Evangelisches
Studienwerk e.V. Villigst

UNIVERSITÄT HOHENHEIM 1818

CARL VON OSSIETZKY universität OLDENBURG

Schriftenreihe des Promotionsschwerpunkts
Globalisierung und Beschäftigung

Nr. 23/2006

Service Offshoring: A Challenge for Employment?

Evidence from Germany

von

Deborah Schöller

Stuttgart-Hohenheim
ISSN 1618-5358

Service Offshoring: A Challenge for Employment?

Evidence from Germany

Deborah Schöller*

ABSTRACT

Besides material offshoring, economists have started to analyze the impact of service offshoring on domestic employment. Services are of particular interest since their significance has grown not only in terms of quantity, but also of qualitative understanding. One decade ago, most services were considered non-tradable, but the appearance of new information and communication technologies has contributed to overcoming geographical distance. The introduction of the paper aims at giving an appropriate definition of service offshoring also taking into account the different motives behind offshoring. The theoretical part gives a brief literature overview of the predicted effects of offshoring on domestic employment.

The empirical part first compares import data of computing and information as well as other business services and states that service offshoring is more relevant in Germany than in most other countries. Secondly, German service offshoring intensities are calculated on a sectoral basis using input-output data. This measurement represents the proportion of imported service inputs used in home production. Germany's average service offshoring intensity more than doubled from 1991 to 2002. Besides this, indications for a possible negative correlation between German service offshoring and manufacturing employment are given.

Thirdly, the impact of service offshoring on German domestic manufacturing employment is estimated at a sectoral level. The author refers to the labor demand specification of Hamermesh using sectoral wages, output and other input prices as exogenous variables. The estimation results indicate that service offshoring was negatively related to manufacturing employment in Germany between 1991 and 2000.

JEL No. F1, F2
Key Words: Service Offshoring, Employment, Globalization

*University of Hohenheim
Department of Economics
Chair for Economic Theory (520H)
70593 Stuttgart, Germany
Phone: (0049)711-459-23113
E-mail: deborahs@uni-hohenheim.de

1. Introduction

1.1 Definition of Service Offshoring

Growing globalization processes, especially in the 1990s, have coincided with low economic growth rates and high unemployment in Germany for some years now. Globalization in the economic sense understands the transnational movement of production factors, commodities and services which is reflected in a higher integration of international goods, money and capital markets (Reining, 2003). Trade and investment flows, in particular, have increased which often leads – on static consideration – to a one-sided conclusion, i.e. that growing globalization causes negative labor market effects. This could also explain the enlarged pessimistic attitude in Germany, which therefore demands academic clarification.

Globalization processes have an impact on domestic labor markets via three main channels. Firstly, integrated product markets augment the international commodity and service trade which influences the home labor market. Secondly, domestic labor markets can also be affected by economic integration via FDI and the fragmentation of production. Both channels have an indirect effect on national labor markets, whereas the third channel focuses on the direct labor market integration via migration (Landesmann, 2000). As regards globalization-induced labor market effects, economists are often first interested in quantitative labor market effects, i.e. the *level of home employment*, before moving to qualitative aspects such as *income or employment distribution*.

Recently, the new phenomenon of service offshoring which was first debated in the Anglo-Saxon countries seems to have spread to Germany. The discussion has become more relevant due to the geographical and cultural proximity of the new Central and Eastern European Countries (CEEC) that have joined the EU. Services are of a particular interest since their significance has grown not only in terms of quantity, but also of qualitative understanding. One decade ago, most services were considered non-tradable, but the appearance of new Information and Communication Technologies (ICT) has contributed to overcoming geographical distance.

Offshoring is used as a general term to describe all kinds of entrepreneurial activities taking place in a country other than the domestic one in order to support a company's business. Often, terms such as outsourcing, international outsourcing, offshoring or offshore outsourcing[1] refer to the same phenomenon but, strictly speaking, do not mean the same. Therefore, a clear definition of offshoring is required, beginning with a distinction between outsourcing and offshoring. Outsourcing asks for the "source" of production, i.e. if the input is produced within an internal source (self-production or subsidiary) or an external source (independent

[1] Fragmentation and even foreign direct investment (FDI) is also used.

supplier/subcontracting) wherever the geographical position might be. Offshoring on the other hand asks for the "shore" or the country of production, i.e. if the input is produced at home or abroad regardless of the source. *Figure 1* shows the 4 possible combinations of both criteria: (a) internal production in the home country (captive home production), (b) external production in the home country (onshore outsourcing), (c) internal production abroad (captive offshoring or FDI) and (d) external production abroad (offshore outsourcing or international outsourcing). Offshoring comprises both, internal and external production in a foreign country (c and d).

While the above classification refers to offshoring in general, the following paragraph aims to give an appropriate definition of *service offshoring*. Service trade has been fostered by global drivers that have appeared simultaneously. On the one hand, *developments in ICT* need to be highlighted, sometimes designated as the digital-electronic revolution. For a long time, services, unlike commodities, were considered intangible and invisible and thus not storable or transferable.[1] Hence, direct contact between the producer and consumer of a service was required (*uno-actu-principle*). According to the uno-actu-principle either the consumer of a service had to seek the producer out (e.g. retail, wholesale, tourism sector) or vice versa (e.g. transport sector, waste disposal). Recent developments in ICT have succeeded in uncoupling information from its physical memory, rendering the transfer of huge amounts of data possible within a few seconds ('disembodied services'). Thus, the generality of the uno-actu-principle has been called into question. On the other hand, the process towards the *liberalization of international service trade* has accelerated this process.

Service offshoring in the broader sense comprises each kind of foreign service activity of a multinational company (MNC) in order to support its domestic production. The motives behind an offshoring decision can be market-oriented, cost-oriented or procurement-oriented which will be defined in the following chapter. Service offshoring is rather expected to have the potential for harming employment when formerly home produced services are transferred for cost reasons. Therefore, the following definition of service offshoring in the narrower sense focuses on cost-oriented motives:

"Service offshoring designates the provision of service inputs from a foreign supplier that are produced abroad mainly for cost reasons and re-imported to the home country. Here, the foreign procurement either happens externally, via an independent supplier (offshore outsourcing), or internally within the multinational company (FDI)."

[1] This distinction between services and commodities should not be understood in a strict sense. Some services have features of commodities and are tangible (e.g. the printed report of a management consultant) or visible (e.g. theatre). Beyond this, most commodities depend on service inputs in their production and vice versa.

1.2 Motives Behind an Offshoring Decision and Expected Employment Effects

This chapter examines the diverse motives for MNCs behind an offshoring decision and their expected employment effects. Here the impact on employment depends on the relationship between offshoring and exports. Before disembodied services appeared, a local presence abroad (FDI) was required to serve foreign markets. Since the alternative export strategy did not exist, service offshoring decisions were expected to have at least a neutral or even positive domestic employment effect. The tradability of disembodied services, however, made negative employment effects possible within the formerly inviolable service sector. Therefore, traditional material offshoring motives count for services, too.[1]

Firstly, traditional *motives* can be *market-oriented* in order to build up, maintain or increase the company's market share abroad (Trabold et al., 2001), especially in the presence of stagnating domestic demand like in Germany. This integrates aftersales activities (customer service, sales and distribution, marketing, etc.) as well. Markets with huge growth potential such as China or India thus represent attractive offshore destinations. Market-oriented motives affect domestic employment in a threefold manner depending on their relationship to exports. *Export-substituting* offshoring is expected to replace formerly home produced goods, thereby laying off labor at home. *Export-accompanying* offshoring decisions are presumed to have a neutral domestic employment effect. *Export-boosting* offshoring is anticipated to stimulate home production and increase home employment. The overall employment effect of market-oriented motives is assumed to be generally positive in the short- and medium-term (Roling, 1999).

Whereas previous studies mainly outlined market-oriented motives as the principal drivers behind an offshoring decision, more recent studies show a trend towards *cost-oriented motives*. Market proximity as an instrument to foster exports becomes less relevant with ICT (Beyfuß and Eggert, 2000). In most cases, MNCs apply the "mixed calculation" strategy relocating labor-intensive parts of their value chain and maintaining (human) capital-intensive parts at home. Since services are generally more labor-intensive, they contain high offshoring potential. Cost-oriented motives aim at exploiting lower (production) costs abroad, such as lower prices and other related advantages in the host country. One can distinguish between *production-oriented* (lower wages, non-wage labor costs, construction and transport costs, land prices), *location-oriented* (subsidies, tax incentives, less environmental requirements, less regulations or more liberal redundancy protection) and *scale-effect oriented* (at

[1] See Gregory Mankiw (2004): "We're very used to goods being produced abroad and being shipped here on ships or planes. What we are not used to is services being produced abroad and being sent here over the Internet or telephone wires. But does it matter from an economic standpoint whether values of items produced abroad come on planes and ships or over fiber-optic cables? Well, no, the economics is basically the same." (Andrews, 2004; taken from: Bhagwati et al., 2004)

the company level and at the operational level) *cost motives*. When labor is transferred in order to cut costs, the effect on home employment is expected to be negative. However, this "job export" can only be considered to be avoidable, if an alternative domestic solution exists. Adversaries therefore argue that offshoring helps MNCs to safeguard more productive jobs at home by relocating less productive jobs abroad. This study is mainly interested in cost-oriented motives, as negative home employment effects are most probable within this category (Roling, 1999; Trabold et al., 2001).

Thirdly, the *procurement of inputs* which are rare or unavailable in the home country (e.g. raw materials, preliminary products) represents another traditional offshoring motive. More recent motives in this category are the provision of human-capital, know-how and technology from abroad. To guarantee a regular and secure provision of such inputs the form of FDI is often preferred. Marin (2004) found a high average qualification and R&D intensity of German affiliates in the CEEC indicating a *human capital scarcity* in Germany. The procurement of foreign services is one option to counteract the decreasing demographic trend and with it the talent shortage in many developed countries. Jungnickel and Keller (2003) showed that the relevance of strategic *asset-seeking* for German companies in the industry sector has grown, especially where transaction costs are low. In that case companies are located at the most competitive sites where they can benefit from knowledge, technology or spillover effects. The liberalization of the service sector, combined with the developments in ICT, has significantly lowered the transaction costs of service trade which facilitates the offshoring decision. Since the procurement of inputs makes domestic production possible, it is not expected to affect home employment negatively, but even positively, according to some authors (e.g. Roling, 1999).

The theoretical side of the paper wants to evaluate the expected effects of (service) offshoring on home employment. Following this, the empirical part examines the development and relevance of German service offshoring within a worldwide comparison. Furthermore, indications for a possible negative correlation between German service offshoring and manufacturing employment are given. Thirdly, the impact of service offshoring on German domestic manufacturing employment is estimated at a sectoral level, referring to a theoretical model of Hamermesh (1993).

2. Literature Overview

2.1 Theoretical Insights

The following chapter evaluates how offshoring has already been modeled in existing theories. There are three main caveats using traditional trade models to predict employment effects of offshoring. Firstly, trade models focus on the international trade of goods but do not integrate the possibility of FDI, whereas the latter induces preceding capital flows to the destination country. In our context, the difference between internal and external trade should actually not matter, since both put the focus on re-importing to the country of origin. Thus, trade models capture both forms at least in an indirect manner. Secondly, traditional theories center trade in final commodities, whereas service offshoring is interested in intermediate service inputs. In an economic sense, service and commodity trade can be treated equally. The distinction between intermediate and final inputs, however, could be important. And thirdly, neoclassical models presume full employment and perfect labor mobility[1] between the sectors. Even in the short-run there is no unemployment, as offshoring affects labor markets solely through wage adjustments. However, assuming labor market rigidities, layoffs are possible in the short-run. Thus, trade models are suitable for making predictions about the losers and winners of the trade process.

Ricardo's international trade model (1817) predicts that countries specialize in the production and export of one good according to their comparative cost advantages while importing the other good. A better endowment of a country with production technologies leads to higher factor and labor productivities in the technologically favored sector and thus to a comparative advantage. International trade is advantageous for both countries due to an improvement in the terms-of-trade. Because of the international labor immobility restriction disadvantaged labor in the import-competing sector cannot benefit from higher wages abroad. Under the additional assumptions of a temporarily imperfect labor mobility and labor market rigidities there might be released labor in the technologically disadvantaged sector in the short-term. In the long-term, as labor from the disadvantaged sector switches to the export sector, there is no unemployment and wages remain the same in both sectors (Henneberger et al., 2000; Eckel, 2000; Krugman and Obstfeld, 2006).

Besides labor the *Heckscher-Ohlin-Samuelson-Model* (Heckscher 1919, Ohlin 1931, Samuelson 1948) allows for production factor capital which can be interpreted as human capital. Comparative advantage is the crucial factor which – contrary to the Ricardian model – is solely determined by differences in the relative factor endowment. Again, international trade is advantageous for both countries. Increasing demand from abroad results in higher product

[1] Perfect labor mobility of at least one factor in the import-competing sector.

prices, a stronger demand for the abundant factor and a higher relative factor price. Therefore, a country augments the production and exports of the good which uses the abundant factor more intensely (e.g. capital-intensive goods). On the other hand, the more expensive good (e.g. labor-intensive goods) can be imported at a lower price improving the terms-of-trade. There are two income effects on the scarce factor. Firstly, purchasing power worsens due to a rise in the relative price of the other good. And secondly, assuming temporary factor immobility, the relative wage of the scarce factor decreases transitionally (Stolper-Samuelson-Effect). When instant wage adjustments are not possible due to labor market rigidities, the second effect could result in a layoff of labor like in the Ricardo model. In the long run, inter-sectoral factor mobility leads to a shift from the import-competing to the export sector, thus equalizing factor prices. Since relative prices for goods converge, factor prices tend to converge between both countries (Factor Price Equalization Theorem). Free trade leads to an efficient international division of the factors (Henneberger et al., 2000; Eckel, 2000; Krugman and Obstfeld, 2006).

During the US election campaign in 2004, a big political debate about the impact of service offshoring on domestic labor markets was started. This quickly reached the economic level and was mainly driven by the 'Samuelson-Bhagwati debate'. Samuelson (2004) argued with a theoretical Ricardian model that offshoring might contain negative domestic labor market effects when the trade partner has productivity gains (innovation) in its initially import-competing sector. That means that the trade partner gets some of the comparative advantage that was previously limited to the domestic economy. Thus, technological innovation could permanently reduce the per capita income in the country of origin (Samuelson, 2004).

