Kommerskollegium 2010:1

# Servicification of Swedish manufacturing

2010 03

Kommerskollegium
National Board of Trade

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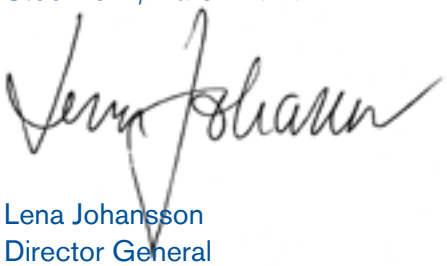
National Board of Trade, March 2010. ISBN: 978-91-978154-9-9

# Preface

In the last few years, the National Board of Trade has stepped up its effort to analyse trends in international trade. The purpose is not only to increase knowledge about developments as such, but also to understand the impact of changing trade patterns on trade policy. Indeed, the analysis of future trade patterns and trade policies is part of our mission this year, as given by the Swedish government.

The present report is part of that effort. The rise in the economic importance of services and services trade needs to be better understood as well as implications for trade policy. Therefore, we analyse the increasing inter-linkage between goods and services, both in production and trade. We find that Swedish manufacturing has been servicified. Our analysis of implications for trade policy will continue, though, and impacts of manufacturing's servicification will be studied more in-depth in a subsequent report of the Board.

Stockholm, March 2010



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# Summary


### Servicification of Swedish manufacturing

Our analysis shows that Swedish manufacturing is being servicified. Servicification means that manufacturing both buys and produces more services in-house than before, but also that it sells and exports more services. One illustrative example of the increased importance of services for manufacturing firms is Sandvik Tooling. In order to uphold its delivery chain, Sandvik Tooling uses some 40 types of services. Moreover, Sandvik Tooling offers some 15 types of services to its customers. Services offered range from research and development to maintenance of delivered products.

Servicification is particularly strong when we consider the fact that firms increasingly are parts of enterprise groups. The reason is that manufacturing enterprise groups place a great number of activities in firms that mainly produce services. Volvo is one example. The Volvo Group has several firms that mainly provide services, for example Volvo Logistics and Volvo Information Technology.

### Manufacturing uses more services

Firms in manufacturing are buying more and more services. Our analysis shows that the costs for bought-in services have more than doubled between 1975 and 2005 as a share of the production value. Imports are also increasingly important, and especially imports of services. This might be interpreted as manufacturing firms focusing on production, while outsourcing other activities to services firms. However, this is not the case. Instead, costs are increasingly dominated by services being produced in-house, especially by qualified services production. This is confirmed by the fact that more and more employees in manufacturing are in services-related occupations. In 2006, almost half of manufacturing employees worked in services-related occupations, if employees in the industry's subsidiaries are included.

### Manufacturing sells more services

Moreover, manufacturing firms sell and export much more services than a decade ago. The share of services sales in total turnover has risen by 25 percent when subsidiaries are included. This means that the industry's sales have broadened (diversified). Furthermore, we find that sales of services – as a share of total turnover – are almost 60 percent higher than indicated in official statistics, when all manufacturing subsidiaries are included.

### Manufacturing's share of the Swedish economy falls slightly

In addition, the study shows that manufacturing's share of the Swedish economy continues to diminish. However, the decline is not as large if all of the industry's subsidiaries are included. Part of the decline may also be due to manufacturing firms outsourcing activities to non-affiliated firms and offshoring to firms overseas.

At the same time, this is expected. Firstly, manufacturing has become increasingly efficient historically - productivity has risen - in comparison with the services industry. Secondly, demand for services usually rises as a country's income grows. Thirdly, countries specialise in activities where they have comparative advantages. Sweden's advantage is currently in more advanced manufacturing and qualified services. Therefore, it is natural that for Swedish manufacturing to specialise in these elements of the value chain and leave the remainder to others. Part of the industry's business will then be classified as services in official statistics.

### Servicification and trade and trade policy

Servicification implies that liberalising trade in services is becoming increasingly more important for the manufacturing industry. Trade in services and merchandise are much more interdependent than they were a few decades ago. Manufacturing buys more services from its own or non-affiliated firms abroad and the industry imports more intermediates, even if merchandise imports do not increase as much as imports of services. Moreover, manufacturing is selling more services overseas.

Swedish manufacturing's specialisation is to a large extent based on Sweden's comparatively well-educated labour force and extensive research and development. Domestic skills and technologies are in turn positively related to trade, investment and migration. Therefore openness to trade, investment and migration is important. Moreover, it is becoming increasingly important since a firm's production is increasingly being divided up between firms in different countries and continents.

### Statistics are needed at the enterprise group level

Finally, our results point to the importance of data at the enterprise group level when analysing major changes in the Swedish economy. Enterprise groups are rising in number in Sweden and most of those working in private industry are now in an enterprise group. Moreover, enterprise groups account for at least 75 percent of turnover and value-added in Sweden. Hence, official statistics at the enterprise group level would be welcome, or at least an industry classification of enterprise groups.

### About the report

The report is the first in the Board's efforts of analysing the relation between the manufacturing and services industries and implications for trade policy. The analysis is mainly based on data from Statistics Sweden, at the industry, enterprise group and firm level and for the 1997-2006 period. Focus is on developments during the last decade. The report is written by Magnus Lodefalk, Department for WTO and Developments in Trade, National Board of Trade. In the forthcoming and second report, we study how the Swedish multinational Sandvik uses and offers services in parts of its business. Later on, we will analyse the consequences for trade and trade policy more in-depth.

# Summary in Swedish

## Sammanfattning

### Tjänstefiering av svensk tillverkningsindustri

Kollegiets analys visar att svensk tillverkningsindustri håller på att tjänstefieras. Med tjänstefiering menar vi att industrin både köper och själv producerar mer tjänster än tidigare men också att den säljer och exporterar alltmer tjänster. Ett exempel på tjänsternas ökade betydelse för industriföretagen är Sandvik Tooling. I steget mellan fabrik och kund använder Sandvik Tooling ett 40-tal tjänster och företaget erbjuder ett 15-tal tjänster till sina kunder. Tjänsterna som kunderna erbjuds spänner över alltifrån forsknings- och utvecklingstjänster till underhåll av sålda produkter.

Tjänstifieringen är särskilt påtaglig när vi tar hänsyn till att företag allt oftare ingår i företagsgrupper (koncerner). Detta beror på att industrins koncerner har en hel del verksamhet i dotterföretag som främst producerar tjänster. Ett exempel är Volvo. Volvo-koncernen har flera företag som främst sysslar med tjänster, till exempel Volvo Logistics and Volvo Information Technology.

### Tillverkningsindustrin använder mer tjänster

Företag i tillverkningsindustrin köper alltmer tjänster. Vår analys visar att utgifterna för inköpta tjänster har mer än fördubblats mellan 1975 och 2005 som en andel av produktionsvärdet. Importen har också blivit betydligt viktigare och särskilt importen av tjänster. Detta skulle kunna tolkas som att tillverkningsföretagen fokuserar på att producera varor och lägger ut annan verksamhet på tjänsteföretag. Men så är det inte. Istället domineras kostnaderna i tillverkningsindustrin allt mer av deras egen tjänsteproduktion, inte minst av kvalificerad tjänsteproduktion. Detta bekräftas också av att fler och fler anställda i tillverkningsindustrin har tjänsterelaterade yrken. År 2006 hade nästan hälften av de anställda tjänsterelaterade jobb, om de anställda i industrins alla dotterbolag inkluderas.

### Tillverkningsindustrin säljer mer tjänster

Dessutom säljer och exporterar industriföretagen mycket mer tjänster än för ett decennium sedan. Tjänsteförsäljningens andel av den totala omsättningen har ökat med 25 procent under det senaste decenniet, när dotterbolagen inkluderas. Med andra ord breddas industrins försäljning (diversifiering). Vi ser också att försäljningen av tjänster – som andel i total omsättning – är nästan 60 procent högre än vad som den officiella statistiken tyder på, när vi inkluderar industrins alla dotterbolag.

### Tillverkningsindustrins andel av Sveriges ekonomi minskar något

Studien visar också att industrins andel av svensk ekonomi fortsätter att minska. Men minskningen är inte lika stor om industrins alla dotterbolag inkluderas. Dessutom kan industriföretagens utlokalisering av verksamhet till fristående företag i Sverige och till företag i andra länder förklara en del av minskningen.

Samtidigt är utvecklingen väntad. För det första har industrin historiskt sett blivit allt mer effektiv - produktiviteten har ökat - jämfört med tjänstesektorn. För det andra brukar efterfrågan på tjänster öka när länder blir rikare. För det tredje specialiserar länder sig på det de är jämförelsevis bra på. Sverige har i nuläget en fördel i mer avancerad tillverkning och kvalificerade tjänster. Det är därför naturligt att svensk tillverkningsindustri specialiserar sig på dessa delar i produktionskedjan och låter andra göra resten. En del av verksamheten kommer då att klassificeras som tjänsteverksamhet i den officiella statistiken.

### Tjänstefieringen och handeln samt handelspolitiken

Tjänstefieringen betyder att liberaliseringen av tjänstehandeln blir allt viktigare för tillverkningsindustrin. Tjänste- och varuhandeln är mycket mer beroende av varandra än för några decennier sedan. Industrin köper alltmer tjänster från egna eller andras företag utomlands och importerar mer insatsvaror, även om varuimporten inte ökar lika mycket som tjänsteimporten. Industrins säljer också mer tjänster utomlands.

Industrins specialisering i Sverige bygger till stor del på Sveriges jämförelsevis höga utbildningsnivå och omfattande forskning och utveckling. Kunskaper och teknologier är i sin tur positivt relaterade till handel, investeringar och personrörlighet. Därför är öppenhet för handel, investeringar och personer viktigt. Dessutom blir öppenhet allt viktigare eftersom företagens produktion allt oftare delas upp mellan företag i olika länder och världsdelar.

### Statistik behövs på koncernnivå

Till sist ger våra resultat en fingervisning om att data på koncernnivå är viktigt när man analyserar stora förändringar i ekonomin. Detta är en konsekvens av att koncernerna blir allt fler i Sverige och av att de flesta i det privata näringslivet nu jobbar i en koncern. Koncernerna står också för minst tre fjärdedelar av omsättningen och förädlingsvärdet i Sverige. Därför vore det välkommet med officiell företagsdata på koncernnivå eller åtminstone en branschklassificering av koncerner.

### Om rapporten

Rapporten är den första i kollegiets arbete med att analysera förhållandet mellan tjänste- och varuproduktion och implikationer för handelspolitiken. Analysen i rapporten baserar sig till största delen på statistik från SCB, på bransch-, koncern- och företagsnivå samt för åren 1997-2006. Fokus är på utvecklingen under det senaste decenniet. Rapporten är skriven av Magnus Lodefalk, Enheten för WTO och handelsutvecklingen, Kommerskollegium. I den kommande och andra rapporten beskriver vi hur verkstadskoncernen Sandvik använder och erbjuder tjänster i en del av sin verksamhet. Senare kommer vi att mer ingående analysera konsekvenser för handel och handelspolitiken.

# Index

# 1. Introduction

The manufacturing industry in industrialised countries seems to be focusing more on services than before. Case studies show that the industry both increasingly uses services in production as well as increasingly offers services to its customers (servicification). Meanwhile, firms in industrialised countries outsource and offshore more activities as competition from emerging economies intensifies. Nevertheless, manufacturing appears to be in decline. As manufacturing's share of employment falls and services are more easily offshored, recent debate has centred on the implications for employment and economic growth.[1]

These trends and how they are perceived are likely to have consequences for how different industries are treated in policy-making in general, including with respect to trade policy. Therefore, the aim of this report is to analyse the decline and servicification of manufacturing as well as the implications for international trade. The analysis is based on comprehensive firm and enterprise group level data for Sweden in the 1997 to 2006 period.[2]

The report confirms manufacturing's continued decline in Sweden. However, the decline is smaller than previously shown when considering services activities in manufacturing enterprise groups. Moreover, the results confirm in detail that manufacturing is servicifying substantially. For example, manufacturing's sales of services are up relative to overall turnover and in particular when all of manufacturing's subsidiaries are included. From a trade policy perspective, the servicification of manufacturing implies that treating services and manufacturing separately in policy formation and negotiations may be out-of-date.

The report is the first in the National Board of Trade's effort of analysing the relation between the manufacturing and services industries and implications for trade policy. In the next report, we will study the large Swedish multinational manufacturer Sandvik.[3] Substantial use and offers of services are found.

The outline of the report is as follows: In section two, we provide a backgrounder on overall trends in manufacturing and the drivers behind manufacturing's decline. Next, in section three, we review literature on the organisation of firms, their sourcing and services focus. Long-term trends in Swedish manufacturing's use of domestic and imported services are reviewed in section four. In section five, we discuss our empirical approach and the data used. The results for Swedish manufacturing between 1997 and 2006 are presented and discussed in section six. Finally, in section seven, we conclude and make some final remarks. (Additional tables are available in annex one.)

# 2. Overall trends in manufacturing and their drivers

Firstly, in this section, we discuss changes in the importance and character of the manufacturing industry in industrialised economies. Secondly, key drivers behind the industry's decline are discussed. Thirdly, we conclude on the need for further work.

