The role of global value chains for German manufacturing

Olivier Godart and Holger Görg

Kiel Institute for the World Economy

and

Christian-Albrechts-University of Kiel, Germany

Paper for International Trade Canada

Final Draft, 2 September 2010

The authors are very grateful for excellent research assistance to Donnachad Krüger, Philipp Labonte and Tillmann Schwörer, and to Aaron Sydor for very helpful comments on an earlier draft.

Summary

This paper examines the role of global value chains by German manufacturing. Global value chains have clearly expanded in recent years. Still the bulk of outsourcing concerns materials outsourcing but services outsourcing is growing and catching up at a fast. There is strong evidence that not all German firms participate in global value chains. But, participants are among those that are more efficient in Germany

Close by Central Eastern European countries and new European Union member states have been attractive locations for German firms, not only for low wage manufacturing activities. However, the value generated in these countries and flowing to German firms is still small, albeit growing rapidly compared to other European Union members. Furthermore, these countries seem often to be chosen in an overall global value chain strategy including jointly other more distant locations.

Among the distant trading partners, China has not only become a source of many inputs but also an important customer of German exports of products and services which accounts in 2009 for about 5 percent of total German export. The academic reasoning follows traditional comparative advantages and patterns of specialization. China demands goods like capital-intensive and research-intensive machinery and equipment in which German has a comparative advantage.

There is also evidence that workers in Germany are affected by outsourcing decisions by German firms. However, empirical research does not support net employment destruction following relocation decisions of firms. Instead, German firms adjust and specialize into more skill intensive activities which demand relatively more skilled workers. Another related finding is that some wage decrease is observed among workers employed in activities prone to be outsourced. It appears however that the economic magnitude of it is economically small and far apart from the popular myth of disruptive consequences of global value chains for employment and wages.

More recent empirical research shows economic benefits for German firms from their involvements in global value chains. Reductions in total factor costs induced by increased outsourcing of goods and services permit firms to achieve gains in production efficiency and competitiveness.

1. Introduction

Since the 1960s Germany has established itself as European manufacturing centre, and its export of goods *made in Germany* has become a pillar of its economic post-war success. In recent years, many German firms have further deepened their international involvements with links to global value chains. Lower costs of doing business internationally and increasing possibilities to source material and service inputs in multiple countries have triggered new forms of organizational adjustments. Such novel types of adjustment faced by firms have, in turn, further pushed the issue of global value chains at the forefront of the policy and academic debate, and this surrounded by public fear about job losses and foreign competition.

This paper investigates the role taken by global value chains in the organization of Germany´s manufacturing activities and its recent economic developments. In particular it asks: how important are global value chains for German manufacturing firms? Why do firms use global value chains? What are the implications for Germany of the use of global value chains? The paper measures the extent of Germany's link into global value chains, discusses the causes and consequences of such, and concludes with a brief outlook on the likely future of such international production chains.

2. German manufacturing: Overview and trends

This section describes Germany's manufacturing sector and compares it with that of other countries. It presents some statistics on the size of the sector, distribution of activities across manufacturing sub-sectors, levels of employment and estimates of productivity. Furthermore, in order to give a first impression of Germany's links into the global economy, we also describe briefly export activity and activity of outward

investment by multinationals across broad manufacturing sub-sectors. We will also look at aggregate trade statistics for Germany to gauge the importance and implications of import competition from low-wage countries for German manufacturing industries.

Table 1 shows the prominence of the manufacturing industry for Germany and compares it with a number of other countries. As can be seen, in Germany, manufacturing accounts for about 22 percent of GDP. This is a very high share compared to other industrialized countries such as Canada, the UK, France or the US. It is also higher than in the newly industrializing BRIC countries, with one exception. The only country that has a higher, and still growing, manufacturing share is China. Its manufacturing sector accounted for roughly one-third of Chinese economic activity in the last few years. Also, while there has been a downward trend in the share of manufacturing in GDP in most OECD countries, this does not appear to have been the case to the same extent in Germany.[1]

[Table 1 here]

Table 2 depicts some vital statistics for the German manufacturing industry overall. It shows in the same table the number of firms and employees in all manufacturing sub-sectors. German firms and employees are active within the whole range of manufacturing activities, as expected from an economy of the size of Germany. In 2007, there were roughly 37,000 manufacturing firms which employed about 6.2 million employees. By far the largest sectors in terms of employment are "Machinery" and "Motor Vehicles", the two German flagship manufacturing sectors. These two

[1] One argument why Germany keeps this current constellation and the resulting stable share of manufacturing in value added is that German firms produce highly sophisticated goods less inclined to foreign competition from emerging countries. Figure 1 below shows that highly skilled industries (with high wage rates) are less exposed to foreign competition from low-wage countries.

sectors alone account for about 30 percent of employment in all manufacturing industries.

The "Machinery" sector is not only a key industry in terms of employment, but is also important in terms of actual firm numbers. Other sectors that boast substantial numbers of firms are "Fabricated Metals" and "Food & Beverages", but these employ relatively fewer workers. This is best reflected in the average number of employees per firm, which is quite low in these three sectors compared to "Motor Vehicles". It points to the importance of the German small and medium sized firms, also known as the *"Mittelstand"*, within the spectrum of German firms. These are often small firms (less than 1000 employees), family owned and active in the German manufacturing sector. These firms are often described as being at the core of German industrial structure and behind the export success of Germany.

[Table 2 here]

Table 2 also presents some valuable data on average yearly wages and labour productivity (measured as value added per worker) across manufacturing sub-sectors in 2007. While Germany is generally considered to be a high wage country, the statistics show that there is considerable heterogeneity in wages across manufacturing sectors. The average employee in the "Food & Beverages" sector earns, for example, around 30,000 euros per year, compared to 68,000 for an employee in "Office Machinery" or 88,000 in the "Coke & Petroleum" industry. The spread of average labour productivity is equally wide, ranging from 41,000 in "Food & Beverages" to 175,000 in "Coke & Petroleum". "Office Machinery" is also a highly productive industry by this benchmark.

Table 3 dispels the popular myths that all German firms export their goods or source their inputs abroad. The table presents the percentages of firms that export, import, do both or neither of these international trade activities. Actually, the data show that most German firms are not involved in any form of trading activity with foreign associates in 2005 (61 percent).[2] However, among German firms that are trading with foreign partners, most of them import and export simultaneously. Indeed, from 2001 to 2005 the proportion of firms doing so has even increased from 16 to 19 percent. Also, the share of firms that do not engage in any international trade activity has declined by 6 percentage points over the same period. This substantial increase in internationally active firms has also been highlighted by Vogel et al. (2009). It suggests that foreign markets, not only as a source for demand but also for supply of global value chains, have become more important for a wider range of German firms over the last years.

[Table 3 here]

Table 4 also displays some information about the trading status of German firms, but this time disaggregated by two-digit ISIC manufacturing industry. It shows that different industries face diverse shares of export and import participation of their firms. It ranges from "Food and Beverage" with the highest share of firms that neither export nor import (82 percent), to "Rubber", "Machinery" or "Chemicals" in which the majority of firms have undertaken some international transactions in 2006. A look back to Table 2 also shows that the industries with high export and import activity are also those sectors where the *Mittelstand* is important.

[2] This is not specific to Germany but is mirrored in other countries, see, for example, Bernard et al. (2007) for the US.

[Table 4 here]

After showing export and import activity based on firm level information, we now turn to aggregated trade statistics for Germany to look, firstly, at the main export destinations and, secondly, gauge the importance of import competition from low-wage countries for German manufacturing industries.

Table 5 shows that the destinations of German exports are heavily concentrated: the top ten export destinations account for roughly 60 percent of total exports in 2009. Another interesting fact is that these top destinations are mainly industrialized countries in Europe and the US. There is one important exception, however: China, which receives about 5 percent of German exports. While the growing importance of China for German exports has, to the best of our knowledge not be investigated in detail yet, it may be partly explained by the pattern of German comparative advantage and export specialization, which is mainly in capital-intensive and research-intensive machinery and equipment (Clemens and Schumacher, 2010); goods that are in high demand Chinese manufacturing industry. Furthermore, German export promotion policy may also have played a non-negligible role. The German government provides an export guarantee scheme which compensates for possible non-payment for the export good by the foreign customer. This guarantee scheme has been in high demand recently, in particular for exports to South Korea, the US and China.[3]

[Table 5 here]

[3] See "Bundesbürgschaften: Exporthilfen gefragt wie nie" at http://www.manager-magazin.de/politik/artikel/0,2828,702619,00.html, accessed on 23 August 2010.

Turning to imports, Figure 1 illustrates the relationship between hourly wages in 21 German manufacturing industries and competition from low-wage countries in 1999 and 2006. Competition is here defined as the ratio of low-wage country imports to Germany over total German imports. Thus, it includes import of final goods as well as inputs incorporated in this industry classification. The size of the dots represents the relative employment of the respective industries, and the numbers related to each dot correspond to the International Standard Industry Classification (ISIC), Revision 3.

The information in this figure indicates that German manufacturing industries vary substantially in their exposure to competition from low-wage countries. Most noticeable, competition from low-wage countries is concentrated in low-wage industries such as "Wearing Apparel", "Leather" and "Textiles". Meanwhile, large German industries with high wages, such as "Motor Vehicles", "Machinery" and "Equipment" face much less competition from low-wage countries.

Another interesting fact is that such industries like "Televisions and Communication" (32) and "Computers" (30) exhibit intensified competition from low wage countries between 1999 and 2006. Such increased competition is likely to affect indirectly other downstream industries, which might benefit from the arrival on the market of imported goods that they use as inputs but and available at a lower cost.

[Figure 1 here]

This discussion of the current state of German manufacturing then leads to the question as to what role global value chains may have played for the development of the manufacturing sector. This will be the focus of the rest of the paper.

3. The importance of global value chains

This section deals with measuring the importance of global value chains. While the academic literature on the causes and consequences of offshoring and global value chains (also referred to as vertical disintegration, fragmentation of production, etc.) has grown in recent years (e.g., Arndt and Kierzkowski, 2001; Feenstra and Hanson, 2003; Crino, 2008), it is still fair to say that there is no generally recognized definition of how exactly to measure this phenomenon. We therefore consider a number of important aspects of GVC in order to triangulate the importance thereof.

The first approach to measuring GVC follows the academic literature that attempts to measure the impact of offshoring on labour markets. These studies generally tend to approximate offshoring using industry level data on imported inputs (see, for example, Feenstra and Hanson, 2003, Hijzen et al., 2005, Geishecker and Görg, 2008). Broadly speaking, three main sources have been used to document the trend in international trade in intermediate inputs: data on outward processing trade, trade statistics on trade in intermediate goods, and input-output tables.