Globalization advocate Bhagwati, however, used specific-factors models to show that service offshoring is generally advantageous for the countries of origin. Purchased service imports are used in the final good production. The models predict a total welfare increase for a country which allows for service offshoring, whereas the exact underlying processes depend on the structure of the economy. If the losing factor is compensated for, all production factors can win. However, the authors acknowledge that in a large economy that influences world prices, offshoring could worsen the terms-of-trade, since the rise in the export supply could be higher than the demand for it. In such cases the poorer terms-of-trade could counteract the initial welfare gains (Bhagwati et al., 2004). We can deduce for our discussion that (service) offshoring generally leads to positive economic effects in the trade models. Under certain conditions, however, such as short-term factor immobility and market rigidities or a loss in the initial comparative advantage, offshoring could lead to layoffs.

2.2 Empirical Studies for Germany

Empirical research on German service offshoring and possibly related employment effects is indispensable due to the aforementioned limitations of the trade models. Furthermore, empirical research evaluates the extent to which offshoring has influenced employment. However, the service offshoring debate in Germany is not yet well established. Even the Anglo-Saxon countries have little empirical research to show. While the impact of service offshoring on domestic employment has been empirically measured for the US (e.g. Amiti and Wei, 2004a, 2006) and the UK (Amiti and Wei, 2004b), there are no comparable studies for Germany to my knowledge.

There are four main deficits concerning German studies: Firstly, empirical research focuses more on material offshoring and its labor market effects, whereas tradable services have not been integrated into empirical studies yet. Secondly, there is no empirical study for Germany at a macro-economic level to my knowledge. Goerzig and Stephan (2002), for instance, analyze the impact of outsourcing at a micro-economic level. Thirdly, most studies differentiate between offshore outsourcing and FDI. Only few studies integrate both in their empirical analyses. Fourthly, German studies stress some aspects, but neglect others. Thus, Goerzig and Stephan (2002) do not differentiate between domestic and foreign service purchases and study the effects on firm-level performance but not on employment. Falk and Koebel (2002) only consider domestic service outsourcing and its impact on the national labor demand structure. Moreover, they use data from 1978 to 1990 which does not cover the relevant ICT-period. The McKinsey Global Institute report (2005), for instance, measures the welfare gain of service offshoring but does not clearly reveal the underlying method.

3. German Service Offshoring in a Worldwide Comparison

3.1 The Biggest Offshorers

The following chapter identifies the biggest service offshoring countries. Therefore, imports of other business services as well as computer and information services are used as a proxy for service offshoring as in Amiti and Wei (2004b). They chose these service categories, since cost-oriented service offshoring followed by re-imports seems to be most probable there. *Other business services* include merchanting and other trade-related services, operational leasing services as well as miscellaneous business, professional and technical services. The last three, for instance, comprise legal services, accounting, management consulting, market research, research and development, architectural and engineering services (United Nations, 2002). The data is retrieved from the UNCTAD online database which, in turn, is based on the IMF Balance of Payments Statistics.

Table 1 shows that the 10 biggest absolute offshoring countries in 2003[1] (in Mio. US$) were exclusively developed countries. The US was the largest importer of *other business services* (44,188m US$), followed by Germany (39,716m US$) and the Netherlands (24,589m US$). In the category *computer and information services* Germany was clearly ranked first (7,269m US$) in front of the UK (2,807m US$) and Japan (2,109m US$). The *total sum* of both categories reveals Germany and the US to be the largest importers, and a considerable way ahead of the rest of the field. Interestingly, India and China – typically considered as onshore-countries – were also classed among the top 20 offshorers. Also, the leading position of the Netherlands as a small open economy seems to be surprising.

Table 2 takes the size of the economy into account, listing service imports relative to GDP. Most of the biggest relative offshorers of *other business services* are developing countries except for Ireland (14.63%) ranked 2nd. Possible reasons could be the lack of qualified labor in these service sectors requiring purchased imports or simply a relatively small GDP. Germany (1.63%), ranked 53rd, is situated in front of the other large developed countries. Luxembourg was the biggest relative offshorer of *computer and information services* with a ratio of 1.36%. Germany (0.3%) was ranked 14th in front of the other large developed economies. The *total sum* confirms the higher relevance of service offshoring for Germany (1.96%) compared to other large developed countries, especially the US (0.42%).

3.2 The Biggest Onshorers

Table 3 examines the biggest service onshorers. Analogously, exports of both service categories are used as a proxy for service onshoring. The US was the largest exporter of *other business services* in 2003 (64,074m US$), followed by the UK (47,322m US$) and Germany (33,120m US$). The front rows are mainly occupied by developed countries. Among the less developed countries, the Asian states Hong Kong (19,382m US$), China (17,427m US$), Taiwan (13,529m US$) and Singapore (11,426m US$) are ahead. Israel and India as well as some CEEC follow on the ranking list. Ireland (14,372m US$) and India (11,366m US$) exported most of the *computer and information services* showing themselves to be global specialists in this area. Israel as a small economy also appears to have specialized in computer and information services and is ranked 6th (3,657m US$). Even China, ranked 14th, seems to perform strongly not only in exports of commodities but services, too. The *overall view* sees developed countries at the top of the rankings. The largest less developed countries are Hong Kong, China, India, Taiwan, Singapore, Israel and South Korea. Some CEEC such as Russia, Hungary, Poland and the Czech Republic are likewise situated among the largest onshorers.

[1] 2004 data is not available yet for some of the countries that show 2003 data.

The relative consideration in *Table 4* relates service exports to local GDP and confirms the above mentioned specialization patterns. Smaller economies and developing countries, particularly, are placed ahead. The Tiger States Hong Kong and Singapore seem to have focused on exports of *other business services* (both 12.37%). The UK share (2.63%), ranked 24th, is the largest among the large developed countries. Among the CEEC, Hungary, Slovakia, the Czech Republic and Bulgaria concentrate on the exports of other business services. Ireland's leading position in exports of *computer and information services* is evident showing an export share of 9.45% of its local GDP. Ireland is followed by Luxembourg (4.21%), Israel (3.18%) and India (1.91%). The leading CEEC Estonia, Slovenia, Hungary and Latvia are also positioned in front of Germany. The *total sum* underlines the aforementioned trends. Relative service exports among the large developed countries are most important for the UK (3.07%) and Germany (1.66%).

3.3 The Countries with the Highest Surplus and Deficit

The balance in *Table 5* reveals the UK (24,843m US$) and the US (19,886m US$) as the largest surplus countries of *other business services* in 2003 in front of the Asian states Hong Kong, Taiwan and China. Ireland (-15,513m US$) and Germany (-6,596m US$) showed the largest deficits and were followed by India, Japan and South Korea. On the other hand, Ireland (13,987m US$) and India (10,706m US$) formed the largest net exporters of c*omputer und information services.* At the same time, both countries were net importers of other business services indicating their specialization in the production and export of computer und information services. The US, the UK and Canada are ranked after them. Brazil (1,034m US$), Japan (-1,033m US$) and Germany (-589m US$) were the countries with the highest deficit, followed by Italy and Russia. The *total sum* follows the ranking of the other business services for the surplus countries. Germany (-7,185m US$), Japan (-6,14m US$), Korea (-4,652m US$) as well as Italy and Austria were the countries with the highest deficit.

To sum up, Germany was the biggest absolute offshorer of computer and information services in 2003 as well as of both service categories put together. Among the large developed countries, Germany again represented the largest relative offshorer which emphasizes the high significance of service offshoring in Germany. However, Germany also exports many of these services placing itself behind the US and the UK in 3rd place in the ranking among the largest onshoring countries. Even on relative consideration Germany was the 2nd largest economy among the biggest developed countries behind the UK. This shows that service exports are relevant for Germany, too. The balance however reveals that Germany had the largest deficit when both service categories were taken together. Compared to the largest surplus countries, UK and US service offshoring could potentially result in different home employment effects.

3.4 German Service Offshoring Compared to Selected Large Developed Countries

The following chapter compares the *development of service offshoring* in Germany to France, Japan, the UK and the US in the years 1991, 1996, 2000 and 2004. *Figure 2* plots the imports and the balance of *other business services*. The US was the largest importer in 2004 (48,269m US$), followed by Germany (44,588m US$), France (26,209m US$), the UK (24,757m US$) and Japan (24,611m US$). Japan's import value was ranked 1st in 1991 and 1996, but dropped to 3rd in 2000 behind the US and Germany. The UK shows the largest Compound Annual Growth Rate (CAGR) of 12.5%, but still one of the smallest import values. The US (11.2%) and Germany (7.6%) have the 2nd and 3rd largest CAGR, whereas the French CAGR is only half of the German one (3.8%). Only Japan shows a negative CAGR of -0.2%.

The *balance* reveals that the UK and the US had the largest net surpluses of 26,259 and 19,469m US$, respectively. Both of them managed to enlarge their net surpluses over the four years. In 2004, Germany and Japan showed a net deficit of -4,134 and -2,699m US$, respectively, both of them being net importers over the four years. Representing the largest net surplus in 1991, France turned into a net importer in 2004 (-1,054m US$) which is also reflected in the large negative CAGR of -18.4%. The UK shows the highest CAGR (11.7%), followed by the US (6.5%). Japan was the largest net deficit country in 1991 and 1996 but was able to reduce its deficit with a CAGR of -9%. Germany enlarged its net deficit in the 1990s but reduced it in 2004 with a CAGR of 2.7%.

The same analysis follows for the *computer and information services* sector[1] in *Figure 3*. Germany represented the *largest importer* of these services in 2004 (7,965m US$) followed by the UK (3,566m US$), Japan (2,188m US$), the US (1,632m US$) and France (1,440m US$). Over the four years Germany represented one of the largest importers with a CAGR of 16.3%. The UK has turned from the 2nd smallest importer in 1991 to the 2nd largest importer in 2004 showing the highest CAGR of 27.2%. France constantly enlarged its import value, too, with a CAGR of 14.6%. The US saw an increase in its import value from 1991 to 2000, but a decrease in 2004. Nevertheless, its CAGR was 17.8%. Once again only Japan showed a negative CAGR of -1.3%.

Having a look at the balance, a similar pattern as for the other business services arises. Thus, the Anglo-Saxon countries showed themselves to be net exporters over the four years, while Germany and Japan constantly showed net deficits. The UK achieved the largest net surplus in 2000 and 2004, removing the US from its hegemony in 1991 and 1996, thereby showing the largest CAGR of 24.8%, followed by the US (6.2%). Japan slowly reduced its

[1] Data of computer and information services for Japan is only available from 1996 onwards. Therefore, the calculation of the CAGR is based on the years 1996 and 2004 for all countries.

net deficit with a CAGR of -0.7%, while Germany managed to reduce its net deficit strongly from 2000 to 2004 with a high negative CAGR of -23.9%. France turned from a net importer in 1991 to a slight net exporter in the following years with a CAGR of 4.9%.

Figure 4 evaluates the *imports of other business services* and *computer and communication services relative to all imported other commercial services* in 1996 and 2004. In 2004, the US had a share of other business services and computer and information services of around 44% in all other commercial services, which represented a slight decrease of one percent compared to 1996. Japan experienced a relative decrease of both sectors from around 61% in 1996 to about 50% in 2004. The UK expanded its share from around 48% to almost 58%, Germany from 59% to 65% and France from 65% to 66%. This expansion in the continental European countries was due to an increase in computer and information services, while the UK enlarged both sectors. The fall in Japan and the US was mainly due to a reduction in the share of other business services. In summary, Germany was one of to the largest absolute importers of other business services as well as computer and communication services between 1991 and 2004. It likewise showed the highest share of these service categories in all other commercial services. Beyond this, Germany's net deficits increased in both categories during the 1990s indicating a different starting position for Germany than for the Anglo-Saxon countries.

4. Service Offshoring Intensity

4.1 Two Different Measures of Service Offshoring Intensity

The following analysis for Germany uses input-output data from the Federal Statistical Office which originally comprised 71 sectors. I used all 36 manufacturing sectors plus 7 selected service sectors (see *Appendix I*). The primary sector (sectors 1-3) and the sectors mining and quarrying of the secondary sector (sectors 4-8) have been dropped, as they generally do not represent offshoring sectors. The selection of the 7 service sectors out of 27 includes *tradable business activities* in the broader sense according to the aggregation of Kalmbach et al. (2005) except for the wholesale sector[1]. Consumer-related[2] and social services[3] have not been considered, since the former in general do not represent typical offshoring services and the latter are not tradable. Business activities comprise firstly 'other business activities' in a narrower sense (sector 62). Secondly, the following 6 sectors have been added: post and telecommunications; financial mediation (except insurance and pension funding); activities

[1] The sector 'wholesale, trade and commission excl. motor vehicles' (sector 46) was dropped due to strong fluctuations in the data between 1991 and 1995.

[2] Sectors within the classification of the Federal Statistical Office: 45, 47-53, 56, 58, 69-71

[3] Sectors within the classification of the Federal Statistical Office: 63-68

related to financial mediation; rental of machinery and equipment; computer and related activities as well as research and development (sectors 54, 55, 57, 59-61).

The service offshoring intensity represents a more sophisticated measure of service offshoring than import data. It measures the share of service import j by sector i in total non-energy inputs used by sector i and is calculated as follows:

$$OSS_i(a) = \sum_j \left[\frac{\text{imported service j by sector i}}{\text{total non-energy inputs used by sector i}} \right]$$

The denominator contains all 36 non-energy manufacturing inputs, plus the 7 service sectors selected above. German input-output data differentiates between home purchased inputs and imported inputs, whereas import data at a sectoral level is not available for the US and the UK according to Amiti and Wei (2004a, b, 2006). Therefore, they applied the methodology of Feenstra and Hanson (1996, 1999) who calculated offshoring intensities of material imports to the US. This second measure of service offshoring intensity OSS_i (b) for a given sector i is a *proxy* for the proportion of imported service inputs used in home production. Besides the OSS_i (a) measure, I also calculated the OSS_i (b) measure for Germany to allow for a country-wide comparability. The second measure is defined as follows:

$$OSS_i(b) = \sum_j \left[\frac{\text{input purchases of service j by sector i}}{\text{total non-energy inputs used by sector i}} \right] * \left[\frac{\text{imports of service j}}{\text{production}_j + \text{imports}_j - \text{exports}_j} \right]$$

The first bracket calculates the share of purchased service inputs j in total non-energy inputs for sector i. However, the first ratio does not distinguish between home and foreign service inputs, while service offshoring solely focuses on services from a foreign source. Therefore, the second bracket calculates the share of total imported service j in the entire domestic disposability of this service j (denominator) which is composed of home production plus imports minus exports. This data is retrieved from the input-output tables. The service offshoring intensity OSS_{ij} (b) of service j in sector i is calculated by multiplying both ratios. This proxy assumes the same overall import share of service j, regardless of sectoral differences. In Germany, for instance, the overall import share of other business activities was 4.9% in 2002. Hence, an import share of 4.9% is assumed for each sector i.