## 2.1 Overall trends in manufacturing

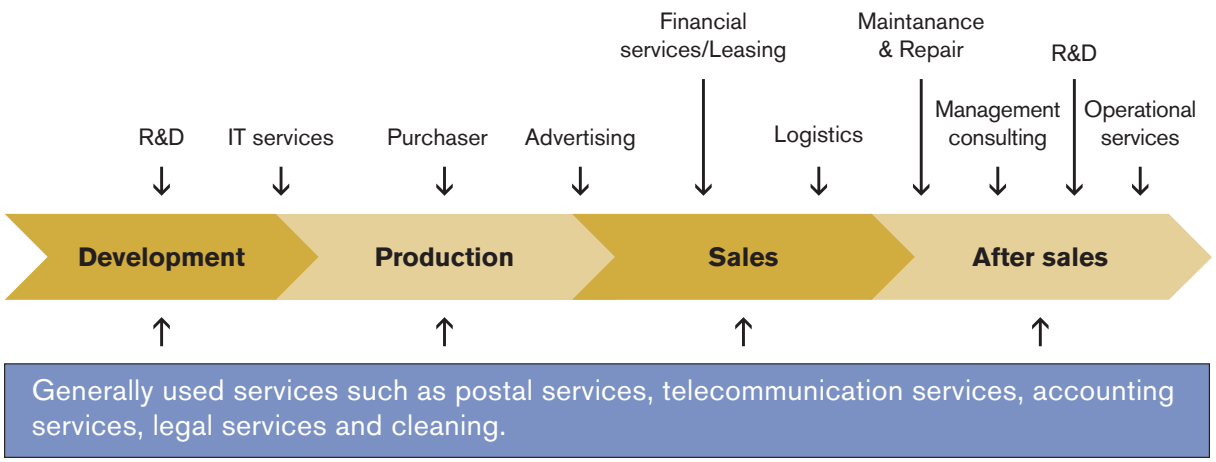
Between 1991 and 2006 manufacturing's share of employment has fallen by 29 percent in industrialised countries (from 19.4 to 13.8 percent) and the share of the services industry has expanded[4]. For Sweden, manufacturing's decline is smaller, but the long-term trend seems clear. Since 1970, Swedish manufacturing's employment is down by 29 percent and value added by 22 percent[5].

Meanwhile, there is some evidence that manufacturing is being servicified[6]. This means that services are increasingly used as input (such as software) in production and services are included in manufacturing's offerings (such as financing, education and updates related to the product). In figure 1, some services that may be used in today's manufacturing are displayed. An actual example is Sandvik Tooling's use and offers of services[7]. Sandvik Tooling is part of Sandvik, a Swedish engineering multinational with some 50,000 employees world-wide. Sandvik Tooling uses some 40 types of services – ranging from accountancy services to audio-visual services – only to uphold its delivery chain. Moreover, it offers some 15 types of services to its customers such as design, maintenance, research and development (R&D) and logistics services.

Simultaneously, economic globalisation has gathered pace. Over only the last decade, Foreign Direct Investment (FDI) inflow has more than doubled and trade increased by almost 20 percent, as shares of the Gross Domestic Product (GDP). Trade and investment integration indicators have risen for both high and low income countries as well as for large regional country groups[8]. Important factors behind the globalisation are liberalisation of trade and capital, as well as technological advances in areas such as transport and information and communication technologies (ICT).

Regarding merchandise, exports have gone from constituting a tenth to more than a quarter of global output today, since the mid-1960s[9]. However, with respect to global market shares, there has been a downward trend for merchandise export from industrialised economies. Looking at Sweden, its export market share fell by 38 percent between 1970 and 2005[10]. Moreover, also during the last decade, the Swedish and the other OECD economies have lost export market shares, for example in the USA and the EU15[11]. In Sweden this has occurred despite a strong performance in manufacturing exports. Two explanations advanced for the losses in merchandise export market shares are: the economic growth and export-orientated policies of emerging markets such as China and India; and the interna-

**Figure 1: Some services that manufacturing firms may use and offer**



tionalisation of business, including globalisation of value chains. As emerging economies grow relatively faster than the OECD economies, their share of world markets will rise and that of others will fall. With respect to the internationalisation of OECD business, firms increasingly locate production in several countries around the globe, including non-OECD countries. Hence OECD firms are likely to export more than before from non-OECD countries. A third explanation for the decline in merchandise export market shares is the rising importance of services for the industrialised economies and the global economy overall[12]. Indeed, the Swedish services export market share has risen substantially, from 1.3 in 1995 to 1.8 percent in 2006. Compared with reference countries[13], the Swedish services sector has performed second best as regards labour productivity[14].

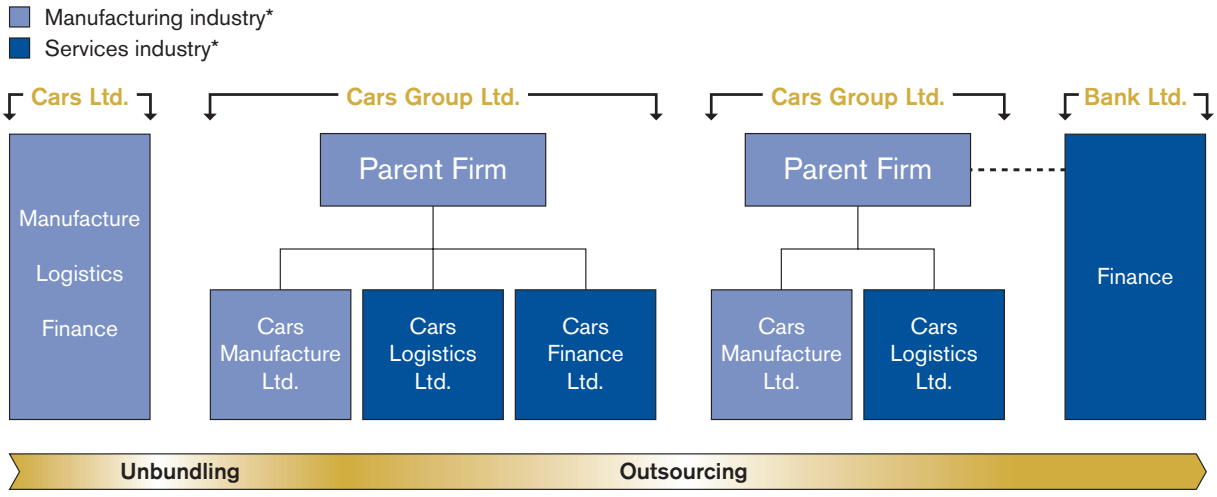
With these trends, it is no wonder that there is concern about deindustrialisation or, alternatively, embracement of the "services economy", whether connected to globalisation or not[15].

## 2.2 Manufacturing's decline – drivers and perspectives

Part of the reason for manufacturing's decline is likely to be related to organisational changes and improved performance in manufacturing, that is, changes on the supply side of the economy.

Some argue that manufacturing's diminishing share of the economy is to some extent a statistical phenomenon related to organisational changes in the industry, see figure 2[16]. One line of the argument is that fragmentation of firms by definition means that some activities of manufacturing are classified as services activities. Although enterprise groups are becoming increasingly important, official statistics still have the firm or establishment as the key observation unit. As enterprise groups frequently place activities in specialised firms, their activities may be classified as belonging to industries other than that of the rest of the enterprise group. One example is the Volvo Group, which has several specialised services firms such as Volvo Logistics.

**Figure 2: Reorganisation of manufacturing – the case of Cars Limited (fictive case)**




* Standard industry classification

The fictive manufacturer Cars Limited (Ltd) starts out as a single firm that produces cars and offers some logistics and financial services to its customers. However, in the 1980s, Cars Limited is transformed unbundled into the Cars Group Ltd, consisting of a parent firm and three subsidiaries: Cars Manufacture Ltd; Cars Logistics Ltd.; and Cars Finance Ltd. Around the millennium, the next big organisational change is made outsourcing. Cars Finance Ltd. is closed down. Financial services is instead offered through Bank Ltd, a specialized financial services provider.

Volvo Logistics is recorded as a services entity although it is part of a manufacturing enterprise group. Another line of the argument is that manufacturing is as large as it was some decades ago if the services that have been outsourced, such as business services, are considered[17].

Nickell et al (2008) argue that manufacturing has indeed declined. They find that changes in total factor productivity and in the relative price of manufactures and other merchandise comprise important factors behind the steeper fall in manufacturing's share of the Gross Domestic Product (GDP) in some countries relative to others.

Other explanations for manufacturing's decline are related to the demand side. It has been argued that as income rises, people increasingly demand services[18]. This argument draws on the hierarchy of needs and the income elasticity of services[19]. Indeed, a strong correlation between services employment and per capita income is found in the literature[20].

The effect of a diminishing manufacturing industry on overall productivity is another issue. Baumol (1967) expects negative effects. An expansion of the relatively unproductive services industry in combination with wages in that industry rising as much as the whole economy's productivity growth could lead to services dominating the economy[21]. This would result in lower potential for economic growth. However, Oulton (2001) shows that low productivity prospects may not be inevitable if the services industry produce intermediate products rather than final ones.

Lately, the relatively low productivity traditionally observed in services has been questioned[22]. Investment and innovations in ICT as well as changes in business structures and practices have contributed to productivity growth in services[23]. Services productivity has also benefited from improved competition and access to capital from liberalisation of services trade and capital markets.

Moreover, measurement of productivity growth in services is inherently difficult and recent improvements may not have been captured fully[24]. Hultkrantz (1999) argues that unobserved quality improvements in services industries above those in manufacturing might contribute to actual productivity growth as high as or above the growth in manufacturing. Furthermore, when needs satisfied rather than the means to fulfil them are considered, it is possible that the potential for rationalisation in services industries is significantly larger than otherwise assumed. Hultkrantz takes the cost of hearing a good performance of a piece of music as an example. (A symphony can be watched or listened to at home over and over again at relatively low cost compared to when visiting the concert hall.) Nevertheless, ITPS (2008) conclude that many services sector industries lag behind manufacturing in productivity growth. They note, however, that difficulties remain in measuring productivity in services, among other things in regard to identification of changes in quality.

## 2.3 Conclusions

Having reviewed overall trends in manufacturing and their drivers it appears as if manufacturing's share of the economy has declined and that the industry is focusing more on services. However, the extent of the decline is questioned and evidence is limited on servicification of manufacturing. More work is thus needed on these two issues and this motivates our study. In the next section, we review how firms are organising their business, since it is related to both these trends.

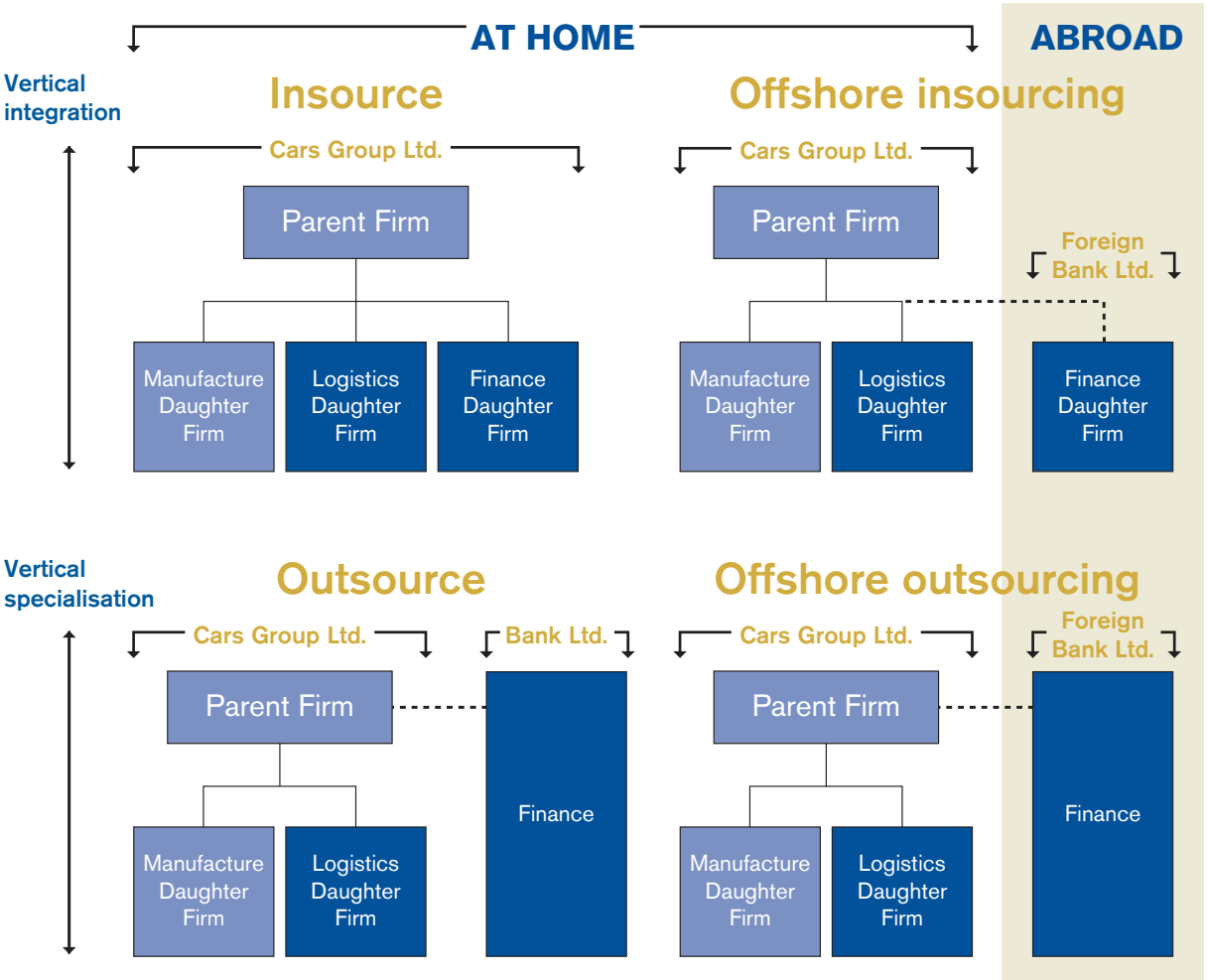
# 3. Perspectives on the organisation, sourcing and services of firms in manufacturing

In this section, we review recent strategies and possible motives for the organisation and business of firms, as well as for manufacturing's use of services, drawing on more theoretical literature. We then arrive at tentative conclusions on manufacturing's servicification.

