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Mit der Reihe „IAB-Discussion Paper“ will das Forschungsinstitut der Bundesagentur für Arbeit den Dialog mit der externen Wissenschaft intensivieren. Durch die rasche Verbreitung von Forschungsergebnissen über das Internet soll noch vor Drucklegung Kritik angeregt und Qualität gesichert werden.

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Abstract

This paper deals with the measurement of motives for foreign direct investment (FDI). Due to a lack of information, several indirect measures exist in order to classify multinational firms into the two main types of FDI. While vertical foreign direct investment (VFDI) refers to the international fragmentation of the production process for cost-saving reasons, horizontal foreign direct investment (HFDI) is performed in order to gain access to new markets. One common approach to identify the dominant reason for firms to go abroad is to compare the industry affiliation of the investing company in the home country and the subsidiary in the target country. The question arises as to how reliable this measure is for identifying FDI motives.

The IAB-ReLOC survey allows a profound investigation on the issue of classifying the motives of the firms for going abroad into vertical and horizontal FDI. Apart from industry affiliation data applied in conventional approaches to categorize FDI types, the survey data also includes a self-assessment of the firms with respect to the main motive for investing in the neighboring country, and information on intra-firm trade concerning the flow of intermediate inputs between the German headquarters and the Czech affiliates.

Against the background of featuring a well-grounded database, we shed a light on the relevance of productivity in the German-Czech FDI relations. We pursue a reference group approach by comparing German multinational firms that have an affiliate in the Czech Republic to German companies without direct investment abroad. The data provided by the German multinationals enables us to investigate the size of FDI under the aspect of the number of employees in their Czech affiliates. By applying a two-step Heckman procedure, we control for sample selection bias: in the first stage we analyze the extensive margin of FDI, i.e. the probability to select into the group of multinational investors. The second stage examines the relationship between productivity and the intensive margin of FDI.

We find evidence that productivity is not only a crucial factor for the decision to invest in the neighboring country, but plays also a relevant role for the number of employees in the Czech subsidiary. Differences are revealed between direct and indirect measures of FDI types. The size of horizontal investments is significantly affected by productivity only in the case of classifications that are based on survey responses. This result confirms theoretical expectations and previous empirical literature by standing in marked contrast to the outcome for indirect measurement concepts. Our finding leads us to the conclusion that one should be more cautious in interpreting differences between vertical and horizontal FDI when using approximative classification concepts.

Zusammenfassung

Dieses Papier beschäftigt sich mit der Klassifikation von Motiven für ausländische Direktinvestitionen (FDI). Da häufig keine direkten Informationen zum Motiv vorliegen, existieren mehrere indirekte Maße um multinationale Unternehmen den zwei Haupttypen von Direktinvestitionen zuzuweisen. Während vertikale Direktinvestitionen (VFDI) mit einer internationalen Aufteilung des Produktionsprozesses aus Gründen der Kostenersparnis zusammenhängen, werden horizontale Direktinvestitionen (HFDI) getätigt um neue Märkte zu erschließen. Ein häufig verwendeter Ansatz um den Hauptgrund der Unternehmen für die Auslandsinvestition zu bestimmen ist, die Branchenzugehörigkeit des Mutterunternehmens mit derjenigen des Tochterunternehmens zu vergleichen. Es stellt sich die Frage, wie zuverlässig dieses Maß für die Identifikation der Investitionsmotive ist.

Die Daten der IAB-ReLOC Befragung ermöglichen es, die Einteilung der Investitionsmotive von multinationalen Unternehmen in vertikale und horizontale Direktinvestitionen im Detail zu untersuchen. Neben der Branchenzugehörigkeit, die in konventionellen Ansätzen verwendet wird, um FDI-Typen zu kategorisieren, beinhalten die Befragungsdaten auch eine Selbsteinschätzung der Unternehmen hinsichtlich ihres Hauptmotivs für die Investition im Nachbarland und Informationen zum firmeninternen Handel mit Vorprodukten zwischen dem deutschen Mutter- und dem tschechischen Tochterunternehmen.

Auf Basis dieser fundierten Datenbank beleuchten wir die Relevanz der Produktivität in den deutsch-tschechischen FDI-Beziehungen. Wir verfolgen einen Referenzgruppenansatz, indem wir deutsche multinationale Unternehmen, die eine Tochterfirma in Tschechien haben, mit deutschen Unternehmen ohne ausländische Direktinvestitionen vergleichen. Die Angaben der deutschen multinationalen Unternehmen ermöglichen es uns, die Höhe der Auslandsinvestition gemessen als Zahl der Beschäftigten in der tschechischen Niederlassung zu untersuchen. Wir verwenden ein zweistufiges Heckman-Verfahren um für eine mögliche Selektionsverzerrung zu kontrollieren: Auf der ersten Stufe analysieren wir die Wahrscheinlichkeit, dass ein Unternehmen zur Gruppe der multinationalen Investoren gehört. Die zweite Stufe untersucht die Beziehung zwischen Produktivität und der Größe der ausländischen Tochterfirma.

Unsere Ergebnisse zeigen, dass Produktivität nicht nur ein entscheidender Faktor für die Investitionsentscheidung ist, sondern auch eine wichtige Rolle für die Zahl der Beschäftigten in der tschechischen Niederlassung spielt. Insbesondere decken wir Unterschiede zwischen direkten und indirekten Klassifikationsmaßen auf. Die Höhe horizontaler Investitionen wird nur bei den Klassifikationen, die auf den Angaben aus der Befragung basieren, signifikant von der Produktivität des Mutterunternehmens beeinflusst. Dieses Ergebnis bestätigt sowohl theoretische Erwartungen

als auch bisherige empirische Untersuchungen und steht im Kontrast zu den Resultaten für indirekte Messkonzepte. Daraus schließen wir, dass hinsichtlich der Interpretation von Unterschieden zwischen vertikalen und horizontalen Direktinvestitionen besondere Vorsicht geboten ist, wenn approximative Klassifikationskonzepte verwendet werden.