The service offshoring intensities for both measures are calculated as follows: (1) Aggregating all OSS_{ij} in sector i results in the sectoral service offshoring intensity OSS_i. (2) This should not be mixed up with OSS_j which represents the average offshoring intensity of a certain service j across all sectors i which is calculated by aggregating the respective OSS_{ij}, weighted by their sectoral output. (3) Adding all OSS_j yields the average service offshoring intensity OSS over all sectors i and services j. The construction for the material offshoring intensities is calculated analogously.

The calculation of the offshoring intensity contains three related disadvantages. The first two caveats refer to both offshoring intensity measures, whereas the last one only holds for the OSS(b) measure. First, the low figures underestimate the actual offshoring values, since import prices are generally lower than the actual purchase prices of these services. Secondly, the denominator in the first bracket only integrates the purchased inputs, but not the self-produced inputs used by industry i. Finally, the overall application of the same import share (second bracket) in OSS(b) is not accurate, since not every sector uses imports to the same extent. Thus, the offshoring intensity cannot be exactly measured (Amiti and Wei, 2004b). Anyhow, the calculation of the offshoring intensities, especially OSS(a), presents a good measure for the proportion of imported service inputs being used in home production.

4.2 Results

The first column of *Table 6* presents the *average service offshoring intensities* OSS_j (weighted by sectoral output) of the 7 selected services j over all 43 sectors i in 1991, 2000 and 2002. The next column shows the (unweighted) mean, standard deviation as well as the minima and maxima over the 43 sectors. The 1991 and 2000 data is in unrevised form, whereas the 2002 data is revised. Both are not fully comparable due to changes in the classification[1]. The average service offshoring intensity OSS(a) has more than doubled from 1.466% in 1991 to 3.169% in 2000. At the services level computer and related activities grew strongly from the 2nd smallest share of 0.033% in 1991 to 0.601% in 2000. Other business activities have almost quadrupled their intensities from 0.369% in 1991 to 1.436% in 2000. The last three service sectors (computer and related activities, research and business development and other business activities) that are typically associated with service offshoring formed more than a third (2.305%) of the total OSS(a) in 2000. The revised 2002 intensities differ somewhat from the 2000 data, especially in financial mediation and related activities that are much higher 2002. This is probably due to the data revision, as bank charges are now added to the using sector of financial services.

Figure 5 plots the development of the *average OSS(a) and OSM(a) intensities* in Germany between 1991 and 2002. Service offshoring intensity has grown considerably since 1991 with a CAGR of 8.39% possibly due to the use of ICT. The material offshoring intensity on the other hand has decreased by 0.59% per year from 17.29% in 1991 to 16.21% in 2002. The CAGR between the low level year 1993 and 2002 is 1.30%. The stronger growth between 1993 and 2000 can be explained by the fall of the iron curtain and the succeeding FDI to-

[1] The revision of the input-output tables integrates, for instance, all the changes of the national accounts revision of 2005 and the new service statistics of the Federal Statistical Office.

wards the CEEC, and likewise by the growing significance of the Asian markets. Over the whole period, OSM seem to have stagnated. An interpretation would be that the process of material offshoring, which has already started in the 1980s, has probably reached its limit, whereas service offshoring has not exploited its full potential yet.

Finally, an *international comparison* between Germany, the UK and the US follows. Data for the UK and the US is based on the studies of Amiti und Wei (2004a, b, 2006). One could argue that comparability is not given, since the respective sectoral classifications differ and are more disaggregated for the Anglo-Saxon countries. On the other hand, such differences should only be compensated in OSS and OSM, as they represent a weighted aggregation (by sectoral output) of all sectoral offshoring intensities. Comparability of the three countries then requires that similar manufacturing and service sectors are chosen. There should be no problem with the manufacturing sector, since all manufacturing industries are included in the 3 countries. Country-specific differences could just arise in the selection of the service sectors. *Table 7* shows that the selected services are similar with respect to their activities. All services find an equivalent in the other countries which allows for comparison.

Table 8 specifies the *average service and material offshoring intensities for Germany, the UK and the US* between 1991/1992 and 2000/2001. Only the four columns on the right hand side are comparable using the offshoring (b) measure. UK data is not directly available, but was reconstructed thanks to figure 2 in Amiti and Wei (2004b). As for service offshoring it is evident that the UK shows the highest intensities. Between 1992 and 2000, they were more than triple those of the German OSS(b) and reached a peak of 5.5% in 2000. The US intensities, both in the older (Amiti and Wei, 2004a) and the recent calculation (Amiti and Wei, 2006) are far below the German level and were always less than 1%. Nevertheless, they follow an increasing trend. Interestingly, Germany has the highest CAGR of 7.38%.

As regards material offshoring, the UK had the strongest intensity (28%) in 2001, followed by Germany (19.88%) and the US (11.5%). Over the period, both, German and US intensities were much lower than the UK intensities. The old and recent OSM(b) calculations for the US strongly diverge. The old calculation has much lower intensities, whereas recent measurements are closer to the German level in 2000 (17.33%). OSM(b) in the US grew nearly continuously between 1992 and 2000/2001 which is different in Germany and the UK. In the UK, it grew slightly until 1995/1996 and fell back to its initial level showing no clear trend. The German OSM(b) started at a very high level in 1991 and fell to a low in 1993 before growing constantly until 2000.

5. The Impact of Service Offshoring on Employment

5.1 Indications for a Relationship Between German Service Offshoring and Employment

Figure 6 maps a scatter plot of the *German service offshoring intensity and employment growth* from 1991 to 2000 as Amiti and Wei (2004b) did for the UK. All of the 43 sectors selected above have been taken into account using the $OSS_i(a)$ measures. 34 sectors denoted a negative employment growth. 21 sectors are placed in the 2nd quadrant plus 2 sectors in the 4th quadrant implying a possible negative relationship between service offshoring growth and employment growth. Anyhow, 7 sectors are situated in the 1st quadrant and 13 sectors in the 3rd quadrant presuming a possible positive relationship between both variables.

For further indications the sectors with the strongest service offshoring growth and the slowest employment growth between 1991 and 2000 are ranked in *Table 9*. The question is whether the sectors with the highest service offshoring growth show a weak employment growth. The upper part of Table 9 lists the 10 sectors with the largest service offshoring intensity growth rates. The 3 highlighted service sectors computer and related activities (1,267%), other business activities (279%) as well as research and development (212%) indicate positive employment growth rates. Computer related activities, particularly, display the largest growth rates in both service offshoring and employment (91%). On the other hand, the remaining 7 manufacturing sectors with the highest service offshoring growth all have negative employment growth rates. As a first indication one could presume a fairly positive relationship between service offshoring growth and employment growth for the service sector but a rather negative one for the manufacturing sector.

The bottom part of the table ranks the sectors with the slowest employment growth. Uniquely manufacturing sectors, especially the office, accounting and computing machinery industry (-66%), apparel (-64%), leather (-60%) and textile industry (-50%) are listed. 4 sectors had a positive service offshoring growth, while only the office, accounting and computing machinery sector can be found in the top ten sectors with the strongest service offshoring growth. A presumption cannot be drawn from the 2nd ranking, as the sectors with the lowest employment growth show both a positive and negative service offshoring intensity growth.

Figure 7 maps the *German OSS and employment development in the manufacturing sectors* in logarithms by year as a final indication. In the early 1990s, the 36 manufacturing sectors showed similar service offshoring intensities. Simultaneously with the appearance of service offshoring in the mid 1990s the scatter plots seem to move to the left indicating a possible negative relationship between OSS and employment for the manufacturing sectors. Anyhow, this presumption only states a possible negative relationship but does not draw a conclusion about the causality between both variables. Thus, the impact of service offshoring on domestic manufacturing employment is to be estimated referring to the theoretical labor demand model of Hamermesh (1993) in a next step.

5.2 Theoretical Model

A firm's linear homogeneous production function F with constant returns to scale is described as follows:

$$Y = F(L,\Omega), \quad \frac{\delta F}{\delta x_1} > 0, \ \frac{\delta^2 F}{\delta x_1^2} < 0, \ \frac{\delta^2 F}{\delta x_1 \delta x_2} > 0 \quad \text{with } x_1, x_2 = L, \Omega \tag{1}$$

where Y is the output, L is the homogeneous labor input and Ω is a vector of homogeneous other inputs, such as capital, intermediate goods and services as well as the rate of technology. The total vector of other inputs Ω and labor are treated as *substitutional* factors of production.

Due to the homogeneity assumption multiplying the inputs with a constant λ (λ=2,3,…) augments production by λ^r where r is constant and positive:

$\lambda^r Y = F(\lambda L, \lambda\Omega)$.

On the assumption that a firm maximizes its profits π :

$$\pi = pF(L,\Omega) - wL - \omega\Omega \tag{2}$$

where p is the competitive product price equal to one, w the exogenous wage and ω a vector of other exogenous input prices, profit maximization under perfect competition yields:

$$F_L = \frac{\delta F}{\delta L} = \frac{w}{p} = w \quad (3.1) \qquad \text{and} \quad F_\Omega = \frac{\delta F}{\delta \Omega} = \frac{\omega}{p} = \omega \quad (3.2) \qquad \text{or} \quad \frac{F_L}{F_\Omega} = \frac{w}{\omega} \quad (3.3)$$

The ratio of the values of marginal products equals the factor price ratio (3.3) and can likewise be defined as the elasticity of substitution between other inputs and labor holding output Y constant.

The labor demand function is based on the cost minimization of a firm. Total costs are calculated summing up the products of optimal input demands and their respective factor prices. Optimal input demand refers to profit-maximizing amounts. The following linear homogeneous cost function is assumed:

$$C = C(w, \omega, Y), \quad \frac{\delta C}{\delta c_1} > 0, \ \frac{\delta^2 C}{\delta c_1 \delta c_2} > 0 \quad \text{with } c_1, c_2 = w, \omega . \tag{4}$$

The profit-maximizing input demand depends on wages w, the vector of other input prices ω, such as the rental price of capital and the prices of imported material and service inputs, output Y and technology. Using *Shephard's Lemma*[1], the following input demand functions can be derived:

$$L^* = C_w = \frac{\delta C(w,\omega,Y)}{\delta w} \quad (5.1) \qquad \text{and} \quad \Omega^* = C_\omega = \frac{\delta C(w,\omega,Y)}{\delta \omega} \quad (5.2)$$

The ratio $\frac{L^*}{\Omega^*} = \frac{C_w}{C_\omega}$ implies that cost-minimization results in an input use that equals the ratio of the marginal effects on costs. The *conditional labor demand function*, holding output Y constant, can be specified as follows:

$$L^* = L^d(w,\omega,Y) \qquad (5.3)$$

Under the assumption that Y is linear homogeneous and therefore $C(w,\omega,Y) = YC(w,\omega,1)$ the *elasticity of substitution σ* between other inputs Ω and labor L as a consequence of an exogenous change in relative factor prices results in

$$\sigma = \frac{\delta \ln(\Omega/L)}{\delta \ln(w/\omega)} = \frac{\delta \ln(\Omega/L)}{\delta \ln(F_L/F_\Omega)} = \frac{F_L F_\Omega}{Y F_{L\Omega}} \qquad (6.1)$$

where σ is always nonnegative by definition (see Allen, 1938). If the factor price for labor L increases relative to the factor price for other inputs Ω, i.e. w/ω rises, labor will be substituted for other inputs, i.e. Ω/L increases. The macro-economic explanation would be that if the supply of other inputs Ω grows stronger than labor supply L (e.g. due to import possibilities of tradable services), the wage-to-other input prices ratio w/ω will increase due to changes in the relative scarcity of the production factors (the scarcer factor labor becomes more expensive relative to other inputs). Firms adopt to these supply changes by using more other inputs Ω relative to labor L. Since output is considered constant, labor L is thus substituted for other inputs Ω.

The *factor demand elasticities* given a constant output Y are:

$$\eta_{LL} = -(1-m)\sigma < 0 \quad (6.2) \qquad \text{and} \quad \eta_{L\Omega} = (1-m)\sigma > 0 \quad (6.3)$$

[1] According to Shephard's Lemma factor demand is determined by the first partial derivative of the cost function with respect to the corresponding factor price, regardless of the kind of production function.

where η_{LL} is the price elasticity of labor demand, $\eta_{L\Omega}$ is the cross-elasticity of demand for labor due to a change in other input prices and m is the share of labor in total costs. A larger m for a given technology σ yields a smaller η_{LL}, since there are less substitution possibilities for labor when wages increase.

Equations (6.1) and (6.2) are the basic results in the theory of factor demand. An increase of wage w is expected to reduce domestic labor demand L, whereas the growth of other input prices ω (such as imported inputs) is likely to augment domestic labor demand, as companies will substitute inputs for labor (Hamermesh, 1993; Rose, 1987).

5.3 Empirical Specification

5.3.1 Model Selection

The following section measures the impact of service and material offshoring on domestic employment in the manufacturing sector including the 36 manufacturing and 7 service sectors in a panel regression analysis. The conditional labor demand function (5.3) can be written in the logarithmic form as a common log-linear equation for sector i at time t:

$$\ln L_{it} = \alpha_0 + \alpha_1 \ln w_{it} + \gamma \ln \omega_{it} + \delta \ln y_{it}$$

In this form, the equation results in the price elasticity of demand for labor η_{LL}, the cross-elasticity of demand for labor due to a change in other input prices $\eta_{L\Omega}$ and the employment-output elasticity η_{LY}. The latter is expected to be positive, i.e. output growth leads to an increase in labor demand.