## 3.1 Recent changes in firm's organisation and sourcing

There is arguably a wider choice of business strategies available today than two decades ago. Country and firm boundaries are less relevant. International

**Figure 3: Organisational and sourcing decisions - the case of Cars Limited (fictive example)**




The fictive manufacturer Cars Group Limited (Ltd) runs into difficulties in the beginning of the 21st century. Their customer stock declines when previous customers choose to buy their new cars from Foreign Cars Ltd. As part of its deliberations on how to face up to the intensified competition, management discusses sourcing options. Apart from considering buying-in more parts and components from external suppliers abroad, management discusses how best to deliver financial services to its customers. Four options are put on the table: 1) Continue to buy-in financial services from Bank Ltd (outsourcing); 2) Start its own financial services subsidiary (insourcing); 3) Accept the services offer by the external foreign firm Foreign Bank Ltd (offshore outsourcing); or 4) Establish its own financial services subsidiary but in a foreign country, where many other financial services firms are located (offshore insourcing).

trade increasingly consists of an exchange of value added by various job tasks instead of an exchange of complete goods[25]. This has been facilitated by trade and investment liberalisation as well as improvements in transportation and information and communication technologies (ICT).

More generally, with respect to vertical organisation, firms may integrate or specialise[26]. If they specialise, other inputs are sourced elsewhere: at home or offshore. There are four alternative combinations for a firm as regards organisation and sourcing, as displayed in figure 3[27].

*Vertical integration* can be in the form of *insourcing*, which is, expanding (or keeping) activities in-house, or in the form of *offshore insourcing* (FDI and intra-firm trade). One strategy observed in recent years is manufacturing firms' *integration downstream*[28]. For Sweden, Berggren and Bergkvist (2006) illustrate this with numerous examples. Offers of service packages may be bundled with manufactures, including distribution to the final customer but also financial solutions, technical support and sometimes even operation of the delivered products. The business of the telecommunications company Ericsson illustrates this. It has moved from only producing telecommunications equipment to installing, maintaining and operating such equipment world-wide. Today, services account for 40 percent of its turnover[29].

*Vertical specialisation* means that a firm hives off some activity to external suppliers at home – *outsourcing* – or abroad – *offshore outsourcing*[30]. Vertical specialisation may change the character of a manufacturing firm to become more of a services firm[31], although the opposite is also possible. Since ICT facilitates global marketing strategies, the nurturing of global brands might be considered the core activity of a manufacturing firm. Nike is an example of a manufacturing company that concentrates on services content such as design and marketing while manufacturing to a large extent is provided by external contractors[32]. Lately, outsourcing has been on the rise in industrialised economies after a long period of vertical integration, facilitated by technological and liberalisation advances[33].

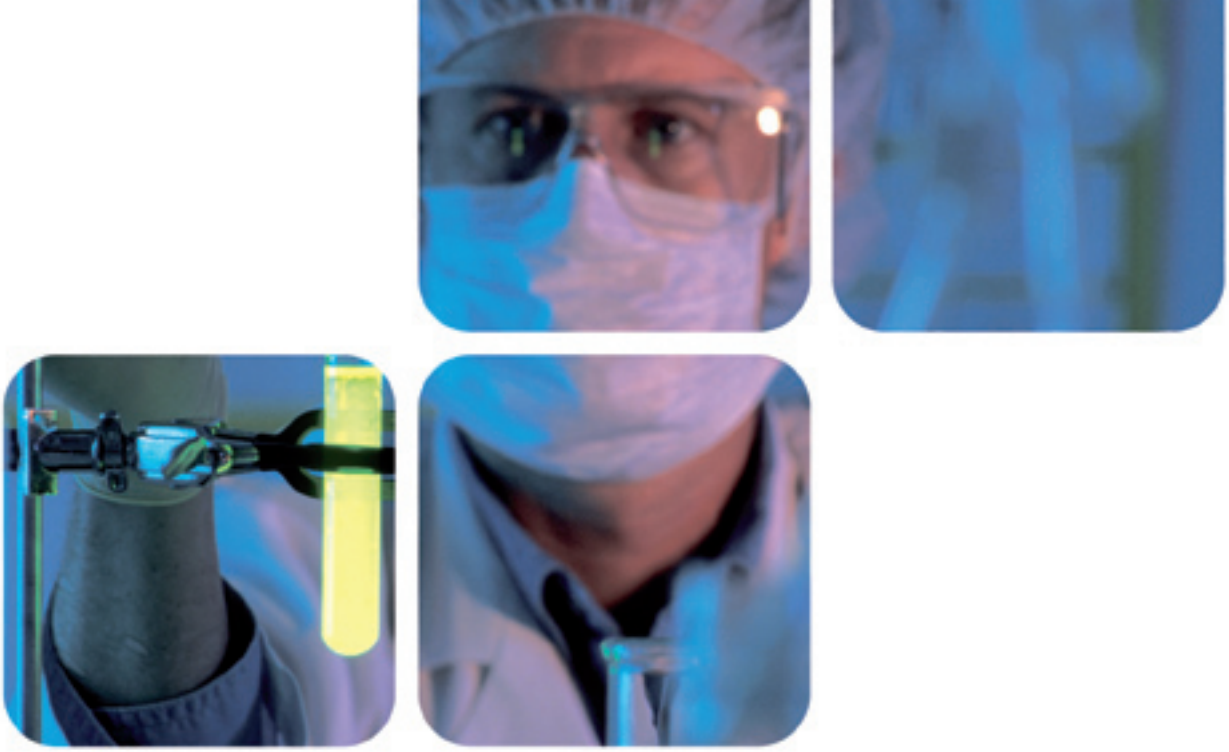
## 3.2 Firm's decisions on organisation and sourcing

Firm's decisions on whether to internalise a particular activity or keep it external have been deliberated upon at length and in different veins of the literature. Works by Coase (1937), Williamson (1979), Dunning (2001) and others shed light on the interaction between a firm's specific advantages or disadvantages and transaction costs involved in a particular organisational set-up of the business. The strategic management literature discusses competencies of firms and pros and cons of a deepened division of labour[34]. Finally, literature on the international dimension contributes reasons for foreign trade, including comparative advantages and technology transfer, as factors behind offshoring activities[35].

Essentially, key reasons for internalisation as well as outsourcing appear to be the same[36]. After reviewing previous work, Maskell et al (2006) boil down motives behind the make-or-buy decision to an assessment of cost and differentiation advantages of outsourcing a particular firm activity, in responding to a more competitive environment. Differentiation advantages pertain to quality and innovation benefits.

Cost advantages with outsourcing are related to: economies of scale and scope of contractors; lower organisational costs for outsourced activities; and the possibility of turning fixed into variable costs. A downside with outsourcing may be the higher cost of governing a complex supply chain. Bargaining over e.g. contract details is costly and the firm and its contractors may both act in their self-interest in such a way that the overall outcome is suboptimal. On the overall, outsourcing costs are related to: the activity's complexity; the thickness of the market (the number of suppliers); and the extent of specific assets involved in the activity being outsourced[37].

The relative demise of country and firm boundaries over the last few decades means that markets of firms have expanded, both on the input and output side. This is a reason for vertical specialisation. The larger the market, the more firms will focus on activities with increasing returns to scale and where it has comparative advantages, while buying-in other inputs from domestic and foreign providers[38]. The demise of boundaries also means that so-called agglomeration forces – for example, previous experience - increasingly influence sourcing and specialisation[39]. For example, if a few large multinational firms in a specific industry already buy an essential input from suppliers in a certain geographical area, it is more likely today that new firms in that industry will also choose to source that input there. The reason is that suppliers in that area already have the know-how and experience necessary to be competitive in comparison with suppliers elsewhere.



## 3.3 Services in manufacturing

In the business strategies above, the profit-maximising manufacturing firm may put an emphasis on raising services content – whether supplied in-house or externally – along the product life cycle. Such a servicification[40] is interpreted here as raising the amount of services incorporated into the manufacture as well as services offered in conjunction with it[41]. Thus, focus is changed from the manufacturing of a good to the provision of value-in-use[42].

The emphasis on services may apply more to qualified non-personal services (e.g. R&D, information technology services and finance) than other services (e.g. cleaning and construction). Many non-personal services are skills-intense[43], have capital-intensity ratios closer to that of manufacturing[44], and can more easily be traded, for example, using the Internet[45]. Non-personal services include distribution, producer and social services[46].

A basic reason for manufacturing to increasingly use non-personal services in manufacturing, for example ICT, may be to raise a firm's productivity. Moreover, qualified services could be used to further differentiate, customise and up-grade offers in order to raise profits and compete in the market. By differentiation, competition may lessen, see the box below for an example. This applies both to the product market itself and to the markets for support or management of the product.

An additional effect of these developments could be that the firm and its customers develop closer and more longstanding contacts. Rather than being limited to the actual sales event, the relation may be kept over the manufacture's entire lifetime. (An example is the telecom industry. Advanced cellular phones have operating system and built-in additional software that are upgraded and may be expanded during the cellular phone's lifetime and where the phones may be connected to e.g. online record stores.) There are also some indications that the complexity of the manufacture is positively correlated with servification[47].

Another reason for a relative expansion of services in the activities of manufacturing firms may be investments abroad. One example is the offshoring

**Differentiation and competition – an example of screwdrivers**

Consider two screwdrivers of different brands and firms but with the same functions. The similarities between the products make customers rather indifferent between the two products. In order to become more competitive on the market, one of the firms wants to niche its screwdrivers to professional users who are ready to pay substantially more. Therefore, it replaces standard and low cost components with more expensive high quality components in producing its professional screwdrivers. Its marketing is also redirected to such customers. Although still similar in function, the quality and price gap makes the two seemingly identical products different in the eyes of customers. For occasional use, the low quality screwdriver will still be considered adequate, while for sustained and intense professional use the high quality one is considered more up to the task. By this differentiation, the two firms compete only to a limited degree over the same customers. As a consequence, they may both raise prices without losing market shares.

of manufacturing production (vertical specialisation) mentioned in section 3.1, assuming that this cuts costs for production. More generally, if a firm invests in production, sales or other services activities abroad, then its headquarters in the home country is likely to export more services than before. This includes intra-enterprise group services such as management services, R&D services, IT services and human resources services. Thus, the relative importance of services in the business in the home country may grow for manufacturing firms who invest abroad. However, this is not clear cut. Manufacturing firms may invest in services activities abroad in order to focus on production back home. In that case, the rise in intra-enterprise group services exports may be small relative to total activities in the home country. For Sweden, however, investments abroad may be part of the reason behind the servicification suggested by numerous case studies[48].

With respect to effects of servicification, productivity should rise for the firm, the industry and the overall economy, everything else equal. However, prerequisites are international competition in the market supplied by the firm and free entry domestically[49]. van Ark (2004) argues that combining manufactures and services in offers might be important for the EU to catch up in services productivity with the US.

## 3.4 Perspectives from the literature – what to expect

Based on the discussion above, manufacturing firms in industrialised countries are expected to increasingly specialise in high value-added manufacturing and services activities. This includes expansion of in-house production of services. Less complex services activities with lower productivity potential may be candidates for outsourcing or offshoring, along with low-skill-content intermediate goods more cost-efficiently produced abroad[50]. More complex activities may be kept in-house or bought-in externally, depending on outsourcing and offshoring costs as well as agglomeration forces involved.

In the next section, we review long-run changes in Swedish manufacturing's input usage, before moving on to the empirical approach of the study and to our main analysis of the most recent developments.

# 4. Input usage in Swedish manufacturing since the 1970s

Our study of Swedish manufacturing starts with a brief review of input usage in Swedish manufacturing since the mid-1970s, using input-output (I-O) tables. I-O tables capture manufacturing firms' use of *externally* produced services and merchandise in relation to other inputs. Moreover, they distinguish between domestic and imported inputs[51].

## 4.1 Bought-in input

As displayed in table 1 and column 2, the services input share has more than doubled in Swedish manufacturing between 1975 and 2005, from 12 to 25 percent of the production value. Services and merchandise imports have also become more important, columns three and five. This goes especially for the share of imported services in the total external input of services, which is up some 85 percent, from 9 to 17 percent. In the meantime, manufacturing's merchandise input share has been relatively stable at some 44 percent, column four[52]. However, these figures do not capture merchandise and services incorporated upstream by other firms who then, in turn, sell their intermediate goods and services to the manufacturing industry downstream. For example, the figures exclude services used in producing a datachip that is subsequently used in the motor vehicles industry.

