KOMMERSKOLLEGIUM
NATIONAL BOARD OF TRADE SWEDEN

# The Servicification of EU Manufacturing

## Building Competitiveness in the Internal Market

2016:4

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# Foreword

The EU manufacturing sector has still not fully recovered after the severe downturn during the financial crisis of 2008. In a changing global trade and production landscape servicification can be a key to recovery and competitiveness. Servicification means that manufacturing increasingly depends on services. Manufacturing uses services to differentiate their products from competitors and to take advantage of production in global value chains.

What are the policy implications when manufacturing competitiveness increasingly depends on services? What are the opportunities and challenges on a European, national and company level?

This report examines the servicification of EU manufacturing and its implications for the EU internal market. The report pinpoints in what ways there is a link between services and manufacturing and why this link is important for building competitiveness in the EU.

This report has been written by Agnes Nordwall. Emilie Anér, Petter Stålenheim, Erik Dahlberg and Magnus Rentzhog have contributed with valuable comments. I wish to thank the external reviewer Magnus Lodefalk.

Stockholm, October 2016

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# Svensk sammanfattning

Tjänstefiering innebär att tillverkningsindustrin allt mer baserar sin verksamhet och konkurrenskraft på tjänster. Samtidigt finns många hinder mot fri rörlighet för tjänster inom och utanför EU. Är industrins allt större beroende av tjänster en möjlighet att stärka EU:s konkurrenskraft eller en utmaning för den?

Denna rapport analyserar tjänstefieringen av EU:s tillverkningsindustri och dess implikationer för EU:s inre marknad. Tjänstefiering innebär att industrin köper, producerar och säljer tjänster i allt större utsträckning. Rapporten innehåller beräknade indikatorer på tjänstefiering för enskilda EU-länder och EU som helhet. Den analyserar även forskning på effekterna av tjänstefiering på tillverkningsindustrins konkurrenskraft.

Rapporten visar att EU:s tillverkningsindustri köper och producerar tjänster i stor utsträckning. Att köpa insatstjänster är viktigt för industrin i alla EU-länder och allt viktigare över tid. Rapporten visar också att industrin producerar allt mer tjänster. Detta innebär att allt fler jobb inom tillverkningsindustrin är relativt högkvalificerade tjänstejobb. EU:s industri förändras därmed gradvis genom tjänstefiering mot en allt mer tjänsteintensiv industri.

I ett internationellt perspektiv är EU:s tillverkningsindustri relativt tjänstefierad. EU:s tillverkningsindustri köper och säljer mer tjänster än industrin i USA. Exporten från EU:s industri har också högre andel förädlingsvärde från tjänster än export från industrin i USA och Japan. Detta innebär att tjänster är centrala för konkurrenskraftig varuexport från EU.

Rapporten visar också att det i vissa aspekter är stora skillnader mellan EU:s medlemsländer i graden av tjänstefiering. I många länder är graden av tjänstefiering påtaglig och har ökat signifikant över tid. Detta innebär att tjänster är särskilt viktiga för industrin i flera EU-länder.

Andelen importerade tjänster i EU:s tillverkningsindustri är fortfarande relativt begränsad. Geografisk närhet mellan tillverkningsindustrin och tjänsteleverantörer är viktig för att tjänster ska kunna levereras. Detta gör tjänstehandel genom etablering viktig. Tillverkningsindustrierna i vissa av EU:s medlemsländer importerar dock en stor andel av sina tjänster och framförallt från länder utanför EU. Detta visar på att den finns potential att öka den gränsöverskridande tjänstehandeln inom EU.

Tjänstefiering innebär att hinder för tjänstehandel i allt större utsträckning är hinder för tillverkningsindustrin. Forskningen tyder på att hinder för tjänstehandel påverkar produktivitet och export i industrin negativt. Forskning indikerar också att tjänstehandel i industrin bidrar positivt till produktivitet och export. Detta innebär att fri rörlighet för tjänster inom EU är viktig för att tillverkningsindustrin ska kunna dra nytta av de potentiellt positiva effekterna av tjänstefiering.

# Executive Summary

Servicification means that manufacturing activities increasingly depend on services. Yet, there are still many remaining barriers to the free movement of services within and outside the EU. Is the manufacturing industry's increasing use of services a possibility to build competitiveness in the EU or a challenge to it?

This report investigates the servicification of EU manufacturing and its implications for the EU internal market. Servicified manufacturing refers to the increasing purchase, production and sale of services by manufacturing. The report presents several empirical indicators of servicification in individual member states and for the EU as a whole. It also analyses research into the effects of servicification on manufacturing competitiveness.

The report finds that EU manufacturing, on average, buys and produces services to a great extent. Buying service inputs is important for manufacturing in all EU countries and increasingly so over time. That manufacturing produces more services implies that manufacturing jobs increasingly are relatively skilled service jobs. The manufacturing industry is gradually through servicification becoming a service industry.

The report finds that manufacturing in the EU, in a comparative perspective, uses and sells more services (is more servicified) than manufacturing in the USA. Moreover, EU manufacturing exports have a higher share of value added from services than manufacturing exports from the USA and Japan. This makes services key for EU manufacturing competitiveness and exports.

The report shows that there are large cross-country differences in servicification within the EU. In some EU countries, servicification of manufacturing is substantial and increasing significantly over time. This makes services especially important for manufacturing in several EU countries.

Investigating trade in services in manufacturing shows that service imports in EU manufacturing are still limited. Proximity between manufacturers that buy services and the service suppliers is important. This makes trade in services through foreign establishment essential. However, some manufacturers import services to a great extent and primarily from outside the EU. This shows that there is potential to increase cross-border trade in services within the EU.

Servicification means that barriers to trade in services are increasingly barriers to manufacturing. Research indicates that barriers to trade in services reduce exports and productivity in manufacturing. Similarly, trade in services in manufacturing has a positive effect on manufacturing productivity and exports. The free movement of services in the EU is therefore essential to reap the benefits of the servicification of manufacturing.

# Policy Implications

1. Servicification means that manufacturing increasingly depends on being able to buy service inputs, hire service professionals and to sell service output. This implies that the free movement of services and persons is central to manufacturing.
2. EU manufacturing, in several respects, is more servicified compared to manufacturing in the USA. In an international comparison, policy relating to services is therefore relatively more important for the performance of EU manufacturing.
3. The cross-country differences in servicification mean that the distribution of interests supporting liberalisation of trade in services may vary between different EU countries. Services are important for manufacturers in all EU countries, but especially important for the highly servicified manufacturing industries.
4. Services influence the competitive advantages of high-tech, medium-tech and low-tech manufacturing. However, low-tech manufacturing particularly depends on being able to buy service inputs and high-tech manufacturing particularly depends on selling services as a complement to innovation.
5. The performance of EU manufacturing is highly linked to the competitiveness of distribution and business services. These service sectors should therefore be a policy priority from the perspective of manufacturing.
6. EU manufacturing increasingly needs access to skilled service professionals. The free movement of service providers and persons is therefore important for manufacturing.
7. The large differences in the share of imported services in manufacturing and the prominence of extra-EU imports indicate that there is scope for improvement for trade in services within the EU.
8. The importance of proximity between manufacturers and service providers implies that it is essential to facilitate foreign establishment in the EU to increase trade in services.
9. EU manufacturing exports are, in an international comparison, more highly servicified. This makes EU policy relating to services a priority for the competitiveness of EU manufacturing exports.
10. Evidence indicates that service imports, foreign establishment of service providers and openness to trade in services are positively linked to enhanced performance in manufacturing. Liberalisation of trade in services can therefore be important in reaping the benefits of the servicification of manufacturing.

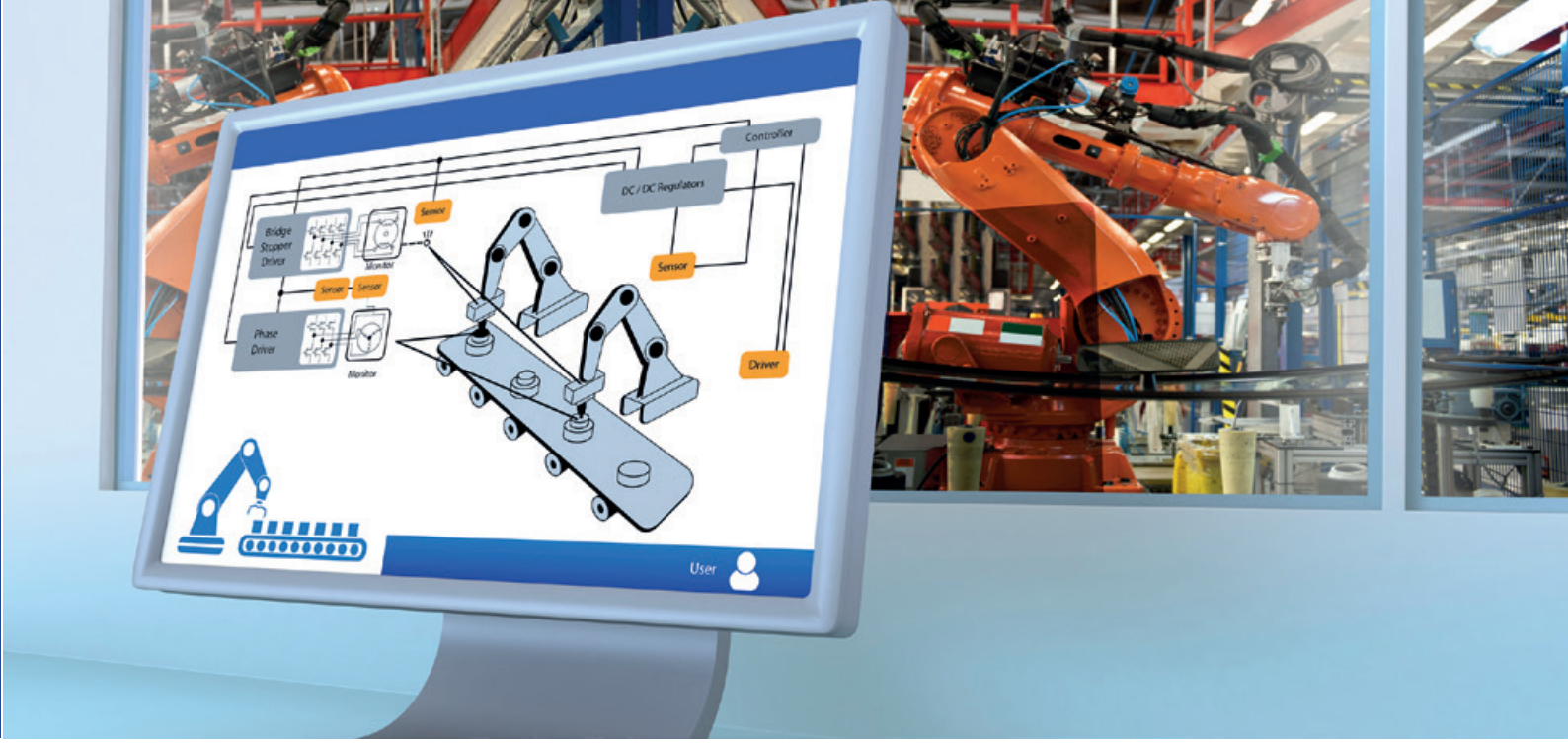
# Contents

# 1 Introduction

The EU manufacturing sector has still not fully recovered in terms of employment and output after the severe downturn during the financial crisis of 2008 (European Commission, 2015). The changing global trade and production landscape, with production hubs in emerging economies, means that EU industry faces new competition. It also means new patterns of production because manufacturing goods increasingly are produced in global value chains. These changing patterns of trade and production have propelled a discussion of what the competitive advantages of EU manufacturing are. That is, what is the European value added in manufacturing that can create jobs and growth in the EU?

In the light of this discussion, the concept of servicification has gained weight amongst policy makers. Broadly, servicification means that services are becoming more important in manufacturing activities. Servicified manufacturing increasingly *buys*, *produces* and *sells* services.

For example, the tool manufacturer Sandvik needs 40 different services to uphold its supply chain and deliver goods (National Board of Trade, 2010a). Rolls-Royce Aerospace not only sells engines but offers an integrated service-product solution. Moreover, some manufacturing firms, such as IBM, have reinvented themselves as service firms (Neely, 2007, p.1). In other words, many manufacturing firms increasingly base their value propositions on services and services are central for managing operations. Servicification, therefore, implies that competitive services could be a key to improving performance in manufacturing.




However, servicification may not automatically strengthen the competitiveness of EU manufacturing. Indeed, the productivity development of the service sector has been slower in the EU compared to the USA (O'Mahony, 2013, p.12). Moreover, several service sectors in the EU demonstrate low efficiency and there are still many remaining barriers to trade in the EU internal market for services (European Commission, 2015).

The question is: what happens when manufacturing competitiveness increasingly depends on service sectors that display relatively slow productivity development and face trade barriers? Openness to trade in services could therefore be a central part of making servicification an asset in manufacturing. The implication of this is that priorities in EU policy for the free movement of services are of strategic importance for manufacturing.