In the first step, the *correct estimation model* needs to be selected. In the presence of unobserved time-constant sector-specific effects c_i the composite error term v_i looks as follows: $v_i = c_i + \varepsilon_{it}$. Implicitly, one assumes sector-specific effects due to technological or productivity differences across the sectors. Therefore, sectoral dummies are added to the pooled OLS model and their joint significance on employment is tested with a F-Test. The test rejects the null hypothesis H_0 that the sectoral dummies have a joint significance of 0 (prob>F=0.000). Hence, the existence of unobservable sector-specific effects c_i can be assumed. If c_i (e.g. technology) is correlated with some exogenous variables x_{it} (e.g. OSS), usual pooled OLS regression would be biased and inconsistent. Transforming the pooled OLS by using first differences or a fixed effects estimator, these time-invariant effects c_i are washed out. Thus, first differences and fixed effects models allow for a correlation between c_i and some x_{it}.

In order to chose between first differences and the fixed effects model a test for serial correlation in the first-differenced equation is run as suggested by Wooldridge (2000). The fixed effects model is more efficient when ε_{it} is serially uncorrelated which can be assumed if $\Delta\varepsilon_{it}$ shows a strongly negative autocorrelation. First differences on the other hand are preferred if ε_{it} follows a random walk with serially uncorrelated $\Delta\varepsilon_{it}$. Serial correlation is tested adding the lagged residuals $\hat{r}_{i,t-1}$ with $r_{it} = \Delta\varepsilon_{it}$ to the first differenced pooled OLS estimation under H_0 of no serial correlation. H_0 is rejected (p-value=0.0000) and the coefficient of $\hat{r}_{i,t-1}$ is 0.6593. Since $\Delta\varepsilon_{it}$ is positively serially correlated the results do not clearly favor one model.[1]

First differences are preferred to the fixed effects model due to a reduction of multicollinearity among the independent variables. It might seem probable that several independent variables show a linear inter-correlation such as OSS and OSM which is shown in 5.4.[2] The first differenced estimating equation in the logarithmic form is the following:

$$\Delta \ln L_{it} = \alpha_0 + \alpha_1 \Delta \ln OSS_{it} + \alpha_2 \Delta \ln OSM_{it} + \alpha_3 \Delta \ln y_{it} + \alpha_4 \Delta \ln w_{it} + \delta_t D_t + \delta_i D_i + \Delta\varepsilon_{it}$$

where the expected coefficient signs are $\alpha_1 < 0, \alpha_2 < 0, \alpha_3 > 0$ and $\alpha_4 < 0$. All specifications integrate fixed year effects $D_{t,}$, i.e. time-specific cross-sectoral effects, such as common shocks influencing all sectors. When fixed sector effects are not constant but grow over time they do not disappear after differencing. This is especially the case in sectors with higher growth rates or a stronger technological progress. Such growth effects are absorbed in the idiosyncratic error term ε_{it} which is then likely to be serially correlated favoring first differencing to fixed effects models. Another possibility is to include fixed sector effects D_i in the first differenced equation capturing all time-variant effects with constant growth rates which is not possible in the fixed effects model. Therefore, fixed sector effects D_i are added to some specifications. Time-varying unobserved factors are represented by the idiosyncratic error term ε_{it}.

5.3.2 Data

Sectoral *employment* data for the relevant period is used to map labor demand. The data is derived from the input-output tables of the German Federal Statistical Office. Sector-specific data on disaggregated *wages* w (labor compensation of employees) is retrieved from the OECD STAN Industrial Database[3] which consists of annual wages and salaries of employees at a sectoral level paid by producers as well as supplements such as contributions to social security, private pensions, health insurance, life insurance and similar schemes. Labor compensation instead of gross wages and salaries is chosen, since labor demand seems to be driven by a firm's entire labor costs. Some sectors only have wage data available at a

[1] Additionally, two Fisher tests for unit roots in panel data are run using the Phillips Perron test and the Dickey Fuller test. Both tests reject the null hypothesis of a unit root with Prob>chi2=0.0000.

[2] Moreover, first differences allow for better comparability with the dynamic Arellano-Bond estimator which I intend to do in a further step.

[3] The salary and wage data is based on Federal Statistical Office data.

more aggregated level. Therefore, disaggregation is acquired weighting the wage data by its sectoral output share.[1] The data is divided by the respective sectoral employment to calculate average annual labor compensation per employee. As labor demand depends on *real wages*, an appropriate price index is needed. Thereby, sectoral producer price indices from the Federal Statistical Office are used, since producer prices rather than consumer prices matter.[2]

Considering the determination of *other input prices* foreign wages could serve as a proxy. This is, however, only applicable to employment in foreign affiliates. In the case of offshore outsourcing, companies are more interested in import prices than foreign wages. Furthermore, the fixing of an adequate income level becomes difficult for certain countries. Therefore, Amiti and Wei (2004b) decided to use offshoring intensities as an inverse proxy for import prices of services as well as of material. Therefore, the OSS(a) and OSM(a) measures which have been calculated in the previous chapter are used. Due to the input-output data revision and a possible structural break my analysis only includes the unrevised data from 1991 to 2000.

The lower the import prices of services or material are, the higher should the offshoring intensities be. Offshoring can have a threefold effect on employment. Firstly, if other input prices fall, labor is likely to be substituted for inputs (*substitution effect)*. And secondly, offshoring could augment productivity so that less labor is needed for the same amount of output (*productivity effect*). The substitution effect influences labor demand in a direct manner, whereas the productivity effect is indirect. Thirdly, *scale effects* could influence labor demand positively. If the productivity effect leads to lower prices, this could result in a higher competitiveness of firms fostering the demand for goods and labor. Thus, the net effect of offshoring is not clear (Amiti and Wei, 2006). *Other input prices*, such as the rental rate on capital, are expected to be the same for all companies and be a function of time r=f(t). They can be absorbed by the fixed year effects D_t. *Output* data Y for all 43 sectors is derived from the input-output tables. I calculated real output using producer prices.

[1] Thus, for instance, no disaggregated wage data was available for the sector 'food products' and the sector 'beverages', but only for the aggregated sector 'food products and beverages'. Since a similar productivity for both sectors can be assumed, wages of the common sector 'food products and beverages' was weighted with the respective output share of both sectors in order to achieve sectoral wages for the single sectors. This procedure was done 8 times to obtain wages for all 43 sectors. The OECD STAN Industrial Database has aggregated levels in the following sectors: 1-2; 8-9; 10-11; 15-16; 17-18; 19-21; 32-33 and 35-36.

[2] Producer price indices are available at several aggregation levels (28, 107 and 225 sectors). Since some producer prices at the needed input-output aggregation level were not available, I used producer prices of more disaggregated sectors (within the same industry) as a proxy because similar price trends can be expected there. This procedure was also carried out in a few cases where some years were missing.

5.4 Estimation Results

Employment effects are not always instantaneous, which is why the optimal time lags of the independent variables should be chosen. Y is expected to still affect employment after one period, because companies adopt their investment and other decisions (such as labor demand) to their expected output which is mostly calculated on the basis of preceding years. Assuming labor market rigidities wage changes are also likely to influence labor demand even after one period. Hence, one period lags y_{t-1} and w_{t-1} should be included in the model.

OSS and OSM, by contrast, do not represent the decision of a company to offshore parts of its production, but the *result of preceding import decisions*. Let us assume that a company plans its necessary import amounts some periods (e.g. two periods) in advance which seems to match reality especially in the case of offshore outsourcing. On this assumption a company can already adopt its labor demand one period before importing the inputs. If this assumption holds, one-period leads $\Delta lnOSS_{t+1}$ and $\Delta lnOSM_{t+1}$ should be included. Here, I assume labor-saving technical progress (e.g. via ICT) where a relative reduction of capital is accompanied by a disproportionately high decrease of labor. In such a case growing capital intensity (capital/labor) is still assured. A firm that plans to import intermediate goods and services in t+2 is also aware of the need to reduce its domestic capital stock (disinvestment). Firms thus are likely to anticipate part of this disinvestment already in t+1 which is combined with layoffs of labor. Such anticipation could be explained by restructuring measures within the companies.

Following the previous ideas, the joint significance of the variables on employment is tested running some F-tests under the null hypothesis H_0 that there is no joint significance (see *Table 10*). Adding a one period lag of y and w plus fixed year effects, the joint significance of $\Delta lnOSS_t$ and $\Delta lnOSS_{t+1}$ (p>F=0.1351) shows better results than of $\Delta lnOSS_t$ combined with $\Delta lnOSS_{t-1}$ (p>F=0.6176). The joint significance of $\Delta lnOSM_t$ and $\Delta lnOSM_{t+1}$ (p>F=0.1455) compared to $\Delta lnOSM_t$ and $\Delta lnOSM_{t-1}$ (p>F=0.1474) seems to be similar. Anyhow, adding fixed sector effects, the combination with the lead yields better results (p>F=0.3481) than the lag (p>F=0.4286). Thus, one-period leads of OSS and OSM are integrated in the specification.

In a first step, the estimation model is tested for possible *heteroscedasticity* performing a White test of the null hypothesis of homoscedasticity against unrestricted forms of heteroskedasticity. H_0 can be rejected (Prob>chi2=0.0000).[1] Secondly, a test for *autocorrelation*

[1] A further test for heteroscedasticy is run as suggested by Greene "Econometric Analysis" (1993, page 395). This test amounts to a likelihood ratio test of the null hypothesis of homoscedasticity. H_0 is rejected (Prob>chi2=0.0000). The STATA command hetgrot is used as proposed by Nunziata (see http://www.decon.unipd.it/personale/curri/nunziata/software.htm) allowing for time operators and differences.

in ε_{it} of linear panel-data models is run as discussed by Wooldridge (2002). The null hypothesis of no first-order autocorrelation is also rejected (Prob>F=0.0000).[1] Therefore, all estimations include the "robust cluster" option which produces standard errors robust to both heteroscedasticity (Huber-White sandwich estimators) and any form of intra-cluster correlation. Since the clusters are sectors in our case, this option corrects for intra-sector serial correlation and any other correlation provoked by common intra-sector shocks.

A further step controls for *multicollinearity* of the independent variables. In the case of imperfect multicollinearity the estimators are still efficient and unbiased. The problem is that multicollinearity creates large estimator variances and hence large confidence intervals. In the case of multicollinearity and a high R^2, the joint influence of the inter-correlated independent variables on the dependent variable is given, but the estimation of the individual coefficients is difficult to obtain. This is not due to a misspecification of the model, but due to insufficient information in the data. Multicollinearity can be reduced by using first differences which is shown in *Table 11.* The correlation matrix without first differences in the upper part is compared to the correlation matrix using first differences in the lower part. In most cases first differences have reduced the correlation. As none of the first differenced variables shows a higher inter-correlation than -28.9%, multicollinearity should not be considered a major problem.

The *results* of the first differenced robust estimators are shown in the first 6 columns of *Table 10*, whereas the first 3 columns do not include fixed sector effects yet. $\Delta lnOSM_t$ and $\Delta lnOSM_{t+1}$ are negative and significant in the first three columns, while only $\Delta lnOSS_{t+1}$ has a significant negative impact when real wages and real output are included in column 3. Adding fixed sector effects in columns 4 to 6, $\Delta lnOSM_t$ and $\Delta lnOSM_{t+1}$remain negative but no longer significant. $\Delta lnOSS_{t+1}$ is negative in columns 5 and 6, whereas $\Delta lnOSS_t$ is positive, none of them being significant. As a first result the overall effect of service and material offshoring seems to be negative.

For comparison the fixed effects estimators are given in columns 7 and 8 showing a similar pattern of the coefficient signs. It should be noted that the time-demeaned variables $\dot{x}_{it}$ in the fixed effects model differ from the first differenced variables Δx_{it}. The joint influence of material offshoring on employment is significant in both specifications, while the joint influence of service offshoring is only significant in column 7. Nevertheless, $lnOSS_{t+1}$ almost reaches the 10%-level adding fixed year effects in column 8. The F-tests indicate that the combination of $lnOSS_t$ with its lead $lnOSS_{t+1}$ yields better results than in combination with its lag $lnOSS_{t-1}$.

[1] As a further control, the Baltagi test statistic for autocorrelation in panel models is calculated as proposed by Nunziata (see http://www.decon.unipd.it/personale/curri/nunziata/software.htm) used allowing for time operators and differences. The null hypothesis that $\rho = 0$ if residuals are AR(1) can be rejected (Prob>LM=0.0279).

5.4.1 Sensitivity: Measurement Errors

Possible *measurement errors* can be taken into account using longer period differences. In a first step the results are re-estimated using two-period differences. The results are shown in columns 7 and 8 of Table 10. All offshoring coefficients have negative signs, but none of them are significant. In a second step, the variables are estimated using two- or three years averages of the sample (1991-1993, 1994-1995, 1996-1997 and 1998-2000) and first differencing them. The coefficients are higher due to an artificial reduction of the time-series to 4 periods. The results in the last column of Table 10 show a negative effect of OSM and OSS which are significant except for $\Delta lnOSS_{t+1.}$ Despite the insignificant results of the 2[nd] differenced estimations the results indicate a negative impact of offshoring on labor demand.

5.4.2 Sensitivity: Outliers

In the case of short time series and a limited number of sectors *outliers* could lead to biased results. Therefore, an iterative estimation is applied where more extreme outliers are reweighted less heavily and very extreme outliers get omitted (rreg STATA command). The least squares are reweighted using Huber and biweight functions. Each variable in the first two columns of *Table 12* has the expected sign. OSM is significant in the first column, whereas OSS is insignificant. Adding sector fixed effects (column 2), OSM shows much smaller coefficients that are no longer significant. $\Delta lnOSS_{t+1}$ in turn becomes significant at the 5%-level.

In a next step the model is reestimated dropping the two identified outliers – the pharmaceuticals sector and the office accounting, computer machinery sector – as their service offshoring intensities are relatively high compared to the average sample (see Figure 7). Firstly, the pharmaceuticals sector is eliminated (columns 3 and 4). Column 3 shows significant coefficients for OSM and $\Delta lnOSS_{t+1}$ while adding fixed sector effects in column 4 leads to insignificant results. Additionally, the office, accounting, computer machinery sector is dropped from the sample (columns 5 and 6). In column 5, OSM and $\Delta lnOSS_{t+1}$ miss the 10% level narrowly. After adding fixed sector effects, $\Delta lnOSS_{t+1}$ becomes significant at the 10.5% level.

5.4.3 Additional Control Variable

Service offshoring might be swelled due to omitted correlated other variables. I addressed this problem *adding the shares of total imports in total output* by sector as suggested by Amiti and Wei (2006). The higher the import share of a sector, the more probable service offshoring is. The results in *Table 13* show that adding import shares leads to smaller negative coefficients for material offshoring which are all insignificant. Regarding service offshoring,

$\Delta lnOSS_t$ is positive in all specifications, but insignificant. $\Delta lnOSS_{t+1}$ becomes significant at the 10% level when both outliers are dropped (column 6). The additional control variable hardly changes the size of the service offshoring coefficients.

