IAW DISCUSSION PAPERS
iaw@iaw.edu | www.iaw.edu

IAW Diskussionspapiere Nr. 59 Februar 2010 | No. 59 February 2010

The Impact of Horizontal and Vertical FDI on Labor Demand for Different Skill Groups

Anselm Mattes

Institut für Angewandte Wirtschaftsforschung e.V.
Ob dem Himmelreich 1 | 72074 Tübingen | Germany
Tel.: +49 7071 98960 | Fax: +49 7071 989699

ISSN: 1617-5654

IAW-Diskussionspapiere

Das Institut für Angewandte Wirtschaftsforschung (IAW) Tübingen ist ein unabhängiges außeruniversitäres Forschungsinstitut, das am 17. Juli 1957 auf Initiative von Professor Dr. Hans Peter gegründet wurde. Es hat die Aufgabe, Forschungsergebnisse aus dem Gebiet der Wirtschafts- und Sozialwissenschaften auf Fragen der Wirtschaft anzuwenden. Die Tätigkeit des Instituts konzentriert sich auf empirische Wirtschaftsforschung und Politikberatung.

Dieses IAW-Diskussionspapier können Sie auch von unserer IAW-Homepage als pdf-Datei herunterladen:

http://www.iaw.edu/Publikationen/IAW-Diskussionspapiere

ISSN 1617-5654

Weitere Publikationen des IAW:

- IAW-News (erscheinen 4x jährlich)
- IAW-Forschungsberichte

Möchten Sie regelmäßig eine unserer Publikationen erhalten, dann wenden Sie sich bitte an uns:

IAW Tübingen, Ob dem Himmelreich 1, 72074 Tübingen,
Telefon 07071 / 98 96-0
Fax 07071 / 98 96-99
E-Mail: iaw@iaw.edu

Aktuelle Informationen finden Sie auch im Internet unter:

http://www.iaw.edu

The Impact of Horizontal and Vertical FDI on Labor Demand for Different Skill Groups

Anselm Mattes*

This version: February 2010

Abstract

This paper analyzes the determinants and effects of firm-level FDI flows on the basis of German micro-level data. Concering the determinants of FDI, I differentiate between different target regions and motivations for FDI (market seeking/horizontal FDI versus cost reducing/vertical FDI). The main result is that most firms engage in FDI because of market access motives. Further, I focus on the employment effects of direct investment projects abroad. From a theoretical point of view, the effects of FDI flows on labor demand at the firm level are uncertain. Therefore, this paper analyzes this question empirically using theory-based labor demand regressions and and an econometric framework based on the generalized method of moments (GMM). As a main result I find that there is no negative effect of firm-level FDI flows on employment. Positive effects seem plausible in many specification. Further, theory and anecdotal evidence suggest that unskilled workers are affected worse than highly or medium-skilled employees. Hence, the analysis distinguishes between different skill groups. Again, I cannot find negative effects of firm-level FDI flows on any skill group.

Keywords: FDI, horizontal FDI, vertical FDI, labor demand, skill groups, GMM
JEL: F16, F23, J23

*Institute for Applied Economic Research, Ob dem Himmelreich 1, 72074 Tübingen, Germany, anselm.mattes@iaw.edu

1 Motivation

In this paper, I analyze the determinants and consequences of direct investment in foreign countries on the firm-level. For that purpose, I use German data to assess the effects of this channel of globalization on the German economy. I concentrate on the different determinants for vertical and horizontal FDI and on the employment effects of (outward) FDI.

Foreign direct investment is frequently linked to rationalization processes as well as to job losses in the domestic country. Due to the accession of Central and Eastern European countries to the European Union, the debate became more controversial in Germany, partly because of its geographic proximity to those countries. A popular assumption, or widespread belief, is that since the EU-enlargement, small and medium size enterprises can outsource their labor-intensive production to Eastern neighboring countries more easily.

A reduction of the labor demand may lead to lower wages or a rise in unemployment in the domestic country. At the same time direct investment enhances the possibilities from the perspective of entrepreneurs and the employees of multinational firms, since firms can expand their markets, experience more growth and diversify their risks. A large percentage of employees face all these opportunities and dangers directly or indirectly, because they either work in the investing firms or their employer is connected to the investing firms.

In this context Germany is of particular interest for questions of motives and the structure of foreign direct investment, since it possesses an above average-share of exports and is highly integrated into the world economy. Germany also serves very well as an example, because it does not solely benefit from the positive effects of globalization, it is at the same time also disadvantaged by the negative impact of it. For that reason, the analysis of the structure, determinants and effects of FDI can offer new insights.

The main research questions of this paper are:

1. Which factors determine FDI activity at the firm level? What are the patterns of firm-level FDI flows? Where do German firms invest? Does horizontal or vertical FDI activity prevail?

2. What are the effects of direct investment in foreign countries on labor demand on the firm level? What are the differences between horizontal and vertical FDI? How are different skill groups of employees affected?

This contribution can be distinguished from the existing literature in several aspects. On the one hand, most empirical research is based on aggregated data on the level of German states (Bundesländer) or conducted in a sector-specific manner. The micro level has not yet attracted so much attention. On the other hand, the papers dealing with micro-level data focus mainly on multinational firms and their stock of FDI. This paper uses micro-level data enabling the analysis of foreign direct investment flows. The data coverage of all sectors and sizes of enterprises provides a representative and reliable basis for the analysis and contributes to robust results. Further, the dataset used in this paper permits a comparison between investing and not investing firms and an analysis of the effects of FDI flows on the labor demand for different skill groups.

The remainder of this paper is organized as follows. Section 2 gives a short overview of the definition of FDI and the theory of multinational firms. Section

3 introduces the dataset. Section 4 provides descriptive evidence on German firm-level FDI flows. In Section 5 the determinants of firm-level FDI activity are analyzed. Section 6 investigates the effects of FDI flows on firm-level labor demand. Section 7 concludes.

2 FDI and the Theory of Multinational Firms

This section gives a short overview of the definition of FDI and the theory of multinational firms. Specifically, I present the concepts of horizontal and vertical FDI as well as more recent theories featuring heterognenous firms.

2.1 Definition

According to the definition of the OECD (2008) and the IMF (1993), the main feature of foreign direct investment in contrast to foreign portfolio investment consists in the long-term interest of the domestic investor in the foreign affiliate. This implies that the investor gains some essential influence on the management of the firm.

Firms that are engaged in FDI can - in theory - be divided into two groups. Firstly, a multinational firm is classified as a horizontal integrated firm, if the same type of goods is produced at the same stage of production in the domestic as well as in the foreign country. The aim of those activities is to acquire new markets as well as to provide goods for a foreign market by producing directly in the respective country (instead of producing in the home country and exporting the product). Secondly, vertically integrated MNE result from the incentive to save production costs. Due to differences in factor prices, firms minimize their production costs by spreading two or more production stages over different countries. Consequently, one can assume that the motivation for direct investment has a decisive influence on the demand for labor and other production factors.

Greenfield investment versus M&A

Another distinction is made between greenfield investment and FDI via mergers and acquisitions (M&A). Upon entering a foreign market by FDI a domestic firm has the choice between setting up a new company or acquiring (or merging with) an existing firm. The first case is called greenfield investment, the latter M&A. Most FDI projects take the form of M&A (UNCTAD 2008). The dataset used in this paper covers both forms of FDI.

2.2 Horizontal Multinational Firms

Determinants of horizontal FDI

Horizontal FDI describes the international activity of firms that invest in foreign countries in order to gain better access to the local market. Following Brainard (1993,1997) a firm planning to expand to a foreign market faces the choice whether to export the domestically produced goods or to establish a production plant in the foreign country and therefore provide goods or services directly to the foreign market. In the first case, the firm has to include variable trade

costs (tariffs, non-tariff barriers, transportation costs) in its calculation. In the second case, fixed costs for the set-up of the foreign production site must be added.

In both cases, the firms entering a new market bear additional costs. In contrast, a domestic firm doesn't have to bear these costs. This suggests that domestic firms could serve their own, domestic market more efficiently. So why do MNE exist at all? Barba-Navaretti and Venables (2004) show that the existence of multinational firms can be explained by economies of scale. Economies of scale can exist at the firm-level as well as at the plant-level. The scale effects occur at the firm-level, if the entry into the new market increases overall output, whereas at the same time fixed costs, such as the costs for management or headquarters services, remain constant. This way, average costs fall and may be possibly lower than the costs of domestic firms. Headquarters services provided by the headquarters of the (multinational) firm are available for all affiliates of the firm with no or very little further costs. Headquarters services include centrally provided services such as research and development as well as brand names, organizational knowledge or access to modern technology.

However, there are also economies of scale at the plant-level. In the case of lower average costs for high output at a single production site, the concentration of production at one site is more efficient. The trade-off between lower variable costs with an own affiliate in the foreign market and higher fixed costs for two production sites is called proximity-concentration trade-off.

As a consequence, horizontal direct investment is more likely, if economies of scale are high at the firm-level and low at the plant-level. Furthermore, FDI is more likely, the higher the transportation costs and trade barriers between the two countries and the lower the fixed costs of production in the foreign country. The horizontal FDI framework may explain the creation of bilateral direct investment between industrialized countries with similar factor endowments.

The corresponding model in trade theory is the New Trade Theory (Krugman 1979). In this framework horizontal FDI is a substitute for trade, because MNE produce in the country where they want to sell their products instead of producing in the home country and shipping the goods.

Effects on employment of horizontal FDI

From a theoretical point of view, the consequences of horizontal foreign direct investment activity for the employment of the investing firm are ambiguous. On the one hand, demand for headquarters services rises since the new affiliates abroad must be controlled and provided with services. This induces an increase in labor demand. If headquarters services are intensive in the use of highly skilled labor - which is plausible -, the relative demand for highly skilled labor rises. FDI may also increase productivity and consequently the market share and output and thus lead to higher labor demand.

On the other hand, the investment abroad may also lead to a decrease in labor demand. This is the case if former export production is relocated to the new affiliate abroad. If production is intensive in the use of unskilled labor, demand for unskilled labor decreases. If the foreign market was not served by exports before, absolute demand for unskilled labor doesn't fall, because no production is relocated. But since demand for highly skilled labor rises, the *relative* demand for unskilled labor decreases. Hence, the overall effect on labor

demand is not clear a priori.

2.3 Vertical Multinational Firms

Determinants of vertical FDI

The characteristic feature of a vertical multinational firm consists in the fact that the value-added chain of the firm is divided up into several parts and some parts are relocated into different countries. Krugman (1995) coined the phrase "*slicing up the value chain*" for this phenomenon. This kind of FDI attracts most negative attention from the public and policy makers.

A first model of vertical FDI goes back to Helpman (1984). Barba-Navaretti and Venables (2004, chapter 4) give an overview. The underlying model from trade theory is the classical Heckscher-Ohlin model. The motive for vertical FDI is to exploit differences in factor prices between countries. The model assumes that different stages of production are intensive regarding different production factors. All stages of production are relocated to the country with the lowest factor costs for the respective intensive factor. For instance, unskilled labor intensive production is relocated to the country with the lowest wages for unskilled workers. The greater the gap between factor prices, the more attractive becomes the disintegration of the value chain.

However, firms do not only profit from vertical disintegration, they also have to bear disintegration costs. These costs rise with trade costs of intermediate goods that need to be shipped to the different production sites. Also, these costs rise with plant-level economies of scale. If centralized production in a single plant is more efficient, disintegration becomes unattractive.

Compared with other world regions, Germany is endowed with a high amount of capital and highly skilled labor, but with a relatively small number of low-skilled workers. Deducing therefore from the theory of vertical FDI one can conclude that in the case of Germany particularly all those production steps are relocated abroad which require primarily low-skilled labor.

The strict division between horizontal and vertical FDI is artificial. A look at the data shows that firms engage in FDI because of both motives, market access and cost reduction, at the same time. Markusen (2002) developed the so called knowledge capital model that incorporated both vertical and horizontal FDI. The model features two production factors. The first is knowledge which is produced by skilled workers. The second is unskilled labor. Firms consist of a headquarters and a production site. They can locate their headquarters as well as their production site freely. Hence, there are purely domestic firms as well as horizontal multinational firms that have their headquarters and one production site in their home country and another production site abroad. Additionally, there are vertical MNE that have their headquarters in their home country and the production site abroad.

The relative factor endowment of the home country determines the prevailing pattern. A crucial assumption is that headquarters are intensive in the use of skilled labor. Horizontal MNE can exploit the advantage of one headquarters that provides services for two production sites (as opposed to two headquarters for two national firms). A vertical MNE suffers from coordination costs for its production site abroad but can exploit factor cost differences. In this manner, the model can combine the theory of vertical and horizontal FDI. However, the

major predictions for the determinants and effects of vertical and horizontal FDI are unchanged.

The corresponding model for vertical FDI in the trade theory is the classical Heckscher-Ohlin model. Vertical FDI is a complement to trade because the intermediate products manufactured by an affiliate abroad need to be shipped back to the home country for final completion.

Effects on employment of vertical FDI

In comparison to horizontal FDI, the chances are higher that vertical FDI by German firms will lead to a decrease in labor demand for the domestic firm. Industrialized countries like Germany focus on headquarters services and relocate production, or at least parts of it, to foreign countries. Feenstra and Hansen (2001) outline the consequences of production relocation on the income for both low-skilled and highly skilled employees. In a first step, the relocation of production lowers the demand for labor. As discussed, it is plausible to assume that production which is intensive in unskilled labor is relocated. The demand for headquarters services (and thus highly skilled labor) may increase.

In a second step, the investing firm may increase productivity because it can profit from the differences in factor costs across countries. This leads to an increase of the firm's market share and labor demand rises. Again, the overall effect is uncertain. As far as different skill groups are concerned, the *relative* demand for highly skilled workers increases.

2.4 Heterogeneity of Firms

The classical models of trade theory are based on the simplifying assumption of a representative firm. This implies that all firms possess the same characteristics. On the empirical level, one can observe fundamental differences between the individuals firms. Even within a single category of firms, for instance within one sector or industry, these differences appear. New theoretical studies stress the importance of heterogeneity in terms of productivity differences between firms.

Based on the seminal work of Melitz (2003), Helpman et al. (2004) examine how firms decide between domestic production, exporting and horizontal FDI. The key to the Melitz-model and its extensions is the interaction of heterogeneity of firms regarding productivity and fixed costs for entering markets. Ex ante, firms do not know their productivity. Upon entry into the market, they draw their productivity level from a commonly known productivity distribution. Depending on the level of productivity, they exit the market without production, they produce only for the domestic market, they become exporters, or they set up affiliates abroad. The reasons for different patterns of production and of market entry are the different fixed costs of entering markets. The fixed costs of entering the domestic market are lower than the costs of exporting which, in turn, are lower than the costs of setting up foreign affiliates. More productive firms gain a higher market share which enables them to bear higher fixed costs. This leads to cut-off levels of productivity. These levels separate the highly productive multinational enterprises from less productive exporters and those from even less productive domestic firms. This baseline model features a proximity-concentration trade-off between exporting and horizontal FDI.