Outward processing trade in the EU, or the Offshore Assembly Program in the US refers to customs arrangements in which complete tariff exemptions or partial levy reductions are granted in accordance to the domestic input content of imported goods. Such information has been used by, for example, Görg (2000) for the EU and Feenstra et al. (2000) for the US. Other related studies rely on the disaggregated classification of trade statistics to infer whether trade in some particular industry is trade in intermediates or final goods, as for example in the papers by Yeats (2001) and Hummels et al. (2001). Finally, input-output tables in combination with trade statistics have been used by, for example, Feenstra and Hanson (2003), Geishecker and Görg (2008), and Amiti and Wei (2005) to evaluate outsourcing. This measure may be considered the most appropriate

because it enables scrutinizing developments across industries and time simultaneously, which is problematic with the mentioned two other measures. Another advantage of using input-output tables is that they allow considering not only material imports but also imports of services which is arguably an important facet of the newer wave of offshoring from industrialised countries.

We use thus input-output tables for Germany to calculate the importance of imports of intermediates relative to total output in an industry across manufacturing sectors in Germany, Based on the approach by Geishecker and Görg (2008), for the period 1991 to 2005.[4]

Figure 2 shows the importance of imported intermediate materials and services inputs for German manufacturing overall. The scale for services outsourcing is on the left and that for materials outsourcing on the right hand side of the graph. Note, firstly, that the absolute level of materials is substantially higher than that of services outsourcing. However, the growth rate of services outsourcing is much stronger. All in all, this figure shows that Global Value Chains appear to be growing in importance for German manufacturing overall.

[Figure 2 here]

Figures 3 and 4 break down services and materials outsourcing data for different two-digit manufacturing sectors. These two figures show that there is considerable heterogeneity in the importance of imported intermediates across sectors. In particular the "high tech" sectors 30 to 33 show high levels of outsourcing, suggesting that Global Value Chains are particularly important for those manufacturing sectors.

[4] See the appendix for an exact description of the construction of the outsourcing measures.

[Figures 3 to 4 here]

A second possible approach to gauge the importance of GVC is to turn back to the firm level and look explicitly at characteristics of foreign affiliates of German firms. Geishecker et al. (2009) do this for all Euro Area countries. They investigate the location patterns of Euro Area multinationals (not distinguishing nationalities within the EA) and find that most foreign activity is concentrated within the European Union. However, countries like China, Mexico and Brazil have become increasingly important, suggesting some global value chains link Europe to these three countries. We follow their approach but focus exclusively on Germany.

[Figure 5 here]

Accordingly, Figure 5 looks at the location pattern of foreign affiliates of German parents abroad. Similar to Geishecker at al. (2009) we find that many of the most important locations for German affiliates are within the European Union. For example, the figure shows that the UK and Austria are host to roughly 15 percent of German affiliates abroad each. The US is the third most important host country for German firms, while Canada is number 14, followed closely by Mexico. Hence, NAFTA seems to be an important market for German firms. With China, Brazil and Russia there are also three of the most important emerging markets on the list of top locations for German affiliates abroad which point to the global value chains binding German firms with these countries.

Next, we decompose the primary activities of German foreign affiliates in different countries according to four groups: low-technology manufacturing, high

technology manufacturing, less knowledge intensive services and knowledge intensive services suggested by Eurostat. Figure 6 provides a flavour of this break down for four different countries with a large German presence.[5]

[Figure 6 here]

The figure suggests, for example, that Poland looks to be a source of intermediate goods for German firms, as there is a relatively larger share of German affiliates in Poland active in low-tech manufacturing than in the other countries. However, it also appears to be a source of demand for German products, as there is a large share of German affiliates in less knowledge intensive services, which includes wholesale trade and the distribution of products in the foreign market. In the US, by contrast, there is a much higher share of high tech manufacturing firms owned by German parents while in the UK, knowledge intensive services look to take a higher share of German firms when compared to the four other countries. Hence Germany seems to be involved in global value chains with different countries but also with different stages of the production process within each country.

In a last approach to measuring the importance of global value chains for German manufacturing we use firm level information from a recent survey by the German Statistical Office (*Statistisches Bundesamt*). It focuses specifically on firms relocating activities abroad that were previously carried out in-house. This is, thus, a very direct (and perhaps narrow) measure of offshoring, as it considers only production processes that were previously undertaken within the firm. However, this survey provides a rich

[5] Note that for most other countries we do not have adequate information on the activity of German affiliates to disaggregate them according to these four groups.

and unique source of information to better understand the implications of foreign relocation.

Table 6 shows that 16.5 percent of the surveyed firms relocated one or more activities abroad up to 2006. The last column also shows that around 10 percent of firms also plan further relocations abroad in the coming years. The shares of actual and planned relocations are higher in manufacturing, and specifically in technology intensive manufacturing. It is also particularly high in large firms with more than 1000 employees. This suggests that mainly skill and technology intensive larger firms are looking for opportunities to relocate some of their activities abroad.

[Table 6 here]

Table 7 indicates that firms in the survey employed roughly 8 million employees. Approximately one third of those are, however, employed in firms that already relocated activities up to 2006. Comparing the share of outsourcing based on employees (table 7) to the one based on firms (table 6) provides also an interesting insight. The share based on employees is substantially higher than the share using firm numbers. This again suggests that mainly larger firms are prone to relocating activities abroad. The sectoral pattern depicted in Table 7 is however, very similar to the one shown in table 6.

[Table 7 here]

While table 7 is about the total employment in firms with realized or planned relocations, it does not provide any information on whether or not employees are affected by these relocations through, for example, wage cuts or job losses. This and other consequences of offshoring, are the focus of a later sections and will be discussed after we consider the possible causes for entering into global value chains.

4. Causes for entering in global value chains

The data in section 3 show that global value chains are an important aspect of German manufacturing, irrespective of the type of measure used. To understand the role of global value chains, then, it is important to understand the driving forces for such involvement in GVCs, or offshoring. To do so, we focus on answering three related questions:

- Why do firms offshore activities that they previously carried out themselves?
- Where do firms offshore their inputs?
- What types of firms offshore?

We firstly discuss these issues in general terms, and then focus on the particular case of Germany.

4.1 Why do firms offshore activities that they previously carried out themselves?

As we have seen above, offshoring has increased tremendously over the last decade. Indeed, it is the prevalence of offshoring that, according to a number of observers, make the current wave of globalization unique and different from previous ones.

First of all, it is important to point out that offshoring incurs important costs. The production process (be it manufacturing or services) needs to be split in its components, with some activities migrating to different countries. Doing so incurs substantial new costs of coordination between headquarters and the foreign affiliates, or the independent supplier (Jones and Kierzkowski, 2001). As an example, the following costs may occur:

- Telecommunication between the different partners of a global value chain
- remote management coordination
- maintaining effective quality control
- transportation for intermediate inputs procured abroad
- travel costs for staff
- search costs for finding adequate foreign partners or recruitment costs

This is not an exhaustive list, of course, but gives some idea of what is involved when a firm makes the decision to offshore part of their production process. It is widely recognized that costs of "coordination" have dropped significantly in the last decade or so (e.g., Arndt and Kierzkowski, 2001). There are two important explanations for this recent trend: first, technological progress and second, liberalization in the world trading system. Let us examine these issues in turn.

Technological progress has arguably changed significantly the way international business is structured around the globe. Due to the rise of data dissemination through the internet people can now gather information and order products from firms all over the world. This implies that costs of searching for potential suppliers are now much lower, as are costs for looking for new staff abroad. The related drop in the costs of electronic data transfers, telecommunications and video conferencing means that communication between headquarters and foreign locations is eased and now possible at a fraction of what it cost previously. This has, in turn, also helped management planning, co-ordination, and has facilitated regular quality control.

Another central aspect of technical progress is that many services that were previously non-tradable have now become tradable (e.g., financial services, back office

functions, routine business processes etc.) which implies that the production of services can be located anywhere in the world and traded through electronic communication.

In line with technical progress, cost of travel and transportation have also dropped significantly recently, making it now possible for managers or workers to travel easily between headquarters and foreign affiliates when required. Furthermore, trading intermediate inputs through air, rail, sea freight, or roads, central to offshoring is now relatively less costly than it used to be and can be monitored in real time.

Technological advances have gone hand in hand with policy moves to liberalize further the world trading system, making it easier for trade and foreign direct investment to take place. Negotiations starting under the GATT (General Agreement on Tariffs and Trade) and GATS (General Agreement on Trade in Services) culminated in the founding of the World Trade Organisation, liberalizing many aspects of international trade in goods and services (though with significant exceptions). China's accession to the WTO in 2001 arguably was an important step to incorporate China into global value chains.

Furthermore, many governments around the world have successively liberalized restrictions on inward and outward FDI flows, allowing firms to enter countries and set up affiliates abroad. For example, the *UNCTAD World Investment Report 2006* shows that in 2005, 93 countries introduced changes to their regulatory regime towards foreign investment. In total, 205 changes were implemented and 164 of those related to making regulations more favourable towards inward investment, thus contributing to promoting additional global value chains.

4.2 Where do firms offshore their inputs?

Having established that global value chains mainly increased because it is now "easier" to do so, the next question is: where do firms offshore their inputs? The short,

yet somewhat simplistic answer is, of course, where it is cheapest to do so, taking all the potential costs of offshoring into account. A large economic literature has developed investigating this issue, and we summarize their findings here.

At the very basic level, offshoring takes place because firms aim to minimize production costs. They, therefore, choose locations with the lowest costs for inputs. Frequently highlighted is the role of labour costs in this context. As an example, hourly wage rates for programmers differ widely across the world: Euro 9 in Russia, 14 in China, 7 in India, compared to 44 in the US and 54 in Germany according to Deutsche Bank Research (2004). This goes a long way towards explaining why offshoring of such computer services might be executed in India and China, and no longer in developed countries.

At a more formal level, a number of empirical studies by economists have also confirmed the importance of factor costs for the decision where to offshore. Swenson (2000) investigates econometrically the outsourcing decisions of firms operating in U.S. foreign trade zones, paying particular attention to the relative costs of inputs. She finds in her analysis that firms reduce their reliance on foreign offshored inputs when the relative price of these inputs rises vis-à-vis the US price. More precisely, she finds that a dollar depreciation that leads to foreign inputs (including labour) being more expensive, will cause firms to reduce their outsourcing from abroad.