## 1.1 Purpose, outline and contribution

To assess the implications of servicification, it is first necessary to understand its characteristics. The purpose of this report, therefore, is to explore the features of servicification in the EU so as to assess the policy implications for the internal market. This is done in three parts.

- The report firstly investigates the main features of servicification in the EU by studying cross-country and industry differences.
- Secondly, we explore the link between trade in services and manufacturing in the EU.
- Lastly, we analyse research into the effects of servicification on manufacturing performance.

In relation to previous research, this report contributes by providing a comprehensive and comparative perspective on servicification in the EU over a period of approximately 20 years. This approach complements earlier studies that investigate servicification in a single country or company. The report explores three dimensions of servicification and analyses their trade in services dimensions. It thereby differs from earlier research which focuses on a single dimension or does not consider trade in services in manufacturing. The report also contributes by analysing research into the effects of servicification on manufacturing performance.

From a policy perspective, the study contributes by its focus on the implications for the EU internal market. The study shows the link between the two agendas of integrating EU service markets and increasing the competitiveness of EU manufacturing. The report pinpoints in what ways there is a link between services and manufacturing and why this link is important for building competitiveness in the internal market.

# 2 Why does Manufacturing Servicify?

The servicification of manufacturing can be defined as the fact that manufacturing increasingly *buys, produces* and *sells* services (National Board of Trade, 2010b). Services can be described as the "glue that holds the supply chain together" (Low, 2013, p.63). Services are, and have long been, a central part of manufacturing operations. The question is: why does manufacturing increasingly use services? That is, why does manufacturing servicify?

## 2.1 Firm motives for servicification

The motives for manufacturing to servicify have been discussed in several contributions.[1] Using this literature as a starting point, four main reasons for why firms servicify can be identified. These four reasons are common to all three aspects of servicification.

Firstly, manufacturing firms increasingly use services to become more productive. For example, the use of knowledge-intensive services may contribute to the adoption of new technologies and enhance production processes. Secondly, manufacturers increasingly need services to participate in value chains. This means that services such as transport and communication are increasingly necessary for manufacturing. Thirdly, using services can be a strategy for manufacturers to increase the value of products to consumers, strengthen customer relationships and differentiate products from competitors. For example, maintenance and repair services can be used to add value to products and to build customer relationships. Lastly, services are used in manufacturing to overcome market access barriers, both when exporting and when investing. An example is the use of legal services to comply with regulations.

Thus, there are several motives, from the perspective of the manufacturing firm, which can explain why manufacturers would servicify.

## 2.2 Trends in the economy and servicification

However, the process of servicification cannot only be understood in relation to activities at the firm level. The possible motives for servicification can also be related to three broader trends in the economy: 1. production and trade in value chains; 2. the increasing share of services in the economy and 3. the increasing competition in product markets. The servicification of manufacturing firms can be interpreted as a response to these three trends.

### Production and trade in value chains

Firstly, declining coordination costs have led to production increasingly being sliced up into different stages and spread out both geographically and organisationally (Nordås & Kim, 2013). These value chains demand more use of communication and transport services in manufacturing. Servicification can therefore be understood as a result of the global trend of production and trade in value chains.

However, servicification may, from the perspective of production in value chains also, partly be a "statistical phenomenon". Due to increasing outsourcing, services previously produced in-house are now purchased externally as inputs (Baldwin, 2015). This means that the use of services in manufacturing has not actually increased but merely shows up more in statistics.

## The increasing share of services in the economy

Secondly, servicification can also be understood in relation to the increasing share of services in the economy. Because of different relative price developments in services and manufacturing, services are increasing, both as a share of the overall economy and as a cost share in manufacturing. Servicification can therefore be viewed as a phenomenon caused by relative price developments (Baldwin, 2015).

However, the increasing share of services in the economy can also be viewed as a result of growing demand for services among consumers. Because of this growing demand, there is an opportunity for manufacturers to add value by adding service content to their products. Thus, servicification is not only caused by a relative price shift, but also a shift in business models and core activities in manufacturing related to changes in demand.

## The increasing competition in product markets

Lastly, servicification in the EU may also be seen as a result of increasing competition in the markets for manufactured goods, connected to the rise of emerging countries and the EU enlargement in 2004. This increasing competition has led to manufacturers differentiating their products with services (Baker et al., 2008). Indeed, switching to selling services is, in fact, a strategy for European manufacturers to tackle increased competition due to EU trade liberalisation (Breinlich et al., 2014). Hence, manufacturing focuses on service activities as a response to increased competition in goods markets.

## Summary and other possible explanations

In sum, the broader trends in trade and production indicate that servicification could become more prevalent: where the use of value chains is greater; where there is a high share of services in the economy and where manufacturers face greater competition. Servicification can be seen both as a statistical phenomenon and as a real change in the business models and core tasks of manufacturing.

Having summarised the possible drivers of servicification, it should be noted that the causes of servicification in manufacturing are far from being fully established. Moreover, the three possible causes listed do not comprise an exhaustive list; there may be other relevant factors such as digitalisation. This study will not try to explain the differences in servicification. It will, instead, discuss possible interpretations of cross-country differences and those between industrial sectors.

# 3 How can Servicification be Measured?

Servicification encompasses the whole life cycle of a product and all parts of the manufacturing value chain (Cernat & Kutlina-Dimitrova, 2014, p.7). Servicification can entail *embodied services*, such as design, which are embodied in the product and not possible to separate from it. Servicification can also mean *embedded services*, such as insurance services, which are added to the product at the point of sales and hence separable from it (Brockman & Stephenson, 2012; Pasadilla & Wirjo, 2014).

In other words, servicification is a rather broad phenomenon and can entail a wide range of activities in manufacturing. As already mentioned, servicification is defined in terms of manufacturing that increasingly *buys, produces* and *sells* services. Below, we shall disentangle the three dimensions of servicification in manufacturing and how these three dimensions will be operationalised and studied in this report.

## Servicification in terms of buying services: service inputs and service value added in goods

Purchased service inputs are often necessary for manufacturing to produce and sell goods. For example, a small company in the agri-food sector in Sweden needs 50 different services to manage operations (National Board of Trade, 2013). In practice, servicification in terms of purchased service inputs is visible in statistics as *bought service inputs* and *service value added* in manufacturing products.[2] While purchased service inputs represent the directly acquired services by manufacturing, service value added represents the value from all the service providers throughout the value chain.

## Servicification in terms of producing services: service employment

The vehicle manufacturer Volvo produces business services in-house to reduce lead times and develop new products (National Board of Trade, 2012). This is an example of how servicification is changing manufacturing production from within firms. Servicification, when seen as producing services within manufacturing firms, is measured in terms of the share of *service employees* in manufacturing.[3]

## Servicification in terms of selling services: service output

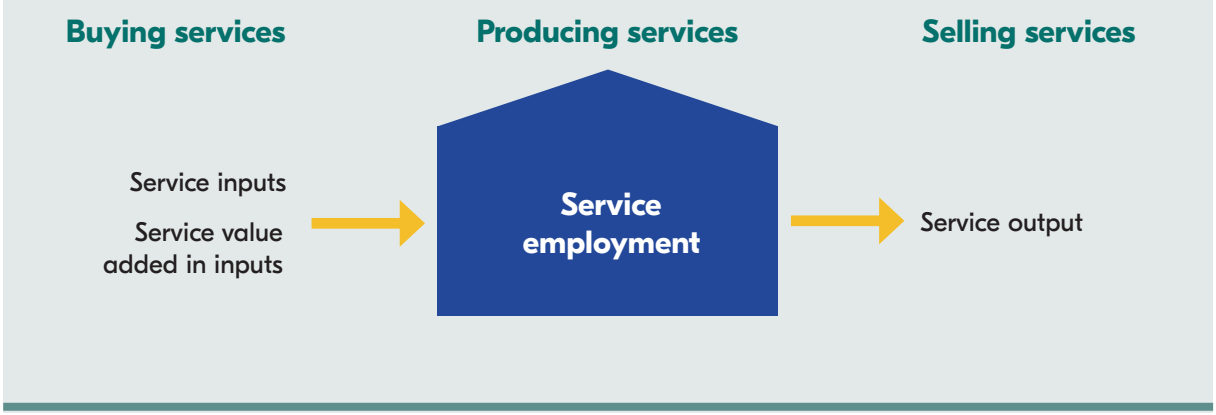
Servicification also means that manufacturing, to an increasing extent, sells services. For example, a manufacturer of wind farms sells maintenance and repair services along with its main product (National Board of Trade, 2014). Servicification in the form of selling services can be seen in the higher levels of *service output* in manufacturing.[4]

However, because many services are not charged for directly but rather sold in a package deal with the product, this aspect of servicification is not entirely covered by available statistics. The respective share of service output in manufacturing can therefore be interpreted as an indication of differences in servicification rather than an accurate measurement of sold services in manufacturing.

## International and domestic servicification

This study also makes a distinction between international and domestic servicification. Ser-

## Servicification: Buying, producing and selling services




vicification can be entirely domestic, for example when a manufacturer produces a service in-house and sells it to a domestic consumer.

However, servicification can also have international dimensions; for example, when a manufacturer imports R&D services or exports maintenance and repair services. This report studies international servicification by considering the links between manufacturing and service imports and exports.

More specifically, international servicification is measured as *service imports* in manufacturing and the link between manufacturing and *foreign establishment of a service provider*. International servicification can also be explored by investigating manufacturing *exports of services* and *service value added* in manufacturing *exports*.[5]

It would also have been interesting to study the link between manufacturing and trade in services in the form of temporary provision of services by a service provider. However, this aspect of trade in services has been excluded, due to data limitations and the fact that there are few studies investigating this phenomenon in the EU.

### Indicators of servicification and data sources

In sum, the report investigates three aspects of servicification, namely that manufacturing increasingly *buys* services (service inputs and value added), *produces* services (service employment) and *sells* services (service output).

Four dimensions of international servicification are explored: *service imports*, *foreign establishment of a service provider*, *service exports* and *service value added in exports* of manufacturing goods.

To study the different dimensions of servicification in the EU, this report uses industry-level data from the World Input Output Tables (WIOT) and the International Supply and Use Tables, both from the World Input Output Database (WIOD). These two datasets are available for all EU countries except Croatia (EU-27). The report also uses the Eurostat European Labour Force Survey, which includes all EU countries (EU-28). We also use the OECD AMNE database on foreign affiliates, which only includes data for some EU countries. The report uses industry-level data because it allows comparisons between different EU countries; the focus of this study. Firm-level data is not used, because comparable data is not available for all EU countries.

Firm-level data has the advantage that it can capture the interactions between the different dimensions of servicification within the firm (Pilat & Wölf, 2005). Studies using firm-level data also report higher shares of revenue generated from services, compared to the shares found in the International Supply and Use Tables.[6] This means that industry-level data could underestimate the extent to which manufacturers sell services. Studies into servicification using firm-level data will be used to give a complementary picture on the different dimensions of servicification.

# 4 Servicification of EU Manufacturing: Buying, Producing and Selling Services

To what extent is EU manufacturing servicified? Are there cross-country and industry differences? What services are important in servicification? The section below analyses the main features of the three dimensions of servicification in the EU; that manufacturing *buys, produces* and *sells* services. It also compares servicification in the EU to servicification in the USA. The section discusses the implications for the internal market.

## 4.1 Servicification of EU manufacturing

It seems uncontroversial that manufacturers are dependent on services for their operations. However, is servicification an economically significant phenomenon? Exploring data from the EU reveals that manufacturing purchases and produces services to a great extent (Figure 4.1-4.3).

Directly purchased service inputs constitute 27 per cent as a cost share of manufacturing output in the EU in 2011. The service value added constitutes 40 per cent of the value in final manufacturing goods. This means that competitiveness in manufacturing to a large degree, depends on being able to buy cost-efficient and high quality services.

Moreover, in-house production is also significant, with 42 per cent of employees in EU manufacturing working in service occupations. In other words, a substantial amount of economic activity in EU manufacturing is made up of services.