The Melitz (2003) model inspired many new models with the same basic structure and assumptions. For example, Grossman et al. (2006) present an example for a model with heterogeneous firms that allows for more complex patterns of internationalization. This model can explain different patterns of international activity, such as MNEs with affiliates in low-wage countries and assembly in high-wage countries. However, this comes at the cost of higher model complexity and additional assumptions.

Helpman (2006) gives a survey of the recent development of trade and FDI theory in the framework of heterogeneous firms and presents different models of complex international integration strategies.

The Melitz (2003) or Helpman et al. (2004) models don't predict direct labor demand effects for firm-level FDI flows. Instead, firm size in terms of employees depends on productivity which also determines international activity. That is, highly productive firms are larger than less productive firms and they engage in FDI while less productive firms export or serve only the domestic market. However, the model and its extension like the Bernard et al. (2007) model predict major job flows from less productive to more productive firms and industries if trade or investment barriers are lowered.

3 The LIAB dataset

The empirical work in this paper is based on the Linked Employer-Employee Panel (LIAB) dataset provided by the Research Data Center of the Institute for Employment Research in Nuremberg. This dataset consists of two separate datasets. The first dataset is the IAB Establishment Panel.

The basic population of the IAB Establishment Panel survey are all plants in Germany that have at least one employee subject to social insurance contribution. Many other firm-level datasets have restrictions concerning the industry, the size or other properties of the firms. The IAB Establishment Panel is built on a much broader basis and doesn't have any of these problems. Hence, with only very few exceptions, it allows deep analyses of the universe of all German firms. The sample size is about 16,000 firms per year and is stratified according to the size of the firms, the industry and the state (Bundesland) in which the firms are located. The ratio of surveys that are returned and can be evaluated is about 75%. This is much higher than in other comparable surveys. Most of the interviews are conducted at the firm site with an interviewer talking directly to the responsible persons. Hence, the dataset is highly representative, of high quality and more reliable than many (commercial) datasets, such as Amadeus, for example. The main focus of the survey is firm-level labor demand. Each year, there are additional topics included, of which some are repeated every second or third year. The key variables of interest are the questions on FDI and export activity. Information on export activity and volume is available for every single year. However, data on FDI is only included in the 2006 survey (referring to the years 2004 and 2005).

However, some methodological aspects need to be discussed. Firstly, the unit of observation in the survey is a plant or an establishment, which is a local production facility. This definition is not identical with the definition of a firm, which can include one or more plants. However, nearly 90% of all plants in the survey are also firms. Secondly, the protection of data privacy has to

be taken into account. The dataset is anonymized only weakly. This means that basically only the name and exact location of the firm is not available in the dataset. Especially for large firms in small industries or states, this may not be sufficient to secure the firms' interest in data privacy. Therefore, I may not report descriptive results that are based on less than 20 firms. This is no problem for the econometric analysis, however. For more information regarding the dataset, its properties and its availability see Fischer et al. (2008).

The second dataset provides information about single employees. It is a total population survey containing data on all employees subject to social insurance contribution from 1975 onwards. It contains information on various variables of interest, such as age, education, wages, profession, and work experience. The data also include an identifier for the plant in which the employees have their job. I used this dataset to calculate the number of employees of three different skill groups and their respective average wage for each establishment. Then, the establishment identifier is used to match this dataset with the IAB Establishment Panel. The three different skill groups are highly skilled employees with a university or college (*Universität* or *Fachhochschule*) degree, skilled employees with vocational training and unskilled employees without vocational training. In this way, I enriched the IAB Establishment Panel with information on the number and wages of these skill groups. I used data from the years 2002 to 2007 to construct a panel of six years. However, effectively the regression in the next subsection runs only on 3 years for the regressions containing the skill groups and on 4 years for the regressions on all employees. That is because I lose observations due to first differencing and the construction of the dataset (some variables that are collected in a given year correspond to a year before or after). I provide more detailed information on the matching procedure in Appendix 1.

Data access was granted by the research data center (*Forschungsdatenzentrum*) at the Institute for Employment Research in Nuremberg. Firstly, several research visits gave me the possibility to work directly with the IAB Establishment Panel. Secondly, data access was also granted by controlled remote data processing.

The IAB Establishment Panel has some strengths, but also weaknesses in respect to research on FDI. One of the major positive aspects is the high representativeness and the high reliability of the dataset. It has a remarkable high return rate of surveys and it includes all firm sizes, industries and German states (*Bundesländer*). Furthermore, the dataset includes a high number of variables about very different aspects of the firms. Most other firm surveys concentrate on special topics, such as international activity or balance sheet data. This richness of the dataset allows me to correlate different aspects of economic activity. For example, the analysis of the effects of FDI flows on labor demand for different skill groups is possible only with such a dataset.

Of course, there are also drawbacks. As a very general dataset covering many firm characteristics, special topics like international activity are not included in a very detailed way. In order to cover all aspects of the international activities of firms, additional information on international (out-)sourcing, FDI stocks or international financial relations would have been highly welcome. Furthermore, the absence of balance sheet data impedes some analysis. The need for data privacy protection and controlled remote data processing complicated the analysis and forced me to aggregate some descriptive statistics on a higher level than I

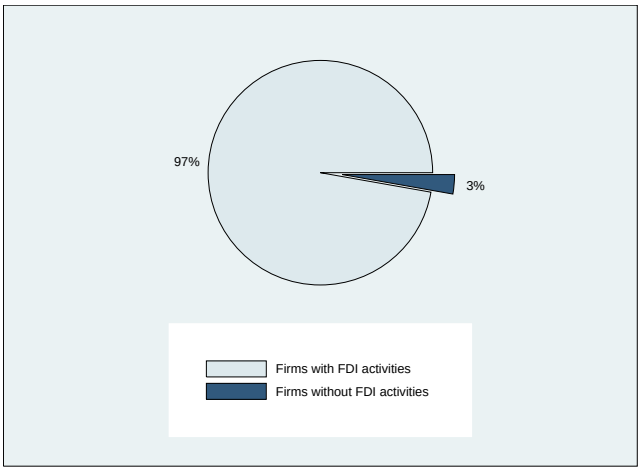
initially wished.

4 Patterns of firm-level FDI flows: descriptive evidence

4.1 Share of Firms Engaged in FDI and Volume of FDI

Referring to the theory of multinational firms, I outlined in Section 2 the hypothesis that only a small number of highly productive firms engages in foreign direct investment. The empirical analysis of the IAB Establishment Panel supports this, since only less than 3% of all German firms have bought or established subsidiary enterprises in foreign countries in 2004 or 2005. Figure 1 shows, that solely 3% of firms are engaged in foreign direct activities abroad. 4% of all employees subject to social insurance contributions however work in these firms. This reveals on the one hand, that the investing firms are of larger size than the non-investing ones and on the other hand, a non-negligible share of employees is directly confronted with the FDI activities of their firms. This number rises further if indirect effects are taken into account. These indirect effects consist of the relationship of the investing firms to suppliers, purchasers and competitors as well as of external effects (spill-over effects). There is a growing literature on spill-over effects (see, e.g. Blomström and Kokko 1998and Javorcik 2004). However, this paper focuses on the direct, firm-level effects, so the spill-over effects of FDI will not be analyzed.

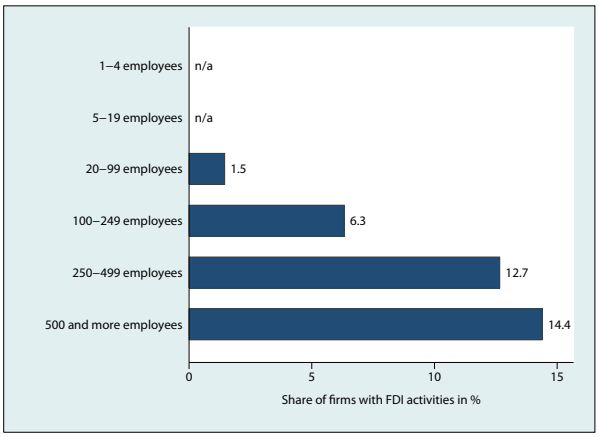
Figure 1: **Share of firms engaged in FDI in 2004/2005**



Source: IAB Establishment Panel 2006, own calculations

Figure 2 shows the share of firms engaged in FDI for different size categories. Due to data privacy restrictions, the corresponding numbers for the two smallest categories may not be reported (less than 21 FDI-firms in the dataset). Large firms are more often involved in FDI activities than small firms. It is mainly the large firms with 100 or more employees that invest abroad. While the share of firms undertaking FDI is less than 2% for firms with less than 100 employees, it is

Figure 2: **Share of firms engaged in FDI by firm size**



Values for firms with 1-4 and 5-19 employees are subject to data privacy restrictions (less than 20 observations).
Source: IAB Establishment Panel 2006, own calculations

more than 14% of the firms with more than 500 employees. With approximately one in seven large firms investing abroad, FDI is not a negligible phenomenon. Additionally, note that this number describes FDI flows for a time period of two years, not stocks of foreign investments. The accumulated FDI stock and the share of large firms with foreign affiliates is higher. These numbers do not yet provide evidence of a causal relationship of firm size and FDI. This will be analyzed in an econometric framework in Section 6.

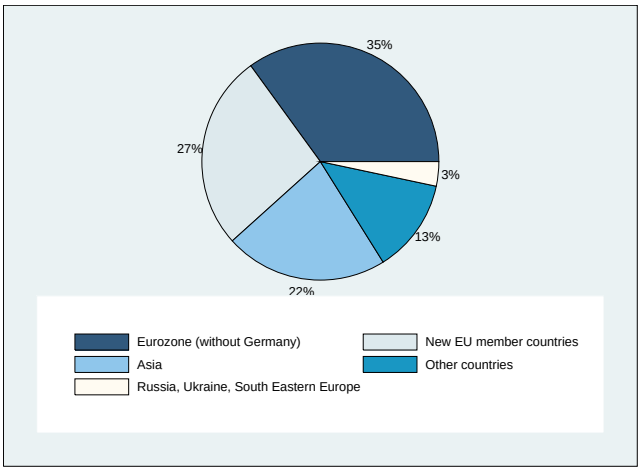
The average volume of FDI undertaken by an investing firm is 623,840 Euro. Compared to other measures of FDI like the balance sheet (stock) data provided by the Deutsche Bundesbank this is a small number. But it has to be taken into account that these are gross flows and not stocks which are naturally higher. Additionally, there is no minimum reporting threshold in the IAB Establishment Panel (as opposed to the official Bundesbank MiDi data). Within the investing firms, the investment activities are concentrated as well. The 10% largest investors account for about 80% of total FDI flows from Germany in the observed period. The corresponding Gini coefficient is 0.81.

4.2 Target Regions for FDI

The data provided in the IAB Establishment Panel allows not only the analysis of outward FDI flows in general. Beyond that the target regions and the motives for FDI can be observed.

The main target region for German firms engaged in FDI in 2004/2005 was the Euro area. 35% of investing firms declared the countries in the Euro area as their most important target area. These countries are developed industrialized countries with relatively large markets and relatively high labor costs. Theory suggests that FDI in this area is mostly market seeking or horizontal FDI. The new EU members in Central and Eastern Europe since 2004 rank second as the most important target area. Just over one quarter (27%) of all investing firms

Figure 3: **Target regions for FDI flows**



Source: IAB Establishment Panel 2006, own calculations

declared the new EU members as their most important target area. With a share of 22% Asia is also an important target region for German FDI flows. Countries of the former Soviet Union (CIS) and South-eastern Europe (including Turkey) play an important role for only 3% of the investing firms.

Figure 3 illustrates the main target regions for German FDI flows.

4.3 Motives for FDI

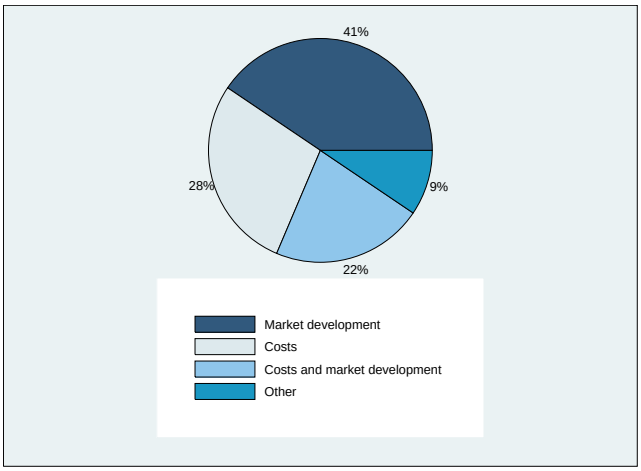
The descriptive analysis in this subsection highlights the main firm-level motives for direct investment in foreign countries. The analysis of the motives for FDI are one possible way to approach the effects of FDI. Theory suggests that market seeking (horizontal) FDI has rather positive effects on employment, whereas cost seeking (vertical) FDI has rather negative effects.[1]

Figure 4 shows that market access is the most important driver for firm-level FDI flows. 41% of the investing German firms declared the acquisition of new markets as their single motive for investing abroad. Vertical or cost seeking FDI seems to play a less important role. About 28% of all firms indicated that they are engaged in FDI because they are trying to reduce (labor) costs abroad. 22% of the firms gave market access as well as cost reduction as reasons for their international activity. Nearly one tenth (9%) of the firms declared that they did not invest because of the two main motives deducted from theory. All in all, horizontal FDI seems to be more important than vertical FDI.

The use of a direct question about investment motives may itself be a questionable approach. Possible impreciseness of the results may stem from either

[1] Usually, when theory meets empirical evidence, things become more complicated. The empirical evidence of the IAB Establishment Panel shows that firms do not strictly sort into horizontal or vertical FDI. There are firms that indicated having undertaken FDI because of both main motives as well as firms that stated that they engaged in FDI neither because of market seeking nor because of cost seeking motives. Chance and random contacts to possible business partners seem to play an important role, too. Other motives, like empire building need to be investigated in future research.

Figure 4: **Motives for firm-level FDI flows**



Source: IAB Establishment Panel 2006, own calculations

the operationalization of the subjective answers in the course of the quantitative analysis or the response behaviour. For instance, if a firm declared both motives, due to the structure of the question it is not possible to identify the primary motive. Consequently, some firms may have marked the market motive, although the cost motive played the most important economic role. Furthermore, it seems possible that to a certain extent those answers might be knowingly as well as unknowingly wrongly answered.

In spite of all inexactness, one has to take into account the advantages of the direct question about the motives. In the first place, asking directly is better than all other operationalizations of motives that depend on industries or target areas. To support this further, the results correspond with those of other empirical studies based on micro level data, which used for their analysis on the one hand questions asking directly for the motives from other data sources (Buch et al. 2007) and, on the other hand, reference values based on quantitative variables (Buch et al. 2005). Compared to Arndt and Mattes (2007; 2009) the last subsections show that there is a lot of heterogeneity between different German states (Bundesländer) regarding the firm-level FDI flows. For the state of Baden-Württemberg the results seem to differ. In Baden-Württemberg, cost reduction plays an even less important role as a motive for FDI and the share of total employees affected by FDI is twice as big.