Furthermore, Hanson et al. (2005) examine the vertical fragmentation of activities around the globe by US multinational firms. They find that US headquarters' demand for intermediate inputs imported from their affiliates abroad is higher when affiliates face lower wages for less skilled workers. This is in line with the hypothesis that production is offshored to affiliates in low cost locations and their output is then used by headquarters as inputs in the US.

Unfortunately, to the best of our knowledge, formal econometric studies focusing on the determinants of services offshoring and the relative importance of labour costs are missing in the literature. However, the anecdotal evidence available strongly suggests that labour costs differences play an important role for the decision as to where to offshore services inputs (Deutsche Bank Research, 2004).

It is important to point out, however, that wages, albeit important, are only one aspect of total labour costs. What matters to a firm is arguably not only the hourly wage a worker receives but the labour cost per unit of production. Hence, the productivity of workers needs also to be taken into account. Omitting such a factor, would overlook the fact that some programming services are still carried out in the US and Germany. In line with this argument, Yeats (2001) shows that the combined effects, of low wages and large pools of skilled workers have contributed to the attractiveness of Central and Eastern European countries for offshoring activity from EU countries.

While labour and other production costs are important components of total costs of a product, fragmenting stages of production internationally involve also resources in order to trade these inputs across borders. Such resulting trade costs (widely defined as costs of transportation and tariffs/non-tariff barriers) also contribute substantially to overall costs incurred. Notwithstanding the fact that trade costs in general have fallen and thus enabling more offshoring to take place, research has found that these costs can also be important in determining to which locations and in which countries firms offshore activities.

Hanson et al. (2005) in their analysis of fragmentation of production by US multinationals find that the level of costs of trading between the foreign affiliate and the US parent is an important determinant of offshoring activity. Baier and Bergstrand (2000) also show in their analysis that tariff rates and transport costs are important

determinants of outsourcing. Specifically, in model simulations they find that a 7.5 percentage point decline in tariff rates combined with a 5 percentage point decrease in transport costs can lead to an increase in vertical specialization (offshoring) by around one-third.

The importance of tariff barriers for offshoring is also highlighted by government policies which provide tariff reductions or exemptions for trade in intermediate goods which are processed abroad and are then shipped back to the home country for final production. As alluded to above, this is known as outward processing trade in the European Union, which is the customs´ arrangement allowing goods to be temporarily exported from EU territory for processing, and the resultant products to be released for free circulation in the EU with total or partial relief from import duties (e.g., Görg, 2000). In the US a similar programme is known as overseas assembly provision (e.g., Swenson, 2004).

Finally, risk is an important determinant of where offshoring activity takes place. This includes issues such as exchange rate risk (Swenson, 2000) but also more broadly defined risks such as political disruptions, corruption, patent protection laws etc. Yeats (2001) provides an empirical analysis which points to the important role played by country risk in determining the location of offshoring activities in the Caribbean region.

4.3 What types of firms offshore?

Let us now turn to the question whether, among a random sample of firms we would expect all firms to engage in offshoring or whether it is only a certain group of firms with some specific characteristics that would do so. The answer to this is: only a certain group – and this should consist of the "better" firms in our sample. Not all firms engage into outsourcing.

Recent developments in international trade theory have argued that it is reasonable to assume that offshoring (as any other type of international engagement, such as exporting or foreign direct investment) involves substantial sunk costs. These are irreversible costs that occur due to searching for a foreign partner, setting-up a business partnership, and learning about the possible contractual arrangements, etc. Under this assumption, only very efficient firms will be able to overcome these sunk cost barriers and successfully start to offshore (Antras and Helpman, 2004).

Empirical evidence has been produced which supports this theoretical prediction emphasizing sunk costs. A number of studies look at large samples of firm level data for a number of countries. For example, Tomiura (2005) and Kurz (2006) using data for Japan and the US, respectively, model a firm's decision to outsource and find that more productive firms are more likely to outsource. In particular, Kurz (2006) concludes that outsourcers are "outstanding" in that they are larger, more capital intensive and more productive. Görg et al. (2008) use firm level data for Ireland to look at differences in productivity between firms that offshore services (i.e., import services inputs from abroad) and firms that do not. They also find that outsourcers are more productive than firms that do not engage in offshoring of services.

From a somewhat different angle, Geishecker et al. (2009) use a large European firm level dataset and investigate the characteristics of firms that trigger the decision to set up affiliates abroad. They find that firms that own affiliates abroad account for an over-proportionally large share of output, employment and profits in their home countries. These firms also exhibit higher survival rates and productivity growth when compared to firms that did not expand abroad.

Thus, theory and evidence strongly suggest that it is indeed the "better" firms, i.e., those that are more productive and larger, that are linked into global value chains through offshoring activities abroad.

4.4 Evidence for Germany

For the specific case of Germany, the survey evidence from Statistisches Bundesamt (2008) provides some useful information. In particular, the survey asks firms about their potential motives and possible barriers for relocating activity. These questions are answered by firms that did relocate as well as those that did not. The possible motives are displayed in Table 8.

[Table 8 here]

The table shows that more than 80 percent of firms answered that lowering labour costs and accessing new markets were "important" or "very important" motives for an actual or possible foreign relocation of activity. Other reasons that were rated as important by a majority of firms are other costs and tax incentives. Furthermore, among the least important reason chosen by German firms is "to follow suppliers and competitors" which suggests that a "race to outsourcing" is not a predominant factor that triggers outsourcing decisions by German firms. Notice, finally, that individual firms generally consider multiple reasons simultaneously as important and different firms tend to attach different weights to different motives. This suggests that firms´ decisions as to whether to start outsourcing or not are also strongly driven by firm specific intrinsic factors. There are no "one fits all" motives of outsourcing for all firms. They vary across

firms and time, which may be difficult to pick up in specific surveys or econometric analysis.

Table 9 looks at another dimension of the location decision by asking firms (both those that did and did not relocate) what the possible barriers (actual or perceived) to such relocations are. Here, roughly two-thirds of firms rank language and cultural barriers, or other legal and administrative barrier as most relevant or highly relevant parameters that hinder relocation decisions. Furthermore, labour regulations, tax issues, distance to the foreign location and general cost-benefit concerns are important issues that play a role in firms´ decision process to relocate production abroad ~~or not~~.

[Table 9 here]

One frequently voiced perception is that German firms took advantage of the emergence of close by and low-wage Central and Eastern European (CEE) countries by outsourcing most of their inputs in these countries. Such an argument clearly deserves some attention. To assess this, we can relate to evidence by Geishecker (2007) who uses calculations similar to those reported in Figure 2, but where he is able to break down outsourcing by partner country. He finds that outsourcing to CEE countries is at a relatively low level for Germany. In 2004 it accounts for about 13 percent of total imported intermediate inputs; the bulk of outsourcing (almost three-quarters) is with other developed countries. Still, outsourcing to CEEC has by far the highest growth rates, between 1995 and 2004 it roughly doubled in size.

Another indication to illustrate the attractiveness of German firms to Eastern European Countries´ products and services is suggested in Table 10 which is taken from the survey by the German Statistical Office. It shows the relocation destinations of

German firms according to 9 broad regions including one on the neighbouring new member states of the European Union. We observe that most German firms in the sample relocated some activities in these new EU member states, but among these firms, the majority (54 percent) relocated some activities in at least another broad region beside the new EU member states. This suggests that new European Union member states are attractive to German firms, but that relocating activities there is also often part of a broader strategy as to where to outsource their activities.[6]

[Table 10 here]

As such, this suggests that proximity, low trade costs, an educated workforce, and lower wages than in Germany are not the sole factors that drive the decision about outsourcing activities in its eastern close by countries. Factor costs and productivity considerations as well as firm-level characteristics shown in section 4.2 are also included in the choice of an optimal outsourcing strategy for German firms.

Additional studies that focus specifically on German outsourcing to CEEC are informative too. Marin (2006) defines outsourcing as any foreign direct investment (FDI) that also involves intra-firm trade between the parent and its foreign affiliates. She finds that almost half of German FDI in CEEC fulfils this condition and therefore is categorized as outsourcing. In particular, she shows that outsourcing dominates German FDI in the Czech Republic, Bulgaria, Slovakia and Romania, but is less important in Slovenia and Poland.

[6] An interesting further question is whether Germany's geographical location aids it in attracting other firms to locate in Germany. For example, all else being equal, a manufacturer that uses intensively inputs from low wage countries could locate in Germany, rather than say France to be closer to suppliers in low-wage Eastern Europe. As far as we are aware there is no evidence to judge whether or not this is happening to any large extent

Marin (2006) and Marin et al. (2002) also investigate what may drive the German outsourcing decisions to CEEC. Low labour costs are, of course, important, as is the proximity between Germany and these countries, which presumably allows relatively easy relocations of activities and minimised trade costs. Furthermore, reduced levels of corruption and improvements in the contracting environment in CEEC are found to affect positively German outsourcing to these countries. There is no evidence that tax holidays granted by host countries play any role, however.

We now turn to the question of "which German firms outsource". The survey of the German Statistical Office does, unfortunately, not provide any information on the characteristics of firms involved in global value chains. However, we can use some alternative data on German firms to those used so far. The database we use is part of the "Business Environment and Enterprise Performance Survey" (BEEPS) which is carried out jointly by the World Bank and the European Bank for Reconstruction and Development. While this firm-level business survey focuses on transition countries in Eastern Europe and Central Asia, a comparison survey of firms in a number of more developed countries, including Germany, was also carried out in 2004.[7]

These data permit to look at some microeconomic characteristics of offshoring firms given that the database includes information on firms´ imported intermediate inputs, which we use as a measure "offshoring". Specifically, we calculate offshoring as the percentage of imported material inputs in total supplies, and alternatively as the proportion of imported inputs to total sales. Using information on the roughly 1,100 manufacturing firms available and based in Germany, we run regressions of the form:

$$\ln(\text{labour productivity})_i = \beta_1 \, \text{offshoring}_i + \beta_2 \ln(\text{size}_i) + \varepsilon_i$$

[7] A more detailed description of this data base is available at http://www.ebrd.org/pages/research/analysis/surveys/beeps.shtml, accessed on 6 July 2010.

where the dependent variable is labour productivity in firm *i*, calculated as sales per worker, and the variable *size* is measured in terms of employment in order to control for size differences across manufacturing firms.

The regression results are reported in Table 11. They show that firms´ offshoring activity, measured in terms of imported intermediate inputs, is positively and statistically significantly correlated with labour productivity, even when controlling for firm size. These results are, thus, in line with the above reported international evidence by Kurz (2006), Tomiura (2005) and Görg et al. (2008) and indicate that more productive firms are more likely to be intensively engaged in global value chains.