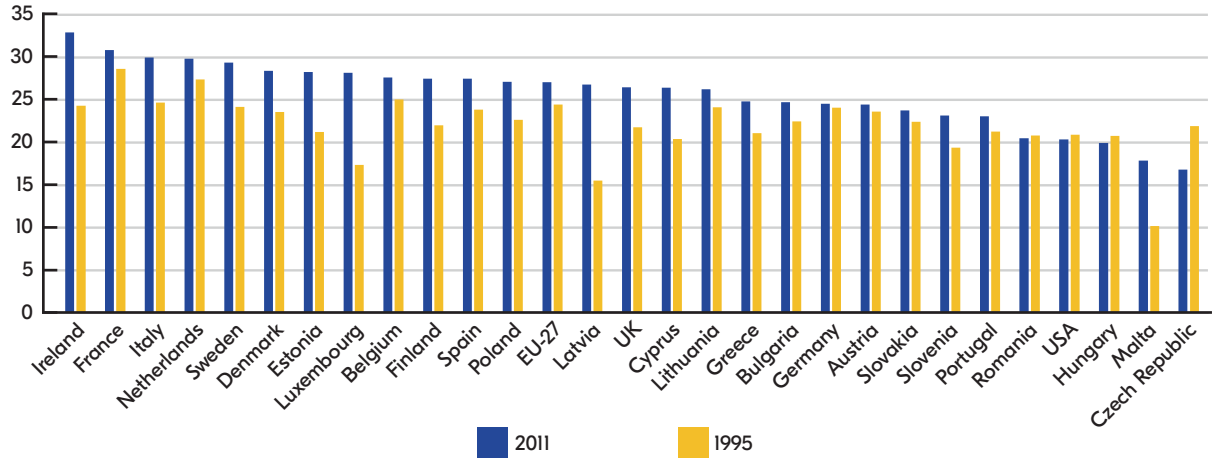
Selling services is still a comparatively limited phenomenon with only 5 per cent of revenue in EU manufacturing generated from services (Figure 4.4). However, industry-level data on service output may not fully measure the extent to which manufacturing sells services. This is because data only covers services charged for directly and not those charged for indirectly when services and goods are sold in a package deal.

Dachs et al. (2012, p.15) confirm that in most EU countries the revenue generated indirectly from selling services is slightly larger than the revenue generated directly from selling services. This means that the actual share of service output could be twice as large when compared to the figures reported in Figure 4.4.[7]

It should also be considered that services sometimes are necessary complements to the product, so called "indispensable services" (National Board of Trade, 2014). Thus, services could have a more central part in manufacturing value propositions than what is reflected in revenue statistics. In sum, industry-level data only displays marginal shares of service output in manufacturing. However, these statistics probably only partly measure the phenomenon of servicification.

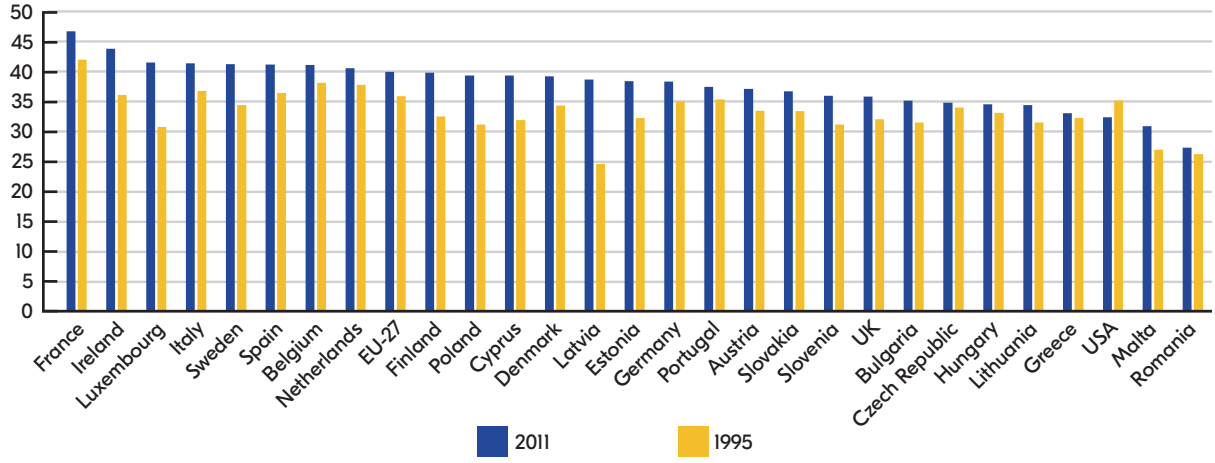
**Policy implication 1:** *Servicification means that manufacturing increasingly depends on being able to buy service inputs, hire service professionals and to sell service output. This implies that the free movement of services and persons is central to manufacturing.*

**Figure 4.1 Cost share of service inputs in manufacturing as % of gross output in manufacturing in the EU-27 and the USA, years 1995 and 2011**



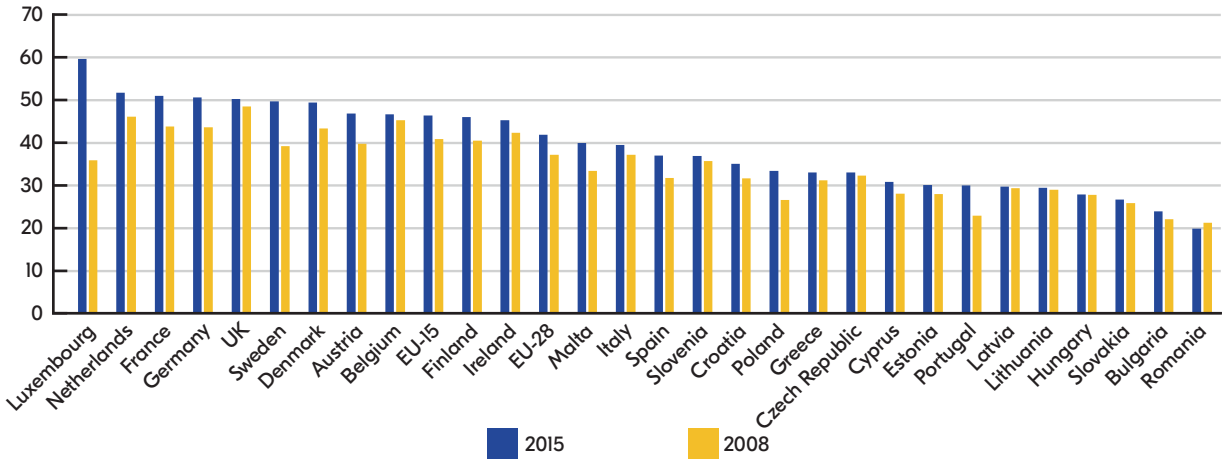

Source: WIOD and National Board of Trade calculations

**Figure 4.2 Service value added as % of final manufactured goods in the EU-27 and the USA, years 1995 and 2011**



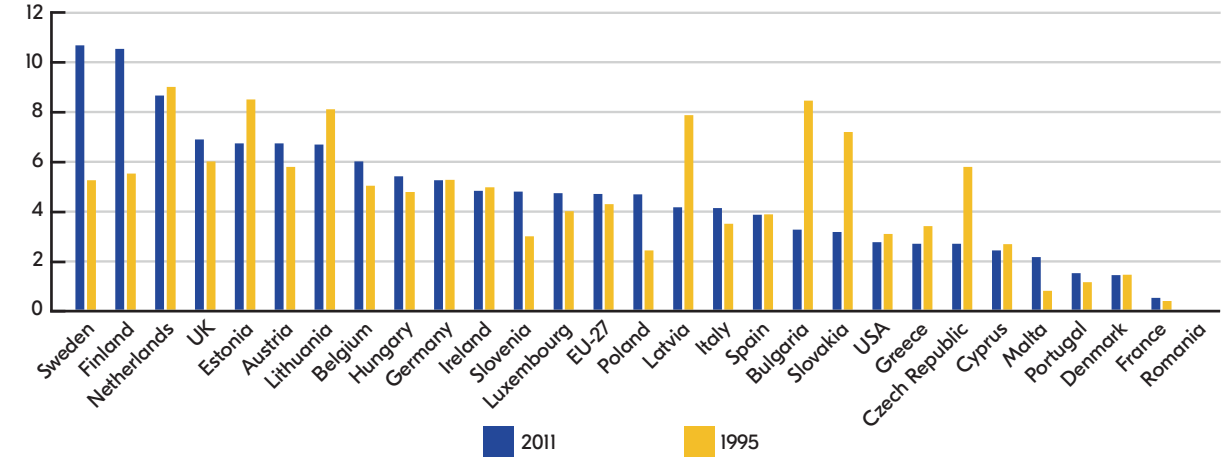

Source: WIOD and National Board of Trade calculations

**Figure 4.3 Service employees in manufacturing as % of total employees in manufacturing in the EU-28, years 2008 and 2015**




Source: EU-LFS and National Board of Trade calculations

**Figure 4.4 Service output in manufacturing as % of gross output in manufacturing in the EU-27 and the USA, years 1995 and 2011**




Source: WIOD and National Board of Trade calculations

## 4.2 Servicification in the EU and the USA

As highlighted above, services are important in EU manufacturing. However, is servicification in EU manufacturing significant from an international perspective? To assess this, we compare servicification in the EU to servicification in the USA.

Firstly, EU manufacturing on average buys more services compared to manufacturing in the USA (Figures 4.1-4.2). The share of service inputs in manufacturing is 27 per cent in the EU compared to 20 per cent in the USA. Similarly, the share of service value added in final manufactured goods is 40 per cent in the EU, compared to 32 per cent in the USA. Hence, EU manufacturing buys services to a greater extent than manufacturing in the USA.

Secondly, EU manufacturing also sells more services. Service output is 5 per cent in EU manufacturing compared to 3 per cent in the USA (Figure 4.4). Servicification is thus more prominent in the EU when it comes to selling services.

Lastly, Miroudot (2016, p.18) compares the share of service employees in manufacturing in 24 EU countries with the share of service employees in US manufacturing. The study finds that the share of service employees was approximately the same in 2015. Thus, servicification is more pronounced in the EU compared to the USA, in several but not all aspects.

Investigating changes over time displays that the share of service inputs, value added and output have on average increased in the EU between 1995 and 2011, but declined slightly in the USA over the same period. This means that the differences in servicification between the EU and the USA have increased over time.

How can we understand the differences in servicification between the EU and the USA? One possible explanation is that the differences partly reflect higher prices for services in the EU compared to the USA. The prices for services were, on average, 11 per cent higher in the EU compared to the USA (USITC, 2013, p.3-24). However, the decline in servicification in the USA over time is not as intuitively explained by price developments. This indicates that other factors could be relevant in order to understand the different trends in servicification in the EU and the USA.

**Policy implication 2:** *EU manufacturing, in several respects, is more servicified compared to manufacturing in the USA. In an international comparison, policy relating to services is therefore relatively more important for the performance of EU manufacturing.*

## 4.3 Cross-country differences in servicification

Thus, servicification is important in EU manufacturing but is it equally important in all member states? The EU average measurements of servicification hide significant differences between countries.

Starting with service inputs (Figure 4.1), buying services is common in manufacturing in most EU countries. However, there are some cross-country differences. In the most servicified countries, such as France and Ireland, the cost share of services in manufacturing is 30 per cent. In the least servicified countries, such as the Czech Republic, the cost share of services is below 20 per cent. A similar pattern can be seen for the service value added in final goods. In French manufacturing, 47 per cent of the value added in final goods comes from services, while in Romania this share is only 27 per cent (Figure 4.2). Thus, buying services is common in most EU countries, although there are some cross-country differences.

However, on investigating in-house production of services, the cross-country differences are even larger. The share of service employees in the EU range from above 50 per cent in the Netherlands to 30 per cent in Portugal and less than 20 per cent in Romania (Figure 4.3). In other words, there are significant cross-country differences when it comes to producing services.

Furthermore, there are also relatively large differences in the extent to which manufacturing sells services, as seen in Figure 4.4. In Sweden, 11 per cent of the revenue in manufacturing comes from services while in France, less than 1 per cent is generated from selling services.

Analysing changes over time reveals that there are not only differences in the scope of servicification but also the speed and direction of change. Overall servicification in terms of buying and producing services has become more pronounced in EU manufacturing between 1995 and 2011. Yet, there are substantial increases in servicifica-

tion in several EU countries, while other countries display modest increases. For example, in Poland the share of service value added has increased by 8 percentage points, while in Czech Republic the share has remained relatively stable. Moreover, in Sweden the share of service employees has increased by more than 10 percentage points, while in seven EU countries the increase is less than 1 percentage point. This points to slightly differing speeds of change.

Moreover, there is not a common EU trend for service output in manufacturing. Some EU countries have seen significant increases, such as in Sweden and Finland where the revenue generated from services is 5 percentage points larger in 2011 compared to 1995. By contrast, in Bulgaria, Slovakia and Latvia the revenue from services has declined by 4-5 percentage points. Indeed, servicification in the form of selling services is declining in almost half of EU member states. This suggests that EU manufacturing does not share a common trajectory in this aspect of servicification. Thus, manufacturers in different EU countries have different patterns of specialisation, where only manufacturers in some countries focus on adding value by increasingly adding services.

In sum, buying service inputs is common in manufacturing in most EU countries, although there are some cross-country differences. There are even larger differences in the degree to which manufacturers produce services and sell services. There are differing speeds of change in servicification. Some EU countries have seen large increases in servicification while other EU countries have had modest increases or even a decline in servicification.