4.4 Differences between Firms Engaged and Those not Engaged in FDI

In this subsection I will point out major differences with regard to essential key figures between firms engaged in FDI and domestic firms. However, a purely descriptive comparison of key figures such as productivity or average wage level may lead to a wrong impression, because differences in these variables may exist due to size or industry effects. In order to control for those influences, I chose an empirical approach similar to Bernard et al. (2007). Using simple

Table 1: **FDI premia**

Dependent variable	[1]	[2]	[3]
Employees	1130% ***	903% ***	-
Labor productivity [Euro]	107% ***	85% ***	37% ***
Value added [Euro]	2788% ***	1712% ***	40% ***
Sales [Euro]	2910% ***	1806% ***	39% ***
Share of highly skilled employees [%]	9% ***	10% ***	6% ***
Share of unskilled employees [%]	3% ***	3% ***	-2%
Average wage rate [Euro]	76% ***	62% ***	5% *
Included control variables	none	industry dummies	industry dummies and size

Significance on the basis of robust, clustered standard errors. *** significant at the 1%-level, * significant at the 10%-level
Source: IAB Establishment Panel 2006, own calculations

OLS, I regress several key variables of firms on a dummy variable for FDI. Additionally, I include the log number of employees and industry dummies as control variables. The estimation equation is the following:

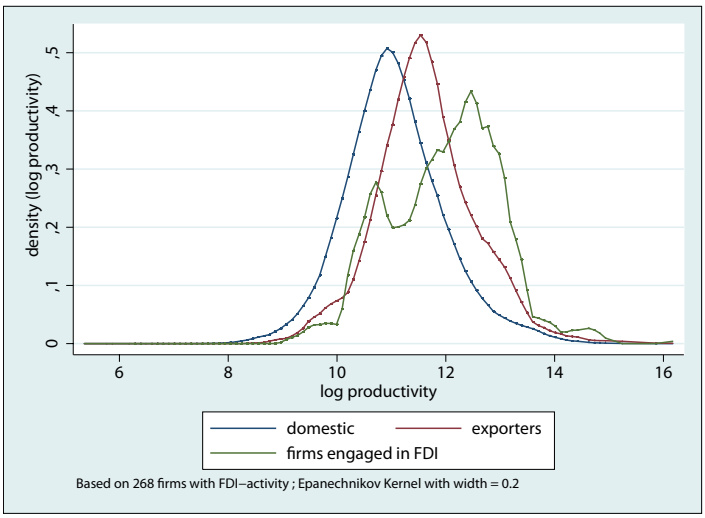
$$y_i = \alpha + \beta_1 FDI + \beta_2 ln(size)_i + \beta_3 industry_i + \epsilon_i \quad (1)$$

The coefficient β_1 of the FDI dummy variable can be interpreted as a "FDI premium". It gives the difference between firms engaged in FDI and those not investing abroad. The dependent variables y_i are productivity, size in terms of employees, values added, average wage, sales and the share of unskilled and highly skilled employees. These variables are all in logs, except for the shares.

The FDI premium is estimated in three different versions: in column [1] of Table 1 the dummy variable standing for FDI activity is the only regressor, in column [2] industry dummies are included and in column [3] the industry and size effects (measured by the log number of employees) are controlled for. Furthermore, the statistical significance of this relationship was tested. It should be noted, that only a descriptive connection is outlined, here. Based on these models, no causal statements about the consequences of FDI can be given. The numbers presented in Table 1 are not the coefficients obtained from the regression. Since the dependent variables y_i are in logarithmic form, the coefficient β_1 has to be transformed by $100[\exp(\beta_1 - 1)]$, such that it can be interpreted as the difference between firms engaged in FDI and domestic firms in percent.

Table 1 illustrates, that the firms engaged in FDI are larger in terms of employees and sales, more productive and have a higher value added than domestic firms. They have also a higher share of highly skilled employees with a university degree. These differences are statistically highly significant and of remarkable size in economic terms. In a simple comparison without further control variables, firms engaged in FDI also have higher shares oft unskilled employees without vocational training and pay higher wages. If size and industry effects are controlled for (column [3]), the magnitude of the difference between firms undertaking FDI and domestic ones decreases. But the difference in terms of productivity, value added and sales is still significant and around 40%. The share of highly skilled employees is also significantly higher (about 6 percentage

Figure 5: **Productivity distribution of domestic firms, exporters and MNE**



Source: IAB Establishment Panel 2006, own calculations

points). However, the difference in the share of unskilled workers is not significant and the difference in average wages is much smaller and significant only at the 10%-level. The higher productivity of firms with direct investment activity supports the approach of Helpman et al. (2004). Wagner (2006) concludes in the same way using German micro level data.

4.5 Productivity of Domestic Firms, Exporters and Firms Engaged in FDI

The last subsection revealed that firms engaged in FDI are more productive than other firms. However, this result corresponds to average values of productivity. In this subsection I give deeper insight into the distribution of productivity across firms. The Helpman et al. (2004) model states that productivity is the main determinant of firm-level FDI activity. The model predicts that firms self-select into different modes of international activity depending on their productivity (see Section 2). There are clearly defined cut-off levels of productivity which divide domestic firms from exporters and these from firms engaged in FDI.

Figure 5 shows the productivity distribution of domestic firms, exporters and firms engaged in FDI. The figure results from kernel density estimations of the three groups of firms using a Epanechikov kernel and a bandwidth of 0.2. Productivity was defined as labor productivity as in the following section. The ordering of the three distributions is as expected: firms engaged in FDI are more productive than exporters, which in turn are more productive than domestic firms. This goes in line with the Melitz-style models.

But, in contrast to theory, there are no clearly defined cut-off levels for the different international activity. The productivity distributions overlap to a non-

negligible extent. This may have different causes. Firstly, note that productivity is defined differently in the theoretical model and the empirical approach. Theory models productivity as marginal productivity whereas the available measure of productivity is average productivity. This may have consequences for firms with productivity just around the cut-off level for FDI activity Schröder and Sørensen (2009). But this shouldn't influence the results on all firms. Secondly, productivity is most probably not the only determinant of international activity. Arndt, Buch and Mattes (2009) provide evidence, that the labor market frictions, which a firm experiences, have an effect, too. Other determinants may also have an influence. Moreover, the Melitz-style models of FDI assume that FDI is horizontal. The descriptive evidence of this section shows that this is true for the majority of FDI flows but not for all. Firms engaged in vertical FDI do not necessarily have a higher productivity than exporters or domestic firms. There are other aspects that could play a role.

5 Firm-level Determinants of FDI Activity

Depending on the aggregation level, different factors play a decisive role for direct investment in foreign countries. Consequently, for the analysis, a distinction between the micro and the macro level should be drawn. Gravity-style equations can be used on the macro level in order to demonstrate that the larger the market size, the higher the GDP per capita in the receiving country, the lower the distance between the two concerned countries and the smaller cultural differences are, the higher are the FDI flows (and stocks) from one country to another (see e.g. Buch et al. 2007 or Mattes and Spies (2009)). The gravity framework is an intuitive approach that emerged from the empirical trade literature. Deardorff (1998) showed that different theoretical trade models are compatible with the gravity approach. Kleinert and Toubal (2005) analogously show that different models of multinational enterprises can lead to the gravity framework for FDI. However, this relation is not biunique. Estimating a gravity equation does not permit to draw a conclusion about which underlying theoretical model of trade or FDI is correct.

The main focus of this paper is the analysis of firm-level FDI flows. An analysis on the firm-level has the major advantage that implications from different models of the multinational firm can be tested. In this section I will analyze the determinants of FDI in general and will further study the different determinants of vertical and horizontal FDI. Therefore, I exploit the fact that the IAB Establishment Panel provides direct information on the motivation of firms for undertaking FDI.

The descriptive analysis in Section 4 showed that market access seems to be the most important driver for foreign direct investment. Hence, most firm-level FDI flows are supposed to be horizontal FDI and go into the highly developed Euro area or the fast growing Asian markets. But more than a third of all investing firms declared that they didn't engage in FDI because of market access motives. The main research questions in this section are the following: What are the firm-level determinants of FDI? How do these determinants differ between horizontal and vertical FDI?

I estimate five Probit models to analyze the firm-level determinants of direct investment abroad using data from the IAB Establishment Panel survey from

2004 to 2006. The dependent variable in the first model [1] takes the value 1 if a firm was engaged in FDI in the years 2004 or 2005, irrespective of the motivation for this international activity. In the second model [2], the dependent variable takes the value 1 only if the firm was engaged in FDI in the respective period and reported exclusively market access motives. In model [3] the dependent variable takes the value 1 for firms reporting solely cost reduction motives for FDI. Model [4] explains all horizontal FDI, irrespectively whether other motives were reported additionally. Model [5] does the same for vertical FDI.

I sort the firm-level determinants of direct investment into four categories. The first category is productivity, which recent theory regards as the most essential factor. The market access motive, leading to horizontal FDI which emerges from the proximity-concentration framework, covers the second category. The third category is the cost reduction motive, which supports the idea of vertical direct investment. A fourth hypothetical category is proposed: that firms invest abroad because of the lack of domestic human capital.

Productivity is operationalized as labor productivity (sales per capita). For that purpose the number of employees is transferred into full-time equivalents to take the different shares of part-time workers of the various companies and industries into account. In order to control for the varying capital intensities in different industry dummies are introduced in the Probit estimation. Productivity is the most important (and only) driver of FDI activity in the Helpman et al. 2004 model. Therefore, this model implies that high productivity leads to FDI activity, and I expect a positive sign for the corresponding coefficient (see Section 2). Additionally, I included a dummy variable indicating whether a firm is active in R&D or not. Again, I expect a positive coefficient. The operationalisation of the market access motive was carried out over the export share of total firm-level sales. In order to control for non-linear effects I included a squared term. I expect a positive sign for the export share and a negative sign for the squared term. The idea behind this way of modeling the market access motive is that firms may first export to foreign markets and then go one step onward and invest abroad to develop foreign markets further. The basis for this motive is the proximity concentration trade-off framework (Brainard 19931993, 1997). The Helpman et al. (2004) model also assumes that firms invest abroad in order to gain better market access than by exporting (see Section 2).

Two variables are used to construct the (wage) cost reduction motive. On the one hand firms could express directly in the questionnaire, whether they expect problems because of too high labor costs. On the other hand the proportion of low skilled workers of all employees is included. The wage cost motive assumes that Germany is well endowed with skilled labor and relatively poorly endowed with unskilled labor. This results in relatively high wage costs for low skilled employees as compared to other countries. So, firms with a high share of low skilled employees could profit most from a relocation of (production) activities into countries with lower wages for unskilled employees. The basis of this motive is the vertical FDI framework that builds on the works of Helpman (1984) and emerged from the Heckscher-Ohlin model of trade (see Section 2).

The lack of human capital is operationalized by two dummy variables. The first one takes the value 1 if a firm expects shortages of qualified personnel. The second one indicates whether a firm experiences problems regarding the innovative environment in Germany. If firms relocate activities abroad because of these kinds of problems the underlying theoretical model is also the vertical

Table 2: **Probit estimates of FDI activity**

	[1] FDI	[2] only HFDI	[3] only VFDI	[4] HFDI	[5] VFDI
log Productivity	0.004***	0.002*	0.000	0.003***	0.001**
	[2.70]	[1.94]	[0.13]	[2.76]	[2.06]
R&D (0/1)	0.016***	0.012***	0.004**	0.012***	0.006***
	[4.28]	[3.61]	[2.14]	[3.87]	[2.97]
Export intensity	0.062***	0.033***	0.024***	0.047***	0.032***
	[4.75]	[3.10]	[3.35]	[4.37]	[4.74]
Export intensity (squared)	-0.050***	-0.026**	-0.023***	-0.038***	-0.029***
	[3.38]	[2.16]	[2.83]	[3.10]	[3.85]
Wage cost problems (0/1)	-0.003	-0.003*	-0.001	-0.002	-0.001
	[1.60]	[1.82]	[1.27]	[1.19]	[0.70]
Share of unskilled employees	-0.004	-0.003	-0.001	-0.004	-0.001
	[1.10]	[0.90]	[0.43]	[1.13]	[0.72]
Lack of qualified personnel (0/1)	0.002	0.001	-0.001	0.003	0.000
	[0.80]	[0.80]	[1.45]	[1.61]	[0.31]
Innovative problems (0/1)	-0.001	-0.002	0.001	-0.003	-0.000
	[0.44]	[0.89]	[0.83]	[1.37]	[0.13]
Works council (0/1)	0.004	0.002	0.001	0.004	0.002
	[1.46]	[1.16]	[0.66]	[1.59]	[1.28]
log Employees	0.005***	0.002***	0.001***	0.004***	0.002***
	[6.05]	[4.11]	[3.13]	[5.66]	[5.04]
Industry dummies	yes	yes	yes	yes	yes
Observations	4143	4061	3632	4117	4079
Pseudo-R2	0,3541	0,2818	0,2734	0,3522	0,3608

Robust z statistics in brackets, * significant at 10%; ** significant at 5%; *** significant at 1%

Source: IAB Establishment Panel, 2004-2006, own calculations

FDI framework. But the initial assumptions are different. In contrast to the wage cost motive, this motive assumes that Germany is poorly endowed with skilled labor. Consequently, if this holds true, firms relocate those parts of the production chain that are intensive in the use of skilled labor. In this case, a positive sign is expected for the corresponding coefficients.

Further control variables are included in the model. Industry dummies control for industry-specific effects and particularly for varying capital intensities in different industries. Also, it is checked whether there is a works council in the firm. A works council may increase the bargaining power of employees and thus decrease the probability to invest abroad. Hence, I expect a negative sign. The logarithm of the number of employees controls for size effects. I expect a positive sign here.

The results of models [1] to [5] are presented in Table 2.

In model [1] with FDI in general as the dependent variable, labor productivity has a significantly positive effect on the probability to invest abroad. This holds true for all other models with the exception of model [3] where only firms are included which reported cost reduction motives for the engagement in FDI. That means that in all models, in which firms that reported the market access

motive are included, productivity plays an important role. This underlines the importance of productivity for the decision to invest abroad and the connection between productivity and the horizontal FDI framework. The dummy variable for R&D activity as another indicator for productivity also has a positive and significant effect on the FDI decision. The coefficient corresponding to this variable also takes a significantly positive value for firms which reported only vertical motives for FDI. This suggests that even if a firm goes abroad in order to reduce costs, it has to be productive enough to overcome the connected fixed costs.

The second motive for FDI is the market access motive. The lagged share of exports has a significantly positive effect on the decision to invest abroad. However, this seems to be a non-linear, inverted U-shaped effect, as the squared value of the export share has a significantly negative impact. Lagged exports belong to the most important variables with the highest explanatory power in the models.

The variables representing the cost reduction motive do not affect the probability to invest abroad in a significant way. Only the dummy variable indicating whether firms expected problems due to high wage costs has a weakly significantly negative effect on FDI activity in the model with only horizontal FDI included. The negative coefficient is counterintuitive especially for the firms with vertical motives. The share of unskilled workers in the firms does not have a significant effect at all. In sum, the cost reduction motive seems to have no explanatory power for the decision to invest abroad.