[Table 11 here]

5. Consequences of global value chains

This section discusses the evidence on the implications of relocation activity / GVCs for German manufacturing firms and considers also their employment decisions. Here we will focus on productivity / competition / technology effects for firms, and labour market outcomes (employment levels, relative demand for skills and wages) for workers, relying on survey evidence and the existing relevant literature for Germany (e.g., Wagner 2009, Geishecker, 2009, Geishecker and Görg, 2008, Winkler, 2009).

As a first step, the survey evidence provided by the German Statistical Office can be used to gauge some of these effects. Table 12 shows that 85 percent of firms replied that the relocation contributed to improved their overall competitiveness. Three quarters of firms also indicated that it had positive implications for their labour costs, i.e., reduced labour costs in line with the expectations. These two facts can be interpreted together

with a more formal econometric study of the effects of outsourcing on firm performance by Görg and Hanley (2010), based on Irish micro data. They argue that firms engage in outsourcing in order to locate some of their "non-core" labour intensive production stages abroad. This enables them to reduce labour costs for production at home, and use the increased profit to enhance their competitiveness through R&D and innovation. Their empirical analysis based on a large sample of Irish firms not only confirm this theoretical mechanism, but also might help explain why enhancing competitiveness and reducing labour costs found in table 10 are seen as an important effects of offshoring for German firms.

[Table 12 here]

As for possible labour market effects, Table 13 indicates that firms view the relocation of employment as important, irrespective of the skill levels of the employees. However, the skill levels of workers are important for the creation of new jobs in firms that offshore. Indeed, two thirds of firms did not create any new jobs for low skilled workers. By contrast, almost half of the firms indicate that they created new high skilled jobs.

[Table 13 here]

Table 14 provides even more detailed evidence on job creation and job destruction in firms that relocated activities abroad. Overall, 188,600 jobs were destroyed in Germany, while 105,500 were generated as a result of firm relocations. Hence, the ratio of jobs created to jobs destroyed is 56 percent overall. The picture is however much

more positive for high skilled workers. 63,300 lost jobs are balanced by 59,300 newly created positions, yielding a ratio of 94 percent. The table also shows that this pattern in favour of skill intensive jobs is particularly pronounced in high tech manufacturing and knowledge intensive services industries.

Hence, low skilled workers are apparently the group that incur most losses due to relocations of activities abroad. In absolute terms, more low skilled jobs are relocated abroad, and substantially fewer new jobs for workers with such a level of qualifications are generated at home.

[Table 14 here]

Of course, the survey answers provide only a subjective assessment of the actual situation on net job changes in Germany. This may be particularly problematic when it comes to isolate and assess the effects per se of linking into global value chains. Fortunately, more systematic research, using the mentioned survey data linked to official firm census data, is undertaken by Wagner (2009). He uses these combined data to estimate the actual employment effects due specifically to firms´ relocations abroad, using a propensity score matching approach. This empirical approach permits to compare very similar firms which differ only because some outsource abroad while other comparable, *matched* firms do not. He finds, firstly, that, in line with the literature surveyed above, firms that relocated activities tend to be larger and more productive before their relocation takes place compared to other firms that never relocated activities abroad. Secondly and more importantly concerning the employment effect resulting from relocations abroad, he finds that there are no statistically discernible effects on employment from the relocation decision.

A similar question is addressed by Bachmann and Braun (2010) and Geishecker (2008), but from another perspective using large samples of data on individual workers. They estimate whether offshoring (measured in terms of imported inputs constructed with input-output tables) has any noticeable effect on workers' movement into unemployment or/and into non-participation in the labour market. Both papers use different datasets but apply similar methodologies which nevertheless lead to slightly different results. While Geishecker (2008) finds that offshoring significantly increases the risk of becoming unemployed, Bachmann and Braun (2010) find for workers in the manufacturing industry that only the risk of moving out of the labour force is affected, but not the risk of moving into unemployment. Both studies, however, find that their main effects do not differ strongly among skill groups. The jury is, thus, still out on judging the possible effects of offshoring on employment when using such worker-level data.

In related research, a number of studies have also tried to estimate the possible effects of international outsourcing on wages. Here, Geishecker (2006) and Winkler (2009) investigate how outsourcing affects the relative wage of skilled and unskilled workers using industry level data. Their main findings are in line with the international literature (e.g., Feenstra and Hanson, 2003; Hijzen et al., 2005): outsourcing indeed raises the relative wage of skilled workers. Geishecker (2006) finds that in particular outsourcing to Central and Eastern European Countries has contributed to increase the skill intensity of German production at home, in line with the idea that low skill intensive activities are more likely to be relocated to (low wage) Central and Eastern European Countries.

More recent studies dig deeper into the relationship between outsourcing and wages using worker level data with even more precise information on workers'

employment profiles and activities. Here, Geishecker and Görg (2008) find that a one percentage point increase in outsourcing reduced the wage for workers in the lowest skill categories by up to 1.5 percent while it increased wages for high-skilled workers by up to 2.6 percent. These results are statistically significant, but economically small (mirroring those found for the US in Liu and Trefler, 2008).

Baumgarten et al. (2009) expand on this analysis by adding to the picture the tasks workers carry out in addition to information on workers' skill levels. They rely on a different estimation approach and thus find economically much stronger effects of outsourcing on workers. For example, their estimations suggest that low-skilled workers that carry out mainly non-interactive tasks that can be easily outsourced (c.f. Blinder, 2006) experience cumulated wage cuts of 8.85 percent per hour (equivalent to 1.31 euros). For low-skilled workers with medium degrees of interactive tasks, the cumulated wage cut is 0.77 euros while low-skilled workers with the highest degree of interactive tasks only experience wage cuts of 0.29 euros. An additional important finding is that there are no discernible wage effects for high skilled workers, irrespective of the tasks they carry out.

To sum up, recent empirical evidence suggests that relocating production abroad does have some implications for firms and workers, as one would expect, but that the magnitude of these effects appears to be far less adverse, than is generally expected.

6. Possible future development

The concluding section will briefly consider the question as to what may be the likely future development of Global value chains with a particular attention to the future of services offshoring.

Recent work by Blinder (2006) and van Welsum and Reif (2006) argue that a growing number of jobs in the service sector have the characteristics to be offshored if not now, then very soon.[8] Given that the service sector employs most workers in developed countries, and that technological progress combined with reduced barriers to international trade and investment allows a wider range of jobs to be done remotely, they suggest that a wide range of jobs could be under threat, depending on the specific task or occupation the workers carry out. The possibility to offshore numerous jobs does not mean, however that firms are necessarily going to adjust to this new strategic possibility. Table 6 shows clearly that only 10.4 percent of all firms interviewed in the survey plan to outsource in the future. This low number deserves attention.

Why are not more firms planning to outsource? First, most firms that never outsourced are unlikely to be able to support the costs involved in engaging in global value chains. This would be in line with the survey findings that there is no "race to outsourcing" because of costs of searching for partners, planning and coordinating the sourcing of inputs from abroad. These costs hamper their possibility to outsource. However, no race to outsourcing would also be consistent with firms struggling or failing in their outsourcing experience.

Indeed, the survey evidence present in table 12 shows that at least 13 percent of outsourcing experiences did not contribute to any labour cost reduction. If firms were planning to reduce their labour costs than such a result suggests that firms did not achieve their objectives. Another facet of unanticipated costs is also presented in Table 12. It shows that numerous firms (16.8 percent) had negative experiences with logistics costs. This suggests that a wide range of hidden costs are linked to outsourcing.

[8] Similar analyses for Germany are presented in Schrader and Laaser (2009).

On this issue, an additional insight is provided by a study on outsourcing decisions of German firms by Kampker (2009). He calculates total production cost savings of firms relocating activities abroad, including all costs such as labour and logistics costs already mentioned.[9] The results show that most firms realized only minor savings, if any. More striking is the fact that truly successful outsourcers (saving more than 20 percent in costs compared to the initial situation) are the exception, rather than the rule. If their findings can be generalized, then they partially explain why "following competitors" is not an important parameter among the motives to outsource: gains from outsourcing might not contribute extensively to a competitive advantage for all firms. Competitors without outsourcing activities are thus not forced, in turn, to engage in global value chains.

We may now consider firms that had already an experience with outsourcing. These firms overcame the sunk costs and integrated their foreign sourcing of inputs to their traditional activities. This does not mean that all firms were successful with their foreign engagement. Indeed, as show in table 15, 4 percent of German firms surveyed plan to make a U-turn or to pull out partially from sourcing goods abroad.

[Table 15 here]

Even if this is a minority of cases, some firms are at least pushed to optimize their outsourcing strategies. For example, BMW had to halt part of its automobile production in Germany during the volcanic ash cloud interruption in spring 2010, as supplies from

[9] Note that the survey is very detailed about the cost structure before and after relocation and thus has been undertaken on a rather small sample of 54 German firms in 3 industries with 77 foreign plants openings during a span of 5 years.

foreign sources were not forthcoming due to restrictions on air transport.[10] Similarly, Boing recently reconsidered its global outsourcing strategy because of coordination problems resulting in important delays for their 787 "Dreamliner" airplane.[11] It is difficult to isolate the most important factors that lead to problems and result in failure, but it suggests that offshoring does not warrant "success" for all firms.[12]

As for the motives for outsourcing, firm and time characteristics might be important, but the recognition of possible failure is rather understudied and not well documented yet in the case of outsourcing. The risk of failure is likely to be taken into account, when the decision to engage in global value chains is set.

Concerning firms that have been successful in their outsourcing strategy, two scenarios might be proposed (e.g., Kampker, 2009). First, those firms may optimize their outsourcing activities, by relocating among their foreign activities and locations. This might be the result of relative labour costs changes between foreign locations, or new risks, that firms want to circumvent. Another possibility, one that has attracted much attention recently is that successful experiences with partners abroad lead firms to deepen their relationship and to reward their partners with new orders, but this time with more skill intensive activities. This would be in line with a so called second stage of outsourcing, where presence abroad permits to firms to build upon a first stage experience, assess the strength and potentials of their foreign partners and locations and finally outsource more skill intensive parts of their activities.

[10] See „BMW to Halt Three German Plants Because of Ash Cloud" at http://www.businessweek.com/news/2010-04-20/bmw-to-halt-production-at-three-german-plants-due-to-ash-cloud.html, accessed on 7 July 2010.
[11] See "Boeing to Rein in Dreamliner Outsourcing" at http://www.businessweek.com/bwdaily/dnflash/content/jan2009/db20090116_971202.htm?campaign_id=rss_daily, accessed on 7 July 2010.
[12] Table 15 also shows that among the firms that already relocated abroad, only 53 percent planned some further relocation. This has to be contrasted with table 6 where 10,4 percent of the whole sample of firms are planning a future relocation.