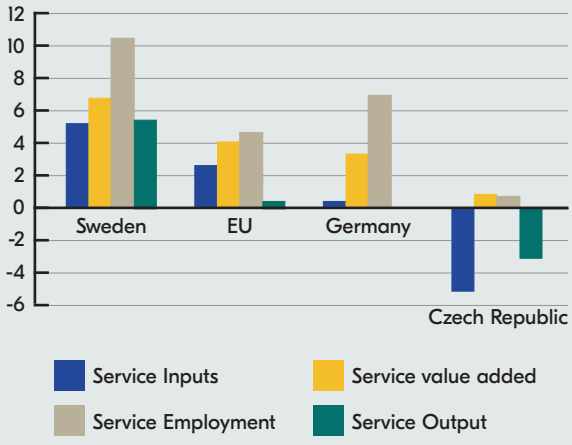
The cross-country differences suggest that EU countries, to some extent, have different points of departure considering the effects of services on manufacturing. Competitive services are generally important for all manufacturers and may have a higher marginal utility in the least servicified manufacturing firms. However, the competitiveness of services could have a larger direct effect on manufacturing firms that use services more intensively. For these manufacturers, liberalisation of trade in services is a key interest.

**Policy implication 3:** *The cross-country differences in servicification mean that the distribution of interests supporting liberalisation of trade in services may vary between different EU countries. Services are important for manufacturers in all EU countries, but especially important for the highly servicified manufacturing industries.*

## Box 4.1 Cross-country differences in servicification

There are differing speeds of change in servicification. As the examples below illustrate, some EU countries have seen large increases in servicification. However, other EU countries have had modest increases or even a decline in servicification.

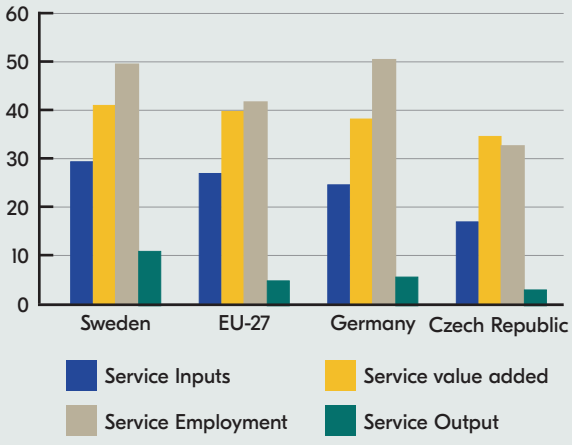
**Changes in servicification between 1995 and 2011 in percentage points**




Source: WIOD, EU-LFS and National Board of Trade calculations

There are also differences in the scope of servicification. As the examples below indicate, there are especially large differences in servicification when it comes to service employment and service output in manufacturing.

**Servicification in 2011 in per cent**




Source: WIOD, EU-LFS and National Board of Trade calculations

## 4.4 An overall assessment of cross-country differences in servicification

We have identified above that there are significant differences in the three dimensions of servicification in EU member states. How do member states rank if all three dimensions of servicification are considered collectively? To capture the general picture of differences in servicification, an index has been constructed. In this index (Figure 4.5), a country achieves the maximum score of three if it has the highest value in the EU on all three dimensions of servicification (service inputs, employment and output).[8]

Investigating the ranking in this index demonstrates that Sweden, Finland and the Netherlands hold the top three positions in terms of servicification in the EU. Other countries ranking at the top of this index are Luxembourg, the UK, Ireland, Belgium, Austria, and Germany.

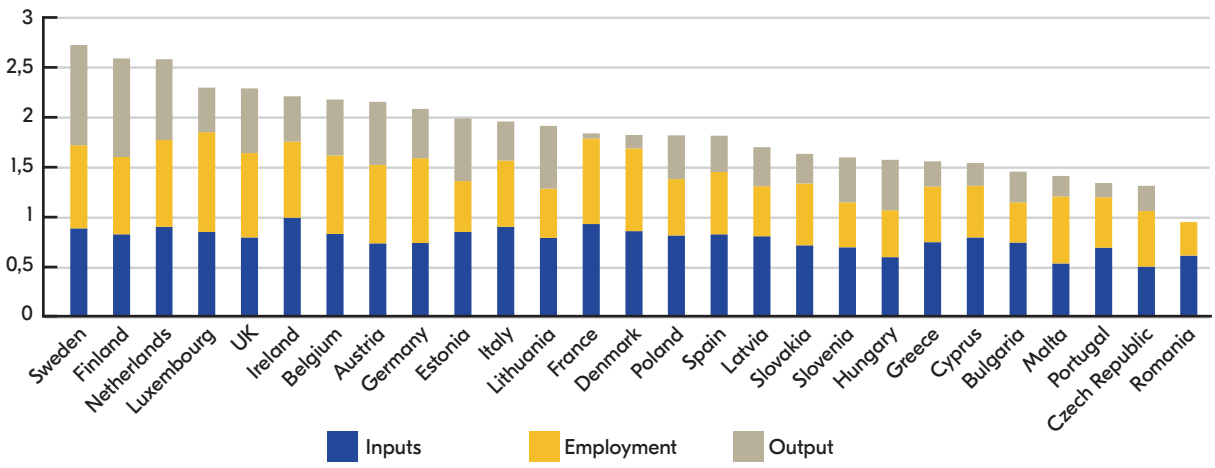
Moreover, comparing all the three dimensions of servicification highlights that some countries have high shares in all three aspects of servicification. However, some countries only have high shares in one or two dimensions. For example, Sweden, Finland and the Netherlands have relatively high shares in all three dimensions of servicification. By contrast, France, Belgium, Ireland and Luxembourg have high shares of service inputs and employment but relatively low shares of service output. Thus, there seems to be different patterns for the servicification of EU manufacturing.

How can we make sense of the different scales, trends and patterns of servicification in the EU? Previous research has noted that differences in *service inputs* can be understood in relation to different levels of economic development in EU member states (Baker et al., 2008, p.96). This makes sense from the perspective that EU countries with higher incomes generally rank higher in the index. Yet, it is also clear from the index that differences in economic development not fully explain the differences in servicification.

Moreover, studies have identified that the EU countries with the highest share of *service output* also have high R&D intensity (Sweden, Finland, Netherlands and the UK). However, some EU countries with high R&D intensity do not display high shares of service output in manufacturing (Denmark and France) (Dachs et al., 2012).

Consequently, previous research indicates that servicification is related to economic development and partly R&D intensity. Yet, these factors do not fully explain the cross-country differences in servicification. Other possible explanations, as discussed previously, are the drivers of servicification: participation in value chains, the increasing shares of services in the economy and competition in goods markets. Servicification could thus be higher where these factors are more prevalent. However, more research is needed to fully understand the cross-country differences in servicification.

**Figure 4.5 Index on servicification in the EU-27, years 2011 and 2015**




Source: WIOD, EU-LFS and National Board of Trade calculations

## 4.5 Industry differences in servicification

As highlighted above, there are significant cross-country differences in the degree of servicification in the EU. Are there also industry differences in servicification?

Figures 4.6 and 4.7 compare service inputs, service value added and service output in EU high-tech, medium-tech and low-tech manufacturing industries in 1995 and 2011.[9] Importantly, there is not a linear relationship where servicification increases with the technology intensity in manufacturing. However, some interesting industry differences can be discerned.

Starting with service inputs, the EU average suggests that buying services is especially important for low-tech manufacturing. The cost share of service inputs is 31 per cent in low-tech manufacturing, which can be compared to 25 and 26 per cent in medium- and high-tech manufacturing. A similar trend can be seen for service value added, which is 42 per cent in low-tech manufacturing compared to 37 and 39 per cent in medium- and high-tech manufacturing. The low-tech sector has also experienced the largest increases over time (5 and 6 percentage points).

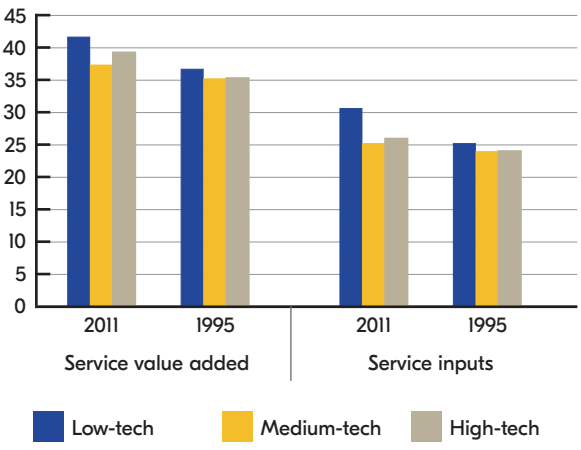
The high use of service inputs in low-tech manufacturing can partly be explained by the fact that transport and distribution services are especially important for these industries that often produce consumer goods (Stöllinger et al., 2013, p.7). Moreover, the significant increase over time can be understood in relation to the fact that low-tech sectors, such as textiles have been particularly impacted by globalisation and the reorganisation of manufacturing production. The ability to buy efficient service inputs is therefore particularly important for low-tech manufacturing companies in the EU.

By contrast, the selling of services is most pronounced in high-tech manufacturing. As seen in Figure 4.7, the share of revenue generated from selling services is 6 per cent in the more technology intensive industries compared to 3 and 4 per cent in medium- and low-tech manufacturing.

That technology intensive industries, such as the electrical and optical equipment industry, sell more services can be understood in light of the Dachs et al. (2012) and Stehrer et al. (2012) findings that service output in manufacturing is a result of innovative activities. Industries that often introduce new products sell complementary services to a greater extent. These complementary services are needed to reach the full potential of new products. Thus selling services is a key component in the value proposition of innovative manufacturing.

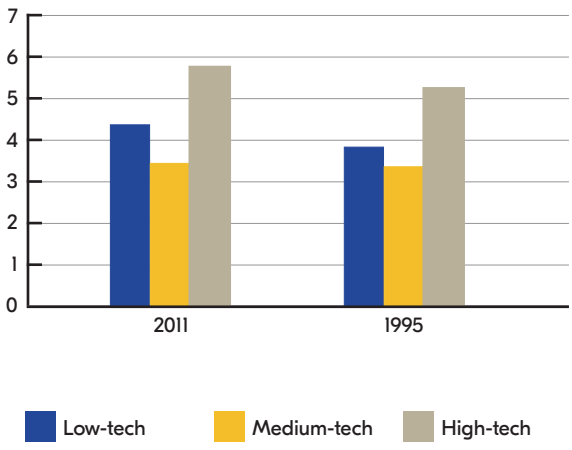
**Policy implication 4:** *Services influence the competitive advantages of high-tech, medium-tech and low-tech manufacturing. However, low-tech manufacturing particularly depends on being able to buy service inputs and high-tech manufacturing particularly depends on selling services as a complement to innovation.*

**Figure 4.6 Cost shares of service inputs as % of gross output and service value added as % of final goods in low-tech, medium-tech and high-tech manufacturing in the EU-27, years 1995 and 2011**




Source: WIOD and National Board of Trade calculations

**Figure 4.7 Service output in low-tech, medium-tech and high-tech manufacturing as % of gross output in these industries in EU-27, years 1995 and 2011**




Source: WIOD and National Board of Trade calculations

## 4.6 Key service sectors in servicification

As stated previously, the manufacturing company Sandvik uses 40 different services to uphold its supply chain and sell goods. What service sectors are most important in the servicification of EU manufacturing?

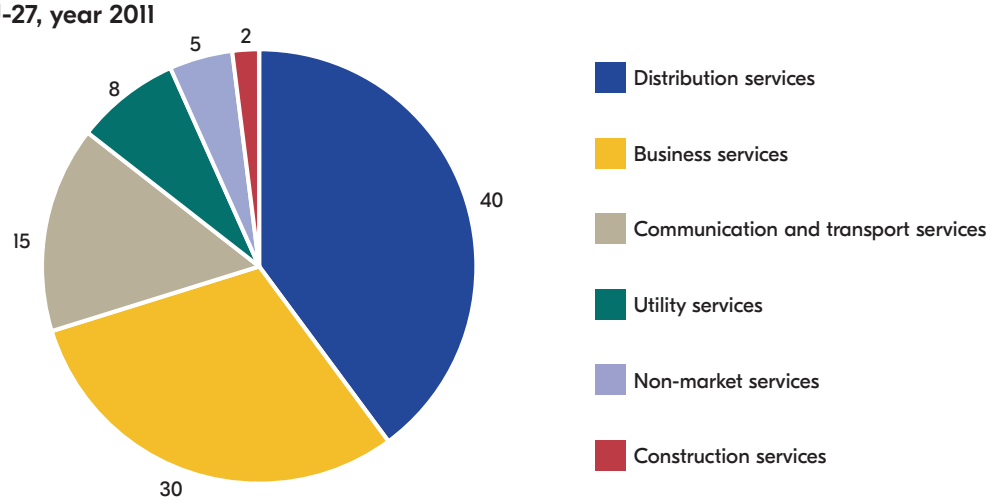
Investigating the different types of services reveals that distribution services and business services constitute the largest categories. Distribution services are for example maintenance and repair services and wholesale trade services. Examples of business services are computer services and R&D services.

Starting with purchased services, Figure 4.8 shows that service inputs comprise 40 per cent distribution services and 30 per cent business services.[10] In service value added (Figure 4.9) distribution, services make up 34 per cent while business services is the largest sector constituting 36 per cent. Thus, when the whole value chain is considered, business services constitute the largest category.