JEL classification: F23, J21, R12

Keywords: multinational firms, firm heterogeneity, productivity, vertical FDI, horizontal FDI, employment

1 Introduction

In the course of globalization, foreign direct investment (FDI) is a widespread phenomenon which is closely related to the process of economic integration. The economic consequences for the labor market are an issue of an ongoing debate. Not least due to the lack of suitable data sets, key hypotheses and research questions are empirically unexplored (Pflüger et al. 2013). A central topic concerns the differences in the characteristics between firms that are investing abroad and firms without foreign affiliates. There is a broad consensus in theory that only the most productive firms engage in FDI (Helpman/Melitz/Yeaple 2004; Melitz 2003). Basically, the theory of FDI distinguishes between two types of providing capital abroad: vertical foreign direct investment (VFDI) and horizontal foreign direct investment (HFDI) (Markusen 2002). Vertically integrated firms pursue the international fragmentation of the production process for the reason of factor cost savings (Helpman 1984). Thus, VFDI is connected to the slicing-up of the value-added chain (Krugman 1995), where each production step is performed at the location where the factor needed for production is relatively cheap (Helpman/Krugman 1985). In contrast, HFDI is related to a firm's wish to get access to a new market and typically occurs when it is more profitable for a firm to serve the foreign market by producing in a local plant than by exporting from the company's home country (Markusen 1984). As a consequence, horizontally integrated multi-plant firms produce the same goods in various countries for local sales.

For both types of FDI the Central and Eastern European Countries (CEEC) constitute an attractive target area for Western European FDI. On the one hand, a still substantial wage gap enables firms to cross the border in order to realize labor cost cuttings. On the other hand, the purchasing power of customers has been on the rise since the early 1990s, and thus market development might be a profitable strategy for investments. In this context, FDI relations are of specific economic importance when neighboring countries along the former Iron Curtain are involved. The common border enables investing firms to enter a foreign market and establish a subsidiary not far away from their headquarters. However, as the two main investment motives substantially differ, one can assume that the relationship between the characteristics of firms and the size of investment is associated with the underlying type of FDI. Nevertheless, due to a lack of appropriate databases, only little studies analyzing the internationalization process differentiate between the two motives.

Against this background, we take a closer look on Germany and the Czech Republic, the only neighboring country that on a length of over 800 km/500 miles shares a direct border with both Eastern and Western Germany. Our paper investigates the relevance of productivity for the size of German FDI in the Czech Republic. Is productivity not only a main factor for going multinational as proven by many studies (extensive margin), but also for the size of FDI in the host country (intensive mar-

gin)? Are differences observable between vertically and horizontally integrated firms? Rather than examining the causal effect of productivity on the size of FDI, we bring the measurement of FDI types to the fore that underlies the interpretation of results. A newly established data set enables the utilization of the broad reservoir of firm-level information that yields unique findings about the structure of multinational firms. We base our analysis on a two-step Heckman model that corrects for sample selection bias and identifies in the first stage the significantly different characteristics between multinational firms and firms without foreign affiliates. In the second stage, the determinants for the affiliate size are examined. By extending the baseline specification, the main contribution of the study is the application of different methods for the classification of FDI types. The self-assessment of firms can be contrasted with common approaches in the literature for the assignment of firms to vertical FDI and horizontal FDI. Comparable information is not available in most of the data sets used in previous research. While we find robust evidence that multinational firms are significantly more productive than purely domestic firms, our results show that it depends on the classification how productivity is related to the extent of FDI. Opposite to the indirect measures of FDI, the classifications that exploit the direct survey responses are in line with theoretical expectations by pointing to a relevant role of productivity for the size of FDI in the case of horizontal investments, but not so for vertical FDI.

The remaining paper is organized as follows: Chapter 2 examines the related literature on the relevance of productivity for the foreign market engagement of firms. Chapter 3 provides a description of the IAB-ReLOC data and illustrates differences to hitherto existing databases with regard to FDI. In Chapter 4, we present classification concepts to distinguish between VFDI and HFDI by using the information from the survey. Chapter 5 outlines the econometric method used for our analyses on FDI size in the Czech Republic. The empirical results are presented and discussed in Chapter 6. Finally, Chapter 7 concludes with a summary and implications for future research on determinants of FDI.

2 Literature review

2.1 Firm heterogeneity and FDI

Since the introduction of the widely noticed model by Helpman/Melitz/Yeaple (2004) it is regarded as common knowledge that firm heterogeneity plays an important role in the internationalization process of companies. While the least productive firms are active on the domestic market only, more productive firms also serve foreign markets – depending on their productivity either by exporting or, in the case of the most productive firms, by FDI. Using data of U.S. affiliates, Helpman/Melitz/Yeaple (2004) also empirically analyze the correlation between productivity and internationalization behavior. The outcome supports their theoretical assumptions: increasing firm heterogeneity significantly leads to higher rates of FDI relative to exports. Empirical

studies dealing with the influence of firm characteristics on a firm's probability to invest abroad have confirmed productivity to be a key driver of the internationalization decision. Using data on Japanese companies, Head/Ries (2003) show that firms that serve foreign markets by FDI are larger and more productive than firms that serve foreign markets by exports. Firms operating only on the domestic market are found to be least productive and smallest. Using also Japanese firm-level data, Raff/Ryan (2008) find out that for the initial decision to invest abroad only the productivity of the firm is decisive and not the firm's size. Larger firms, however, on average undertake more investment projects. Other studies confirming the result that only the most productive firms engage in FDI have been conducted by Tomiura (2007) for Japanese firms, by Arnold/Hussinger (2010) for German manufacturing firms, by Engel/Procher/Schmidt (2013) for French firms and by Cainelli/Di Maria/Ganau (2014) for Italian manufacturing firms. A further bulk of studies finds that the productivity of firms investing in multiple regions is higher than of firms with one destination country (Aw/Lee 2008; Wakasugi/Tanaka 2012).