5.4.4 Discussion of Results

The results show that besides material offshoring and real wages, service offshoring had a negative effect on domestic labor demand in Germany. $\Delta lnOSS_{t+1}$ shows negative coefficients between -0.0050 und -0.0086. Allowing for outliers, an additional control variable as well as fixed year and sector effects, the results of column 6 in Table 13 should be interpreted. The F-test indicates that the joint influence of $\Delta lnOSS_t$ und $\Delta lnOSS_{t+1}$ almost reaches the 10%-level (11.9%). Therefore, the net effect of service offshoring on labor demand is calculated taking the sum of both coefficients (-0.0055). Between 1991 and 2000, the CAGR of service offshoring weighted by sectoral employment was 6.8% for the manufacturing sector. Thus, service offshoring led to an average employment reduction of 0.0375% p.a. and 0.34% over the entire period, respectively. Having a total of 12,649,000 employees in the manufacturing sector in 1991, this would imply an employment reduction of 42,800 employees.

The negative impact of service offshoring compared to material offshoring and real wages is relatively small. Interestingly, the effect of real output appears to be strongly positive so that it could counteract possible negative employment effects. However, compared to material offshoring the potential of service offshoring has not fully been exploited yet, which is why in future negative employment effects could be stronger. A further step would be to address the possible endogeneity of offshoring using adequate instrumental variables. Furthermore, the results should be compared to a dynamic model where labor demand of the previous period is integrated besides the independent variables.

6. Concluding Remarks

Since the new tradability of services has made services vulnerable to relocation, the public awareness of service offshoring and its potential employment effects has increased significantly. This paper first aims at giving an understanding what service offshoring concretely means. The underlying offshoring motives are relevant, as re-imports and potential layoffs of domestic employees are mainly given within the category of cost-oriented motives which was thus included in the definition of service offshoring in the narrower sense.

Traditional trade models generally assume full employment and perfect labor mobility between the sectors. In the long-term, there is no unemployment because offshoring affects labor markets solely through wage adjustments. Even if one assumes labor market rigidities, layoffs are only possible in the short-term. Since unemployment is not only a short-term problem in Germany, empirical research can give further clarification.

The worldwide comparison of trade in other business services as well as computer and information services shows that Germany was the biggest absolute offshorer of computer and information services in 2003 as well as of both service categories put together. The balance reveals that Germany has the largest deficit taken both service categories together, whereas the Anglo-Saxon countries show large and increasing surpluses. Taking service offshoring intensities as a more adequate measure, German OSS(a) has more than doubled from 1.94% in 1991 to 4.25% in 2002.

Indications for a relationship between German service offshoring and employment lead to the hypothesis that service offshoring might have a possible negative impact on manufacturing employment. The estimation results show that between 1991 and 2000 service offshoring has led to an employment reduction of 0.0375% p.a. and 0.34% over the period, respectively. This implies a release of 42,800 employees. Anyhow, the influence appears to be relatively small compared the impact of real wages and material offshoring intensities. The positive impact of real output could counteract negative employment effects. However, since service offshoring intensities have not exploited their full potential yet, negative employment effects could be higher in the future.

Interestingly, the results for Germany are indeed different from the results for the UK and the US. Amiti and Wei (2004a) tested the impact of service offshoring on manufacturing employment for the US. At a highly disaggregated sectoral level (450 industries) they derived a significant negative effect, whereby service offshoring reduced manufacturing employment between 0.4 and 0.7 percent per year during 1992 and 2001. At a more aggregated level (100 industries), the negative effect disappeared. The authors interpret this phenomenon with the potential of service offshoring to increase efficiency in certain sectors which leads to the creation of new jobs in other sectors. Amiti and Wei (2004b) likewise tested the impact of service offshoring on home employment for the UK integrating 78 industries. They also found no negative correlation of service offshoring on manufacturing employment using the same explanation as for the US. As there are only 43 sectors in the German study, but there is still a negative impact on sectoral employment, I draw the following conclusion. Companies in Germany that offshore services do not create new jobs despite efficiency gains, and thus, layoffs are not compensated for.

This hypothesis is supported by a study of the McKinsey Global Institute saying that the US gained 1.14 to 1.17$ for every Dollar being invested in the Indian service sector. Germany, on the other hand, obtains only 0.74€ per Euro that has been invested to Indian and Eastern European service jobs indicating an overall economic loss of 26%. According to this study, the principal reason is the higher reemployment chance of released labor in more productive activities in the US due to the more flexible labor market as well as the disposability of more productive jobs in the high-tech sector (McKinsey Global Institute, 2005; Farrel, 2004).

Nevertheless, there are some *caveats* concerning studies on service offshoring and employment effects. Firstly, long-term effects cannot be predicted yet because of the novelty of the phenomenon. Thus, positive employment effects are possible in the long term, when domestic companies reinvest their efficiency gains in new jobs. Secondly, the relationship between offshoring and employment is complex as it links foreign trade, home production and gross fixed investments which can provoke direct and indirect as well as static and dynamic effects. Hence, the sign and extent of offshoring in existing studies should not be considered universally valid (Tüselmann, 1998). Thirdly, the diverse offshoring motives do only associate labor market effects, since the underlying cause for the domestic employment reduction – especially in the case of cost-oriented motives – is not offshoring, but high labor costs. Offshoring then is rather a symptom than a cause of domestic labor market problems (Roling, 1999). And finally, the main cause of the increase in service offshoring is not clearly determinable. Service offshoring can be traced back not only to increased service trade as a consequence of globalization but also to technological progress (ICT). Despite the caveats the estimation results allow for the conclusion that service offshoring has reduced German labor demand in the manufacturing sector between 1991 and 2000.

Table 1: Biggest Absolute Offshoring Countries in 2003 (in Mio. US$)

Rank	Country	Other Business Services	Rank	Country	Computer & Information Services	Rank	Country	Total
1.	United States	44188	1.	Germany	7269	1.	Germany	46985
2.	Germany	39716	2.	United Kingdom	2807	2.	United States	45735
3.	Netherlands	24589	3.	Japan	2109	3.	Netherlands	26132
4.	Italy	24249	4.	Spain	1662	4.	Italy	25304
5.	France	23457	5.	Belgium	1593	5.	United Kingdom	25286
6.	Japan	23149	6.	United States	1547	6.	Japan	25258
7.	United Kingdom	22478	7.	Netherlands	1543	7.	France	24694
8.	Ireland	22255	8.	France	1238	8.	Ireland	22641
9.	Austria	19135	9.	Sweden	1179	9.	Austria	19512
10.	Spain	15273	10.	Canada	1148	10.	Spain	16935
14.	China	10371	11.	Brazil	1063	13.	China	11407
18.	India	8088	13.	China	1036	16.	India	8747
21.	Russia	5046	14.	India	659	18.	Russia	5504
			18.	Russia	458			

Source: Own calculations, Data: International Monetary Fund (IMF), Balance of Payments, CD-OM via UNCTAD

Table 2: Biggest Relative Offshoring Countries in 2003 (in % of GDP)

Rank	Country	Other Business Services/GDP	Rank	Country	Computer & Information Services/GDP	Rank	Country	Total/ GDP
1.	Angola	15.56%	1.	Luxembourg	1.36%	1.	Angola	15.57%
2.	Ireland	14.63%	2.	Vanuatu	0.57%	2.	Ireland	14.88%
3.	Antilles (Neth.)	11.06%	3.	Syrian Arab Rep.	0.54%	3.	Antilles (Neth.)	11.37%
4.	Congo	10.14%	4.	Belgium	0.52%	4.	Luxembourg	9.45%
5.	Azerbaijan	9.25%	5.	Guyana	0.43%	5.	Aruba	9.23%
53.	Germany	1.65%	14.	Germany	0.30%	37.	Germany	1.96%
66.	India	1.36%	36.	United Kingdom	0.16%	49.	India	1.47%
68.	France	1.31%	46.	India	0.11%	51.	United Kingdom	1.41%
72.	United Kingdom	1.25%	48.	Russia	0.11%	53.	France	1.38%
76.	Russia	1.17%	59.	China	0.07%	58.	Russia	1.28%
92.	China	0.73%	61.	France	0.07%	68.	China	0.81%
102.	Japan	0.54%	70.	Japan	0.05%	76.	Japan	0.59%
109.	United States	0.40%	85.	United States	0.01%	83.	United States	0.42%

Source: Own calculations, Data: International Monetary Fund (IMF), Balance of Payments, CD-ROM via UNCTAD

Table 3: Biggest Absolute Onshoring Countries in 2003 (in Mio. US$)

Rank	Country	Other Business Services	Rank	Country	Computer & Information Services	Rank	Country	Total
1.	United States	64074	1.	Ireland	14372	1.	United States	69505
2.	United Kingdom	47322	2.	India	11366	2.	United Kingdom	55214
3.	Germany	33120	3.	United Kingdom	7893	3.	Germany	39800
4.	France	24133	4.	Germany	6680	4.	France	25389
5.	Netherlands	22045	5.	United States	5431	5.	Netherlands	24099
6.	Italy	21000	6.	Israel	3657	6.	Italy	21501
7.	Hong Kong SAR	19382	7.	Spain	2916	7.	Ireland	21115
8.	Japan	18042	8.	Canada	2788	8.	Hong Kong SAR	19627
9.	China	17427	9.	Belgium	2118	9.	Japan	19117
10.	Austria	15936	10.	Netherlands	2054	10.	China	18529
12.	Taiwan	13529	12.	France	1256	14.	India	13967
15.	Singapore	11426	14.	China	1102	15.	Taiwan	13639
19.	Ireland	6743	15.	Japan	1076	18.	Singapore	11744
25.	Israel	3445	20.	Singapore	319	19.	Israel	7101
26.	Russia	3177	21.	Hong Kong SAR	245	20.	Korea, Rep. of	6702
27.	India	2601	22.	Hungary	244	24.	Russia	3352
34.	Poland	1532	25.	Russia	175	30.	Hungary	1763
35.	Hungary	1519				31.	Poland	1666
36.	Czech Republic	1406				32.	Czech Republic	1482

Source: Own calculations, Data: International Monetary Fund (IMF), Balance of Payments, CD-ROM, via UNCTAD.

Table 4: Biggest Relative Onshoring Countries in 2003 (in % of GDP)

Rank	Country	Other Business Services/GDP	Rank	Country	Computer & Information Services/GDP	Rank	Country	Total/ GDP
1.	Antilles (Neth.)	21.25%	1.	Ireland	9.45%	1.	Antilles (Neth.)	21.29%
2.	Hong Kong SAR	12.37%	2.	Luxembourg	4.21%	2.	Ireland	13.88%
3.	Singapore	12.37%	3.	Israel	3.18%	3.	Singapore	12.71%
4.	Luxembourg	8.37%	4.	India	1.91%	4.	Luxembourg	12.57%
5.	Cyprus	8.06%	5.	Costa Rica	0.95%	5.	Hong Kong SAR	12.53%
12.	Ireland	4.43%	13.	United Kingdom	0.44%	8.	Israel	6.18%
24.	United Kingdom	2.63%	18.	Singapore	0.34%	15.	Estonia	4.22%
35.	Hungary	1.85%	19.	Estonia	0.34%	18.	United Kingdom	3.07%
36.	Slovakia	1.69%	22.	Slovenia	0.32%	23.	Croatia	2.35%
37.	Czech Republic	1.55%	23.	Hungary	0.30%	24.	India	2.35%
38.	Bulgaria	1.55%	24.	Latvia	0.30%	27.	Hungary	2.15%
52.	Germany	1.38%	25.	Germany	0.28%	30.	Slovakia	1.95%
54.	France	1.35%	26.	Slovakia	0.26%	32.	Latvia	1.84%
59.	China	1.23%	52.	France	0.07%	33.	Slovenia	1.67%
76.	Russia	0.74%	56.	United States	0.05%	35.	Germany	1.66%
82.	United States	0.59%	59.	Russia	0.04%	44.	France	1.42%
89.	India	0.44%	66.	Japan	0.03%	48.	China	1.31%
92.	Japan	0.42%				59.	Russia	0.78%
						66.	United States	0.63%
						71.	Japan	0.45%

Source: Own Calculations, Data: International Monetary Fund (IMF), Balance of Payments, CD-ROM, via UNCTAD.

Table 5: Biggest Surplus and Deficit Countries in 2003 (in Mio. US$)

Rank	Country	Other Business Services	Rank	Country	Computer & Information Services	Rank	Country	Total
Biggest surplus			**Biggest surplus**			**Biggest surplus**		
1.	United Kingdom	24843	1.	Ireland	13987	1.	United Kingdom	29929
2.	United States	19886	2.	India	10706	2.	United States	23770
3.	Hong Kong SAR	15610	3.	United Kingdom	5085	3.	Hong Kong SAR	15573
4.	Taiwan	7328	4.	United States	3884	4.	Taiwan	7190
5.	China	7056	5.	Canada	1640	5.	China	7122
Biggest deficit			**Biggest deficit**			**Biggest deficit**		
118.	Korea, Rep. of	-4549	81.	Russia	-283	80.	Austria	-3388
119.	Japan	-5107	82.	Italy	-554	81.	Italy	-3802
120.	India	-5487	83.	Germany	-589	82.	Korea, Rep. Of	-4652
121.	Germany	-6596	84.	Japan	-1033	83.	Japan	-6141
122.	Ireland	-15513	85.	Brazil	-1034	84.	Germany	-7185

Source: Own calculations, Data: International Monetary Fund (IMF), Balance of Payments, CD-ROM via UNCTAD.