Communication and transport services constitute approximately 15 per cent of service inputs and value added. However, it should be noted that these services are necessary for the delivery and production of goods (Nordås & Kim, 2013).

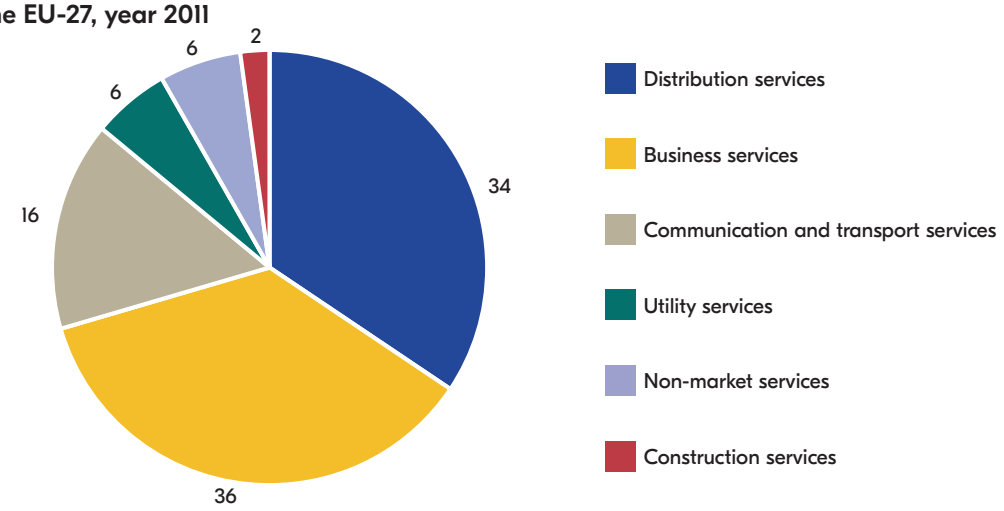
Moreover, investigating service output in manufacturing reveals that it consists of 55 per

**Figure 4.8 Different service inputs in manufacturing as % of total service inputs in manufacturing in EU-27, year 2011**



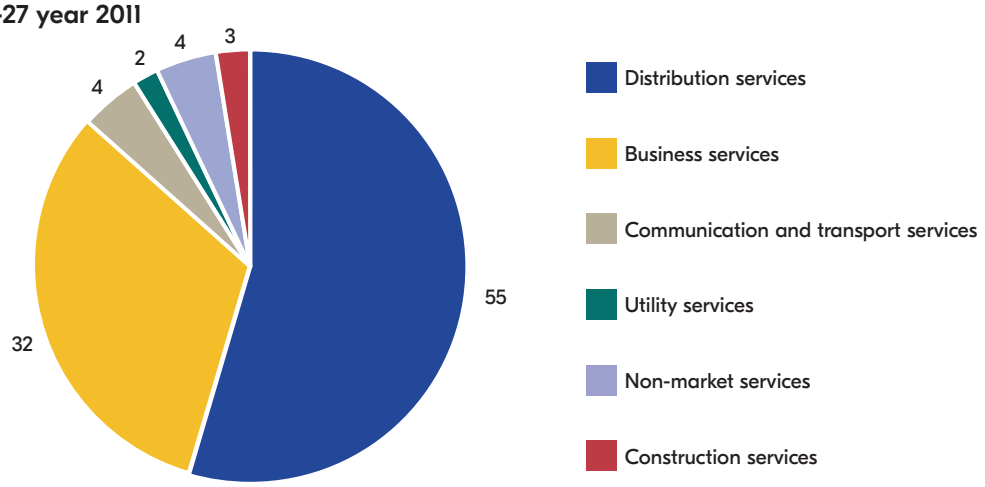

Source: WIOD and National Board of Trade calculations

**Figure 4.9 Different service sectors as % of total service value added in final manufacturing goods in the EU-27, year 2011**




Source: WIOD and National Board of Trade calculations

**Figure 4.10 Different service output in manufacturing as % of total service output in manufacturing in EU-27 year 2011**




Source: WIOD and National Board of Trade calculations

cent distribution services and 32 per cent business services (Figure 4.10).[11]

In sum, the large shares of distribution and business services in manufacturing mean that the performance of these sectors will be reflected in manufacturing. It is important to note that these service sectors display lower efficiency than for example communication and transport services (European Commission, 2015, p.75). The competitiveness of business services and distribution services is therefore a policy priority for manufacturing.

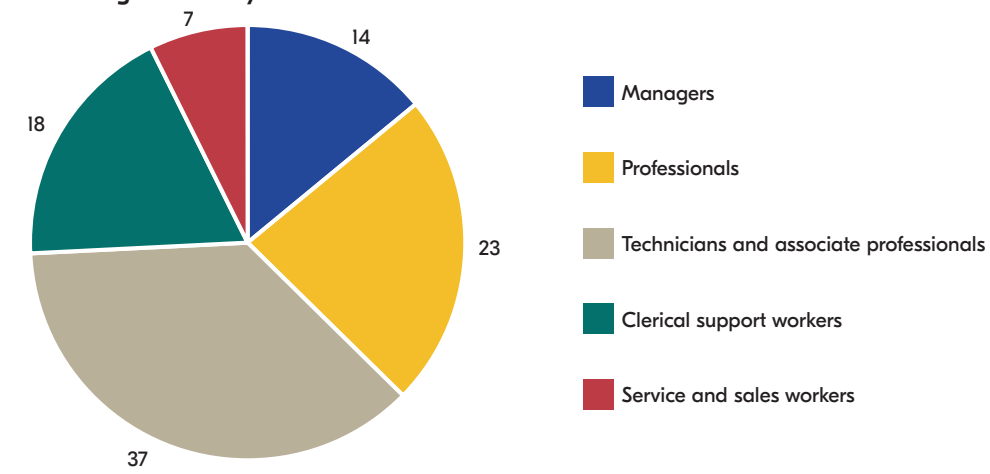
**Policy implication 5:** *The performance of EU manufacturing is highly linked to the competitiveness of distribution and business services. These service sectors should therefore be a policy priority from the perspective of manufacturing.*

## 4.7 Key service occupations in servicification

The key services in the servicification process can also be identified by looking at the types of service employees in EU manufacturing. As seen in Figure 4.11, the more high-skilled occupations; managers, professionals and technicians constitute more than 70 per cent of service employees in manufacturing. The more low-skill professions such as clerical support workers and service and sales workers constitute less than 30 per cent. Servicification as in-house production of services is therefore rather skill-intensive.

In other words, manufacturing, to a large degree, consists of skill-intensive service production. This high share of skilled service profession-

**Figure 4.11 Different service occupations in manufacturing as % of total service employment in manufacturing in EU-28 year 2015.**




Source: EU-LFS and National Board of Trade calculations

als is partly a result of servicification. A study of EU countries reveals that increases in service output in manufacturing have led to a higher share of employed managers, professionals and technicians. In contrast, service occupations such as clerks and administrative support have not gained in terms of employment. Moreover, purchased service inputs are found to be complementary to service occupations such as professionals and technicians (Falk & Peng, 2013). Thus, servicification is changing the employment structure in manufacturing firms, leading to an increase of skilled service employees and a decrease in lower skilled professions.

**Policy implication 6:** *EU manufacturing increasingly needs access to skilled service professionals. The free movement of service providers and persons is therefore important for manufacturing.*

## 4.8 Conclusion

Servicification is a central aspect in manufacturing operations. Being able to buy services, hire service professionals and sell service output are all essential for manufacturing operations. EU manufacturing, in several ways, is more servicified than manufacturing in the USA. This makes EU policy for the free movement of services relatively important for EU manufacturing.

There are different scales, speeds and directions of change of servicification in EU countries. Cross-country differences are particularly large when it comes to producing and selling services. The differences in servicification indicate that services vary in importance for industrial sectors. Services are important for manufacturing in all EU countries, but especially for highly servicified manufacturing industries.

Servicification influences the performance in all manufacturing sectors. However, low-tech manufacturing, particularly, depends on access to service inputs while high-tech manufacturing depends on selling services. Distribution and business services constitute a large part of the services used in manufacturing. The performance of these sectors will therefore be reflected in manufacturing. Moreover, with increasing shares of service employees, manufacturing firms are gradually becoming skill-intensive service firms.

# 5 International Servicification in the EU

The above section has shown that servicification is a central aspect of EU manufacturing activities. Is servicification a purely domestic phenomenon or does it have trade dimensions? The extent of international servicification shows to what degree manufacturers trade in services and, therefore, are affected by regulation of trade in services.

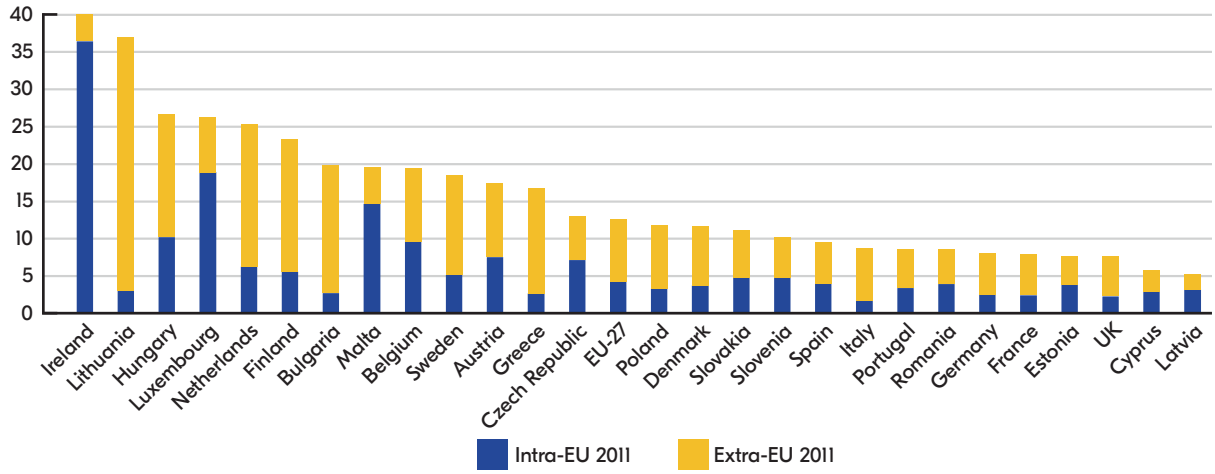
The section below investigates the extent of international servicification in the EU and discusses its policy implications. More specifically, the section analyses *service imports* and the relationship between manufacturing and *foreign establishment of a service provider*. It also investigates *service exports* in manufacturing and *service value added* in manufacturing *exports*.

## 5.1 The share of imported services

As described in the previous section, service inputs on average constitute 27 per cent of the cost share in EU manufacturing. To what extent are these service inputs imported?

Figure 5.1 shows that on average 13 per cent of service inputs are imported in EU manufacturing. However, some EU countries have significantly higher import shares. In addition to exceptionally high imports in Ireland (75 per cent), imports are significant in Lithuania where the import share is 37 per cent and in the Netherlands where 25 per cent of inputs are imported. This can be compared to Latvia where 5 per cent of services

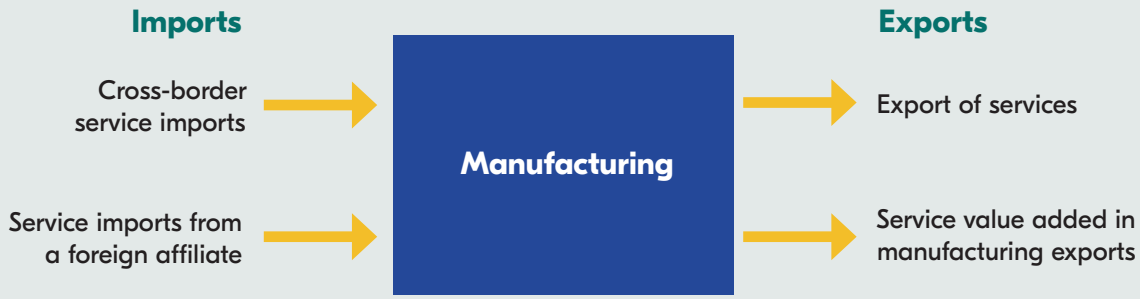
**Figure 5.1 Intra- and extra-EU-27 imports of services in manufacturing as % of total service inputs in manufacturing, year 2011**




Source: WIOD and National Board of Trade calculations


## Box 5.1 Types of trade in services[12]

### International Servicification




Trade in services is a wider concept than trade in goods. While the latter simply covers goods sent from one territory to another, the former includes several different ways of delivering a service. The WTO and EU definitions of trade in services differ slightly. The EU definition distinguishes between two types of trade in services: temporary and permanent service provision. The WTO definition uses four categories of services trade: cross-border, consumption abroad, movement of natural persons and establishment. Using both the EU and WTO definitions, trade in services can be categorised as below.

### Temporary service provision

**Cross-border trade:** Services are delivered from one country to another; in this scenario it is only the service that moves (e.g. e-accounting services). This type of trade corresponds to trade in goods.