Closely connected to our research are analyses that look at the correlation between firm heterogeneity and the size of FDI. Previous studies have applied different ways to capture the size of FDI: the number of employees of the foreign affiliate, the affiliate's sales or the number of affiliates. Yeaple (2009) uses data for U.S. multinational enterprises (MNEs) and shows that firms that become multinational not only differ systematically from firms that export but that this sorting also strikes the scale and scope of MNEs. More productive firms extend their FDI activities to a broader range of countries and their affiliates are bigger than those of less productive firms. This finding is supported by Hur/Lee/Hyun (2013) for Korean FDI in China as well as by Hyun/Hur (2013) for Korean FDI in general. Based on a sample of German companies with affiliates in the Czech Republic, Görg/Mühlen/Nunnenkamp (2010) find that more productive companies are not only more likely to engage in FDI but that the productivity of the German parent company also affects the size of FDI.

2.2 Vertical FDI (VFDI) and Horizontal FDI (HFDI)

Studies dealing with the importance of VFDI and HFDI among German investments have come to different results. According to Buch et al. (2005), German FDI is mainly market seeking, but there are some target regions where the cost-saving motive is quite important, e.g. the transition economies in Central and Eastern Europe. Marin/Lorentowicz/Raubold (2003) find that in the Czech Republic 17 percent of the German affiliates' sales result from exports to the German parent company. Compared to Slovakia (82%), Romania (44%) and Hungary (31%) this share is rather low. Thus, the authors conclude that horizontal FDI is the dominant motive for German FDI in the Czech Republic. In a follow-up paper, however, Marin argues that German FDI in the Czech Republic is mostly motivated by cost savings, as more than 75 percent of the German parent companies import intermediate goods produced by their Czech affiliates. When a tighter criterion is used requiring that at least

20 percent of the affiliate's output is imported by the German parent company, only around 10 percent of the German parent companies are classified as VFDI (Marin 2004). The contradicting outcomes show that the importance of the two main motives for FDI strongly depends on the underlying classification concept. This assessment is also confirmed by Alfaro/Charlton (2009) and by Görg/Mühlen/Nunnenkamp (2010). The first study suggests that the prevalence of HFDI in the literature might be due to a misclassification when using aggregated industry-level data. The latter study shows that German FDI in the Czech Republic is predominantly horizontally motivated when using the concept of revealed comparative advantage to distinguish the two motives and predominantly vertical when the industry classification concept is applied.

Evidence on the relation between firm characteristics and investment motives is, however, rare. Although many studies consider the relationship between productivity and FDI, most of them focus on HFDI and only few studies distinguish between different types of FDI in this context. Head/Ries (2003) develop an alternative model to Helpman/Melitz/Yeaple (2004) that yields the same predictions concerning the productivity ranking of firms in the internationalization process. However, they show that the productivity order can be reversed when the foreign country is a low-cost production site: in this case, the least productive firms engage in vertical FDI. Grossman/Helpman/Szeidl (2006) show theoretically that heterogeneous firms pursue different FDI strategies. As in previous models, the least productive firms produce in the home market and more productive firms engage in FDI. Among these FDI firms, however, the most productive firms choose to move both intermediate production stages and final assembly abroad. Thus, they engage in vertical and horizontal FDI. The model of Hayakawa/Matsuura (2015) also allows firms to choose between VFDI and HFDI. When plant setup costs differ between VFDI and HFDI, the least productive firms operate in the domestic market, more productive firms engage in VFDI and the most productive firms invest horizontally. The authors empirically confirm their model using Japanese data. Hyun/Hur (2013) obtain similar results for Korean firms: the most productive firms engage in both types of FDI (for market-seeking and cost-saving reasons), while less productive firms solely apply a single FDI strategy (HFDI *or* VFDI). They cannot identify a productivity difference between VFDI and HFDI firms when looking at the extensive margin of FDI. However, looking at the intensive margin, the size of FDI, they find that the correlation of productivity and size of FDI is higher for horizontal FDI than for vertical FDI.

Summing up the literature, up to now only few studies have empirically addressed the question how a firm's productivity is related to engagement in VFDI and HFDI. A reason for this missing evidence may be the lacking information on FDI motives in most datasets. This paper wants to contribute to the closure of this research gap. Based on the IAB-ReLOC data, we examine whether there is a productivity difference between VFDI and HFDI firms – looking at the extensive as well as the inten-

sive margin of FDI. Referring to the literature presented above, we expect that the role of productivity in the firms' internationalization behavior differs between the two main motives – especially what concerns the intensive margin of FDI, thus the size of the foreign affiliate. The results of previous theoretical and empirical studies suggest that more productive HFDI firms own larger affiliates abroad while this correlation is not so distinct for VFDI firms. In particular, we address the question whether the results vary between different classifications of VFDI and HFDI.

3 Data: the IAB-ReLOC survey

Regarding empirical research with respect to German FDI, it has clearly been noted that there is still a lack of appropriate data that hinders progress (see Pflüger et al. 2013; Wagner 2010, for example). This data problem has several aspects. First, certain specific characteristics simply cannot be studied by the use of industry-level data, as examinations may suffer from aggregation bias. Second, the lack of adequate data sets limits the applicability of econometric methods which require control groups. Finally, the bulk of data used is selective with respect to the characteristics of the firms or the investment projects. Data suitable for scientific investigations are provided by some commercial suppliers, the Deutsche Bundesbank and various Chambers of Industry and Commerce that make their firm-level surveys available. Unfortunately, in most cases, the data offer only a small part of the population of firms actively operating in the home and in the host country of FDI, or due to thresholds for mandatory reporting of company figures, small and medium-sized firms are strongly underrepresented in these databases. Taking into account that there are many small firms in our German-Czech case, it is not clear, what this bias in favor of large firms exactly implies. This assessment is supported by the finding of Buch et al. (2005) indicating that German FDI in nearby countries is provided for relatively many and relatively small companies. Moreover, though many empirical studies use information at firm level, evidence on the motives behind FDI is quite scarce in the used data sets.