Hagman and Lind (2008) analyse total linkages – direct as well as indirect linkages – by looking at so-called employment multipliers for Sweden[53]. They find that manufacturing has important and expanding linkages to other industries, including services. For every new job in manufacturing, 0.34 and 0.64 new jobs were generated in services in 1975 and 2005, respectively. That is, there has been an 88 percent increase in the effect on the services industry's employment of a marginal change in manufacturing's employment. Moreover, only manufacturing has an employment multiplier above 2 and slightly rising over the last decade. This means that more jobs are generated in other sectors than in manufacturing, whose employment is rising initially. Furthermore, this indirect effect has become gradually more important.

## 4.2 Input from overseas

Foreign content that is implicit in domestically sourced inputs has also increased in the last decade in Sweden. Using I-O data, Ekholm and Hakkala (2005) and Hagman and Lind (2008) confirm the rising trend in offshore sourcing since 1995. The strongest growth has occurred in the services industry, although from a lower level than for manufacturing[54]. In 2000, the import share in total input use was 17-19 percent for services and 38-53 percent for manufacturing, depending on how narrow a definition of offshore sourcing is used[55].

## 4.3 Conclusions from input-output analysis

Our input-output analysis shows that externally bought-in services accounted for a much larger share of the production value in manufacturing in 2005 than three decades ago. Consequently, the links between manufacturing and services industries are stronger than before. Imports have also become more important for private business and imported services in particular.

What is not clear from the above, however, is whether manufacturing firms indeed use more services or if they merely outsource them. Hence we will perform more a detailed analysis of recent developments in section six. However, before turning to the results, an account of our empirical approach and data is provided in the next section.

**Table 1 Intermediate usage in manufacturing, 1975-2005, as shares (%)**

| | Services shares | | Merchandise shares | |
|---|---|---|---|---|
| | **Total services in output ($input^s$/output)** | **Imported services in services input ($import^s$/$input^s$)** | **Total merchandise in output ($input^m$/output)** | **Imported merchandise in merchandise input ($import^m$/$input^m$)** |
| 1975 | 12 | 9 | 44 | 47 |
| 1995 | 21 | 9 | 45 | 45 |
| 2000 | 25 | 15 | 43 | 52 |
| 2005 | 25 | 17 | 44 | 54 |

Source: Input-output tables, Statistics Sweden, own calculations.

# 5. Empirical approach and data

In the remainder of the report we will draw on data from the firm and enterprise group levels. Firm-level data has been provided by Statistics Sweden. The database includes core financial information as well as data on employment and foreign trade. All firms in Sweden that existed in any year between 1997 and 2006 are included, except for firms in the primary, financial and core public sectors. (For more details on data, see annex two.)

The reason for also using enterprise group level data is firstly that it can provide information additional to that from I-O or firm data and it is useful when studying structural economic changes. Enterprise groups consist of interdependent firms – e.g. one entity providing advanced and differentiated products, another technical support and a third customised financial solutions – where key economic decisions are made at the enterprise group level[56]. Enterprise groups account for the bulk of the Swedish economy (see section 5.2 below). Secondly, analysis at the enterprise group level is also called for in the report since there is an unexpectedly large difference in manufacturing's services diversification in Canada compared with that in other OECD countries, when using establishment and enterprise level data. The difference may be related to the fact that statistical offices in North America and Europe use different definitions of an enterprise[57]. In North America the definition includes enterprise groups whereas in Europe it does not[58]. Thirdly, enterprise group data may shed new light on the potential overestimation of manufacturing's decline that has been discussed above.

## 5.1 Empirical approach

Unfortunately, structural business statistics do not yet exist at the enterprise group level in the EU. Furthermore, there is no industry classification of enterprise groups. A solution would thus be to determine the industry affiliation of enterprise groups and then aggregate firm level data to the enterprise group level. This is the approach taken here.

Firstly, we classify firms of an enterprise group as belonging to the manufacturing or services industry. Secondly, the largest two-digit industry of the dominating overall industry in the enterprise group is identified and this determines the classification of the entire enterprise group. Thirdly, we aggregate firm level data to the enterprise group level. The result is the enterprise group level dataset, which comprises all Swedish business entities (enterprise groups as well as stand-alone firms). In the analysis we will compare information from this dataset with the information from the original firm level dataset. (For more details, see annex two.)

The two micro level datasets of the study, one based on the firm and another having the enterprise group as its key unit, include quite detailed information. For example, data on bought-in inputs, employment costs and sales are included. With this information we may illuminate the intricacies of servicification in manufacturing. Generally, micro level data is to be preferred over I-O data when in-house production is of interest.

It can be added that with the method we use for industrial classification, enterprise groups may be reclassified. For example, a manufacturing enterprise group will eventually be reclassified as a services enterprise if the relative weight of its services firms in the enterprise group grows over time. Yet, tests with an alternative industry classification method that classify an entity once and for all at the time of establishment do not change the conclusions in the report and results differ only slightly in numbers. For example, manufacturing employment contracts slightly less than otherwise.

Even though only 13 percent of all firms are part of an enterprise group, enterprise groups account for 75 percent of value added and 69 percent of employment in 2006. (Their share is even higher in manufacturing, representing 90 percent of value added and 82 percent of employment.) Enterprise groups also trade much more frequently than stand-alone firms. 33 percent of the enterprise groups import merchandise and 37 percent of them export. Thus, enterprise groups account for the lion's share (93 percent) of foreign trade, as expected.

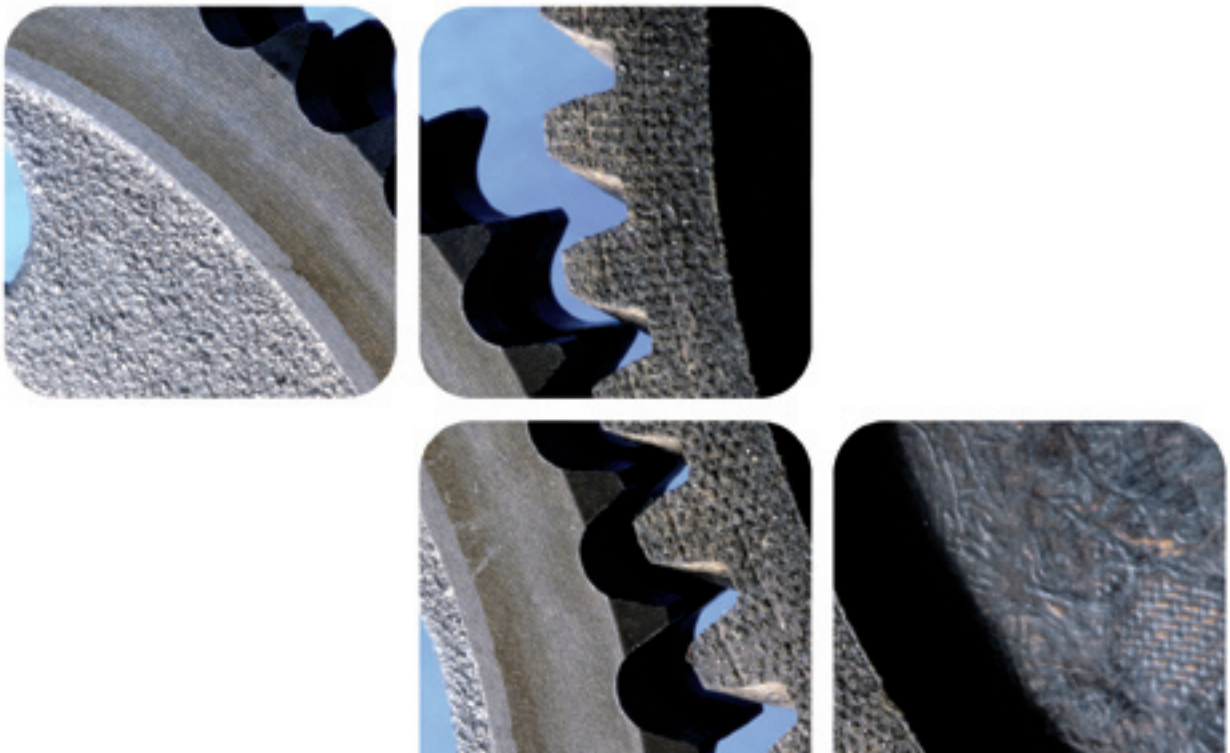
## 5.2 Data description

In table 2, data summary statistics for 2006 are provided. In rough numbers, 660,000 firms are included in the dataset for firms. Of these, there are some 35,000 parents (with 51,000 subsidiaries), while the remainder are stand-alone firms. About four percent of firms export merchandise and five percent import merchandise. This may seem low but is due to the inclusion of the large number of micro firms and small firms in the datasets. Small firms are known to participate less in foreign trade than larger firms. However, if only manufacturing is considered, trade participation is much higher, some 14 percent.

**Table 2 Descriptive statistics for enterprise groups and all firms, 2006**

| | Enterprise groups only | | All firms | |
|---|---|---|---|---|
| | **Total** | **Share** | **Total** | **Mean** |
| No Employed | 1,580,205 | 69% | 2,302,678 | 3.5 |
| Value added | 1,210,149,660 | 75% | 1,615,487,602 | 2,447.1 |
| Sales | 4,567,422,949 | 79% | 5,806,030,800 | 8,794.9 |
| Trade* | 1,683,814,906 | 93% | 1,810,034,636 | 4,488.7 |
| No importers* | 11,223 | 33% | 34,152 | na |
| No exporters* | 9,384 | 37% | 25,356 | na |
| No Units | 34,607 | 5% | 660,172 | na |

Source: SBS, RAMS, FTS, Statistics Sweden, own aggregation and calculations.
Note: Values in SEK 1,000. "*" means that only merchandise is considered.



# 6. Results – Swedish manufacturing since the 1990s: decline and servicification

In this section, we discuss results from our analysis of Swedish firm and enterprise group level data for the period of 1997 to 2006. Focus is on the extent of servicification in Swedish manufacturing. However, we start out by revisiting the issue of the industry's decline.

## 6.1 Manufacturing declines

Our data confirms that manufacturing's share in the Swedish economy continues to diminish during the 1997–2006 period, while the services share has expanded[59]. Manufacturing's share of total employment in the private industry has fallen by 19 percent, from 35.4 to 28.7 percent, according to firm level data in table 3. A drop is also shown in manufacturing's share of the total value added in the private sector, primarily in the late 1990s. However, enterprise group level data displays a somewhat smaller fall in the employment share and the value added share contracts much less and from a lower level, table 4. The lower share of manufacturing in enterprise group level data is due to manufacturing enterprise groups being classified as services enterprise groups in the study if their main activity is in services.

To conclude, the downward trend for manufacturing visible in Sweden's national accounts since the early 1970s continues[60]. However, the decline is smaller when the manufacturing industry's services firms are considered. Those firms are classified as manufacturing in enterprise group level data but not in firm level data. It is possible that outsourcing may account for another part of the contraction. It can be added that manufacturing still dominates the Swedish economy in some other respects. For example, the industry continues to account for the major share of private R&D in Sweden, and this applies even if we disregard R&D in the services subsidiaries of manufacturing enterprises[61].

**Table 3 Firm data: Shares of total value added and employment 1997-2006, percent**

| | 1997 | 1999 | 2001 | 2003 | 2005 | 2006 |
|---|---|---|---|---|---|---|
| Manufacturing | | | | | | |
| Value added | 36.3 | 34.8 | 31.8 | 31.9 | 32.0 | 32.0 |
| Employment | 35.4 | 34.1 | 32.1 | 31.1 | 29.8 | 28.7 |
| Services excl finance | | | | | | |
| Value added | 63.7 | 65.2 | 68.2 | 68.1 | 68.0 | 68.0 |
| Employment | 64.6 | 65.9 | 67.9 | 68.9 | 70.2 | 71.3 |

Source: SBS and RAMS, Statistics Sweden, own aggregation and calculations.

**Table 4 Enterprise group data: Shares of total value added and employment 1997-2006, percent**

| | 1997 | 1999 | 2001 | 2003 | 2005 | 2006 |
|---|---|---|---|---|---|---|
| Manufacturing | | | | | | |
| Value added | 32.9 | 32.8 | 28.9 | 33.1 | 31.6 | 31.0 |
| Employment | 31.9 | 32.9 | 28.1 | 31.6 | 28.8 | 27.6 |
| Services excl finance | | | | | | |
| Value added | 67.1 | 67.2 | 71.1 | 66.9 | 68.4 | 69.0 |
| Employment | 68.1 | 67.1 | 71.9 | 68.4 | 71.2 | 72.4 |

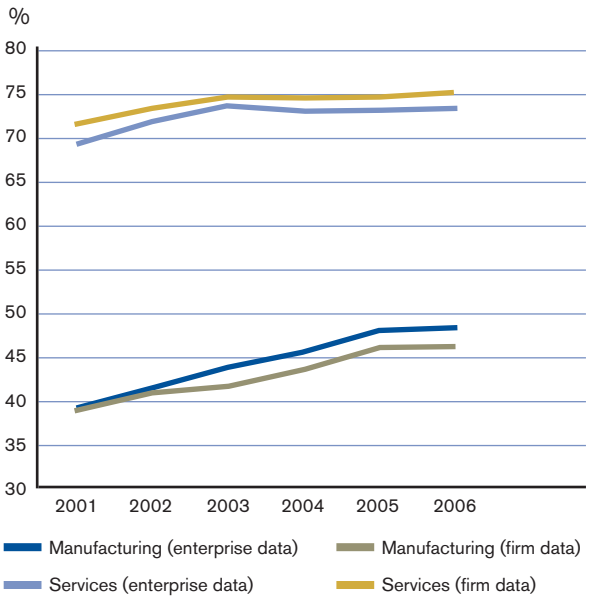
Source: SBS and RAMS, Statistics Sweden, own aggregation and calculations.