There is clearly a need for more research on the role of global value chains. In particular, cross country analysis and the recent wave of services outsourcing are central to a better understanding of global value chains. It could benefit from interactions between policy makers, business and academic practitioners.

Overall, the impression from academic research on German data is global value chains, offshoring and relocations are clearly important for German manufacturing industries. Policy makers should be skeptical about claims of pervasive and large adverse effects resulting from global value chains in Germany. While, as expected, some negative effects appear for some groups of workers in empirical evidence; those are far less adverse than generally claimed in public discussions. Also, losers could be supported through appropriate policy measures, which need to be seriously debated. A sensible approach for policy is to make sure that global value chains are not hampered in order to ensure that competitiveness and overall benefits of global value chains are fully exploited.

References

Amiti, M. and S.J. Wei, 2005, Fear of service outsourcing: is it justified?, *Economic Policy*, 20, 308-347

Antras, P. and E. Helpman, 2004, Global sourcing, *Journal of Political Economy* 112, 552-580

Arndt, S. and H. Kierzkowski, 2001, "Introduction", in S. Arndt and H. Kierzkowski, eds., *Fragmentation: New production patterns in the world economy*, Oxford University Press

Bachmann, R., Braun, S., 2010, " The Impact of Offshoring on Labour Market Dynamics in Germany", *Scottish Journal of Political Economy*, forthcoming

Baier, S. and J. Bergstrand, 2000, "The growth of world trade and outsourcing", mimeo, Notre Dame University

Baumgarten, D., Geishecker, I., Görg, H., 2010, "Offshoring, tasks and the skill-wage pattern", Kiel Working Paper 1603, Kiel Institute for the World Economy, Kiel

Bernard, A.B., J.B. Jensen, S. Redding, and P. Schott, 2007, "Firms in International Trade", *Journal of Economic Perspectives*, 21, 105–130

Blinder, Alan S., 2006, "Offshoring: The Next Industrial Revolution?", *Foreign Affairs*, *85* (2), 113-128.

Clemens, M. und D. Schumacher, 2010, "Deutschland im Außenhandel mit forschungsintensiven Waren gut aufgestellt", *Wochenbericht des DIW Berlin*, Nr. 9/2010

Crino, R., 2008, "Offshoring, multinationals and the labour market: a review of the empirical literature", *Journal of Economic Surveys*, 23, 197-249

Deutsche Bank Research, 2004, *Offshoring: Globalisation wave reaches services sector* (available at www.dbresearch.com)

Feenstra, R.C., Hanson, G.H. and Swenson, D.L., 2000, Offshore assembly from the United States: Production characteristics of the 9802 program", in R.C. Feenstra, ed., *The Impact of International Trade on Wages*, University of Chicago Press

Feenstra, R.C. and G. Hanson, 2003, "Global Production Sharing and Rising Inequality: A Survey of Trade and Wages", in K. Choi and J. Harrigan, eds., *Handbook of International Trade*, Basil Blackwell

Geishecker, I., 2006, "Does Outsourcing to Central and Eastern Europe really threaten manual workers' jobs in Germany?", *The World Economy*, 29, 559-583

Geishecker, I., 2007, "Assessing the extent and development of international outsourcing in the Euro Area", mimeo, University of Göttingen

Geishecker, I., 2008, "The Impact of International Outsourcing on Individual Employment Security: A Micro-Level Analysis", *Labour Economics*, 15, 291-314

Geishecker, I. and H. Görg, 2008, "Winners and losers: A micro-level analysis of international outsourcing and wages", *Canadian Journal of Economics*, 41, 243-270

Geishecker, I., Görg, H. and D. Taglioni, 2009, "Characterising euro area multinationals", *The World Economy*, 31, 49-76

Görg, H., 2000, "Fragmentation and trade: US inward processing trade in the EU", *Review of World Economics*, 136, 403-422

Görg, H. and A. Hanley, 2010, "Services outsourcing and innovation: An empirical investigation", *Economic Inquiry*, forthcoming

Görg, H., A. Hanley and E. Strobl, 2008, "Productivity effects of international outsourcing: Evidence from plant level data", *Canadian Journal of Economics*, 41, 670-688

Hanson, G.H., R.J. Mataloni and M.J. Slaughter, 2005, "Vertical production networks in multinational firms", *Review of Economics and Statistics*, 87, 664-678

Hijzen, A., Görg, H. and Hine, R.C., 2005, "International outsourcing and the skill structure of labour demand in the United Kingdom", *Economic Journal*, 115, 860-878

Hummels, D., Ishii, J. and Yi, K., 2001, "The nature and growth of vertical specialization in world trade", *Journal of International Economics*, 54, 75-96

Jones, R.W. and H. Kierzkowski, 2001, "A framework for fragmentation", in S. Arndt and H. Kierzkowski, eds., *Fragmentation: New production patterns in the world economy*, Oxford University Press

Kampker, A., 2009, "Global Footprint Design — Managing the Complexity of a Globalized Production Network", presentation available at http://www.awoip.rwth-aachen.de/download.html

Kurz, C.J., 2006 'Outstanding outsourcers: A firm and plant level analysis of production sharing,' Working Paper, Federal Reserve Board, Washington DC

Marin, D., 2006, "A new international division of labor in Europe: Outsourcing and offshoring to Eastern Europe", *Journal of the European Economic Association,* MIT Press, 4, 612-622

Marin, D., L. Lorentowicz and A. Raubold, 2002, "Ownership, capital or outsourcing: What drives German investment in Eastern Europe?", in Herrmann, H. and R. Lipsey (eds.), *Foreign direct investment in the real and financial sector of industrial countries*, Berlin, Springer

Schrader, K. and C.F. Laaser, 2009, „Globalisierung in der Wirtschaftskrise: Wie sicher sind die Jobs in Deutschland?“, Kiel Discussion Papers 465, Kiel Institute for the World Economy, Kiel

Statistisches Bundesamt (2008), *Verlagerung wirtschaftlicher Aktivitäten: Ergebnisse der Piloterhebung*, Statistisches Bundesamt, Wiesbaden

Statistisches Bundesamt (2010), *Außenhandel: Rangfolge der Handelspartner im Außenhandel der Bundesrepublik Deutschland*, Statistisches Bundesamt, Wiesbaden.

Swenson, D., 2000, “Firm outsourcing decisions: Evidence from U.S. foreign trade zones”, *Economic Inquiry* 38, 175-189

Swenson, D., 2004, “Entry costs and outsourcing decisions: evidence from the US overseas assembly provision”, *North American Journal of Economics and Finance*, 15, 267-286

Tomiura, E.. 2005, ‘Foreign outsourcing and firm-level characteristics: Evidence from Japanese manufacturers,’ *Journal of the Japanese and International Economies* 19, 255-271

Van Welsum, D. and X. Reif, 2006, “We Can Work It Out - The Globalisation of ICT-enabled Services”, NBER Working Paper 12799

Vogel, A., F. Burg, S. Dittrich, J. Wagner, 2009, Zur Dynamik der Export- und Importbeteiligung deutscher Industrieunternehmen – Empirische Befunde aus dem Umsatzsteuerpanel 2001-2006, Working Paper 148, University of Lüneburg

Wagner, J., 2009, "Offshoring and Firm Performance: Self-Selection, Effects on Performance, or Both?" Working Paper 153, University of Lüneburg

Winkler, D., 2009, *Services Offshoring and its Impact on the Labor Market,* Springer Verlag, Berlin

Yeats, A., 2001, Just how big is global production sharing?, in S.W. Arndt and H. Kierzkowski, eds., *Fragmentation: New Production Patterns in the World Economy*, Oxford University Press

Appendix

Calculation of outsourcing measures (imported intermediate inputs) in Figures 2 - 4

This definition is based on Geishecker (2006).

International Outsourcing is measured as the value of an industry's imported intermediate inputs from industries abroad as a share of the domestic industries output. In order to allocate imports according to their use as inputs across industries we employ input-output tables for Germany. This enables us to observe the share of imports from an industry abroad that is used by the domestic industry in a given period (denoted *k* in the equation below).

Formally, outsourcing in domestic industry *j* in year *t* is defined as

$$OUT_{jt} = \sum (IMP_{jt} * k_{jt}) / Y_{jt}$$

where *IMP* are imports, *k* is the proportion of imports used by the domestic industry, and *Y* is industry output. By differentiating imports by the origin while assuming k to be constant across countries one can construct offshoring measures for different geographic regions.

Data come from Eurostat trade statistics, German Input output tables and the OECD STAN database.

Tables and Figures

Table 1: Manufacturing value added as percentage of GDP

	2005	2006	2007
Germany	22.5	22.6	..
Canada	16.2	15.5	14.9
China	32.8	33.6	34.1
Brazil	18.1	17.4	17.4
India	15.8	16.3	16.3
Russian Federation	19.0	18.2	19.0
United Kingdom	13.5	..	..
France	13.2	12.7	12.2
United States	14.1	13.9	..