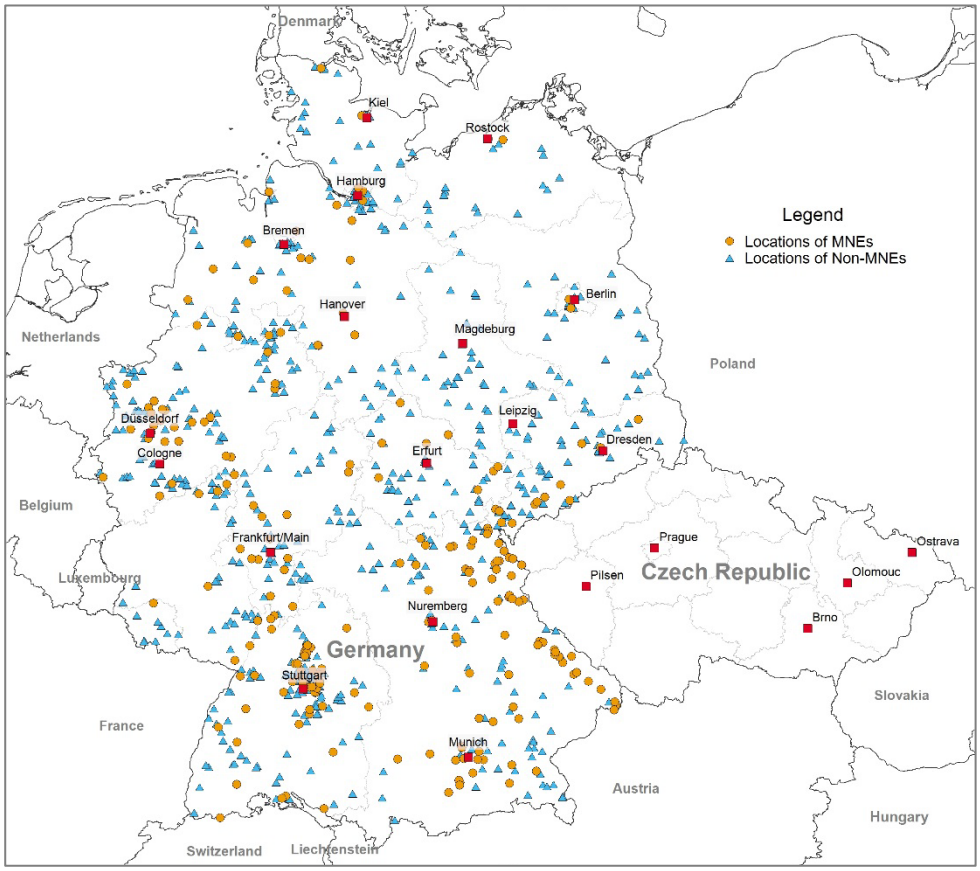
Against the background of the mentioned weaknesses of data sets used to study FDI relations, we base our investigation on the IAB-ReLOC survey, a unique micro data set for German and Czech firms.[1] In this paper, we exploit the information that was provided by German MNEs and Non-MNEs in the survey. The research design of the survey is based on the total population of German multinationals with affiliates in the Czech Republic that were enrolled in the Commercial Register of the Czech

[1] The abbreviation ReLOC stands for *Research on Locational and Organisational Change*. The survey, whose fieldwork took place from September 2010 to April 2011, was conducted by the Institute for Employment Research (*Institut für Arbeitsmarkt- und Berufsforschung – IAB*), whereby the data were collected via face-to-face interviews carried out by a market research institute, *TNS Infratest Sozialforschung*. For detailed information on the survey design see Hecht/Litzel/Schäffler (2013), and for an overview of descriptive statistics (in German), see Hecht et al. (2013).

Republic at the beginning of the year 2010. As we pursue a reference group approach we also surveyed a group of German companies that in the year 2010 neither had direct nor indirect equity investments abroad nor had they foreign sister companies. It is important to note that before the fieldwork, for reasons of better comparison between the two groups of observation, the distribution of employment size of the Non-MNE group was approximated to the size distribution of the MNE group. Therefore, when composing the reference group, stratified sampling was used on the basis of employment size categories.

In a next step, the IAB-ReLOC survey data were enriched by information from the IAB Establishment History Panel (BHP). The BHP covers all establishments in Germany with at least one employee liable to social security registered on the yearly reference date of June 30th. In order to merge the two data sets, it is necessary to identify the establishments of the BHP that belong to the firms captured by the survey. The assignment of establishments to firms is done by the ReLOC linkage method developed by Schäffler (2014) that is based on the matching of firm names and addresses. Since an unambiguous identification in the BHP failed for some surveyed firms and particularly due to missing information for some variables used in the econometric analysis, the number of cases in the MNE group decreases after the merging process to 230. The reference group of firms without FDI finally includes 650 German firms. Accordingly, the total sample for the analysis in this study contains 880 German companies. Figure 1 depicts the locations of both multinational and non-multinational firms.

Figure 1
Locations of MNEs and Non-MNEs



Source: Authors' own calculations from IAB-ReLOC survey.

