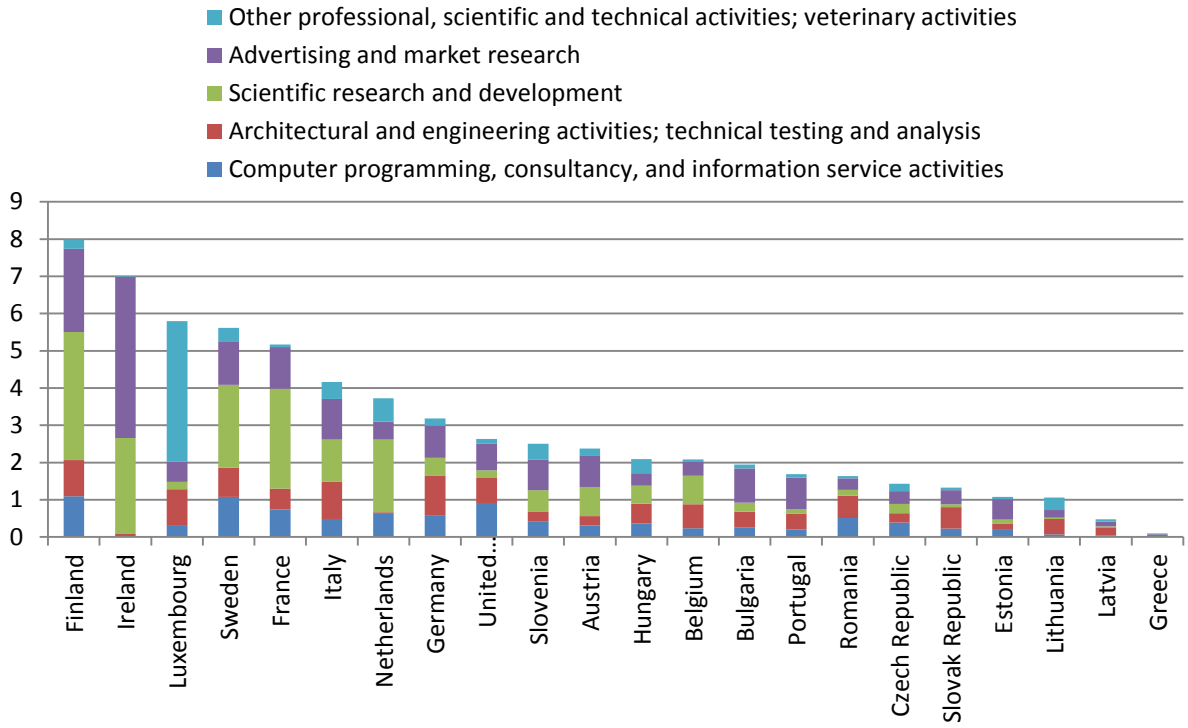
An analogous exercise can be undertaken at the level of individual Member States. Figure 2.15 presents the shares in gross output for the performance related categories. Similar to the results above countries with the highest shares are the Nordic countries, Ireland and the larger economies. The smaller economies have input shares of less than 3%. These differences are mostly driven by differences in the shares of scientific research and development and advertising and market research.

Figure 2.14 - Structure of performance related services, 2010



Note: These performance related services account for 3.6% of gross output.
Source: Eurostat; wiiw calculations

Figure 2.15 - Structure of use of performance related services in manufacturing in % of gross output, 2010



Source: Eurostat; wiiw calculations

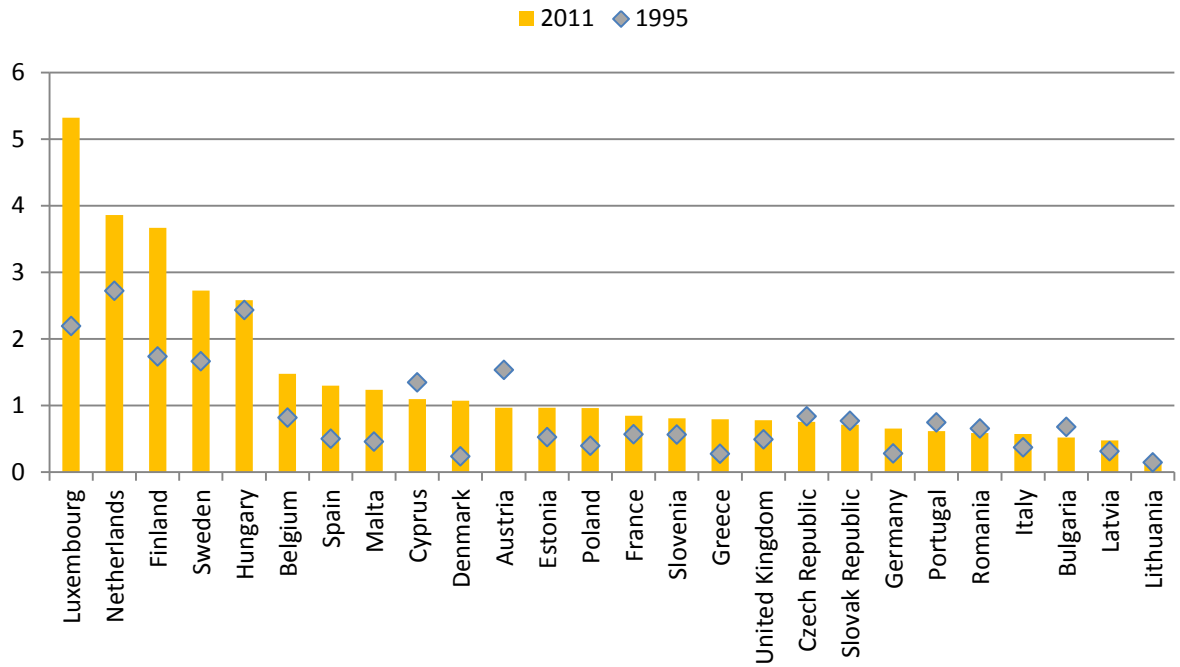
The direct cost share of services in gross output in the EU-27 takes account of about 25% in 2011 with only a relatively small increase observed since 1995 with distribution and business services showing the largest shares. However, the results point towards a wide range for these shares across countries mostly driven by business services. More detailed results based on the new NACE classification also highlight country differences with respect to scientific research and development and advertising and market research. It needs to be stressed that these direct cost shares only capture bought-in services, and do not take in-house provision of services into account.

2.2.3 Imported services cost shares

Part of the (business) services used in manufacturing industries as intermediate inputs are imported from other countries. This becomes more and more important when taking account of the increasing specialisation across Europe, as indicated above. As the bulk of imported services for most countries are in business services and these are also the services which are the focus of in this study,[19] It needs to be emphasised, that for the distinction between domestic and imported intermediaries (and therefore also for business services) it is the location of production which matters, but not the ownership of the providing firms, in line with national accounting principles. Furthermore, it should be stressed that these figures only include Mode 1 and Mode 2 services trade.[20] Figure 2.16 presents the shares of imported business services used in manufacturing in per cent of gross output for individual Member States.[21]

[19] Imports of transport and communication services in manufacturing play a relatively important role in e.g. Sweden, Belgium, Austria and Denmark with a cost share of about 1 per cent. Distribution services show cost shares of less than 1 per cent in general.
[20] These two modes characterise services supply where the supplier is not present within the territory of the member: Mode 1 (cross-border services supply) are defined as delivery of a service from the territory of one country into the territory of other country, whereas Mode 2 (consumption abroad) comprises consumption abroad (supply of a service in a country to the service consumer of any other country). Mode 3 (commercial presence) and 4 (presence of a natural person) are services deliveries where the supplier is present in the territory of the partner.
[21] Comparing the EU-27 (extra-EU imports) with the US and Japan reveals that for these large countries the imported services account for a very small share only, usually less than 1%. These are slightly higher for the EU-27 as some European economies (e.g. Switzerland, Norway) are

Figure 2.16 – Direct cost shares of imported business services in manufacturing in % of gross output



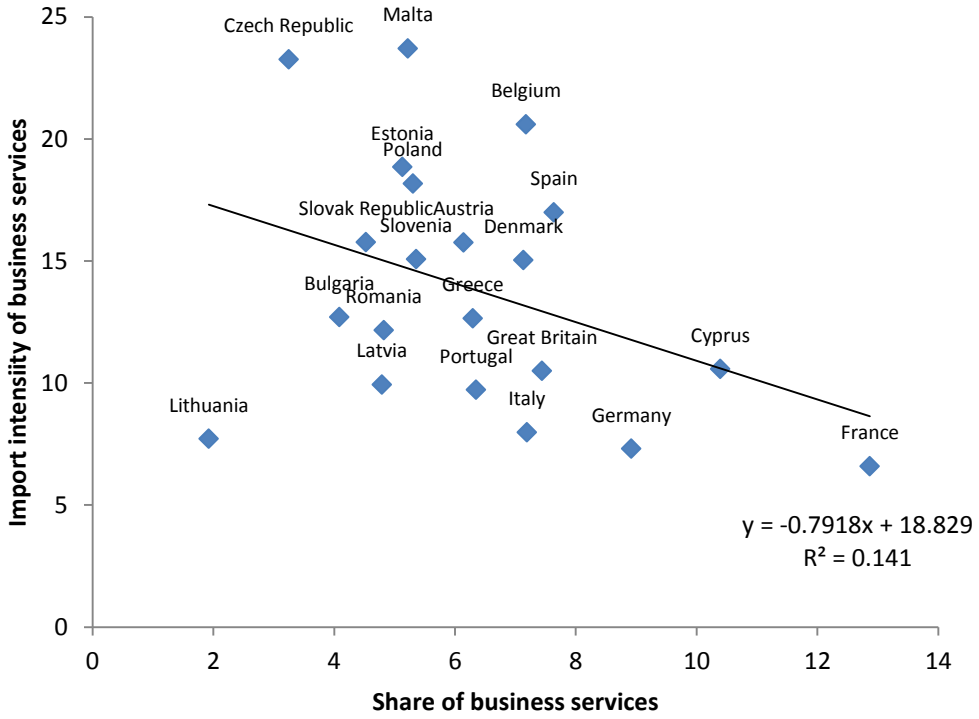
Note: Ireland is not reported.
Source: WIOD; wiiw calculations.

For individual Member States, the shares of imported services in per cent of gross output range from more than 5% in Luxembourg to about 1-2% or less in a number of countries; in fact, in 17 countries these shares are below 2% in 2011. This group comprises both large countries such as Germany, Italy, Great Britain or France but also most of the Eastern European countries. Larger shares are observed for the Netherlands, Finland, Sweden and Hungary with about 3%. In most countries these shares have been increasing over time.

There is a wide range of import intensities – defined as the share of imported business services in per cent of total business services used in manufacturing – ranging from more than 50% in Ireland and Luxembourg to less than 10% in France, Germany, Italy and others. The arithmetic EU average was 20% in 2011. These patterns are highlighted in Figure 2.17. These shares have increased over time in most countries with a few exceptions such as Austria, the Slovak Republic, Hungary, Latvia, Cyprus and Malta. A potential reason for this could be that some headquarters moved activities to these countries. This allows one to study the relationship between import intensities and the overall share of business services used in manufacturing. When not considering the countries which have very high import intensities (such Finland, Hungary, Ireland, Luxembourg and Sweden) there is a rather clear negative relationship. Particularly high import intensities can be seen for smaller countries for which therefore imports of business services play an important role in the manufacturing process when compared to larger countries.

included in the rest-of-world category. This is also the reason why shares for individual EU Member States are generally larger when including intra-EU imports.

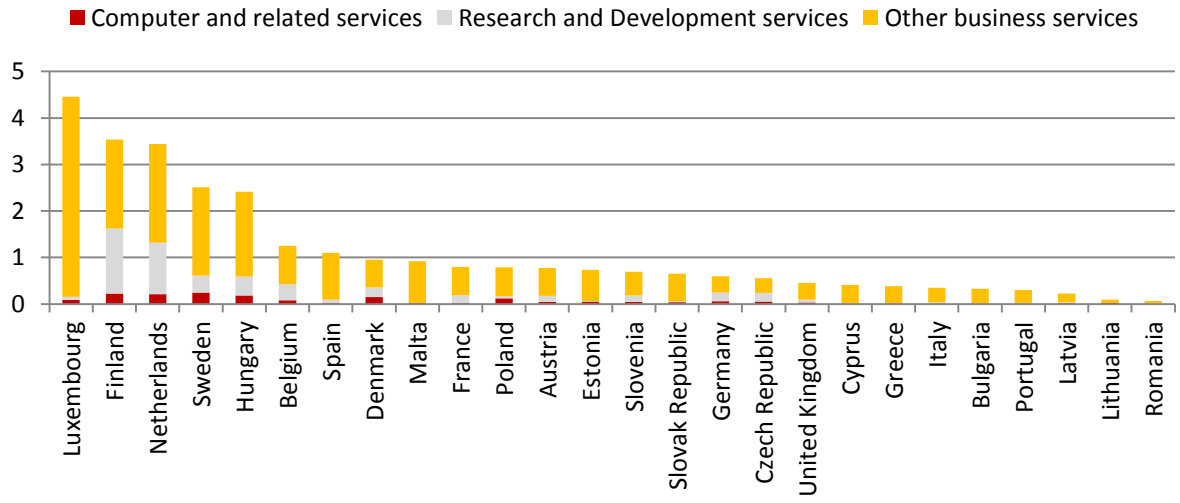
Figure 2.17 – Import intensities and the cost share of business services in manufacturing in %, 2011



Note: Excluded are Finland, Netherlands, Hungary, Ireland, Luxembourg and Sweden.
Source: WIOD; wiiw calculations.

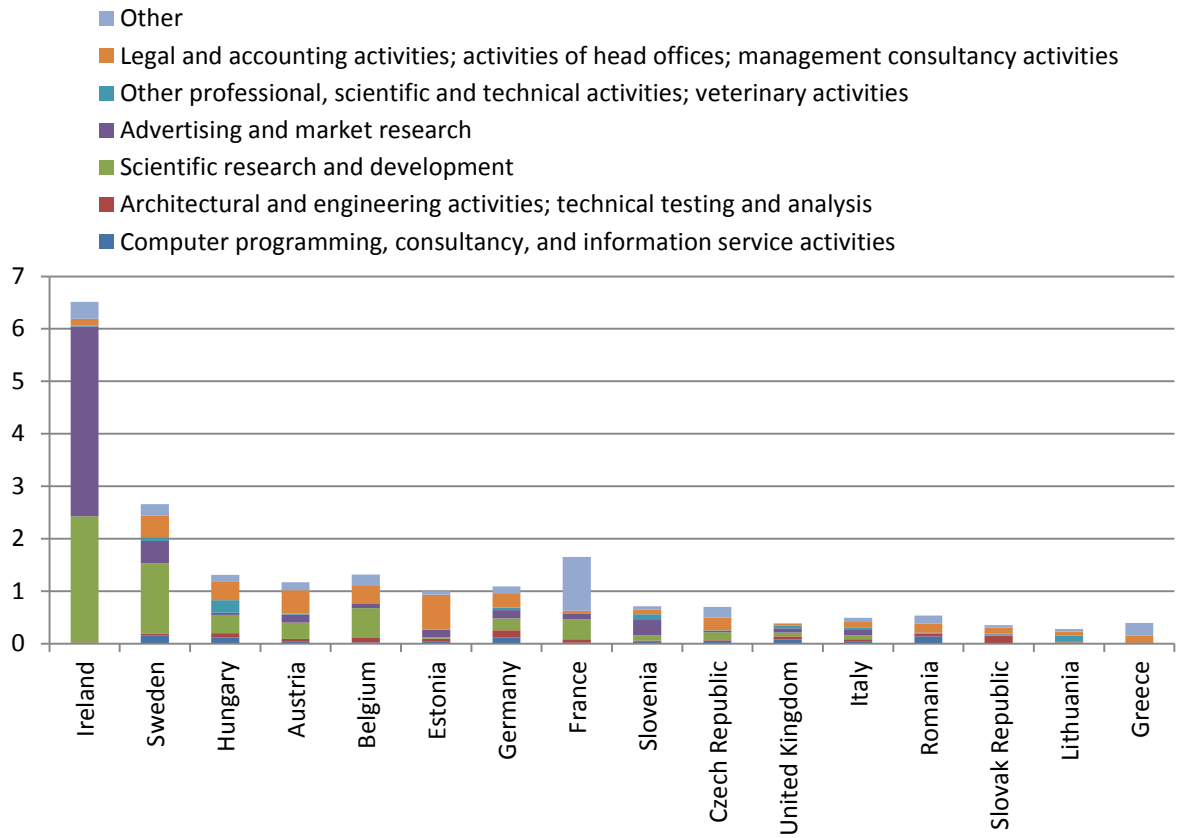
These results suggest that it is worth to have a look at the more detailed business services categories. Focusing on the performance related business services only, the category 'Other business services' (CPA74) is the most important one which is highlighted in Figure 2.18. Only in Finland and the Netherlands are imports of research and development (CPA73) relatively important. This can be compared with the same indicator however based on NACE Rev. 2 (for those countries reporting import IO tables) as is done in Figure 2.19 for the performance related business services where research and development together with legal and accounting activities dominate. In Ireland, importing advertising and market research services activities is important as well.

Figure 2.18 – Cost shares of imported business services used in manufacturing in % of gross output, 2011



Note: These figures do not include financial intermediation services.
Source: Eurostat; wiiw calculations.

Figure 2.19 – Costs shares of imported performance related business services used in manufacturing based on NACE/CPA Rev. 2 in % of gross output, 2011



Source: Eurostat; wiiw calculations.

The role of imported business services is rather small on average, comprising about 1% as a direct cost share in gross output. For a few countries only these shares are higher and amount to up to 5%. Smaller countries – and the Eastern European countries in particular – are characterised by higher import intensities of business services. The most important item is 'other business services' and R&D for some countries.

2.2.4 Direct and indirect production linkages

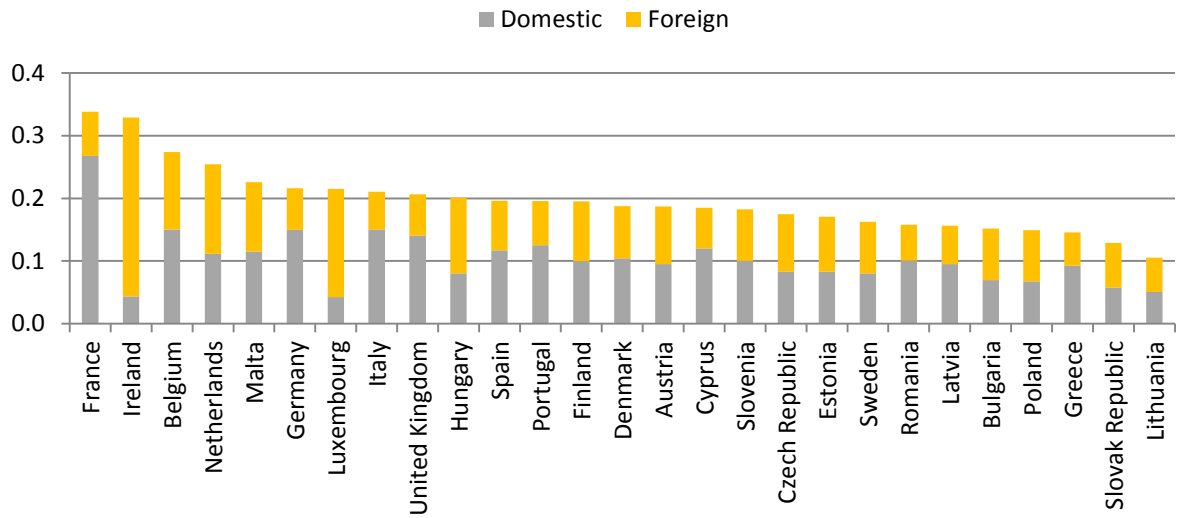
Having considered the services inputs into manufacturing in terms of direct cost shares (and those of manufacturing in services though these are less important), this section goes a step further and provides descriptive indicators concerning backward (and forward linkages) between manufacturing and services which are later on also used in the econometric analysis (see Section 3). These (direct and indirect) linkage effects are further distinguished with respect to domestically and foreign-sourced inputs in analogy to domestic and foreign cost shares. Methodologically this follows the multiplier concept in input-output analysis. In broad terms, the interaction between the manufacturing sector and services can be considered in two ways: On the one hand, the manufacturing sector buys inputs from the service sector, e.g. transport services for sourcing its intermediate products, R&D services, marketing etc. On the other hand, manufacturing supplies its (intermediate) products to the service sector. While the first relationship is termed 'backward linkages' (from the viewpoint of manufacturing), the second one is termed 'forward linkages' with the focus being on the first indicator. As a measure we use the gross output multiplier (as defined in standard Input-Output Analysis) showing the direct and indirect effects of a change in final demand in manufacturing on output in the respective services categories.

Box 2.2 – *Backward linkages*

Backward linkages show how much additional inputs are required to produce one unit of additional final demand. An increase in final demand of a specific sector requires output from this sector. However, for the production of this additional output the sector under consideration also uses inputs from other sectors, which themselves need inputs from other sectors, etc. Technically, backward linkages can therefore be calculated as the column sum of the Leontief inverse derived from an input-output model. The column sum can be split into the various contributing sectors or even countries in case that a world-input-output table exists. Formally, therefore $BL_k^c = \mathbf{1}\,\mathbf{l}_k^c$, where $\mathbf{l}_k^c$ denotes the column for country c and sector k in the Leontief inverse. Focusing on the role of services and business services in particular results are presented when summing over the respective delivering sectors distinguishing domestic and foreign linkages.

Focusing on manufacturing backward linkages with *business services* which are highlighted in Figure 2.20, domestic linkages are very large for France, followed with some distance by Italy, Belgium, Germany, and the United Kingdom. Domestic linkages were the lowest for Lithuania, Ireland and Luxembourg. Foreign linkages, on the other hand, were very high for Ireland, followed by Luxembourg, the Netherlands, and Hungary. Looking again at both domestic and foreign backward linkages together, domestic linkages are larger in 16, while foreign linkages are larger in 11 countries. In relative terms, domestic linkages are more important compared to foreign ones in France, Italy and Germany, while foreign linkages are more pronounced compared to domestic ones in Ireland and Luxembourg.

Figure 2.20 – Domestic and foreign backward linkages of manufacturing sectors with business services, 2011

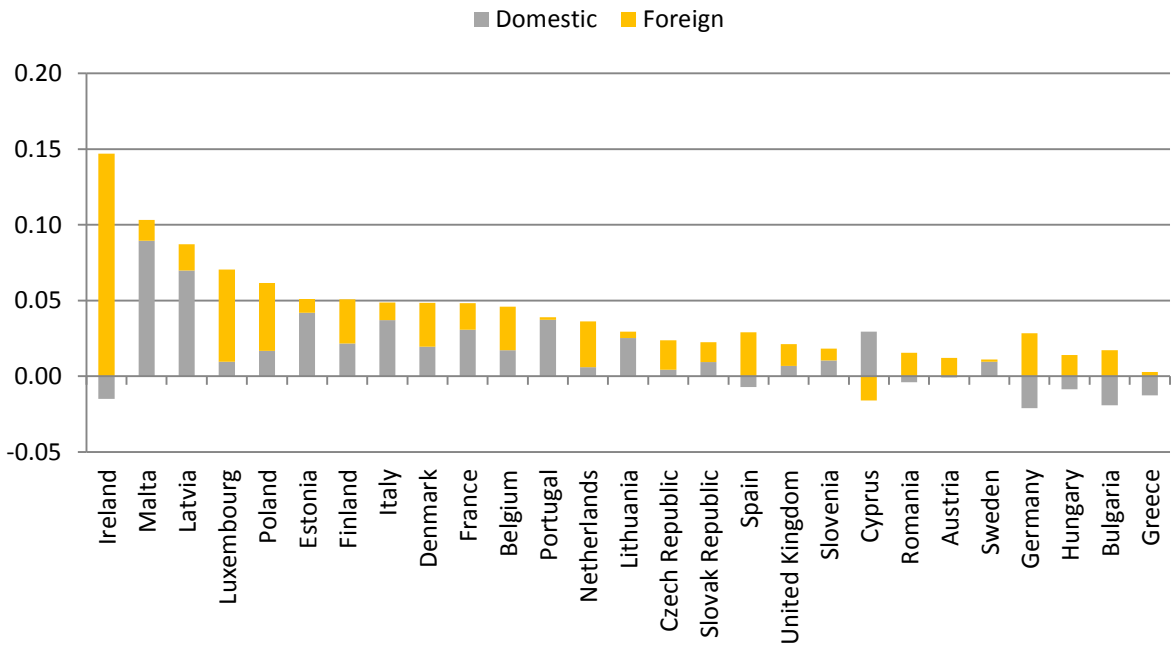


Source: WIOD, wiiw calculations.

Next, we investigate how backward linkages have evolved over time. Whereas total domestic backward linkages remained mostly constant over time while foreign backward linkages have increased due to international fragmentation and increasing internationalisation of production. These are however mostly referring to the total backward linkages. In addition, outsourcing of service functions from manufacturing to services should also have increased backward linkages with service sectors in general which is one of the concerns of this study. Figure 2.21 illustrates the change of manufacturing backward linkages in the business services sectors between the years 1995 to 2011. In general, both domestic and foreign backward linkages with the service sectors have

increased during this time period. Domestic increases dominate in Malta, Latvia, Estonia, Italy, France, Portugal and Cyprus. Generally however the increases tend to be rather small (10-15% over the whole period).

Figure 2.21 – Changes in backward linkages of manufacturing sectors with business services, 1995-2011



Source: WIOD, wiiw calculations.

Considering backward linkages allows one to study the role of directly and indirectly used business services in manufacturing production and to split between domestic and foreign linkages. Whereas in most countries domestic linkages still dominate – though not necessarily for smaller countries – the role of foreign linkages is more significant and increasing over time for most countries.

2.2.5 Domestic and foreign services contents of manufacturing

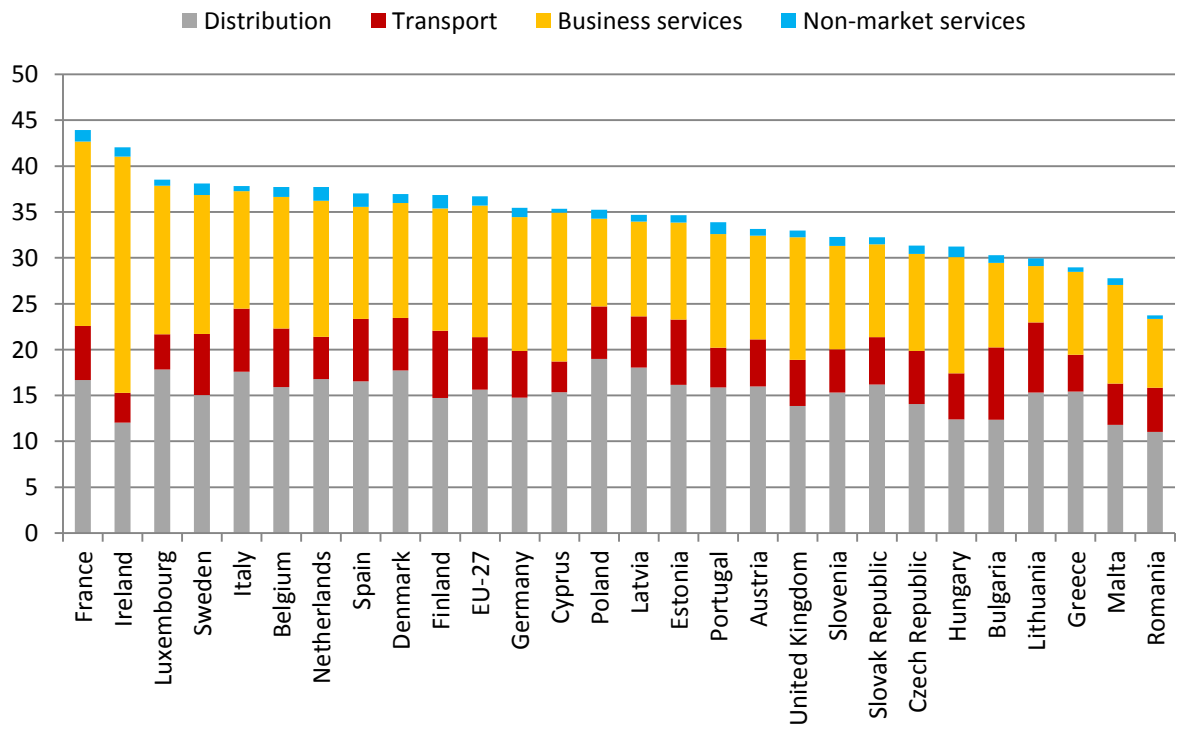
The production of a manufacturing final product requires not only primary inputs from the specific manufacturing sector itself, but also from other industries nationally and from foreign countries. This has already been picked up above by considering the simple cost shares in manufacturing production by country and industry. However, this measure does not take into account the indirect effects of linkages in using intermediate inputs from other industries and countries. The concern in this section is, therefore, to present the direct and indirect service content of manufacturing production of final demand (both for domestic and foreign demand) or exports (which comprise both intermediate and final demand exports) goods.

Box 2.3 - *Direct and indirect value added content of manufacturing output*

Formally, the direct and indirect service content in manufacturing output is calculated by pre-multiplying the final output of manufacturing industries of interest with the value added coefficients vector of the supplying industries and countries of interest. More specifically to assess the value added content of e.g. business services in final goods production of industry k of the domestic economy one has to calculate $\mathbf{v}_i^r \mathbf{L} \mathbf{f}_k^r$ where $\mathbf{v}_i^r$ denotes a 1xNC vector of value added coefficients in country r and industry i (the supplying industry), $\mathbf{L}$ denotes the global Leontief inverse and $\mathbf{f}_k^r$ denotes a NXx1 vector of final output of industry k in country r and zeros otherwise. Alternatively this can be replaced by a vector of exports denoted by $\mathbf{x}_k^r$.

Figure 2.22 plots the direct and indirect service content of manufacturing final goods production distinguishing four service categories. Distribution and business services comprise the largest direct and indirect shares in the value of final goods production with more than 10% in most cases followed by transport services with about 4-5%. Concerning the share of business services similar cross-country patterns as already observed above hold: Within Europe the shares range from 6.1% in Lithuania up to 14-15% in a number of countries; France with 20% and Ireland with 25.8% show the largest values. Across countries, these patterns strongly resemble the simple cost shares already reported above; in fact, there is a strong correlation between the simple cost shares and the direct and indirect service content of 0.9. This also holds for the changes to the service content shares; business services are again the most dynamic component (see Figure 2.23).

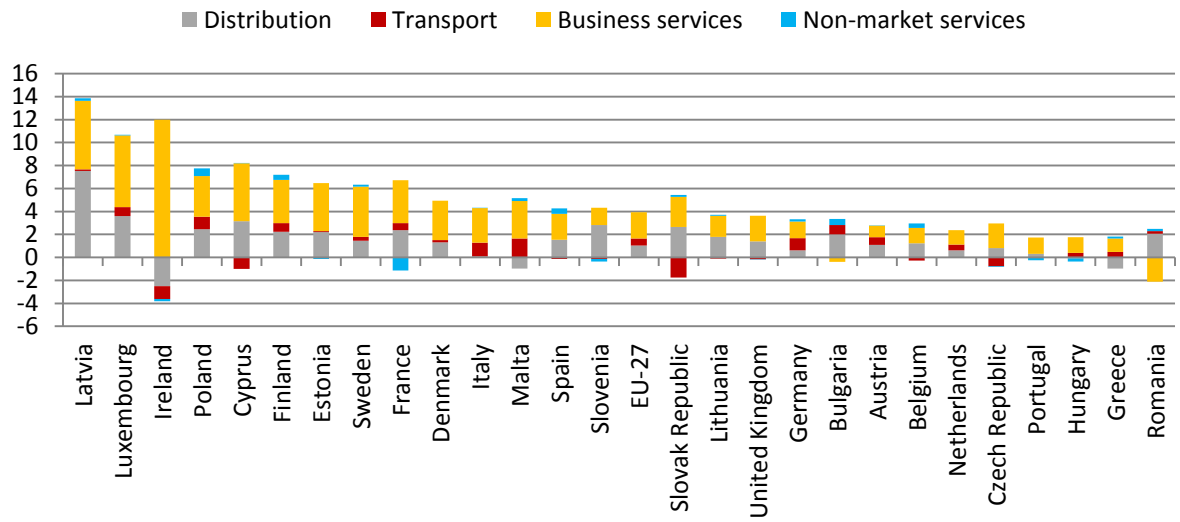
Figure 2.22 – Structure of service content of manufacturing final goods production 2011, in %



Note: Ranked according to direct and indirect service content share.