Source: World Bank, World Development Indicators

Table 2: Activities by manufacturing sub-sector, 2007

		firms	employment	employment per firm	net value added	annual wage per employee	value added per worker
		#	#	#	thousand euros	thousand euros	thousand euros
2007							
15	Food & Beverages	5 040	617 614	123	25 517 535	30.57	41.32
16	Tobacco	24	11 592	483	1 196 012	65.72	103.18
17	Textiles	766	81 467	106	3 613 428	36.41	44.35
18	Wearing apparel	340	39 484	116	2 144 891	36.80	54.32
19	Leather	164	16 256	99	667 137	32.74	41.04
20	Wood	989	83 031	84	3 890 241	37.36	46.85
21	Paper	816	137 730	169	8 069 339	45.71	58.59
22	Publishing & Printing	2 376	284 365	120	13 957 954	38.46	49.08
23	Coke & petroleum	47	20 221	430	3 552 444	88.10	175.68
24	Chemicals	1 411	440 846	312	42 777 215	65.08	97.03
25	Rubber	2 632	355 877	135	18 420 174	41.00	51.76
26	Non-metallic minerals	1 509	195 926	130	11 077 309	43.68	56.54
27	Basic Metals	902	252 828	280	21 501 929	54.49	85.05
28	Fabricated Metals	6 252	608 756	97	31 933 115	41.80	52.46
29	Machinery	6 042	997 246	165	67 875 414	53.51	68.06
30	Office Machinery	159	38 701	243	3 774 406	68.62	97.53
31	Electrical Machinery	1 945	446 217	229	28 584 256	55.99	64.06
32	Radio and Communication	545	145 746	267	10 624 203	66.90	72.90
33	Medical Instruments	2 047	234 159	114	16 088 584	50.47	68.71
34	Motor Vehicles	1 005	837 542	833	61 105 943	64.80	72.96
35	Other Transport Equipment	313	138 778	443	9 899 881	63.73	71.34
36	Miscellaneous	1 449	165 538	114	8 123 040	38.80	49.07
37	Recycling	172	13 607	79	807 903	37.29	59.37
	Total	36 945	6 163 527		395 202 353		

Source: Statistisches Bundesamt

Table 3: Export- and import-participation in manufacturing 2001 - 2006

Reporting year	Share (in percent) of firms which...			
	Neither export nor import	Only export	Only import	Export and import
2001	67%	8%	9%	16%
2002	64%	9%	10%	17%
2003	63%	9%	10%	18%
2004	62%	9%	11%	18%
2005	61%	9%	11%	19%

Source: Own calculations based on Vogel et al. (2009)

Table 4: Export and Import participation of German firms by 2-digit manufacturing industry, 2006

Industry key	Share of firms which...			
	Neither export nor import	Only export	Only import	Export and import
15 Food and Beverage	82%	3%	9%	6%
16 Tobacco	39%	X	X	41%
17 Textiles	48%	6%	17%	28%
18 Wearing Apparel	51%	4%	19%	25%
19 Leather	50%	5%	21%	24%
20 Wood	70%	7%	13%	10%
21 Paper	38%	10%	11%	41%
22 Publishing and Printing	62%	18%	7%	13%
23 Coke and Petroleum	45%	7%	13%	29%
24 Chemicals	36%	11%	10%	43%
25 Rubber	35%	13%	10%	42%
26 Non-metallic Minerals	57%	6%	24%	14%
27 Basic Metal	52%	10%	10%	43%
28 Fabricated Metal	65%	9%	10%	16%
29 Machinery	41%	11%	11%	37%
30 Office Machinery	62%	11%	9%	18%
31 Electrical Machinery	43%	10%	12%	35%
32 Radio and Communication	47%	9%	10%	34%
33 Medical Instruments	61%	6%	13%	20%
34 Motor Vehicles	48%	9%	12%	31%
35 Other transport Equipment	44%	X	X	30%
36 Miscellaneous	60%	7%	16%	17%
37 Recycling	64%	14%	7%	15%

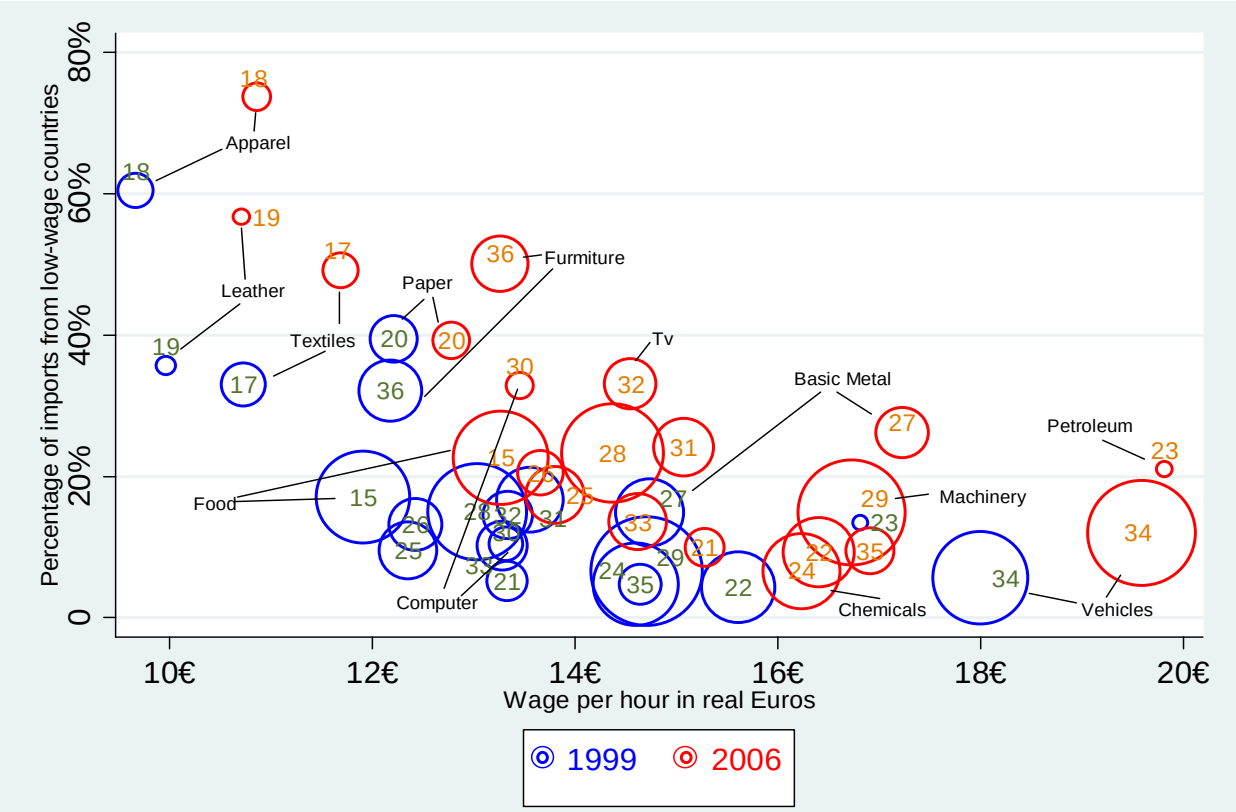
Source: Own calculations based on Vogel et al. (2009). X means that the information was not disclosed.

Table 5: Top 10 Export destinations, 2009

		million euros	percent of total exports
1	France	81941	10.1
2	Netherlands	54142	6.7
3	USA	53834	6.7
4	UK	53156	6.6
5	Italy	51050	6.3
6	Austria	48235	6.0
7	Belgium	42155	5.2
8	China	36459	4.5
9	Switzerland	35323	4.4
10	Poland	31626	3.9
…			
31	Canada	5216	0.6
	Total	808155	100

Source: Own calculations based on Statistisches Bundesamt (2010)

Figure 1: German exposure to competition from low-wage countries 1999-2006

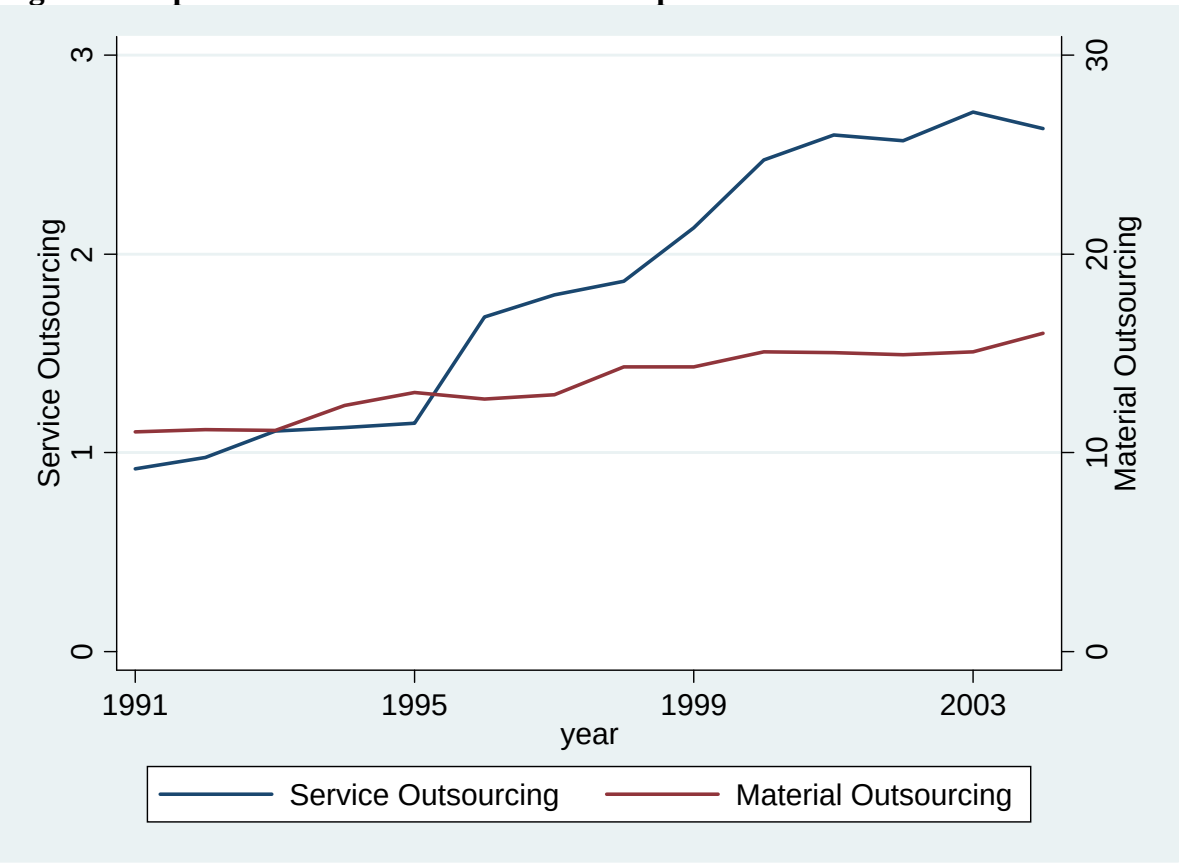


Low-income countries include all countries that are not high-income countries according to the World Bank
Industry classification is based on the International Standard Industrial Classification Rev. 3

15 Food	23 Petroleum	30 Computers
17 Textiles	24 Chemicals	31 Electrical Machniery
18WearingApparel	25 Rubber and Plastics	32 TV and Communication
19 Leather	26 Other non Mineral Products	33 Medical, Precision and Optical Instruments
20 Wood	27 Basic Metals	34 Motor Vehicles
21 Paper	28 Fabricated Metal Products	35 Other Transport Equipment
22 Publishing	29 Machinery and Equipment	36 Furniture and NEC