One of the great advantages of the composed data set is the bulk of information it comprises, especially with regard to the workforce and the international activities of firms. Concerning the subject of our investigation, the size of FDI is measured by the total headcount of employees in the associated Czech affiliate of a German MNE. The multinational companies revealed in the survey their main motive for investing in the Czech Republic. Therefore, it is possible to contrast the classification of FDI types based on the responses of firms to categorization schemes that are commonly used in the literature (see Chapter 4 below).

Our explanatory variable of main interest is the productivity of the multinational firms. To capture productivity, we include the turnover per full-time equivalent employee in our analysis. Following the results of previous theoretical and empirical studies (see Chapter 2 above), we expect that productivity is not only positively correlated with the extensive margin of FDI, i.e. a firm's probability to invest abroad but also with the intensive margin of FDI represented by the size of the foreign affiliate. As newer theoretical models suggest, we expect productivity to be more important for the internationalization of firms in the case of HFDI compared with VFDI. To identify the effect of productivity, we include a wide range of control variables in our

analysis. With our rich data set we can analyze the structure of the foreign firms in more detail than most previous investigations.

As there is theoretical and empirical evidence that not only more productive but also bigger companies are more likely to be engaged in FDI, we control for the *number of employees* of the German company. Due to the above-mentioned stratified sampling that was applied for composing the reference group, we expect that the number of employees in the German mother company is not a significant factor for explaining foreign market entry, but is a decisive determinant of the FDI size abroad (see Görg/Mühlen/Nunnenkamp 2010, for example). To account for the industry affiliation of the firms we include the dummy variable *services* denoting 1 if the firm is active in the services sector and 0 otherwise, that is if the firm belongs to the manufacturing sector. We expect firms operating in the service sector to invest rather horizontally, while the investments of the firms belonging to the manufacturing sector should rather be attracted by lower labor costs as it was found out for German multinationals in general by Buch et al. (2005) and explicitly for the target country Czech Republic by Münich et al. (2014).[2] Another dummy variable reflects whether a firm has a *works council* or not. As a works council decentralizes a firm's decision power which boosts the costs of organizing an activity within a firm, it can be assumed that the bargaining power of a works council both decreases the probability to be engaged in FDI and the size of FDI. In order to account for the wage formation process in a firm, the information on the application of a *collective agreement* is included in our analysis. As there is already evidence that firms active in research and development (R&D) are more likely to become multinational (Cainelli/Di Maria/Ganau 2014; Tomiura 2007), we include a dummy variable reflecting the existence of a *R&D department*. A unique feature of the IAB-ReLOC data is the information on the firm's *position in the value-added chain*.[3] According to theory, vertical investments are implemented in order to offshore production steps to the host country for further processing (Helpman 1984). If the downstream activities close to the final product and the end consumer are not performed in the home country, it can be assumed that the company's domestic activities are rated at lower positions in the value-added chain. In case of horizontal FDI, a higher position in the value-added chain is expected, as the same products are sold to the end consumer in both the host and the home country (Markusen 1984). To account for the composition of the workforce, the share of employees performing occupations that require engineering, academic

[2] For differences between manufacturing FDI and services FDI of German multinationals in the Czech Republic, see also Eisermann/Moritz/Stockinger (2015).

[3] In the survey, the firms were asked to indicate their position in the value-added chain by classifying themselves on a seven-point scale ranging from 1 for activities at the beginning of the chain, such as the extraction of raw materials, product design and prototype testing, to 7 representing the final stage, when the product or service is delivered to the end consumer with the total value added.

or managerial skills is included. With this variable, we have the possibility to test whether a higher share of these *non-routine cognitive (NRC) occupations* relates to a higher probability to have a foreign affiliate as well as to the size of FDI (Acemoglu/Autor 2011; Goos/Manning/Salomons 2014). Although there are some "born globals", i.e. firms that at a very young age become multinational, the international business is usually the domain of large, well-resourced enterprises (Engel/Procher/Schmidt 2013; Madsen/Servais 1997). Thus, *age* referring to the time since the foundation of a firm on the domestic market should have a positive effect on a firm's likelihood to become multinational and on its extent of FDI. As a measure for transaction costs we incorporate the *distance* measured in minutes of driving time between the headquarters of the firms in Germany and the capital city of the Czech Republic, Prague.[4] As an alternative measure to the distance, and in order to account for the specific closeness of border regions, we use the proportion of firms that are located in the two German federal states that share a direct border with the Czech Republic, *Bavaria* in Western Germany and *Saxony* in Eastern Germany. Our general assumption is that transaction costs not only affect a firm's probability to invest abroad, but also the size of FDI. There is evidence that the probability to undertake FDI increases with the international experience of a firm (Vernon 1979). As companies gain international experience by exporting, we control for the *export share* (measured as the export share in total turnover).

In Table 1, descriptive figures for the variables that are relevant in our study are shown. German multinationals on average employ 71 workers in their Czech affiliate. The measure of productivity, the turnover per full-time equivalent employee, is for the MNE group on average almost twice as high as for Non-MNEs. The composition of the reference group by considering employment size categories of the multinational group helped to mitigate the difference between the two groups of observation regarding the number of employees in Germany. Nevertheless, the average full-time equivalent workforce in Germany is with 187 employees still apparently larger in multinational firms compared to 114 employees in non-multinational firms. The share of firms that are assigned to the services sector amounts to around 40 percent in both groups. The concerns of the workforce are represented through an employee elected works council in just above one third of the firms in both groups. Regarding wage formation, a collective agreement is applied in around 32 percent of the multinational firms, whereas 43 percent of the Non-MNEs commit themselves to this kind of wage settlement. Concerning the existence of a R&D department, we observe a considerable difference of nearly 40 percentage points between the two observation groups. 71 percent of the multinationals perform R&D activities in Germany, but only

[4] The distance to Prague is measured as the calculated driving time (in minutes) of a heavy-goods vehicle between the capital of the German spatial planning region where the headquarters of the firm is located and Prague, assuming a speed of 75 km/h on motorways, 45 km/h on federal highways, 40 km/h on country roads and 30 km/h on urban roads.