Source: WIOD; wiiw calculations.

Figure 2.23 – Change in structure of service content of manufacturing final goods production 1995-2011, in percentage points

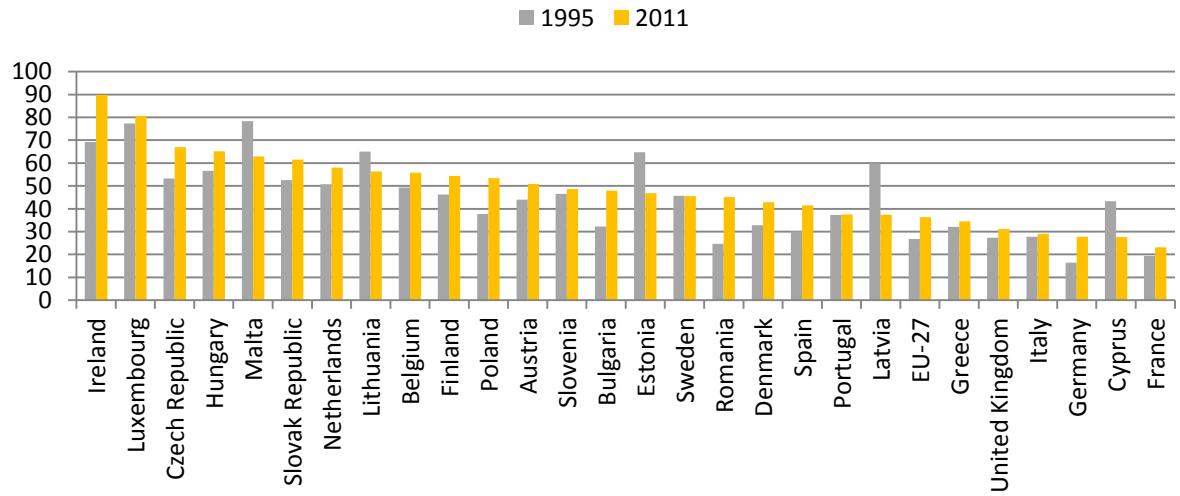


Source: WIOD; wiiw calculations.

A part of these direct and indirect services contents are imported from other economies. Comparing EU Member States the shares of imported direct and indirect service contents go up to 23% in Ireland and 12% in Luxembourg in per cent of final demand; generally however these are at levels between slightly less than 4% up to 8%. The shares of imported direct and indirect business services contents in total direct and indirect business services use ranges from almost 90% in Ireland to about 20% in France (see Figure 2.24). Larger countries as France, Germany and Great Britain tend to have lower imported shares resembling the patterns of direct import cost shares above. In most cases – apart from a few exceptions – these imported shares have tended to increase since 1995.

Figure 2.24 – Imported direct and indirect business services content of manufacturing final goods production, 2011

in % of total direct and indirect content of business services in final goods production



Note: EU-27 average includes intra-EU trade.

Source: WIOD; wiiw calculations.

2.3 Summary

This section first presented the relative importance of manufacturing and business services in a country's GDP highlighting the differentiated specialisation patterns across European economies over the period 1995-2011. Whereas some countries managed to keep a stronghold in manufacturing others succeeded in specialising in business services; some countries however could not hold their manufacturing base nor specialise strongly in business services. To a certain extent these differentiated patterns of specialisation might be explained by relative growth performances of productivity levels and wage costs across countries and industries. It further needs to be emphasised, that manufacturing in all countries has been growing in real terms, though at lower rates as compared to services.

Second, a number of indicators concerning the inter-linkages between manufacturing and services have been presented and the most important results are summarised as follows. The share of secondary production of services for the EU-27 amounts to about 4% of manufacturing gross output with a rather wide range across countries. Distribution and business services account for the bulk of secondary production of manufacturing industries. Over time there is a slight increase of these shares which is particularly pronounced in Sweden and Finland. It should however be emphasised that these numbers do not include the services provided in-house and servitisation activities by manufacturing firms.

The second indicator considered has been the direct cost shares of services inputs in manufacturing industries, which accounts for about 25% of total costs (i.e. including value added costs) in manufacturing in 2011 for the EU-27 services and increased only slightly since 1995. Again there are remarkable differences across countries. Differentiating by services categories shows that distribution (12% on average) and business services (9% on average) are the most important services inputs on average. Over time, the shares of business services are the most dynamic component over time in the majority of countries. The cost share of imported services in manufacturing gross output is at about 1% for most countries; only a few countries show significantly larger shares. These patterns are dominated by imports of businesses services which account for about 50% of services imports. Most of the smaller countries tend to have lower shares of business services in manufacturing output together with relatively larger imports resulting in a larger 'import intensity'. The most important items imported for use in manufacturing are scientific research and development, legal and accounting activities followed by advertising and market research according to NACE/CPA Rev. 2 classification. Again, there is a wide heterogeneity across countries.

These direct and indirect production linkages – as driven by use of other industries output – are captured using an indicator of backward linkages. Concerning business services, larger countries tend to have larger backward linkages which are mostly domestically oriented (e.g. particularly in France). Smaller countries (including the Eastern European countries) are characterised by relatively larger foreign linkages. These linkages, and in particular foreign linkages, have generally increased over time, though at a slow pace. Domestic increases dominate in a few countries only.

Taking this together, the results show that services account for slightly less than 40% in the value of a final manufacturing production in the EU-27 as a whole where the bulk stems from distribution services and business services with about 15% each. These shares range from more than 40% in France and Ireland to less than 30% in Greece, Malta and Romania. Over time, these shares increased mostly due to a change in the respective content of business services confirming the results already found when considering direct cost shares.

3 Assessing the role of business services linkages for manufacturing performance in EU Member States

3.1 Introduction

The previous chapter provided an overview of the patterns and magnitudes of manufacturing-services interactions based on information from input-output tables. In this section light is shed on the role these interactions play for the performance or performance improvements observable in the manufacturing sector. The analysis focuses on business services[22] linkages as discussed in Section 2.2.4 since business services are considered more relevant and important sources of spillovers for the manufacturing sector as compared to other types of services. Additionally, the analysis also accounts for geographic sourcing strategies and their likely effects on performance changes in the manufacturing sector and accordingly differentiates between (i) business service linkages which are sourced domestically and (ii) business service linkages which are sourced from abroad.

3.2 Data and methodology

The empirical analysis uses a number of different data sources. As in Section 2 above, the analysis draws on the World Input-Output Database (WIOD), which covers the time horizon from 1995 to 2011 (see Dietzenbacher et al., 2013; Timmer, 2012). However, to avoid any crisis-related distortions, the ensuing empirical analysis focuses on the period between 1995 and 2007. Indicators such as domestic and foreign business service linkages, shares of high, medium and low-skilled labour or exports are taken from the corresponding WIOD satellite accounts. This data are complemented by a number of additional data sources: Information on R&D expenditure stems from the OECD Analytical Business Enterprise Research and Development database (OECD ANBERD, ISIC Rev. 3) while data on inward FDI stocks are taken from the OECD International Direct Investment Statistics (OECD IDI, ISIC Rev. 3). Moreover, given the scarcity of data in the OECD IDI particularly for New Member States, inward FDI stocks for the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia are taken from the wiiw FDI Database.

To take account of prevailing cross-country and cross-industry differences and the different business service linkage effects that may arise, results are presented for a number of different groupings:

- The first grouping differentiates between the group of EU-15 member countries on the one hand and the group of New Member States (EU-12) which is referred to as EU-membership status (as countries joined the EU in different years). Particularly, in the period under consideration, the group of EU-12 underwent strong growth and convergence processes and initiated key financial market and trade liberalisation policies and, as a result, became strongly integrated into the EU and global markets.
- The second grouping is based on country-size and differentiates between the group of the 5 largest economies in the EU on the one hand (comprising France, Germany, Italy, Spain and the UK) and the remaining 22 remaining medium and small EU-economies on the other. Throughout the period under consideration, the five largest EU-economies together account for about 70 per cent of total EU-27 GDP. Given the size of their internal markets size-related differences in business service linkages are evident and

[22] Business services comprise Financial intermediation services (NACE Rev. 1 70) and Renting of M&Eq and Other Business Activities (NACE Rev. 1 71t74).

differences with respect to performance effects can be expected. This is particularly the case concerning the domestic and foreign sourcing patterns as shown in Section 2.3.3 above.

- Finally, the third grouping accounts for the cross-industry heterogeneity in the sample and differentiates by technology-intensity of industries. In particular, in accordance with the R&D intensity based OECD technology intensity definition[23], it differentiates between medium-high and high-technology industries (MHT) comprising Chemicals (ISIC 24), Machinery and equipment (ISIC 29), Electrical machinery (ISIC 30t33), Motor vehicles (ISIC 34t35), medium-low-technology industries (MLT) comprising Coke and refined petroleum products (ISIC 23), Rubber and plastic (ISIC 25), Non-metallic mineral product (ISIC 26) and Basic and fabricated metal products (ISIC 27t28) and low-technology industries (LT) comprising Food, beverages and tobacco (ISIC 15t16), Textiles and wearing apparel (ISIC 17t18), Leather and leather products (ISIC 19), Wood and wood products (ISIC 20), Paper, paper products, printing and publishing (ISIC 21t22) and Manufacturing nec. and recycling (ISIC 36t37).

Methodologically, since the descriptive analysis above clearly reveals that linkages between services and manufacturing show little variation over time and that most variation is across countries and industries, a growth-equation approach is chosen as the most meaningful and promising approach capturing long-term trends. In particular, the following specification is used to shed light on the performance effects in manufacturing of *domestic* and *foreign* business service linkages between manufacturing and services:

$$\begin{aligned} \text{grLPVA}_{ik}^{manuf} = {} & \beta_0 + \beta_1 \text{initLPVA}_{ik}^{manuf} + \beta_2 \text{BSlink}_{ik}^{dom} + \beta_3 \text{BSlink}_{ik}^{for} + \beta_4 \text{HS}_{ik}^{manuf} + \beta_5 \text{LS}_{ik}^{manuf} + \dots \\ & \dots + \beta_6 \text{FDIint}_{ik}^{manuf} + \beta_7 \text{RDint}_{ik}^{manuf} + \nu_k + \varepsilon_{ik} \end{aligned} \quad (3.1)$$

where $\text{grLPVA}_{ik}^{manuf}$ refers to the manufacturing sector performance indicator in terms of the real (in 1995 prices) PPP-adjusted average labour productivity growth rate (value-added based) in manufacturing in country i and industry k. $\text{initLPVA}_{ik}^{manuf}$ is the real (in 1995 prices) PPP-adjusted initial level of labour productivity (value-added based) in manufacturing in 1995 included to capture the process of convergence of productivities over time. The two major variables of interest are BSlink_{ik}^{dom} and BSlink_{ik}^{for} which serve to capture performance improvement effects emanating from linkages between manufacturing and business services, differentiated by sourcing strategy, where dom and for refer to domestic and foreign, respectively (see Section 2.2.4 for a discussion of these linkage indicators). Furthermore, a set of additional control variables are included. HS_{ik}^{manuf} and LS_{ik}^{manuf} are human capital proxies which refer to the shares of high-skilled and low-skilled labour in an industry, respectively. Two more variables are included to account for the role of intangibles for labour productivity growth. In particular, $\text{FDIint}_{ik}^{manuf}$ is the inward FDI intensity (as the share of inward FDI stock in gross output) of industry k in country i to control for intra- and inter-industry spillover effects emanating from the presence of (more productive) foreign-owned firms while $\text{RDint}_{ik}^{manuf}$ refers to the R&D intensity (as the share of R&D expenditures in gross output) of industry k in country i to capture productivity improvements stemming from innovative activities. Finally, ν_k are industry fixed effects while ε_{ik} denotes the error term.

[23] The OECD classification had to be adapted to the slightly more aggregated industry classification in the WIOD.

3.3 Differentiated impact of business services linkages on manufacturing performance

Table 3.1 reports selected results concerning the impact of business services linkages on manufacturing performance and other variables as outlined above focusing on the role of business services to manufacturing linkages. Results by ***EU-membership status*** point to the presence of non-negligible business service linkage effects: for the EU as a whole, strong business service linkages are associated with significantly higher labour productivity growth in manufacturing. However, these backward linkage effects strongly depend on the particular sourcing strategy and are only significant in the case of strong *foreign* business service linkages. This finding also holds both for the EU-15 and EU-12.

When differentiating by ***size of economies*** results again consistently point at the presence of non-negligible business service linkage effects which, however, depend on the country-sample analysed and the sourcing strategy considered. In particular, for the group of the five largest EU economies, strong *domestic* business service linkages are associated with significant labour productivity improvements in manufacturing. With respect to foreign business service linkages results suggest a positive though insignificant relationship. However, for the group of remaining small and medium-sized EU economies, the opposite holds: strong *foreign* business service linkages are associated with labour productivity improvements in manufacturing. This result is in line with findings from Section 2.3.3 and 2.3.4 that smaller countries tend to have larger share of imported business services which makes – direct and indirectly sourced – foreign services inputs an important factor in these countries' manufacturing performance.

Finally, when splitting the sample ***by technology-intensity of industries*** results highlight that strong business service linkages only matter for the group of medium and high-technology industries. More specifically, strong *foreign* business service linkages are associated with significant increases in labour productivity growth in medium and high-technology industries only while no significant backward linkage effects emerge for either medium-low technology or low technology industries. A reason for that is that medium and high-technology industries are generally characterised by on average more and complex international production linkages (e.g. in terms of the varieties of international/imported inputs used in production and the diversity of locations from which they are sourced), which renders foreign linkages important sources of performance improvements (see Backer and Mirodout, 2013, for evidence).[24]

Concerning the other control variables in all cases there is evidence of productivity convergence which tends to be stronger in more technology-intensive industries when splitting the sample according to technology intensity. Higher R&D intensities are associated with significantly higher labour productivity growth in manufacturing which holds for the group of small and medium-sized EU economies only when splitting the sample by country size. Furthermore the positive relationship between R&D intensity and labour productivity growth is only evident for the group of medium to high-technology industries only. Concerning the human capital endowment indicators, larger shares of low-skilled labour are associated with significantly lower labour productivity growth. This effect is more consistent among the group of small and medium-sized EU economies however and particularly holds for medium and high as well as low technology industries. There is no evidence that a higher inward FDI intensity is associated with higher labour productivity growth, irrespective of country sample considered.[25]

[24] Generally, low-tech sectors such as textiles can have a high level of internationalisation but relatively low level of complexity of international production linkages.

[25] This finding is particularly surprising for the group of NMS which experienced strong inward FDI flows and a rapid accumulation of inward FDI stocks after the fall of the iron curtain. However, there are a number of reasons for the absence of any positive effect in the group of NMS countries: firstly, the strongest push in inward FDI accumulation took place in the initial transition phase of the 1990s, a period not properly covered by the analysis due to low data quality and limited availability in either OECD IDI or wiiw FDI databases. Secondly, firm-level analyses (e.g. Evenett and Voicu, 2001) find support of 'cherry picking', i.e. foreign firms are found to invest in domestic firms which are more productive ex ante so that hardly any productivity effects materialise as a result of the investment. And even if productivity improvements occur at the micro-level, aggregation tends to blur effects.

Table 3.1 – Selected results of business service linkages and manufacturing performance

Dependent variable: Labour productivity growth rates (VA-based)

	Membership status			Country size		Technology intensity		
	EU-27	EU-15	EU-12	Large	Small	Medium-high	Medium-low	Low tech
Initial VA-based LP	-0.038***	-0.014*	-0.048***	-0.028***	-0.038***	-0.049***	-0.048***	-0.020*
	(-7.84)	(-1.88)	(-4.91)	(-3.23)	(-6.42)	(-6.57)	(-4.76)	(-1.92)
Business service linkages: domestic	-0.017	0.007	0.279	0.240***	-0.211	0.144	-0.280	0.028
	(-0.21)	(0.10)	(0.87)	(2.93)	(-1.14)	(1.58)	(-1.23)	(0.22)
Business service linkages: foreign	0.274**	0.281***	0.517**	0.452	0.264**	0.396***	-0.115	0.086
	(2.60)	(2.87)	(2.13)	(1.28)	(2.11)	(4.05)	(-0.32)	(0.51)
Share high-skilled labour	0.042	-0.079	0.214	0.026	0.032	-0.047	0.057	0.099
	(0.85)	(-1.34)	(1.59)	(0.38)	(0.45)	(-0.83)	(0.44)	(1.31)
Share low-skilled labour	-0.045**	-0.059**	-0.254***	-0.038	-0.035	-0.058***	-0.014	-0.062**
	(-2.27)	(-2.48)	(-2.74)	(-1.10)	(-1.32)	(-2.77)	(-0.27)	(-2.31)
Inward FDI intensity	0.010	-0.008	-0.011	0.066	0.010	0.019	0.010	-0.009
	(0.54)	(-0.47)	(-0.20)	(1.02)	(0.48)	(1.19)	(0.22)	(-0.17)
R&D intensity	0.592***	0.385**	2.066***	0.219	0.739***	0.327*	2.046	-0.237
	(3.17)	(2.38)	(3.04)	(0.95)	(2.94)	(1.93)	(1.59)	(-0.10)
Constant	0.156***	0.092**	0.150***	0.064	0.171***	0.191***	0.237***	0.096***
	(8.36)	(2.54)	(2.80)	(1.28)	(6.88)	(9.04)	(4.30)	(3.36)
No of observations	189	106	83	44	145	76	59	54
Adjusted R^2	0.371	0.201	0.431	0.582	0.281	0.579	0.375	0.226

Note: t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Moreover, a number of sensitivity checks were conducted to determine the robustness of main results with respect to (i) alternative industry classifications to account for the changed status of textiles and wearing apparel (ISIC 17t18) from a low-technology to a medium-low technology industry on the one hand or the particularities of the coke and refined petroleum products industry (ISIC 23) on the other, (ii) the inclusion of additional control variables such as export intensity, ICT investment or the OECD Regulation Impact Indicator to capture the presence and degree of service regulation[26], (iii) different weighting strategies of spillover effects to test whether domestic and foreign business service linkage effects are stronger in industries with either higher shares of high-skilled labour or higher labour productivity levels (value-added based), or (iv) alternative measures of performance in manufacturing such as labour productivity growth (gross-output based), total factor productivity growth (TFP growth value-added based), or value-added growth. Generally, results from all robustness checks consistently confirm the main findings that (i) for the EU-27 as a whole and the group of EU-15 economies, for the group of small and medium-sized economies as well as for the group of medium and high-technology industries, strong *foreign* business service linkages are positively associated with productivity improvements in manufacturing while (ii) for the group of the five largest economies in the EU (comprising Germany, France, Italy, Spain and the UK), higher *domestic* business service linkages are associated with performance improvements in manufacturing.

3.4 Summary

Summarising, the effect of manufacturing backward linkages with business services on the growth rate of labour productivity in manufacturing are significant and positive at the EU level, but only for foreign linkages for the EU-27 countries. A similar result holds when splitting the sample into EU-15 and EU-12. This result is however qualified when splitting the sample by country size as for the larger economies only domestic backward linkages impact positively on labour productivity growth in manufacturing with foreign linkages showing a positive, but insignificant coefficient. In contrast, for the smaller countries only foreign backward linkages are significant. A potential reason for this is that foreign business services are relatively more important for smaller countries. When splitting the sample by technology-intensity of industries it turns out that the positive effect of foreign backward linkages with business services holds only for medium-high- and high-tech industries; these industries are highly integrated in the most complex and diverse international production networks and value chains.

[26] Finally, information on regulations that create barriers to entrepreneurship and restrict competition in domestic markets is taken from the OECD Regulation Impact Indicator (OECD RII, ISIC Rev. 3). This indicator measure the potential costs of anti-competitive regulation in selected non-manufacturing sectors on sectors of the economy that use the output of non-manufacturing sectors as intermediate inputs in their production process. It is constructed from non-manufacturing regulation indicators for three different groups of sectors namely, (i) energy (covering electricity and gas), transport (comprising airlines, rail and road) and communications (comprising post and telecoms), (ii) retail distribution and some business services, and (iii) the finance sector. The set of indicators used to construct sector-specific regulation indices cover the following main areas: state control, barriers to entry, involvement in business operations and, in some cases, market structure.

4 Services in the manufacturing value chain

4.1 The value chain perspective

As has become clear from above, manufacturing production involves not only activities from the respective manufacturing industries, but also requires inputs from other sectors (e.g. services) which are produced in the domestic or in foreign economies (again by use of intermediate inputs and primary factors such as labour and capital). Still, the 'classical' perspective when studying the size and volume of the manufacturing sector is to consider only the value added created through pure manufacturing activities, which will be referred to as the 'industry perspective'. The alternative perspective would focus on value added created in all production stages of the final manufacturing product: Manufacturing then is composed of the sum of all (domestic) activities (including, in particular, services) along the whole production chains, and which are used to create a final product with the focus on the contribution of a specific country. This 'value chain perspective' was introduced and analysed at a global level in Timmer et al. (2013) and Timmer et al. (2014). This perspective basically considers 'vertically integrated' production processes as theoretically introduced in Pasinetti (1983). Figure 4.1 schematically depicts the calculation of the different shares according to the two different approaches.

Figure 4.1 – Industry and value chain perspective of the manufacturing process

				Value chain perspective
	VA created in 'other industries' to satisfy final demand for 'other' products	VA created in manufacturing to satisfy final demand for 'other' products	VA created in services to satisfy final demand for 'other' products	VA created to satisfy final demand for 'other' products
	VA created in 'other industries' to satisfy final demand for manufacturing products	**VA created in manufacturing to satisfy final demand for manufacturing products**	VA created in services to satisfy final demand for manufacturing products	VA created to satisfy final demand for manufacturing products
	VA created in 'other industries' to satisfy final demand for services products	VA created in manufacturing to satisfy final demand for services	VA created in services to satisfy final demand for services products	VA created to satisfy final demand for services products
Industry perspective	VA created in 'other industries' to satisfy final demand	VA created in manufacturing to satisfy final demand	VA created in services to satisfy final demand	Total VA (= GDP)

The following example highlights the difference between the two perspectives:

***Industry perspective**:* Final demand for any product – be it a manufacturing product such as a car, or a service such as in tourism, be it domestic or foreign – requires inputs from the own sector and from other sectors via inter-industry linkages. The production of these inputs generates income, i.e. value added, in each sector of the economy. Summing up the value added according to the origins of the inputs (i.e., service inputs accrue to the service industry, etc.) yields the value added created in a particular industry as is reported in industry statistics. In Figure 4.1 this is represented as the column sum for a specific industry, e.g., total 'manufacturing' is the sum of the three central cells of the matrix.

***Value chain perspective**:* Alternatively, one might consider the value added created in any industry – be it manufacturing or services – due to final demand for a final manufacturing product (where final demand can be domestic or foreign).[27] This perspective, first, circumvents the argument that the share of manufacturing declined because of (domestic) outsourcing of service activities from the manufacturing industries to service industries or firms. E.g., if design or marketing activities were originally carried out in-house by the manufacturing firms, but then outsourced to a service provider, the value chain perspective still considers them to be a part of the manufacturing process. Second, also the role of specialisation due to offshoring activities is viewed differently. For example, a country offshoring the assembly process but keeping other activities related to the manufacturing production – either in the manufacturing industries or services – retains these shares of the manufacturing value chain.

In Figure 4.1 this is represented by the row sum for final demand products, e.g., in manufacturing.[28] Consider the most extreme case: A country in which no manufacturing activities are carried out any more directly could still be involved in the manufacturing value chain by providing service activities which are required for production. For example, countries specialising in pre- and post-production activities such as design and sales would still be considered as generating value added in the manufacturing value chain. To highlight the differences between the two perspectives, Table 4.1 provides the numbers in line with the concept set out in Figure 4.1 above for the EU-27 in 1995 and 2011.[29]

Table 4.1 – Value added creation in EU-27 in % of total value added (GDP), 1995 and 2011

	Other	Manufacturing	Services	Value chain perspective
		1995		
Other	8.2	2.4	4.0	14.6
Manufacturing	2.3	14.8	8.5	25.7
Services	2.3	3.8	53.7	59.7
Industry perspective	12.8	21.0	66.2	100.0
		2011		
Other	7.4	2.1	4.2	13.7
Manufacturing	1.7	11.8	8.6	22.0
Services	2.1	3.4	58.8	64.3
Industry perspective	11.2	17.2	71.6	100.0

Source: WIOD; wiiw calculations

In 2011, the manufacturing share in GDP was slightly above 17%, whereas more than 70% of total GDP in the EU-27 was created in services industries and the remaining 11% in other industries such as agriculture, mining and construction. The assessment changes substantially when one recognises that the value created to meet final demand for products also includes contributions form services and other industries; in this perspective, a higher share of value added created due to manufacturing final goods production is reported. In fact, about 22% of the EU-27 overall GDP is related to manufacturing production, i.e. about 5 percentage points more than reflected by the shares based on industry classifications. Similarly, an increase is also observed for 'other' activities which in the value chain perspective show a share of 13.7%, compared to 11.2%. The share of services however declines in the value chain perspective to 64.3%, i.e. by more than 7 percentage points.

27 To be even more specific 'final demand' includes domestic demand for a domestic or foreign final manufacturing product, foreign demand for a domestic or foreign final manufacturing product.
28 Results reported in this section are based on figures on gross domestic product at market prices including international transport margins. These have been calculated as the difference between gross output and intermediate inputs in the WIOTs.
29 Using value added at basic prices the corresponding numbers for 2011 would be 15.8% from the industry perspective (according to Table 2.1) and 21.2% from the GVC perspective, respectively.

For a more detailed view on the inter-linkages between these sectors from a value chain perspective Table 4.2 presents the shares in industry and value chain totals, respectively, with the figures for manufacturing begin highlighted.

Table 4.2 – Structure of value creation process in EU-27, 2011

	Other	Manufacturing	Services	Value chain perspective
Other	66.0	12.0	5.9	13.7
Manufacturing	15.1	68.4	12.0	22.0
Services	18.9	19.6	82.1	64.3
Industry perspective	100.0	100.0	100.0	100.0

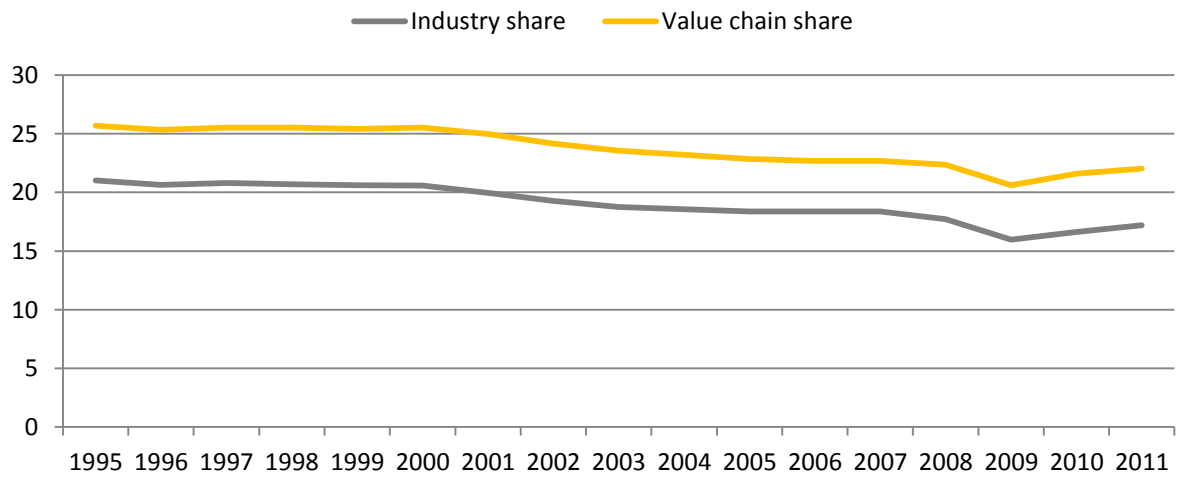
	Other	Manufacturing	Services	Value chain perspective
Other	53.9	15.1	31.0	100.0
Manufacturing	7.7	53.4	38.9	100.0
Services	3.3	5.2	91.5	100.0
Industry perspective	11.2	17.2	71.6	100.0

Source: WIOD; wiiw calculations.

Within the classical manufacturing activities, the upper panel of this table shows that 12% of value added created in manufacturing was due to final demand in the other industries and about 20% due to final demand in services. Almost 70% of value added created in manufacturing was created due to final demand for manufacturing products. However, the value chain perspective indicates that almost 40% of value added is related to the production of manufacturing final products were attributable to services and 53.4% to manufacturing, highlighting again the important role of services for the manufacturing process.

Considering the changes over time, depicted in Figure 4.2 one finds that both shares declined since 1995 at a rather uniform pace. The share of manufacturing value added according to the industry perspective declined from more than 21% in 1995 to about 17% in 2011, i.e. by slightly less than 4 percentage points. But also the share of manufacturing in the value chain perspective declined from 25.7 to 22% over the same period, i.e. also by about 4 percentage points. In both cases these shares remained rather constant up to 2000 and started to decline only then. Furthermore, it seems that the decline has flattened apart from the crisis period.

Figure 4.2 – Industry and value chain shares for manufacturing in % of GDP, EU-27

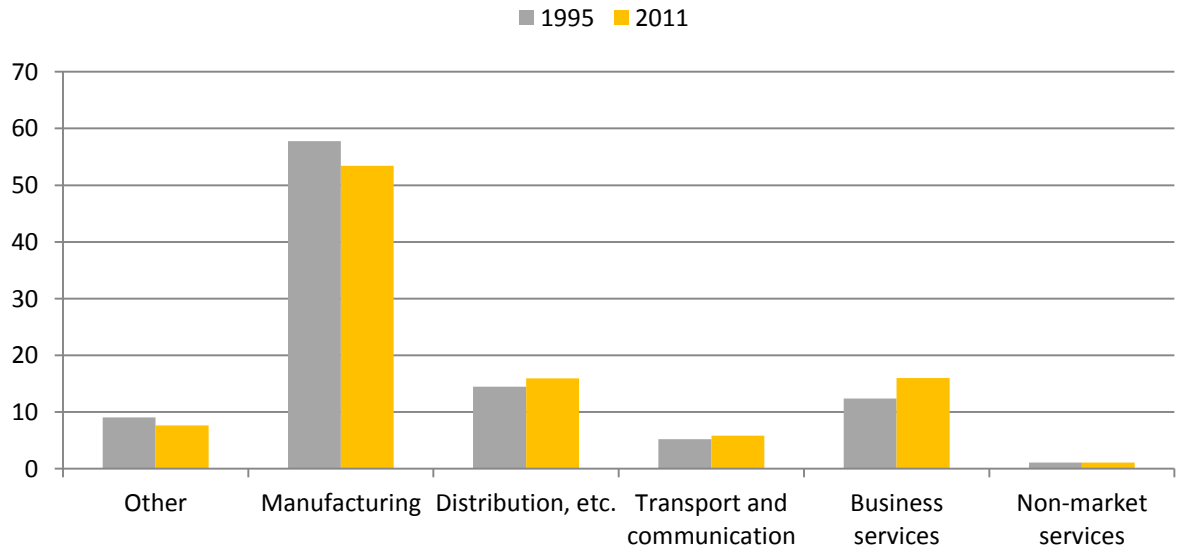


Source: WIOD; wiiw calculations.