**Consumption abroad:** Consumers in one country travel to another country to consume services (e.g. tourism)

**Temporary movement of service providers:** The delivery of services is made by a service provider making a temporary visit to another country (e.g. temporary visit by an expert).

### Permanent service provision

**Establishment:** Services are delivered by a supplier establishing an operation in another country (e.g. establishment of a subsidiary company).

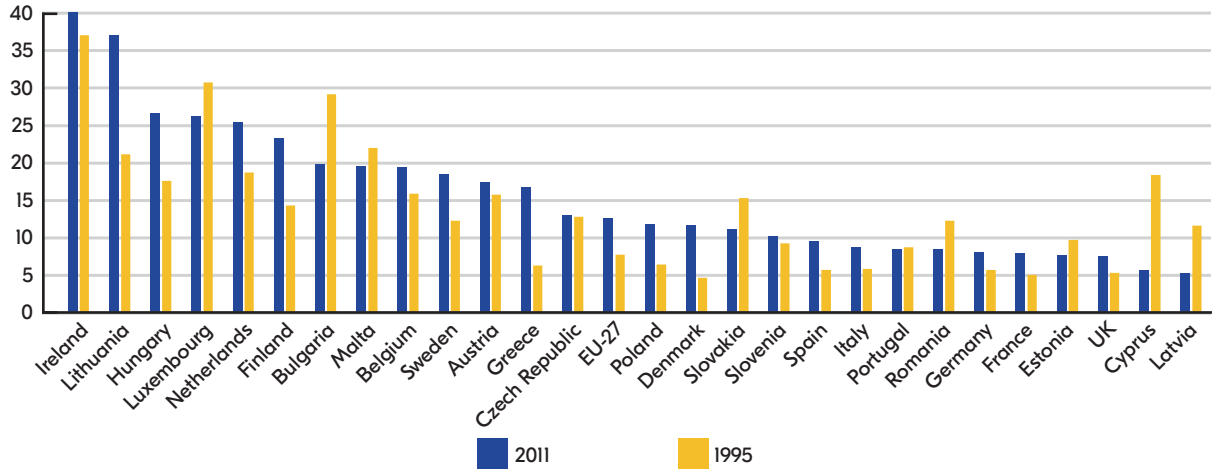
are imported and the UK where the import share is 8 per cent. Thus, there are relatively large differences in the share of imported service inputs in EU manufacturing. However, on average the share of imported service inputs in manufacturing is limited.

Moreover, exploring the intra- and extra-EU components of imports in Figure 5.1, it is interesting to note that extra-EU sourcing is relatively more pronounced. In most EU countries, manufacturing imports more than half of services from countries outside the EU.

Investigating changes over time (Figure 5.2), the EU average import share has increased by 5 percentage points between 1995 and 2011, from 8 to 13 per cent. This is a rather substantial increase. Moreover, manufacturing in ten EU countries has seen even larger increases of above 5 percentage points. By contrast, in eight member states import shares in manufacturing have in fact declined.[13] Thus, international servicification is increasing substantially in many EU countries but not in all countries.

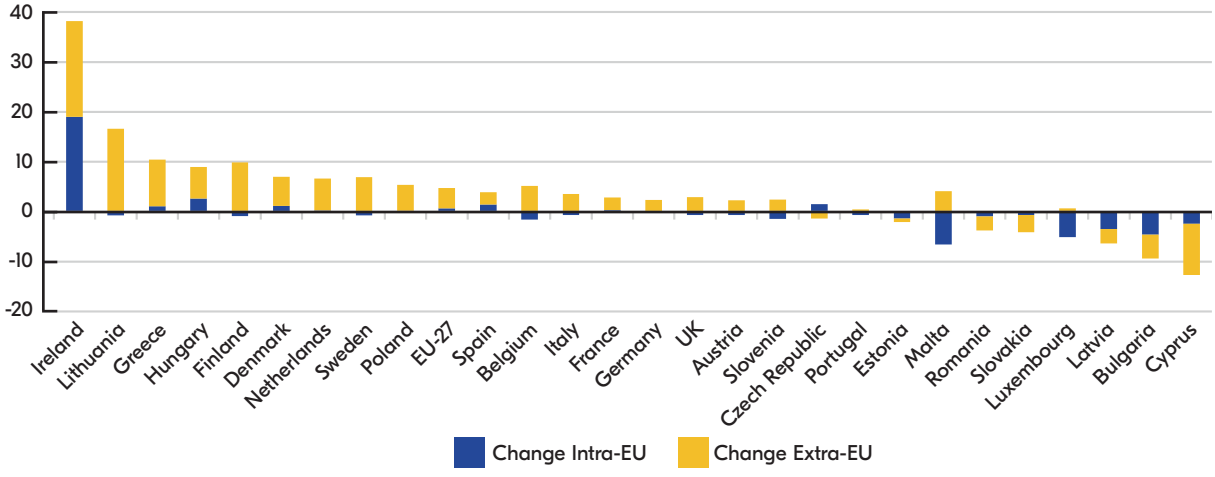
If we analyse the changes in service imports, it is clear from Figure 5.3 that it is mainly imports from outside the EU that have increased. By contrast, the share of intra-EU imports of services in manufacturing has even declined in some countries. EU manufacturers thus seem to integrate faster with countries outside the EU.

**Figure 5.2 Import of services in manufacturing as % of total service inputs in manufacturing in the EU-27, years 2011 and 1995**




Source: WIOD and National Board of Trade calculations

**Figure 5.3 Changes in the share of intra- and extra-EU-27 imports of services in manufacturing between 1995 and 2011, in percentage points**




Source: WIOD and National Board of Trade calculations

The low import share of services in manufacturing can, to some extent, be understood in relation to the limited tradability of services across borders. This results in a large share of trade in services occurring through establishment. The size of the home market of service providers naturally also matters. Manufacturing in large EU countries such as Germany, the UK and France generally has lower import shares. These factors are to some extent natural barriers which may not be influenced by policy.

The declining import shares of services in manufacturing in several EU countries could both be related to barriers and increases in foreign establishments, which replace cross-border imports. Several of the countries with declining import shares rank relatively high in barriers to trade and investment (Estonia, Latvia, Cyprus and Malta). By contrast, some of the countries with declining shares have seen significant inward FDI (Luxembourg, Bulgaria, Slovakia and Romania).[14] Thus, both explanations could be relevant in relation to declining import shares in some EU countries.

It is important to note that manufacturers in several EU countries have in fact succeeded in importing substantially and primarily from outside the EU. Furthermore, service imports have in many countries increased considerably over time. The large differences in import shares and the prominence of extra-EU imports indicate that there is probably untapped potential for trade in services by manufacturers within the EU.

**Policy implication 7:** *The large differences in the share of imported services in manufacturing and the prominence of extra-EU imports indicate that there is scope for improvement for trade in services within the EU.*

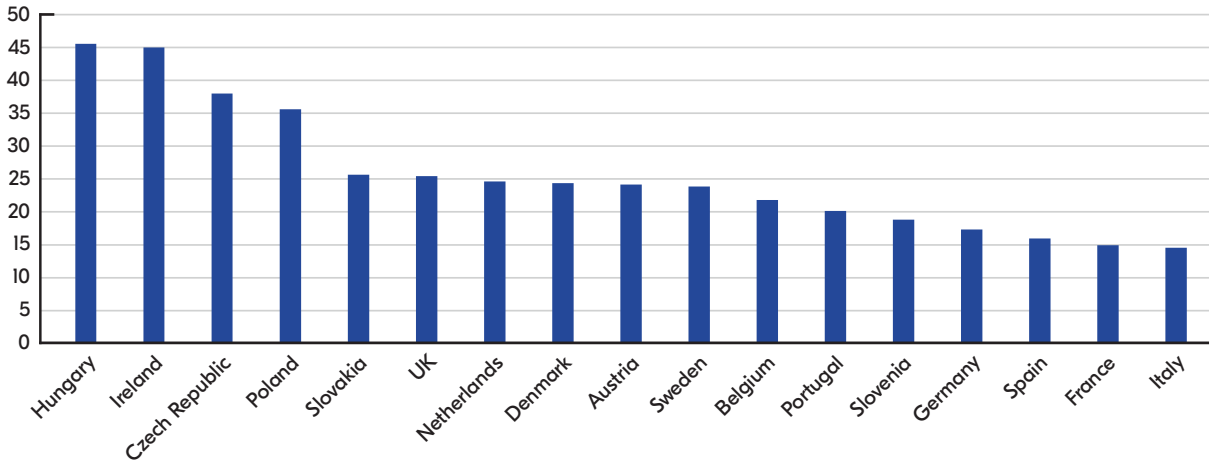
## 5.2 The importance of foreign affiliates

The degree of service inputs in manufacturing by foreign affiliates is of interest because multinational companies are often more productive. A multinational company providing services could, for example, be a management consultancy firm or advertising agency established in multiple countries. However, there do not seem to be any statistics on the extent of service inputs in manufacturing provided by foreign established firms. The share of imported service inputs is thereby underestimated.

The value in national production of services generated by foreign affiliates can be substantial.[15] Figure 5.4 shows that the shares range from 45 per cent in Hungary to 25 per cent in the UK and 15 per cent in France. With considerable shares of services generated by foreign affiliates, this may be an important channel of service imports in manufacturing.

Research indicates that service inputs from foreign affiliates are important. This is demonstrated by the fact that the foreign establishment of service firms and the supply of services both

**Figure 5.4 The value added share of foreign affiliates in the service sector in selected EU countries, year 2011**




Source: AMNE/OECD and National Board of Trade calculations

increase in regions where there are many manufacturing firms. In other words, service suppliers agglomerate close to manufacturing firms that buy their services (Castellani et al. 2016; Meliciani & Savona, 2015).

This makes sense owing to the fact that services often are co-produced by the seller and the buyer of the service (Baker et al., 2008). Frequent interactions between suppliers and buyers of services can be a requirement. Thus, proximity between manufacturers that buy the services and the service firms is important. This means that facilitating foreign establishment may be necessary to increase the availability of services.

**Policy implication 8:** *The importance of proximity between manufacturers and service providers implies that it is essential to facilitate foreign establishment in the EU to increase trade in services.*

## 5.3 Manufacturers are also exporters of services

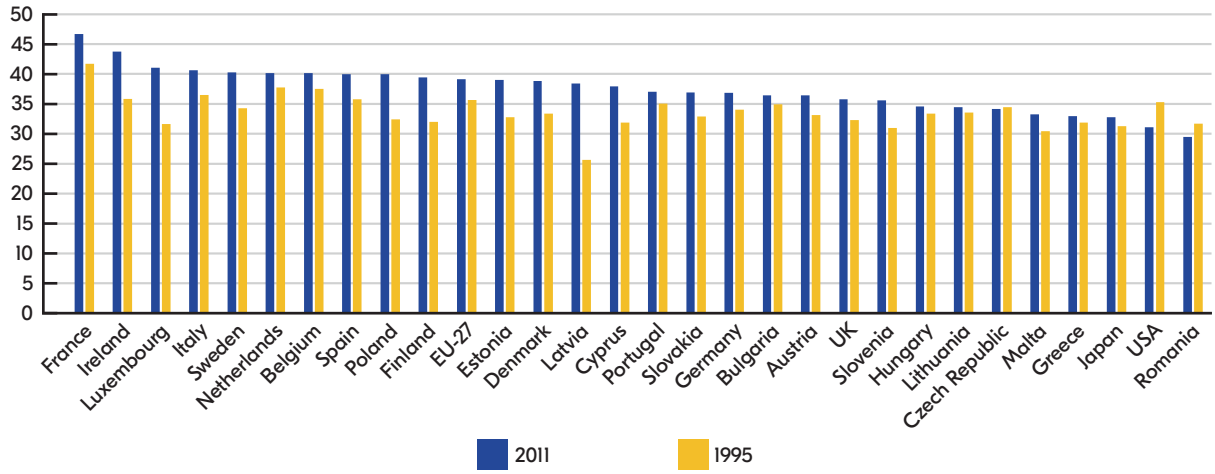
Manufacturers sell services, but do they also export services? We know, for example, that manufacturers of wind farms also export maintenance and repair services. However, is exporting services common in manufacturing?

There is no EU-level data available yet, but country evidence shows that manufacturers are important service exporters. In Germany and Sweden 25 per cent of total service exports come from manufacturing firms. In Italy, 35 per cent of service exports come from manufacturing.[16] Slightly smaller shares are found in Austria and the Czech Republic where 16 per cent of service exports are exported by manufacturers and Denmark and Poland where 10 per cent of total service exports come from manufacturers.[17] Thus, evidence indicates that manufacturers, in fact, are service exporters. The implication of this is that manufacturers are stakeholders in policy regarding trade in services.

## 5.4 Service value added in manufacturing exports

How much of the value of a manufactured good actually consists of services? That is, how much of the value of a car comes from services such as R&D, design, logistics and marketing? Investigating the value added in manufacturing exports in the EU shows that approximately 39 per cent is value added from services. This can be compared to the shares of service value added in manufacturing exports from the USA (31 per cent) and Japan (33 per cent).