The lack of human capital as a motive to engage in FDI is not supported by the data. Neither the variable indicating a lack of qualified personnel, nor the variable indicating problems with the implementation of innovations has a significant impact on the decision to invest abroad.

As a control variable, firm-size in terms of the number of employees (in full-time equivalents) was included in the models. It has a positive and significant effect on FDI activity. This goes in line with the descriptive evidence in Section 4 that showed that it is mostly the large firms which invest abroad. Partly, this could also represent the higher productivity of bigger firms. Furthermore, bigger firms have better access to banks and other financial institutions. Thus they are able to cover the fixed costs of FDI more easily than smaller firms. Additionally, the existence of a workers council was included as a control variable. However, it does not have a significant effect.

To summarize, the main determinants of FDI are size, productivity and the orientation towards foreign markets. These factors have a high explanatory power for firm-level FDI activity. If the sample is restricted to vertical FDI, productivity loses its significance. These results support some features of the Helpman et al. (2004) model which describes FDI activity as horizontal, market seeking FDI and shows that productivity is the main determinant for investment abroad. Models of vertical FDI do not find support in this empirical model. However, there are firms which reported vertical motives for their FDI activity. Further research should examine these firms more closely.

6 The Effects of FDI on Firm-level Labor Demand

6.1 Hypotheses

In Section 2 I discussed the possible effects of foreign direct investment on the employment of the investing firms. I showed that there is not one unifying framework to analyze and predict the effects on firm-level labor demand. On the one hand, horizontal, market-seeking FDI may have positive effects on labor demand because there is additional demand for headquarters services. But if this horizontal investment substitutes for export production, labor demand in production may decrease. The overall effect is unclear a priori.

On the other hand, vertical FDI causes a decrease in employment, in the first place. Relocated production now takes place somewhere else, hence labor demand falls. But as a consequence, productivity and competitiveness may increase, and thus the demand for the firm's output increases, causing an increase in labor demand. Again, the overall effect is unclear a priori.

Theory also suggests that FDI flows have different effects on different skill groups. Low-skilled employees working in a production process that is offshored may be affected worse than highly skilled white collar workers in the firm's R&D division. The relative demand for headquarters services, which are supposed to be skill intensive, rises.

These questions cannot be entirely solved in a purely theoretical approach. Only an empirical analysis can provide deeper insight. Building on the propositions of Section 2, I set up following hypotheses:

Hypothesis 1a: FDI in general has a positive impact on labor demand
Hypothesis 1b: Horizontal FDI has a positive impact on labor demand
Hypothesis 1c: Vertical FDI has a negative impact on labor demand
Hypothesis 2: FDI has a positive impact on demand for highly skilled labor
Hypothesis 3: FDI has a negative impact on demand for low-skilled labor

6.2 Empirical Strategy

This subsection describes the strategy employed to estimate the effects of FDI on the labor demand of firms. The basic framework is a Cobb-Douglas production function that is transformed by taking the logarithm as done by Sargent (1978) or Breitung (1992a). I follow the approaches of Kölling (1998) and Bellmann and Pahnke (2006) who developed a way to estimate dynamic labor demand equations using the LIAB data.

Kölling (1998) models firm-level labor demand in a dynamic framework. The production function has the following form:

$$F(N_t) = a_1 N_t - \frac{1}{2} a_2 N_t^2 \tag{2}$$

where N_t is the number of employees. One important difference to the usual Cobb-Douglas approach is that capital is considered fixed in the short run, so labor is the only production factor firms adjust in the short run. If, for example due to production or wage shocks, the number of employees is not at the optimal level for the firms, they try to adjust this number in every period to the optimal

level. A firm has to consider that adjustment is not costless. Adjustment costs are modeled following Sargent (1978):

$$C_t = \frac{c}{2}(N_t - N_{t-1})^2 \tag{3}$$

The costs for adjustment increase more than proportionally with the distance from the optimal level of employment. Firms try to maximize profits, which are given by:

$$\pi = \sum_{t=0}^{\infty} b_t \left\{ a_1 N_t - \frac{1}{2} a_2 N_t^2 - w_t N_t - \frac{c}{2}(N_t - N_{t-1})^2 \right\} \tag{4}$$

and $0 < b < 1$. b is the discount factor for future periods and π profits.

This leads us to the following empirical dynamic labor demand equation in logs:

$$n_t = \alpha_1 n_{t-1} + \alpha_2 n_t^* + \upsilon_t \tag{5}$$

with n_t^* as the long run optimal level of employment and υ_t as the error term of the estimation. The optimal long-run level of employment cannot be observed. In the neoclassical context, this depends on the marginal productivity of labor and the wage rate. Breitung (1992b) shows that this can be derived as

$$N^* = \alpha(\frac{pF}{w}) \tag{6}$$

with $F()$ as production function, p as price level and α as partial elasticity of production regarding labor from the Cobb-Douglas production function.

Taking logs and considering the adjustment costs leads us to the following equation that can be estimated (Kölling 1988):

$$n_{it} = \alpha n_{i,t-1} + \beta_0 + \beta_1 ln(sales)_{it} + \beta_2 ln(wage)_{it} + \upsilon_{it} \tag{7}$$

with $i = 1, ..., N$ indicating the individual firm and $t = 1, ..., T$ the time period. This is the baseline dynamic labor demand regression equation I use. It relates labor demand in a given year to the labor demand of the year before, the firm's sales and the average wage of an employee in the firm. Furthermore, I will augment this baseline equation with FDI as the variable of interest and several control variables.

The estimation of this dynamic labor demand equation is complicated because of two major issues. The first one is the possible existence of individual effects that cannot be assumed to be uncorrelated with the regressors.[2] A Hausman test shows that there are individual effects present in the data. These can purged by first differencing or mean differencing (the within transformation) the equation.

However, this leads to the second problem, which is correlation between the lagged dependent variable and the error term. The lagged dependent variable in differences $\triangle n_{i,t-1} = n_{i,t-1} - n_{i,t-2}$ is correlated with the transformed error term $\triangle \upsilon_{i,t} = \upsilon_{i,t} - \upsilon_{i,t-1}$. The same holds true for the within transformation.

[2]For example, the individual effect could cover the ability of the management. This is probably correlated with sales.

As Nickell (1981) shows, ordinary least squares (OLS) and the within estimator are biased. The bias is called Nickell-bias or dynamic panel bias. This bias vanishes if the number of periods goes to infinity. But the dataset is clearly a "large N, small T"[3] environment, so the estimation technique has to take this into account.

Nevertheless, it makes sense to calculate the OLS and within results even so. It can be shown that the OLS estimates for the lagged dependent variable is biased upwards and the within results are biased downwards. For the other regressors this relation is interchanged as long as the estimated coefficient is positive. If it is negative, the relation is the same as for the lagged dependent variable. That means that the OLS and within estimators give an upper and lower bound for reliable results (Harris et al. 2008, p. 253).

The preferred estimation technique for the dynamic labor demand equation is the Generalized Method of Moments (GMM). This exploits the fact that in the first-difference transformation deeper lags than $t-1$ of the dependent variable are still orthogonal to the error term. Hence, n_{t-2} may be used as instrument. Arelleno and Bond (1991) ("difference GMM") showed that efficiency is increased if the orthogonality conditions of all deeper lags are additionally used.

However, past levels may be bad instruments for future changes if the variables are close to a random walk. Therefore, as proposed by Blundell and Bond (1998), I apply the "system GMM" estimator that augments the estimator of Arellano and Bond (1991). The system GMM estimator achieves higher efficiency by additionally using the original equation in levels and therefore has more moment condition available. This comes at the cost of an additional assumption. The system GMM estimator assumes that changes in the instrumenting variables are uncorrelated with the fixed effects. See Roodman (2009) for details.

I estimated the model applying the more efficient two-step procedure and obtained the finite-sample corrected standard errors developed by Windmeijer (2005). Furthermore, instead of using first differences, I estimated the equation with forward orthogonal deviations (Arellano and Bover 1995). Instead of subtracting the previous observation from the contemporaneous one, this method subtracts the average of all future available observations of a variable. In this way, sample size is maximized, because the transformation is also possible for observations with a missing lagged value. This estimator was implemented in the statistical analysis software Stata by Roodman (2009).

The empirical strategy for estimating the effects of FDI on firm-level labor demand is further complicated by the fact that data on FDI is available only for one cross-section. This is a major problem for the dynamic panel estimation. The within and the GMM estimators need more than one observation per firm and variation over time for differencing the data. Furthermore, the GMM estimator uses lagged values of possibly endogenous variables (as FDI could be one) as instruments. With only one cross-section of FDI data available these estimators cannot be implemented.

I approach this problem by imputing the missing data. Hence, I use the results from Section 5 and predict the FDI activity of the firms in the years where FDI is not observed directly. I use a scaled-down version of the regression

[3] In this estimation: T is 5 (6 for the model with all employees), N lies between 5000 and 11000.

in Section 5, because the estimation has to be restricted to explaining variables that are available in all time periods in the dataset. Effectively, the scaled-down Probit model explains FDI activity by labor productivity, firm size, export intensity and dummy variables controlling for industry effects. The results are qualitatively the same as in Section 5. I report them in Table 8 in the Appendix.

I then use the predicted values of the probability to engage in FDI as the regressor of interest in the dynamic labor demand equation. Following this strategy, I get a variable indicating FDI activity for every time period in the dataset. This strategy leads to two new problems. Firstly, as I pointed out earlier, the Probit models in Section 5 seem to predict only horizontal (market seeking) FDI in an acceptable way. The model breaks down for vertical FDI. So this approach is limited to the analysis of horizontal FDI. Secondly, the estimation strategy has to take into account that the FDI variable is estimated in a first step. Using this variable in a second step estimation still leads to consistent estimates (Wooldridge 2002, chapter 6), but the standard errors are biased, so it is not possible to test for significance. Murphy and Topel (1985) provide a solution for the OLS case, but not for GMM. Wooldridge (2002, appendix 6A) derives a corrected covariance matrix for the instrumental variable approach. However, this solution is not implemented in Stata. Therefore, I apply bootstrapping with 500 replications in order to obtain the correct standard errors. However, in most cases the bootstrapped standard errors and the analytical ones do not differ qualitatively. So there seems to be no large bias.

The resulting baseline estimation equation is the following:

$$n_{it} = \alpha n_{i,t-1} + \beta_0 + \beta_1 ln(sales)_{it} + \beta_2 ln(wage)_{it} + \beta_3 FDI_{it} + \beta_4 X_{it+} \gamma_i + \upsilon_{it} \quad (8)$$

with X_{it} as a vector of control variables and γ_i representing an unobserved time-invariant firm-specific effect which may be correlated with other regressors. In X_{it} I include the share of unskilled employees in the firm, a dummy variable for the existence of a works council and a dummy variable for domestic investment activity. I further include dummy variables controlling for time, industry and regional effects. I expect a positive sign for the domestic investment variable, while I have no a priori expectations for the other control variables.

The major drawback of this estimation strategy is that it is not possible to analyze the effects of different motives for FDI. Therefore, I try to assess this effect in a second approach. This approach is based on the fact that the FDI variable is a flow value and the assumption that the firms didn't invest abroad in the years before. So I estimate GMM, OLS and within models with the FDI variable subdivided in dummy variables for firms with horizontal motives, vertical motives, and firms which reported both kinds of motives. This variables are set to 0 for the previous periods in which FDI is not reported at all. This may be an acceptable assumption for FDI flows (in contrast to FDI stocks).[4] However, the results should be treated with caution.

$$n_{it} = \alpha n_{i,t-1} + \beta_0 + \beta_1 ln(sales)_{it} + \beta_2 ln(wage)_{it} + \beta_3 horizontal_{it} + \beta_5 vertical_{it} + \beta_5 both_{it} + \beta_6 X_{it+} \gamma_i + \upsilon_{it} \quad (9)$$

[4] Actually, this is what the *xtabond2* command in Stata does by default. See Roodman (2009), p. 22.

I run all models with four different dependent variables: The baseline model estimates the demand for all employees, a second model estimates the demand for highly skilled employees, a third one analyzes the effects of FDI on moderately skilled employees (who have a vocational training), and a last model is estimated for unskilled employees.

6.3 Results

Effects of FDI on Total Employment

In Table 3 I show the results for 3 different specifications of the baseline regression for all employees including the generated FDI variable. In the first specification I run a basic model that includes only lagged employment, averages wages, sales, the FDI variable and time dummies. I present the GMM, OLS and within results for all specifications. In a second specification I add dummy variables for industry and regional effects. In a third specification, I also include the control variables in X_{it}.[5]

The results of this baseline model are as expected: I find a positive effect of the lagged dependent variable, a negative effect of the average wage level and a positive effect of sales. All these variables are highly significant.[6]

The generated FDI variable has a significantly positive impact on the level of employment. This result is not only found in the GMM regression but also in the OLS specification as well as in the within model. In particular the significantly positive result of the OLS regression emphasizes that the true value of the coefficient is positive because the OLS coefficient for FDI is biased downwards. The two further specifications with dummy variables for industry and regional effects included and with additional control variables lead to the same qualitative results. FDI has a significantly positive effect on total labor demand. This confirms hypothesis 1a.

Note that standard errors are computed via bootstrapping with 500 replications. This is necessary, because the analytical standard errors may be biased because of the generated FDI variable (Wooldridge 2002, p.116). A comparison between the analytical and bootstrapped standard errors reveals that the bootstrapped standard errors are a slightly larger, but yield the same qualitative results. A further comparison with an estimation without the FDI variable and reliable analytical standard errors (see Table 9 in the appendix) shows that the analytical standard errors in the model with FDI included do not seem to be biased downwards. This suggests that the analytical standard errors may be more precise.

However, different test statistics show that the results of the Blundell-Bond estimator may be invalid. The Arellano-Bond test for autocorrelation of first order rejects the null hypothesis of no autocorrelation at a high level of significance. This is expected, because first-order correlation of the errors is induced by first differencing the data. Therefore, the relevant test is whether the errors in first differences are AR(2) or not. This null hypothesis of no autocorrelation cannot be rejected at a significance level of 5%, but at the 10% level for some

[5] Table 9 in the appendix present a very basic specification without FDI variables. It shows largely the same results.

[6] This holds true for almost all different specifications, estimations methods, and different dependent variables (different skill groups).