A number of reasons might contribute to the overall decline of the manufacturing share in the EU (and, more generally, other) economies. The actual composition of industries changes due to changes in real income and related demand patterns. Changes in relative prices might also play a role: On the one hand, a price increase of services compared to manufactured products during the time-period under consideration would imply a somewhat lower demand for services. However, on the other hand, this would contribute to the overall trend of increasing shares in nominal terms and therefore exacerbates additional structural effects. This can be interpreted as a national accounting effect whose mechanics are somewhat similar to Baumol's disease[30]. A further potential reason for a declining manufacturing sector may be the overall specialisation of a country (or the EU) as providers of services in a global economy as trade structures change (e.g. manufactured products such as textiles are going to be imported from emerging countries). A further important structural contributor to the decline of the manufacturing share is offshoring of manufacturing activities outside the borders of the EU with some other activities, particularly service activities, are still being undertaken domestically. To explain why a similar tendency is found for the value chain approach one has to take a more detailed look at the structure of the manufacturing value chain.

Thus, the structural changes also affect the share of manufacturing when measured via the value chain approach. The reason for this is that inter-sectoral linkages are still predominant within manufacturing and within services sectors implying that the inter-linkages between manufacturing and services as discussed in Section 2 are – despite the modest increases – not strong enough to compensate. For this more detailed analysis, one can further split the manufacturing value chain into the contributions by the different components. This is shown in Figure 4.3 in which the service contributions are further differentiated. Within the manufacturing value chain of the EU-27, the increase of the share of service activities was mainly driven by the strong development of business services and distribution services. This is in line with the findings from other studies indicating that it is mainly knowledge-intensive industries and services that are driving the current shift towards larger service shares across the board. These results are also in line with the previous results considering cost shares and the service content of manufacturing production.

Figure 4.3 – The structure of manufacturing value chains in %, EU-27



Source: WIOD; wiiw calculations.

[30] See Section 1.1, pp. 14-15

4.2 Manufacturing value chains in EU Member States

The same approach can be looked at for individual Member States. Table 4.3 presents the indicators as discussed above for the EU-27 now for each individual Member State. Thus this table presents the shares of manufacturing in GDP as usually measured, the shares of the manufacturing value chain in GDP. Furthermore, the table also includes the share of services and business services in the manufacturing value chains of each country, respectively.

Table 4.3 – Manufacturing value chain indicators by Member States

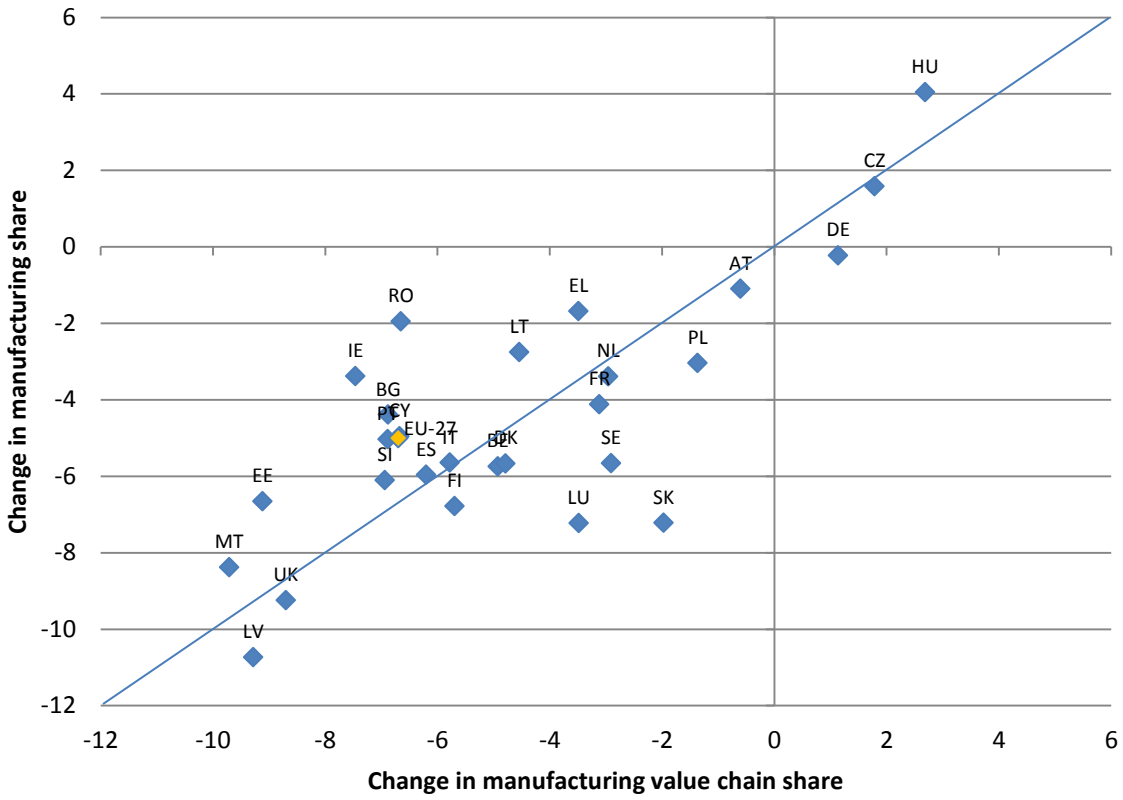
	Value added share		Value chain share		Share of services in manufacturing value chain		Share of business services in manufacturing value chain	
	1995	2011	1995	2011	1995	2011	1995	2011
Hungary	21.3	25.3	29.9	32.6	28.8	28.8	9.2	11.0
Czech Republic	24.3	25.8	29.9	31.6	28.5	28.8	7.0	8.2
Germany	22.6	22.4	27.7	28.9	32.0	35.9	13.7	15.9
Slovak Republic	26.8	19.6	29.8	27.8	28.0	33.3	6.8	8.4
Ireland	30.2	26.8	35.0	27.5	25.6	26.8	9.6	15.6
Poland	21.1	18.1	28.4	27.0	26.2	36.1	4.9	7.9
Romania	25.6	23.6	33.3	26.6	22.1	24.2	10.1	6.7
Bulgaria	22.0	17.6	32.6	25.7	23.3	30.9	9.9	8.3
Italy	22.2	16.6	29.1	23.3	33.7	40.0	9.4	13.9
Slovenia	25.7	19.6	30.1	23.1	26.6	33.0	8.7	10.9
Sweden	22.4	16.7	26.0	23.1	30.8	40.4	9.3	16.1
Austria	19.6	18.5	23.7	23.1	31.2	34.7	10.3	12.4
Netherlands	17.4	14.1	25.6	22.6	36.4	39.8	12.5	15.7
Belgium	20.3	14.5	27.0	22.1	36.7	45.2	13.6	17.8
EU-27	21.0	17.2	25.7	22.0	33.2	38.9	12.4	16.0
Lithuania	19.1	16.4	26.0	21.5	26.0	34.2	2.8	5.6
Finland	25.4	18.6	25.9	20.2	27.5	35.8	7.6	12.6
Estonia	21.0	14.3	29.3	20.1	28.7	41.1	5.2	12.5
Denmark	17.1	11.5	23.9	19.1	33.3	39.6	8.6	12.2
France	14.2	10.1	21.4	18.3	40.1	48.5	17.7	23.7
Malta	21.7	13.3	27.6	17.9	24.4	36.8	6.4	13.4
Portugal	18.4	13.4	24.7	17.8	32.9	36.5	10.5	12.7
Spain	19.2	13.2	23.6	17.4	33.0	39.4	9.5	12.2
Luxembourg	13.7	6.5	20.7	17.2	49.7	73.0	28.5	45.4
United Kingdom	20.9	11.7	24.6	15.9	30.2	39.4	12.3	20.5
Latvia	20.7	9.9	24.1	14.8	27.0	44.7	4.9	11.2
Greece	12.0	10.3	16.8	13.3	28.2	35.3	6.9	8.5
Cyprus	11.8	6.8	15.8	9.1	30.5	46.1	9.8	16.4

Note: Countries are ranked according to value chain share in 2011
Source: WIOD; wiiw calculations.

As the shares and its changes of manufacturing in the countries' GDPs are already discussed above the focus can be on how that relates to the changes in the manufacturing value chains and the role of business services therein. First, there is a close positive relation between the manufacturing and the manufacturing value chain

share, i.e. a higher manufacturing share also implies a higher manufacturing value chain share. This also implies a strong correlation of the respective changes as depicted in Figure 4.4.

Figure 4.4 – Changes in manufacturing and manufacturing value chain share, in percentage points 1995-2011



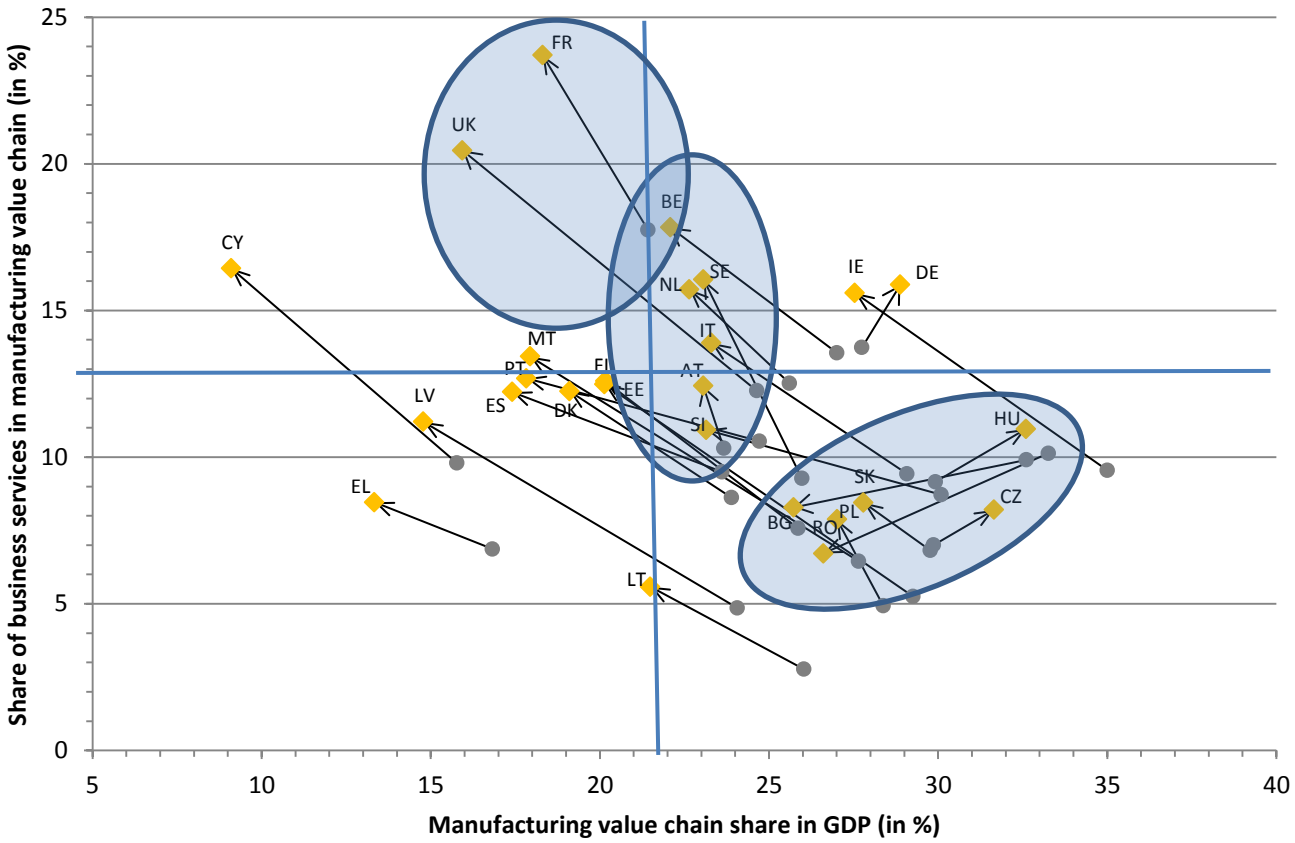
Source: WIOD; wiiw calculations

Most countries are close to the 45 degree line which indicates that their manufacturing value chain share changed more or less in line with their share of manufacturing in GDP similarly to the EU-27 as whole (Figure 4.3). There are few notable exceptions: In some countries – Sweden, Slovak Republic, Luxembourg, Poland – the decline in the manufacturing share has been stronger as compared to the manufacturing value chain share indicating that these countries are contributing to global manufacturing final demand by providing more and more value added created in services (or the non-manufacturing sectors). Another set of countries – Ireland, Romania, Bulgaria, Portugal, Spain, Greece, and Lithuania – experienced a stronger decline of their manufacturing value chain share as compared to the manufacturing share in GDP.

How is this related to the role of business services in the manufacturing value chain? Figure 4.5 presents the share of the manufacturing value chain income in total GDP on the horizontal axis and the share of business services at the vertical axes. Maybe surprisingly, for year 2011 it turns out that countries with a larger share of business services in their manufacturing value chain tend to have – on average – a lower share of manufacturing in GDP. The situation in 1995 however looked quite different as both indicators clustered together (grey dots in Figure 4.5). In 2011 basically four groups – of which three are highlighted - of countries emerged*:* The first group comprises countries with a relatively high share of manufacturing value chain income in GDP and a relatively small share of business services in this value chain with relatively little dynamics over time consisting of EU-12

Member States. The second group comprises countries for which over time the share of business services increased with a relatively small change in the value chain share. A number of countries in these two groups have - together with Ireland and Germany - been classified as part of the manufacturing core countries in Figure 2.3 which maintained a relatively high share of manufacturing in GDP. The third group of countries is characterised by a strong increase in the share of business services in combination with a rather significant decline in the value chain share. This group mostly consists of the 'business services leaders' as shown in Figure 2.3. Finally, the **fourth** group increased the share of business services but also lost significant shares of manufacturing value chain income in GDP. This shows that most countries have been successful in increasing the services component in their manufacturing value chain however only in a few countries the share of manufacturing remained stable.

Figure 4.5 – Manufacturing value chain shares and structures, 1995 and 2011



Note: Grey dots show situation in 1995; yellow dots in 2011. The blue lines indicate the arithmetic averages in 2011.
Source: WIOD; wiiw calculations

4.3 Summary

In this section a 'manufacturing value chain approach' is applied. In this approach all value added generated in a particular economy which contributes to world-wide final demand of manufactured products is assigned to manufacturing thus taking into account services activities which are – together with the core manufacturing activity – provided in-house by a manufacturing firm and service activities which are outsourced to a domestic service provider as part of the manufacturing value chain of this country. Further, services activities undertaken in a particular economy which contribute to the manufacturing process in other countries also are accounted for as being part of the manufacturing value chain of the country under consideration.

Results suggest that in 2011 22% of value added generated in the EU was due to the contribution to world final demand of manufactured products. Over time this share – similarly to the share of manufacturing in GDP – declined from more than 25% in 1995 to about 22%. Within the manufacturing value chain the major part of value added came from manufacturing industries, but almost 40% from services. The share of manufacturing contribution declined over time, whereas the one from business services and distribution services increased in line with results presented in Section 2.

Countries with larger shares of manufacturing also tend to have larger shares of the manufacturing value chain in their GDP. Over time, countries which are characterised by a declining share of manufacturing value added in GDP could only partly compensate to further contribute to the manufacturing value chain by providing corresponding business services, a result in line with the diverse patterns of specialisation documented in Section 2 already.

5 Exploring patterns of manufacturing-services interaction and international linkages for specific country-industry cases

5.1 Introduction

This chapter presents the results of the fieldwork for which interviews have been carried out to gain deeper insights into the interaction of manufacturing and services. Given the complex nature of the interactions and their many dimensions (see Section 1), the fieldwork has aimed at identifying the linkages between the two sectors focusing on performance-enhancing activities – a task that cannot be achieved solely by taking a quantitative approach and applying econometric methods. It is highlighted that the nature of services as well as their importance for and economic effects on manufacturing differ among industries, depending on their structure and their specific environments. The analysis therefore focuses on a few industries, only taking into account issues of technology intensity, market environment as well as performance in and exposure to international competition.

The chapter proceeds as follows: Section 5.2 explains the rationale behind the selection of countries and industries as well as for the fieldwork interviews whereas Section 5.3 provides an overall economic background for the sectors under consideration. Section 5.4 presents the results of the fieldwork, with each industry being discussed in a separate subchapter, highlighting the differences among countries by industry.

5.2 Methodology

5.2.1 Interviews

A number of face-to-face and telephone interviews with firm and industry association representatives were carried out. However, it turned out to be difficult to get hold of experts with knowledge on the relationship between services and manufacturing; only a few interviewees were able to provide a comprehensive view on the broad range of different fields in which services and manufacturing interact. Most interviewees were experts on specific areas for which they provided detailed insights. Most of the interviews therefore became focused on performance-enhancing services, such as IT services, IT-based services, R&D and engineering, which are precisely the areas which experienced the most pronounced and important changes over the period under investigation and from which improvements concerning the companies' economic performance could thus be expected. This does not necessarily imply that these services are the most important ones with regard to their monetary value procured by manufacturing companies. For example, services such as wage and tax accounting together with advertising are responsible for a substantial, though more or less stable share of business services (see Section 2).

5.2.2 Selection of countries and industries

Four industries and six Member States have been selected for this detailed investigation. This selection is partly based on the quantitative results reported in Section 2. With respect to countries, the selections were supposed to represent three groups of countries for which distinct descriptive and econometric results were observed: Large established Member States with mature economies are represented by France and Germany; for the smaller, advanced and open economies Denmark and Sweden are included; finally, the Czech Republic and Poland represent relatively new Central and Eastern European Member States.

Four manufacturing industries have been selected: two high- to medium-tech-tech industries (transport equipment and machinery) and two "so-called" low-tech industries (textiles/clothing and food/beverages). The regression results reported in Section 3 suggest on average stronger productivity effects of services use for the first two industries and weaker (or even insignificant) relationships for the latter two, although differences across countries and within industries are expected to be important.

The **machinery industry** is dominated by smaller enterprises which – in spite of global reach by sales – have remained locally anchored. Typically, a machinery company's production requires a broad range of different intermediaries with the European supply chains supporting a competitive industrial cluster. Companies in the machinery industry are leading suppliers of services to their clients. In particular, manufacturers of final investment goods already gain large portions of their revenues from servitisation such as maintenance.

The focus within the **transport equipment industry** is on the automotive industry, which for a long time has been a trendsetter in advanced management methods and tools, in particular in supply chain management. Contrary to the machinery industry, the automotive industry is characterised by large players and has been an early mover to invest globally, particularly so in important sales markets. Foreign direct investment (FDI) is not only a strategy of individual larger players, but also from groups of companies and their suppliers. For example, original equipment manufacturers (OEM) and their important subcontractors have invested in new locations and created manufacturing clusters.

The two low-tech industries selected for the in-depth analysis, textiles and clothing as well as food and beverages, deliver products mainly to meet private households' demand. The breadth and depth of upstream linkages of these industries focus more on value chain management than in the case of the machinery and the automotive industries, which put more emphasis on R&D and engineering. However, one has to bear in mind that the industries are characterised by a dichotomy of different players. On the one hand, there are global players with footholds in nearly all important sales markets which command large shares in their respective markets. On the other hand, most of the companies in both industries are medium-sized, with the majority focusing on regional markets or specific market niches.

In that respect the **textiles and clothing** industry is a globalisation front-runner with the production of clothing being labour-intensive and carried out predominantly in low-wage countries. Spinning, weaving and other more automated upstream manufacturing processes have lost their proximity to downstream clothing manufacturers. This has caused much of the textile production of yarns, fabrics etc. to follow its downstream clients to foreign locations. European manufacturers have come under pressure from two sides: first, due to from low-wage countries outside Europe and, second, due to (European) distributors and retailers being able to increasingly exploit their bargaining power advantages. In extreme cases companies have ceased to be manufacturers and have become providers of comprehensive services for the design, production, marketing and distribution of clothes. To this end, advanced supply chain management and servitisation have contributed to the survival of EU companies in a hostile market environment, albeit sometimes without any own manufacturing capacities remaining in their respective home countries.

The **food and beverages** industry is similarly heterogeneous. Some segments are dominated by large players, in particular the capital-intensive manufacture of intermediate products as well as mass-market final products. Other segments are characterised by smaller enterprises and the respective manufacturing activities are predominantly labour-intensive. In contrast to 'textiles and clothing', 'food and beverages' has remained a regionally anchored industry which is explained by several factors: First, there is a close linkage to the EU agricultural sector and first-stage processing capacities are frequently located close to agricultural production. Second, storage life of agricultural products and legal requirements such as proof of origin favour regional proximity. And, third,

downstream linkages to distribution and retailing have become more important for successful enterprises, similar to the textiles and clothing industry.

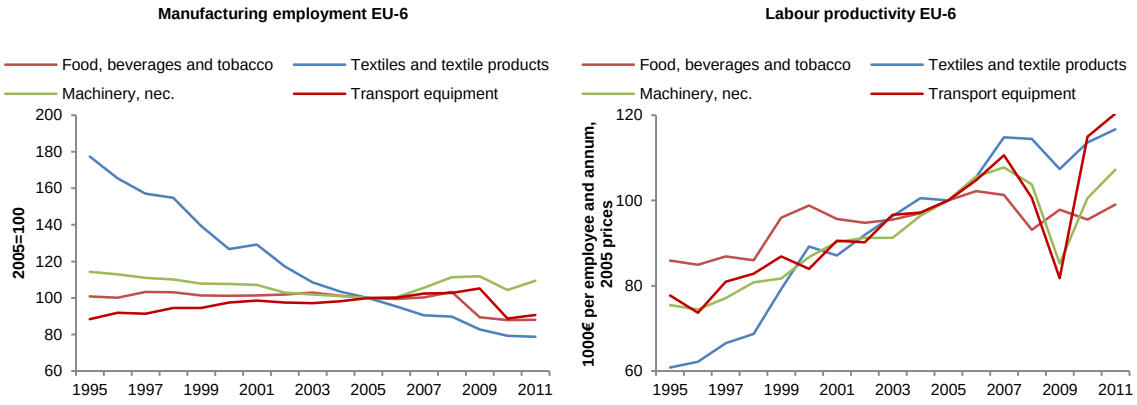
5.3 General developments of the selected industries

Before presenting the results from the firms' perspective derived from the conducted interviews, an overview of the developments in the selected industries and countries is provided. The evolution of employment and labour productivity is discussed, highlighting important differences in performance and changes in capacities. In line with Section 4, indicators based on the traditional Industry Approach (IA) and the Value Chain Approach (VC) are presented.

5.3.1 Developments of employment and productivity

The manufacturing of textiles and clothing has experienced a dramatic decline of employment which seemingly has not yet come to an end (see Figure 5.1) whereas employment in the other industries has remained relatively stable. Over the past 15 years employment in the textiles and clothing industry declined by more than 50 per cent which also had strong implications for the industrial structure: Automation and the closure of unprofitable facilities positively affected labour productivity, resulting in the strongest productivity growth for textiles and clothing among the four selected industries, even ahead of the machinery industry and transport equipment. The other industries displayed a far more stable development and have been able to more or less maintain employment levels while simultaneously increasing productivity.

Figure 5.1 - Employment and productivity by industry (EU-6)

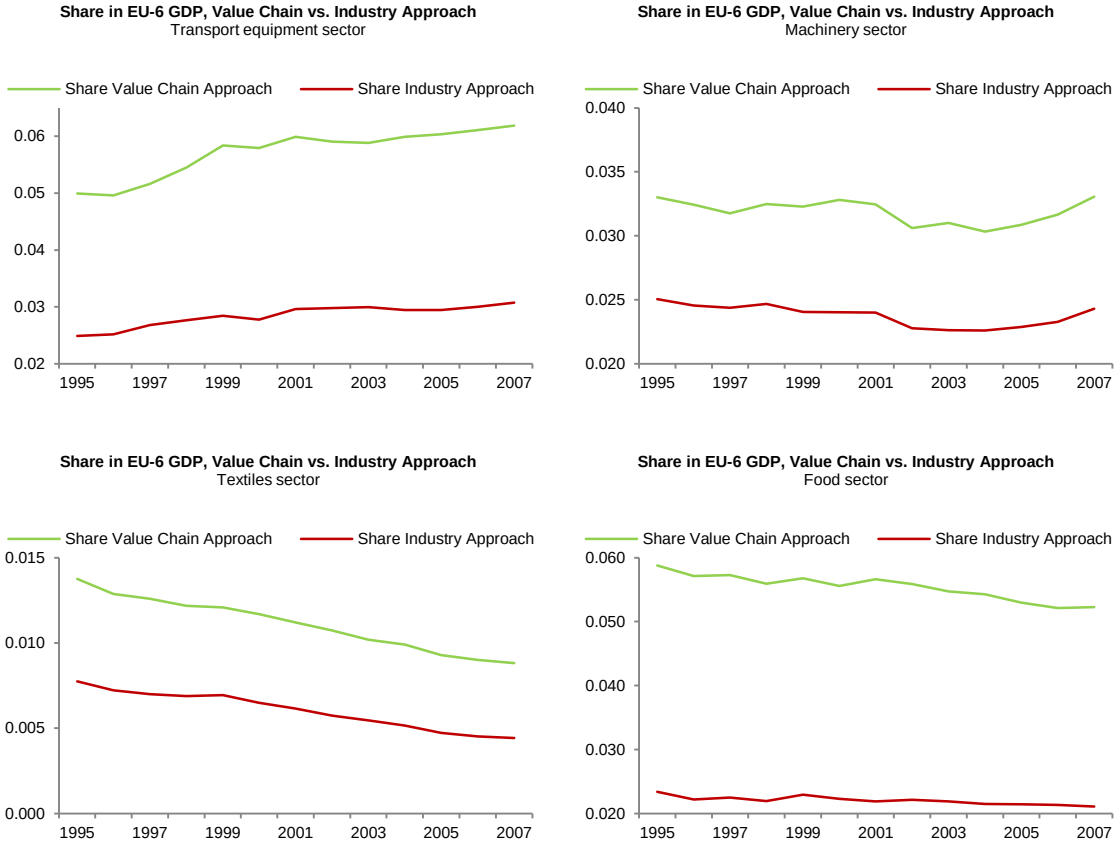


Source: WIOD; ifo calculations.

5.3.2 Developments in terms of GDP and the role of services

Figure 5.2 illustrates both the relevance of services for manufacturing and the weight of each of the four industries in GDP for the selected countries.

Figure 5.2 – Sectoral shares in GDP in EU-6: Industry Approach versus Value Chain Approach



Source: WIOD; ifo calculations.

Over the period under consideration the **transport equipment sector** has become the largest in terms of its share in GDP. Its production contributed 2.5% to GDP in 1995, but steadily increased and exceeded 3% in 2007. Note that the growth of the services attributable to the transport equipment sector using the value chain approach even outpaced the growth of the production value, indicating a general increase in the importance of services. The transport equipment industry was the only among the industries under investigation able to maintain its employment level in spite of a slump by one tenth caused by the financial crisis. Only during the early years of the whole period its increase in labour productivity was lagging behind the textiles and clothing industry; in the years thereafter it increased at roughly the same pace. Over the whole period the transport equipment industry was second in the ranking of labour productivity across the industries considered here.

The development in the **machinery sector** development was slightly less dynamic. In 1995, its contribution to GDP was more or less of the same magnitude as for transport equipment. Over the period under investigation it lost some of its weight and services inputs play a somewhat less important role than in the transport equipment sector, though their relative importance has increased over the whole period as well. As measured by the value chain approach the machinery sector's contribution to GDP was roughly the same in 1995 and 2007 with a share of about 3.3%.

The **textiles and clothing sector** shows a steady decline as a share of GDP without any indication of stabilisation, both for the IA and VC approach, as shown in Figure 5.2. The sector's contribution to GDP declined by almost half from around 0.8% (1995) to below 0.5% (2007); the respective figures for the VC approach indicate a less pronounced decline from 1.4% to 0.9%. Interestingly, therefore, despite the decline in textile manufacturing, the related services display considerable resilience.

In 1995 **food and beverages** was the largest among of the four sectors under consideration. Much of the sector's weight is due to the outstanding importance of services. The food sector's weight in terms of GDP – based on the VC approach – was nearly 6% in 1995 and 5.2% in 2007. The respective figures for the IA were 2.4% and 2.1%.

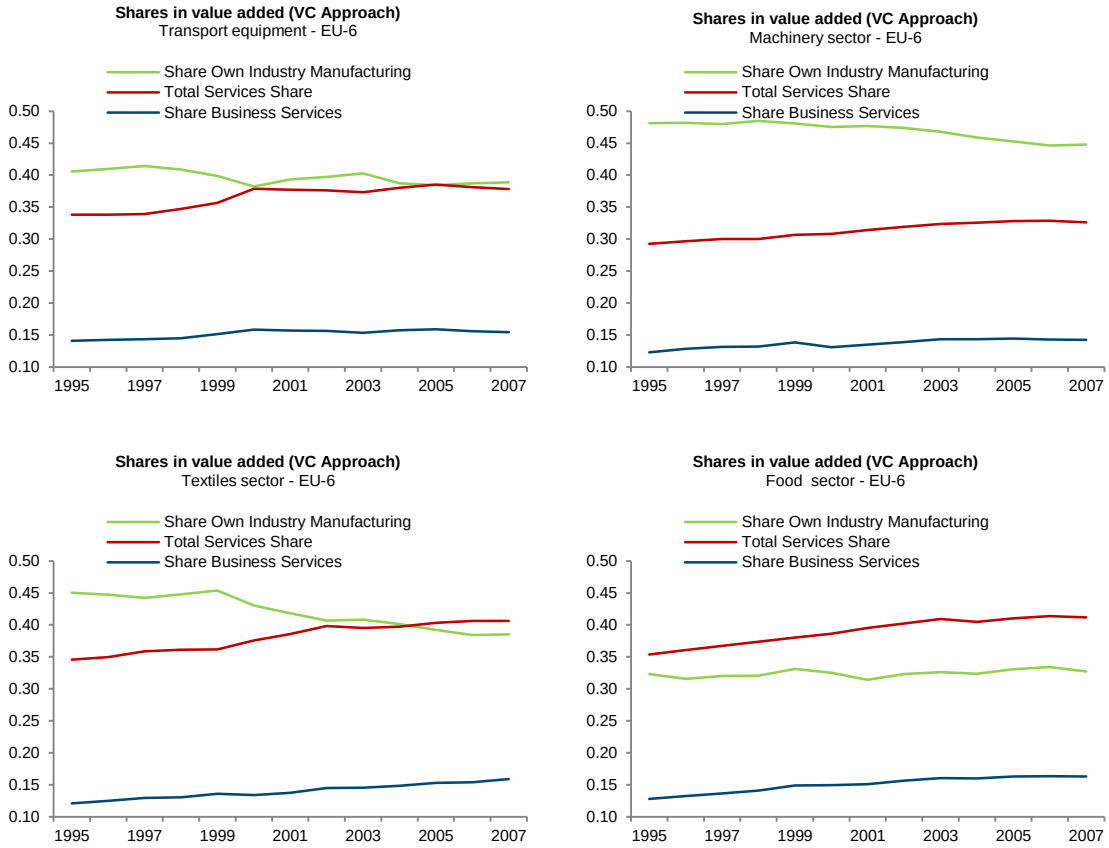
Thus, the overall decline in manufacturing as a percentage of EU GDP – as measured by the value chain approach and the industry approach – is significant for the two low-tech industries under consideration, but not for transport equipment and machinery. This is explained by the higher-tech industries' above-average performance compared to the other industries. Moreover, with Germany, Poland and the Czech Republic, there are three countries among the six Member States under consideration that experienced strong growth in manufacturing and particularly so in these industries.