Table 6: Service Offshoring Intensities in Germany (1991 vs. 2002)

OSS (a): 1991 Service j	OSSj (weighted average)	Mean	Std Dev	Min	Max
Post and telecommunications	0.601%	0.543%	2.922%	0.000%	19.237%
Financial intermediation (except insurance & pension fund.)	0.013%	0.012%	0.021%	0.000%	0.099%
Activities related to financial intermediation	0.220%	0.183%	0.823%	0.000%	4.202%
Renting of machinery and equipment	0.101%	0.116%	0.325%	0.000%	2.155%
Computer and related activities	0.033%	0.038%	0.128%	0.000%	0.758%
Research and development	0.129%	0.294%	1.482%	0.000%	9.578%
Other business activities	0.369%	0.244%	0.375%	0.025%	2.246%
Total OSS (a)	**1.466%**	**1.430%**	**3.314%**	**0.120%**	**19.527%**

OSS (a): 2000 Service j	OSSj (weighted average)	Mean	Std Dev	Min	Max
Post and telecommunications	0.559%	0.433%	2.514%	0.000%	16.530%
Financial intermediation (except insurance & pension fund.)	0.036%	0.025%	0.055%	0.000%	0.352%
Activities related to financial intermediation	0.264%	0.260%	1.212%	0.000%	6.783%
Renting of machinery and equipment	0.006%	0.004%	0.023%	0.000%	0.150%
Computer and related activities	0.601%	0.719%	3.137%	0.000%	19.734%
Research and development	0.268%	0.651%	3.447%	0.000%	22.424%
Other business activities	1.436%	0.611%	1.713%	0.000%	10.853%
Total OSS (a)	**3.169%**	**2.703%**	**5.682%**	**0.000%**	**23.003%**

OSS (a): 2002 Service j	OSSj (weighted average)	Mean	Std Dev	Min	Max
Post and telecommunications	0.573%	0.404%	2.471%	0.000%	16.226%
Financial intermediation (except insurance & pension fund.)	0.213%	0.212%	0.140%	0.000%	0.768%
Activities related to financial intermediation	0.559%	0.592%	2.805%	0.000%	16.645%
Renting of machinery and equipment	0.000%	0.000%	0.000%	0.000%	0.000%
Computer and related activities	0.480%	0.565%	1.760%	0.000%	10.800%
Research and development	0.343%	0.678%	2.703%	0.000%	15.346%
Other business activities	1.389%	0.649%	1.543%	0.000%	9.688%
Total OSS (a)	**3.558%**	**3.101%**	**5.338%**	**0.000%**	**18.994%**

Source: Own calculations, Data: Federal Statistical Office, input-output tables 1991 and 2000 (unrevised form) und 2002 (revised form).

Table 7: Comparison of Selected Services in Germany, the UK and the US

Germany	UK	US
Post and telecommunications	Telecommunications	Telecommunications
Financial intermediation, activities related to financial intermediation	Banking and finance, insurance and pension funds and auxiliary financial services	Insurance, Finance
Renting of machinery and equipment	Renting of machinery	Other Business services
Computer and related activities	Computer services	Computing and Information
Research and development	Research and development	Other Business services
Other business activities	Legal activities, accountancy services, market research and management consultancy	Other Business services
Other business activities	Architectural activities and technical consultancy	Other Business services
Other business activities	Advertising	Other Business services
Other business activities	Other business services	Other Business services

Source: German classification: Federal Statistical Office, UK classification: UK National Accounts, US classification: IMF Balance of Payments Statistics.
NB: Other business services in the US (IMF classification) include merchanting and other trade-related services, operational leasing services and miscellaneous business, professional and technical services.

Table 8: Offshoring Intensity in Germany, the UK and the US

Service Offshoring Intensity					
Year	Germany (a)	Germany (b)	UK	US (I)	US (II)
1991	1.47%	1.01%	-	-	-
1992	1.47%	0.98%	3.50%	0.49%	0.18%
1993	1.46%	0.98%	3.82%	0.53%	0.18%
1994	1.41%	0.94%	3.94%	0.56%	0.20%
1995	2.03%	1.01%	3.98%	0.58%	0.20%
1996	2.15%	1.11%	4.33%	0.61%	0.21%
1997	2.52%	1.33%	4.18%	0.64%	0.23%
1998	2.70%	1.40%	4.65%	0.66%	0.24%
1999	3.01%	1.59%	5.20%	0.75%	0.29%
2000	3.17%	1.74%	5.51%	0.76%	0.29%
2001	3.61%	2.26%	5.50%	0.80%	-
2002	3.56%	2.21%	-	-	-
CAGR*	8.39%	7.38%	5.15%	5.60%	6.14%
Material Offshoring Intensity					
Year	Germany (a)	Germany (b)	UK	US (I)	US (II)
1991	17.29%	18.49%	-	-	-
1992	15.58%	16.46%	28.19%	8.74%	11.72%
1993	14.43%	14.93%	29.49%	9.24%	12.68%
1994	14.66%	16.00%	29.77%	9.92%	13.41%
1995	15.43%	16.89%	30.70%	10.47%	14.18%
1996	15.26%	16.90%	30.66%	10.38%	14.32%
1997	15.93%	18.32%	29.67%	10.51%	14.55%
1998	16.70%	18.97%	28.00%	10.48%	14.94%
1999	16.85%	19.05%	28.00%	10.78%	15.55%
2000	18.73%	21.51%	28.56%	11.94%	17.33%
2001	16.77%	19.88%	28.09%	11.47%	-
2002	16.21%	19.69%	-	-	-
CAGR*	-0.59%	0.57%	-0.04%	3.07%	5.01%
Service Sectors	7	7	9	5	5
Manufacturing Sectors	36	36	69	96	96

Source: Own calculations for Germany (a) and (b). Weighted average across all sectors i by outputs.
Germany (a): $\sum_j$ [(imported service j by sector i)/(total non energy inputs used by sector i)]. *Other measures*: $\sum_j$ [(input purchases of service j by sector i)/(total non energy inputs used by sector i)]* [(imports of service j)/(production$_j$ + imports$_j$ - exports$_j$). Data: input-output tables, Federal Statistical Office. Revised data only for 2001-2002.
Calculations for the UK: Amiti and Wei (2004b). Data: input-output tables, UK National Statistics, IMF: Balance of Payments Statistics. NB: UK data is not directly available, but can be reconstructed thanks to Figure 2 in Amiti and Wei (2004b).
Calculations for the US: (I): Amiti and Wei (2004a); (II): Amiti and Wei (2006). Data: input-output tables, US National Statistics, IMF: Balance of Payments Statistics.

*CAGR: Compound Annual Growth Rate, based on first and last available year

Table 9: Ranking of Service Offshoring Intensity Growth and Employment Growth in Germany (1991-2000)

Ranking of Service Offshoring Growth	**Service Offshoring Intensity Growth**		**Employment Growth**	
Sector	**%**	**Rank**	**%**	**Rank**
Top Ten				
Computer and related activities	1266.8%	1	91.4%	1
Office, accounting and computing machinery	453.4%	2	-65.9%	43
Tobacco products	288.0%	3	-31.6%	31
Other business activities	278.5%	4	83.5%	2
Research and development	212.3%	5	33.7%	5
Chemicals exluding pharmaceuticals	144.9%	6	-35.4%	33
Metal castings	143.3%	7	-35.1%	32
Other transport equipment	134.7%	8	-28.4%	28
Pharmaceuticals	133.2%	9	-4.1%	13
Beverages	96.1%	10	-16.4%	17
Ranking of Employment Growth	**Service Offshoring Intensity Growth**		**Employment Growth**	
Sector	**%**	**Rank**	**%**	**Rank**
Bottom Ten				
Printing	-26.6%	32	-41.0%	34
Gas and gas supply	28.7%	23	-41.1%	35
Radio, television and communication equipment	67.5%	16	-42.0%	36
Iron and steel	30.5%	22	-43.3%	37
Coke, refined petroleum products and nuclear fuel	-79.5%	37	-46.5%	38
Non-ferrous metals	-66.1%	35	-47.3%	39
Textiles	-92.1%	41	-50.3%	40
Leather, leather products and footwear	-100.0%	43	-60.0%	41
Wearing apparel, dressing and dying of fur	-86.1%	38	-64.0%	42
Office, accounting and computing machinery	453.4%	2	-65.9%	43

Source: Own calculations. Data: Federal Statistical Office, STAN Industrial Database OECD.

Table 10: Estimation Results (1991-2000)

Dependent variable: Δlnemployment$_t$											
	First difference						Fixed effects*		Second difference		FD longer periods
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
$\Delta\ln(OSS)_t$	-0.0003	-0.0019	0.0004	-0.0000	0.0007	0.0031	0.0112	0.0023	-0.0011	-0.0006	-0.0020
	(0.965)	(0.777)	(0.947)	(0.999)	(0.913)	(0.617)	(0.279)	(0.817)	(0.839)	(0.915)	(0.832)
$\Delta\ln(OSS)_{t+1}$		-0.0057	-0.0069*		-0.0071	-0.0060	-0.0178**	-0.0106	-0.0032	-0.0027	-0.0801*
		(0.350)	(0.093)		(0.226)	(0.211)	(0.017)	(0.110)	(0.527)	(0.641)	(0.051)
$\Delta\ln(OSM)_t$	-0.0853*	-0.1368**	-0.0725*	-0.0287	-0.0658	-0.0501	-0.0896	-0.0915	-0.0534	-0.0545	-0.5166***
	(0.069)	(0.013)	(0.072)	(0.463)	(0.147)	(0.204)	(0.148)	(0.100)	(0.266)	(0.309)	(0.000)
$\Delta\ln(OSM)_{t+1}$		-0.1334***	-0.0815*		-0.0564	-0.0452	-0.1924**	-0.1323**	-0.0225	-0.0259	-0.1598**
		(0.003)	(0.066)		(0.139)	(0.250)	(0.012)	(0.025)	(0.597)	(0.609)	(0.019)
$\Delta\ln(\text{real wage})_t$			-0.3826***			-0.3446***	-0.3779***	-0.3359***	-0.2910***	-0.2859***	-0.3118
			(0.000)			(0.000)	(0.001)	(0.002)	(0.000)	(0.000)	(0.188)
$\Delta\ln(\text{real wage})_{t-1}$			-0.1618**			-0.0798	-0.4265***	-0.3235***	0.0692	0.0835	-0.2583
			(0.020)			(0.297)	(0.000)	(0.003)	(0.478)	(0.445)	(0.297)
$\Delta\ln(\text{real output})_t$			0.2466***			0.1961***	0.1863*	0.2210***	0.1078	0.0927	0.3502***
			(0.000)			(0.001)	(0.059)	(0.008)	(0.159)	(0.275)	(0.009)
$\Delta\ln(\text{real output})_{t-1}$			0.1582***			0.0868	0.2986***	0.3079***	-0.0275	-0.0464	0.1703
			(0.001)			(0.259)	(0.000)	(0.000)	(0.742)	(0.620)	(0.228)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Sector fixed effects	No	No	No	Yes	Yes	Yes	No	No	No	Yes	No
Joint significance tests:											
$\Delta\ln(OSS)_t + \Delta\ln(OSS)_{t+1} = 0$			p>F=0.1351			p>F=0.1687	p>F=0.0550	p>F=0.2653	p>F=0.8052	p>F=0.8816	p>F=0.1171
$\Delta\ln(OSM)_t + \Delta\ln(OSM)_{t+1} = 0$			p>F=0.1455			p>F=0.3481	p>F=0.0309	p>F=0.0777	p>F=0.5301	p>F=0.5865	p>F=0.0000
$\Delta\ln(OSS)_t + \Delta\ln(OSS)_{t-1} = 0$			p>F=0.6176			p>F=0.2786	p>F=0.3796	p>F=0.8679			
$\Delta\ln(OSM)_t + \Delta\ln(OSM)_{t-1} = 0$			p>F=0.1474			p>F=0.4286	p>F=0.0313	p>F=0.0797			
Observations	318	282	246	318	282	246	282	282	210	210	35
R-squared	0.17	0.21	0.40	0.49	0.53	0.57	0.75	0.77	0.26	0.30	0.72

Source: Own calculations. p*<0.1, p**<0.05, p***<0.001 (p-values in brackets).

* The time-demeaned variables $\dot{x}_{it}$ in the fixed effects model differ from the first differenced variables Δx_{it}.

Table 11: Correlation Matrix (1991-2000)

	$lnoss_t$	$lnoss_{t+1}$	$lnosm_t$	$lnosm_{t+1}$	$lnwage_t$	$lnwage_{t-1}$	$lnoutp_t$	$lnoutp_{t-1}$	$lnimsh_t$	$lnimsh_{t+1}$
$lnoss_t$	1.0000									
$lnoss_{t+1}$	0.9444	1.0000								
$lnosm_t$	-0.1340	-0.1468	1.0000							
$lnosm_{t+1}$	-0.1389	-0.1597	0.9863	1.0000						
$lnwage_{t-1}$	0.2428	0.2619	0.1688	0.1642	1.0000					
$lnwage_{t-1}$	0.2254	0.2462	0.1495	0.1475	0.9872	1.0000				
$lnoutput_t$	-0.1925	-0.2108	-0.1629	-0.1632	0.1065	0.1290	1.0000			
$lnoutput_{t-1}$	-0.1993	-0.2213	-0.1645	-0.1629	0.0978	0.1223	0.9972	1.0000		
$lnimsh_t$	0.0317	0.0266	0.7307	0.7306	0.2287	0.1978	-0.3620	-0.3623	1.0000	
$lnimsh_{t+1}$	0.0364	0.0313	0.7303	0.7305	0.2172	0.1865	-0.3844	-0.3842	0.9938	1.0000
	$\Delta lnoss_t$	$\Delta lnoss_{t+1}$	$\Delta lnosm_t$	$\Delta lnosm_{t+1}$	$\Delta lnwage_t$	$\Delta lnwage_{t-1}$	$\Delta lnoutp_t$	$\Delta lnoutp_{t-1}$	$\Delta lnimsh_t$	$\Delta lnimsh_{t+1}$
$\Delta lnoss_t$	1.0000									
$\Delta lnoss_{t+1}$	0.0221	1.0000								
$\Delta lnosm_t$	-0.1685	0.1214	1.0000							
$\Delta lnosm_{t+1}$	0.0557	-0.2147	-0.2399	1.0000						
$\Delta lnwage_t$	0.0291	0.0471	0.0089	0.0157	1.0000					
$\Delta lnwage_{t-1}$	-0.0244	-0.1227	-0.0543	0.0027	0.0019	1.0000				
$\Delta lnoutput_t$	0.0971	0.1749	0.0948	-0.1905	0.2680	-0.1152	1.0000			
$\Delta lnoutput_{t-1}$	0.1575	0.0810	-0.1686	-0.0953	-0.0717	0.1967	0.1187	1.0000		
$\Delta lnimsh_t$	0.0007	0.0319	0.0956	0.1300	-0.1476	-0.0392	-0.2890	-0.1445	1.0000	
$\Delta lnimsh_{t+1}$	-0.0256	-0.0465	-0.0548	0.1168	0.0689	0.1324	-0.0530	0.0454	0.0551	1.0000

Source: Own calculations. p*<0.1, p**<0.05, p***<0.001 (p-values in brackets).