Table 3: **Labor demand regression and effects of FDI for all employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log Employment$_{t-1}$	0.53***	0.93***	0.23***	0.52***	0.90***	0.23***	0.63***	0.90***	0.23***
	[14.07]	[224.07]	[8.99]	[13.33]	[185.11]	[9.18]	[15.70]	[174.04]	[8.77]
log Wages	-0.06***	-0.05***	-0.03***	-0.05**	-0.05***	-0.03**	-0.07***	-0.05***	-0.03*
	[-2.60]	[-9.60]	[-1.98]	[-2.46]	[-9.89]	[-2.00]	[-3.05]	[-8.48]	[-1.90]
log Sales	0.25***	0.05***	0.19***	0.23***	0.08***	0.19***	0.19***	0.08***	0.19***
	[10.89]	[15.12]	[7.02]	[10.60]	[17.00]	[7.00]	[7.69]	[16.72]	[6.85]
FDI	0.89***	0.11***	0.45***	0.81***	0.04*	0.46***	0.74***	0.06**	0.45***
	[5.57]	[5.98]	[4.20]	[5.02]	[1.76]	[4.33]	[4.47]	[2.51]	[4.20]
Works council (0/1)							0.26***	0.01**	0.00
							[3.89]	[2.08]	[0.52]
Share of unskilled workers							-0.07	0.08***	0.08***
							[-0.76]	[8.72]	[3.75]
Investment (0/1)							0.15**	0.04***	0.00
							[2.31]	[8.23]	[-0.01]
Constant	1.62***	0.19***	0.11	-1.53***	-0.43***	0.05	-1.23***	-0.49***	0.07
	[8.61]	[6.63]	[0.50]	[7.88]	[10.4]	[.21]	[5.93]	[11.4]	[0.31]
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
Regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
Observations	19792	19792	19792	19792	19792	19792	19779	19779	19779
Number of firms	8555		8555	8555		8555	8551		8551
R-squared		0.99	0.19		0.99	0.20		0.99	0.20
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.052			0.050			0.165		
Hansen test (p-value)	0.007			0.008			0.000		

GMM estimates are two-step system GMM (Blundell/Bond 1998). Standard errors are estimated by bootstrapping with 500 replications, z-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

specifications. This may weaken the reliability of the results. Furthermore, the Hansen test of overidentifying restrictions suggests that not all instruments meet the requirement of exogeneity. The Sargan test (not reported) comes to the same result. Choosing other lags or instrument sets as well as dividing the sample into West or East Germany didn't improve the test results.

Contrariwise, there are also factors that support the validity of the results. Firstly, in the subsample of the state of Baden-Württemberg the test results proved to be acceptable. The Baden-Württemberg results and those for the complete sample including all German states do not differ systematically. If there is a bias in the results for the entire sample, it is very small. Secondly, I can exploit the fact that the OLS estimator is biased upwards and the within estimator is biased downwards for the lagged dependent variable. The opposite is true for the other regressors. This relation is interchanged if the coefficient is negative. That way, I can obtain upper and lower bounds for credible estimates of the real coefficients. The unbiased GMM estimator should be in between the

OLS and the within results. The results show that this is true in every case for the lagged dependent variable and in most cases for the other variables. In the few cases when the GMM point estimate lies not in the OLS-within interval, it is not significantly different from one of the two other point estimates. All in all, the GMM results seem to be credible, even if the Hansen test statistic rejects exogeneity of all instruments.[7]

Table 4 presents the results for all employees. In this model, I include 3 dummy variables that indicate different motives for FDI. These dummy variables take the value 1 if a firm reports only horizontal investment motives, if it reports only vertical motives or if it reports both kinds of motives, respectively. In this specification, the results for the lagged dependent variable, for average wages, and for sales do not differ in a relevant way from the the specification with the generated FDI variable. The GMM estimator finds positive and mostly significant effects for firms which reported vertical motives and for firms that reported both motives. The OLS and within results don't support this finding, though. Neither do the GMM estimates of these respective coefficient fall into the interval between the OLS and the within results, nor does this interval lie in a significant range.

Hence, this specification fails to reliably find significant effects of different kinds of FDI. This may have different causes. On the one hand, not all firms with FDI activity also report on their motives. On the other hand, the assumption that the firms didn't invest abroad in the period before 2004 and not after 2005 may be too strict. All in all, hypotheses 1b and 1c cannot be confirmed with this dataset.

[7] The Hansen test statistic seems not to be highly reliable. For example, in several tests, it suggested that the dummy variables controlling for year-specific effects (which must be exogenous) are endogenous.

Table 4: **Labor demand regression and effects of different motives of FDI for all employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log Employment$_{t-1}$	0.68***	0.94***	0.19***	0.62***	0.91***	0.19***	0.64***	0.91***	0.19***
	[28.36]	[305.84]	[5.20]	[21.66]	[210.28]	[5.14]	[19.82]	[198.09]	[5.15]
log Wages	-0.07***	-0.04***	-0.03***	-0.06***	-0.05***	-0.03***	-0.07***	-0.04***	-0.03***
	[-4.57]	[-10.46]	[-2.82]	[-3.77]	[-11.93]	[-2.83]	[-4.52]	[-10.68]	[-2.78]
log Sales	0.22***	0.04***	0.19***	0.22***	0.07***	0.19***	0.20***	0.07***	0.19***
	[14.34]	[18.49]	[12.81	[14.06]	[19.55]	[12.72]	[10.56]	[19.26]	[12.71]
Horizontal FDI (0/1)	0.04	0.04**	0.01	0.09***	0.03*	0.01	0.04	0.03*	0.01
	[1.56]	[2.25]	[0.50]	[2.95]	[1.80]	[0.49]	[1.38]	[1.89]	[0.56]
Vertical FDI (0/1)	0.07***	0.02	-0.02	0.12***	0.02	-0.02	0.08**	0.02	-0.02
	[2.86]	[1.35]	[-1.00]	[3.55]	[1.44]	[-1.00]	[2.36]	[1.3]	[-0.87]
Both motives (0/1)	0.07***	0.04***	0.00	0.10***	0.03*	0.00	0.05*	0.03*	0.00
	[2.87]	[2.83]	[0.33]	[3.36]	[1.86]	[0.32]	[1.87]	[1.84]	[.027]
Works council (0/1)							0.31***	0.01***	0.00
							[4.59]	[3.71]	[0.57]
Share of unskilled workers							-0.02	0.07***	0.07***
							[-0.23]	[9.32]	[4.39]
Investment (0/1)							0.08*	0.03***	0.00
							[1.69]	[9.85]	[.02]
Constant	-1.58***	-0.14***	0.27	-1.54***	-0.39***	0.2	-1.31***	-0.45***	0.20
	[8.98]	[5.04]	[1.12]	[8.04]	[9.64]	[.82]	[6.04]	[10.44]	[.82]
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
Regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
Observations	23304	23304	23304	23304	23304	23304	23278	23278	23278
Number of firms	10515		10515	10515		10515	10506		10506
R-squared		0.99	0.16		0.99	0.16		0.99	0.16
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.022			0.042			0.153		
Hansen test (p-value)	0.000			0.000			0.000		

GMM estimation is two-step system GMM (Blundell/Bond 1998) with corrected standard errors (Windmeijer 2005).
OLS and within standard errors are robust, t-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

Effects of FDI on Different Skill Groups

The regressions results so far, that is for all employees, show that there is a positive effect of firm-level FDI activity on labor demand. However, theory suggests that there are different effects on different skill groups. As hypothesis 2 states, demand for highly-skilled employees should increase. Conversely, hypothesis 3 states that demand for unskilled employees should decrease. There is no a priori hypothesis for medium-skilled employees. They could be affected positively, negatively, or not at all.

In the following I present results for three different skill groups: highly-

skilled employees with a university or college degree, medium-skilled employees with a vocational training or German *Abitur*, and unskilled employees without vocational training. The econometric approach is the same as above for all employees, with the dependent variable being the number employees of a certain skill group in a firm. The average firm-level wage rate is replaced by the average wage rate of the respective skill group. For the sake of brevity, I only present the results for the specifications including the generated FDI variable in the text. In the appendix, I also present the specifications without international activity and the models which include different motives for FDI.

Table 5 presents the results for highly-skilled employees. In comparison to the model with all employees, the values for α are higher in all three specifications. This suggests that the number of highly qualified employees adjusts more slowly to the optimal level. Then again, the wage elasticity of the number of highly-skilled employees is larger than on all employees. A wage increase of 1% leads to a reduction of the number of highly-skilled employees of about 0.5%. While the effect of the wage rate is higher, the sales elasticity of the number of highly-skilled workers is smaller than for all employees. However, these differences may be driven by the characteristics of the dataset. In the model with all employees, only the IAB Establishment Panel is used, the models with different skill groups are based on the matched employer-employee dataset (LIAB). Since there is no perfect match between these two datasets, the differences in the results may stem from the data source.

For highly qualified employees and analytical standard errors, the effect of the FDI variable is significantly positive, too.[8] If bootstrapped standard errors are calculated, the significance is reduced. However, in the full model with controls for industry and regional effects and further control variables, there is still a weakly positive effect of FDI on labor demand. The size of the coefficient in the GMM model is approximately only half the size of the regression for all employees. However, the GMM model seems to be inefficient in this specification. The point estimate for the coefficient lies out of the OLS-within interval, but the standard error is quite big, so that the 95% confidence interval covers the OLS and within results easily. Still, the interval of OLS and within results also suggest that the effect of FDI on highly-skilled employment is smaller than on total employment. All in all, these results support hypothesis 2. Firm-level FDI activity has a positive impact on the demand for highly-skilled employees.[9]

Table 6 shows the results of labor demand regression for unskilled workers. Again, the regression equation is the same as for total employment and for highly-skilled employees, with the only difference, that the dependent variable is the number of unskilled workers and the wage variable is the average wage of unskilled workers on the firm-level. As in the model with all employees, the effects of lagged employment and sales are significantly positive, and the wage elasticity is significantly negative. The magnitude of the coefficient of the lagged dependent variable is approximately the same. The same holds true for the sales elasticity. The wage elasticity though is larger for unskilled workers than for all employees.

[8] The analytical standard errors are not reported in the table.

[9] Table 11 in the appendix presents results for labor demand regressions for highly skilled employees with different motives for FDI included. Again, as in the model for total employment, these regressions fail to find reliably significant effects of different motives on demand for qualified employees.

Table 5: **Labor demand regressions and effects of FDI for highly-skilled employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log highly-skilled employment$_{t-1}$	0.79***	0.96***	0.24***	0.79***	0.95***	0.24***	0.79***	0.95***	0.24***
	[9.57]	[236.04]	[6.54]	[12.23]	[185.18]	[6.63]	[12.51]	[176.55]	[6.40]
log Wages	-0.50***	-0.05***	-0.32***	-0.46***	-0.07***	-0.31***	-0.44***	-0.07***	-0.31***
	[-3.96]	[-4.04]	[-3.58]	[-3.29]	[-4.12]	[-3.60]	[-3.31]	[-4.12]	[-3.56]
log Sales	0.11**	0.03***	0.08**	0.09**	0.04***	0.08**	0.08*	0.04***	0.08**
	[2.03]	[5.69]	[2.32]	[1.97]	[6.07]	[2.19]	[1.65]	[5.88]	[2.13]
FDI	0.40	0.22***	0.24	0.47*	0.20***	0.24	0.52*	0.20***	0.24
	[1.47]	[5.67]	[1.40]	[1.71]	[3.85]	[1.38]	[1.91]	[3.92]	[1.41]
Works council (0/1)							0.26*	0.00	0.01
							[1.71]	[-0.23]	[0.48]
Share of unskilled workers							-0.09	-0.03	0.01
							[-0.37]	[-1.52]	[0.23]
Investment (0/1)							0.17	0.02	-0.01
							[1.18]	[1.43]	[-0.31]
Constant	0.91**	-0.08*	1.63***	0.92*	-0.16**	1.57***	0.77	-0.19***	1.56***
	[2.03]	[1.72]	[3.54]	[1.80]	[2.50]	[3.15]	[1.64]	[2.80]	[3.10]
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
Regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
Observations	8651	8651	8651	8651	8651	8651	8642	8642	8642
Number of firms	3718		3718	3718		3718	3714		3714
R-squared		0.97	0.11		0.97	0.11		0.97	0.11
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.068			0.076			0.083		
Hansen test (p-value)	0.000			0.000			0.016		

GMM estimates are two-step system GMM (Blundell/Bond 1998). Standard errors are estimated by bootstrapping with 500 replications. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

Again, the effect of FDI on demand for unskilled labor is significantly positive. However, this holds true only for the 10% significance level and the coefficient of the GMM (point) estimation is not included in the OLS-within interval. As in the case of highly-skilled workers, the GMM estimator seems to be inefficient, so that the 95% confidence interval of the GMM result overlaps the OLS-within interval. Still, with analytical standard errors, all three estimators lead to a significantly positive effect for FDI.[10] Bootstrapping the standard errors with 500 replications leads to significantly positive results only for the GMM and OLS model. The magnitude of this effect is comparable to the results for highly skilled employees. These results disprove hypothesis 3. Firm-level FDI activity has a positive impact on the demand for unskilled employees, not a negative one as suggested by theoretical considerations. The positive effects on

[10] The analytical standard errors are not reported in the table.

Table 6: **Labor demand regressions and effects of FDI on unskilled workers**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log Unskilled employees$_{t-1}$	0.58***	0.94***	0.17***	0.59***	0.92***	0.17***	0.62***	0.92***	0.17***
	[7.17]	[198.38]	[4.69]	[8.17]	[158.59]	[4.91]	[8.41]	[153.65]	[4.85]
log Wages	-0.48***	-0.04***	-0.35***	-0.42***	-0.07***	-0.35***	-0.36***	-0.08***	-0.36***
	[-6.18]	[-4.46]	[-5.23]	[-5.20]	[-6.25]	[-5.20]	[-4.67]	[-6.82]	[-5.30]
log Sales	0.25***	0.04***	0.16***	0.19***	0.05***	0.15***	0.17***	0.05***	0.16***
	[5.31]	[9.23]	[2.68]	[4.44]	[9.07]	[2.70]	[3.11]	[9.09]	[2.65]
FDI	0.56	0.17***	0.29	0.51	0.10*	0.28	0.62*	0.12**	0.28
	[1.60]	[3.75]	[1.50]	[1.59]	[1.73]	[1.49]	[1.89]	[2.05]	[1.36]
Works council (0/1)							0.33*	0.01	0.01
							[1.90]	[0.86]	[0.42]
Share of unskilled workers							-0.02	0.11***	0.08
							[-0.07]	[4.23]	[1.13]
investment (0/1)							0.11	0.02*	-0.02
							[0.65]	[1.68]	[-0.90]
constant	-1.47***	-0.35***	0.61	-0.6	-0.39***	0.82	-0.80*	-0.42***	0.77
	[3.64]	[8.23]	[1.15]	[1.43]	[6.79]	[1.31]	[1.85]	[6.89]	[1.25]
time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
observations	9723	9723	9723	9723	9723	9723	9711	9711	9711
number of firms	4331		4331	4331		4331	4326		4326
R-squared		0.95	0.12		0.95	0.12		0.95	0.12
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.022			0.014			0.017		
Hansen test (p-value)	0.559			0.154			0.138		

GMM estimates are two-step system GMM (Blundell/Bond 1998). Standard errors are estimated by bootstrapping with 500 replications. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

output seem to overcompensate possible negative effects that could stem from production relocation.[11]

Finally, Table 7 presents the results of regressions estimating the demand for medium-skilled employees. Workers with a medium-level qualification are those who received vocational training, but do not have a university or college degree. Again, the effects of the lagged dependent variable, average wages and sales are highly significant, and have the expected signs and magnitudes.