5.3.3 The relative importance of business services

The next step is to analyse the contribution of industrial production and services to the total value added of the four sectors based on the value chain approach. Figure 5.3 shows that the share of value added created by manufacturing compared to services differs strongly among the four sectors. The value added created in the manufacturing part of these industries' supply chains has lost some of its former weight, only in the case of the food and beverages sector that share has remained at roughly the same levels. As for machinery, although the industrial production share in that industry's value chain has declined, its share remained the highest at 45%, followed by textiles and clothing, transport equipment and food and beverages with 38%, 37% and 31% respectively. Food and beverages manufacturing has been least affected by global competition and offshoring activities because of its strong regional roots, proximity to suppliers and customers. Most affected in this respect has been textiles and clothing manufacturing, which experienced losses of 7 percentage points over the whole period, while food and beverages only lost 1 percentage point. For both the other high- to medium-tech industries losses have been more moderate with around 3% to 4%.

As for the contribution of services, all four industries show remarkable similarities concerning the contribution of business services. Their respective shares in the total value chain income vary between16% and 18%, based on the most recently available figures, with similar trends over time. This upward trend of business services has been generally accompanied by a growing weight of non-business services, which reached about 25% for the two low-cost industries, whereas for transport equipment and the machinery industry the cost share reached up to 23% and 19% respectively.

Figure 5.3 – Value Chain Approach: Shares of manufacturing, total and business services by industry (EU-6)



Source: WIOD; ifo calculations.

5.3.4 Specific services use in selected countries and industries

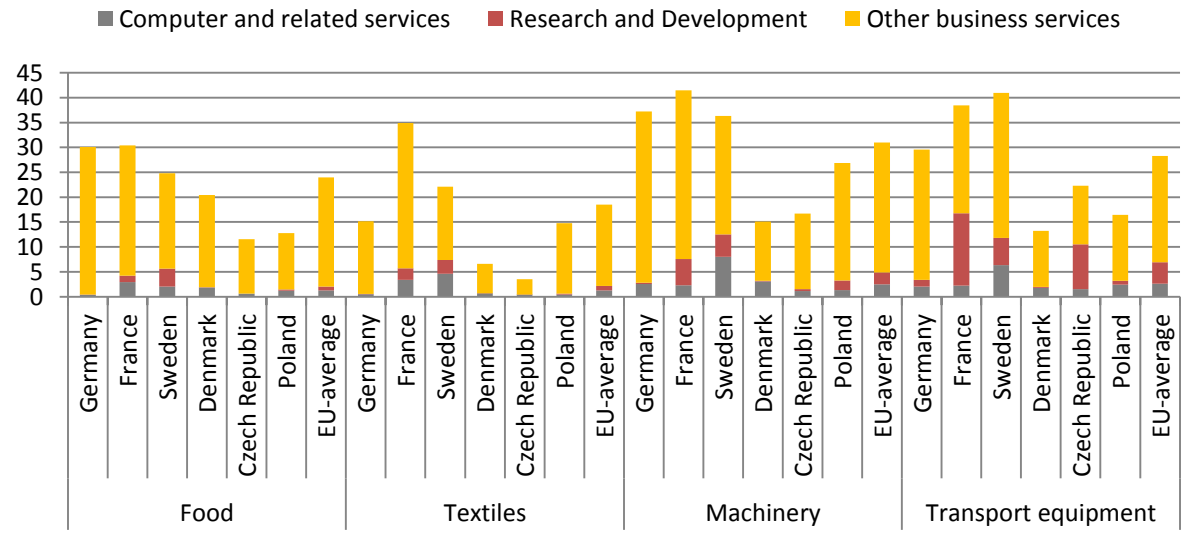
As highlighted in Section 2, the use of business services and the individual categories differ widely across countries. This is now considered across the selected countries and industries in Figure 5.4 (based on WIOD in NACE Rev. 1) and Figure 5.5 for NACE Rev. 2 classification, which provides some more details concerning the category 'Other business services' as discussed in Section 2.[31] Differently from Section 2, business services are now expressed as a share of total services used in manufacturing. The figures highlight noteworthy differences in the application of business services as a percentage of total services. For most of the industries considered business services play a more important role for Germany, France and Sweden than for Poland and the Czech Republic. Denmark is the only long-term EU member state with a lower share of business services than the two member states which accessed the EU only 2004. This result has been confirmed during the fieldwork and is perceived as an explanation for the Danish manufacturing's sector loss of competitiveness.

The **machinery sector** is (on average) relatively more technology-intensive and is characterised by a 'long' supply chain with strong international backward and forward linkages. Since the machinery sector is relatively more technology-intensive, one could assume that the somewhat higher share of R&D services input into the

[31] Since the WIOD data refer to 2011 and the 'other business services' category in the WIOD database also includes some services that do not fall under the definition of "performance-enhancing services", the total shares for the 'other business services' from the WIOD database and from Eurostat do not correspond entirely. However, the patterns provided by the Eurostat data allow us to acquire a better overview of the differences in the use of different types of 'other business services' across sectors and across countries. As, however, the supply and use tables using the new classifications are not yet available for Denmark and Poland, both figures are presented.

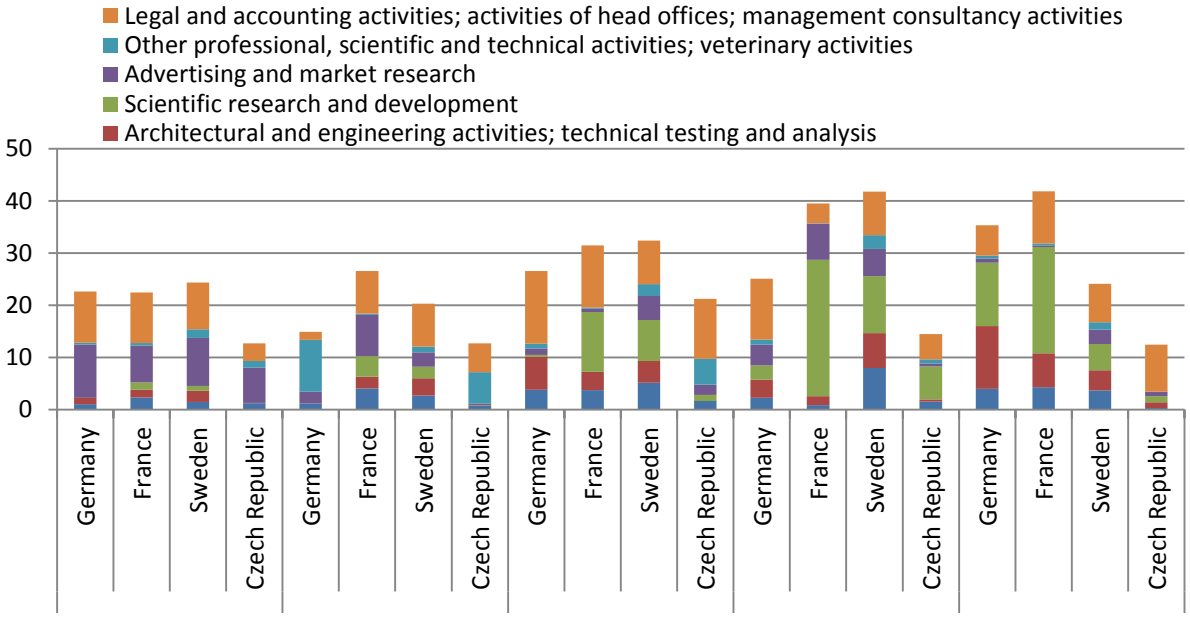
manufacturing sector (on average 2.4% of total intermediate services input) are used for product and process innovation (see Figure 5.4). As in the other industries considered here, other business services are the services most often used also in the machinery sector, with France using the relatively largest share of performance-enhancing services which is driven by a higher than average use of externally bought-in R&D services. This does not imply that France's machinery sector is more R&D-intensive than Germany's, as it may be that the German sector undertakes more 'in-house' R&D. Sweden has a higher than average share of IT services in the production of machinery equipment. In line with the findings in the textiles and food sectors, Denmark, the Czech Republic and Poland buy-in significantly less performance-enhancing services than the EU average.

Figure 5.4 – Share of business services in % of total services used in manufacturing industries, 2011



Source: WIOD, wiiw calculations.

Figure 5.5 – Share of business services in % of total services used in manufacturing industries, 2010



Source: Eurostat, wiiw calculations.

The dominant use of 'other business services' also warrants a closer look at a more detailed split based on NACE Rev. 2 data from Eurostat on the machinery sector. Contrary to the food sector, for example, where a large share of output are consumer products and thus requires a large share of advertising and market research spending, many machinery goods reflect capital expenditures by customers for which production-related services matter more. As Figure 5.5 shows, the share of engineering and technical testing activities in Germany, France and Sweden is high. Still, the largest share of costs in the machinery sector is made up by legal and accounting activities (on average 11% of total intermediate services inputs in the four selected Member States). Sweden uses significantly more advertising and market research services, as the industry is characterised by headquarters of large global players.

Figure 5.4 shows the use of performance-enhancing services in the **transport equipment sector** in the selected Member States. Sweden and France use a very large share of performance-enhancing services, mostly triggered by a large share of R&D services. The German industry does not use much externally bought-in R&D services[32], which explains a large part of the overall lower input of performance-enhancing services in the sector. The Czech Republic and Poland use a less than average of performance-enhancing services in their transport equipment industry, but the share of R&D services inputs into the Czech transport equipment sector is significant (40% of total PE services inputs). Denmark again shows a lower than average use of performance-enhancing services in industry, but the small size of the transport equipment sector in this country might distort the picture. Also consistent with the findings in the other sectors is the relatively high use of IT services in the Swedish manufacturing industry. Technical testing and engineering activities, on the other hand, are more important for the 'other transport equipment sector' (especially in Germany – where these services constitute almost two thirds of overall business services inputs – and France). The overall input of other business services, however, does not differ strongly between the two sectors for the selected Member States. In line with the overall use of PE services, Sweden uses other business services most intensively.

The **textiles and clothing** sector in Europe has been subject to significant changes over the past decades as noted above, with relocation of production playing an important role. Figure 5.4 shows that the overall use of performance-enhancing services in the EU textiles sector (approximately 18% of total intermediate services inputs) is lower than in the food sector. The graph also shows that France buys-in significantly more performance-enhancing services than Germany does, Sweden significantly more than Denmark, and Poland significantly more than the Czech Republic. France and Sweden also use more bought-in IT and R&D services than the EU average in their production of textile products. The dominant category of other business services used in the textiles sectors in Germany, France, Sweden and the Czech Republic signals that the focus of particular countries is on different activities in the textiles supply chain. France, where the textiles industry is dominated by large high-end wearing apparel and fashion industries, uses significantly more advertising and market research services than Germany, where the industry seems to focus on specific production processes (high use of scientific and technical activities). Sweden and the Czech Republic have small production bases, but use mostly technical and legal services.

In the **food, beverages and tobacco sector**, the use of 'other business services' dominates the sourcing of PE services by food manufacturers in the sector (on average 92% of total performance-enhancing services inputs in 2011). France and Germany use on average more PE services (approximately 30% of total intermediate services inputs), Denmark and Sweden use an average amount of services inputs (about 24%), whereas Poland and the Czech Republic both use a (much) lower amount of PE services in production (about 11%) compared to the EU. France and Sweden use above-average amounts of IT services inputs, whereas Germany hardly buys in any IT

[32] This, for reasons mentioned above, does not directly imply that the German production process is less R&D-intensive, since the R&D activity could be generated within firm boundaries.

services inputs for its production process. Sweden uses more than average R&D services inputs (3.6% of total intermediate services inputs) in its food production industry. Since the 'other business services' type of services constitute by far the largest share of inputs in the food sector within PE services, it is worth studying more detailed supply and use data that allow to break down the 'other business services' in more detail (see Figure 5.5). Legal and accounting[33] activities constitute the largest cost share in the food industry in Germany, France and Sweden. The Czech Republic uses significantly less of these services. The pattern of use of advertising and market research services is more stable across the four countries considered and constitutes the second largest input of externally supplied services to food manufacturing firms. Since most products produced in this sector are consumer products and are sold through retail, wholesale and catering services, advertising and consumer preferences research is extremely important for the sector. The large share of advertising and market research spending (on average 47% of total other business services inputs) can thus largely be explained by this demand characteristic.

5.4 Qualitative results concerning the manufacturing-services interactions

5.4.1 Machinery industry

As noted above, the machinery industry is a high- to medium-tech sector which faced a decline in the total number of employees by 10% between 1995 and 2005. Thereafter the industry recorded employment growth despite a setback caused by the financial crisis. Growth in labour productivity has been relatively slow, largely on account of developments in German machine manufacturing where employment growth has been positive, but labour productivity has stagnated. As opposed to this, developments in France – the selective outflow of roughly one fifth of employment over the whole period with sustained value added – contributed to productivity growth. Moreover, the machinery industries of the two countries display considerable differences in their use of services. These factors make it interesting to take a closer look at this country pair when investigating the relationship of manufacturing and services.[34]

Remarkable differences exist when comparing the French and the German industry: According to French interview partners, subcontractors within the French machinery industry often have little or even no engineering capabilities and are exposed to strong price competition, which puts pressure on domestic production locations. By contrast, competitiveness of German firms benefits from own engineering know-how, while mere production firms do not play a considerable role. Data show that the French machinery industry did not only experience higher growth of labour productivity, but also registered much stronger real output increases than its German counterpart. However, German enterprises generated stronger growth of revenues, which is explained by differences in price developments. Thus German enterprises successfully increased prices while simultaneously expanding overall employment, whereas the French machinery industry suffered from falling prices.

This may be explained by certain segments within the machinery market being predominantly served by German, but not by French firms. Specific technologies, customer orientation, quality etc. might play a role in the ability of companies to increase market shares without excessive price pressure. This is underpinned by the interviews conducted which revealed that German firms strongly trust in their own specialised engineering capabilities. This development indicates that German machinery manufacturers - target markets in which they can exploit their comparative advantages concerning engineering capabilities, while French firms are more exposed to price competition relying more on contracted engineering capacities with broader and more general know-how offered

[33] Including headquarter services and management consultancy activities. However, due to the set-up of the WIOD database, which only records transactions from externally bought-in services suppliers (not within-firm transactions), it is unlikely that headquarter services play a large role in this services category.

[34] The other countries are covered in detail in the comprehensive industry reports.

by ESPs. Overall cost cutting pressures and less flexible labour regulations are important drivers of these differences which explains to a certain extent the much higher cost share of business services in the French machinery sector (Figure 5.6).

Box 5.1: The interaction of different types of companies of the machinery and transport equipment industry in product development

In both the machinery and the transport equipment industry different types of companies interact. Their relationship can best be described by using the value chain approach. It is comprised of OEMs, Tier x suppliers and engineering services providers (ESPs). OEMs are manufacturers and system integrators. Tier x suppliers are manufacturers of subsystems, components and parts. There is a division of labour not only by subcontracting, but also for the development of new products. Working packages are assigned to Tier x suppliers with engineering capacities and ESPs. There are Tier x suppliers who are involved in product development and manufacturing, while others are mere manufacturers in the supply chain. ESPs are only involved in product development and prototyping, but production is carried out by OEMs or Tier x suppliers.

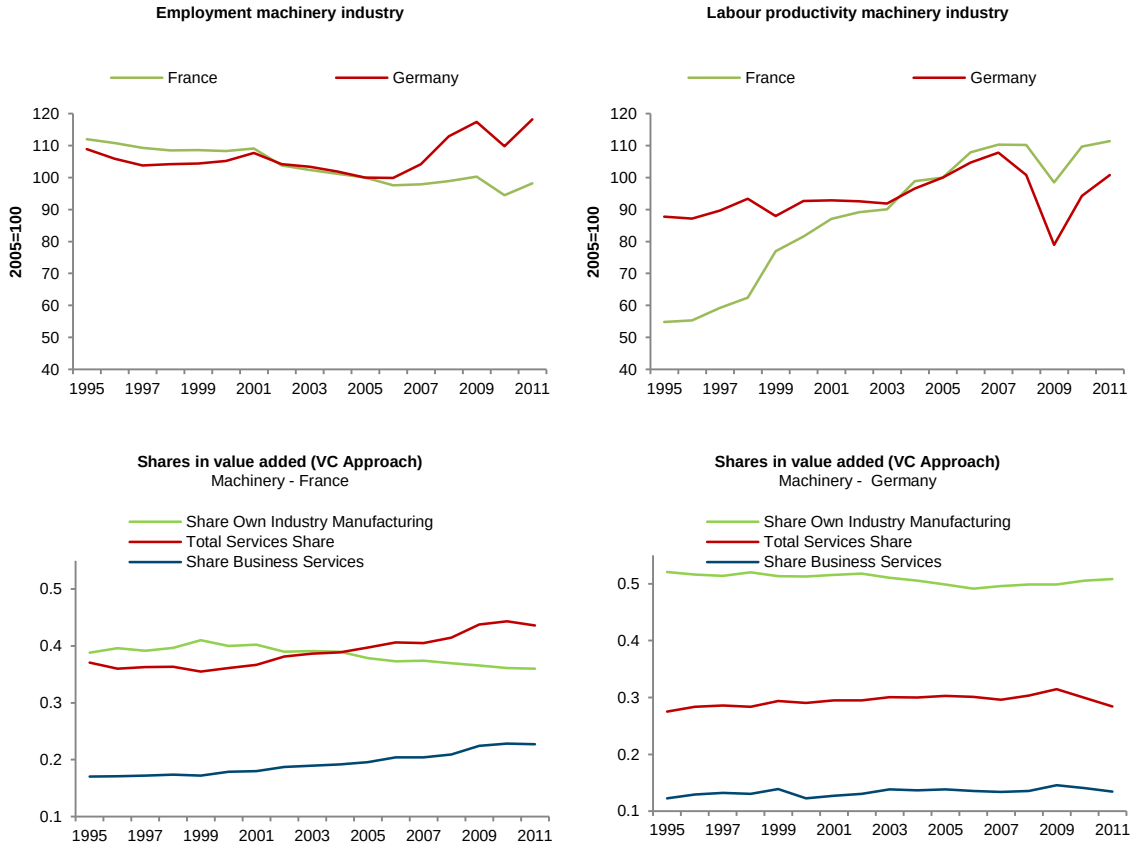
The division of labour between these three types of companies in product development may vary significantly. Interviews revealed typical differences between French and German companies. While German firms prefers to employ own staff, French firms are more inclined to employ contracted engineers or outsource to ESPs. This is largely attributed to stronger cost pressure from sales markets and to stricter labour market regulation in France as compared to Germany. This impacts the WIOD statistics. There is a bias for the use of R&D and engineering services with higher shares for France. For German firms of the machinery and automotive industries with their reliance on internal capacities these shares are lower.

Interrelation of manufacturing and services

In general, it is because of the machinery industry's particular characteristics that geographical vicinity along the supply chain still offers advantages for companies in the era of globalisation, due to the importance of small-batch production, customisation and specifics of intermediary products. Offshoring and overseas procurement are evolutionary trends which do not have as radical effects on the industry's structure as, for instance, in the case of textiles and clothing. As a consequence, supply chain management and the introduction of IT tools are primarily dedicated to improving transactions and communication. To this end structural changes through closure of the least productive capacities are of smaller importance. Agreements on standards and the integration of real-time and non-real-time communication contribute to moderate but steady efficiency gains.

Enterprises in this industry are predominantly medium-sized, thus outsourcing of business operations and services plays a limited role. Facility management, transport, warehousing and IT departments were among those outsourcing activities mentioned most frequently in the expert interviews. Only large enterprises put more emphasis on outsourcing with all non-core business operations being considered, for instance administrative activities such as accounting. These outsourcing activities, undertaken mainly by large firms, have not yet come to an end according to the interviews, although compared to other industries such activities will remain limited.

Figure 5.6 - Comparison of the French and German machinery industry



Source: WIOD; ifo calculations.

In view of the above, the machinery companies' productivity gains are for the most part expected to result primarily from IT-driven reorganisations and not from outsourcing to specialised services providers. Important measures to be undertaken in the coming years will relate to the virtualisation of IT systems. This will contribute to an increase in IT-staff productivity and simultaneously ease the employees' use of IT tools. Another IT novelty, 'cloud computing', will further enhance the efficiency of operations by its potential to integrate data and processes of different locations, an important feature for machinery companies with global distribution networks and several production sites.[35]

The machinery industry's capacity for product innovations is linked to engineering and customised solutions. These activities are considered as core competencies and in Germany mostly done in-house. The growing sophistication of products and the need to integrate different technologies have contributed to more complex innovation processes. As a consequence, the efficiency of development processes has emerged as a topic of growing importance. Project management and IT-supported processes have been introduced to strengthen cooperation and coordination and to reduce throughput times, ensuring timely delivery, while simultaneously increasing the quality of results. For more than a decade the supply of adequate IT tools and organisational structures has become a business field for consultants and IT service providers. In Germany in particular, this

[35] Typically, the combination of the general nature (i.e. lack of client specificity) of network-type services and the associated economies of scale in their provision mean that in-house production is usually neither a viable nor cost-effective option (ECORYS, 2008). That is why Cloud Computing incorporates the potential to change the machinery industry's decision-making on outsourcing of business operations. The offering of IT services can become more attractive by services providers' abilities to exploit scale effects through Cloud Computing and incite machinery manufacturers to relocate business operations.

kind of IT-supported integrated product innovation processes is widespread. By contrast, similar activities have not been reported by French experts of the industry.

Among the industries studied, machinery has a long-standing tradition in servitisation. Services provision has been an important driver of growth, with services having contributed to EU manufacturers' competitiveness in international markets. The focus is on maintenance, repair and overhaul (MRO) and other services complementary to physical products. According to the experts interviewed, the profitability of these after-sales services substantially surpasses that of physical merchandise. Servitisation is an important and continuously growing business field for machinery manufacturers and pivotal for success in international competition. To a large extent these services are provided by subsidiaries or independent representatives abroad. Up to now, full integration of these internationally located establishments into a single enterprise IT system has not taken place for the machinery industry. This increases the potential for Cloud Computing to be a useful tool which can accelerate the integration of IT systems as soon as security concerns have been tackled and resolved.

More recent technologies, such as remote supervision and in-situ monitoring of machine operations at the clients' premises, allow one to offer new services to clients. These are part of a more comprehensive approach referred to as product lifecycle management (PLM). This concept comprises the whole lifecycle from product innovation to the end of a product's life-span. In particular, the permanent supervision of machines allows for repairs in advance to the breakdown of a machine. It increases the availability of machines and strengthens the linkages between manufacturers and clients. There is a feedback loop to product innovation by collecting data from a broad range of clients. In turn the data are used for the development of machines more focused on the clients' needs and higher reliability.[36] The application of IT-supported tools such as cloud computing, Big Data, etc. contributes to new and more efficient services. Since the turn of the millennium, IT-supported services related to PLM have gained importance and will get additional stimuli in particular from cloud computing. These services represent a growth potential for machinery manufacturers through the provision of new business opportunities. The necessary infrastructure might be based on proprietary systems or provided by services providers, but no trend has been identified so far. These advanced services are supplied in advance to the more traditional services, such as MRO.

In particular, larger manufacturers have tapped new business areas that are not closely related to physical products, such as financing, contracting, Build-Operate-Transfer (BOT), etc. The overall share of servitisation for the EU machinery industry is estimated to be between 5% and 10% of total revenues, although some companies' turnover in services reaches up to 30%, depending on their product programmes.

5.4.2 Transport equipment

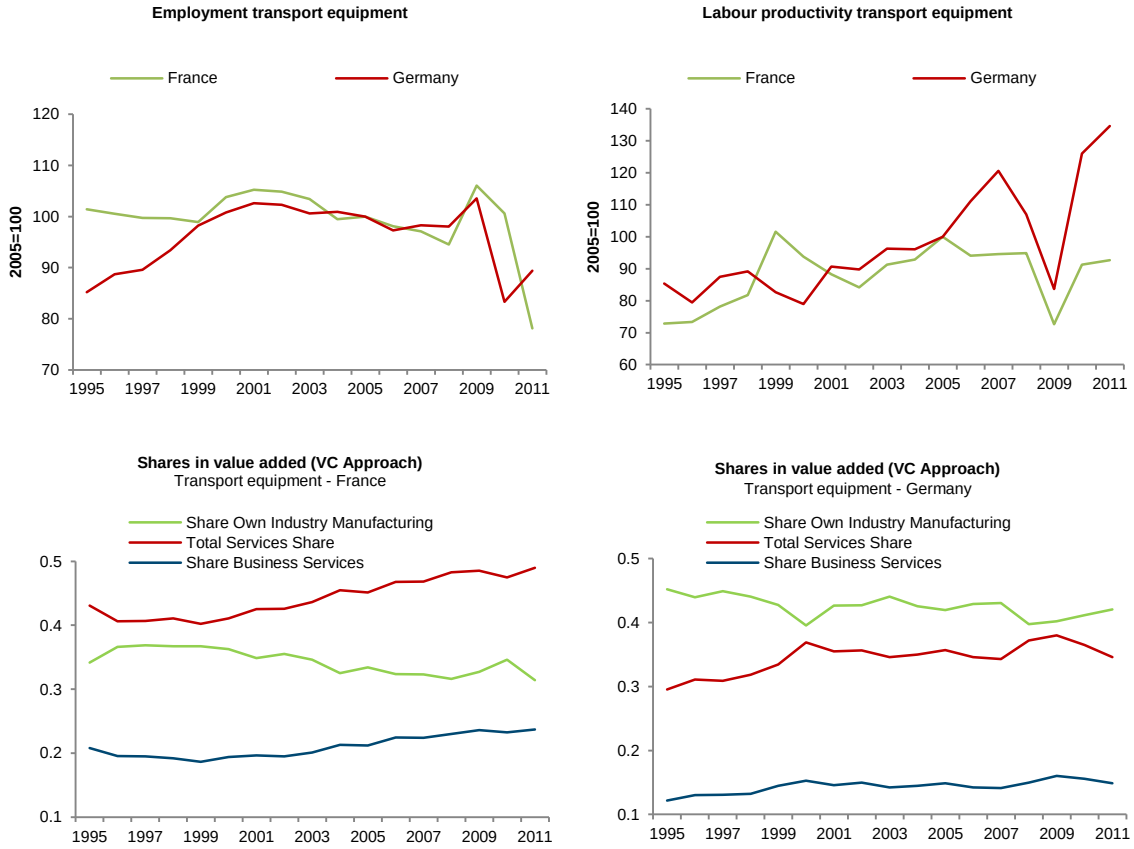
The transport equipment industry is the second high- to medium-tech industry under consideration. It accounts for the best employment record of the EU-6 over the whole period, and was growing steadily until 2009. During the financial crisis the industry suffered a major setback. Labour productivity grew at a similar pace as for textiles and clothing when considering the whole period.

A comparison of Germany and France again reveals important developments and discrepancies for the two advanced economies with mature domestic automotive industries. A recurring fact – also observed for other technology-intensive industries – that appears puzzling is the much higher services cost share in French manufacturing compared to that in Germany. Over the entire period under consideration, the average difference was around 6 percentage points. Figure 5.7 shows the development of manufacturing and services cost shares

[36] The latter is mainly of importance for manufacturers of serial products in large quantities.

over time: Over the whole period the total services share in France is at least 10 percentage points higher than in Germany, starting out at about 43% in 1995 and steadily increasing to almost 50% by 2011. As opposed to this, the share in Germany increased from about 30% to about 36% between 1995 and 2001 and has more or less stopped growing since then. This reflects the introduction of IT services into the industry which took place at a very fast pace prior to 2000, and a more subtle growth subsequently. It is therefore the (generally considered as performance-enhancing) business services, including R&D, which account for almost the entire difference in shares between the two countries: in France, they accrue to more than 20% of value added (increasing throughout), in Germany, they start out at only 12% and level off at a value of around 15% of value added. French productivity growth outpaced Germany's, yet this does not necessarily signify overall economic success: while the French industry lost employment during the period under consideration, employment in Germany grew at a yearly rate of 3.6%. One has to remember that the higher services share in France is explained by the higher degree of externalisation of R&D/engineering services as compared to Germany. Economic performance of the industry in both countries suggests that the use of internal as against external R&D/engineering services is of advantage for the design of high-performance vehicles. However, competitive pressure is growing and permanent cost-cutting is pivotal to securing market shares, because losses in mass markets would endanger OEMs' future strategic positioning. This has led – among other initiatives – to increasing transparency in the value chain by splitting manufacturing and engineering into individual organisations, which allows for a more economical procurement of intermediary products and services. The challenge for OEMs and their suppliers arising from this development is to maintain technological leadership and economic performance at the same time.

Figure 5.7 - Comparison of the French and German transport equipment industry



Source: WIOD; ifo calculations.

According to the findings derived from the interviews conducted with industry experts, the different use of ESPs explains this pattern to a large extent. In the German automotive industry, there are substantial upstream R&D and engineering capacities; according to industry estimates, almost one third of R&D value added is created by Tier-1+ suppliers, while the share of dedicated ESPs is only around 9%. By contrast, according to interviews with French experts, French upstream firms have far fewer own engineering capacities, since the OEM typically provides finalised blueprints to subcontractors for the production of parts and components. While in Germany the development of parts and systems is often outsourced to the supplier jointly with production (in the context of which R&D services do not appear in WIOD statistics), in France OEMs hire engineers from ESPs for internal projects. This is a result of the (historically grown) industry structure: In France, ESPs play a very important role for manufacturing in general, with a strong focus on the areas of aerospace, machinery and defence.[37] Even though these are not purely focused on automotive engineering, they are established and important partners for the French automotive industry. There is a historically established division of labour between ESPs and (manufacturing) suppliers. In contrast, most German automotive supplier - both the largest firms such as Bosch and Continental as well as SMEs – are located close their core engineering firms. They do not contribute less R&D services, but since these are embedded in the parts produced, they do not appear in official statistics to the same extent. As a result, one does not observe differential productivity effects of the services levels for France and Germany. But along with an increase in the role of engineering service providers in the German market (they are already a fixture of French manufacturing) one should expect this service gap to close in the automotive sector in the future. (For a detailed discussion see Box 5.1.)[38] Note that other clients of ESPs include the aerospace, railway, machinery and defence industries.

A general trend in the industry is represented by the shifts in production and assembly location patterns both within the EU and globally. Box 5.1 above explains how the separation of the development of blueprints and the production of parts may further enable offshoring of production to destinations within and outside the EU. Two countries in our sample, Poland and the Czech Republic, have both become important production destinations for international car manufacturers and their suppliers producing for the European market. Both display a strong dependence on the development of the German car industry. However, in Poland Asian manufacturers play an important role. Among the sectors studied, the transport equipment sector in the Czech Republic has experienced the strongest sustained productivity growth over the entire period with an average growth rate of 11.5%. A comparison with neighbouring Poland reveals that this cannot be attributed solely to convergence: While the two countries registered similar levels of labour productivity in 1995 (around USD 20,000, purchasing power parity adjusted, per employed person), the growth rates in the Czech Republic outpaced those in Poland by 7% per year on average between 1995 and 2007. The Czech Republic's much better performance in labour productivity is partly explained by an even larger growth differential of value added. Beyond scale and learning effects, structural differences may have contributed to the more favourable development of the Czech automotive industry.