32 percent of the firms without foreign affiliates. Compared with the average of 5.21 points for the reference group, the MNEs operate with a value of 4.90 points farther away from the final user. With 10 percent the proportion of the non-routine cognitive (NRC) occupations is slightly higher in the MNE group compared to 6 percent in the group of firms without FDI. The age of the firm refers to the number of years since the firm has been established in Germany. At a mean age of almost 45 years the non-multinational firms are on average only just two years younger than the MNEs. The mean driving time from the German MNEs to the capital of the Czech Republic is 418 minutes, while the firms of the reference group exhibit an average of 456 minutes, and thus are located more remote from the economic center of the neighboring country. The proportion of firms with a headquarters in Saxony is at one-digit percentage level for both groups, and at that lower for the MNE group. In contrast, with 36 percent the share of MNEs from Bavaria exceeds the corresponding share of 14 percent for the Non-MNEs by far. Finally, the export share in the total turnover is on average in MNEs two and a half times larger than in Non-MNEs (35% vs. 14%).

Table 1
Descriptive statistics on German MNEs and Non-MNEs

	MNEs (N=230)		**Non-MNEs (N=650)**	
Variable	Mean	SD	Mean	SD
no. of employees in Czech affiliate	71	161		
turnover/employee (in 2009, in thousand €)	475	626	246	389
no. of employees in Germany (in 2009)	187	637	114	150
services (0: no; 1: yes)	0.37	0.48	0.40	0.49
works council (0: no; 1: yes)	0.36	0.48	0.35	0.48
collective agreement (0: no; 1: yes)	0.32	0.47	0.43	0.50
R&D department (0: no; 1: yes)	0.71	0.45	0.32	0.47
position in the value-added chain (1…7)	4.90	1.33	5.21	1.59
non-routine cognitive occupations (in 2009, share)	0.10	0.13	0.06	0.13
age (in years)	47.04	43.55	44.91	45.25
distance to Prague (in minutes)	418	137	456	128
Bavaria (0: no; 1: yes)	0.36	0.48	0.14	0.35
Saxony (0: no; 1: yes)	0.05	0.22	0.08	0.27
exports in turnover (share)	0.35	0.28	0.14	0.22

Note: Unless otherwise indicated, data refer to 2010. SD = standard deviation.
Source: Authors' own calculations from IAB-ReLOC survey & Establishment History Panel (BHP).

4 Classifications of FDI types

The application of different approaches of assigning multinational firms to types of FDI is one of the main aims of our study. By using the information from the IAB-ReLOC survey, we have the possibility to compare different VFDI/HFDI measures. The discrepancies that come up when using the various classifications will be shown in this chapter.

One approach in order to circumvent the lacking evidence on the motive for FDI in firm-level data sets is to make a distinction between VFDI and HFDI on the basis of differences in the industry affiliation of the parent company and the affiliate abroad (Alfaro/Charlton 2009; Buch et al. 2005; Görg/Mühlen/Nunnenkamp 2010; Temouri/Driffield 2009). According to this course of action, FDI is classified as vertical if the two companies operate in different industries and classified as horizontal if the parent company and the foreign affiliate operate in the same industry. Though widely used in the literature, this classification method has the disadvantage that it depends on the number of industry subdivisions used to classify the firms' and affiliates' activities as either same or different. If the number of subdivisions is low, vertical fragmentation of production might take place within each of these subdivisions and what appears as HFDI should be categorized as VFDI. The opposite is the case when the number of subdivisions becomes very high. In this case, the principal activity of the parent company and the affiliate could be very similar, but categorized as different. From survey responses we know about the industry affiliation of the parent company corresponding to the Statistical Classification of Economic Activities in the European Community (NACE), and from the Czech business register about the industry the Czech affiliate is mainly operating in. We construct two measures based on this information, the first one following a structure of 18 NACE classes (*VFDI_industry18* and *HFDI_industry18*), and a second one following a structure of 43 NACE classes (*VFDI_industry43* and *HFDI_industry43*).

An alternative measure is connected to the concept of the export-to-sales ratio to distinguish between VFDI and HFDI (Hanson/Mataloni Jr./Slaughter 2001; Hayakawa/Matsuura 2015; Marin/Lorentowicz/Raubold 2003). This differentiation considers whether goods and services produced by the foreign affiliate in the host country are mainly exported back to the home country or sold on the host country's market. As in case of VFDI products are exported back to the home country for further processing, FDI is classified as vertical according to the export-to-sales ratio as soon as a certain share of the affiliate's sales results from exports to the home country of FDI. In contrast, if the products stay in the affiliate's country, the investment is classified as HFDI. Based on information from the IAB-ReLOC survey, we are able to create a more exact measure as German multinationals assessed the share of intermediate inputs in total intermediate inputs that comes directly from their Czech affiliates. The investment of a German MNE is classified as vertical (*VFDI_inputs*) as soon as it imports intermediate products from its Czech affiliate. If intermediate

goods are imported only to a negligibly small extent or not at all from the affiliate, FDI of the parent company is defined as horizontal (*HFDI_inputs*).[5]

As already mentioned above, one of the great advantages of the IAB-ReLOC data is the detailed information collected in the survey. Especially for the distinction between vertical and horizontal FDI rich information is available that enables a baseline measure for the classification of FDI types: a direct question in the survey gives evidence on the motives of German investments in the Czech Republic. Firms have to choose whether FDI was predominantly undertaken for cost-saving reasons reflecting vertical FDI (*VFDI_survey*) or in order to get market access (*HFDI_survey*). The advantage of this method is the direct self-assessment of the companies on their objectives of investments. As a consequence, we do not have to rely only on indirect and thus potentially inaccurate measures for differentiating between VFDI and HFDI.