Surprisingly, the model cannot identify a significant effect of FDI on the demand for medium-skilled labor. This holds true for analytical as well as bootstrapped standard errors. The sign of the coefficients is positive, though. In two specifications, the OLS estimates lead to significant results, but this is

[11] Table 13 in the appendix presents results for labor demand regressions for unskilled employees with different motives for FDI included. Again, as in the model for total employment and highly skilled employees, these regressions fail to find reliable significant effects of different motives on demand for unskilled employees.

Table 7: **Labor demand regressions and effects of FDI for medium-skilled employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log skilled employees$_{t-1}$	0.71***	0.93***	0.21***	0.72***	0.92***	0.21***	0.74***	0.92***	0.21***
	[14.02]	[161.59]	[4.42]	[12.35]	[139.56]	[4.32]	[13.58]	[131.78]	[4.25]
log wages	-0.28***	-0.06***	-0.25***	-0.26***	-0.08***	-0.25***	-0.28***	-0.08***	-0.25***
	-3.930	-4.930	-3.050	[-3.53]	[-5.33]	[-2.99]	[-3.74]	[-5.40]	[-3.45]
log sales	0.25***	0.05***	0.18***	0.23***	0.07***	0.18***	0.20***	0.06***	0.18***
	[8.06]	[9.56]	[5.82]	[7.24]	[10.18]	[6.12]	[5.11]	[9.44]	[5.77]
FDI	0.29	0.19***	0.16	0.26	0.05	0.15	0.26	0.07*	0.16
	[1.39]	[5.85]	[0.91]	[1.18]	[1.29]	[0.93]	[1.15]	[1.73]	[0.91]
works council (0/1)							0.12	0.02**	-0.01
							[1.04]	[2.04]	[-0.38]
share unskilled							-0.05	-0.02	-0.03
							[-0.29]	[-1.26]	[-0.86]
investment (0/1)							0.15	0.04***	0.01
							[1.16]	[4.56]	[0.67]
constant	-1.82***	-0.39***	0.66*	-1.63***	-0.48***	0.4	-1.36***	-0.42***	0.31
	[6.82]	[10.01]	[1.80]	[5.91]	[8.57]	[1.01]	[4.65]	[7.51]	[0.79]
time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
Observations	16986	16986	16986	16986	16986	16986	16968	16968	16968
Number of firms	7350		7350	7350		7350	7342		7342
R-squared		0.97	0.11		0.97	0.11		0.97	0.11
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.157			0.152			0.148		
Hansen test (p-value)	0.000			0.000			0.000		

GMM estimates are two-step system GMM (Blundell/Bond 1998). Standard errors are estimated by bootstrapping with 500 replications. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

not supported by the GMM and within results. This outcome is surprising, because the effect of FDI on both, highly skilled and unskilled labor, is positive.

7 Conclusions

In this paper, I analyzed the determinants and effects of firm-level FDI flows. In accordance with the new micro-economic theories of heterogeneous firms, I demonstrate that only a small fraction of less than 3% of all firms invests abroad. However, the share of employees subject to social insurance contributions who are employed in those firms is higher. The descriptive analysis shows that firms investing abroad are larger and more productive than domestic firms. The productivity advantage of firms engaging in FDI is highly significant and still observable if size and industry effects are controlled for. Kernel density estimates for the productivity of domestic firms, exporters, and firms engaged in FDI show

an increasing ordering concerning productivity, as predicted by theory. Most firms invest into the Euro area, which is followed by the new EU members since 2004. Asked directly, firms report that the aim to acquire a new market is more important than the idea of saving (wage) costs.

An econometric analysis of the determinants of firm-level FDI activity shows that the most important driver of direct investments abroad are productivity and firm size. This goes in line with recent theoretical models. Furthermore, export experience plays an important role. In contrast to often produced arguments, wage cost reduction seems to play no major role for the decision to engage in FDI. These results are confirmed in the subsample of firms which reported horizontal (market-seeking) motives. Firms that report vertical (cost-seeking) motives seem to follow different decision processes.

Dynamic labor demand regressions based on theoretical models emphasize that direct investment in foreign countries does not lead to negative consequences for the employment in the considered firm. On the contrary, the models showed that there are positive effects of FDI activity on labor demand at the firm-level. This result is confirmed by various robustness checks.

Theory suggests that there are different effects of FDI on different skill groups. Unskilled workers should be affected worse than highly qualified employees. Dynamic labor demand regressions for different skill groups cannot confirm this hypothesis. The econometric analysis finds positive effects of FDI for highly skilled employees who hold a university or college degree as well as for unskilled employees who received no vocational training at all. Surprisingly, the data show no significant effect of FDI on the demand for medium-skilled employees who received vocational training, but hold no university or college degree.

It proves to be difficult to grasp empirically the different effects of horizontal (market-seeking) and vertical (cost-seeking) foreign direct investment. The labor demand regressions could not detect any significant effects of different motives of FDI. Most probably, this is a problem due to the underlying data and estimation strategy. However, it is noteworthy that the data do not show any negative labor demand effects of vertical FDI. This holds true for total employment and for each skill group, including unskilled workers.

All in all, the detailed analysis of determinants and effects of FDI flows on the firm-level proved that it is the most productive firms which invest abroad, that these firms invest because of market access motives, and that these direct investments are beneficial for their domestic employment level. Political or public fears that vertical FDI would lead to relocation of production and job losses seem to be exaggerated.

References

Arellano, M. and S. Bond (1991) "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *The Review of Economic Studies*, Vol. 58, No. 2, pp. 277–297.

Arellano, M. and O. Bover (1995) "Another Look at the Instrumental Variable Estimation of Error-Component Models", *Journal of Econometrics*, Vol. 68, No. 1, pp. 29–52.

Arndt, C. and A. Mattes (2007) "Struktur und Determinanten ausländischer Direktinvestitionen baden-württembergischer Betriebe", IAW-Kurzbericht 7/2007, Insitute for Applied Economic Research.

Arndt, C. and A. Mattes (2009) "Determinanten und Effekte von Direktinvestitionen im Ausland am Beispiel baden-württembergischer Betriebe", *AStA Wirtschafts-und Sozialstatistisches Archiv*, Vol. 3, No. 3, pp. 187–208.

Arndt, C., C. M. Buch, and A. Mattes (2009) "Barriers to Internationalization: Firm-Level Evidence from Germany", IAW Discussion Paper 52, Institute for Applied Economic Research.

Barba-Navaretti, G. and A. J. Venables (2004) *Multinational Firms in the World Economy*, New Jersey: Princeton University Press.

Bellmann, L. and A. Pahnke (2006) "Auswirkungen organisatorischen Wandels auf die betriebliche Arbeitsnachfrage", *Zeitschrift für ArbeitsmarktForschung*, Vol. 39, No. 2, pp. 201–233.

Bernard, A. B., J. B. Jensen, S. Redding, and P. Schott (2007) "Firms in International Trade", *Journal of Economic Perspectives*, Vol. 21, No. 3, pp. 105–130.

Bernard, A. B., S. J. Redding, and P. K. Schott (2007) "Comparative Advantage and Heterogeneous Firms", *Review of Economic Studies*, Vol. 74, No. 1, pp. 31–66.

Blomström, M. and A. Kokko (1998) "Multinational Corporations and Spillovers", *Journal of Economic surveys*, Vol. 12, No. 3, pp. 247–277.

Blundell, R. and S. Bond (1998) "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics*, Vol. 87, No. 1, pp. 115–143.

Brainard, S. L. (1993) "A Simple Theory of Multinational Corporations and Trade With a Trade-Off Between Proximity and Concentration", NBER Working Paper 4269, National Bureau of Economic Research.

Brainard, S. L. (1997) "An Empirical Assessment of the Proximity Concentration Trade-Off between Multinational Sales and Trade", *The American Economic Review*, Vol. 87, No. 4, pp. 520–544.

Breitung, J. (1992a) *Dynamische Modelle für die Paneldatenanalyse*, Frankfurt a.M.: Haag + Herchen.

Breitung, J. (1992b) *Produzieren in Niedersachsen*, Chap. Bestimmungsgründe der Arbeitsnachfrage niedersächsischer Industriebetriebe, pp. 89–105, Hannover: NIW.

Buch, C. M., J. Kleinert, A. Lipponer, and F. Toubal (2005) "Determinants and Effects of Foreign Direct Investment: Evidence from German Firm-Level Data", *Economic Policy*, Vol. 20, No. 41, pp. 52–110.

Buch, C. M., M. Schnitzer, C. Arndt, I. Kesternich, A. Mattes, C. Mugele, and H. Strotmann (2007) "Analyse der Beweggründe, der Ursachen und der Auswirkungen des so genannten Offshoring auf Arbeitsplätze und Wirtschaftsstruktur in Deutschland", IAW Policy Report, Institute for Applied Economic Research.

Deardorff, A. (1998) *The Regionalization of the World Economy*, Chap. Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World, pp. 7–28, Chicago: University of Chicago Press.

Feenstra, R. and G. Hanson (2001) "Global production sharing and rising inequality: A survey of trade and wages", NBER Working Paper 8372, National Bureau of Economic Research.

Fischer, G., F. Janik, D. Müller, and A. Schmucker (2008) "Das IAB-Betriebspanel - von der Stichprobe über die Erhebung bis zur Hochrechnung", FDZ Methodenreport 01/2008, Institut für Arbeitsmarkt- und Berufsforschung.

Gartner, H. (2005) "The Imputation of Wages above the Contribution Limit with the German IAB Employment Sample", FDZ Methodenreport 2/2005, Institut fï¿œr Arbeitsmarkt- und Berufsforschung.

Grossman, G., E. Helpman, and A. Szeidl (2006) "Optimal integration strategies for the multinational firm", *Journal of International Economics*, Vol. 70, No. 1, pp. 216–238.

Harris, M. L., M. and P. Sevestre (2008) *The Econometrics of Panel Data: Fundamentals and Recent Developments in Theory and Practice*, 3rd edition, Chap. Dynamic Models for Short Panels, pp. 249–278: Matyas, L. and Sevestre, P.

Helpman, E. (1984) "A Simple Theory of International Trade with Multinational Corporations", *The Journal of Political Economy*, Vol. 92, No. 3, pp. 451–471.

Helpman, E. (2006) "Trade, FDI, and the Organization of Firms", *Journal of Economic Literature*, pp. 589–630.

Helpman, E., M. J. Melitz, and S. R. Yeaple (2004) "Export versus FDI with Heterogeneous Firms", *American Economic Review*, Vol. 94, No. 1, pp. 300–316.

IMF (1993) "Balance of Payments Manual", Manual, International Monetary Fund.

Jacobebbinghaus, P. (2008) "LIAB-Datenhandbuch Version 3.0", FDZ Datenreport 3/2008, Bundesagentur fï¿œr Arbeit.

Javorcik, B. (2004) "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages", *The American Economic Review*, Vol. 94, No. 3, pp. 605–627.

Kleinert, J. and F. Toubal (2005) "Gravity for FDI", CeGE Discussion Paper 46, Center for Globalization and Europeanization of the Economy.

Kölling, A. (1998) "Dynamische Arbeitsnachfrage und asymmetrisches Anpassungsverhalten in der Bundesrepublik Deutschland. Eine Untersuchung mit Daten aus dem IAB-Betriebspanel", *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung*, Vol. 31, No. 4, pp. 637–647.

Krugman, P. (1979) "Increasing Returns, Monopolistic Competition, and International Trade", *Journal of International Economics*, Vol. 9, No. 4, pp. 469–479.

Krugman, P. (1995) "Urban Concentration: The Role of Increasing Returns and Transport Costs", in *Proceedings of the World Bank Annual Conference on Development Economics 1994*, The International Bank for Reconstruction and Development / The World Bank.

Markusen, J. (2002) *Multinational firms and the theory of international trade*: The MIT Press.

Mattes, A. and J. Spies (2009) "Außenwirtschaftliche Verbindungen der deutschen Bundesländer zur Republik Österreich", IAW Discussion Paper 49, Institute for Applied Economic Research.

Melitz, M. J. (2003) "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica*, Vol. 71, No. 6, pp. 1695–1725.

Murphy, K. and R. Topel (1985) "Estimation and Inference in Two Step Econometric Models", *Journal of Business and Economic Statistics*, Vol. 3, pp. 370–379.

Nickell, S. (1981) "Biases in Dynamic Models with Fixed Effects", *Econometrica*, Vol. 49, No. 6, pp. 1417–1426.

OECD (2008) *OECD Benchmark Definition of Foreign Direct Investment*: Organisation for Economic Co-operation and Development, 4th edition.

Roodman, D. (2009) "How to do xtabond2: An introduction to difference and system GMM in Stata", *Stata Journal*, Vol. 9(1), pp. 86–136.

Sargent, T. (1978) "Estimation of Dynamic Labor Demand Schedules under Rational Expectations", *The Journal of Political Economy*, Vol. 86, No. 6, pp. 1009– 1044.

Schröder, P. J. and A. Sorensen (2009) "Second Thoughts on Exporter Productivity", economics working papers, School of Economics and Management, University of Aarhus. Research Paper.

United Nations Conference on Trade and Development (2008) *World Investment Report - Transnational Corporations and the Infrastructure Challenge*: United Nations.

Wagner, J. (2006) "Exports, Foreign Direct Investment, and Productivity: Evidence from German Firm Level Data", *Applied Economic Letters*, Vol. 13, No. 6, pp. 347–349.

Windmeijer, F. (2005) "A Finite Sample Correction for the Variance of Linear Efficient Two-Step GMM Estimators", *Journal of Econometrics*, Vol. 126, No. 1, pp. 25–51.

Wooldridge, J. M. (2002) *Econometric Analysis of Cross Section and Panel Data*: MIT Press, Cambridge MA.

Appendix 1

The linked employer-employee dataset (LIAB) provided by the Institute for Employment Research in Nuremberg is a complex dataset. In this Appendix I give a short overview of the major features and problems for empirical application. The data stem from two different sources. The first one is the IAB Establishment Panel. This survey is designed to give a rich picture of labor demand of German establishments. It consists of a representative sample of about 16,000 establishments and includes a large variety of questions concerning a firm's employment. Furthermore, questions regarding innovation, international activities, and other topics are included. For the use of the LIAB, it is important to note that the level of observation is the single establishment. I give a more detailed description of this dataset in Section 3. Fischer et al. (2008) provide a detailed overview on the survey, the sampling and questions regarding the sampling weights.