[37] French industry leaders such as AKKA or Altran employ staffs exceeding 10,000 engineers.
[38] Knowledge-intensive business services typically require the retention of a complementary in-house knowledge base. This is assumed to be one factor explaining the better performance of the German machinery and transport equipment industries as compared to the French industries which rely more on external engineering services. (For the role of KIBS as catalysts for innovation see Muller and Doloreux, 2007.)

Box 5.2: The rise of engineering service providers (ESPs) in technology-intensive industries

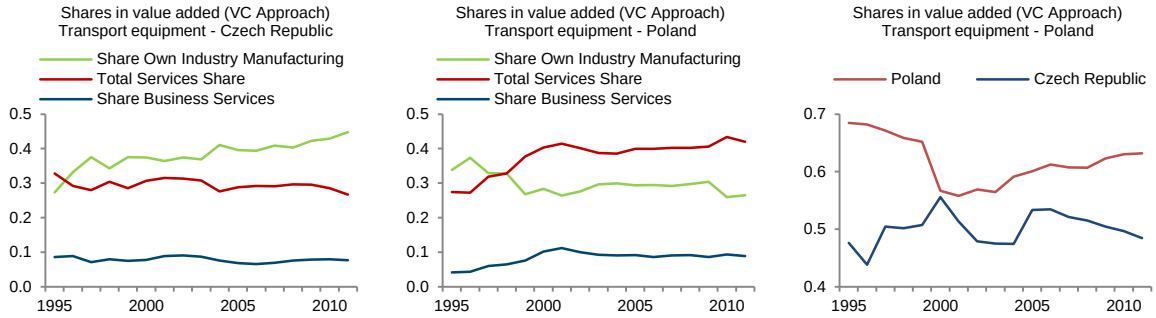
ESPs have emerged over the past decades to become an indispensable part of the automotive value chain. One of the major growth drivers for ESPs was the modularisation and accompanying model profusion beginning in the early to mid-1990s. ESPs focus solely on R&D tasks, which therefore become completely separated from the manufacturing process. Serial production of the parts designed by the ESP has to be carried out either by the client (OEM) or by upstream suppliers in the value chain which then produce according to the specifications set out in the ESP's blueprints. This has two effects: On the one hand, the R&D efforts become more visible in national statistics, since they are procured separately. On the other hand, there is less differentiation potential for the producer of the designed part, as the innovative aspects of the task are no longer directly linked to production. Typically, this is exacerbated by the fact that the OEM assumes intellectual property rights of the ESP's developments and even inventions. In the long run, this separation of research and production will make outsourcing to more distant destinations such as Northern African countries (e.g. Dacia's major investments in Tangier) more feasible.

Most of the ESPs are involved in the development of new components and systems, often with a technological specialisation such as: car bodies, interior, electronics, engines, power trains. More specialised fields of expertise include simulation and testing (e.g. AVL) as well as quality and project management, which play a central role in outsourcing and (even more so) offshoring processes. Other engineering tasks carried out by ESPs in the automotive industry are factory planning and management, as well as the development of design systems for OEMs. A further central role that ESPs have played in the past is the provision of temporary engineering human resources.

Many newer ESPs are spin-offs from suppliers of physical parts in the automotive supply chain. These companies sometimes remain affiliated with manufacturing companies, for instance Schaeffler Engineering or Mahle Engineering. In accordance with this, since the financial crisis hit, a new trend can be observed which can potentially threaten the viability of production facilities in the EU in the long run: Large upstream manufacturers in the automotive value chain are separating their advanced engineering and design efforts from their other activities. In many cases, engineering capacities are bundled in subsidiaries or affiliates within the group. The rationale from the perspective of the suppliers is to generate higher returns from their engineering activities in the short run by being able to charge and account for these separately. The flipside is that this keeps the low-margin serial manufacturing business and, in the process, exerts further pressure on the mark-ups that can be charged for production. From the perspective of the OEMs, this increases cost transparency with regard to their suppliers, by introducing task-based accounting for engineering and design services irrespective of part production. As a result of these developments, the competitive pressure on manufacturing sites will increase.

Both countries are destinations for production outsourcing from western European, in particular German, firms, but the Czech Republic boasted a more developed native auto industry (in particular Skoda), which became part of the Volkswagen group already in 1991. This head-start with respect to skills and (foreign) investment is reflected in the business services shares in the early period, for which a difference of almost 3 percentage points compared to Poland can be observed. This was associated with much stronger output growth in the early period in the Czech Republic. In the years around 2000, the share of business services in Poland increased markedly, reflecting investments into firms' and production sites' IT infrastructure, which is a prerequisite for modern supply chain planning, as discussed above. As Figure 5-8 shows, around 2001, the cost shares of services associated with distribution (e.g. dealerships) and similar activities reached almost identical levels in the two countries in 2001; at the same time, the Polish automotive industry experienced its period of strongest productivity growth.

Figure 5.8 - Value Chain Approach for the Czech Republic and Poland



Sources: WIOD, ifo calculations.

After 2001, while in Poland the production volume increased at almost the same rate as employment, resulting in stalling productivity, it soared in the Czech Republic. Czech manufacturers were able to enter into higher-value-added activities due to the structure of the industry. In Poland, the (non-performance-enhancing) distribution component of services has been steadily increasing since 2001, whereas in the Czech Republic it reached its peak in 2001. To a large part due to the direct link of Skoda/VW, the Czech automotive industry has been more successful in transforming into a provider of (higher-value-added) R&D activities than Poland, whose success has so far been limited to larger ESPs opening subsidiaries to take advantage of cheaper wages for engineers. The Czech Republic has benefited from closer ties into the value chain of the largest European automobile manufacturer[39], while Polish suppliers have so far remained more at the periphery of the European supply network. There are a few notable exceptions of Polish firms attempting to obtain sizeable contracts through foreign acquisitions; a current example of this development are the Polish firm Stomil Sanok's activities in France and the negotiations to acquire Draftex Automotive, a German manufacturer of gaskets.

Summarising, both country comparisons reveal that technology competition and the associated R&D efforts have been crucial factors for the success of automotive firms in the period considered in this study. In the past, the 'German model' of linking upstream R&D with part production[40] has been at least as successful as the 'French approach', in which R&D was more likely to be procured separately. Nevertheless, it appears that the tendency points increasingly towards the French approach, which could facilitate further offshoring of production in the future. The comparison of the Polish and Czech industries revealed that the very large differences in productivity developments are for the largest part attributable to the different levels of integration into the European supplier network. Due to its more advanced local brands at an early stage and the strategic decision of a major player (VW) to make Skoda an important part of its brand strategy, the Czech Republic has been able to attain higher-value-added activities (such as Tier-1 production and R&D), while the Polish automotive industry has remained focused on (volume) production of parts. In the following, we briefly discuss the most important services categories for the automotive industry in the past as well as service concepts that may help the industry cope with future challenges.

Interrelation of manufacturing and services

In the recent past, the central drivers of efficiency and productivity with respect to services in the transport equipment industry have been in the areas of logistics and R&D. IT services and interfaces have played an important role in enhancing processes in these two areas and making their widespread application possible.

[39] This advantage is relative; Czech suppliers also face difficulties of their own, as noted e.g. by Pavlinek (2012).
[40] See Felli et al. (2011) for a detailed discussion of the underlying mechanisms.

Logistics, i.e. storage of parts and delivery to suit the OEM's production process, is a core service function of automotive suppliers.[41] Warehousing and IT management can therefore be considered as servitisation by intermediary goods manufacturers. With the rise of just in time (JIT) procurement[42], pioneered by Japanese automobile firms in the late 1980s and early 1990s, the optimisation of supply chains was an important driver of productivity in the industry throughout the 1990s. Coordination requirements make geographic proximity between production facilities of OEMs and the suppliers of critical parts a necessity; this has benefited high-cost production locations which offer the required technological, IT and transport infrastructure. Efficiency gains of JIT are considered to be largely exploited – further developments such as just in sequence procurement have not been widely adopted, since the relationship of set-up costs, interface requirements and risks to benefits makes it not economical (see e.g. Wagner and Silveira-Camargos, 2011). Even though it is being discussed in the context of the increased importance of services for the automotive industry, decentralised production through micro-factory-retailing appears highly unlikely to gain importance for the industry.[43] One can therefore conclude that, while logistics were an important driver of efficiency in the past, further gains through this channel are likely to be marginal under the present framework conditions, such as through improvements in peripheral production locations and further diffusion of IT. Improving the internal market for transport and logistics might lead to further efficiency gains.

Research and development carried out by suppliers play a central role in the industry, as discussed in detail above. As opposed to logistics, the productivity and value gains from R&D are a sustainable source of future growth for the industry. In the past, Tier-1 suppliers were the main drivers of the development of integral safety features such as anti-block braking systems or the electronic stabilising programme. In general, when planning a new model, the OEM will approach a subset of suppliers for a given part and ask them to develop a technical blueprint that meets detailed specifications.[44] Typically, only a relatively small share of development efforts in this classical approach are reimbursed by the OEM directly (in the order of 10-20% of costs, as found by Felli et al., 2011) – these are accounted for in the national statistics. Instead, reimbursement for research and design costs is granted as a mark-up on the price of parts when the series production is awarded to the supplier producing the best blueprint at the lowest cost. Notable differences in the organisation of R&D have been identified between the automotive industry in France and in Germany and have been presented at the start of this chapter

Due to the complexity of the procurement network and the need for timely delivery, **IT services and interfaces** between firms and advanced IT services in the areas of enterprise resource planning (ERP) and computer-aided design (CAD) are particularly important for efficient transactions and communication. Specialised solutions for the automotive industry have been developed by services providers specialising in the automotive industry's needs. These solutions are attuned mainly to the large OEMs as well as to the most important Tier-1 suppliers who are able to handle such complex software systems. According to our interviews conducted in Germany and Poland, the major players in the area of ERP (especially Oracle and SAP) are fully operational in every automotive market in Europe. The situation is somewhat different for smaller suppliers for whom the full-fledged ERP solutions of the big players would involve too large of a burden on resources, especially with regard to personnel and expertise. Here, the path forward currently seems to differ by country. Primarily in Germany, industry experts observe dedicated suppliers of ERM solutions for automotive SMEs. Parallel to this development, the large IT service

[41] For a more detailed explanation of part classification and sourcing decisions in the automotive industry, see e.g. Felli et al. (2011).
[42] With JIT, the supplier delivers parts only and exactly at the time as needed, thereby reducing the OEM's required storage space and inventory and thus reducing waste and increasing efficiency. This form of procurement also shifts demand risks upstream, which further contributes to its value for OEMs.
[43] See, for example, Williams (2006) on the potential application of this concept in the automotive sector.
[44] Some OEMs also apply online procurement auction platforms to reach a much higher number of suppliers, an approach that is more widespread in the United States. This approach is seldom used in Europe, and then mostly for commodity type parts.

providers are developing and marketing solutions for SMEs, which they see as one of the remaining areas with mostly untapped growth potential and a core part of their business strategy.[45]

Finally, beyond after-sale services closely related to vehicles only little innovative **downstream services** have been provided by OEMs; this is the reason why industry observers consider servitisation in the automotive industry to be still in its infancy. For large firms, OEMs offer sophisticated fleet management services with complex leasing and maintenance schemes. For individual buyers, OEMs offer two main services: financial services attached to the purchase of the car (often through a banking subsidiary) and, mainly in the high-end car segment, customised built-to-order production of vehicles.[46] 'Virtual showrooms', online platforms in which customers can configure their desired car model, have been directly integrated into the ordering system of high-end suppliers, giving the customer the opportunity to choose among millions of different configuration options for a new car,[47] while the direct integration into the supply chain keeps delivery times relatively short. Automobile financing has turned from a service to attract additional customers into a lucrative business model of its own – car firms are extremely well informed with regard to the important collateral of the loan (the car itself) and are extremely adept at profiling customers, thereby gaining advantages in managing their portfolio risks.

A third group of customers will substantially change the role of services in the automotive industry in the coming decades: Customers demanding **individual mobility solutions**, but unwilling to purchase a car, due to personal preferences, overcrowded streets in cities or financial constraints. According to all of our sources, this last group is expected to grow substantially in importance – in Western European metropolitan cities such as Paris, London or Munich, new services have begun to arise targeting this consumer group. The providers include both classic transportation service companies, such as the German railway company Deutsche Bahn, with its car-sharing concept Flinkster, as well as car companies searching for sustainable business models if the importance of car ownership further decreases (such as BMW with its service concept 'Drive Now'). In discussions with German industry experts, it was emphasised that especially the service concepts implemented by OEMs can be seen as a first step towards a future in which electric cars are the most important means of individual transportation within cities. In this case, customers may personally own an electrically powered vehicle for shorter daily commutes and make use of mobility services for longer excursions (or vice versa).

The quantitatively most important classical downstream services in the automotive industry are sales/distribution and repair and maintenance, all of which are carried out both by independent retailers and by the retail units of OEMs, who are competing for customers.[48] According to the WIOD database, distribution, repair and similar services make up a share ranging between 37% of all services (in France, where advanced R&D services are carried out by specialised separate entities) and about 63% (Poland) of the total volume of services in the automotive industry.

Competition is widely functioning in this sector, so that margins for OEMs have been stagnating or declining. One way in which OEMs are trying to counter this development is by applying big data analysis to increase consumer value in the maintenance of vehicles. For modern vehicles, every maintenance or repair is accompanied by an electronic assessment of the vehicle status, during which every required maintenance step is automatically recorded. This conveys a substantial advantage to OEMs, since they have been able to accumulate extensive data on the existing vehicle fleet on the streets. The current efforts of OEMs are focused on predicting patterns in part failures, and thus being able to prevent them from occurring, as well as on better profiling driver behaviour and thereby learning more about their customers (which can benefit the engineering and design divisions, as well

[45] Interviews highlighted a positive relationship between manufacturing and the associated business services. German interviewees from the transport equipment and machinery industries perceive a mutual reinforcement. This confirms findings reported in the literature, see Meliciani and Savona (2011); Castellani and Mirra (2013).
[46] See, e.g. Meyr (2009) for an extensive discussion of this practice.
[47] The BMW car configurator, for example, allowed for 1032 potential configurations, allowing for about one quintillion possibilities.
[48] In this field, additional competition was generated through the European Block Exemption legislation in 2003, and more recently, in 2010.

as marketing, as well as the financial arm of firms). Since OEMs do not necessarily consider big data analysis as one of their core competencies at the current point in time, one can observe spin-offs specialising in scrutinising this type of data, e.g. the Retail Performance Company, a spin-off from BMW. These efforts play a much larger role in the most developed automotive markets (Germany and France) in Europe than elsewhere.

The latest important downstream service trend, which may change the face of the industry in the coming decade, is automated driving. On the hardware side of this engineering issue, all large Tier-1 suppliers are currently undertaking serious efforts, with Continental being among the technology leaders in Europe with its 'Continental Driver Assistance Systems'. On the software side, which requires up-to-the-second map data, among other things, Google is developing into the clear frontrunner, with Apple among the potential serious competitors to produce operating systems for automatically driving cars. Industry experts considered it unlikely that either of these firms would venture into producing complete systems (i.e., cars), but the producer of the dominant operating system will have an extremely strong bargaining position vis-à-vis OEMs, akin to Microsoft in the early 1990s. In the current regulatory environment (the Vienna Convention on Road Traffic, which incidentally addresses both drivers and handlers of animals in road traffic), drivers must be in control or able to assume immediate control of the vehicle whenever it moves, therefore regulatory changes are required for these concepts to become feasible for the mass market.

5.4.3 Textiles and clothing

Between 1995 and 2011 the EU textiles and clothing industry lost 55% of its employment (Figure 5.1), which is the strongest decline in employment compared to the other three sectors under consideration. In particular, one million jobs were destroyed in manufacturing but half a million were created in retail between 2005 and 2009. Regarding the six EU countries under consideration, one finds significant employment reductions in this industry. The Polish textiles and clothing industry was by far the largest industry in absolute terms with more than half a million employees in 1995; it was followed by Germany and France with 330,000 and 280,000 workplaces respectively. More recent figures indicate that the Polish textiles and clothing industry is as large as the German, the French and the Czech industries together with nearly 300,000 employees. Despite this massive loss of workplaces in Poland, the shrinkage was less pronounced as compared to the other countries with the exception of Sweden. However, the Swedish textiles and clothing sector is quite small and the more recently available figures show a domestic industrial base of about 10,000 employees only.

The industry underwent a painful structural change, in spite of its strengths in design and haute couture. Yet the biggest brands worldwide are still based in Europe (Inditex-Zara, H&M, etc.) where the 'fast fashion' was invented. These brands are strongly based on fashion design and creativity: new articles are presented once a month on average. In terms of production, logistics, IT and processes, this rhythm is very challenging. Part of the related manufacturing is based in Southern and Eastern Europe (Spain, Portugal, Romania, Bulgaria) and South Mediterranean countries (Tunisia, Morocco, Turkey) despite massive offshoring to Asian countries. Offshoring of large parts of production did not only concern mass-manufactured, low-quality products, but even some premium fashionable products. The luxury segment is nevertheless an exception in this regard as new manufacturing facilities have been created in Europe in recent years. The EU is dominant in the high-end segment for personal goods and other luxury goods with a market share of 70% of the luxury global market and over 1 million direct jobs. Over 10% of EU exports are luxury goods. It is worth noting that, even in the luxury segment, profits are not mainly from garments but from other diversified products (small leather products, jewellery, perfumes, foulards, etc.).

The structural change affecting the mass market segment has been accelerated by the gradual reduction of quota regulations by the WTO during the 1990s and 2000s and the accompanied international liberalisation of market

entrance for low-cost countries from outside the EU. This has led to a relocation of least productive workplaces, most of which have been low-wage employment segments. Asia, South Mediterranean countries as well as more recently Bulgaria and Romania are the main suppliers. In turn, as EU companies are still selling their products worldwide, productivity increased and roughly doubled within the past 16 years. As such, it even exceeded productivity trends of the two high- to medium-tech industries under consideration. The way forward in countries such as Germany and France has been to develop technical textiles with applications in cars, aeronautics, construction and health. According to Euratex, the European association for textile and clothing industries, one third of the textile industry turnover is already due to technical textiles.

Poland and Sweden are indicative examples of two different developments the EU textiles and clothing industry is going through. The Polish textiles and clothing industry with its strong manufacturing base has benefited from the country's transition from a state-planned to a market-driven economy, while the Swedish textiles and clothing industry benefited from its strong focus on innovation as well as from two large players, H&M (clothes) and IKEA (home textiles) with global production and distribution networks. The Polish textiles and clothing industry in fact experienced three different phases. During the early phase of transition up to 2000, employment declined strongly, a trend mirrored in the growth of labour productivity. The second phase until 2005 was characterised by a more moderate evolution. In the years after the accession to the EU structural change accelerated once more, highlighted by soaring labour productivity, whereas the decline in employment decelerated (Figure 5.9). The Swedish TC industry shed more than a third of its employees between 1995 and 2011 and simultaneously experienced strong growth in labour productivity until 2005 after which productivity growth slowed down. However, although both countries experienced positive trends in productivity, the latter originate from completely different sources, as will be described in the following.

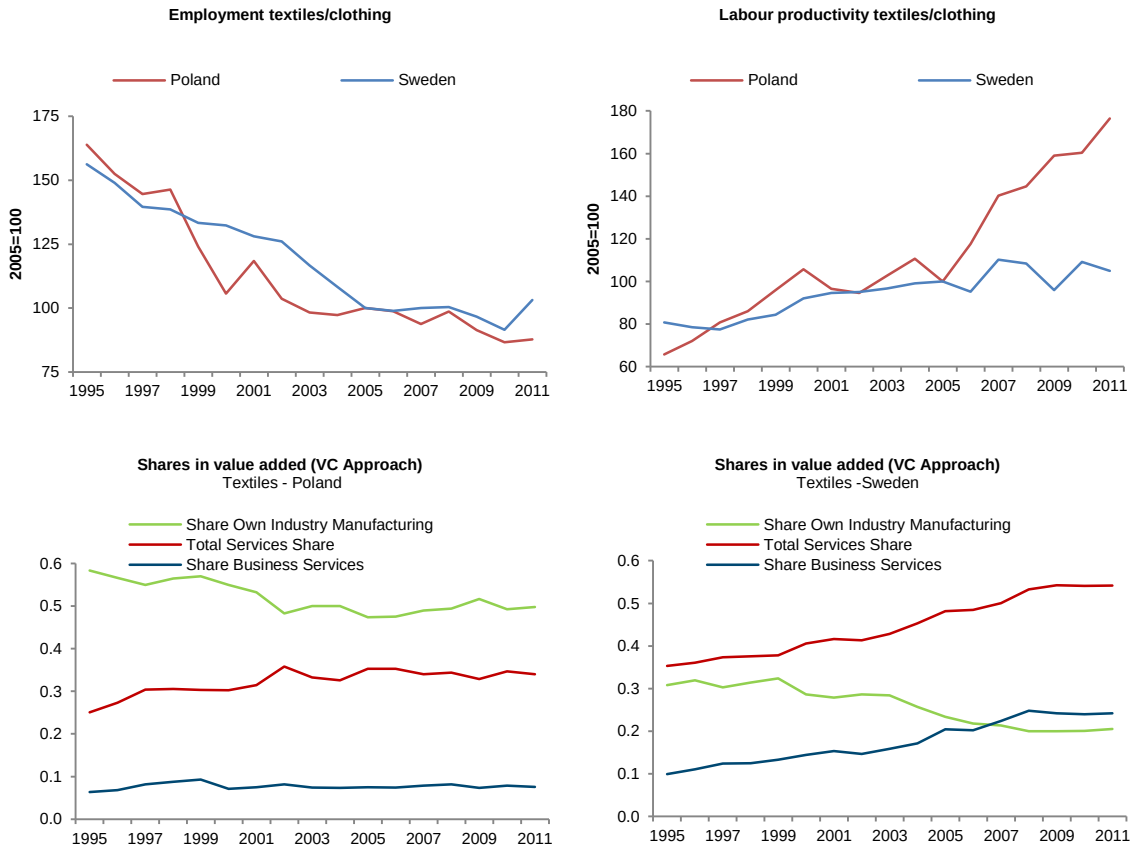
In contrast to Poland, and to a larger extent than any other Member State under consideration, the Swedish textiles and clothing industry developed into a service-driven industry, a development not observed in any of the other three investigated industries in this country. The contribution of manufacturing to total output fell by 10 percentage points over the whole period and now stands at about 20%. Simultaneously, business services gained 15 percentage points and now reach a cost share of 25%. The cost share of non-business services increased as well and reached about 30% of total output. According to industry representatives the above-average growth of business services mirrors Swedish R&D efforts. Considering the small manufacturing base, there exists a remarkably large textiles and clothing cluster, dedicated to the development of new technologies. Important business targets are sustainability of production processes through an increase in resource efficiency, among them dry dyeing, recycling of textiles and cellulose-based fibres. Concerning the latter, for example Sweden is about to exploit opportunities to apply cellulose as raw material for the textile industry. There is public interest to opening up new sales markets for the Swedish forestry industry that is expected to suffer from falling demand of the pulp and paper industry. Moreover, recycling of textiles is an important field of research in to strive for a circular economy. Sweden might be a frontrunner in this respect, where also the EU too has launched similar initiatives. Representatives of the Swedish textiles and clothing industry also reported that the sector attracts young people. This contrasts to reports from other countries and is owed to the perception of the large companies and their brands with positive connotation. Despite these tendencies there is no indication that these developments would provide much impetus for an in-shoring of the textiles and clothing industry. However, Swedish companies that find themselves on the leading edge of technology and dispose of the necessary capabilities in design can build on their strengths to dominate global value chains by their knowledge and can trust in their position in the long run.

For the Polish textiles and clothing industry the value chain approach indicates a quite different situation. Up to the early 2000s the cost share of services increased, driven above all by non-business services. In the years thereafter the share of total services hovered between 30% and 35%, while the share of manufacturing stabilised

at about 50% (a quite similar evolution and structure is found for the Czech textiles and clothing industry, another EU country experiencing a transition). This development suggests that much of the labour productivity growth was driven by structural changes within the industry, e.g. the closure of least productive plants and relocation to lower-wage countries. However, according to industry representatives, offshoring does not yet play an outstanding role in Poland. More precisely, it has been reported that employment shedding has lost momentum in recent years, but that manufacturers' profitability is extremely low. Subcontractors to well-known international brands and domestically owned companies serving final consumers experience strong competition from the Balkans and non-EU locations, which is why further consolidation must be expected.

The most dramatic period of transition has been left behind and a significant industrial basis has remained in Poland. However, low profitability and the existence of numerous subcontractors to large clients indicate that structural change will continue, although at a more moderate pace. To improve the robustness of the Polish textiles and clothing industry in international competition, additional efforts directed towards upstream and downstream integration of the value creation process are necessary. This means manufacturers have to use the know-how of service providers, for instance for the set-up of advanced supply chain management systems, and to offer services downstream and directly access final consumers via online sales, outlet stores, advertisement, social media, etc.

Figure 5.9 - Comparison of the Polish and Swedish textiles and clothing industry



Source: WIOD; ifo calculations.

Interrelation of manufacturing and services

The offshoring of production, in particular in the longstanding Member States of the EU, has left numerous manufacturers of clothing with only small – if any – domestic production capacities. Companies have become more focused on value-creating business operations, R&D, design, marketing and distribution. Much of

manufacturing employment has been shed which is reflected in the significant decline of workplaces. This massive job displacement is the main explanation for the high growth in productivity over the whole period.

Taking a closer look at the services that have emerged within the textiles and clothing sector or/and in interrelation with the low but still existing manufacturing bases, it is the manufacturing companies that compete with large vertically integrated groups with a strong focus on design, branding and marketing. A particular example in this respect is the Swedish firm H&M. The company's supply chain management allows to quickly respond to consumers' preferences and offers up to twelve collections per year.

Supply chain management has become an indispensable feature in many market segments. It is especially the precise planning of production across all stages of the supply chain (concerning own capacities as well as subcontractors) that enables companies to respond quickly to clients' needs and compete on eye level with other large vertically integrated groups. The traditional order system, where new orders feed through the supply chain step by step, is no longer in place for fashionable merchandise, but only for low-margin standard products produced for stock. Due to the fact that the textiles and clothing industry is still transforming and optimising its processes towards global production networks, IT support and expertise has become pivotal know-how within supply chain management. This kind of supply chain management has been widely applied by companies, which do not only manufacture standard goods or any other kind of market niche. Also, successful medium-sized enterprises have invested heavily in the extension of their supply chain management.

However, what remains key to the textile and clothing industries is to be creative and able to offer fashionable products to customers who are not as loyal as in the past. What is making the difference between the individual economic operators in this business (event those involved in 'fast fashion') is the constant capacity to create more intensively (every month) than ever before products which will attract clients to their shops or websites. All processes, logistics and IT are quite common and developed by roughly the same consulting companies: they do not represent a differentiating factor – what matters in this industry is creativity.

R&D engagement in the textiles and clothing industry primarily concerns innovations in fibres, yarns, fabrics and dyeing. Many of these research activities are executed in cooperation with enterprises from the chemical and machinery industries. Basic R&D is of major importance for technical textiles. In contrast, the value chain of the apparel industry focuses more on design. There is no other industry with such a pace of product innovation and short-lived product cycles. Beyond the design of fashionable, leisure-time and sportswear, the development of cutting patterns is still understood as a core competence. However, Asian services providers have already started to develop cutting patterns at reasonable prices for EU manufacturers. This development is perceived as a threat to European players, who fear to lose a key ability to command the value creation in the long run.

Simultaneously to the ongoing trends and changes in upstream processes, there have been changes in downstream value chains, especially the growing importance of manufacturers' access to final consumer markets. Due to the increased direct customer access via outlet stores and B2C platforms, accompanying services such as market research, advertising and branding have grown in importance, too. Only two decades ago department stores and retailing chains were able to fend off manufacturers' initiatives to access sales markets directly. However, these days direct market access of manufacturers has led to a shift in bargaining power between traditional trading and manufacturing companies. Some manufacturers run consignment stores with retailers and take over planning and logistics. In this respect servitisation has become a strategic tool to tap new business areas downstream and to enter new sources of profit. In particular, the improved market access spills over into the industry's value creation as this enables companies to sell their products at higher margins.

Reaping the benefits from enhanced market access is supported by the emergence of new services – additionally to traditional media channels – arising from the utilisation of IT applications, such as services in the field of social media. The latter are a useful strategic supplement to traditional marketing concepts, especially as younger

generations are increasingly using social media platforms. Hence, social media enable companies to target customers more directly by placing customised advertising via appropriate platforms. However, as social media are still in their beginnings, the importance of this channel for advertising is neither yet assessable nor is it clear whether it has the potential to fully replace traditional marketing concepts.

Taking stock, upstream and downstream activities in the EU textiles and clothing industry have driven the cost share of business services up to the levels of transport equipment and machinery. However, this increase is above all driven by services to improve market access, whereas for the other two industries R&D efforts have been more important. Beyond business services, downstream linkages to distribution and retailing via related services explain the remarkably high percentage of non-business services in the EU textiles and clothing industry as depicted in Figure 5.3. However, the strongest impact on productivity of the textiles and clothing industry stems from the still ongoing structural change of shedding least productive workplaces to low-wage countries. Alternatively, in the case of EU countries no longer having a comparative advantage in producing textiles and clothing domestically, services provide an appropriate means to preserve the competitiveness of the industry in the world markets.

5.4.4 Food and beverages

Regarding its overall economic development, the EU food and beverages sector on average experienced strong growth in output and productivity during the second half of the 1990s. Since then the industry's labour productivity has stagnated, lagging far behind the other industries under consideration. Employment was mostly stable up to 2008, but during the financial crisis about one tenth was shed and employment has not recovered in recent years. This corresponds to long-term perspectives for nutrition markets in mature economies, which are expected to show only muted growth. Time series depict a limited increase in productivity for the latest years available in the statistics (Figure 5.1).

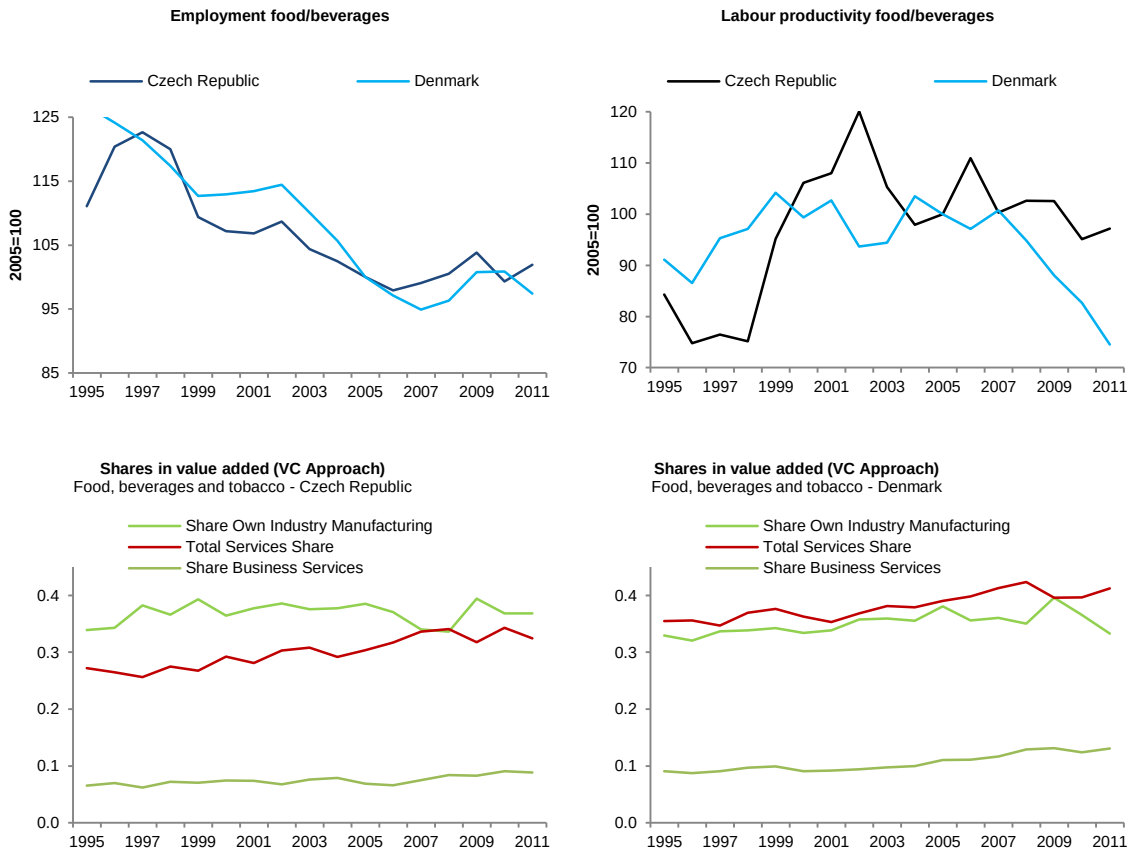
France, Germany and Sweden suffered the strongest declines in employment around 2009. For France and Germany the reduction of staff was accompanied by strong declines in output. The other countries considered were able to maintain employment by and large at the 2005 levels. Poland is the only among the six countries with ongoing growth of output, clearly exceeding former levels.