Table 2 gives an overview of the number of observations assigned to VFDI and HFDI on the basis of the four different measurement concepts. It is obvious that the share of companies assigned to the two groups depends on the classification method. According to the responses of the firms, 193 companies or 57.27 percent of the sample are primarily engaged in horizontal FDI, 144 or 42.73 percent are for the most part engaged in vertical FDI. The proportion of observations in the VFDI group ranges up to almost 55 percent when assigning firms to FDI types on the basis of the narrow classification scheme of 43 NACE codes. Obviously, the level of aggregation with regard to industry affiliation plays a critical role. When using 18 instead of 43 different industry classes, only just above 43 percent of the multinational firms are classified into the group of VFDI. Not only the proportion of the two main motives is affected by the underlying definition, but also the assignment of the individual companies to the two groups is very different depending on the concept. This can be seen from the correlation matrix presented in Table 3 where the four different classifications are opposed to each other. While the correlation between the measures based on NACE codes is with a value of nearly 0.80 rather high, the correlation between the survey and the intermediate inputs concept is positive but not very high. Only low correlation patterns are apparent with respect to other combinations of classifications.

[5] Another commonly used method to determine the main motive for investing abroad is the concept of revealed comparative advantage (RCA) on the basis of industry-level data (see Görg/Mühlen/Nunnenkamp 2010, for example). A ratio of bilateral trade in a specific industry gives evidence on the two involved countries' comparative advantage in this industry. In order to classify the types of FDI, vertical (horizontal) FDI is assumed if the mother firm is assigned to an industry for which the exports from the host country to the home country exceed (fall below) the imports in the opposite direction. Due to data availability reasons, however, the RCA is generally calculated only for industries belonging to the manufacturing sector, so that we refrain from applying this concept in our study.

Table 2
Overview of the four classifications of FDI types

	survey		*inputs*		*industry18*		*industry43*	
	N	share in %	N	share in %	N	share in %	N	share in %
VFDI	144	42.73	152	52.05	148	43.27	187	54.68
HFDI	193	57.27	140	47.95	194	56.73	155	45.32
Total	337	100	292	100	342	100	342	100

Note: The number of observations differs between the classifications due to the deviating number of missings.
Source: Authors' own calculations from IAB-ReLOC survey.

Table 3
Correlation matrix of the four classifications

	survey	*inputs*	*industry18*	*industry43*
survey	1.0000			
inputs	0.2298	1.0000		
industry18	-0.0337	0.0442	1.0000	
industry43	0.0048	0.1014	0.7984	1.0000

Source: Authors' own calculations from IAB-ReLOC survey.

5 Empirical methodology

The analysis on the size of FDI is based on German firms that have done investments in the Czech Republic. Thereby, a selection bias may occur if the selection into the MNE group is not considered. The size of FDI may be affected indirectly by unobserved factors that determine the decision of a company to invest in the Czech Republic without being captured in the regression on FDI size. In order to prevent selection bias, we apply a two-step procedure developed by Heckman (1979). The two-step Heckman regression allows us to correct for the selection bias by determining the probability of a firm i being selected into the MNE group in the first stage. In a probit model, the dependent variable equals 1 if the firm decided to invest in the Czech Republic, and 0 in case of firms without FDI (Equation 1).

$$Prob(FDI_i = 1) = \beta_1 productivity_i + \beta_2 X_i + \beta_3 exclusion_i + \varepsilon_i \qquad (1)$$

The probability of firm i for having FDI in the Czech Republic is assumed to depend on the firm's $productivity_i$, other firm characteristics denoted by X_i, an exclusion variable and the error term ε_i. The explanatory variables in X_i are based on the merged data set of the IAB-ReLOC survey and the BHP described in Chapter 3 (see Table 1). In order to mitigate the problem of reverse causality, we lag the variables productivity, number of employees in Germany and the share of non-routine cognitive occupations by one year. For reasons of model identification, one variable in the

first stage should strongly affect the selection into the MNE group, but not the size of FDI. According to Vernon (1979), exporting companies gain more international knowledge compared to companies without experience abroad, and thus are more likely to undertake FDI. This prediction is in line with the findings of Kimura/Kiyota (2006) who conclude that while exporters do not always engage in FDI, most firms that engage in FDI are exporters. After testing several firm characteristics for significance in the first and second stage to identify the most suitable exclusion variable, we find robust evidence that the share of turnover generated by exports of the company significantly affects the selection into the group of multinational firms, whereas there is no significant impact of the export share on the size of FDI. Hence, we choose the share of exports in a firm's total turnover as exclusion variable in the probit estimation.

The second stage includes only the multinational firms. The logarithm of the size of FDI is regressed on $productivity_i$, the same set of variables X_i as in the first stage, plus the inverse Mills' ratio λ_i representing the probability of a German firm i to be selected into the MNE group. The error term is denoted by ν_i (Equation 2).

$$ln\_FDI\_size_i = \alpha_1 productivity_i + \alpha_2 X_i + \alpha_3 \lambda_i + \nu_i \qquad (2)$$

Analogously to Görg/Mühlen/Nunnenkamp (2010) and Mühlen/Nunnenkamp (2011), we measure the size of FDI by the number of employees in the Czech affiliate. After the investigation of total FDI projects, the analysis on the size of FDI is extended by the differentiation into VFDI and HFDI. Thereby, the firms are grouped according to the classification methods elaborated in Chapter 4.