The second source of data, the IAB employment sample, is process data from the Federal Employment Agency (Bundesagentur für Arbeit). The data come from social security accounts (*Beschäftigten-Leistungsempfänger-Historik-Datei*). It is going back to 1975. Each firm with employees subject to social insurance needs to report certain data about each employee to the social insurance system on a regular basis (at least once a year). The data submitted include the daily wage, the profession, the level of education, age, sex, and an identifier for the establishment the employee is working in. Jacobebbinghaus (2008) provides a detailed overview of the LIAB dataset. In contrast to the IAB Establishment Panel, the level of observation of this dataset is the single employee. Unfortunately, the IAB employment sample contains the wages for the employees only up to the contribution limit of social insurance. This limit is increasing over time and was at 5250 Euro per month at the end of 2006, which was the last year included in the empirical analysis. [12] Earnings above this limit are not subject to social insurance contribution and are therefore not included in the reports to social security accounts. This reporting limit leads to a top-censored dataset, which in turn would lead to wrong results in the empirical analysis. Therefore, I estimated the wages above the limit and imputed the predicted values. I followed Gartner (2005) in the imputation strategy. The idea of this approach is to estimate the censored values by a Tobit model. I used work experience and work experience squared, educational level, sex, age, a West Germany dummy, the citizenship, the professional rank, a variable describing the employment contract and industry dummies on a 2-digit level as independent variables in the Tobit model. In order to avoid problems regarding generated variables in further regressions, I again follow Gartner (2005) and add a random term with the standard deviation from the Tobit estimation to the predicted wage. This way the standard errors of second step estimations are not biased downwards. After imputing the missing, top-censored wages, I aggregated the data at the level of the establishment. This way I obtained the average wages of different skill groups in each establishment. I calculated the average wage for unskilled employees, skilled employees and highly skilled employees. I defined unskilled employees as those who did not complete a vocational training (unless they passed the German Hochschulreife/Abitur, the

[12] 5300 Euro per month at the end of 2008

general qualification for university entrance). Skilled employees are those who completed a vocational training or passed the Abitur. Employees who passed university or college are considered as highly skilled.

In the last step, the two datasets, the IAB Establishment Panel and the aggregated IAB employment sample were merged using the identifier for the establishments.

Appendix 2

This appendix presents the results of the Probit regression used to generate the FDI variable in all years of observation. The regression is based on the model in Section 5. However, in order to obtain estimates for the probability to engage in FDI for every period in the dataset, an additional assumption and some changes in the regressors have to be made. Firstly, I assume that the firms which reported FDI flows for 2004 and/or 2005 invested in 2005 (and maybe also in 2004, but not only in 2004). Secondly, I use contemporary regressors instead of lagged regressors, so that I do not lose all observations for the first period in the dataset. Thirdly, I reduce the set of regressors to variables that are available for all periods. The qualitative results do not differ from the results of the full model in Section 5. The results of the scaled-down Probit model are presented in Table 8:

Table 8: **Scaled-down Probit model for imputation of FDI activity**

	FDI (0/1)
log Productivity	0.1384808**
	[2.43]
Export share	0.0345692***
	[6.28]
Export share (squared)	-0.0002822***
	[-4.49]
log Employees	0.2961114***
	[9.34]
Industry dummies	yes
Observations	5534
Pseudo-R2	0.343

Robust standard errors, z-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2005-2006, own calculations

Since the information about FDI flows is only available for the years 2004/2005, I used the results of this model to estimate the probability to engage in FDI in all periods. The resulting out-of-sample predictions form the generated regressor for the labor demand regressions in Section 6. Note that this leads to the generated regressors problem in any second-step estimations. This problem is tackled by bootstrapping (see Subsection 6.2).

Table 9: **Baseline labor demand regression for all employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log employment$_{t-1}$	0.67***	0.94***	0.19***	0.61***	0.91***	0.19***	0.64***	0.91***	0.19***
	[27.50]	[305.88]	[5.20]	[20.06]	[210.24]	[5.14]	[19.87]	[198.05]	[5.15]
log wages	-0.07***	-0.04***	-0.03***	-0.06***	-0.05***	-0.03***	-0.07***	-0.04***	-0.03***
	[4.50]	[10.45]	[2.82]	[3.62]	[11.94]	[2.83]	[4.55]	[10.7]	[2.78]
log sales	0.22***	0.04***	0.19***	0.22***	0.07***	0.19***	0.20***	0.07***	0.19***
	[14.36]	[18.54]	[12.80]	[14.06]	[19.58]	[12.71]	[10.53]	[19.29]	[12.71]
works council (0/1)							0.30***	0.01***	0.00
							[4.52]	[3.7]	[.57]
share of unskilled workers							-0.03	0.07***	0.07***
							[.37]	[9.29]	[4.39]
investment (0/1)							0.08*	0.03***	0.00
							[1.76]	[9.87]	[.02]
constant	-1.58***	-0.15***	0.27	-1.53***	-0.39***	0.2	-1.30***	-0.45***	0.24
	[8.97]	[5.11]	[1.12]	[7.93]	[9.67]	[.82]	[5.99]	[10.46]	[.97]
time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
observations	23304	23304	23304	23304	23304	23304	23278	23278	23278
number of firms	10515		10515	10515		10515	10506		10506
R-squared		0.99	0.16		0.99	0.16		0.99	0.16
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.016			0.018			0.125		
Hansen test (p-value)	0.000			0.000			0.000		

GMM estimation is two-step system GMM (Blundell/Bond 1998) with corrected standard errors (Windmeijer 2005).
OLS and within standard errors are robust, t-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

Appendix 3

In this Appendix, I provide additional results for the labor demand regressions from Section 6. Firstly, I provide results for the basic models without FDI variables. These results serve as baseline models and are easily comparable to other publications using the IAB Establishment Panel. Furthermore, they allow a comparison between the analytical standard errors and the bootstrapped standard errors in the models with FDI included. Secondly, I present the results for the labor demand regressions containing dummy variables of different motives for FDI. Since the results are mostly insignificant, they are not included in the main text. However, these results provide evidence that even vertical FDI has no significantly negative effect on labor demand which disproves the related hypotheses 1b and 1c.

Table 10: **Baseline labor demand regression for highly-skilled employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log highly-skilled employees$_{t-1}$	0.77***	0.96***	0.19***	0.75***	0.95***	0.19***	0.74***	0.95***	0.19***
	[22.75]	[425.34]	[8.73]	[19.39]	[324.68]	[8.65]	[17.97]	[312.20]	[8.59]
log wages	-0.52***	-0.05***	-0.30***	-0.46***	-0.07***	-0.30***	-0.48***	-0.08***	-0.30***
	[-7.32]	[-6.35]	[-7.18]	[-7.08]	[-7.82]	[-7.14]	[-7.04]	[-7.88]	[-7.12]
log sales	0.11***	0.03***	0.07***	0.10***	0.04***	0.07***	0.08**	0.04***	0.07***
	[5.44]	[13.46]	[3.81]	[3.97]	[14.92]	[3.85]	[2.50]	[14.30]	[3.86]
works council							0.41***	0.00	0.01
							[4.79]	[0.25]	[0.75]
share of unskilled workers							0.07	-0.03**	0.00
							[0.31]	[2.33]	[0.14]
investment (0/1)							0.21***	0.03***	-0.01
							[2.60]	[3.56]	[-0.89]
constant	1.05***	-0.13***	1.82***	0.88*	-0.18***	1.80***	1.08**	-0.18***	1.88***
	[2.76]	[-3.67]	[5.26]	[1.92]	[-3.61]	[4.79]	[2.19]	[-3.50]	[4.96]
time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
observations	13349	13349	13349	13349	13349	13349	13327	13327	13327
number of firms	5718		5718	5718		5718	5710		5710
R-squared		0.96	0.08		0.96	0.08		0.96	0.08
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.044			0.045			0.091		
Hansen test (p-value)	0.000			0.000			0.002		

GMM estimation is two-step system GMM (Blundell/Bond 1998) with corrected standard errors (Windmeijer 2005).
OLS and within standard errors are robust, t-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

Table 11: **Labor demand regressions and effects of different motives for FDI on highly-skilled employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log highly-skilled employment$_{t-1}$	0.79***	0.96***	0.19***	0.75***	0.95***	0.19***	0.74***	0.95***	0.19***
	[24.19]	[425.88]	[8.72]	[20.08]	[325.02]	[8.64]	[18.19]	[312.49]	[8.58]
log wages	-0.51***	-0.05***	-0.30***	-0.46***	-0.07***	-0.30***	-0.48***	-0.08***	-0.30***
	[-7.32]	[-6.40]	[-7.17]	[-7.12]	[-7.80]	[-7.14]	[-7.03]	[-7.86]	[-7.12]
log sales	0.11***	0.03***	0.07***	0.11***	0.04***	0.07***	0.08**	0.04***	0.07***
	[5.37]	[13.34]	[3.81]	[4.07]	[14.86]	[3.85]	[2.55]	[14.25]	[3.86]
horizontal FDI (0/1)	0.14***	0.06***	0.02	0.12***	0.05**	0.02	0.10**	0.04**	0.02
	[3.56]	[2.95]	[0.95]	[2.65]	[2.23]	[0.91]	[2.15]	[2.09]	[0.92]
vertical FDI (0/1)	0.12*	-0.01	-0.03	0.10	-0.02	-0.03	0.12	-0.02	-0.03
	[1.74]	[-0.20]	[-0.67]	[1.49]	[-0.27]	[-0.68]	[1.41]	[-0.29]	[-0.65]
both motives (0/1)	0.16***	0.08***	-0.01	0.12***	0.06***	-0.01	0.08**	0.06***	-0.01
	[4.13]	[4.11]	[-0.31]	[3.11]	[3.36]	[-0.28]	[2.10]	[3.35]	[-0.30]
works council (0/1)							0.40***	0.00	0.01
							[4.68]	[0.27]	[0.76]
share of unskilled workers							0.06	-0.03**	0.00
							[0.29]	[-2.32]	[0.15]
investment (0/1)							0.20**	0.03***	-0.01
							[2.53]	[3.54]	[-0.90]
constant	0.98***	-0.12***	1.81***	0.81*	-0.18***	1.90***	1.06**	-0.18***	1.88***
	[2.62]	[-3.48]	[5.26]	[1.79]	[3.57]	[5.03]	[2.15]	[-3.47]	[4.95]
time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
observations	13349	13349	13349	13349	13349	13349	13327	13327	13327
number of firms	5718		5718	5718		5718	5710		5710
R-squared		0.96	0.08		0.96	0.08		0.96	0.08
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.070			0.060			0.108		
Hansen test (p-value)	0.000			0.000			0.001		

GMM estimation is two-step system GMM (Blundell/Bond 1998) with corrected standard errors (Windmeijer 2005).
OLS and within standard errors are robust, t-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

Table 12: **Baseline labor demand regression for unskilled employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log unskilled workers$_{t-1}$	0.54***	0.94***	0.13***	0.56***	0.92***	0.13***	0.61***	0.91***	0.13***
	[14.15]	[329.45]	[7.74]	[14.88]	[267.29]	[7.70]	[18.25]	[254.23]	[7.66]
log wages	-0.50***	-0.04***	-0.34***	-0.47***	-0.06***	-0.35***	-0.41***	-0.07***	-0.35***
	[-9.34]	[-7.51]	[-9.43]	[-8.20]	[-9.30]	[-9.81]	[-7.84]	[-10.43]	[-9.82]
log sales	0.21***	0.04***	0.17***	0.18***	0.05***	0.16***	0.17***	0.06***	0.17***
	[10.07]	[17.36]	[7.16]	[7.65]	[19.32]	[7.10]	[6.08]	[17.79]	[7.12]
works council (0/1)							0.32***	0.01	0.01
							[3.71]	[1.17]	[0.39]
share of unskilled workers							-0.17	0.13***	0.03
							[-0.95]	[8.58]	[0.89]
investment (0/1)							0.14	0.03***	-0.01
							[1.48]	[3.60]	[-0.60]
constant	-0.65*	-0.40***	0.36	-0.21	-0.45***	0.96**	-0.58	-0.48***	0.43
	[-1.79]	[-12.8]	[0.93]	[-0.47]	[-9.62]	[2.11]	[-1.43]	[-9.79]	[0.97]
time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
observations	15420	15420	15420	15420	15420	15420	15394	15394	15394
number of firms	6729		6729	6729		6729	6720		6720
R-squared		0.94	0.10		0.94	0.11		0.94	0.11
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.515			0.403			0.391		
Hansen test (p-value)	0.022			0.017			0.006		

GMM estimation is two-step system GMM (Blundell/Bond 1998) with corrected standard errors (Windmeijer 2005).
OLS and within standard errors are robust, t-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

Table 13: **Labor demand regressions and effects of different motives for FDI on unskilled employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log unskilled employment$_{t-1}$	0.56***	0.94***	0.13***	0.57***	0.92***	0.13***	0.61***	0.91***	0.13***
	[16.19]	[328.39]	[7.74]	[15.97]	[267.16]	[7.70]	[18.55]	[254.06]	[7.66]
log wages	-0.50***	-0.04***	-0.34***	-0.47***	-0.06***	-0.35***	-0.41***	-0.07***	-0.35***
	[-9.45]	[-7.52]	[-9.43]	[-8.26]	[-9.30]	[-9.81]	[-7.83]	[-10.43]	[-9.82]
log sales	0.20***	0.04***	0.17***	0.17***	0.05***	0.16***	0.17***	0.06***	0.17***
	[9.66]	[17.30]	[7.16]	[7.34]	[19.28]	[7.10]	[6.07]	[17.76]	[7.12]
horizontal FDI (0/1)	0.32***	0.02	-0.02	0.15**	0.00	-0.02	0.05	0.00	-0.01
	[4.11]	[1.00]	[-0.51]	[2.31]	[0.13]	[-0.51]	[0.81]	[0.07]	[-0.50]
vertical FDI (0/1)	0.36***	0.05	-0.01	0.21***	0.02	0.00	0.16**	0.02	-0.01
	[3.60]	[1.19]	[-0.27]	[2.89]	[0.64]	[-0.15]	[2.53]	[0.67]	[-0.25]
both motives (0/1)	0.39***	0.04	-0.01	0.18***	0.01	-0.01	0.07	0.01	-0.01
	[4.93]	[1.45]	[-0.42]	[2.77]	[0.40]	[-0.43]	[1.35]	[0.42]	[-0.44]
works council (0/1)							0.32***	0.01	0.01
							[3.77]	[1.18]	[0.39]
share of unskilled workers							-0.16	0.13***	0.03
							[-0.90]	[8.58]	[0.88]
investment (0/1)							0.14	0.03***	-0.01
							[1.43]	[3.60]	[-0.60]
constant	-0.61*	-0.39***	0.36	-0.14	-0.45***	0.96**	-0.57	-0.48***	0.43
	[-1.69]	[-12.75]	[0.93]	[-0.32]	[-9.61]	[2.11]	[-1.41]	[-9.77]	[0.97]
time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
observations	15420	15420	15420	15420	15420	15420	15394	15394	15394
number of firms	6729		6729	6729		6729	6720		6720
R-squared		0.94	0.10		0.94	0.11		0.94	0.11
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.931			0.515			0.414		
Hansen test (p-value)	0.063			0.029			0.007		

GMM estimation is two-step system GMM (Blundell/Bond 1998) with corrected standard errors (Windmeijer 2005).
OLS and within standard errors are robust, t-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