The examples of the Czech Republic and Denmark provide some insight into the different development paths in the food and beverages industry, which mirror the situation of the other Member States under consideration. The Danish food industry is well-known for its dairy and meat cluster and the close linkages to agriculture and the machinery industry, important for automated manufacturing processes in a high-wage economy. Danish manufacturing has experienced growing problems due to stagnating productivity since the turn of the millennium. Mostly stable employment with simultaneously shrinking value added is reflected in a substantial decline in labour productivity (Figure 5.10). This relatively weak development in Denmark is comparable to similar developments in all industries under investigation, but it is most pronounced for the food and beverages sector. Wage reductions as agreed upon by firms and the unions will not bring a lasting relief, although some production was relocated from Poland back to Denmark.

Recently the Danish government and the Confederation of the Danish Industry have acknowledged the problem and launched initiatives to raise productivity. The measures focus on small companies which play an outstanding role in Danish manufacturing but whose productivity development has been lagging. One Danish expert pointed to expensive domestic services as a serious burden (especially for food and beverages producers with tight margins), in particular legal consultancy, book-keeping and facility management. However, except for language barriers and geographic distance, there were no indications of barriers to imports of services. High prices of services contribute to explaining the low importance (measured by cost shares) of business services for the food

and beverages industry in Denmark. Further, as shown in Section 2, in Sweden business services were found to play a more important role, which is however less true in case of the food and beverages sector. The cost share of business in food and beverages with 25% (in terms of total services use in manufacturing) is even below the one for Germany or France with about 30% (see Figure 5.4).

Figure 5.10 - Comparison of the Czech and Danish food and beverages industry



Source: WIOD; ifo calculations.

In the Czech Republic the food and beverages sector, which overall displays a very similar development as compared to Poland, employment fell during the transition phase, which was accompanied by strong growth in labour productivity. In the early 2000s this phase of productivity growth ended, with relatively strong fluctuations but no apparent trend in overall productivity. The value chain approach shows a stable contribution of close to 40% in the food and beverages industry, well above the levels for the more advanced Member States which – with the exception of Denmark – steadily declined over the period under investigation. Business services do not play a substantial role as comparable to these countries. This might be attributed to the importance of FDI which has led to a notable share of foreign-owned production sites during the phase of transition.

To conclude, the Czech – as well as the Polish – food and beverages industry proved to be resilient during the financial crisis and the years thereafter. This is to a certain extent explained by the presence of FDI and the relocation of production from other Member States. Business services play a comparatively small role for both countries which has not yet become a problem because the numerous small manufacturers with labour-intensive processes can build on competitive wages. This is in contrast to Denmark, which also features a large number of small manufacturers: For more than a decade they have remained production-focused enterprises and have lost

price competitiveness. Strategies to apply services to meet the challenges from international competition potentially could have contributed much more to a 'managed' structural change and thus hindering large losses of workplaces at bay. This is particular the case for services dedicated to an integration into the value creation chain: upstream, for instance for the production of regional and organic food, and downstream, to strengthen the contact with final clients via advertisement and social media.

Interrelation of manufacturing and services

Technological change in the food and beverages industry tends to be mostly incremental (improved products, e.g. better packaging) instead of radical (inventing completely new products), as argued in Winter and Wall (2006). Some development can mainly be observed in the areas of organic, convenience and health food. The fact that the majority of newly launched products fail on the market (less than 1% of newly introduced products are still sold after five years) adds to the effective development costs. While a limited number of product innovations may contribute to long-term growth of the sector (such as lactose-free products, which will benefit from demographic changes), for the above reasons it appears that overall productivity effects generated by product innovations remain limited.

Food and beverages show large differences in the level of process innovations. The pace of progress in production technology, for example with regard to resource efficiency, for intermediaries is high. Further downstream there is not much progress, in particular meat, fruit and vegetable processing has remained to a large extent labour-intensive.

Three important market segments are served by the food and beverages sector:

- Wholesale trade, which traditionally provides smaller quantities to independent retail shops and restaurants. Its role has been markedly diminished in the more developed economies due to the emergence of retail chains with own procurement departments.
- Retail chains, which build on their bargaining power to get certified quality and timely delivery while exerting price pressure. A recent trend, whose overall effects on upstream manufacturers and consumers have not yet been carefully studied, is the development of 'store brands', typically produced by upstream firms but marketed by retailers and sold with their labels on them.
- Fast food and catering trade is a strongly growing market segment which benefits from societal change and corresponding consumer behaviour.

As Figure 5.5 shows, advertising is the most important single business service for the food and beverages sector. Establishing brand value is an important strategic tool for producers to create countervailing market power vis-à-vis retailers and to improve market access. Direct access to consumers, e.g. through marketing and advertising campaigns, is mostly limited to global groups and larger companies with sufficient budgets. Due to certain characteristics of the market, producers of food and beverages are at a disadvantage compared to textiles and clothing manufacturers with regard to access to consumers: B2C has not yet become a substantive distribution channel for food and beverages, even for the large corporations, except for a few niche players. Reasons for this include consumer preferences but also the fragmented manufacturing base, as well as the market and bargaining power of large retail chains.

Long-term relations between manufacturers and retailers have evolved through the production of store brand goods, as well as the development and delivery of products for fast food and catering. However, this is mainly an opportunity for larger industrialised firms with a sufficient potential to provide quantity and quality, often with a high degree of flexibility, as required by the client. Though its importance and utilisation is currently still relatively low

(see Figure 5.5), IT and related services can enhance the efficiency of supply chains if manufacturers increasingly operate IT systems that allow for permanent control by and automated electronic data exchange with the retailers' systems.

One example that is currently being adopted is 'Optimal Shelf Availability'. This is a business service which optimises the coordination of the quantity delivered to the retailers and has been introduced as a company-specific ordering procedure. Such services incorporate the potential for more long-term stable relationships between manufacturers and retail chains.

To briefly summarise, up until now many business services – such as advertising and branding – used by food and beverages manufacturers (mostly larger corporations) aim at improving manufacturers' position and relative bargaining power in sales markets. Productivity gains through more direct access to customers and associated strategies, as for example discussed in the context of textiles and clothing manufacturers, are currently limited for food and beverages manufacturers. Though it appears that there is potential for improved efficiency through more widespread utilisation of IT applications, it is likely that their benefits will be limited and in most cases appropriated by large retailing chains due to their superior bargaining power.

5.5 Conclusion

The fieldwork reported in this chapter focused on those aspects of the interrelation between manufacturing and services that could not be identified by desk research as reported in Sections 2 and 3 and particularly tried to identify the kinds of services that have been important factors in the economic performance of the industries under investigation.

The findings – based on expert interviews – show that the relative importance and the impact of services strongly depends on the characteristics of industries: know-how, R&D intensity, applied and produced technologies and their environments, exposure to international competition, etc. Results from the interviews further suggest that the direct impact of services used by manufacturing companies on productivity and growth is – with the exception of mere rationalisation – not immediately clear. Most performance-enhancing services pursue a complex set of aims. For instance, the IT-supported restructuring of engineering processes in the machinery industry are dedicated to streamlining processes, reducing throughput time, flexibility and quality of the output. However, the effects on productivity and growth performances are indirect and can hardly be identified quantitatively. Similarly, advertising services for clothing manufacturers have a direct effect on bargaining power and market shares which in turn have only an implicit impact on productivity and growth.

5.5.1 Industry specificities

Two of the four industries under consideration, the transport equipment and the machinery industry, are *high- to medium-tech industries*. Both industries supply highly sophisticated and complex products which require the integration of a broad range of different technologies. Companies compete on R&D and engineering with their non-EU contenders. The EU provides supportive framework conditions for manufacturing in the form of good infrastructure and the availability of qualified labour. The EU supply chain is internationally competitive, although the integration of overseas production capacities in supply chains is growing. While for the machinery industry's supply chain the predominant flow of products is directed towards the EU, the transport equipment industry has heavily invested in major markets and created clusters of original equipment manufacturers (OEMs) with Tier-x suppliers in their vicinity. However, both industries rely strongly on their EU production networks. For the long-term competitiveness of the EU locations the EU should remain on the leading edge of technology and not lose

competencies. Mature technologies, deceleration of the pace of innovation and increased price competition would increase the risk of relocation of production to low-cost countries.

In the fieldwork the growing importance of services related to product innovation in high- to medium-tech industries has been emphasised. The trend towards more sophisticated products and the integration of quite different technologies has led to a division of development tasks between companies in the value chain and specialised service providers. This development is more pronounced in the transport equipment industry than in machinery. Over the past decades ESPs have gained larger shares in development projects. It is expected that this trend – in line with the growing cost share of services – will even accelerate. The reason is that there is a tendency for Tier-X manufacturers to split their engineering and manufacturing units, a development owed to OEMs' interest in higher market transparency. This kind of unbundling raises the cost shares of bought-in services further. As mentioned above, the intercompany division of labour in R&D/engineering projects does not play an equally important role for the machinery industry as compared to transport equipment. However, the use of external services has gained importance with respect to better structured and streamlined procedures concerning product innovations within machine manufacturing companies.

Therefore**,** the cost share of services in high- to medium-tech industries has been growing and is expected to increase further through outsourcing of R&D/engineering services, structural changes, in particular the spin-off of R&D and engineering units, and the need to set up more efficient and effective development processes. Important drivers behind this trend are the growing complexity of products and the integration of different technologies. Growing competitive pressures and cost reduction strategies via outsourcing of engineering add to this trend. The findings indicate that the success of R&D and engineering projects is to a certain extent dependent on the interaction of the different players involved. It is recommended that public schemes directed at innovation do not focus on technologies only, but need to involve the specific participants, their objectives and interactions.

Both of the so-called '*low-tech industries'* considered here are in essence consumer goods industries, where product innovation predominantly is closely related to market research and consumer preferences. As both sectors depend significantly on final consumer markets, public relations and advertisement are activities of pivotal importance for success. Most of these activities are carried out by specialised agencies. With the Internet and social media the channels to reach consumers have multiplied. For companies in both industries it is crucial to address the final client directly and stimulate preferences. Successful initiatives strengthen manufacturers' bargaining power vis-à-vis distributors and retailers, with positive effect on their economic performance.

In general, global competition for low-tech industries as compared to that for high- to medium-tech industries is to a larger extent driven by cost conditions in different production locations. Production capacities strongly depend on factor price levels (labour, energy and intermediary inputs) and have been relocated from EU to overseas low-wage countries to a much larger extent. This has caused a dramatic loss of workplaces, in particular in the production of textiles and clothing, one of the low-tech industries under consideration.

For the other industry investigated, the manufacturing of food and beverages, the situation is slightly different. This industry is to a significant extent regionally anchored and employment has remained roughly stable. Value chain management has turned out to be an area of interaction between manufacturers and services providers that is of pivotal importance for companies' success in both industries.

For textiles and clothing the management of international supply chains to meet clients' requirements concerning short lead times and flexible deliveries is important, whereas for food and beverages it is the compliance with regulations, safe ingredients and proof of origin. Manufacturers have invested heavily in the set-up of IT-supported tools for the communication along the value chain and the exchange of data. Services providers are employed for the set-up and updating of organisations and systems as well as for the standardisation of data formats. The exploitation of services – in particular business services – has contributed much to the success of

manufacturers of low-tech industries. Above all, textiles and clothing companies strongly investing in value chain management and related upstream and downstream services have been able to meet the challenges of globalisation. They keep in control of their international supply chains and compensate the reduction of domestic production capacities by tapping new business areas. Their success will propel a growing interconnection of services and manufacturing. Although services might not be sufficient to fully compensate for losses of manufacturing activities, they increase EU companies' competitiveness and reduce frictions caused by structural change in low-tech industries in the course of globalisation. EU support for the development of adequate tools and initiatives to standardise the exchange of data have contributed to the beneficial use of services, and further initiatives in this direction should be taken.

Summarising the empirical findings for the four industries under consideration, it is obvious that there are significant differences in the priority fields for the interaction of manufacturers and services providers. For the high- to medium-tech industries it has turned out that R&D and engineering are fields of close interaction between manufacturers and services providers which are of pivotal importance for competitiveness and economic performance. For the low-tech industries, downstream activities have gained much importance, enabled through the internet and innovative IT tools. In spite of these discrepancies between the two groups of industries the overall cost shares of business services among the four industries investigated do not differ much with regard to levels and their evolution over the period under consideration. For all four industries, performance-enhancing business services are of similar and growing importance. For non-business services, differences in the amount of services have been identified: The low-tech industries show a higher cost share of industrial output caused by transport and distribution services that is explained by the industries' deliveries into consumer markets.

The differences in the interaction of services and manufacturing between the industries under consideration suggest that public policies need to take these specificities into account. If schemes are set up dedicated to improving competitiveness through the use of services, a sectoral approach is to be recommended to intensify the interaction of services providers and manufacturers. For instance, value chain management is highly relevant for 'low-tech' industries' companies in order to stay on top of global production networks. IT-supported communication, monitoring and the exchange of data are pivotal for an efficient and effective functioning of international value chains. In spite of some initiatives already taken by manufacturers and services providers, much remains to be done for the development of standardised interfaces and data formats allowing for automated communication. In particular smaller companies are challenged if firms cannot apply recognised standards, whereas large players impose their proprietary standards. EU policies dedicated to enforcing international environmental standards, minimum labour and safety requirements in the workplace ask for additional monitoring and reporting along the value chain. The documentation of proof of origin, eco standards, etc. will require an additional administrative burden. In this respect public initiatives to stimulate the cooperation of manufacturers and service providers could contribute to the competitiveness of smaller EU manufacturers, in particular those in the textiles and clothing industry where minimum labour standards have become an important topic. Initiatives to create standardised interfaces for communication and the exchange of data should be taken by bringing together service providers and manufacturers at EU level.

5.5.2 Country specificities

Typical patterns have been identified for the interaction of services providers and manufacturers which differ among the analysed industries, but there is much leeway for companies concerning the form of cooperation and the choice of services most important for them. It has turned out that the interrelation of services and manufacturing shows quite different patterns between the Member States under consideration.

The predominant strategies pursued by manufacturers in using services result in differentiation not only in the levels of services, measured by their contribution to industrial output, but also by kind of service and by objectives. The most striking finding in this respect is the use of R&D and engineering services in high- to medium-tech industries. R&D and engineering services are well suited to contributing to manufacturers' economic performance and their supply of technologically leading, high-performance products. However, their impact on sustainability and long-term competitiveness is above all dependent on the objectives pursued by manufacturers. Outsourcing driven exclusively by the intention to reach economic targets bears the risk of ending up in a vicious cycle. This said, the amount of services used by an industry in one Member State does not tell much about the benefits exploited by manufacturers. It is crucial to know the underlying drivers to make an assessment about future viability and performance in international competition. A comprehensive use of services is not a clear indication for a viable and sustainable industry. It is of importance to consider the underlying objectives.

For example, there are significant differences in the amount of external services used by French and German companies. French companies are more inclined to outsource whereas German firms build to a larger extent on internal activities and specific know-how. Outsourcing is not only driven by the sophistication of products and the integration of numerous different technologies but by opportunities to improve the manufacturers' economic performance. This last point is of greater importance to French companies because many of them struggle in a difficult environment. By contrast, technology-driven outsourcing benefits much from specialisation and is prerequisite for innovative products on the leading edge of technology with outstanding characteristics.[49]

A striking specific of the Danish manufacturing sector is the contribution of services to industrial output which is much lower than for any of the other long-term Member States under consideration. The fieldwork revealed that the Danish manufacturing sector is struggling with a loss of competitiveness and that manufacturers do not exploit services sufficiently. This cannot be blamed on the size of the economy, as like other Scandinavian countries the Danish economy is internationally open and foreign services providers do not face any major hindrances. The Danish example highlights the importance of the interaction of services providers and manufacturers for a sustainable development. Services incorporate the potential to strengthen the EU manufacturing sector's competitiveness and manufacturers are called upon to better exploit their advantages. Still, while services are necessary for the long-term competitiveness of the EU manufacturing sector, they will not stop the changes in the international division of labour and the relocation of manufacturing capacities. In this respect the Swedish textiles and clothing industry provides a good example for maintaining a viable industry through services activities. Although only marginal manufacturing capacities are left in Sweden, the industry is viable, provides attractive workplaces, is strong in R&D and design and keeps its position in the global value chain.

[49] OEMs show growing interest in more transparent procurement markets. Some German Tier-X suppliers have responded and split their manufacturing and engineering units into separate firms. It is too early to assess these structural changes with regard to the German automotive industry's technological excellence in the future. Exclusively economically driven activities not taking into account technological competence and interaction with manufacturing would incorporate the risk of Germany losing its position in the global automotive market.

6 Cross-border services provision and the international dimension of manufacturing services linkages for specific country-industry cases

Chapter 3 showed that the most dynamic component of the productivity-enhancing relation between industry and services sectors is determined by the use of imported services by manufacturing sectors. This relationship is significant for all EU economies, especially for smaller EU economies which do not have a significant productivity enhancing relation between manufacturing and domestic services industries. Since the use of foreign-sourced business services is found to increase the productivity of manufacturing sectors in all EU Member States, this chapter analyses the use of imported services with a significant potential to increase productivity (performance enhancing – PE – services) in the selected sectors and Member States, mostly small Member States, and aims to identify the factors that inhibit the provision of services by foreign providers to manufacturers. Potential barriers to the provision of PE services in EU Member States would namely reduce access (or increase the costs of) to these services, which could inhibit further productivity increases in EU's manufacturing sectors. The section starts with a general discussion on the way services can be supplied abroad and explains that depending on the mode of supply, the factors that influence services trade can differ. After reviewing the use of foreign services by the selected manufacturing industries, the section conducts an analysis on potential barriers that hinder the provision of services to manufacturers in the EU. The last section summarises.

6.1 Tradability of services and fragmentation of services supply

Fundamentally, international trade in services does not differ from trade in goods. Both involve an exchange of a 'product' between two parties located in different countries. For goods trade, however, this reflects an exchange involving a physical product. In the case of services trade, the 'product' traded is something intangible. By definition, a service is also a flow (it cannot be stored) and thus often requires the proximity (either digitally or physically) of supplier and customer. For some services, the need for proximity between supplier and customer is a more stringent requirement (e.g. hair dressing) than for other services which can be more easily provided at a distance. The characteristics of a service thus define to a large extent the 'tradability' of a service, the degree to which it can be supplied cross-border. Jensen and Kletzer (2010) developed a methodology to measure the potential for services to be traded across borders by comparing the concentration of production and demand. For services where production (employment) is more geographically concentrated than demand, the services will be exchanged at a distance and thus also the potential for international trade is higher. This methodology has been applied to France by Barlet et al. (2010), which is believed to be an accurate reflection of the EU average. The index for concentration (and thus the potential for cross-border trade) is highest for all types of transport services and, with regard to our services selection, also high for *R&D services* and *computer services*. The tradability of *advertising and market research* is relatively high and fairly low for *architecture and engineering services* and other professional services. For foreign services providers that wish to supply services in another country, the degree of tradability of the service will to a large extent determine the way in which he chooses to supply the foreign market. As argued in Smith (2014), the two options for serving a foreign market by a service provider are either through exports or through Foreign Direct Investment (FDI). He argues based on the conditions favourable to FDI (Dunning, 1989) and the tradability of the various services categories (Barlet et al., 2010) that services are likely provided abroad largely through FDI (commercial presence) when the demand for a service requires production to take place close to the user because of a requirement for strong interaction between both, the

repetitive nature of purchases, oligopolistic market structures discouraging import penetration or cultural factors that require service tailoring to local needs. For example, many operational services necessarily need to be supplied in proximity to the production activities that they support. Also the contribution of externally-supplied services to the performance of manufacturing will depend to a large extent on prevailing conditions in local service markets. On the other hand, for internally-supplied services, factors influencing FDI conditions for service activities are likely to be important. In this respect, we can notice two opposing forces to be operating at the same time: (i) Services without a direct relation to the industrial product are increasingly outsourced to specialised service firms, allowing companies to concentrate on their core competences; (ii) Services which are more directly related to the manufactured product ('product-accompanying services') are growing in importance within manufacturing companies, and are less likely to be outsourced. These outsourcing strategies for service inputs, in turn, also relate to similar decisions concerning the organisation of industrial production activities, particularly in terms of the relocation of core fabrication and assembly activities – especially those with high labour intensity and/or low labour skill requirements – to lower cost production locations. The tradability of the service activity plays an important role here as *foreign* lower cost production locations might be preferred when the service can be easily supplied cross border. A related concern is for example that the loss of certain manufacturing activities in the EU could be accompanied by a subsequent loss of R&D, engineering and similar service activities that require a high level of interaction with industrial production processes.

Other recent dynamic forces that influence the tradability of a service and the concomitant choice for international services provision are also at play. In particular, the fact that many knowledge and information services are amenable to codification means that ICT-enabled forms of digital transmission can radically affect the tradability (both geographically and in time) of service outputs and the possibilities for service providers to interact with their clients 'at distance'. [50] Equally, the increased importance of intangible capital assets derived from services as drivers of competitiveness, may place a premium on situating service functions in locations that offer favourable environments for the protection of service-related intellectual property. Finally, knowledge spill-overs linked to the specialised capabilities required for delivery of knowledge-intensive services is likely to favour a degree of locational concentration of service providers. This, in turn, may contribute to an increase in service trade as industrial clients seek out specialised service providers.

Overall, we can see that there is a mixture of centripetal and centrifugal forces at play, the balance of which will influence the organisational (ownership) and spatial (geographical) location of service activities within (global) value chains. On the one hand, there are factors that tend to pull towards the co-location of manufacturing activities and associated services (i.e. agglomeration of services around production locations) and, on the other hand, factors that support the de-location of services and that may support locational specialisation of service activities. Interviews (see Section 6.4) with representatives from the selected services industries in this report have been conducted to understand more about the degree of cross-border trade of the different services categories. The next subsection elaborates on how the two different ways of services provision may lead to different sets of factors that could potentially hinder international trade in services (to EU manufacturers).

6.1.1 Related framework conditions influencing the international trade in services

Since the analysis in Section 3 showed the importance of foreign-sourced business services for EU manufacturers, it is crucial for policy makers to know whether there are factors that still inhibit the international trade of services with EU manufacturers, i.e. make the trade transaction more costly than needed. It is important to note that perhaps the most important factor (or 'barrier') with respect to services trade is defining how the

[50] Cloud Computing incorporates the potential for basic changes in the interaction of service providers with manufacturers and an increased outsourcing of manufacturers' business operations, see Section 5.

service is provided abroad (commercial presence, exports or through temporary movement). This implicit barrier (called the 'proximity burden' in literature) to international trade in services captures 'soft' factors such as distance, differences in culture and language that given the frequent need for co-creation of services with clients constitute a 'natural' cost burden on cross-border supply of services (Francois & Hoekman, 2010). For services where the burden is too large, commercial presence will be the preferred mode of supplying services abroad. Differences in these soft factors cannot easily be addressed, but if barriers to trading services cross-border (export), through local affiliates (commercial presence) and through temporary movement are as low as possible, then there would still be a free and open environment allowing for unrestricted use of foreign services. Many of the barriers that currently still exist on each of the different forms of international services trade and that can be tackled by policy makers are of regulatory nature. The regulatory framework influencing trade in services is a translation of a myriad of domestic, EU and international regulations, where *differences* between regulatory regimes between countries matter most for cross-border trade in services. When regulatory regimes differ strongly between regions, exporting involves additional costs of familiarising with another regulatory environment, adding costs to exporting (and as a result favouring business through commercial presence). Discriminatory regulation or excessive red tape with respect to foreign investments might depress services trade through local affiliates. Lastly, restrictions on the movement of people can make providing services abroad through temporary presence more difficult.

Section 6.3 explores the presence of different types of regulatory barriers for the selected services by means of data available in public databases. Section 6.4 discusses any other barriers that might play a role in the hindering (performance enhancing) services provision to EU manufacturers. However, first, the degree of foreign-sourced performance enhancing services by different manufacturing sectors is reviewed in the next section in order to understand which services are typically imported, so that the characteristics of these services (and the resulting expectations on the mode of supply) can be taken into account in discussing barriers to services trade.

6.2 Use of imported performance enhancing services

As highlighted in Section 2 there are important cross-country differences with respect to the use of imported versus domestically produced services which also impact differently across country groups (see Section 3). To follow-up on these findings, this present section explores patterns of imported performance enhancing (PE)[51] business services for the selected countries and industries.

6.2.1 Imports of PE services in selected industries and countries

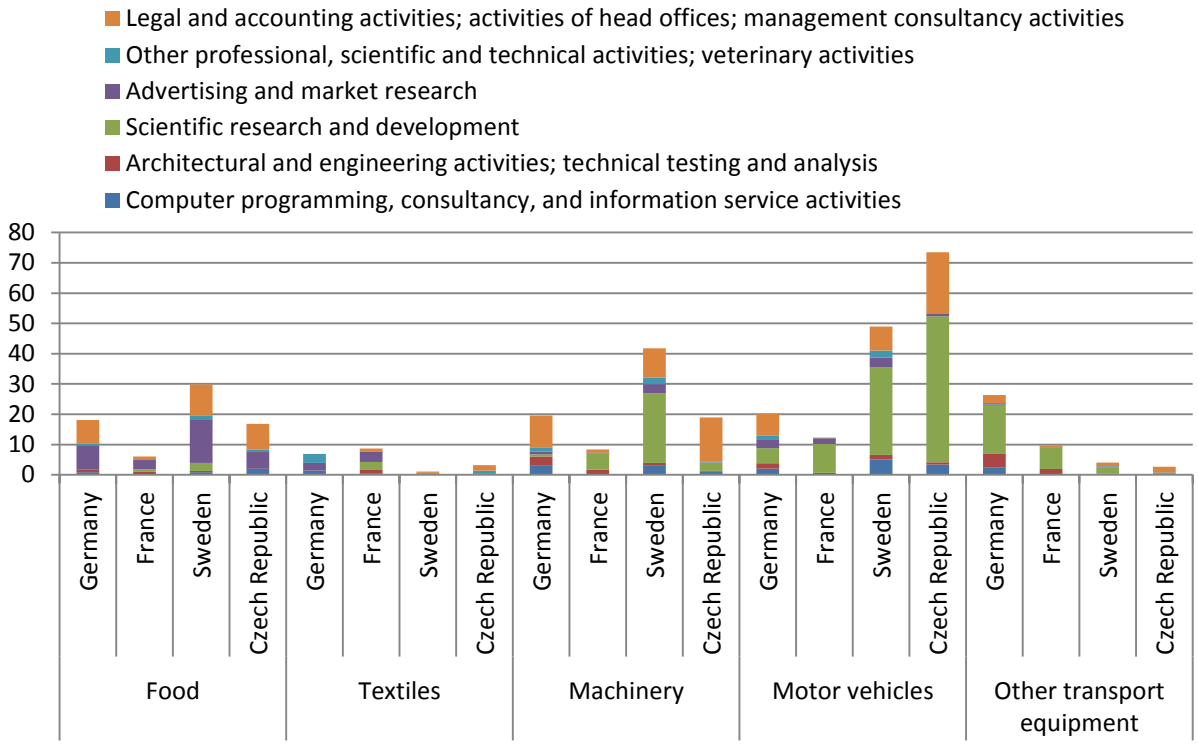
Figure 6.1 presents the shares of imported PE services (together with legal and accounting services) in per cent of total use of PE services in the selected countries for which data are available (Eurostat NACE Revision 2 tables) and the four selected industries (with the transport equipment industry split into motor vehicles and other transport equipment). When evaluating the figure, it should be recalled that estimates based on input-output data reflect cost shares of bought-in services from external providers but typically do not capture services that are supplied within a firm's (enterprise) boundaries.

In the **food, beverages and tobacco sector** Sweden has the highest share of imported PE services (some 30% of total PE services inputs of this sector) and France with 6% imports least. Across all countries, the main PE

[51] Performance enhancing business services are those which have been under investigation above, i.e. Computer programming, consultancy and information service activities (J62-63), Architectural and engineering activities, technical testing and analysis (M71), Scientific research and development (M72), Advertising and market research (M73), Other professional, scientific and technical service activities; veterinary activities (M74-M75)

services bought in from international services suppliers are advertising and market research services, as well as legal accountancy and consultancy activities (approximately 80% of all imported PE services).

Figure 6.1 – Share of imported PE services in % of PE services, 2011



Source: Eurostat; wiiw calculations.

Sweden is the only country importing a significant share of R&D services (3% of total use of PE services in the sector), which implies that Sweden imports (and not sources domestically) a relatively large share of total R&D services inputs. Lastly, the Czech Republic imports almost all computer related services since the share of imports constitutes 2% of total PE services, and the overall use of computer services is also close to 2%. The Czech as the Polish food and beverages industry has experienced strong FDI inflows from large foreign groups which to a certain extent explain the high share of foreign services.

In line with the findings for the food and beverages industry, the patterns of use of PE services in the **textiles sector** show that France is also the most intensive user of imported PE services, largely driven by the international sourcing of R&D services and advertising and market research activities. It may also be noted that the French textiles sector is also shown to import most of the R&D services used in the sector. Still, the overall use of imported PE services in all countries is rather low (< 10% of total PE services input). [52] Germany's textile sector seems more strongly oriented in technological production activities, signalled by the higher share of technical and computer programming services imports. The low use of imported PE services in Sweden should be interpreted with caution since Sweden has virtually no domestic production of textiles sector left (similarly for the Czech Republic).

Similarly to the food and beverages sector, Sweden imports the largest share of PE services in the **machinery sector** (more than 40% of total PE services input in the sector), largely driven by a significant component of R&D imports. Both Sweden and (to a lesser extent) France appear to source a large share of the total R&D services

[52] The overall low share of imports is explained by foreign services providers' difficulties to access the French market and interviewees reported about cultural barriers as being an important determinant. However, as compared to the other considered countries the share of service imports of total PE services is higher. This is due to the global reach of the French Haute Couture.

inputs from abroad; although, overall, the French industry has a much stronger domestic orientation for total use of PE services inputs.[53] Whereas total PE services imports in France and Sweden are dominated by R&D, imports in the Czech Republic and Germany are largely driven by legal, accounting and consultancy activities.