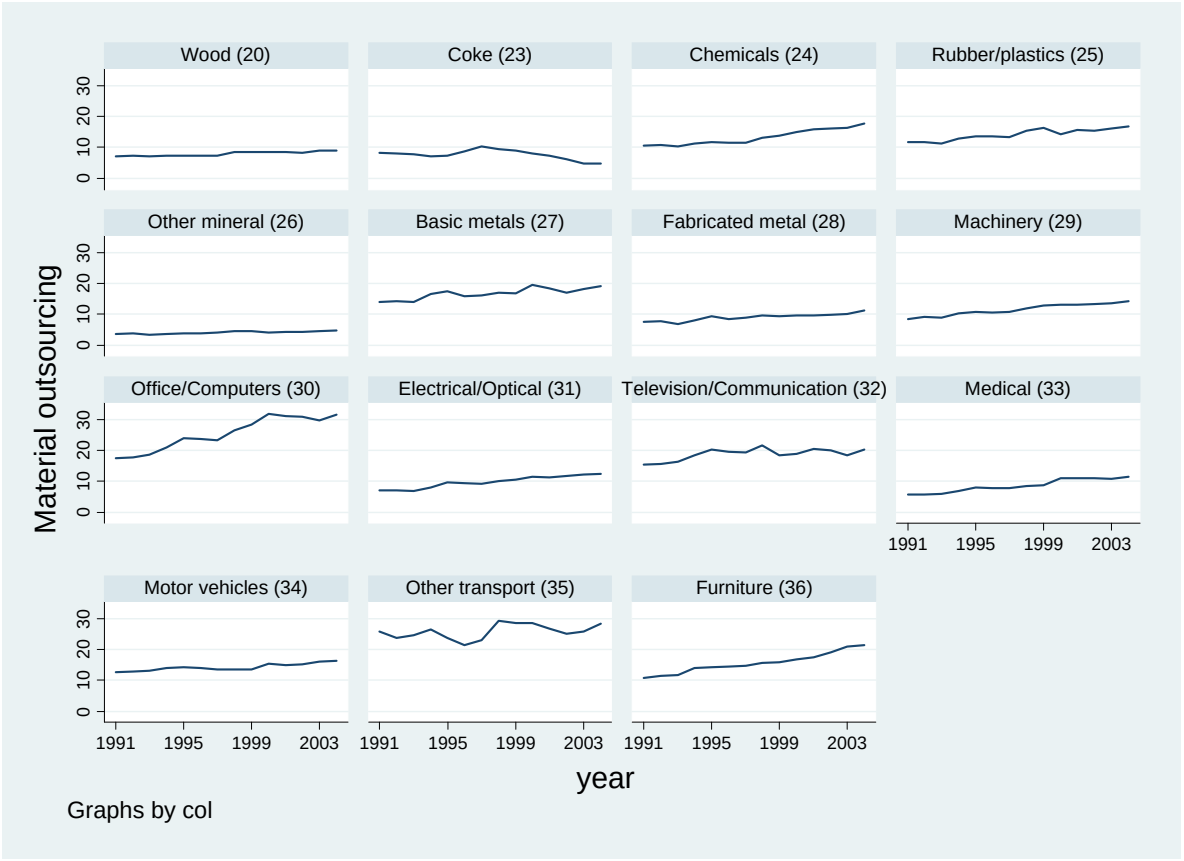
Sources: Statistisches Bundesamt, own calculations.

Figure 2: Imported intermediates relative to output



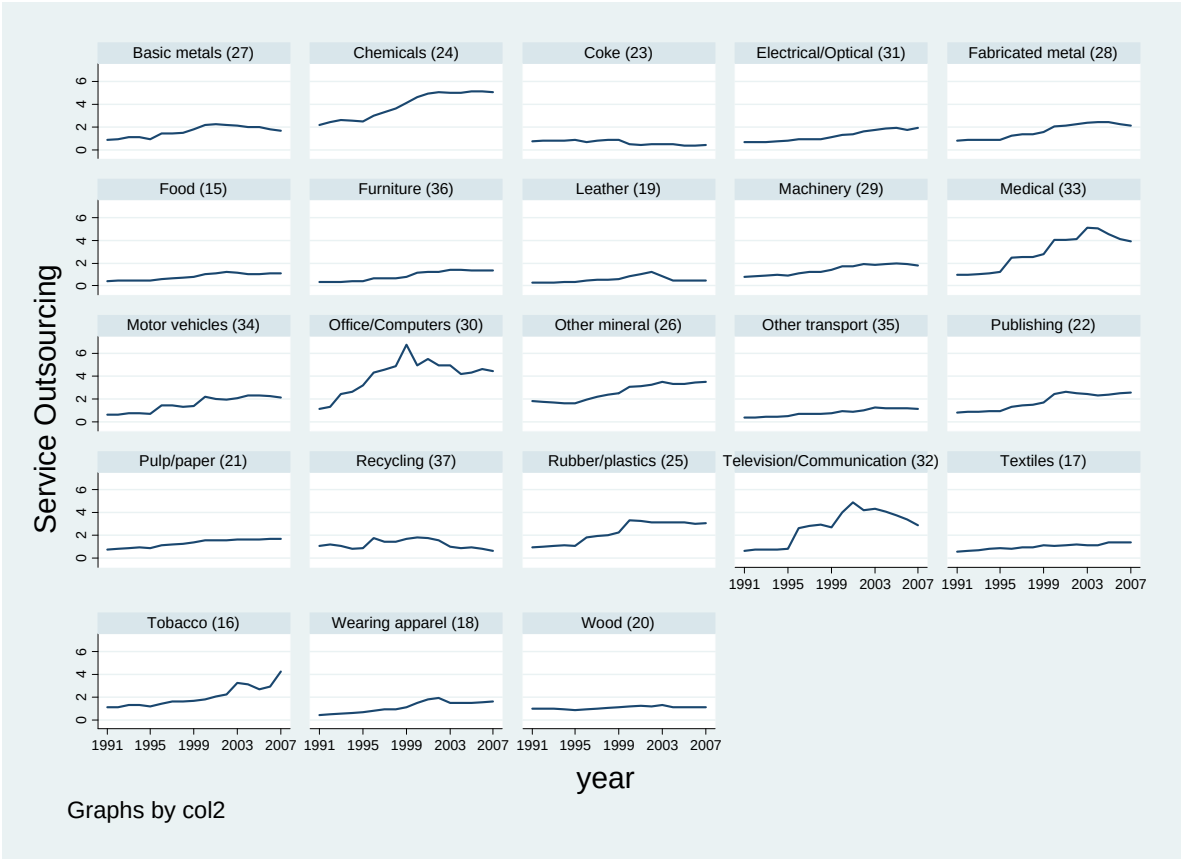
Source own calculations following Geishecker and Görg (2008)

Figure 3: Material outsourcing by two digit industry



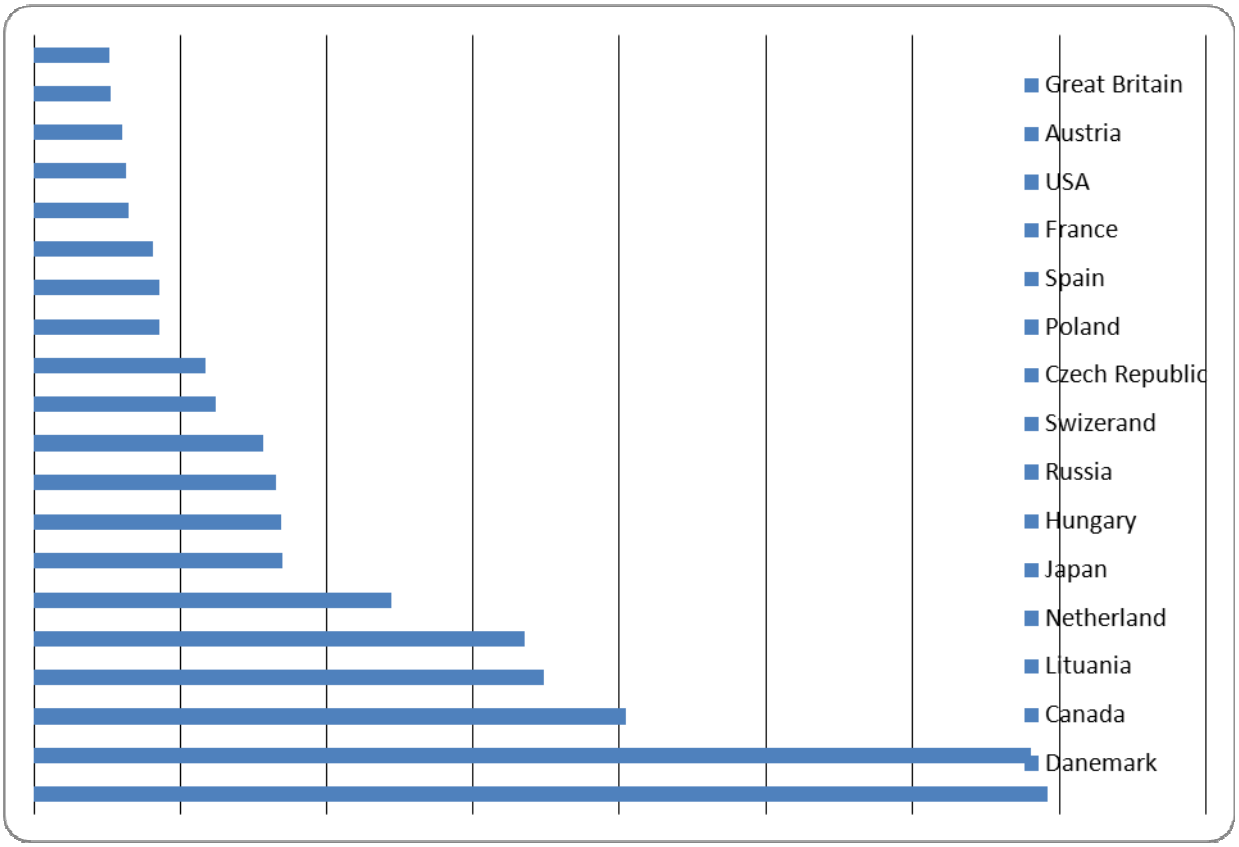
Source: own calculations following Geishecker and Görg (2008)