## 6.2 Manufacturing uses more services

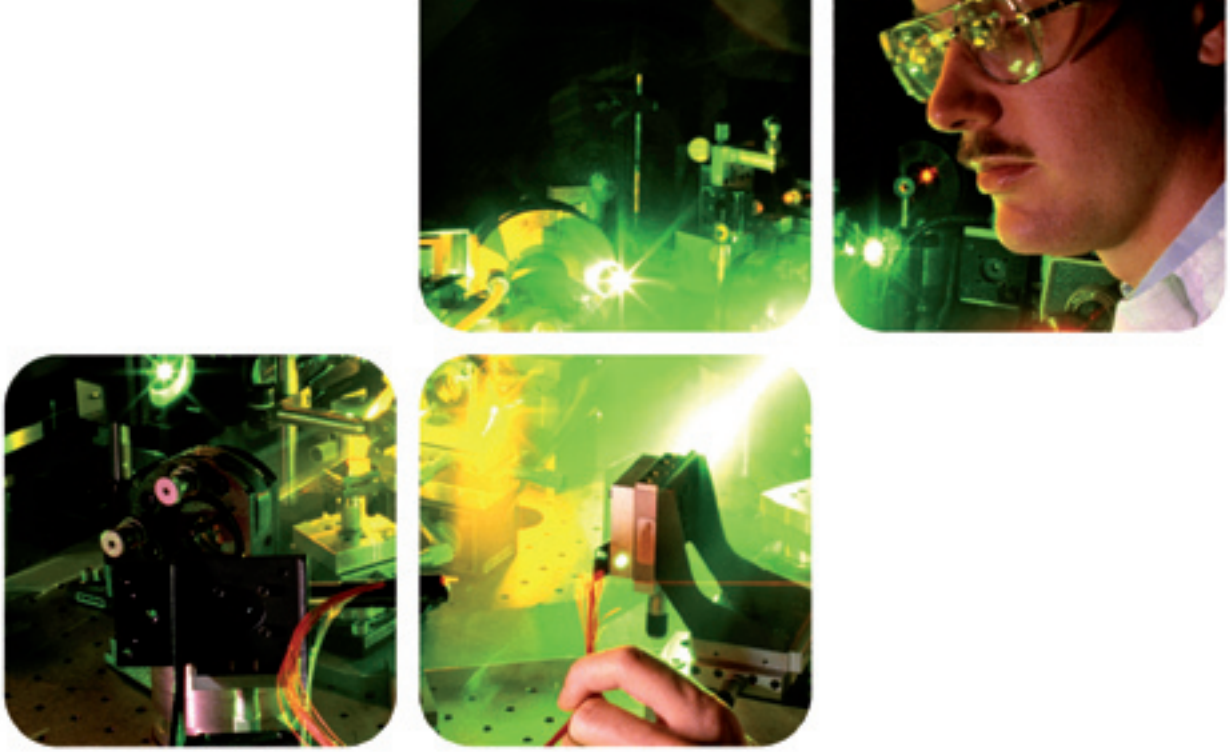
Manufacturing production is becoming more services intense, both at the firm and enterprise group level[62].

As for an earlier period in several OECD-countries[63], we find a substantial rise in manufacturing's share of employees in services-related occupations: from 39.1 percent of those employed in manufacturing in 2001 to 46.2 percent in 2006, figure 4[64]. This corresponds to an 18 percent rise and can be compared with a 5 percent rise in the services sector. Looking at enterprise group data, an even more

**Figure 4: Industry shares of employees in services-related occupations, 2001-2006**




Source: SBS & RAMS, Statistics Sweden, own aggregation and calculations.
Note: ISCO-codes: 100-500; 830; 910; and 933.



pronounced increase is noted in manufacturing. As a result, 48.5 percent of those employed in manufacturing in 2006 were in services-related occupations[65]. It can be added that large business entities have a much larger share of employees in services-related occupations than smaller entities do. The share in large manufacturing enterprise groups is more comparable with the one in micro businesses of the services industry than in smaller manufacturing enterprise groups (table A3).

Additionally, the overall trend in educational composition in manufacturing is analysed. This is interesting more generally, as regards the character of manufacturing, and is also related to classification of foreign trade into qualified and less qualified trade later in this report. Firm data shows that the share of employees in the manufacturing industry with post-secondary school education or higher has risen by 37 percent, from 17.5 to 23.9 percent between 1997 and 2006, table 5 and firm level data. Enterprise group data shows an even stronger rise (39 percent). In the services industry the rise is lower (some 35 percent), both according to firm and enterprise group data.

**Table 5 Industry shares of employees with higher education 1997-2006, percent**

| | 1997 | 1999 | 2001 | 2003 | 2005 | 2006 |
|---|---|---|---|---|---|---|
| Manufacturing | | | | | | |
| Firm | 17.5 | 18.4 | 20.1 | 21.8 | 23.3 | 23.9 |
| Enterprise group | 17.7 | 18.8 | 18.5 | 22.5 | 24.0 | 24.6 |
| Services excl finance | | | | | | |
| Firm | 21.3 | 22.9 | 25.3 | 26.4 | 27.9 | 28.7 |
| Enterprise group | 21.0 | 22.7 | 25.7 | 26.0 | 27.6 | 28.4 |

Source: RAMS from Statistics Sweden, own calculations.

We then analyse expenditures in Swedish manufacturing. Costs for goods and raw materials together with remuneration to blue collar workers constitute "goods input costs", whereas costs for bought-in services plus remuneration to white collar workers constitute "services input costs". The results show that services input costs account for an increasing share of manufacturing's expenditures, and the same applies to services produced in-house. Furthermore, at the enterprise group level, the difference is narrowing between the manufacturing and services industries in terms of the input mixture of services and merchandise. Still, services continue to be a relatively small component in manufacturing compared to merchandise. (It can be added that only direct services costs are included in this report, that is, the numbers would be even larger if services used for producing intermediate goods bought by the firm or enterprise group were also considered.)

According to table 6[66], services costs have risen and represented 32 percent of total (variable) input costs in 2006 at the enterprise group level[67]. The rise is in line with developments in industrialised countries in the late 20th century and with recent evidence for Sweden, using I-O tables[68].

Micro-data in this study also includes information on in-house services production costs, using labour remuneration as a proxy. While still only accounting for roughly a quarter of the total costs for services input into manufacturing (figure 5), in-house services input costs are higher in 2006 than in 2001 as a percentage of total input costs (table 6)[69]. According to firm level data, manufacturing has substituted in-house services for external services. Meanwhile, manufacturing's share of in-house services costs in total costs for *internally* sourced inputs has risen, figure 5. (This is particularly pronounced in enterprise group level data, where the in-house services cost share is up 21 percent, from 47 percent in 2001 to 58 percent in 2006.)

The rise in the relative importance of in-house services in manufacturing means that services in general, rather than merely being outsourced, increasingly are characterising manufacturing's in-house activity[70].

Next, we study the composition of manufacturing's expenditures for in-house services production. This is done by dividing costs for employees in services-related occupations into costs for qualified and less qualified workers. Qualified occupations is defined here as managers, professionals, technicians and associated professionals[71].

It emerges that manufacturing is not merely using more services in general than before, and in comparison with the services industry, but it is also spending increasingly more on qualified than on less qualified services professionals. The share of manufacturing's costs for qualified services-related employees has risen by some 6 percent between 2001 and 2006, while it has fallen by 25 percent for other workers, according to enterprise group data, see table 7. This development is also reflected in the employment numbers, figure 6[72].

The pattern that emerges in manufacturing is one where services and in particular qualified in-house services increasingly dominate total costs. Services also constitute an ever-larger share of costs for internally sourced inputs. This fits with the upward trend in imports of intermediate goods

**Table 6 Industries' services costs as share of total input costs 1997-2006, percent**

| | 1997 | 1999 | 2001 | 2003 | 2005 | 2006 |
|---|---|---|---|---|---|---|
| Manufacturing | | | | | | |
| Firm | 29.7 | 33.7 | 36.3 | 34.6 | 33.5 | 32.7 |
| *In-house* | | | *7.3* | *8.0* | *8.1* | *7.8* |
| Enterprise group | 29.5 | 31.6 | 30.4 | 34.2 | 33.4 | 32.0 |
| *In-house* | | | *7.5* | *7.8* | *8.3* | *7.9* |
| Services excl finance | | | | | | |
| Firm | 32.7 | 33.3 | 40.5 | 43.8 | 44.4 | 39.8 |
| *In-house* | | | *10.6* | *11.0* | *10.9* | *10.8* |
| Enterprise group | 32.7 | 34.3 | 42.2 | 44.3 | 44.4 | 40.0 |
| *In-house* | | | *10.3* | *11.2* | *10.9* | *10.8* |

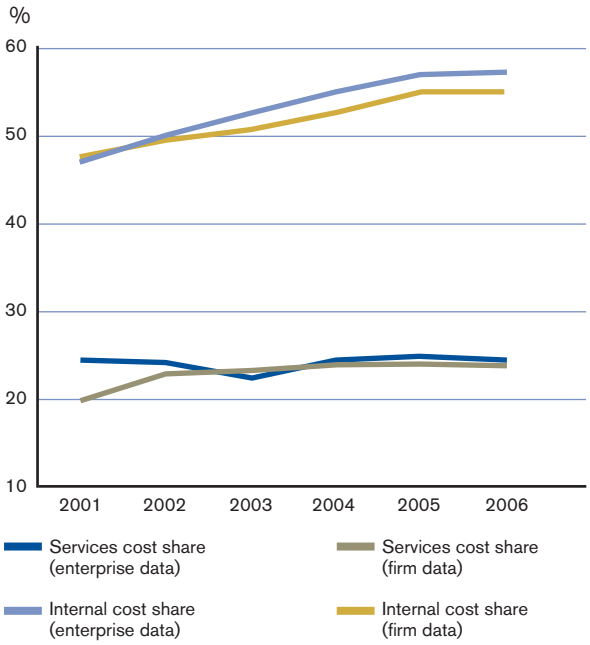
Source: Source: SBS and RAMS data from Statistics Sweden, own calculations.
Note: Only externally sourced inputs available for 1997-2000.

**Table 7 Qualified and less qualified services produced in-house as shares in total costs 2001-2006, percent**

| | 2001 | 2003 | 2005 | 2006 |
|---|---|---|---|---|
| Manufacturing | | | | |
| *Qualified* | | | | |
| Firm | 5.9 | 6.6 | 6.5 | 6.2 |
| Enterprise group | 5.9 | 6.4 | 6.7 | 6.3 |
| *Less qualified* | | | | |
| Firm | 9.3 | 9.2 | 8.4 | 7.9 |
| Enterprise group | 9.9 | 8.3 | 8.0 | 7.4 |
| Services excl finance | | | | |
| *Qualified* | | | | |
| Firm | 6.6 | 6.8 | 6.7 | 6.6 |
| Enterprise group | 6.6 | 6.8 | 6.6 | 6.6 |
| *Less qualified* | | | | |
| Firm | 6.8 | 6.8 | 6.8 | 6.7 |
| Enterprise group | 6.8 | 7.1 | 7.0 | 6.9 |

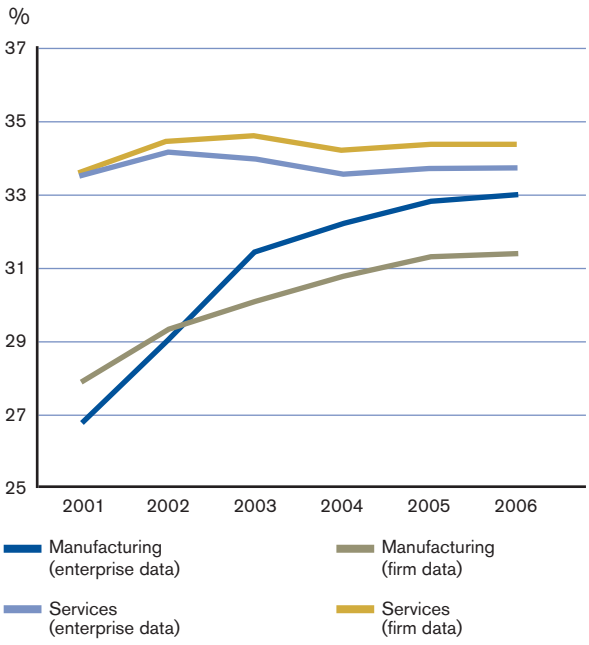
Source: SBS and RAMS, Statistics Sweden, own aggregation and calculations.
Note: ISCO-codes: qualified (100-300) and less qualified (400-500; 830; 910; and 933) services.