Finally, international sourcing of intermediate PE services in the **transport equipment sector** appears to be of greater importance than for other reported sectors. The finding from the econometric results (that imported business services are most important for smaller EU economies) is best illustrated in this sector. Both Germany and France show relatively low shares of imported PE services when compared to the Czech Republic and Sweden. The Czech transport equipment sector[54] is highly integrated in international supply chains as over 70% of their total PE services is sourced from other countries (largely driven by imports of R&D and legal and accountancy services). Swedish imported PE services are again significant and largely driven by R&D imports (not considering the *other transport equipment* segment, in which Sweden does not produce a large volume of output). Across all countries, most of the imported services constitute R&D services inputs.

Considering the geographic sourcing structure of these imported business services in manufacturing industries is less straightforward as either this is not reported in the supply and use and input-output tables (which provide only information on total imported use by industry as presented above) or WIOD which however applies a 'row proportionality' assumption that implies that there is no differentiation concerning the share of imports of specific service activities for particular industries. In Table 6.1 therefore only broad structures of services imports by intra- and extra-EU sources in percent of total imports based on Balance-of-payment data are reported.

Table 6.1 – Geographic structure of services imports in % of total imports of this service category, 2011

	Germany	France	Denmark	Sweden	Czech Republic	Poland
			Computer and information services			
Intra-EU share	67%	92%	76%	76%	67%	75%
Extra-EU share	33%	8%	24%	24%	33%	25%
			Research and Development			
Intra-EU share	37%	66%	58%	27%	81%	97%
Extra-EU share	63%	34%	42%	73%	19%	3%
			Advertising and market research			
Intra-EU share	37%	74%	67%	29%	49%	60%
Extra-EU share	63%	26%	33%	71%	51%	40%
			Other business services			
Intra-EU share	56%	71%	60%	40%	67%	62%
Extra-EU share	44%	29%	40%	60%	33%	38%

Source: BoP statistics (WIOD); Ecorys calculations.

The most important points are that the Czech Republic and Poland rely more strongly on imports from other EU countries, which could to a large extent be explained by FDI, particularly from other Member States. In case FDI is of a vertical nature (consolidation across the supply chain), one indeed expects that trade in goods and services between the headquarter firm and the local affiliate will increase, i.e. there is a complementarity between FDI and foreign affiliates trade. Denmark and particularly Sweden (58% from extra-EU sources in 2010 based on Balance-of-payment statistics) rely relatively more on extra-EU sources[55]). In more detail the data indicate that inside the EU, the UK (and Ireland for computer services) supplies a significant share of PE services to all

[53] Generally speaking the Sweden economy is one of the most internationally open economies. The country is home of the headquarters of some large global players. Interviewees reported that Swedish R&D is focused and does not cover the breadth of technologies required by the machinery industry. This is an important factor explaining the high share of R&D imports.
[54] Not taking into account the other transport equipment segment, which constituted 8% of total output in the combined sector in 2010.
[55] In particular US IT services providers command high market shares in Scandinavia. An interviewee reported that tough competition aggravates access to this region.

selected countries, whereas the top extra-EU trading partner – especially for R&D services – for most countries is the USA.

6.3 Barriers and framework conditions in services trade

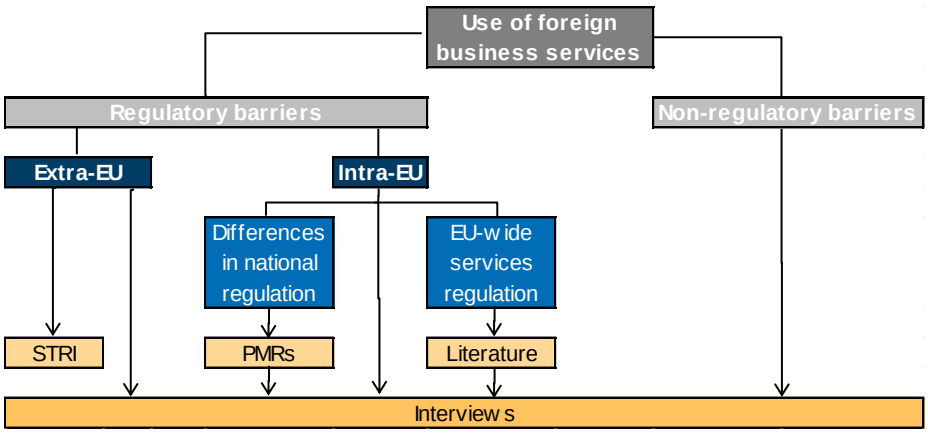
The introductory section explained that many barriers to services trade (which can be influenced by policy) are of regulatory nature. A part of the regulation potentially hindering services trade stems from the fact that some services markets are typically subject to 'natural' market failures. An example of such market failures is the information asymmetries that exist in the provision of professional services where the 'quality' of the service is more difficult to judge from the outside than for a physical product. Much of this regulation is often national and no binding regulation on services exists in an international context. This regulation does not have to be a barrier to services trade when it is effectively applied in a non-discriminatory manner, but unjustified regulation (not tackling market failures directly) or regulation applied in a discriminatory manner often exist, giving rise to difficulties for (foreign) service suppliers to enter a market or provide a service (Mustilli & Pelkmans, 2013). The enforcement of existing regulation plays an important role here; for example, regulation might *in theory* be well designed but if implementation fails then the business environment can become more uncertain, thus hurting services trade. The difference between EU level trade (intra-EU) and international level trade (extra-EU) becomes important here, as the enforcement of effectively applied and non-discriminatory regulation is different on both levels. The Treaty on the Functioning of the European Union provides for a free movement and free establishment of services within the EU. Resulting regulation at the EU level (such as the Services Directive[56]) provide for the right of demanding non-discriminatory access to a market. Outside of the EU, international agreements such as the GATS do not encompass all countries in the world and are not as binding as EU regulation. Thus, the legislative framework for services trade within the EU is better able to address regulatory barriers to services trade. Still, a truly free and open market for services is not reached and might perhaps be impossible to reach due to the 'proximity' burden problem described at the start of the chapter. Recent evaluations of the implementation of the Services Directive show that the Directive indeed addresses sources of barriers to cross-border services trade within the EU, but that there are still gains to be achieved from better implementing the Directive (Mustilli and Pelkmans, 2013 or Monteagudo et al., 2012). Due to the differing regulatory 'tools' available at intra-EU and extra-EU level, we will thus differentiate between barriers that exist to intra-EU trade and barriers that exist to extra-EU trade in (performance enhancing) services.

Building on the notion that barriers to services trade typically arise from regulation (differences in regulation, qualification requirements etc.) and constitute behind-the-border trade measures, this section aims to explore the sources and nature of regulatory barriers to services trade (see the methodological scheme below). Since factors inhibiting the flow of services trade can arise from a large variety of sources, we distinguish between the factors that are of regulatory nature and the factors that are of non-regulatory ('soft') nature. We aim to identify the significant factors from three perspectives. In order to identify regulatory factors, this section explores two publicly available databases that contain indicators on barriers that can inhibit trade in services and aim to capture common sources of regulatory divergences between countries. The OECD-STRI aims to capture barriers to trade with extra-EU partners[57] and the OECD-Product Market Regulation indices, reflecting the restrictiveness of domestic regulatory environments, should capture differences in the regulatory regimes of Member States with respect to firm conduct and entry, which can be a source of barriers to services trade within the EU. However, translating regulatory barriers into a comparable index across countries that aims to capture the effect of these 'barriers' to business decisions of firms that trade in services is courageous, and will give a rough estimation at

[56] Directive 2006/123
[57] The OECD STRI also includes data on services barriers from EU countries, but all indicators included in the STRI should be covered by EU regulation, such as the Services Directive, and thus mainly apply to extra-EU trading partners.

best. Thus secondly, a review of the literature about EU regulation is conducted to identify the barriers to services trade that should already be tackled by EU regulation. Additionally, interviews and literature reviews were conducted to identify the regulatory factors and non-regulatory factors that are not captured by the databases or picked up in the literature. The interviews also serve as verification of the findings from the literature and the data.

Figure 6.2 – Schematic overview of approach



6.3.1 Barriers to import of services from outside the EU

Factors that influence the import of services from partners outside the EU can take many forms. In a recent effort by the OECD, some regulations and measures that affect the trade in services have been mapped in the Services Trade Restrictiveness Index (STRI), which is a measure that quantifies the degree to which services are restricted for entry into a particular country by translating trade restricting policies into an index. The STRI indices are defined by services industry and by country and take the value from 0 to 1, where 0 is completely open to trade in services and 1 is completely closed. The index is based on the trade and investment regulations and policies currently in force with respect to import from outside of the EU. The STRI distinguishes between five types of restrictions that potentially affect trade in services: (i) *Restrictions on foreign ownership and other market entry conditions, (ii) Restrictions on the movement of people, (iii) Other discriminatory measures and international standards, (iv) Barriers to competition and public ownership, and (v) Regulatory transparency and administrative requirements*. The type and number of restrictions that a country has in place that restrict trade in services will determine the overall restrictiveness score for a country using a formula of weighing the different restrictions across the five groups. The STRI is defined for 18 different services industries. From these eighteen industries, the following correspond to the adopted definition of PE services as defined in this study, i.e. *architecture services, engineering services;*[58] *and computer services*[59] which are listed in Table 6.2. Unfortunately, no separate data on the restrictiveness of services trade is available for R&D services, which were shown to be the type of services mostly imported by manufacturing industries.

[58] Architecture and engineering services cover Architectural and engineering activities; technical testing and analysis (NACE rev 2 category 71).
[59] Computer services cover computer programming, consultancy and related activities and Information service activities (NACE rev 2 categories 62 and 63).

Table 6.2 – STRI scores

	Computer services	Engineering services	Architecture services	Mean
Czech Republic	0.21	0.24	0.24	0.23
Denmark	0.10	0.07	0.08	0.08
France	0.12	0.10	0.19	0.14
Germany	0.08	0.17	0.17	0.14
Poland	0.11	0.46	0.47	0.35
Sweden	0.17	0.11	0.11	0.13

Source: OECD STRI database.

Box 6.1 – Restrictions according to STRI database

Labour market tests are needed in all countries (except for Sweden and the Czech Republic) and relate to the check by authorities whether similarly qualified domestic professionals are not able to provide the service. These tests thus often require authorities to test the added value to the economy of the service provision in question. Particularly in the case of France, the gross salary for intra-corporate transferees from outside the EU should be at least 1.5 times the minimum wage of France (which might discourage the transfer of non-EU employees to France for low-wage jobs). Although it is not a labour market test in the proper definition, in Sweden, the legislation for providing architectural or engineering services contains a clause that the vacancy needs to have been posted at least 10 days in the European Economic Area (EEA), before opening it to outside EU markets. This is a clear barrier for service suppliers from outside the EU.

Limitations on stays for services suppliers relate to the length of visas granted for services suppliers or the requirements to obtain visa for these services suppliers. Limitations on stay are most stringent in the Czech Republic. For all three professions, the maximum stay is 6 months, after which a residence permit is needed. Worth noting is the restriction that German regulation introduces for contracted service suppliers in all three services sectors. For both architects and engineers, the theoretical limitation on stay is 36 months, though in practice the yearly admittance is zero according to the database as the national regulation does not foresee in the case of Contractual Service Suppliers.

Regulations on the movement of people play a less important role in the ***computer services*** segment, but still make up the most important share of the total number of restrictions to computer services trade. Unlike architecture and engineering services, computer services can be traded across borders much easier, via electronic networks. But cross-border services need to be supported by visits to the premises of the customer, both through business travel for technical support and for longer visits to work with clients for instance on organisational reforms to maximise the benefit of new software. Two countries stand out in terms of additional regulatory barriers for engineers and architects. The first, Poland, has a nationality requirement for the licence to practice. Both engineers and architects need to be EU nationals or have a proof of EU citizenship. The second country in this example, the Czech Republic, requires engineers and architects to possess permanent residency before a licence is granted. Moreover, the Czech Republic has a requirement for extra-EU suppliers to take a local examination before one is accepted as full member in the profession. As measured by the (time) costs to complete all official procedures and the number of procedures, the regulatory transparency in the Czech Republic is ranked to be particularly low and thus acts as a barrier to services inputs for the architectural and engineering services. Some restrictions to foreign entry exist in the other countries, but the burden caused to services trade is relatively low.

On average, the largest barriers for extra-EU service providers into the selected 6 countries exist in Poland and the Czech Republic with scores of 0.35 and 0.23 respectively. The least restrictive country in this sample is Denmark with a score of 0.08. A more detailed look at the data show that the most restricting conditions for provision of extra-EU services in all selected countries fall in the category of 'restrictions to movement of people' (more than half of the total barrier for most countries and services). Particularly, *labour market tests* and *limitations on the duration of stay for services suppliers* can still be perceived as significant barriers in the selected countries. In the former category France is rather strict while Poland, Denmark and Germany are also relatively demanding. The Czech Republic stands out when it comes to the limitation on stay, only 6 months visa are

distributed, after which the service supplier is required to apply for a residence permit. Moreover, successful participation in a local, Czech, architecture or engineering examination is needed to qualify for full membership of the professional association, which is often needed for the recognition of the services provided. Box 6.1 provides some more details by country and restriction.

6.3.2 EU legislation with respect to services

According to article 56 of the Treaty of the Functioning of the European Union (TFEU), Free Movement of Services is one of the four freedoms of the EU. European policy is thus aimed at removing any barriers to the functioning of the internal market, allowing optimal use of import of services within the EU. Any barriers remaining to intra-EU trade may reduce the use of services, in particular PE services, thus limiting the possibilities for the cooperation of services and manufacturing and negatively impacting the growth and productivity potential resulting from this cooperation. Specifically, the Services Directive (Dir. 2006/123/EC) provides the legal framework that aims to abolish (most of) the restrictions on the provision of services between Member States. Combined with the Directive on the Recognition of Professional Qualifications (Dir. 2005/36/EC) the EU provides a regulatory framework that is conducive for the provision of services between Member States. This framework has been amended by Directive 2013/33/EU, to allow for changes in Member States' educational and training systems, though the Directive's transposition period for the Member States is still ongoing[60]. For services that are covered by the Services Directive, there should not be any additional requirements for foreign services suppliers compared to national services suppliers. Any requirements placed on foreign suppliers should meet the principles of non-discrimination, necessity and proportionality[61], thus safeguarding equal and fair treatment of foreign suppliers. Unless there is a direct threat to public policy, public health, public safety or the environment, Member States are not allowed to introduce barriers to certain services provided from other EU Member States. Most services included in the focus of this study are covered by the Services Directive (i.e. most business services, such as engineers, accountants, advertising and IT services fall under the Directive). Some of these services are provided by regulated professions[62]. Regulated professions are, in addition to the Services Directive, also covered by Directive 2005/36/EC, which deals with the recognition of professional qualifications. This Directive prescribes a general system in which the service provider only needs to show s/he fulfils the requirements of the home MS in order to be allowed to provide the services in the host MS. The Directive demands automatic recognition of professional qualifications for some professions (mostly medical professions and architects). Engineers do not enjoy automatic recognition, but they may qualify for the European Professional Card (EPC), which is part of the modernised Professional Qualifications Directive (as amended by Directive 2013/33/EU). This EPC aims to simplify the recognition procedure across borders[63]. Also, Title II of Directive 2005/36/EC allows service providers to provide their services abroad without a check of their professional qualifications if it happens on a temporary and occasional basis (with the exception of the public health and safety sector).

In order to be effective, the Directives need to be properly implemented in national law and require compliance. Performance checks are conducted by Commission staff to see how the Directives are applied 'on the ground'. According to their performance checks, there remains a degree of incomplete or incorrect implementation of the Directives, resulting in differences between Member States in terms of their openness to intra-EU services trade.[64] Mustilli & Pelkmans (2013) found remaining barriers with respect to the removal of compulsory authorisation and entry registration. Some eleven sectors have remaining restrictions despite the introduction of

[60] See http://ec.europa.eu/internal_market/qualifications/policy_developments/index_en.htm
[61] Art. 5 of the Treaty on the European Union (TEU) defines the principle of proportionality as 'the content and form of Union action shall not exceed what is necessary to achieve the objectives of the Treaties'.
[62] A regulated profession is defined in Directive 2005/36/EC as an professional activity which requires specific professional qualifications, in particular the use of a professional title that is limited by national provisions in a Member State.
[63] Available at: http://ec.europa.eu/internal_market/qualifications/policy_developments/european_professional_card/index_en.htm
[64] Available at: http://ec.europa.eu/internal_market/services/services-dir/implementation/mutual_evaluation/index_en.htm

EU Directives. Moreover, the fact that in federal states these authorisation procedures may need to be repeated at the subnational level is another barrier. Many instances of the requirement to notify the authorities of a cross-border service provision are still prevalent in half of the Member States. The last set of restrictions remaining in few Member States is a combination of 'other requirements', including requirements on certain equipment, insurance and ID cards for service providers who aim to supply their services across the border. Jointly, Commission calculations show that if all Member States implement the Services Directive correctly and completely, there would be a total economic benefit of 2.6% of GDP (Monteguado, 2012). Going forward, Corugedo and Ruiz (2014) argue that Article 15 of the Services Directive gives Member States too much leeway in judging what national protective regulations could remain in place to protect the public interest. Their policy proposals include the transfer of competency from national governments to a (politically independent) national competition authority to judge what is in the public interest. Greater cooperation between the national competition authorities then allows for a larger degree of conformity of the Directive and its aims.

6.3.3 Differences in national regulation as source of intra-EU services trade barriers

As explained in the introduction, *differences* between Member States' regulations affecting the provision of business services to manufacturers could be another source of impediments to cross-border service provision. In particular, national regulation could form barriers to cross-border trade, for example if the requirements on the service providers in one county exceeds the lower criteria applied in another country. There exists EU-wide regulation specifically aimed at easing services trade, but its effectiveness depends on implementation. In this context, the analysis is extended by focusing on differences in national regulations for professional services more generally, insofar as they are not yet covered by European regulation. If national regulation indeed forms a barrier to cross-border trade, we would expect to see countries with a high level of national regulation importing fewer services than countries with lower levels of regulation.

The Product Market Regulation (PMR) database of the OECD contains a comprehensive set of indicators measuring the restrictiveness of a countries' regulatory regime. Specifically, the indicators on conduct and entry regulation could be informative of the degree of regulatory 'difficulty' for foreign providers of providing services in that country, constituting an implicit barrier to trade. The indicators represent internationally comparable data on certain economy-wide and industry-specific economic and administrative regulations that affect product markets where competition is viable (OECD, 2014)[65]. Economic regulation covers a wide range of restrictions and incentive mechanisms affecting market access, the use of inputs, output choices, pricing and international trade and investment. Administrative regulation covers the ways the regulatory requirements are disseminated to the public and compliance procedures. The PMR indicators are complemented by a set of indicators that provide information not by a regulatory domain but by sector. The sector covered by the PMR that are relevant for this study are professional services, which include legal, accounting, engineering and architecture services[66]. The numerical value of the indicators represent the stringency of the economic and administrative regulation on a scale from 0 to 6, with 0 indicating a policy environment that is deemed to be the most conducive to competition.[67]

[65] The PMR indicators do not include other regulatory areas such as environmental and health and safety regulations.
[66] Other sectors covered in the database are retail distribution, network sector (telecoms, electricity, gas, post, rail, air passenger transport and road).
[67] The value for a category of indicators is calculated as a simple average of the individual indicators.

Table 6.3 – PMR indices (2013)

	Accounting services	Legal services	Architecture services	Engineering services
Czech Republic	2.4	3.3	2.1	1.7
Denmark	1.0	2.2	0.2	0.0
France	2.9	3.2	3.3	0.0
Germany	2.6	3.6	2.6	1.7
Sweden	1.6	0.6	0.0	0.0

Source: OECD.

Table 6.3 shows the overall PMR indicator for the professional services, including a breakdown into accounting, legal, architecture and engineering services for the six analysed countries with the exception of Poland that is not covered in PMR database.[68]. Denmark and Sweden have the most conducive regulatory environment in professional services. Among the four professional services, accounting and legal services are the most heavily regulated in the selected countries as well as for the rest of the OECD countries. Engineering services are the least regulated: the scores for Denmark, France and Sweden are equal to 0 which means that the regulation in the sector is the least restrictive to competition. Box 6.2 provides more details on specific regulations pertaining to the selected business services sectors, resulting from a more detailed analysis on the different regulatory indicators available in the PMR database for the selected countries and sectors, where particular attention was paid to the indicators capturing discriminatory regulation (entry and conduct). The next section aims (6.4.1) to link the general findings to the patterns of use of imported performance enhancing services by the manufacturing industries in the selected countries.

6.4 Linking barriers to services trade to the use of imported services by EU manufacturers

Using the above findings, the framework introduced at the start of the section, can now partially be filled in with findings on regulatory barriers captured by the PMRs and STRI and the literature on the EU-wide services Directives, which allows us to make some preliminary comparisons between the use of imported performance enhancing services by EU manufacturers and the restrictiveness of their surrounding regulatory framework. In the next section, the overall analysis will be completed by discussing the findings from the interviews with services representatives.

6.4.1 The restrictiveness of the overall national regulatory framework and services trade

In general, literature specifically dealing with barriers to the import of performance enhancing services by manufacturers is scarce, but the impact of regulation as quantified in the STRI and the PMRs on cross-border services is more commonly investigated. Recently, van Der Marel and Shepherd (2013) measure the impact of regulation on cross-border services trade at the sectoral level. They find that policy barriers, as measured by the overall Services Trade Restrictiveness Index (STRI) for each sector, have a negative and significant effect on total services trade, as well as trade in business and financial services. Restrictions of national rules as presented by the PMR measure are found to negatively impact on trade in all sectors except wholesale and retail trade.

Our analysis using STRI and PMR data focused both on examining the source data on which the STRI and PMR indicators are built in order to identify which specific individual policies might have a trade inhibiting effect as well as on analysing whether the overall regulatory restrictiveness levels (as measured by the overall STRI and PMR scores can explain the degree to which imported business services are used by manufacturers.

[68] All indicators show the values of the index that is calculated for the beginning of the year thus not reflecting the reforms that took place later those years.

Box 6.2 – A detailed look at PMR

With respect to *regulatory barriers in professional services*, Germany scores a bit higher than the other countries while Sweden scores much lower. Denmark has the least restrictive regulatory environment for **accounting services**, while France, on the contrary, has the most restrictive environment for accounting and architecture services. Entry regulations in accounting services are mainly found in France, Germany and Czech Republic and to a lesser extent in Sweden and Denmark. A similar pattern is observed in conduct regulation though the scores are considerably lower. In **legal services**, Germany and Sweden have the highest and the lowest scores respectively among the selected countries, thus having the most and the least restrictive regulatory environment respectively. While in terms of conduct regulation The Czech Republic has the most restrictive environment. In addition, in **engineering services** The Czech Republic and Germany have the highest scores on the PMR indicator while the other countries under investigation have the least restrictive regulatory environment. Denmark, Sweden and France have the least restrictions in engineering services. The Czech Republic imposes only entry regulations: exclusive rights, education requirements and compulsory chamber membership. Germany has both entry and conduct regulation in the areas of exclusive rights, education requirements, fees and prices and advertising.

Turning attention to the specific indicators, it can be observed that there is a similarity in terms of the categories that cause the regulatory barriers the most, namely **entry regulation** (with the exception of Sweden where entry regulation is present only in accounting services). Among the different types of entry regulation the most prevalent one is the regulation concerning the exclusivity of rights and compulsory chamber membership. For all the analysed countries there are no quotas thus there are no restrictions on the number of foreign professionals permitted to practice in professional services in 2013[69]. **Entry regulation** is again the least restrictive for competition in Sweden, followed by Denmark. The Czech Republic, France and Germany impose regulations on exclusive rights, compulsory chamber membership, thus the countries are the most restrictive in these areas.

In terms of **conduct regulation**, the regulations on the form of business and on the prices and fees are less common in professional services being mostly present in legal services. In Denmark only conduct regulations are imposed on legal services while in Germany the conduct regulation is in all professional services. In terms of **conduct regulation** the Czech Republic, Denmark and Sweden are the countries with the lowest scores, which implies that they have the most conducive environment to competition. Germany has the most restrictions on prices and fees.

For Poland and the Czech Republic, which both display a high share of intra-EU services sourcing (more than 60% of other business services imports from intra EU sources), the STRI indicates specific restrictions on engineers and architects for extra-EU service providers. Poland applies (EU) nationality requirements to professionals that wish to provide these services in Poland such that services providers from outside the EU, which do not enjoy the advantages provided by EU-wide legislation, might *ceteris paribus* face a competitive disadvantage. In the Czech Republic, several procedures for extra-EU professionals are required before being able to supply services in the country (such as residency requirements and the need for a qualification test). Sweden is characterised by low regulatory burden for extra-EU suppliers (the STRI index is one of the lowest for all three services considered) and, a relaxed general regulatory environment from (the PMR showed only some light restrictions to accounting services). Sweden also displays a high use of imported services, with imports from extra-EU partners often dominating. The generally lax regulatory environment (and unregulated architects and lawyer professions) could play a role in attracting extra-EU services provision in Sweden. On the other hand, the pattern of use of imported services in France shows that nearly all French manufacturing industries largely rely on domestic services provision (except for R&D, but these are not covered by the STRI or PMR). The STRI analysis shows that, for the three reviewed services, the most significant barrier concern salary requirements for intra-corporate transferees from outside the EU; however, as WIOD does not pick up intra-firm services provision, this cannot be correlated to the low import shares observed for France. On the intra-EU side, the PMR analysis shows that French regulations mostly place restrictions in relation to entry requirements. A closer look at the nature of

[69] There were restrictions on the number of foreign professionals practicing professional services (accounting, legal, architecture and engineering) in Germany in 1998.

the identified barriers reveals that most should be tackled by the Services Directive. At the same time, however, French manufacturing industries use relatively little foreign business services, whereas the PMR and STRI for France does not show particular inhibiting trade barriers. It should however not be forgotten that demand preferences and respective structures of the local industries strongly determine the demand for (imported) performance enhancing services (see also Section 5) and thus the real extent to which these factors captured by the STRI or PMR form a prohibitive barrier for access to foreign services by manufacturers in these countries.

At a more general level, the analysis on the correlation between the share of imported performance enhancing services used by EU manufacturing industries and the overall height of the STRI (for extra-EU imports) and the PMRs (for intra-EU imports) finds that there is no overall systematic relationship. For the imports from extra-EU partners, we find that both high and low overall STRI scores correspond to identical import-shares, while equally high indices correspond to sometimes large differences in import-shares. For the imports of performance enhancing services from countries within the EU, the height of the PMRs in selected countries did not correlate with the height of the import shares of PE services in manufacturing. Only national regulation of conduct (see Box 6.2) seemed to correspond with levels of imports of services from other EU Member States. Since even the presence of correlation cannot be used to argue that a causal relationship exists between two variables, we are not able to draw any meaningful inferences about the overall relation between the (potentially inhibiting) regulatory aspects captured by the STRI and the PMRs and the degree to which foreign services can be imported by countries. This might not be surprising as the introduction to this section already explained that regulatory barriers to services trade are numerous and the STRIs and PMRs only capture a fraction of the plethora of potential barriers at best. Also, the overall PMRs and STRIs scores are constructed in such a way that a potentially very burdensome regulatory barrier to services trade might exist in one particular category, but in case no particular restrictive policies are found in the remaining categories, the overall index might still be relatively low. It is also important to recall the discussion on how the tradability of services and location factors influence the preferred mode of entry of a service provider into a foreign market and how, in turn, the different modes of services provision are affected by different (regulatory) framework conditions. The data available to measure the shares of intra and extra EU imports only cover Mode 1 (cross-border trade) and – to some extent – Mode 2 (consumption abroad) categories of foreign service provision. Performance enhancing services however often fulfil many of the characteristics that are in favour of supplying the service through commercial presence (as discussed in the introduction and confirmed with interviews, see next section 6.4), relating to Mode 3 type of services trade. Measuring the use of imported business services (at a distance, Mode 1) might thus exclude a large share of foreign business services. In addition, most of the identified barriers to performance enhancing services trade present in the PMR and STRI databases relate to restrictions on the movement of people, which directly relate to Mode 4 type of services provision.

In order to identify the type of regulatory or non-regulatory barriers that are not captured by the indices, but could play a significant role in influencing (PE) services provision to EU manufacturers, additional interviews with representatives from manufacturing and services suppliers were conducted.

6.4.2 Regulatory and non-regulatory barriers from the perspective of industry

Overall, the findings from interviews both with services providers and manufacturers sourcing business services reveal that non-regulatory barriers (capturing 'soft' factors) play an important role in influencing cross-border provision of business services in EU Member States. The factors relating to cultural and linguistic differences, trust and control and an understanding of the local business environment seem very important in determining the extent to which EU manufacturers use foreign performance enhancing services. They also have a strong

influence on the way in which performance enhancing services are provided abroad. Moreover, the interviews also find some specific regulatory factors to be inhibiting cross-border services trade in particular sectors.

From the manufacturing point of view: Procurement of cross-border services

Problems with manufacturing companies' access to business services, whether from domestic or foreign suppliers, was not highlighted as a problem by representatives of industry associations and manufacturing companies; this topic has been discussed in particular with representatives of smaller economies. At the same time, it was mentioned that the lack of perceived problems could reflect a broader lack of knowledge of possible advantages of seeking out foreign supply. Moreover, interviewees from the manufacturing sector even underscored that if there are difficulties in cross-border services supply then it would be the responsibility of foreign services providers' to overcome these difficulties rather than the responsibility of their clients. To this end it is not surprising that no evidence was highlighted during interviews.

Additionally, the lack of perceived hindrances for cross-border supply of services might be caused by the fact that, in particular, the more sophisticated business services require a close communication in a broader sense between the client and its service provider. For less complex services such as transport and warehousing different languages do not impede cross-border activities. But difficulties were reported by interviewees with expertise in IT-services, where linguistic skills are critical for success of service projects, such as the implementation of IT-systems. Proper mutual understanding is indispensable for project definition and execution. Moreover, social skills and cultural specifics have to be considered in particular in direct contact with concerned employees to create the necessary mutual trust. To this end software houses run own subsidiaries in important sales markets or co-operate with small IT-firms in target markets. The employment of native speakers seems to be indispensable at least for the direct and permanent contact with a foreign company in the field of IT-services.

From the manufacturing point of view: Services provided by manufacturers cross-border (servitisation)

It could have been expected that interviews with manufacturers would bring to light impediments for own cross-border provision of services. However, there was not much evidence of impediments reported by interviewees. The German machinery association, which is aware of possible hindrances, has not yet received much evidence. Only the free movement of workers is sometimes delayed by intra-EU administrative provisions sometimes. In several Member States (Sweden, Belgium, Luxembourg, Estonia, Austria) registration of foreign employees working is obligatory, if the tasks exceed certain number of days. For Sweden initially problems were reported concerning a revised online registration procedure. Only for Switzerland problems have been mentioned, Registration is frequently related to the enforcement of Member States' minimum wage regulations. Other problems arise from different legal provisions (Member States provisions on safety in the workplace, health and environment) and a lack of knowledge on regulations.