Table 14: **Baseline labor demand regression for medium-skilled employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log medium-skilled employees$_{t-1}$	0.63***	0.94***	0.14***	0.63***	0.92***	0.14***	0.68***	0.92***	0.14***
	[20.67]	[307.12]	[6.43]	[17.97]	[257.06]	[6.41]	[21.34]	[247.87]	[6.43]
log wages	-0.30***	-0.05***	-0.25***	-0.27***	-0.07***	-0.25***	-0.28***	-0.07***	-0.25***
	[5.95]	[7.26]	[7.1]	[5.63]	[7.82]	[7.14]	[6.26]	[8.21]	[7.13]
log sales	0.26***	0.05***	0.19***	0.25***	0.06***	0.19***	0.22***	0.06***	0.19***
	[14.59]	[19.35]	[11.04]	[14.22]	[19.57]	[11.06]	[10.14]	[18.43]	[11.01]
works council (0/1)							0.22***	0.02***	0.01
							[3.00]	[3.83]	[1.24]
share of unskilled workers							-0.11	-0.01	0
							[0.80]	[1.31]	[0.04]
investment (0/1)							0.17***	0.04***	0.01*
							[2.83]	[8.61]	[1.68]
constant	-1.70***	-0.43***	0.51*	-1.65***	-0.52***	0.53	-1.46***	-0.46***	0.31
	[7.21]	[14.25]	[1.79]	[6.38]	[11.98]	[1.63]	[5.44]	[10.71]	[0.96]
time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
observations	26917	26917	26917	26917	26917	26917	26876	26876	26876
number of firms	11047		11047	11047		11047	11031		11031
R-squared			0.09		0.97	0.10		0.97	0.10
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.045			0.041			0.032		
Hansen test (p-value)	0.000			0.000			0.000		

GMM estimation is two-step system GMM (Blundell/Bond 1998) with corrected standard errors (Windmeijer 2005).
OLS and within standard errors are robust, t-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

Table 15: **Labor demand regressions and effects of different motives for FDI on medium-skilled employees**

	[1]			[2]			[3]		
	GMM	OLS	within	GMM	OLS	within	GMM	OLS	within
log medium-skilled employees$_{t-1}$	0.63***	0.94***	0.14***	0.63***	0.92***	0.14***	0.68***	0.92***	0.14***
	[21.23]	[306.65]	[6.43]	[18.58]	[257.04]	[6.41]	[21.34]	[247.85]	[6.43]
log wages	-0.29***	-0.05***	-0.25***	-0.27***	-0.07***	-0.25***	-0.28***	-0.07***	-0.25***
	[5.93]	[7.27]	[7.10]	[5.61]	[7.83]	[7.14]	[6.25]	[8.22]	[7.13]
log sales	0.26***	0.05***	0.19***	0.25***	0.06***	0.19***	0.22***	0.06***	0.19***
	[14.57]	[19.32]	[11.04]	[14.12]	[19.59]	[11.06]	[10.14]	[18.45]	[11.01]
horizontal FDI (0/1)	0.11**	0.03*	0.02	0.07*	0.00	0.02*	0.00	0.00	0.02*
	[2.52]	[1.67]	[1.64]	[1.72]	[0.26]	[1.68]	[0.03]	[0.11]	[1.67]
vertical FDI (0/1)	0.1	-0.04	0.01	0.05	-0.06	0.01	0	-0.06	0.02
	[1.44]	[0.41]	[0.47]	[0.71]	[0.68]	[0.41]	[0.05]	[0.67]	[0.52]
both motives (0/1)	0.12**	0.03	-0.02	0.07	0.00	-0.03	-0.02	0.00	-0.03
	[2.41]	[1.35]	[1.31]	[1.29]	[0.02]	[1.29]	[0.40]	[0.07]	[1.34]
works council (0/1)							0.22***	0.02***	0.01
							[3.07]	[3.81]	[1.24]
share of unskilled workers							-0.11	-0.01	0.00
							[0.81]	[1.30]	[0.04]
investment (0/1)							0.18***	0.04***	0.01*
							[2.86]	[8.62]	[1.68]
constant	-1.71***	-0.42***	0.51*	-1.65***	-0.52***	0.52	-1.45***	-0.46***	0.41
	[7.23]	[14.16]	[1.79]	[6.36]	[11.98]	[1.63]	[5.42]	[10.72]	[1.26]
time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
industry dummies	no	no	no	yes	yes	yes	yes	yes	yes
regional dummies	no	no	no	yes	yes	yes	yes	yes	yes
observations	26917	26917	26917	26917	26917	26917	26876	26876	26876
number of firms	11047		11047	11047		11047	11031		11031
R-squared		0.97	0.09		0.97	0.10		0.97	0.10
AB test (1) (p-value)	0.000			0.000			0.000		
AB test (2) (p-value)	0.053			0.044			0.032		
Hansen test (p-value)	0.000			0.000			0.000		

GMM estimation is two-step system GMM (Blundell/Bond 1998) with corrected standard errors (Windmeijer 2005).
OLS and within standard errors are robust, t-values in brackets. *, **, *** significant at the 10%, 5%, 1%-level.
Source: IAB Establishment Panel 2002-2007, own calculations

IAW-Diskussionspapiere

Bisher erschienen:

Nr. 1 (September 2001)

Das Einstiegsgeld – eine zielgruppenorientierte negative Einkommensteuer: Konzeption, Umsetzung und eine erste Zwischenbilanz nach 15 Monaten in Baden-Württemberg

Sabine Dann / Andrea Kirchmann / Alexander Spermann / Jürgen Volkert

Nr. 2 (Dezember 2001)

Die Einkommensteuerreform 1990 als natürliches Experiment. Methodische und konzeptionelle Aspekte zur Schätzung der Elastizität des zu versteuernden Einkommens

Peter Gottfried / Hannes Schellhorn

Nr. 3 (Januar 2001)

Gut betreut in den Arbeitsmarkt? Eine mikroökonomische Evaluation der Mannheimer Arbeitsvermittlungsagentur

Jürgen Jerger / Christian Pohnke / Alexander Spermann

Nr. 4 (Dezember 2001)

Das IAW-Einkommenspanel und das Mikrosimulationsmodell SIMST

Peter Gottfried / Hannes Schellhorn

Nr. 5 (April 2002)

A Microeconometric Characterisation of Household Consumption Using Quantile Regression

Niels Schulze / Gerd Ronning

Nr. 6 (April 2002)

Determinanten des Überlebens von Neugründungen in der baden-württembergischen Industrie – eine empirische Survivalanalyse mit amtlichen Betriebsdaten

Harald Strotmann

Nr. 7 (November 2002)

Die Baulandausweisungsumlage als ökonomisches Steuerungsinstrument einer nachhaltigkeitsorientierten Flächenpolitik

Raimund Krumm

Nr. 8 (März 2003)

Making Work Pay: U.S. American Models for a German Context?

Laura Chadwick, Jürgen Volkert

Nr. 9 (Juni 2003)

Erste Ergebnisse von vergleichenden Untersuchungen mit anonymisierten und nicht anonymisierten Einzeldaten am Beispiel der Kostenstrukturerhebung und der Umsatzsteuerstatistik

Martin Rosemann

Nr. 10 (August 2003)

Randomized Response and the Binary Probit Model

Gerd Ronning

Nr. 11 (August 2003)

Creating Firms for a New Century: Determinants of Firm Creation around 1900

Joerg Baten

Nr. 12 (September 2003)

Das fiskalische BLAU-Konzept zur Begrenzung des Siedlungsflächenwachstums

Raimund Krumm

IAW-Diskussionspapiere

Nr. 13 (Dezember 2003)
Generelle Nichtdiskontierung als Bedingung für eine nachhaltige Entwicklung?
Stefan Bayer

Nr. 14 (Februar 2003)
Die Elastizität des zu versteuernden Einkommens. Messung und erste Ergebnisse zur empirischen Evidenz für die Bundesrepublik Deutschland.
Peter Gottfried / Hannes Schellhorn

Nr. 15 (Februar 2004)
Empirical Evidence on the Effects of Marginal Tax Rates on Income –The German Case
Peter Gottfried / Hannes Schellhorn

Nr. 16 (Juli 2004)
Shadow Economies around the World: What do we really know?
Friedrich Schneider

Nr. 17 (August 2004)
Firm Foundations in the Knowledge Intensive Business Service Sector. Results from a Comparative Empirical Study in Three German Regions
Andreas Koch / Thomas Stahlecker

Nr. 18 (Januar 2005)
The impact of functional integration and spatial proximity on the post-entry performance of knowledge intensive business service firms
Andreas Koch / Harald Strotmann

Nr. 19 (März 2005)
Legislative Malapportionment and the Politicization of Germany's Intergovernmental Transfer System
Hans Pitlik / Friedrich Schneider / Harald Strotmann

Nr. 20 (April 2005)
Implementation ökonomischer Steuerungsansätze in die Raumplanung
Raimund Krumm

Nr. 21 (Juli 2005)
Determinants of Innovative Activity in Newly Founded Knowledge Intensive Business Service Firms
Andreas Koch / Harald Strotmann

Nr. 22 (Dezember 2005)
Impact of Opening Clauses on Bargained Wages
Wolf Dieter Heinbach

Nr. 23 (Januar 2006)
Hat die Einführung von Gewinnbeteiligungsmodellen kurzfristige positive Produktivitätswirkungen? – Ergebnisse eines Propensity-Score-Matching-Ansatzes
Harald Strotmann

Nr. 24 (März 2006)
Who Goes East? The Impact of Enlargement on the Pattern of German FDI
Claudia M. Buch / Jörn Kleinert

Nr. 25 (Mai 2006)
Estimation of the Probit Model from Anonymized Micro Data
Gerd Ronning / Martin Rosemann

IAW-Diskussionspapiere

Nr. 26 (Oktober 2006)
Bargained Wages in Decentralized Wage-Setting Regimes
Wolf Dieter Heinbach

Nr. 27 (Januar 2007)
A Capability Approach for Official German Poverty and Wealth Reports:
Conceptual Background and First Empirical Results
Christian Arndt / Jürgen Volkert

Nr. 28 (Februar 2007)
Typisierung der Tarifvertragslandschaft – Eine Clusteranalyse der tarifvertraglichen Öffnungsklauseln
Wolf Dieter Heinbach / Stefanie Schröpfer

Nr. 29 (März 2007)
International Bank Portfolios: Short- and Long-Run Responses to the Business Cycles
Sven Blank / Claudia M. Buch

Nr. 30 (April 2007)
Stochastische Überlagerungen mit Hilfe der Mischungsverteilung
Gerd Ronning

Nr. 31 (Mai 2007)
Openness and Growth: The Long Shadow of the Berlin Wall
Claudia M. Buch / Farid Toubal

Nr. 32 (Mai 2007)
International Banking and the Allocation of Risk
Claudia M. Buch / Gayle DeLong / Katja Neugebauer

Nr. 33 (Juli 2007)
Multinational Firms and New Protectionisms
Claudia M. Buch / Jörn Kleinert

Nr. 34 (November 2007)
Within-Schätzung bei anonymisierten Paneldaten
Elena Biewen

Nr. 35 (Dezember 2007)
What a Difference Trade Makes – Export Activity and the Flexibility of Collective Bargaining Agreements
Wolf Dieter Heinbach / Stefanie Schröpfer

Nr. 36 (Dezember 2007)
To Bind or Not to Bind Collectively? Decomposition of Bargained Wage Differences Using Counterfactual Distributions
Wolf Dieter Heinbach / Markus Spindler

Nr. 37 (Dezember 2007)
Neue Ansätze zur flächenschutzpolitischen Reform des Kommunalen Finanzausgleichs
Raimund Krumm

Nr. 38 (Januar 2008)
Banking Globalization: International Consolidation and Mergers in Banking
Claudia M. Buch / Gayle L. DeLong

IAW-Diskussionspapiere

Nr. 39 (Januar 2008)
Multiplicative Measurement Error and the Simulation Extrapolation Method
Elena Biewen / Sandra Nolte / Martin Rosemann

Nr. 40 (Juni 2008)
Das Konzept des „Regionalen Gewerbeflächenpools" aus ökonomischer Sicht
Raimund Krumm

Nr. 41 (Juli 2008)
Openness and Income Disparities: Does Trade Explain the 'Mezzogiorno' Effect?
Claudia M. Buch / Paola Monti

Nr. 42 (August 2008)
Flächenschutzpolitische Implikationen eines Regionalen Gewerbeflächenpools
Raimund Krumm

Nr. 43 (September 2008)
Mikroökonomische Determinanten und Effekte von FDI am Beispiel Baden-Württemberg
Christian Arndt / Anselm Mattes

Nr. 44 (September 2008)
The Impact of Macroeconomic Factors on Risks in the Banking Sector: A Cross-Country Empirical Assessment
Olga Bohachova

Nr. 45 (Oktober 2008)
Effects of Dismissal Protection Legislation on Individual Employment Stability in Germany
Bernhard Boockmann / Daniel Gutknecht / Susanne Steffes

Nr. 46 (November 2008)
Trade's Impact on the Labor Share: Evidence from German and Italian Regions
Claudia M. Buch / Paola Monti / Farid Toubal

Nr. 47 (März 2009)
Network and Border Effects: Where Do Foreign Multinationals Locate in Germany?
Julia Spies

Nr. 48 (März 2009)
Stochastische Überlagerung mit Hilfe der Mischungsverteilung (Stand: 18. März 2009 – Version 49)
Gerd Ronning

Nr. 49 (April 2009)
Außenwirtschaftliche Verbindungen der deutschen Bundesländer zur Republik Österreich
Anselm Mattes /Julia Spies

Nr. 50 (Juli 2009)
New Firms – Different Jobs? An Inquiry into the Quality of Employment in Start-ups and Incumbents (Stand: 28. Juli 2009 – Version 1.3)
Andreas Koch / Jochen Späth

Nr. 51 (Juli 2009)
Poverty and Wealth Reporting of the German Government: Approach, Lessons and Critique
Christian Arndt / Jürgen Volkert

IAW-Diskussionspapiere

Nr. 52 (August/September 2009)
Barriers to Internationalization: Firm-Level Evidence from Germany
Christian Arndt / Claudia M. Buch / Anselm Mattes

Nr. 53 (September 2009)
IV-Schätzung eines linearen Panelmodells mit stochastisch überlagerten Betriebs- und Unternehmensdaten
Elena Biewen / Gerd Ronning / Martin Rosemann

Nr. 54 (November 2009)
Financial Constraints and the Margins of FDI
Claudia M. Buch / Iris Kesternich / Alexander Lipponer / Monika Schnitzer

Nr. 55 (November 2009)
Offshoring and the Onshore Composition of Tasks and Skills
Sascha O. Becker / Karolina Ekholm /Marc-Andreas Muendler

Nr. 56 (November 2009)
Intensifying the Use of Benefit Sanctions – An Effective Tool to Shorten Welfare Receipt and Speed up Transitions to Employment?
Bernhard Boockmann /Stephan L. Thomsen / Thomas Walter

Nr. 57 (November 2009)
The Responses of Taxable Income Induced by Tax Cuts – Empirical Evidence from the German Taxpayer Panel
Peter Gottfried / Daniela Witczak

Nr. 58 (November 2009)
Reformoption Duale Einkommensteuer – Aufkommens- und Verteilungseffekte
Peter Gottfried / Daniela Witczak

Nr. 59 (Februar 2010)
The Impact of Horizontal and Vertical FDI on Labor Demand for Different Skill Groups
Anselm Mattes