**Figure 5.5 Service value added as % of manufacturing exports of final goods in EU-27, years 2011 and 1995**

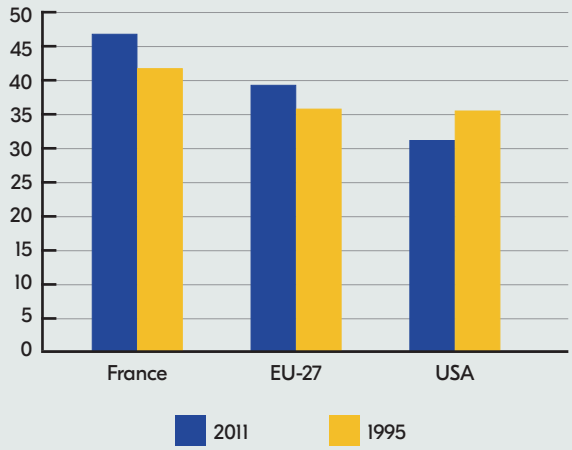



Source: WIOD and National Board of Trade calculations

## Box 5.2 Cross-country differences in international servicification

There are significant cross-country differences in the share of service value added in manufacturing exports. As the example below illustrates, French manufacturing exports are more servicified compared to manufacturing exports from the USA. There are also different trends where manufacturing in the USA has seen a decline in service value added in exports.

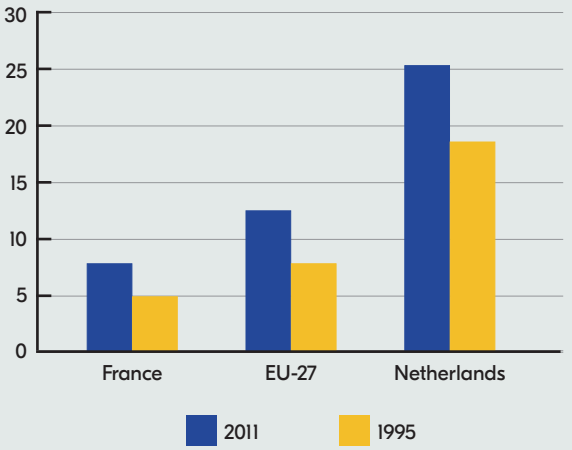
**Service value added in manufacturing exports in 2011 and 1995 in per cent**




Source: WIOD and National Board of Trade calculations

There are substantial differences between EU countries in the share of imported services in manufacturing. As the example below illustrates, manufacturing in the Netherlands imports a large share of service inputs and increasingly so over time. By contrast, in France the share of imported services is more limited.

**Share of service imports in manufacturing in 2011 and 1995 in per cent**




Source: WIOD and National Board of Trade calculations

Interestingly, all EU countries (except Romania) have higher shares of service value added in their exports compared to the USA and Japan. Moreover, in most EU countries the share of value added from services has increased between 1995 and 2011, while in the USA this share has declined.

As discussed previously, there are many possible explanations for the different shares of service inputs in manufacturing. However, regardless of its causes, it is clear that the competitiveness of EU exports to a larger extent is determined by services. In comparison with other major exporting countries, manufacturing exports from EU countries are more servicified.

**Policy implication 9:** *EU manufacturing exports are, in an international comparison, more highly servicified. This makes EU policy relating to services a priority for the competitiveness of EU manufacturing exports.*

## 5.5 Conclusion

In sum, international servicification in the EU, measured as service imports in manufacturing, remains low. However, service imports have in many countries increased considerably over time. Furthermore, the large differences in import shares between manufacturing in different EU countries and the prominence of extra-EU imports indicate that there is scope to increase intra-EU imports.

Research also points to the fact that proximity between service providers and manufacturers that buy services is important. This means that it may be necessary to facilitate foreign establishments to increase the availability of services.

Country evidence indicates that a considerable share of services is exported by manufacturing firms. Moreover, a large share of EU manufacturing exports consists of value added from services. The implication of this is that EU export competitiveness, to a large degree, is determined by services.

# 6 The Effects of Servicification on Manufacturing Performance

So far, the importance of services in manufacturing has been highlighted from several perspectives. As discussed previously, there are several reasons for manufacturing to servicify such as becoming more productive and facilitating exports. But does servicification actually result in these benefits?

The next section analyses the research into the effects of servicification on manufacturing performance. The focus has been on empirical studies using data from the EU and OECD or from a single EU country. Manufacturing performance is in these studies defined primarily in terms of profits, productivity and exports.

Research into the effects of the two dimensions of servicification, namely that manufacturing *produces* and *sells* services is relatively limited. This literature will therefore only be discussed in brief. By contrast, there are several contributions investigating the effects of *bought service* inputs. This literature will therefore be discussed in more detail.

## 6.1 The effects of producing and selling services

Manufacturers sell services to gain advantages against competitors, strengthen customer relationships, differentiate market offerings and diffuse new innovations (Vandermerwe & Rada, 1988). However, does *selling services* actually improve performance in manufacturing? This question has been explored in some recent contributions using firm-level data.[18] Findings indicate that whether servicification improves performance depends on several factors. This complex relationship between selling services and performance in manufacturing has been called the "service paradox". This means that manufacturers start selling services to increase profits, but are not always rewarded for their investment (Gebauer et al., 2005).

The most comprehensive empirical study in this field is Crozet and Milet (2015) who investigate whether starting selling services impacts performance in French manufacturing. They find that firms that start selling services increase their profitability, employment and total sales of goods.[19]

Moreover, does *service employees* in manufacturing influence the performance in manufacturing? Lodefalk (2014) explores the effects of in-house production of services on the export performance of Swedish manufacturing. The study finds that in-house employed service professionals indeed increase the export intensity in manufacturing. Possible explanations are that in-house services can be used to overcome costs of exporting and enhance productivity.

In sum, servicification could improve performance in manufacturing in terms of profits, employment, output and exports. However, more research is needed to establish when and how servicification improves performance in manufacturing.

## 6.2 The effects of buying services

The previous section has found that manufacturing firms that start selling services and employ service professionals in-house could improve performance. How does *buying* services impact performance in manufacturing? Research into the effects of buying services investigates both the effects of *servicification* and *international servicification* (trade in services in manufacturing). Manufacturing performance is in these studies defined mostly in terms of productivity and exports.

The literature on the effects of *bought services* can be divided into three broad categories: 1.the effects of purchased services and service imports, 2. the effects of foreign establishment of a service provider 3.the effects of domestic regulation in services and barriers to trade in services.

### The effects of purchased services and imported services

As already mentioned, where EU manufacturing is concerned, on average 27 per cent of the cost share comprises purchased service inputs and 40 per cent of the value added in goods comes from services. Does EU manufacturing benefit from buying service inputs?

To start with, Lodefalk (2014) finds that purchased service inputs in Swedish manufacturing do not on average improve performance in manufacturing in terms of increased exports of goods. However, the study does not distinguish between domestic and imported service inputs. This is of relevance because research indicates that whether service inputs improve performance in manufacturing or not depends on whether they are bought domestically or imported.

More specifically, studies by Wolfmayr (2012, 2008) show that service imports in manufacturing increase manufacturing exports while domestic service inputs do not display a positive effect.[20] Similarly, Schwörer (2012) finds that imported service inputs increase manufacturing productivity while domestically sourced services do not have a significant effect.[21] Thus, research indicates that imported service inputs display positive effects on manufacturing exports and productivity. However, domestic inputs do not have significant effects.

How can we make sense of the fact that it is imported inputs that display positive effects on manufacturing performance? A possible explanation is that trade in services increases the availability of service providers. Greater availability of service providers enables manufacturers to have access to cost-efficient, high-quality and better matching service inputs. Thus, service imports could improve performance in manufacturing through efficiency gains, quality gains and knowledge spillovers (Schwörer, 2013; Wolfmayr, 2012).

### Industry differences in the effects of purchased and imported services

Previously we have highlighted that there are industry differences in servicification in the EU. Interestingly, research indicates that trade in services especially is connected to improved perfor-

mance in more technology intensive manufacturing industries. Indeed, service imports in manufacturing and the level of service imports overall mainly increase productivity and exports in technology intensive manufacturing industries (Francois & Woerz, 2008; Wolfmayr, 2012).[22] Similarly, Stehrer et al. (2015) finds that the foreign value added of services only has a positive effect on productivity in more technology intensive industries. This means that openness to trade in services could be particularly important for competitiveness in more technology intensive manufacturing.

One possible explanation for the fact that positive effects are mainly found in technology intensive manufacturing is that high-tech manufacturers are more intensive users of business services (Baker et al., 2008). Stehrer et al. (2015) only studies the effects of business services and Francois and Woerz (2008) only find significant effects for trade in business services. However, further research is probably necessary to fully understand the implications of trade in services for different manufacturing industries.

## The effects of foreign establishment of service providers

Manufacturers can also buy service inputs from foreign affiliates established in the same country as the manufacturer. As highlighted previously, these type of service imports are central because proximity between manufacturers and service providers is often necessary.

Interestingly, recent research has found a positive relationship between FDI in services and productivity in manufacturing firms buying service inputs. To start with, Damijan et al. (2015) investigate the newer EU member states and find that FDI in services is positively linked to productivity in manufacturing firms buying services. Effects are significant for domestic rather than foreign-controlled manufacturing firms.[23]

Likewise, Arnold et al. (2011) find a positive relationship between liberalisation of foreign establishment in the service sector in the Czech Republic and productivity in manufacturing firms using service inputs. Thus, openness to establishment in services and performance in manufacturing that buys service inputs are positively related.

Why would manufacturers benefit from FDI in services? This relationship could be explained by several factors. Foreign firms can introduce new technologies or organisational skills, which result in knowledge spillovers from service firms to manufacturers. Foreign firms can also increase competition in domestic markets, offer higher quality services and introduce greater variety of services (Damijan et al., 2015; Arnold et al., 2011).

## The effects of domestic regulation and barriers to trade in services

Manufacturer's access to service inputs can also be affected by burdensome domestic regulation in services and barriers to trade in services.

Starting with the impact of the regulatory burden in the service sector, this is negatively related to productivity in manufacturing firms. Barone and Cingano (2011) investigate the effects of the regulatory burden in service sectors on

manufacturing in the OECD. They find that a high regulatory burden has a significant negative impact on value added, productivity and export growth in manufacturing industries that buy services. Thus, burdensome service regulations seem to impact productivity in manufacturing negatively.[24]

Likewise, Fernandes (2009) finds that policy reforms in services in nine Eastern European countries have had positive effects on labour productivity and growth in manufacturing. [25]

Furthermore, when investigating how trade barriers in services impact manufacturing firms the research points in a similar direction. Barriers to trade in several service sectors are related to a reduction in manufacturing exports and a decrease in product differentiation. This is demonstrated by Nordås and Rouzet (2015) who study the effects of the services trade restrictiveness index (STRI) on manufacturing trade in OECD countries.[26]

Why would regulation and trade barriers in the service sector have an impact on manufacturing performance? Domestic regulation and trade barriers could increase the costs for existing service providers. These costs are then passed on to servicified manufacturing which buys service inputs. Moreover, many barriers to trade in services are found in the area of establishment. Reduction of these barriers can lead to entry of new service providers which are more productive and that increase competition in domestic service markets (Nordås & Rouzet, 2015). In sum, research indicates that burdensome regulation and barriers to trade in services are negatively linked to performance in manufacturing.

**Policy implication 10:** *Evidence indicates that service imports, foreign establishment of service providers and openness to trade in services are positively linked to enhanced performance in manufacturing. Liberalisation of trade in services can therefore be important in reaping the benefits of the servicification of manufacturing.*

## 6.3 Conclusion

Research into the effects of the servicification of manufacturing where buying and producing services is concerned is relatively limited. Initial evidence indicates that servicification can be positively related to performance in manufacturing.

There is comparatively more research into the effects of purchased service inputs and trade in services on manufacturing performance. Evidence indicates that imported service inputs and foreign establishment of service providers have positive effects on exports and productivity in manufacturing.