From the services point of view: Provision of performance enhancing services to EU manufacturers

As mentioned at the start of the section, trading services across borders (as compared to trading goods across borders) suffer from the 'proximity burden': services often need to be provided jointly with the client (e.g. 'co-creation' and 'co-production') and require interaction and exchange between client and contractor which makes 'soft' factors to trade such as culture, language and habits constitute a large natural barrier. Interviews results[70] found that knowledge about the client, the local market (regulatory environment, the particular business environment in which the services are to be provided, culture etc.) have a strong influence on the provision of most PE services. We can conclude that on average for PE services the proximity burden is high. The need for interaction in the same language, understanding of the culture and close interaction with the client has resulted in

[70] With representatives from the advertising, communication, marketing, industrial design, engineering consultancy, architects and computer services sectors

the dominant mode for PE service provision abroad to be through local affiliates (Mode 3). This particularly holds for the professional services (architects, engineers, designers) and advertising and marketing services. Only more 'standardised' (or amenable to codification services products, such as software development) or simpler industrial design activities, are more often provided at a distance, which also increasingly come from low wage countries outside the EU (as a result of the location advantages trade-off discussed earlier). Secondly, the need for knowledge of the local business environment and regulations, gives rise to a large source of barriers to services trade stemming from *differences in national regulation* between the host country of the service provider and the destination country of services provision. Particularly for the case of services provision to manufacturers, not only the regulatory environment surrounding the trade of services matter, but also the regulatory environment on the final products produced by manufacturers. In the industrial design sector, for example, the sketches might need to take into account local requirements (which could be local market requirements, e.g. due to differences in consumer preferences, and regulatory barriers). The larger the differences in such local requirements, then the more local knowledge of the market is needed, which in turn increases the costs for exporting or the need for establishing a local office. Lastly, due to the knowledge-intensive nature of PE services, differences in training and educational systems across Member States (or between EU and non-EU countries) increases uncertainty surrounding the quality of services offered from foreign regions to a manufacturer in a particular country. An important difference between extra-EU service providers and intra-EU service providers still exists, as the EU addresses many of the above issues by the Directive on Recognition of Professional Qualifications, the Services Directive and the general alignment of the educational systems (Bologna Process). The findings from interviews show that generally speaking these two regulatory measures are relatively effective in addressing the source of the problem, but that further improvement is possible with respect to improvements in their implementation.

The specific regulatory and non-regulatory barriers that were identified in the interviews differed per type of performance enhancing service. For the provision of **advertising, marketing and communication services** within the EU, service providers still face differentiated legislation across MS, which is the largest source of uncertainty and thus impediment to services trade. This does not concern regulations with respect to the services provision *per se*, but rather on the goods and products for which the advertising and communication services are used (an indirect barrier). For example, differences exist in national regulations governing advertising of products such alcoholic beverage and food, while there may also be different approaches and sensitivities concerning things such as gender issues or children. These different rules are known, so they do not constitute a large barrier but they can still hinder free provision of services. Advertising and communication service providers from outside the EU are not considered a strong competitive force for European service providers. This is rather driven by the need for a sound knowledge of the local market, which is less strongly present at non-EU service providers, than by the presence of trade barriers.

In the **industrial design sector**, there is generally little cross-border provision of services, even though some design-related activities are rather conducive to exports since they can often be provided via electronic platforms. For the Dutch and Polish industrial design industries, for example, domestic clients are most important by far (in the Netherlands, exports represent 8% of total revenue). If a cross-border element is present in their sales, then it is usually done through subsidiaries (branches) in the targeted country. The introduction of the Services Directive had seemingly had little effect on international trade flows due to this dominant mode of services provision. The small effect of regulation is also confirmed by the perception that the most important trade barriers to Sweden and Denmark is the strong domestic competition (strong design community and local preferences) and to Germany and France the language and the culture (combined with a large local design industry). Specifically regarding the use of industrial designers in the transport equipment sector in Poland, the manufacturers that use foreign design services are larger companies that source the services mostly from within the EU and do so due to historic relations with a particular partner country or because of personal relationships of the management in foreign

countries. The most important barriers experienced in the design sector that are associated to the regulatory environment are regarded as concerning the risk of non-payment (and the repatriation of payments) and tax compliance issues. For non-European design service providers, their situation is quite similar to that of European providers with the potential addition of (non-trade) barrier in the form of language needs.

In the **engineering and architecture services** sectors two main issues regarding the cross-border provision of services in the EU emerge. The first concerns the regulated nature of the professions in many countries and the concomitant uncertainty surrounding the guarantee of quality of supply and recognition of qualifications. Even in the absence of trade barriers, manufacturers might still often prefer local professionals due to a lack of trust in the quality of foreign services provision; for example, which may arise from differences in qualifications or education systems. In the EU, the Directive on Recognition of Professional Qualifications provides for the right (non-discriminatory) legal environment for architects (automatic recognition once the minimum training requirements are met). However, the administrative burden can often be considered high, especially for engineers, whose qualifications are not automatically recognised. As a result, private initiatives from engineering industry associations have emerged to provide mutually recognised professional cards (recognising credentials) or a recognised engineering title. This facilitates the application of EU-wide regulation and might place extra-EU professionals at a disadvantage. Secondly, the issue of insuring projects was mentioned as a significant barrier to doing business abroad. In the worst case, foreign engineering services providers could find themselves trapped in a vicious circle whereby winning a project abroad requires showing insurance cover for that particular potential project but where local insurance covers is only available to foreign service providers that have already won the project. The engineering firm could turn to a domestic insurance provider for foreign cover, but will often be charge a premium for the extra risk associated with a project undertaken in an environment that the domestic insurance provider is less familiar with (and where the culture on applying for claims could be different). These extra costs for insurance cover could place a foreign services provider at a competitive disadvantage compared to a domestic service provider.

Regarding **computer (related) services**, it appears from interviews that compared to other PE business services, on average more services are provided cross-border without the need for a local affiliate. Non-trade related barriers, such as language and culture, are believed to become less important due to the increasing sophistication of software. The most dominant barrier to cross-border provision of services was found to be differing regulation on data protection and privacy, and local rules on requirements for local data processing or storage centres, which increase the cost of exporting services. Streamlining regulation on this matter would help. The (temporary) movement of persons is crucial for many IT-projects where experts are needed on the ground to install systems. Within the EU, in line with the findings from the STRI, some restrictive measures remain on the movement of some Eastern European nationals as well as for non-EU nationals that migrated to the EU for work. EU employers also incur larger administrative burden when sending these experts temporarily to other EU countries since they do not automatically enjoy the benefits from EU regulation on free movement of people. Furthermore, temporary travel within the EU might be burdensome and act as a barrier to services provision abroad. A medium-sized German IT-service provider with a European wide distribution network also mentioned that linguistic skills are crucial for successful projects concerned with more traditional types of computer services activities (IT interface or network design). On a national basis, it has been reported that markets in Scandinavian countries are subject to strong competition from US services providers while access to the French market is difficult due to the strong preference of French companies for domestic service suppliers, such that local representation alone is not seen as sufficient to access the market. It appears that the French situation applies to smaller and larger firms that are both more inclined to use domestic suppliers. This finding is in line with the observed patterns in the data (Section 6.2) that most performance enhancing services in France are provided by domestic suppliers. Another

interviewee, representative of an ESP, highlighted that in individual cases procurement provisions of large manufacturers are designed to discriminate foreign suppliers.

6.5 Summary

Following up on the empirical finding of a positive relationship between the use of foreign business service inputs and manufacturing performance, the aim of this chapter has been to explore whether there is any observable correspondence between patterns of use of foreign (imported) performance-enhancing business services and corresponding regulatory environments. In keeping with the approach of the study, the analysis has focused on a limited set of countries and manufacturing sectors. For this sample, two databases including indicators on the regulatory restrictiveness of the business environment for professional services (PMR) and on discriminatory regulation for foreign services providers (STRI) were examined. Moreover, a short review of the (functioning of) EU-wide legislation affecting services trade was conducted. The 'bottom-line' conclusion from the analysis using PMRs and STRIs is that there is no evidence of cross-country patterns in the use of foreign performance-enhancing business services that would suggest a systematic relationship between the height of the indices and patterns of foreign services use. This conclusion does not imply that regulatory frameworks are unimportant when it comes to trade in services. On the contrary, a number of limitations surrounding the construction of the indices and surrounding the data that measures the use of foreign services in manufacturing limits the analysis. An examination of some of the underlying source data on which the indicators are built suggest that some Member States can still address lingering discriminatory legislation, particularly with respect to extra-EU service providers. Moreover, this is also in line with the finding by Ecorys (2011) that differences in regulatory regimes are significant determinants of the relative in services between Member States.

Additional interviews conducted with industry also found that some specific regulatory barriers still exist across different performance enhancing service categories. The introductory section explained that characteristics of services define the 'tradability' of a service, which, in turn, strongly drives the entry strategy of a foreign services provider into a particular market (i.e. through exporting or through FDI). The importance of local presence for the professional services under consideration in this study favour – on average – the provision of services through local affiliates. Results from the interviews confirmed that proximity requirements (e.g. need for local presence) and 'soft' factors (e.g. linguistic and cultural differences) are very important determinants influencing the provision of performance enhancing services to EU manufacturers and drive foreign service suppliers to mostly enter foreign markets not through direct exports, but through investments in affiliates. These finding suggests that, in addition to any further efforts to strengthen legislative frameworks (and their implementation), further enhancing the international dimension of inter-linkages between industry and services may best be supported through policy initiatives targeting 'soft' factors both within services and industry (such as differences in language, recognition of qualifications or a better information/understanding about local regulatory environments). Not all of these can be tackled by policy (such as language), but some can be alleviated, such as the recognition of qualifications. Monitoring of correct implementation and enforcement is key here as well. Lastly, in the context of service manufacturing linkages, policy efforts should be targeted at removing barriers to entry and investment of foreign services providers as being the dominant mode of foreign services provision for the knowledge intensive business services that were the focus of this study.

7 Summary of main findings

This study focuses on the interaction between manufacturing and services and – in particular – the way the latter contribute to productivity and value creation in the former. First and foremost, interest in this subject is triggered by the fact that the share of manufacturing in most industrialised economies in the world is declining whereas the share of services – and business-related services in particular – is rising. This pattern is observed for the EU as a whole, although there is not a homogeneous development across European countries: Some countries have faced rather strong declines in their manufacturing shares whereas other countries succeeded in keeping their shares more or less constant. Second, there is the question as to the extent that both industries are dependent on each other, with the focus in this study being the manufacturing sector as a user of activities provided by the (business) services industries. To the extent that this is the case, manufacturing plays an important 'carrier function' of services as a share of the value of output (and therefore also exports) produced in manufacturing embodies value added created in services. As a consequence, countries facing declining shares of manufacturing might still provide inputs to the manufacturing activities in the domestic or foreign countries via provision of services. One question is, therefore, to which extent the specialisation in business service activities – and particularly business services related to manufacturing – have compensated the loss in manufacturing activities. Third, given the differentiated specialisation patterns within Europe – with a set of countries keeping a stronghold in manufacturing industries whereas others specialising in the provision of related services – an important issue is the role of cross-border flows of services and the patterns of outsourcing and offshoring of such activities across Europe.

This study first sketches the complexity and multifaceted dimensions of the issue of manufacturing-services interaction and the role services and services performance play, first, within manufacturing industries, within services sectors and, in particular, at the interface between manufacturing and services industries. This is best seen when considering a manufacturing activity – i.e. the provision of a manufacturing final product – in terms of its underlying value chain. From this perspective, services can be categorised relative to their position in the value chain as (i) upstream (development) services including activities such as R&D and design; (ii) core (production) services including supply management, production and process engineering and other technical services; and (iii) downstream (market) services, which are also manifestations of the 'servitisation' of manufacturing products through which firms increasingly tend to supply hybrid goods and service combinations or services solutions rather than just supplying the physical goods as such. The important point is that industry-service interactions occur throughout the value chain and that at each stage, potential choices exist both in terms of (i) whether to provide services 'in-house' or to 'buy in' services from an external service provider, and (ii) – in the latter case – whether to source services locally, i.e. domestically, or from a foreign supplier. These decisions can be influenced by prevailing framework conditions at all levels.

The first sections of the study are based on available quantitative indicators – most of them from input-output data – allowing one to study the relative importance of the manufacturing-services interaction, differences across countries, industries and services activities, and the respective changes over time. Sections 5 and 6 highlight important dimensions of services use in manufacturing and issues related to services trade in that respect for selected industries and countries, incorporating both quantitative and qualitative insights.

7.1 Performance of manufacturing and services and their inter-linkages

The first specific aim of the study is to quantify the magnitudes and patterns of interactions between manufacturing and services, focusing on services activities which are bought in from manufacturing industries, particularly in relation to performance-related business services such as advertising, R&D, engineering, etc.

7.1.1 Relative performance of manufacturing and services and patterns of specialisation

Before delving into the details of the inter-linkages between manufacturing and services, the report provides an overview concerning performance indicators by first considering the evolvement of manufacturing and services categories as a proportion to GDP. The share of manufacturing in total GDP declined from 20% to slightly less than 16% in the EU-27 over the period 1995-2011 compared to a decline from 15.5% to 12.3% in the United States. By contrast, the share of business services increased in the EU-27 over the same period from 14.3% to 18% (for comparison, the US experienced an increase from 18% to 23%) with shares of other services categories remaining relatively stable. Similar trends can be observed for individual EU Member States, with the manufacturing shares having declined in most countries, though the magnitudes varied widely across countries. The share of business services increased in most countries. However, the relative pattern of development points to the emergence of a 'European manufacturing core' based around Germany and including countries such as Austria, the Czech Republic, Hungary and the Slovak Republic, and another group of countries – 'business services leaders' – which succeeded in specialising in service activities (e.g. UK, Netherlands and Belgium), with a third group of countries falling in neither of these categories. As a consequence, as compared to the mid-1990s, the European economic landscape nowadays looks much more differentiated with respect to specialisation patterns in manufacturing and services.

A second set of performance indicators which have been looked at are productivity growth and unit labour costs dynamics. There has been a rather diverse pattern of relative productivity developments across countries both in manufacturing and business services sectors. By contrast, growth rates of wage rates across sectors are much more similar within countries. As a consequence, this gives rise to a 'dynamic Ricardian specialisation'[71] pattern: The specialisation pattern within the EU mentioned above – with some countries specialising in business services whereas others keep a relatively high share of manufacturing in GDP – can to a certain extent be explained by relative differences of productivity growth in manufacturing and services and wage drift across sectors. Other factors, such as agglomeration and scale effects, FDI patterns and evolution of production linkages, in both manufacturing and services activities are likely to play an additional role. These patterns underpin the increasing need for cross-border flows of services within Europe, particularly so for those smaller countries that maintained a significant share in manufacturing activities.

7.1.2 Manufacturing-services linkages

Analysing the mutual dependence between manufacturing and services has been the particular focus of this study. A first aim was to assess the magnitudes of these interactions and the respective changes over time. A number of indicators have been presented which are summarised as follows.

[71] A Ricardian specialisation pattern is determined by relative productivity differences across countries and sectors with wages across sectors being equalised. Analogously, a dynamic Ricardian specialisation arises due to differential growth rates of productivities whereas wage growth rates are similar.

The first indicator considered is the role and magnitudes of **secondary production** of services in manufacturing industries, i.e. those services which are sold to the market additionally to the main product.[72] For the EU-27 about 4% of manufacturing gross output is due to secondary services production, although a wide range from 10% to less than 2% exists across countries. Within services use, distribution and business services account for the bulk of secondary production of manufacturing industries. Over time there is a slight increase in these shares which is particularly pronounced in Sweden and Finland. On the opposite side, the share of secondary production of manufacturing products in services industries is on average less than 1% with a slight decline since 1995. Only a few countries report larger shares. These numbers however do not capture the role of services provided in combination with the delivered product.

The second indicator considered is the **direct cost shares** of services inputs in manufacturing industries, with a special focus on the role of business services. Overall, in the EU-27 services have accounted for about 25% of total costs in manufacturing (i.e. including value added costs) in 2011. This share had only slightly increased since 1995. There are some differences across countries with shares at the lower end being about 15%, which is the case for most of the East European countries. Significantly higher shares are only observed for Ireland which, however, experienced a rather strong increase starting from 1995. Only a few countries experienced significant changes over time. Differentiating by services categories shows that distribution with about 12% and business services with about 9% are the most important services inputs on average. Across countries, larger shares of business services correlate with a larger overall share of services use in manufacturing industries in most cases, particularly so for Ireland, Sweden, France and the Netherlands. The shares of business services are also the most dynamic component over time in the majority of countries.

Looking into the more detailed structure of business services, the item 'Other business services' (NACE Rev. 1 CPA 74) account for the bulk of business services inputs (in the EU-27 5.6% as compared to 8.8% of the total direct cost share of business services). The new NACE/CPA classification allows one to differentiate this heterogeneous category into a more detailed structure: about 30% of costs of 'Other business services' (about 2% in terms of gross output) are made up by legal and accounting activities, about 13% (0.8% in terms of gross output) by architectural and engineering activities, 16% (0.9% in terms of gross output) by advertising and market research, and 4.1% (0.2% in terms of gross output) by other professional and scientific activities. Of the remaining performance-related business services, about 0.6% of gross output are for computer programming, etc. and 1.1% for scientific research and development. The latter category, scientific research and development, is – when compared to other countries – particularly important as a cost share of inputs in manufacturing in Finland, Ireland, Sweden, France and the Netherlands. The direct cost shares of manufacturing inputs in services production are generally low, on average at 2%. Here one has to consider however that manufacturing plays an important role in delivering investment goods supporting the provision of output in the services sectors. Input-output data do not identify costs of capital formation, which means that use of manufactured goods by services is underestimated.

Related to the overall direct cost shares of services in manufacturing production is the **share of imported services** in the overall costs of production, which – as mentioned above – is likely to become more important given the diverse specialisation patterns in Europe. The cost share of imported services in manufacturing gross output is on average at about 2%, with some countries such as Luxembourg, the Netherlands, Finland and Sweden having shares of more than 4% and Hungary, Denmark, Austria, Belgium and Malta more than 3% with smaller countries and CEECs experiencing higher import intensities. These patterns and shares are dominated by imports of businesses services, which account for about 50% of services imports. The largest parts of these are

[72] These are products which are sold additionally to the company's main product to the market and can include maintenance and repair services, business advisory, presales and sales services. In the input-output framework these include subsidiary products, by-products, and joint products. It should be emphasized that this indicator does however not fully capture the role of 'servitisation of manufacturing products', i.e. other services supplied with the particular manufacturing products.

due to imports of the category 'Other business services' (CPA 74). Despite a positive relation between the overall shares of (business) services used in manufacturing and the imported shares in gross output, the import intensity, i.e. the share of imported business services in total buy-in of business services, is negatively correlated with the overall buy-in. This pattern is mostly driven by country size as most of the smaller countries tend to have lower shares of business services in manufacturing output together with relatively larger imports. Within the category business services, the most important items imported for use in manufacturing are scientific research and development and legal and accounting activities, followed by advertising and market research according to NACE/CPA Rev. 2 classification, though there is again a wide heterogeneity across countries.

The use of other industries' outputs as a means of production – which enters as an intermediary input and therefore a cost item in the producing industry – which are then further used as intermediate inputs in the production stages in other industries implies that industries' outputs – and in particular outputs from services – are directly and indirectly used in other industries. These **direct and indirect production linkages** are captured in this study by an indicator of backward linkages (which is closely related to the multiplier concept in input-output literature) but focusing on services and business services in particular. Focusing on business services, larger countries tend to have larger backward linkages which are mostly domestically oriented. Particularly, France has the largest domestic backward linkages in business services. In the smaller countries (including the Eastern European countries) these domestic linkages are smaller with foreign linkages therefore playing a more important role. These linkages have generally increased over time, though at a slow pace with domestic increases dominating in few countries only.

Therefore, as services are used in the production processes of a manufactured product, the value of a final manufacturing product embodies directly and indirectly value added created in services to a large extent. These **domestic and foreign services contents of manufacturing products** can make a large proportion of manufacturing output underpinning the relevance of the services sector for manufacturing production – or, vice versa, the role of manufacturing as having a 'carrier function' for (business) services: Services account for slightly less than 40% in the value of a final manufacturing product in the EU-27 as a whole where the bulk stems from distribution services and business services with about 15% each. This share is larger compared to the one in the US mostly due to differences in the share of distribution services (a potential reason for that could be that distribution and retailing depends on Member States specifics). Across EU countries these shares range from more than 40% in France and Ireland to less than 30% in Greece, Malta and Romania. The largest part of these differences is due to differences in the direct and indirect value added content of business services in line with the findings concerning direct cost shares. Over time, these shares increased mostly due to a change in the respective content of business services confirming the results already found when considering direct cost shares.

7.2 Manufacturing-services interaction and manufacturing performance

Based on these indicators the next part of the study has focused on the issue whether increased linkages impact the performance of manufacturing industries and the potential determinants of these linkages across industries and countries. Based on the results of Section 2 a distinct econometric exercise has been undertaken aiming at revealing the importance of manufacturing service linkages to manufacturing performance. This exercise considered the productivity effects of interactions of manufacturing and services across countries and industries. When considering the impacts of backward linkages of manufacturing with business services on the growth rate of labour productivity in manufacturing for all EU-27 countries significantly positive effects are found for foreign linkages only. A similar result holds when splitting the sample into EU-15 and EU-12. This result is however qualified when splitting the sample by country size: For the larger economies only domestic backward linkages impact positively on labour productivity growth in manufacturing, whereas for the smaller countries only foreign

backward linkages matter. This result is in line with the fact from Section 2 that foreign business services are relatively more important for smaller countries. When splitting the sample by technology-intensity of industries it turns out that the positive effect of foreign backward linkages with business services holds only for medium-high- and high-tech industries.

7.3 Services in the manufacturing value chain

The fact that manufacturing output (either measured in terms of final goods produced or in terms of exports) embody value added created in services maybe implies that 'manufacturing' has to be defined in a broader sense, namely by considering all activities related to the production of manufactured final products as being part of the 'manufacturing value chain'. This approach is reported as '**manufacturing value chain approach**' and calculates (by means of input-output analysis) all value added generated in a particular economy which contributes to world-wide final demand of manufactured products. This measure accounts services activities which are – together with the core manufacturing activity – provided in-house by a manufacturing firm and service activities which are outsourced to a domestic service provider as part of the manufacturing value chain of this country. Further, services activities undertaken in a particular economy which contribute to the manufacturing process in other countries also are accounted for as being part of the manufacturing value chain of the country under consideration.

For the EU-27 as a total this perspective reveals that in 2011 22% of value added generated in the EU was due to contribution for world final demand of manufactured products (the 'value chain perspective') which is to be compared with about 16% when considering the share of manufacturing in the EU-27 (the 'classical industry perspective'). Over time this share – similarly to the share of manufacturing in GDP – declined from more than 25% in 1995 to the above mentioned 22%. Within the manufacturing value chain about 40% of value added is contributed by service activities (a figure more or less in line with the services contents of manufacturing mentioned above), slightly more than 50% by manufacturing industries and less than 10% by the remaining industries. Over time the share of manufacturing contribution declined whereas the one from business services and distribution services increased; the former from about 11% to 16% (business services), the latter from about 13% to 15% (distribution).

Across EU Member States, these value chain shares correlate positively with the shares of manufacturing in GDP. From a dynamic perspective, countries which lost their shares of manufacturing value added in GDP could only partly compensate to further contribute to the manufacturing value chain by providing corresponding business services. The results indicate that an increase in business services or business services in the manufacturing value chain may be a necessary condition to circumvent a stronger decline in the manufacturing value chain share in a country's GDP (though this is less the case so for the share of manufacturing in GDP) but it is not sufficient to keep the manufacturing value chain share or the manufacturing share in GDP at a constant level.

This result is in line with the diverse patterns of specialisation documented above. In the European context the specialisation patterns observed for both manufacturing and services industries therefore necessitates a proper functioning of the single market not only for goods but especially for business services trade. The emergence of manufacturing and business services clusters in Europe makes service trade flows even more important.

7.4 A detailed look at manufacturing-services inter-linkages and business services trade

As mentioned above the issue concerning the interrelation of manufacturing and services and the role of services production in the manufacturing value chain is rather complex and multi-faceted with the quantitative approach only shedding light on several aspects. Therefore the quantitative analysis has been complemented by in-depth qualitative research focusing on specific cases. The selection for this analysis was grounded in considering the indicators developed above at a detailed country-industry level. In the end a set of four industries representing low and high-tech industries – food and beverages, textiles and clothing, machinery and transport equipment – in six countries representing small and large, developed and emerging countries – Germany and France, Sweden and Denmark, Czech Republic and Poland – have been selected for studying concerning the role of performance enhancing business services – like R&D, advertising, engineering, etc. A number of interviews have been dedicated to provide insight in the interaction of manufacturing and services which cannot be gained by quantitative approach and the application of econometric methods. These interviews confirmed that there are major discrepancies between the industries and countries under investigation. These differences are to a certain extent explained by different challenges from globalization, production technologies, innovativeness and resources required with country and industries being affected differently. In particular, there are noteworthy differences between Member States that are explained by supply side specifics and different framework conditions. Results provide a wide panorama of the interaction of manufacturing and services in various economic circumstances which have been documented and analysed above.

The second part of the qualitative approach was to study the patterns of imported versus domestically sourced performance related services and to study the factors that influence the use of foreign sourced knowledge intensive business services due to the significant empirical results (Chapter 3). In terms of the three different types of performance related services, the data clearly show that R&D services have the highest share of imports (in total use by the six selected countries and four selected manufacturing sectors): on average 35% of total R&D services inputs, compared to 19% for computer services and 15% for other business services. The largest differences, however, stem from the use of imported performance related services across different Member States. From the six selected countries France imports structurally a (much) lower share of these services than the EU average, whereas Sweden and the Czech Republic (and to a lesser extent Denmark) import higher shares than the EU average. Poland imports a particularly large share of its *computer and related services* as intermediate inputs for its manufacturing sector (more than four times larger share than the EU average).

Accordingly, the 'larger' countries Germany and France seem to rely more on domestic sources of performance related services supply, especially so for the *other business services* (except for R&D services that Germany largely imports – 49% - and France sources domestically, 92%). The Czech Republic and Poland rely more strongly on imports from other EU countries and the 'small but open' economies of Sweden and Denmark more strongly on extra-EU sources. Particularly Sweden sources a relatively large share of these services from extra-EU sources. Inside the EU, the UK (and Ireland for computer services) supplies a significant share of performance related services to all selected countries, whereas the top extra-EU trading partner – especially for R&D services – for most countries is the USA.

The subsequent analysis on the barriers to trade in performance enhancing services aimed at understanding the factors that influence provision of services to EU manufacturers from within and outside the EU. It is important to note that due to the characteristics of trade in services, perhaps the most important factor (or 'barrier') that defines services trade is a natural barrier called the 'proximity burden' in the literature which resembles 'soft' (non-regulatory) factors such as distance and differences in culture and language. For services where the proximity burden is large, foreign services providers tend to prefer to serve the market through local commercial presence rather than exporting at a distance. For these services, barriers to entry and investment matter more, whereas for

services that can be traded at a distance differences in national regulation and barriers to the movement of people could constitute significant barriers. Since most barriers to services trade have a regulatory nature (e.g. not tariffs), two databases that capture elements of regulatory barriers to services trade have been studied: (i) Regulatory barriers to provision of services from outside the EU as captured by the recently released OECD-STRI index, (ii) The overall restrictiveness of the regulatory environment surrounding specific professional business services sectors as captured in the OECD PMRs. However, the potential sources of barriers inhibiting trade from regulation are large and the indicators of the STRI and PMRs only measure certain regulatory barriers. In order to complement the analysis on regulatory barriers and in order to find possible other sources of barriers to services trade in the EU, additional literature concerning the impact of EU services regulation has been overviewed and interviews with EU services industry have been conducted. The overall conclusion from the analysis using the PMRs and STRIs is that there is no evidence of cross-country patterns in the use of foreign performance-enhancing business services that would suggest a systematic relationship between the height of the overall indices and the patterns of foreign services use. Several limitations to the construction of the indices and the manner in which use of foreign business services is measured make it difficult to draw meaningful conclusions on the aggregate level for the influence of the regulatory measures captured by the STRIs and PMRs. However, some of the underlying source data on which the indicators are built suggest that some Member States can still address lingering discriminatory legislation, particularly with respect to extra-EU service providers. The findings from the STRI analysis showed that particularly the 'newer' and smaller EU Member States Poland and the Czech Republic still maintained some restrictions to the movement of people from extra-EU countries.

In order to complement the analysis on the possible sources of regulatory or non-regulatory barriers to services trade, interviews with knowledge intensive service providers were conducted and revealed that 'soft' factors such as language, culture and knowledge of the local (regulatory) environment played the most important role in influencing services provision to EU manufacturers. This so-called 'proximity burden' not only works as a 'barrier' to overall services trade, it also influences the way in which service providers prefer to serve a foreign market. This especially holds for the performance enhancing service providers, which provide very knowledge intensive services for which local requirements are determining for the provision of services. The interviews also revealed some specific regulatory barriers to trade for individual performance enhancing services types.

Some specific areas for policy attention result from the analysis on barriers inhibiting the provision of services cross-border in the EU. First, due to the stressed need for local knowledge and interaction, **barriers to the movement of people** should be addressed. Within the EU, the Services Directive and the Directive on the Recognition of Professional Qualifications are believed to provide a good legislative basis for removing barriers to intra-EU movement of professionals, but differences in implementation of the Directives gives rise to differences between Member States and room for further improvement. Additionally, the underlying data for the STRI show that for some countries (particularly Poland and the Czech Republic) some restricting measures on architects and engineers from outside the EU remain. Secondly, the need for local knowledge and interaction has also determined the dominant mode of supply of services across borders to be through the **establishment of local affiliates** that use local staff and have the local presence to overcome the 'proximity burden'. Barriers to investment or to entry should thus also be addressed, especially in the case of PE services where the need for interaction is particularly high. Maximum foreign ownership requirements (such as in the computer sector in Sweden), or requirements regarding the legal form of establishment in a country (present in nearly all six selected MS) could still be considered as a burden to entry for the establishment of such local affiliates.

Second, even though existing EU regulation addresses some regulatory barriers to PE services provision within the EU, **effective implementation** of EU-wide regulation remains crucial and the burden to complying with the regulation should not be too high. Evidence from the engineering services sector, where private industry initiatives regarding the mutual recognition of engineering titles (EUR ING) and professional cards have emerged to

facilitate the process of complying with EU regulation, show that regulation that is overly complicated or difficult to comply with could create costs to exporting and thus barriers to trade itself. The performance reviews of the European Parliament on the effectiveness of the Services Directive also suggest that differences in implementation and interpretation of the Directive still give rise to uncertainty regarding cross border provision of services which are advised to be addressed in order to reap the full benefits of the productivity-enhancing relation of the use of imported services.

Third, even though of lesser importance, regulatory factors that were mentioned that still inhibit provision of services abroad relate to finance and tax issues (from the industrial design sector). Obtaining insurance abroad could sometimes still be difficult when acquiring a project abroad requires an arranged insurance cover, but the foreign insurers are only willing to cover when the project is acquired and the local insurer charges a premium for the extra risk incurred from insuring a project in an environment they are less familiar with (and might have a different claiming culture). Also administrative burden regarding tax compliance or risk of non-payment abroad were found to sometimes add extra uncertainty and costs to providing PE services abroad.

Lastly, due to the focus on services provided to manufacturers and the emphasis on the productivity enhancing relations, future policy on improving this link through use of foreign business services should consider not only regulatory barriers to services trade only, but also regulatory differences across nations in product requirements or regulation on final manufactured products. In the advertising, marketing and communications sector, differences in national regulation on products (alcohol advertising, or gender issues in communication) increase the need to local knowledge and add (sunk) costs for foreign services providers.

Representatives from the manufacturing sector, on the other hand, did not mention particular problems with manufacturing companies' access to the services, be it domestic or foreign services. The lack of perceived hindrances for cross-border supply of services might be caused by the fact that in particular the more sophisticated business services require a close communication between the client and its service provider which is less the case for less sophisticated services such as transport and warehousing (where e.g. different languages do not impede cross-border activities). Difficulties that have been reported are e.g. in the realm of linguistic skills, social skills and cultural and country specifics. Concerning the cross-border flow of services provided by manufacturers mostly hindrances related to the free movement of workers have been mentioned which is sometimes delayed by intra-EU administrative provisions or country-specific regulations (e.g. concerning labour market regulations, recognition of qualifications). Other problems which have been mentioned arise from different legal provisions (member states provisions on safety in the workplace, health and environment) and a lack of knowledge on regulations.

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