**Figure 5: Manufacturing´s in-house services, as shares in services costs and in total internal costs, 2001-2006**




Source: SBS & RAMS, Statistics Sweden, own aggregation and calculations.

**Figure 6: The shares of employees in qualified services occupations, 2001-2006**




Source: SBS & RAMS, Statistics Sweden, own aggregation and calculations.

noted in the literature as well as in this study[73]. It thus seems that the character of manufacturing firms' activities is changing in Sweden, although a somewhat longer period would be needed to draw a more definite conclusion.

As regards *bought-in* services in manufacturing, our data does not allow us to decompose them into qualified and less qualified services. However, ITPS (2008) finds that non-personal services industries in Sweden now have more than twice the employment share they had in 1970. In 2005, a substantial share of the employment in several producer services branches was related to demand in manufacturing; this applied to transportation, travel services, post- and telecommunications, real estate, R&D as well as other business services[74].

## 6.3 Manufacturing sells more services

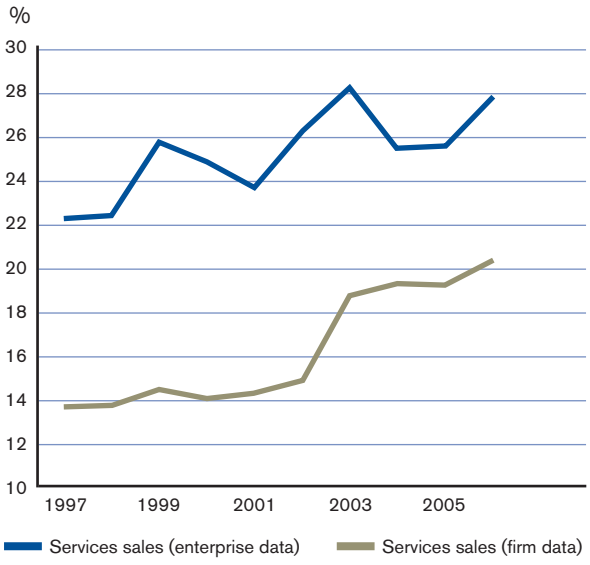
The process of the services diversification indicated earlier for Swedish manufacturing continues but is stronger than shown previously[75]. Manufacturing's services sales has gone up by half, from 13.6 to 20.3 percent of total sales over the 1997-2006 period, according to firm level data, figure 7. This rise is to a large extent explained by the growth of services sales shares in engineering and changes there in 2002/2003. However, enterprise group data displays a somewhat weaker but smoother and more general upward trend (up 25 percent), and from an initially much higher level (22 percent) than in firm level data (14 percent). The services sales share level in manufacturing is still higher if stand-alone firms are disregarded. With respect to the trend over time, manufacturing's slightly weaker increase in enterprise group data (compared with that in firm data) is nevertheless three times as large as the rise in the services industry, 18 versus 6 percent.

As regards types of services offered by manufacturing business, wholesale, retail and repair dominate with some 79.6 percent, but computer and related services are up from 3.6 to 6.6 percent of services turnover (table A6)[76].

One might have expected that the move towards services diversification would be relatively stronger in the enterprise group dataset than in the firm level dataset. One reason for the differing degrees of moves towards services diversification in the two datasets might be that services sales at the enterprise group level take place instead in enterprise groups' firms abroad[77].

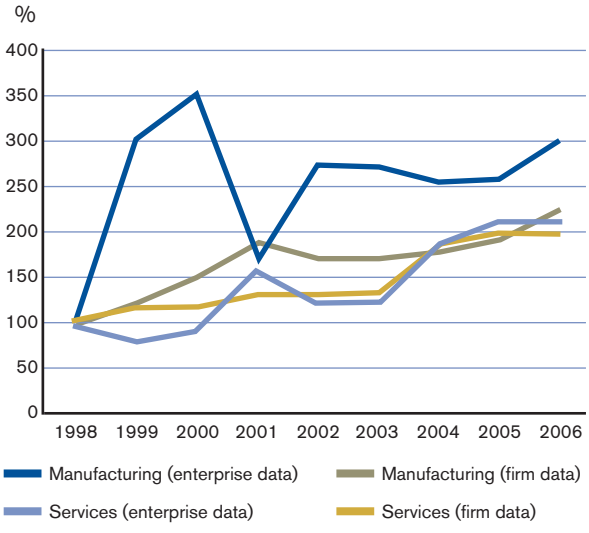
Evidence of manufacturing's services diversification is also apparent in exports[78]. Manufacturing's services exports have risen considerably between 1998 and 2006. The rise is higher than in the services industry and especially pronounced in enterprise group data, see figure 8[79]. Furthermore, we analyse the "skills-content" of trade. Products are divided into qualified and less qualified products, drawing on skills classifications of industries[80]. We find that the pattern for overall services exports also applies to the export of qualified services, table A7[81].

**Figure 7: Manufacturing´s services sales, as shares in total turnover, 1997-2006**




Source: SBS, Statistics Sweden, own aggregation and calculations.

**Figure 8: Services export, 1998-2006 (SEK)**




Source: Trade and trade price statistics, Statistics Sweden, own calculations.
Note: Break in 2002/2003 and 2003 values imputed. Index=100 in 1998. Deflated export values.

## 6.4 Servicification across manufacturing industries

Finally, we create an index on servicification in order to get an overall indication of the phenomenon across manufacturing industries, table 8. The index ranges between zero and one, where zero means that an industry ranks the lowest among manufacturing industries in both services use and services sales and one that the industry ranks the highest in both respects. To be specific, the index value is the simple mean of the (normalised) services shares in total costs and in total sales[82].

The pattern that emerges is one where servicification is spread across manufacturing industries. The medicines industry and the coke, refined petroleum, nuclear and chemicals industry stand out as the most servicified ones, while the basic metals and fabricated metals products industry as well as the other electrical machinery and apparatus industry are the least servicified ones[83]. The most servicified manufacturing industries resemble business services industries as regards services and qualified services cost shares. They also have high shares of qualified services sales compared to many other manufacturing industries. It can be mentioned that the relatively low ranking for the ICT equipment industry is a result of its very low services sales share. Meanwhile it is the number one services user. Moreover, its qualified services share is the third highest in manufacturing.

**Table 8 Servicification index for manufacturing industries, 2006 (enterprise group data)**

| Industry | Index | Use of services | Sale of services |
|---|---|---|---|
| Medicines | 0.82 | 0.49 | 0.21 |
| Coke, refined petroleum, nuclear and chemicals | 0.73 | 0.54 | 0.15 |
| Furniture, manufacturing n.e.c. and recycling | 0.62 | 0.47 | 0.13 |
| Mining and quarrying | 0.61 | 0.59 | 0.09 |
| Rubber and plastic products | 0.60 | 0.38 | 0.14 |
| Textiles and leather and their products | 0.54 | 0.60 | 0.06 |
| ITC equipment | 0.54 | 0.76 | 0.02 |
| Pulp, paper, publishing and printing | 0.43 | 0.55 | 0.03 |
| Medical, precision and optical instruments | 0.43 | 0.24 | 0.11 |
| Other transport equipment | 0.41 | 0.25 | 0.10 |
| Non-metallic mineral products | 0.38 | 0.45 | 0.04 |
| Other machinery, office machinery and computers | 0.35 | 0.24 | 0.08 |
| Wood products | 0.34 | 0.29 | 0.06 |
| Food, beverages and tobacco | 0.33 | 0.08 | 0.11 |
| Motor vehicles, trailers and semitrailers | 0.33 | 0.16 | 0.09 |
| Other electrical machinery and apparatus | 0.31 | 0.09 | 0.10 |
| Basic metals and fabricated metal products | 0.23 | 0.22 | 0.03 |

Source: SBS, Statistics Sweden, own aggregation and calculations.
Note: Columns 3 and 4 contains shares in totals, while the index is the mean of the normalised values of these shares.

# 7. Conclusions and final remarks

The report illustrates the added value of data at the enterprise group level when studying structural economic changes such as the servicification of manufacturing. This is the result of enterprise groups becoming more prominent and, in 2006, accounting for 75 percent of value added, 69 percent of employment and 93 percent of foreign trade in Sweden. In the absence of official data and industry classifications at this level, we have used a simple method for industry classification of enterprise groups and then aggregated firm level data to the enterprise group level. However, for the future, official enterprise group data or at the least an official industry classification of them according to activity would be welcome.

Turning to the actual results, the study confirms that manufacturing's share of the Swedish economy continues to fall. However, we show that the decrease is smaller when enterprise groups are considered. The smaller fall in enterprise group level data is due to the fact that manufacturing industry's services firms are included at that level while excluded in firm level data. The fundamental reason behind the less pronounced fall at the enterprise group level may be either that manufacturing firms are unbundling or that the services firms of manufacturing enterprise groups are expanding, or a combination of these two explanations. More generally, outsourcing and offshoring may be responsible for another part of the decline in manufacturing but this is difficult to substantiate in the absence of additional data.

On manufacturing's input side, externally bought-in services accounted for a much larger share of the production value in 2005 than three decades ago. Imports have also become more important for private business. Yet, we find that the rise in bought-in services in manufacturing is not matched by a fall in the industry's own services activities. To the contrary, in-house services increasingly dominate manufacturing's activities. This goes particularly for qualified services.

On the output side, manufacturing's services sales and services exports are up in comparison with total sales, compared with that in the late 1990s. Moreover, we show that services sales are much greater (almost 60 percent higher) when all activities in manufacturing's enterprise groups are considered. This has not been shown for a European country before.

To conclude, Swedish manufacturing seems to be changing character – it is being servicified. This finding confirms what case studies have indicated and fits well with what is expected from the literature.

Overall, the results imply that treating services and manufacturing separately e.g. in trade policy formation and negotiations may be out-of-date in an industrialised country such as Sweden. Furthermore, attention should be paid to the interdependence of manufacturing and services industries in analysis of trade statistics. Services trade barriers are likely to significantly affect manufacturing. Manufacturing substantially and increasingly uses offshore services and itself provides services abroad, often in combination with manufactures. This underlines the importance for manufacturing of liberalising trade in services. The interdependence between manufacturing and services is indeed reflected in a recent proposal for the Doha negotiations. In the proposal, the WTO member suggests that negotiations of some sectoral non-agricultural goods agreements and liberalisation of related services should be done jointly. (Implications for trade policy and trade analysis of manufacturing's decline and servicification will be studied more in-depth in a subsequent report of the board.)

It can be added that these trends rely on the present distribution of factors of production across countries and industries and cannot be taken for granted. Industrialised countries such as Sweden may only continue their functional specialisation in high value added activities if their competitive advantages of highly skilled labour and advanced technologies remain. Skills and technologies are in turn positively related to trade, investment and migration. Openness is therefore key for the firms of industrialised countries, which are ever more fragmented internationally.

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# Annex 1. Tables and figures

**Table A1.1 Private employment shares 1993-2007 (%)**

| | 1993 | 1995 | 2000 | 2005 | 2007 |
|---|---|---|---|---|---|
| **All goods production** | **46** | **46** | **43** | **41** | **40** |
| All industry | 28 | 30 | 28 | 26 | 25 |
| Consumption-good industry | 3 | 3 | 3 | 3 | 2 |
| Basic industry incl. chemicals | 7 | 7 | 7 | 6 | 6 |
| Engineering industry | 17 | 19 | 19 | 17 | 17 |
| Other goods production | 18 | 16 | 15 | 15 | 15 |
| **All private services** | **54** | **54** | **57** | **59** | **60** |
| Business services | 9 | 10 | 13 | 14 | 14 |
| Transport services | 8 | 8 | 8 | 7 | 7 |
| Post and telecommunication | 3 | 2 | 2 | 2 | 2 |
| Finance and insurance | 3 | 3 | 3 | 3 | 3 |
| Real estate | 3 | 3 | 2 | 2 | 2 |
| Other private services | 29 | 28 | 29 | 31 | 31 |

Note: Statistics Sweden, National Accounts, share of hours worked in private sector by economic activity, own computations. Classification (SNI 02): consumption-good (SNI15-19); basic industry (SNI10-14 and 20-24); engineering (SNI25-37); other goods (SNI01-05 and 40-5); business services (SNI71-74); transport (SNI60-3); post and tele (SNI64); finance and insurance (SNI65-67); real estate (SNI70); and other private services (SNI50-55 and 80-95).

**Table A1.2 Private employment shares 1963-2007 (%)**

| | 1963 | 1970 | 1980 | 1990 | 2000 | 2007 |
|---|---|---|---|---|---|---|
| **All goods production** | **62** | **58** | **54** | **48** | **43** | **40** |
| Industry | 35 | 35 | 34 | 30 | 28 | 25 |
| **All private services** | **38** | **42** | **47** | **53** | **57** | **60** |
| Business services* | 8 | 9 | 5 | 8 | 13 | 14 |

Note: Statistics Sweden, National Accounts, share of hours worked in private sector by economic activity, own computations. Classification (SNI 69, 1963-79; SNI 92, 1980-1993; and SNI 02, 1993-2007): goods (SNI01-45); industry (SNI10-37); services (SNI50-95, excl. 75); * business services (SNI65-74, 1963-1970; SNI71-74, 1980-).