Figure 4: Services outsourcing by two digit industry



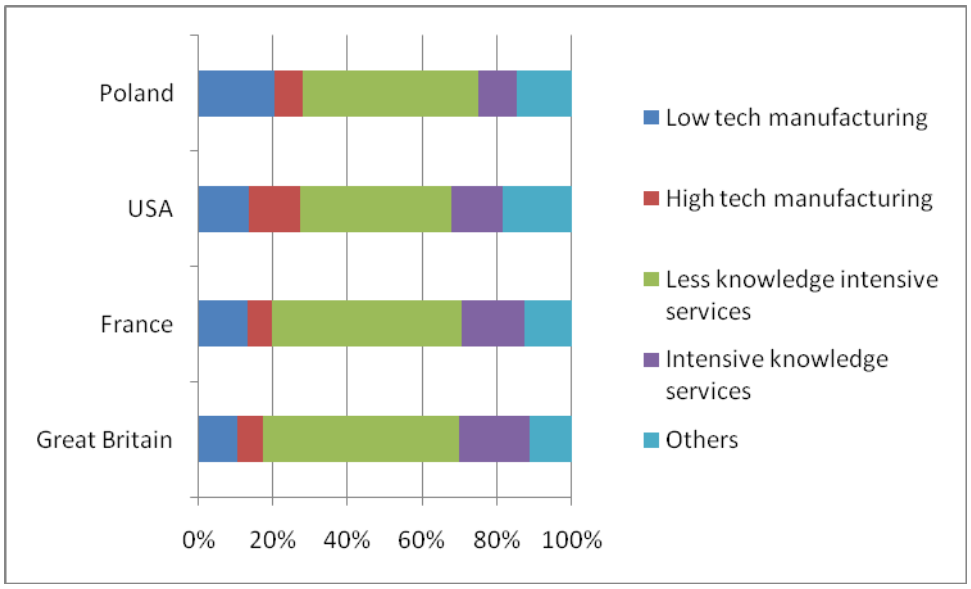
Source: own calculations following Geishecker and Görg (2008)

Figure 5: Geographic distribution of German foreign affiliates by destination country (2009)



Sources: Bureau van Djik, own calculations. A foreign affiliate is defined by an ownership of at least 10 percent by a German company. Only countries with more than 1 percent of total German affiliates are represented.

Figure 6: Location of German foreign affiliates and the type of activities abroad (2009)



Sources: Bureau von Djik, own calculations. A foreign affiliate is defined by an ownership of at least 10 percent by a German company. The definition of the groups is taken from EUROSTAT.

Table 6: Firms relocating abroad

	Companies	Companies that relocated until 2006	Companies planning to relocate
	Number	%	
Aggregate	19 787	16.5	10.4
Divided in industries			
Mining and quarrying	60	11.7	6.7
Manufacturing industry	9 573	24.5	16.1
Energy- and water-supply	389	5.1	0.0
Construction	861	6.3	5.7
Catering and hotel industry and commerce	4 017	8.5	4.2
Transport and communication	1 195	10.7	4.4
Real Estate business and other services	3 690	9.7	6.2
Divided in technology areas			
Manufacturing industry with intense use of technology	4 029	31.0	21.8
Other manufacturing industries	5 544	19.9	12.0
Knowledge driven industries	1 599	15.4	10.7
Other areas	8 615	7.7	3.9
Divided in employment-size classes			
100 to less than 250	13 486	13.5	8.2
250 to less than 500	4 148	18.4	12.0
500 to less than 1000	1 808	20.6	14.3
1000 to more …	1 270	24.5	15.2

Source: Statistisches Bundesamt (2008), own translation.

Table 7: Employment in firms relocating abroad

	Employees	Companies that relocated until 2006	Companies planning to relocate
	Number	%	
Aggregate	7 964 478	28.8	17.0
Divided in industries			
Manufacturing industry	4 151 318	38.2	(28.4)
Other manufacturing industries	428 530	(8.9)	(3.6)
Catering and hotel industry and commerce	1 386 802	1.6	(1.0)
Transport and communication	/	/	/
Real Estate business and other services	1 137 924	34.7	1.6
Divided in technology areas			
Manufacturing industry with intense use of technology	2 508 816	(45.5)	(35.8)
Other manufacturing industries	1 642 502	27.1	17.1
Knowledge driven industries	504 376	21.1	11.3
Other areas	3 308 784	/	3.5
Divided in employment-size classes			
100 to less than 250	2 044 650	14.1	8.4
250 to less than 500	1 297 321	20.5	13.3
500 to less than 1000	1 047 468	24.7	16.7
1000 to more …	3 575 039	(41.4)	(23.3)

Source: Statistisches Bundesamt (2008). "/" means that this number is uncertain and thus not disclosed by the Statistical Office.

Table 8: Motives for relocating production abroad

Motive	Companies	Importance				
		Very important	Important	Barely important	Not important	Don't know
	Number	%				
Labour costs	16 649	39.7	42.2	11.2	2.9	4.1
Access to new markets	16 651	45.3	36.5	9.9	4.2	4.1
Other costs	16 649	25.7	48.0	17.8	4.0	4.5
Tax incentives	16 649	17.0	42.0	29.4	7.3	4.3
Strategical target	16 642	21.7	35.8	19.4	17.3	5.8
Less regulation	16 644	15.1	33.4	34.9	11.9	4.7
Implementation of a new business model	16 644	14.5	34.0	31.0	15.1	5.5
Product development	16 647	18.0	29.3	33.2	14.9	4.6
Access to new know-how	16 644	13.7	30.0	33.3	18.5	4.5
Following customers or competitors	16 644	8.8	30.9	38.6	17.0	4.7
Others	524	71.4	26.3	/	/	/

Source: Statistisches Bundesamt (2008), own translation. "/" means that this number is uncertain and thus not disclosed by the Statistical Office.

Table 9: Barriers to relocating production abroad

Barrier	Companies	Importance				
		Very important	Important	Barely important	Not important	Don't Know
	number	%				
Language and cultural barriers	16 631	27.4	43.2	19.0	6.5	3.9
Other legal and administrative barriers	16 631	13.0	49.9	26.6	6.2	4.2
Cost-benefit ratio	16 630	20.1	38.8	25.2	11.2	4.6
Distance to production facilities	16 628	19.5	36.5	27.6	12.2	4.3
Fiscal issues	16 631	11.7	41.5	34.9	7.7	4.1
Interests of employees	16 628	10.3	42.1	32.9	10.5	4.3
Business ethics problems	16 628	7.9	42.1	34.5	10.7	4.8
Uncertainty about international standards	16 631	9.3	40.4	36.0	10.0	4.3
Risk of patent infringement	16 631	16.0	32.9	32.5	14.5	4.2
Distance to core markets	16 630	16.2	32.1	33.2	14.2	4.3
Tariffs	16 631	10.6	36.5	34.7	14.1	4.2
No suitable suppliers abroad	16 628	11.2	32.5	34.9	17.0	4.5
Insufficient process documentation	16 626	5.5	25.4	43.9	20.3	4.8
Other	254	64.2	31.7	0.0	/	/

Source: Statistisches Bundesamt (2008), own translation. "/" means that this number is uncertain and thus not disclosed by the Statistical Office.

Table 10: Geographic relocation of German firms by broad regions

	Firms relocating (Number)	Germany	EU-15	New EU member states	Rest of Europe	China	India	Australia and Oceania	North America	Latin America	Africa
	percentage										
All	3261	38,6	27,6	59,3	19,1	33,7	16,4	11,5	14,9	7,5	3,8
Among them To multiple Regions	2123	-	32,5	54,2	24,0	43,2	23,6	15,0	21,1	11,2	5,2

Source: Statistisches Bundesamt (2008), own translation.

Table 11: Regressions on productivity and offshoring

	(1)	*(2)*
Imported inputs / total Inputs	*0.005****	--
Imported inputs / sales	--	*0.011****
Size	*0.087***	*0.078***

*Table reports coefficient estimates from OLS regression. Dependent variable is log labour productivity. Regression also includes a constant, which is not reported. *** and ** denote statistical significance at 1 and 5 percent level, respectively.*

Source: Own calculations based on BEEPS firm level data for Germany for the year 2004.

Table 12: Effects on firms with relocations

	Effect			
	Negative	neutral	Positive	Not specified
Aspect	**%**			
Competitiveness	/	7,9	84,6	9,9
Cost of labour	(1,2)	13,0	77,4	8,4
Access to new markets	(1,2)	21,0	59,3	18,6
Other costs	4,1	31,6	56,4	8,0
Own know-how	7,9	48,5	22,8	20,7
Access to new knowledge	5,2	47,0	13,0	34,8
Logistic	16,8	35,4	24,5	23,3
Product development	6,7	40,0	11,1	42,3
Other aspects	(0,5)	0,0	2,4	97,0

Source: Statistisches Bundesamt (2008), own translation. "/" means that this number is uncertain and thus not disclosed by the Statistical Office. "(…)" means that the number is not as accurate.

Table 13: Employment effects in firms with relocations

Employment effects by skill level		Employment effects		
		applies	Does not apply	Not specified
		In … % of the enterprises		
Relocation of employees…	In low skill occupations	*61,8*	*25,0*	*13,1*
	In high skill occupations	*62,1*	*27,2*	*10,7*
Employment creation…	In low skill occupations	*15,1*	*65,6*	*19,3*
	In high skill occupations	*46,4*	*38,4*	*15,2*

Source: Statistisches Bundesamt (2008), own translation.

Table 14: Job creation and destruction due to relocations

	Employment at the old location				Created / relocated	
	Relocated		Created			
	Aggregate	skilled	Aggregate	skilled	Aggregate	skilled
	Number				Percent	
Economy overall	188600	63300	105500	59300	55,9	93,7
Divided into technology areas						
- Manufacturing industry with intense use of technology	91500	30500	46500	28700	50,9	93,9
- Other manufacturing industries	45300	11500	22500	8300	49,7	72,2
- Knowledge-driven services	23700	7300	18000	8800	75,9	120,5
- Other areas	28200	13900	18500	13500	65,5	97,1
Divided into employment-size classes						
- 100 to less than 250	73000	21700	33600	18400	45,5	83,4
- 250 to less than 500	38300	(13700)	22800	9400	58,8	(67,7)
- 500 to less than 1000	28900	(8900)	(19600)	(10800)	(66,9)	119,9
- 1000 and more...	(48400)	(19100)	(29500)	(20600)	(60,2)	106,3
Divided into group membership						
- Headquarters	(54300)	(20700)	(38100)	(24800)	(69,4)	(117,3)
- Part of business group with headquarters in Germany	32000	9800	(24500)	(11800)	(32,7)	(54,8)
- Part of business group with headquarters abroad	65900	(21200)	(21800)	(11800)	(32,7)	(54,8)
- Independent Enterprise	36100	11500	20800	11700	57,1	99,9

Source: Statistisches Bundesamt (2008), own translation.

Table 15: Future plans about relocation abroad

Outsourcing firms	Expand further	Unchanged	Partial or complete withdrawal	Decision Dictated by group strategy
Number	**%**			
3106	53,3	36,1	4,0	6,7

Source: Statistisches Bundesamt (2008), own translation.