Table 12: Outliers (1991-2000)

Dependent variable: $\Delta lnemployment_t$						
	Iterative Estimation		OLS without pharmaceuticals		OLS w/o pharmaceuticals and office accounting & computer machinery	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta ln(OSS)_t$	-0.0034	-0.0063	0.0003	0.0033	0.0024	0.0030
	0.472)	(0.103)	(0.957)	(0.587)	(0.673)	(0.630)
$\Delta ln(OSS)_{t+1}$	-0.0071	-0.0086**	-0.0071*	-0.0059	-0.0063	-0.0075
	(0.134)	(0.032)	(0.084)	(0.210)	(0.126)	(0.105)
$\Delta ln(OSM)_t$	-0.0556**	-0.0171	-0.0685*	-0.0469	-0.0621	-0.0538
	(0.011)	(0.347)	(0.087)	(0.228)	(0.127)	(0.186)
$\Delta ln(OSM)_{t+1}$	-0.0659***	-0.0156	-0.0773*	-0.0424	-0.0707	-0.0532
	-0.4475***	-0.4612***	(0.086)	(0.295)	(0.111)	(0.184)
$\Delta ln(\text{real wage})_t$	(0.000)	(0.000)	-0.3865***	-0.3440***	-0.4120***	-0.3709***
	-0.1495***	-0.1571***	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta ln(\text{real wage})_{t-1}$	(0.000)	(0.000)	-0.1630**	-0.0745	-0.1189**	-0.0482
	0.2711***	0.3172***	(0.023)	(0.331)	(0.046)	(0.516)
$\Delta ln(\text{real output})_t$	(0.000)	(0.000)	0.2475***	0.1951***	0.2431***	0.1867***
	0.1888***	0.2161***	(0.000)	(0.001)	(0.000)	(0.004)
$\Delta ln(\text{real output})_{t-1}$	(0.000)	(0.000)	0.1603***	0.0889	0.1685***	0.0950
			(0.001)	(0.250)	(0.001)	(0.243)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	No	Yes	No	Yes	No	Yes
Joint significance tests:						
$\Delta ln(OSS)_t + \Delta ln(OSS)_{t+1} = 0$	p>F=0.2547	p>F=0.0439	p>F=0.1223	p>F=0.1620	p>F=0.1136	p>F=0.0760
$\Delta ln(OSM)_t + \Delta ln(OSM)_{t+1} = 0$	p>F=0.0020	p>F=0.5680	p>F=0.1804	p>F=0.3967	p>F=0.2404	p>F=0.2872
Observations	246	246	239	239	232	232
R-squared	0.63	0.81	0.39	0.57	0.42	0.58

Source: Own calculations. p*<0.1, p**<0.05, p***<0.001 (p-values in brackets).

Table 13: Additional Control Variable (1991-2000)

Dependent variable: Δlnemployment$_t$						
	OLS all sectors		OLS w/o pharmaceuticals		OLS w/o pharmaceuticals and office accounting & computer machinery	
	(1)	(2)	(3)	(4)	(5)	(6)
Δln(OSS)$_t$	0.0021	0.0037	0.0019	0.0038	0.0034	0.0027
	(0.720)	(0.560)	(0.747)	(0.545)	(0.565)	(0.664)
Δln(OSS)$_{t+1}$	-0.0055	-0.0066	-0.0057	-0.0065	-0.0050	-0.0082*
	(0.173)	(0.168)	(0.156)	(0.165)	(0.196)	(0.067)
Δln(OSM)$_t$	-0.0386	-0.0122	-0.0328	-0.0091	-0.0280	-0.0184
	(0.154)	(0.583)	(0.194)	(0.672)	(0.290)	(0.414)
Δln(OSM)$_{t+1}$	-0.0647	-0.0351	-0.0554	-0.0302	-0.0503	-0.0431
	(0.136)	(0.349)	(0.183)	(0.421)	(0.217)	(0.228)
Δln(real wage)$_t$	-0.3902***	-0.3734***	-0.3953***	-0.3718***	-0.4271***	-0.4036***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δln(real wage)$_{t-1}$	-0.2228***	-0.1496**	-0.2280***	-0.1443**	-0.1765***	-0.1029
	(0.004)	(0.031)	(0.003)	(0.039)	(0.009)	(0.130)
Δln(real output)$_t$	0.2387***	0.2235***	0.2392***	0.2230***	0.2463***	0.2214***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δln(real output)$_{t-1}$	0.1853***	0.1470***	0.1884***	0.1502***	0.2005***	0.1621***
	(0.000)	(0.005)	(0.000)	(0.004)	(0.000)	(0.002)
Δln(import share)$_t$	-0.0109	-0.0131	-0.0138	-0.0145	0.0006	-0.0076
	(0.591)	(0.526)	(0.511)	(0.497)	(0.968)	(0.714)
Δln(import share)$_{t+1}$	-0.0357	-0.0529**	-0.0427*	-0.0589**	-0.0446	-0.0660**
	(0.150)	(0.050)	(0.092)	(0.033)	(0.102)	(0.020)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	No	Yes	No	Yes	No	Yes
Joint significance tests:						
Δln(OSS)$_t$ + Δln(OSS)$_{t+1}$ = 0	p>F=0.3031	p>F=0.2068	p>F=0.2876	p>F=0.2059	p>F=0.2672	p>F=0.1191
Δln(OSS)$_t$ + Δln(OSS)$_{t-1}$ = 0	p>F=0.2993	p>F=0.6358	p>F=0.3639	p>F=0.7133	p>F=0.4555	p>F=0.4782
Observations	225	225	218	218	211	211
R-squared	0.44	0.60	0.44	0.60	0.47	0.61

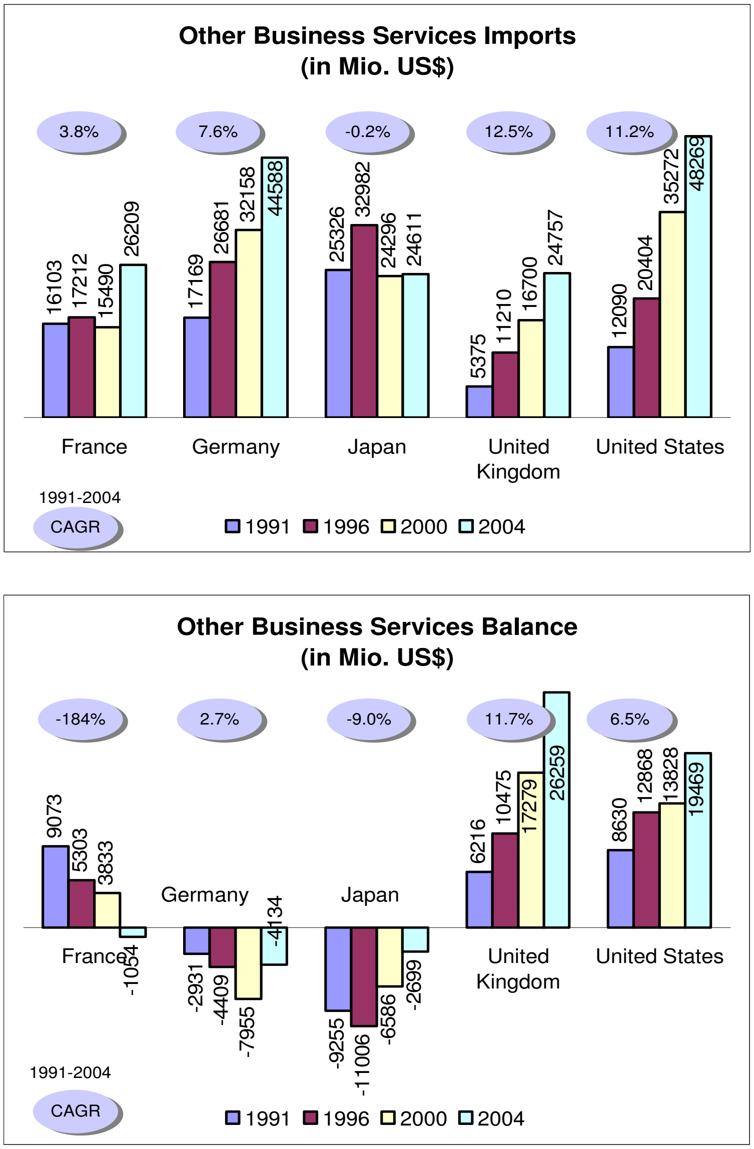
Source: Own calculations. p*<0.1, p**<0.05, p***<0.001 (p-values in brackets).

Figure 1: Classification of Offshoring

Criteria: Frontier	**outside** (Offshoring)	*Captive Offshoring / FDI*	*Offshore Outsourcing*
	inside (Onshoring)	*Captive Home Production*	*(Onshore) Outsourcing*
		inside (Insourcing)	**outside** (Outsourcing)
		Criteria: Boundary of the Firm	

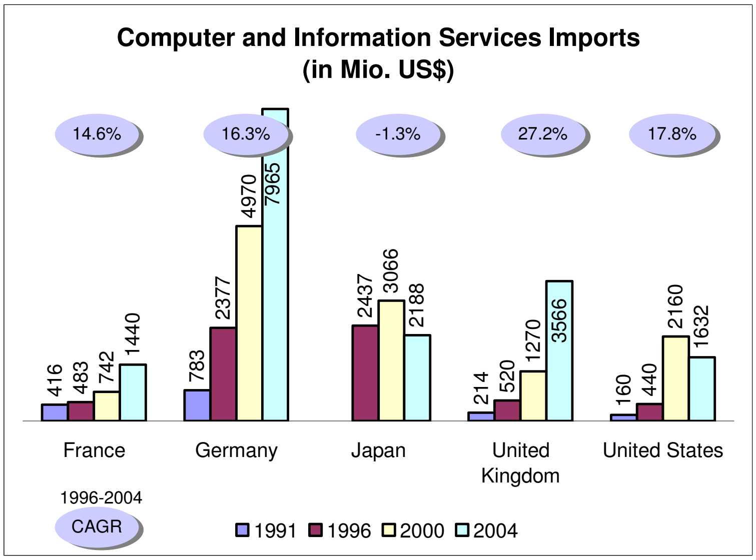
Source: Own illustration.

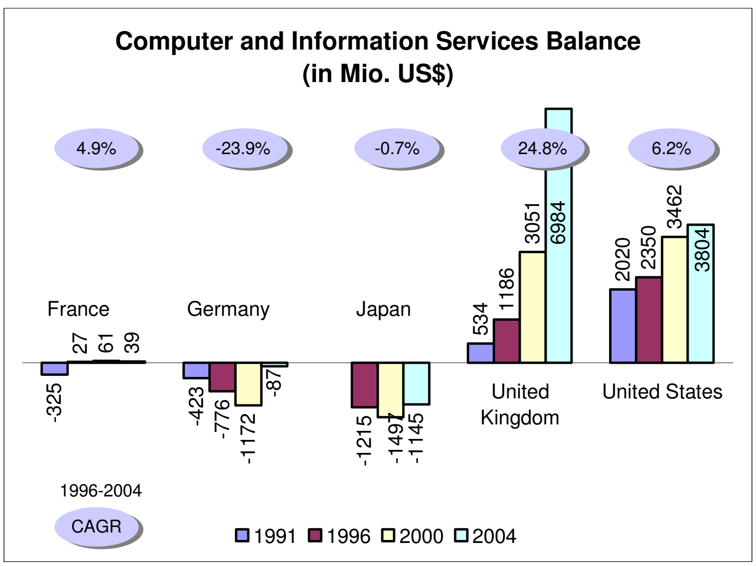
Figure 2: Other Business Services Imports Balance



Source: Own calculations, Data: International Monetary Fund (IMF), Balance of Payments, CD-ROM, via UNCTAD.

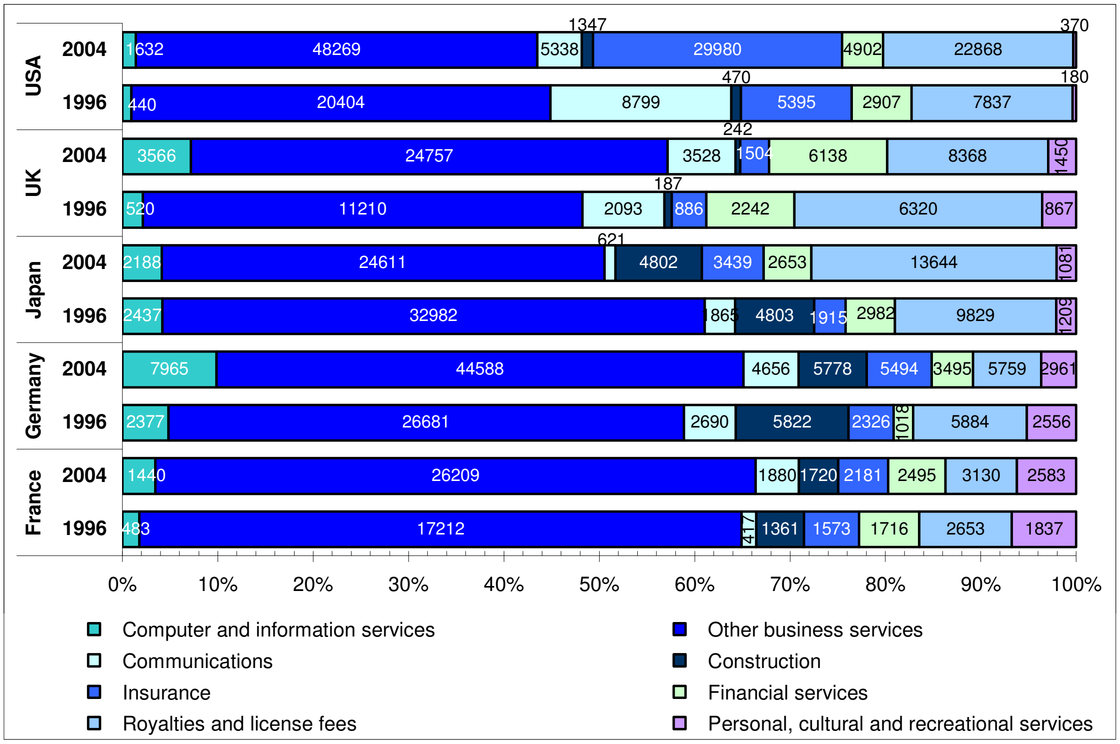
Figure 3: Computer and Information Services Imports and Balance