**Table A2.1 Private production shares 1993-2007 (%)**

| | 1993 | 1995 | 2000 | 2005 | 2007 |
|---|---|---|---|---|---|
| **All goods production** | **39** | **40** | **39** | **38** | **37** |
| All industry | 24 | 27 | 28 | 27 | 27 |
| Consumption-good industry | 3 | 3 | 3 | 2 | 2 |
| Basic industry incl. chemicals | 9 | 9 | 9 | 10 | 9 |
| Engineering industry | 12 | 15 | 17 | 15 | 16 |
| Other goods production | 14 | 13 | 11 | 10 | 10 |
| **All private services** | **61** | **60** | **61** | **62** | **63** |
| Business services | 12 | 12 | 13 | 14 | 14 |
| Transport services | 6 | 7 | 6 | 6 | 6 |
| Post and telecommunication | 2 | 2 | 3 | 3 | 3 |
| Finance and insurance | 6 | 5 | 5 | 6 | 6 |
| Real estate | 16 | 15 | 13 | 12 | 11 |
| Other private services | 19 | 19 | 20 | 22 | 23 |

Note: Statistics Sweden, National Accounts, share of private sector VA in basic values by economic activity, own computations. Classification (SNI 02): consumption-good (SNI15-19); basic industry (SNI10-14 and 20-24); engineering (SNI25-37); other goods (SNI01-05 and 40-5); business services (SNI71-74); transport (SNI60-3); post and tele (SNI64); finance and insurance (SNI65-67); real estate (SNI70); and other private services (SNI50-55 and 80-95).

**Table A2.2 Private production shares 1963-2007 (%)**

| | 1963 | 1970 | 1980 | 1990 | 2000 | 2007 |
|---|---|---|---|---|---|---|
| **All goods production** | **54** | **55** | **46** | **44** | **39** | **37** |
| Industry | 32 | 35 | 29 | 27 | 28 | 27 |
| **All private services** | **46** | **45** | **54** | **56** | **61** | **63** |
| Business services | 2 | 3 | 6 | 8 | 13 | 14 |

Note: Statistics Sweden, National Accounts, share of private sector VA in basic values by economic activity. Classification (SNI 69, 1963-79; SNI 92, 1980-1993; and SNI 02, 1993-2007): goods (SNI01-45); industry (SNI10-37); services (SNI50-95); business services (SNI71-74); transport (SNI60-3); post and telecommunications (SNI64); finance and insurance (SNI65-67); real estate (SNI70); and other private services (SNI50-55 and 80-95). Difference between -1992 and 1993-: other repairs moved from engineering to other private services. Finally, please note breaks in SNI and price-series in 1980 and 1992.

**Table A3 Enterprise group data: Industry shares of service-related employees, 2006, %, by size**

| | |
|---|---|
| **Manufacturing** | |
| Micro | 39.4 |
| Small and Medium-sized Enterprises | 39.3 |
| Large | 54.3 |
| **Services excl. finance** | |
| Micro | 64.0 |
| Small and Medium-sized Enterprises | 74.9 |
| Large | 80.3 |

Source: RAMS, Statistics Sweden, own aggregation and calculations.

**Table A4.1 Enterprise group data: Merchandise trade value 1997-2006, index=100 in 1997**

| | 1997 | 1999 | 2001 | 2003 | 2005 | 2006 |
|---|---|---|---|---|---|---|
| **Manufacturing** | | | | | | |
| Qualified import | 100 | 113 | 116 | 132 | 130 | 138 |
| Other import | 100 | 131 | 105 | 161 | 142 | 155 |
| Qualified export | 100 | 107 | 113 | 138 | 147 | 154 |
| Other export | 100 | 120 | 96 | 159 | 152 | 156 |
| **Services excl finance** | | | | | | |
| Qualified import | 100 | 103 | 107 | 104 | 116 | 120 |
| Other import | 100 | 99 | 118 | 93 | 120 | 122 |
| Qualified export | 100 | 93 | 123 | 107 | 152 | 180 |
| Other export | 100 | 101 | 178 | 55 | 123 | 138 |

Source: Trade and trade price statistics, Statistics Sweden, own aggregation and calculations. Note: Deflated values. Intermediate to very high skills, drawing on O'Mahoney and van Ark (2003) and Peneder (2007).

**Table A4.2 Firm data: Merchandise trade value 1997-2006, index=100 in 1997**

| | 1997 | 1999 | 2001 | 2003 | 2005 | 2006 |
|---|---|---|---|---|---|---|
| **Manufacturing** | | | | | | |
| Qualified import | 100 | 102 | 109 | 111 | 118 | 125 |
| Other import | 100 | 109 | 108 | 106 | 114 | 114 |
| Qualified export | 100 | 101 | 114 | 124 | 137 | 146 |
| Other export | 100 | 114 | 119 | 123 | 135 | 140 |
| **Services excl finance** | | | | | | |
| Qualified import | 100 | 111 | 112 | 118 | 125 | 129 |
| Other import | 100 | 111 | 118 | 123 | 138 | 147 |
| Qualified export | 100 | 114 | 124 | 155 | 204 | 230 |
| Other export | 100 | 114 | 142 | 149 | 198 | 224 |

Source: Trade and trade price statistics, Statistics Sweden, own aggregation and calculations. Note: Deflated values. Intermediate to very high skills, drawing on O'Mahoney and van Ark (2003) and Peneder (2007).

**Table A5.1 Services import values 1998-2006, index=100 in 1998**

| | 1998 | 2000 | 2002 | 2004 | 2006 |
|---|---|---|---|---|---|
| **Manufacturing** | | | | | |
| Firm | 100 | 154 | 179 | 169 | 178 |
| Enterprise group | 100 | 248 | 284 | 229 | 253 |
| **Services excl. finance** | | | | | |
| Firm | 100 | 110 | 123 | 158 | 172 |
| Enterprise group | 100 | 102 | 111 | 165 | 174 |

Source: Trade and trade price statistics, Statistics Sweden, own aggregation and calculations. Note: Deflated import values. Break in the series 02/03 and 2003 values imputed.

**Table A5.2 Qualified services import values 1998-2006, index=100 in 1998**

| | 1998 | 2000 | 2002 | 2004 | 2006 |
|---|---|---|---|---|---|
| **Manufacturing** | | | | | |
| Firm | 100 | 170 | 200 | 185 | 197 |
| Enterprise group | 100 | 279 | 346 | 270 | 308 |
| **Services excl. finance** | | | | | |
| Firm | 100 | 113 | 130 | 158 | 162 |
| Enterprise group | 100 | 104 | 111 | 179 | 169 |

Source: Trade and trade price statistics, Statistics Sweden, own aggregation and calculations. Note: Deflated import values. Break in the series 02/03 and 2003 value imputed. Services classification draws on O'Mahoney & van Ark (2003) and Peneder (2007).

**Table A7 Qualified services export values 1998-2006, index=100 in 1998**

| | 1998 | 2000 | 2002 | 2004 | 2006 |
|---|---|---|---|---|---|
| **Manufacturing** | | | | | |
| Firm | 100 | 153 | 177 | 188 | 241 |
| Enterprise group | 100 | 376 | 293 | 276 | 333 |
| **Services excl. finance** | | | | | |
| Firm | 100 | 128 | 153 | 222 | 236 |
| Enterprise group | 100 | 86 | 131 | 226 | 260 |

Source: Trade and trade price statistics, Statistics Sweden, own aggregation and calculations. Note: Deflated export values. Break in the series 02/03 and 2003 values imputed. Services classification draws on O'Mahoney & van Ark (2003) and Peneder (2007).

**Table A6 Enterprise group data: Services sales by service products 2003-2006, percent**

| | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|
| **Manufacturing** | | | | |
| Wholesale, retail and repair | 84.0 | 75.3 | 76.6 | 79.6 |
| Hotels and restaurants | 0.1 | 0.1 | 0.0 | 0.0 |
| Transport, storage and other communication | 3.1 | 3.7 | 3.6 | 3.2 |
| Post and telecommunications | 0.1 | 1.0 | 0.3 | 0.3 |
| Financial services | 0.0 | 0.0 | 0.1 | 0.1 |
| Real estate and renting | 2.3 | 3.3 | 2.2 | 2.4 |
| Computer and related activities | 3.6 | 6.1 | 7.9 | 6.6 |
| Research and development | 2.4 | 3.1 | 3.3 | 3.0 |
| Other business activities | 3.3 | 5.5 | 4.9 | 3.8 |
| Education; and health and social work | 0.0 | 0.1 | 0.1 | 0.0 |
| Other community, social and personal services | 0.8 | 1.7 | 0.9 | 0.9 |
| Other industrial services | 0.2 | 0.0 | 0.1 | 0.0 |
| **Services excl. finance** | | | | |
| Wholesale, retail and repair | 59.1 | 55.3 | 56.3 | 58.8 |
| Hotels and restaurants | 1.0 | 1.3 | 1.2 | 1.1 |
| Transport, storage and other communication | 12.4 | 13.2 | 11.9 | 11.7 |
| Post and telecommunications | 5.9 | 5.3 | 5.4 | 5.1 |
| Financial services | 0.2 | 0.0 | 0.0 | 0.0 |
| Real estate and renting | 7.1 | 6.8 | 7.2 | 5.8 |
| Computer and related activities | 2.6 | 3.3 | 3.5 | 3.3 |
| Research and development | 0.2 | 0.3 | 0.2 | 0.1 |
| Other business activities | 6.1 | 8.1 | 8.2 | 8.4 |
| Education; and health and social work | 2.0 | 2.5 | 2.3 | 2.1 |
| Other community, social and personal services | 3.3 | 3.9 | 3.7 | 3.4 |
| Other industrial services | 0.1 | 0.0 | 0.0 | 0.1 |

Source: SBS, Statistics Sweden, own aggregation and calculations. Note: Services related to SNI 40-45; 65-67 and 75 are excluded.

**Table A8 Sectors of the study**

| No. | SNI 2002 code | Sectors | Study sectors |
|---|---|---|---|
| 1 | sni01-05 | Agriculture, hunting, forestry and fishing | Other goods |
| 2 | sni10-14 | Mining and quarrying | Basic industry |
| 3 | sni15-16 | Food, beverages and tobacco | Consumption goods industry |
| 4 | sni15-37 | Manufacturing | |
| 5 | sni17-19 | Textiles and leather and their products | Consumption goods industry |
| 6 | sni20 | Wood products | Basic industry |
| 7 | sni21-22 | Pulp, paper, paper products; and publishing, printing and reproduction of recorded media | Basic industry |
| 8 | sni23-24 excl. 244 | Coke, refined petroleum, nuclear and chemicals, except medicines | Basic industry |
| 9 | sni244 | Medicines | Engineering industry |
| 10 | sni25 | Rubber and plastic products | Engineering industry |
| 11 | sni26 | Non-metallic mineral products | Basic industry |
| 12 | sni27-28 | Basic metals and fabricated metal products | Engineering industry |
| 13 | sni28-35 | Engineering industry | |
| 14 | sni29-30 | Other machinery, office machinery and computers | Engineering industry |
| 15 | sni31 | Other electrical machinery and apparatus | Engineering industry |
| 16 | sni32 | ITC equipment | Engineering industry |
| 17 | sni33 | Medical, precision and optical instruments, watches and clocks | Engineering industry |
| 18 | sni34 | Motor vehicles, trailers and semitrailers | Engineering industry |
| 19 | sni35 | Other transport equipment | Engineering industry |
| 20 | sni36-37 | Furniture, manufacturing n.e.c. and recycling | Consumption goods industry |
| 21 | sni40-41 | Electricity, gas, steam and hot water supply; and collection, purification and distribution of water | Other services |
| 22 | sni40-93 excl. 65-67, 75 | Services | |
| 23 | sni45 | Construction | Other services |
| 24 | sni50-52 | Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods | Other services |
| 25 | sni55 | Hotels and restaurants | Other services |
| 26 | sni60-63 | Transport, storage and communication except post and telecommunications | Other services |
| 27 | sni64 | Post and telecommunications | Other services |
| 28 | sni70-71 | Real estate and renting | Business services |
| 29 | sni72 | Computer and related activities | Business services |
| 30 | sni73 | Research and development | Business services |
| 31 | sni74 | Other business activities | Business services |
| 32 | sni80-85 | Education; and health and social work | Other services |
| 33 | sni90-93 | Other community, social and personal service activities | Other services |
| 34 | sni65-67** | Financial intermediation (except compulsory social security) and activities auxiliary to financial intermediation | Other services |
| 35 | sni75** | Public administration and defence, and compulsory social security | Other services |
| 36 | sni95** | Activities of households | Other services |
| 37 | sni99** | Extra-territorial organisations and bodies | Other services |

Note: Sectors in blue are not in the database. On SNI 2002, see www.scb.se/Grupp/foretagsregistret/_Dokument/040115snisorteradeng.pdf.

# Annex 2. More on data and method

## Data

Data for chapters 5 and 6 of the study comes from Statistics Sweden and covers 1997-2006. The resulting unbalanced micro panel database encompasses all firms in Sweden except for firms in the primary, financial and core public sectors[84].