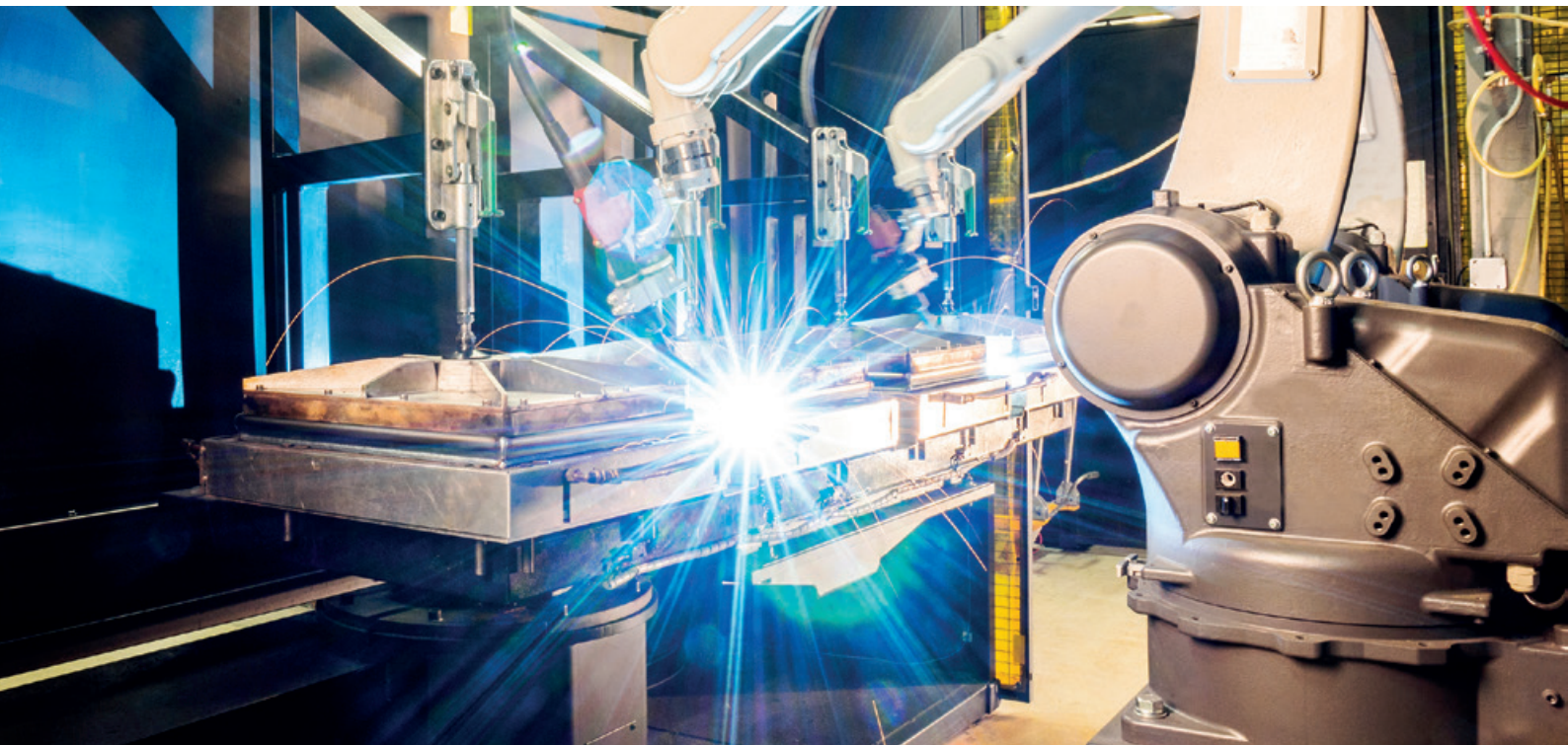
Burdensome domestic regulation and barriers to trade in services are negatively related to productivity and exports in manufacturing. Following from this, trade in services and openness to trade in services could be important for manufacturing in order to benefit from servicification.

# 7 Conclusion

EU manufacturing is still struggling to regain momentum after the financial crisis of 2008. The recovery is taking place in a changing global trade and production landscape, which entails new competition and production patterns. In this changing global context, servicification can be a key to recovery in manufacturing. Servicification can differentiate the value propositions of EU manufacturing. Servicification is also a way to take advantage of production in global value chains, because services are crucial for coordinating production.

This report has provided a comprehensive and comparative perspective on servicification in the EU over a period of approximately 20 years. The report has explored three aspects of servicification and analysed the trade in services dimensions, using industry-level data. The report has also analysed research into the effects of servicification on performance in manufacturing.

The report finds that EU manufacturing, on average, buys and produces services to a great extent. Buying service inputs is important for manufacturing in all EU countries and increasingly so over time. Moreover, the report shows that servicification in terms of producing services is common, which means that manufacturing jobs increasingly are service jobs. Interestingly, the report finds that EU manufacturing in several respects is more servicified than manufacturing in the USA. Collectively, this means that EU manufacturing competitiveness is increasingly about services. Policies for EU competitiveness cannot consider manufacturing in



isolation but need to consider how services impact manufacturing competitiveness.

The findings in this report suggest that there is not a common pattern of servicification in the EU. Rather, there are large cross-country differences, especially in the share of service employees and service output. The cross-country differences in servicification indicate that the interests in promoting the free movement of services may differ between member states. Although services are important for manufacturing in all countries they may be especially important for the highly servicified manufacturing industries.

Investigating industry differences, the report finds that low-tech manufacturing, particularly, depends on access to service inputs while high-tech manufacturing particularly depends on selling services as a complement to innovation. Moreover, distribution and business services constitute a large part of the services used in manufacturing and the performance of these sectors will therefore be reflected in manufacturing.

Furthermore, investigation of the trade in services linked to manufacturing reveals that the share of imported services in EU manufacturing is still rather small. However, some manufacturers import services to a great extent and primarily from outside the EU. The share of imported services has also increased substantially in some EU countries. Collectively, this shows that there is potential to increase cross-border trade in services in the EU.

Moreover, proximity between service suppliers and manufacturing firms may sometimes be necessary. This means that the foreign establishment of service firms is of central importance. Facilitation of both service imports and establishments of service providers is therefore important in increasing the supply of services in the EU.

Country evidence indicates that the manufacturing industry is an important exporter of services. The value added of services in EU manufacturing exports is larger compared to exports from the USA and Japan. In other words, in an international comparison, the competitiveness of EU manufacturing exports is particularly dependent on services.

Research indicates that trade restrictions in the service sector are connected to a reduction in exports and productivity in manufacturing. Likewise, trade in services is positively linked to enhanced performance in manufacturing, both in terms of exports and productivity. The importance of trade in services for manufacturing should be considered in light of the fact that there are many remaining barriers to trade in services in the EU internal market. Facilitating the free movement of services is therefore important for manufacturing performance. Without trade in services, manufacturing may not reap the benefits of servicification.

The importance of services for manufacturing is clear from this report. However, further research could explore the causes of servicification in order to better understand the cross-country and industry differences. Further research could also explore the differential impact of liberalisation of trade in services on different manufacturing sectors.

# Notes

1 See, for example, studies by: Baldwin et al., (2015); Lodefalk, (2013); Lodefalk, (2015); Lodefalk (2016); National Board of Trade, (2012); Nordås, (2010) and Nordås & Kim (2013).

2 Service inputs and service value added are calculated using the World Input-Output Tables (WIOT) available in the World Input-Output Database (WIOD). Manufacturing is defined as sectors 3-16 in WIOD. This corresponds to sectors 13-34 in the NACE rev 1. Services are defined as sectors 17-35 in WIOD. This corresponds to sectors E, F, 50-52, H, 60-64, J, 70-74, L, M, N, O, P and 36 in the NACE rev 1.

3 Service employees are calculated using the European Labour Force Survey (EU-LFS) available at the industry level. Services and manufacturing sectors are defined according to the NACE rev 2 and occupations are defined according to the ISCO-08. Service occupations are managers, professionals, technicians and associate professionals, clerical support workers and service and sales workers. See, for example, Veugelers (2013) who calculates the share of service employees in manufacturing. See also Falk & Peng (2013) who use the EU-LFS micro data based on NACE rev 1 classification of industries and find higher shares of service employees in 2010.

4 Service output is calculated using the International Supply and Use Tables from WIOD. In WIOD, service output is defined as products 40-45, 50-52, 55, 60-67, 70-75, 80, 85, 90-93 and 95. This corresponds to the statistical Classification of Products by Activity (CPA).

5 Service imports and service value added in exports are calculated using WIOT. Foreign establishment of service firms is investigated using the OECD AMNE database on foreign affiliates. Service exports in manufacturing are analysed using available research from different EU countries due to lack of EU-level statistics.

6 See for example Crozet & Milet (2014) and Lodefalk (2013) that find higher shares of revenue from services. Lodefalk (2013) finds higher shares of revenue from services when enterprise data is used. This can be explained by the fact that this data captures activities of firms specialised in services within a manufacturing enterprise group.

7 Dachs et al. (2012) use the European manufacturing survey, which studies companies in 13 European countries.

8 The index has been generated by dividing the average share of a dimension of servicification in each country by the value for the country with the largest share (the maximum value). Each dimension of servicification is given equal weight, despite the fact they may be different in terms of economic importance. The index therefore reflects the ranking within the EU rather than the economic significance. Service value added has been excluded because this measure partly overlaps with purchased service inputs.

9 High-tech manufacturing includes both high-tech and medium-high tech manufacturing industries (NACE rev 1 industries 24, 29-35). Medium-tech manufacturing implies medium-low tech manufacturing (industries 23, 25-28). Low-tech manufacturing includes industries 15-22 and 36-37. Classifications correspond to the Eurostat definition of high-tech, medium-high-tech, medium-low-tech and low-tech manufacturing.

10 Different types of service inputs are defined using NACE Rev.1. **Utility services include**: Electricity, Gas and Water Supply (Nace Rev. 1 H). **Construction services mean** (Nace Rev. 1 F). **Distribution services include**: Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel; Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles; Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods; Real Estate Activities and Private Households with Employed Persons (NACE Rev. 1 50-52, 70, P). **Transport and communication services include**: Hotels and Restaurants, Inland Transport; Water Transport; Air Transport; Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies and Post and Telecommunications (NACE Rev. 1 H, 1 60-64). **Business services include**: Financial Intermediation; Real Estate Activities and Renting of M&Eq and Other Business Activities (NACE Rev. 1 J, 71-74). **Non-market services include**: Public Admin and Defence; Compulsory Social Security; Education; Health and Social Work and Other Community, Social and Personal Services (NACE Rev. 1 L, M, N and O).

11 Different types of service output are defined using the CPA. **Utility services include**: Electrical energy, gas, steam and hot water and Collected and purified water, distribution services of water (CPA 40-41), **Construction includes**: Construction work (CPA 45), **Distribution services include**: Trade, maintenance and repair services of motor vehicles and motorcycles; Retail sale of automotive fuel; Wholesale trade and commission trade services except of motor vehicles and motorcycles; Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods; Real estate services and Private households with employed persons (CPA 50-52, 70, 95), **Communication and transport services include**: Hotel and restaurant services; Land transport; Transport via pipeline services; Water transport services; Air transport services; Supporting and auxiliary transport services; Travel agency services and Post and telecommunication services (CPA 55, 60-64). **Business services include**: Financial intermediation services, except insurance and pension funding services; Insurance and pension funding services, except compulsory social security services; Services auxiliary to financial intermediation; Renting services of machinery and equipment without operator and of personal and household goods; Computer and related services; Research and development services and Other business services (CPA 65-67, 71-74) and **Non-market services include**: Public administration and defence services; Compulsory social security services; Education services; Health and social work services; Sewage and refuse disposal services, sanitation and similar services; Membership organisation services n.e.c.; Recreational, cultural and sporting services and Other services (CPA 75, 80, 85, 90-93).

12 Information on the WTO definitions is based on National Board of Trade (2012).

13 Ireland, Lithuania, Hungary, Netherlands, Finland, Sweden, Greece and Poland have seen above average increases of service imports in manufacturing. Service imports have declined in Luxembourg, Bulgaria, Malta, Slovakia, Romania, Estonia, Cyprus and Latvia.

14 See the report from European Commission (2015) p.61 and p.76.

15 Service sectors G-N, excluding K ISIC classification rev. 4, are included in this measure. This implies distribution services, transport services, communication services and business services (excluding financial services).

16 See Kelle & Kleinert, 2010, p.12; Statistics Sweden, 2015, p.6 and Federico & Tosti, 2012, p.11.

17 Eurostat (2016) Statistics Explained, Service Trade by Enterprise Characteristics —STEC p.7.

18 See, for example, Suarez et al., 2013; Egger et al., 2011; Benedettini et al., 2013; Fang et al., 2008.

19 Crozet & Milet (2015) study a sample of 50 000 French manufacturing firms between 1997 and 2007.

20 Wolfmayr (2012) studies 13 EU countries between 1995 and 2007. Wolfmayr (2008) investigates 16 OECD countries for the years 1995 and 2000.

21 Schwörer (2012) studies nine EU countries between the years 1996-2008.

22 Francois & Woerz, 2008 investigate OCED countries between the years 1994-2004.

23 Damijan et al. (2015) study Bulgaria, Czech Republic, Estonia, Romania, Slovakia and Slovenia between the years 2003-2008.

24 Barone and Cingano (2011) investigate OECD countries between the years 1996-2002. To measure regulatory burden they use the OECD indicators on Product Market Regulation (PMR).

25 Fernandes (2009) uses the European Bank for Reconstruction and Development index and data from Bulgaria, the Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania, Slovenia and Slovakia between the years 1996 -2004.

26 Nordås & Rouzet (2015) study a cross-section of OECD countries. Services Trade Restrictiveness Index (STRI) captures regulatory impediments to trade in services and establishments. STRI does not capture the internal market framework.

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