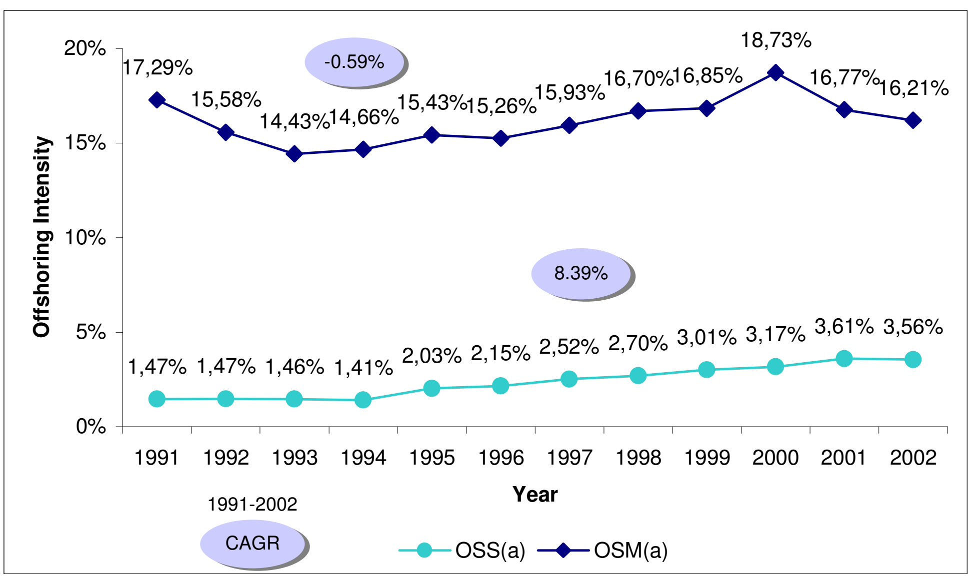
Source: Own calculations, Data: International Monetary Fund (IMF), Balance of Payments, CD-ROM, via UNCTAD.
NB: The CAGR only refers to the years 1996 and 2004, since Japanese data for computer and information services is only available from 1996 onwards.

Figure 4: Imports of Other Commercial Services Standardized to 100% (Mio. US$)



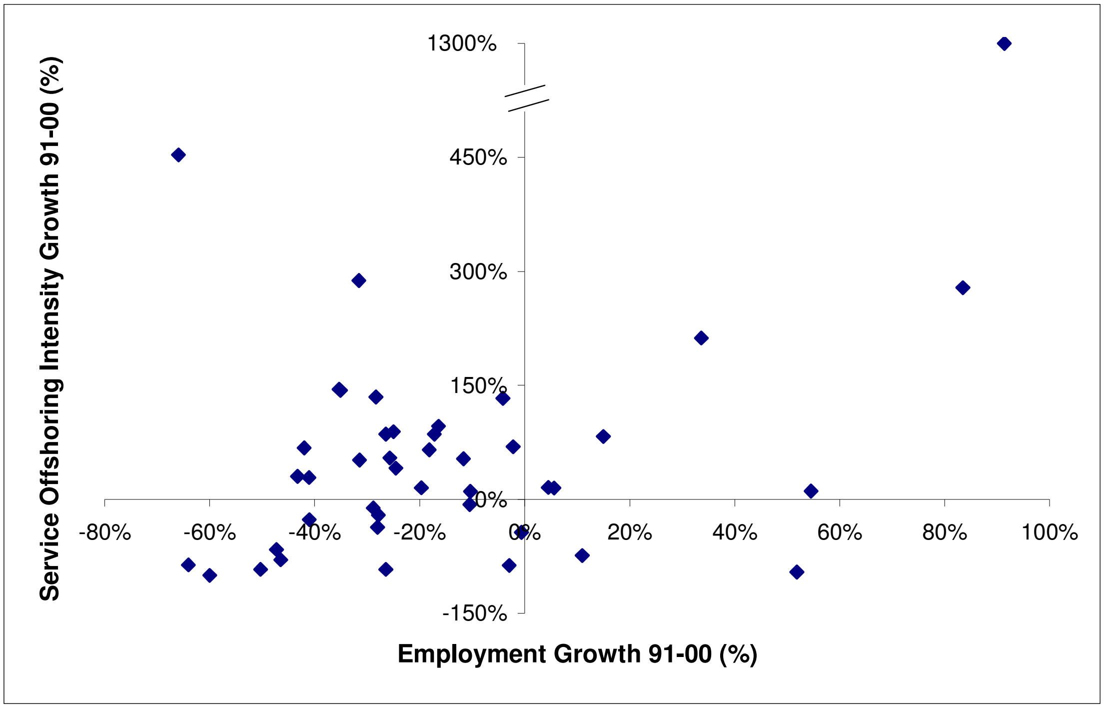
Source: Own calculations, Data: International Monetary Fund (IMF), Balance of Payments, CD-ROM, via UNCTAD.

Figure 5: Offshoring Intensity of Intermediate Inputs in Germany



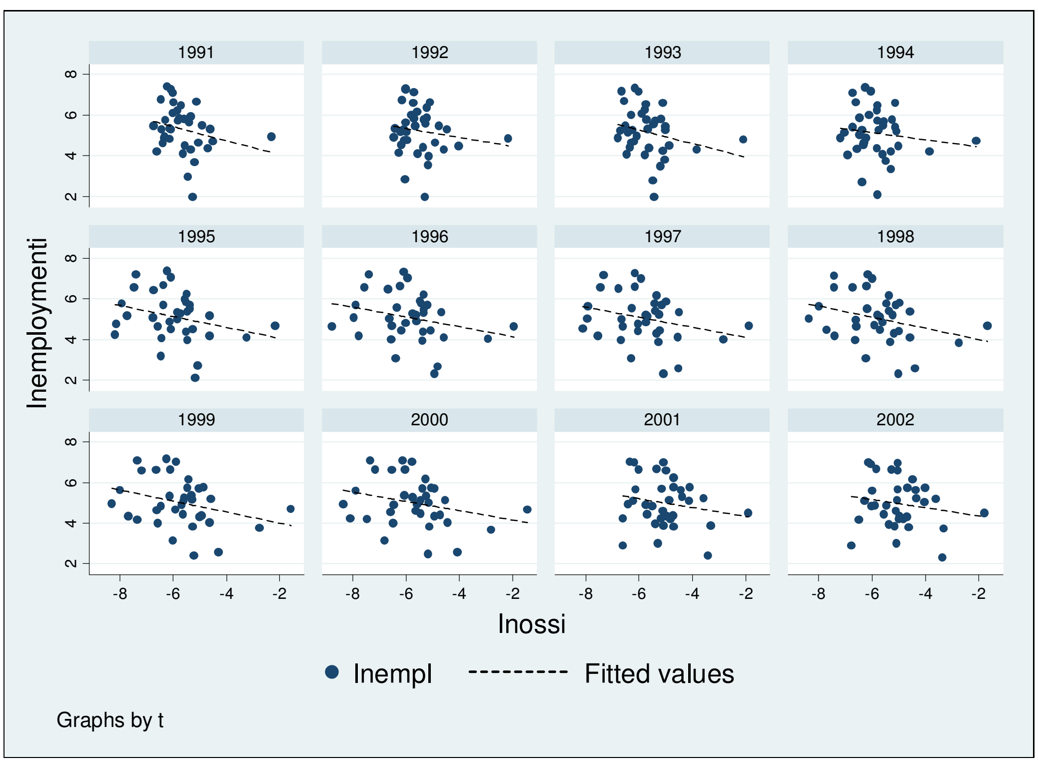
Source: Own calculations. Federal Statistical Office, input-output tables (1991-2002). Weighted average across all sectors i by outputs. Revised input-output tables only for 2001-2002.
Calculations for Germany (a): $\sum_j$ [(imported service j by sector i)/(total non energy inputs used by sector i)].

Figure 6: German Service Offshoring Intensity Growth and Employment Growth (1991-2000)



Source: Own calculations. Data: Federal Statistical Office, STAN Industrial Database OECD.

Figure 7: German OSS and Employment Development in the Manufacturing Sector (1991-2002)



Source: Own calculations. Data: Federal Statistical Office, STAN Industrial Database OECD.

Appendix 1

	Manufacturing Sectors (36 Sectors)
1	Food products
2	Beverages
3	Tobacco products
4	Textiles
5	Wearing apparel, dressing and dying of fur
6	Leather, leather products and footwear
7	Wood and products of wood and cork
8	Pulp and paper
9	Paper products
10	Publishing
11	Printing
12	Coke, refined petroleum products and nuclear fuel
13	Pharmaceuticals
14	Chemicals exluding pharmaceuticals
15	Rubber products
16	Plastic products
17	Glass and glass products
18	Ceramic goods and other non-metallic mineral products
19	Iron and steel
20	Non-ferrous metals
21	Metal castings
22	Fabricated metal products, except machinery and equipment
23	Machinery and equipment, n.e.c.
24	Office, accounting and computing machinery
25	Electrical machinery and apparaturs, n.e.c.
26	Radio, television and communication equipment
27	Medical, precision and optical instruments
28	Motor vehicles, trailers and semi-trailers
29	Other transport equipment
30	Manufacturing n.e.c.
31	Recycling
32	Electricity, steam and hot water supply
33	Gas and gas supply
34	Collection, purification and distribution of water
35	Construction site and civil engineering
36	Construction installation and other construction
	Service Sectors (7 Sectors)
37	Post and telecommunications
38	Financial intermediation except insurance and pension funding
39	Activities related to financial intermediation
40	Renting of machinery and equipment
41	Computer and related activities
42	Research and development
43	Other business activities

Source: Input-output tables, Federal Statistical Office.

REFERENCES

Amiti, M.; Wei, S.-J. (2004a): Service Outsourcing, Productivity and Employment: Evidence from the US, Research Department, Trade Unit, International Monetary Fund, Washington, First draft – May 2004

Amiti, M.; Wei, S.-J. (2004b): Fear of outsourcing: Is it justified?, NBER Working Paper, No. 10808, September 2004

Amiti, M.; Wei, S.-J. (2006): Service Offshoring, Productivity and Employment: Evidence from the US, CEPR Discussion Paper, No. 5475, February 2006

Beyfuß, J.; Eggert, J. (2000): Auslandsinvestitionen der deutschen Wirtschaft und ihre Arbeitsplatzeffekte: Aktuelle Trends, Ergebnisse einer Unternehmensbefragung und die Bedeutung der staatlichen Förderung, Beiträge zur Wirtschafts- und Sozialpolitik, Institut der deutschen Wirtschaft Köln, Schriftenreihe 258, 4/2000

Bhagwati, J.; Panagariya, A.; Srinivasan, T.N. (2004): The Muddles over Outsourcing, in: The Journal of Economic Perspectives, Volume 18, Number 4, S.93-114

Eckel, C. (2000): Verteilungswirkungen der Globalisierung: Folgen für den Arbeitsmarkt, 1. Auflage, Wiesbaden

Falk, M.; Koebel, B.M. (2002): Outsourcing, Imports and Labor Demand, in: Scandinavian Journal of Economics 104(4), S. 567-586

Farrel, D. (2004): Can Germany Win from Offshoring, McKinsey Global Institute, July 2004

Goerzig, B.; Stephan, A. (2002): Outsourcing and Firm-level Performance, DIW Discussion Paper, No. 309

Greene, W.H. (1993): Econometric Analysis, 2nd Edition, New York

Hamermesh, D. (1993): Labor Demand, Princeton, NJ: Princeton University Press.

Henneberger, F.; Graf, S.; Vocke, M. (2000): Globalisierung und Arbeitsmarkt: Auslandsinvestitionen von Dienstleistungsunternehmen und ihre Auswirkungen auf die Beschäftigung, 1. Auflage, Baden-Baden

Jungnickel, R.; Keller, D. (2003): German FDI and Integration of Production in the EU, HWWA Discussion Paper, No. 232

Kalmbach, P.; Franke, R.; Knottenbauer, K.; Krämer, H. (2005): Die Interdependenz von Industrie und Dienstleistungen, Zur Dynamik eines komplexen Beziehungsgeflechts, Berlin, 2005

Krugman, P.R.; Obstfeld, M. (2006): Internationale Wirtschaft, Theorie und Politik der Außenwirtschaft, 7. aktualisierte Auflage, München, 2006

Landesmann, M. (2000): Migration und Arbeitsmarkteffekte der EU-Erweiterung, in: Die Union – Vierteljahreszeitschrift für Integrationsfragen, Nr. 3, S. 15-40

Marin, D. (2004): ‚A Nation of Poets and Thinkers' – Less So with Eastern Enlargement? Austria and Germany, Munich Economics, Discussion Paper 2004-06

McKinsey Global Institute (2005): How Offshoring of Services Could Benefit France, June 2005

Reining, A. (2003): Lexikon der Außenwirtschaft, München, Wien, Oldenburg, 1. Auflage, 2003

Roling, J. (1999): Bedeuten deutsche Direktinvestitionen im Ausland einen ‚Export' deutscher Arbeitsplätze?, in: Zeitschrift für Wirtschaftspolitik (Lucius & Lucius Stuttgart), Jg. 48, Heft 2, S. 147-167

Rose, K. (1987): Grundlagen der Wachstumstheorie, Eine Einführung, 5. unveränderte Auflage, Göttingen, 1987

Samuelson, P.A. (2004): Where Ricardo and Mill Rebut and Confirm Arguments of Mainstream Economists Supporting Globalization, in: Journal of Economic Perspectives, Vol. 18, Nr. 3, S. 135-146

Trabold, H.; Bach, S.; Franzmeyer, F.; Schultz, S.; Schumacher, D.; Weise, C. (2001): Herausforderung Globalisierung: Konsequenzen für die Bildungs-, Steuer- und Arbeitsmarktpolitik, 1. Auflage, Schüren

Tüselmann, H.-J. (1998): Deutsche Auslandsinvestitionen in den neunziger Jahren: Abwanderung der deutschen Industrie und Abbau von Arbeitsplätzen?, in: WSI Mitteilungen, 5/1998, S. 292-303

United Nations (2002): Manual on statistics of international trade in services, Statistical Papers, Series M No.86

Wooldridge, J.M. (2000): Introductory Econometrics: A Modern Approach, South-Western College Publishing, 2000