Core financial information comes from the Swedish Structural Business Statistics (SBS). The SBS is based on data of the Swedish Tax Authority but is supplemented by survey data for some variables as well as for the largest firms. A firm is generally defined as the smallest legal entity. However, there are some 50 "composite firms" who report for more than one legal entity within the same enterprise group[85]. Industry affiliation of firms and entities is from the Business Register and is done using the Swedish standard industrial classification (SNI 2002). SNI 2002 corresponds to NACE (rev. 1.1) up to 4-digit level. The Swedish product classification by activity (SPIN 2002) is also used. It can be described as an industry classification of products and corresponds to Eurostat's Classification of Product by Activity (CPA), at the 4-digit level.

Information on enterprise affiliation comes from the Swedish Enterprise Group Register (EGR). Data has been collected by Statistics Sweden and PAR AB. An enterprise group is defined as a group consisting of a parent firm and at least one additional firm, where the parent holds the absolute and therefore controlling majority (>50%) of the stocks[86].

Statistics on the highest education attained for each resident aged 16-74 come from the register based labour market statistics (RAMS). Since 2001 RAMS also contains information on number of employees, their occupation and remuneration.

Foreign trade data is from the Swedish Foreign Trade Statistics (FTS). It includes value (SEK) and country of origin or destination. With respect to merchandise trade with non-EU countries, data comes from compulsory registration information of the Swedish Customs. Regarding intra-EU merchandise trade, data covers the trade of all firms with annual imports or exports of 2.2 and 4.5 million SEK, respectively[87]. For services trade, all collated bank transactions larger than SEK 150,000 crossing the Swedish border are included before 2003. Since 2003 data is based on a quarterly survey. A representative sample of some 5,000 services traders is included in the survey – 10 percent of the population – and a third of the sample is replaced each year[88].

## The enterprise group level dataset

Analysis in chapters 5 and 6 is partly based on data at the enterprise group level. Below, we account for the construction of that dataset.

The first step is to classify the firms of an enterprise group in any one year as belonging to the manufacturing or services industry, based on industry classification at the firm level[89]. (For the industries of the study, see table A8.) The industry with the largest value added, net sales and number of employees (in consecutive order) determines the overall classification of the enterprise group.

In the second step, the largest two-digit industry of the dominating overall industry in the enterprise group is identified. That two-digit industry decides the classification of the whole enterprise group at that level and year, using the same parameters as in the first step. (The choice of value added as the key parameter in this process is made in line with practice in North America.[90])

Finally, when all enterprise groups have been classified according to industry, firm level data is aggregated to the enterprise group level. This is the study's enterprise group level dataset.

It can be mentioned that Swedish and foreign multinational enterprises (MNEs) are treated no differently in this scheme. However, due to the lack of data on foreign activities and industry classification elsewhere, enterprise groups established in Sweden are by necessity considered on their own.

# Notes

1 See e.g. Smith (2006); Gresser (2007); Dobbs (2006); and Robert-Nicoud (2006).

2 An enterprise group consists of a parent firm and at least subsidiary, where the parent holds more than half of the subsidiary's stocks. Key decisions are made at the enterprise group level and the firms of the group are often interdependent.

3 National Board of Trade (2010).

4 No. employed in 23 OECD-countries, OECD STAN-database and Labour Force Statistics.

5 Tables A1-2.

6 Pilat and Wölfl (2005) and Pilat et al (2006) provide surveys and point to the need for more analysis and consideration of enterprise groups in such analysis. See also Neely (2008) and Braunerhjelm et al (2008).

7 National Board of Trade (2010).

8 Trade (in merchandise and services) and FDI inflows divided by GDP; and No. of products traded, World Trade Indicators 2008, World Bank. For Sub-Saharan Africa, however, FDI inflows have declined in the same period.

9 1965-2007 period (National Board of Trade, 2009).

10 National Board of Trade (2005).

11 SOU (2008).

12 SOU (2008).

13 Denmark, Finland, United Kingdom, Germany, France and the USA.

14 ITPS (2008).

15 See e.g. Dobbs (2006) and views expressed by leading Swedish members of parliament in Tjänstesektorn i samverkan (2007). See also the overview of several governmental investigations on the issue in Djerf et al (2005).

16 See e.g. McCarthy and Anagnostou (2004); Greenhalgh and Gregory (2001); and Schettkat and Russo (1998).

17 See e.g. Djerf et al (2005).

18 See e.g. Clark (1940) and Kuznets (1966).

19 The income elasticity of services means that the percent change in services demand related to a rise in income is greater than the percent increase in income. However, the income elasticity of services is disputed by Hammes, Rosa and Grubel (1989).

20 Schettkat and Yocarini (2006).

21 Traditionally, the potential for productivity growth has been regarded as low in services. The reason is that many services activities (e.g. cleaning and haircuts) have been difficult to speed up or replace with machinery.

22 Triplett and Bosworth (2003). See also ITPS (2008).

23 See e.g. Inklaar et al (2008).

24 See e.g. Wölfl (2003).

25 Grossman and Rossi-Hansberg (2006 and 2008).

26 These alternatives are vertical in the sense that they are about which parts of the value chain within a specific industry that the firm is to engage in. This is also the common terminology in the literature as well as what is used in this report. (However, they could be viewed as horizontal alternatives within the industry, since they include choices among activities at a specific part of the value chain.)

27 Empirically, it is difficult to distinguish between: a) the continuation of an existing strategy and the start of a new one; and b) a long-term strategy (e.g. outsourcing a firm's activity) and a temporary arrangement (e.g. subcontracting an activity of a specific contract).

28 Pilat et al (2006).

29 Ericsson (2009).

30 Outsourcing proper is the hiving off of an existing activity rather than the buying-in of a new activity. Since data of necessary detail is lacking on intra-firm activities, this distinction is commonly not considered.

31 Djef et al (2005).

32 van Dusen (1998).

33 Barrar and Gervais (2006).

34 E.g. Quinn and Hilmer (1994).

35 E.g. Grossman and Helpman (2005); Lewin et al (2009); Antràs and Helpman (2004); and Barba Naveretti et al (2005).

36 Paul and Wooster (2008).

37 See e.g. Barrar and Gervais (2006).

38 Stigler (1951).

39 Grossman and Rossi-Hansberg (2008)

40 Tomiyama (2002).

41 Other terms used are servicisation, servification and servitization, while other related concepts are functional products and product-service system. , see e.g. Sakao et al (2009), Kindström and Kowalkowski (2009) and Vandermerwe and Rada (1988).

42 Martinez et al (2008).

43 Peneder (2007),

44 Triplett and Bosworth (2003).

45 The tradability of non-personal services is related to the fact that they are more separable, can be standardised and are intermediate rather than final in character; this in contrast with personal services as traditionally characterised e.g. in Wolak et al (1998).

46 Singelmann (1978). Producer services are essentially financial and business services whereas personal services e.g. include repair, laundry, hotels, catering and entertainment.

47 Avadikyan and Lhuillery (2007). It can be mentioned that the management literature points to the need for including services as part of manufacturers' product offers (Oliva and Kallenberg, 2003). Witell et al (2009) survey servicification and its motives in the Swedish motor vehicle industry.

48 SOU (2008, p. 93-95) shows net-exports of royalties and licenses have expanded tremendously in the last decade and profits from activities abroad are considerable. Swedish multinationals' activities abroad have also expanded substantially in recent years. As a whole, there is reason to believe that this is behind part of the servicification in Swedish manufacturing.

49 Evidence on productivity effects of services outsourcing is limited. ten Raa and Wolff (2001) analyse services outsourcing in the US over the 1977-1996 period at the industry-level. They find it to contribute positively to manufacturing's productivity. However, services' tradability and general character have changed considerably since then.

50 Such services may be more distant to the core business of the firm than qualified ones.

51 An I-O table shows who produces and who uses goods and services in an economy and for what purpose (consumption, production, investment and government use). The use of imports is also captured. Thus, it is e.g. possible to estimate how much electronics is imported for final consumption, for the motor vehicle industry directly as well as for the same industry indirectly (via other industries that incorporate foreign electronics in products that are supplied to the motor vehicles industry).

52 Our micro-data shows that the total of bought-in inputs rises moderately, 1997-2006.

53 The multiplier measures the total employment effect of an increase in demand for an industry's products. If the value is one, no employment is generated in other sectors than the original one (direct effect only). A value above one means that employment is also generated in other sectors since they supply the original industry with inputs (indirect effect). Multipliers are calculated using I-O matrices based on the national accounts. Note that the estimates are lower limits since income effects are ignored by the authors.

54 Analysis of IO-tables from Statistics Sweden for 1995 and 2000 in Ekholm and Hakkala (2005); and for the same years plus 2005 in Hagman and Lind (2008).

55 For the share of imported inputs in total Swedish merchandise imports, see www.konj.se.

56 The number of enterprise groups has risen by 87 percent, 1997-2006. It can be added that some enterprise groups are conglomerates that for this analysis ideally would have been decomposed into more distinct components, if the necessary information had been available. Postner (1990) has such information and creates an intermediate statistical unit, the division, for structural analysis of contracting-out in the Canadian services sector.

57 Pilat and Wölfl (2005).

58 The North American Industry Classification System (NAICS) and the International Standard Industrial Classifications (ISIC) includes but the Statistical Classification of Economic Activities in the European Community (NACE) excludes enterprise groups. Generally, classification in official statistics follows the primary activity of the largest entity.

59 Manufacturing is comprised of SNI industries 10-37 and services of the rest, while 65-67, 75, 95 and 99 are excluded from our population.

60 Own calculations, using OECD STAN Database, 2008.

61 Own R&D expenditure of firms, by industry, current prices, 1997-2007, Statistics Sweden.

62 In line with I-O evidence in Pilat and Wölfl (2005), between 1995 and 2002.

63 Pilat et al (2006).

64 Services-related occupations are defined to include these ISCO codes: 100 (legislators, senior officials and managers); 200 (professionals); 300 (technicians and associated professionals); 400 (clerks); 500 (services workers and shop and market sales workers); 830 (drivers and mobile plant operators); 910 (sales and service elementary occupations); and 933 (transport labourers and freight handlers).

65 Of all service-related jobs in Sweden, some 19 percent were in manufacturing.

66 Please note that costs of internally sourced inputs only are available from 2001. In the preceeding years, only costs for externally sourced inputs are presented.

67 The services industry's small services input share is explained by the domination of the group of other services over the group of business services in the industry and by the fact that the merchandise input share is large in the group of other services.

68 Pilat and Wölfl (2005); and Hagman and Lind (2008).

69 There is a drop in manufacturing's cost share of externally sourced services between 2001 and 2006 (firm level data). This indicates that internal services are substituted for external services. However, external services costs have risen in absolute terms.

70 That bought-in services have become more expensive in relation to other externally sourced inputs might explain part of the rise in the services cost share. However, employment in services-related occupations has gone up in manufacturing too. This confirms that in-house services activities are becoming increasingly important in manufacturing.

71 Qualified services occupations are defined as those belonging to ISCO-codes 100-300 while less qualified services occupations are those belonging to codes 400-900.

72 The trend is especially pronounced in engineering and, as regards services industries, the trend is visible in business services, table availble upon request.

73 Tables A4 and e.g. Falk and Koebel (2002) as well as Grossman and Rossi-Hansberg (2006).

74 Hagman and Lind (2008).

75 Pilat and Wölfl (2005) study an earlier period. It can be added that a firm's net services sales data in any year is survey-based, if included that year, or else imputed either from information of the preceding year, if available, or from the industry average at the stratum level (four-digit SNI-code).

76 Services sale by product is a survey-based variable.

77 Letting an entity be classified into an industry once and for all at the time of establishment, results only in marginally different results.

78 Services trade is a survey-based variable after 2002.

79 Services exports are likely to be underestimated in a sense, since much of multinational's services production and sales take place via local presence. Local presence is particularly advantageous for services delivery, e.g. because of language and cultural barriers.

80 Qualified products are products of high-skill services industries, which, in turn, are industries dominated by occupations requiring high or very high skilled labour, drawing on O'Mahony and van Ark (2003) and Peneder (2007).

81 Manufacturing's services imports are also up, and more so in enterprise group data; due to an increase in qualified services imports. The basic industry's services trade value is down. It can be added that merchanting (a domestic actor's buying and reselling of foreign goods without the goods entering its country) and tourism are excluded from our trade data.

82 Normalisation is done to give the same weight to services use and services sale in the index. The procedure means that an industry's services share in costs (or sales) is divided by the maximum services cost (or sales) share in any manufacturing industry.

83 The pulp, paper, publishing and printing industry ranks relatively high on services usage, but its important publishing sub-industry has lately been reclassified as a services industry in the revision of SNI (SNI 2007).

84 That is, SNI-industries 01-05; 65-67; 75; 95; and 99 are excluded, see table A8.

85 For 2006, 55 "composite firms" enclosed 1071 other legal entities.

86 In 2006 about 70 percent of firms in the EGR were in Swedish-only groups, 17 percent in foreign ones and 13 percent in Swedish multinationals.

87 Earlier limits for exports and imports being covered were SEK 1.5 million (1998-2004) and SEK 0.9 million (1995-1997). For trade via another EU member, information on the actual sender or receiver is unavailable.

88 Data for travel funds and some government authorities are reported separately by the Central Bank to Statistics Sweden.

89 SNI 2002-based classification, corresponding to NACE Rev. 1.1 and ISIC Rev. 3. The primary, financial and core public sector industries are excluded.

90 www.statcan.gc.ca/subjects-sujets/standard-norme/naics-scian/2002/naics-scian-02intro-eng.htm#a12. Using the No. of employees as a key parameter changes results only marginally.

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