6 Results

6.1 Baseline model

The baseline model is presented in Table 4 and shows the results for the estimation of the size of FDI in terms of the number of employees in the Czech affiliate. In the selection equation, the coefficient of the exclusion variable, the export share in total turnover, is highly significant, denoting the higher export orientation of MNEs. The coefficient of the inverse Mills' ratio, λ, marginally misses the 10 percent significance level, i.e. there is only weak evidence for a selection bias. Concerning the explanatory variables for selection into the MNE group, the significantly positive coefficient for productivity at the 1 percent level corresponds to theoretical expectations and former empirical results on the higher productivity of multinational firms (see Head/Ries 2003; Helpman/Melitz/Yeaple 2004, for example). The close-to-zero result of the coefficient for employment size in Germany can be explained by the stratification of the reference group as already mentioned before. Firms operating in the service sector exhibit ceteris paribus a significantly higher probability to select into the MNE group than manufacturing firms. While there is no significant difference between the two groups regarding the application of a collective agreement in the

firm, the existence of an employee-elected works council significantly decreases the likelihood of selection into the multinational group. Potentially, this outcome points to the easier implementation of a foreign subsidiary if the workforce at home has a rather weak representation in the firm. As in previous studies, the coefficient for the existence of a R&D department is positive and highly significant, i.e. firms performing R&D in Germany have a higher probability of being involved in investments abroad compared to firms without a R&D department (see Cainelli/Di Maria/Ganau 2014, for example). The results for the position of a firm in the value-added chain, the share of non-routine cognitive occupations and the age of the company are insignificant in the first stage of the estimation process. Concerning transaction costs, the distance to Prague is significantly lower for the headquarters of German firms with FDI in the Czech Republic compared to the firms without FDI. This result implicates that the locational distribution of our MNE group deviates from the geographical distribution of the reference group of non-multinational firms. While it is not a surprising finding that distance obviously matters for the locational pattern of MNEs investing in a neighboring country, it is worth to take a closer look at the federal states of Germany that share a common border with the Czech Republic (see Hecht 2015; Schäffler/Hecht/Moritz 2016). Therefore, we include two dummy variables for Bavaria and Saxony as substitute for the distance variable. Apart from the coefficient for the value-added chain being now negatively significant at the 10 percent level, other results do not essentially change. It turns out, however, that the border regions of Eastern and Western Germany are involved to different extents in cross-border FDI relations. While the outcome for Saxony is insignificant, the dummy variable for Bavaria yields a highly significant positive coefficient indicating above-average representation of the federal state in the MNE group. Thus, regarding the closeness to foreign markets, an East-West divide in the locational pattern of firms is still observable.

The second stage investigates the impact of the explanatory variables on the size of FDI in the multinational firms. Using the logarithm for the dependent variable as well as for explanatory variables enables the interpretation of the results as elasticities. A 1 percent increase in productivity implicates a 0.27 percent increase in the number of employees in the Czech Republic. This outcome confirms previous findings that productivity is not only important for the extensive but also for the intensive margin of FDI (see Yeaple 2009, for instance). While the result that more productive firms employ more people in their Czech affiliate is significant at the 10 percent level, the size of the German mother company is highly significant with a 1 percent rise leading to a 0.24 percent larger daughter firm – a result in line with the findings of Görg/Mühlen/Nunnenkamp (2010). The differences between the manufacturing and the service sector are not significant. The sign for works council changed from the first to the second stage. Hence, the existence of a works council obviously impedes only the fundamental decision of a firm to internationalize. Concerning the size of the investment abroad, it is not a hindering factor anymore, but rather promotes the

number of employees in the Czech affiliate. On the contrary, the application of a collective agreement is negatively associated with the size of the Czech workforce. The existence of a R&D department in the mother company significantly boosts the number of employees in the Czech Republic. Thus, doing R&D in Germany is not only an outstanding characteristic of the MNE group, but also indicates a larger size of FDI. The significantly negative impact of the firm's position in the value-added chain on the size of FDI implies that the larger part of the domestically performed activities of MNEs is accomplished farther away from the end customer. The share of non-routine cognitive employees, however, lessens the size of the affiliate significantly, whereas the age of a company is no factor of relevance for the size of FDI. The higher the distance to Prague, the smaller is the FDI size in terms of employees in the Czech affiliate, i.e. distance is not only a determinant for the selection into the multinational group, but also for the size of the workforce. The coefficient, however, is significant only at the 10 percent level. In our alternative specification, we observe also in the second stage different results for firms in the Eastern and in the Western German border region. While Bavarian MNEs have a significantly larger workforce in their Czech subsidiaries, this is not the case for Saxon affiliates. Due to the apparent dissimilarities between the bordering German federal states, we privilege the use of the Bavarian and Saxon dummies instead of distance in the following regressions.

Table 4
Baseline model

	Coef.		Std. Err.	Coef.		Std. Err.
FDI size (number of employees in CZ, ln)						
Productivity (ln)	0.2690	*	0.1457	0.2401	*	0.1440
Number of employees (GER, ln)	0.2401	***	0.0819	0.2335	***	0.0815
Services	-0.3858		0.2560	-0.3847		0.2567
Works council	0.6217	**	0.2892	0.6608	**	0.2890
Collective agreement	-0.4238	*	0.2416	-0.4394	*	0.2418
R&D	0.8544	**	0.3849	0.8500	**	0.3912
Value-added chain	-0.1792	**	0.0759	-0.1881	**	0.0801
NRC occupations	-2.1792	***	0.8251	-2.2058	***	0.8208
Age (ln)	0.1835		0.1153	0.1571		0.1154
Distance to Prague	-0.0016	*	0.0009			
Bavaria				0.5812	**	0.2731
Saxony				0.2332		0.4755
Constant	0.3465		1.3308	-0.2399		1.4910
Selection						
Productivity (ln)	0.2908	***	0.0579	0.2673	***	0.0584
Number of employees (GER, ln)	0.0056		0.0405	0.0068		0.0408
Services	0.4219	***	0.1267	0.4169	***	0.1278
Works council	-0.2833	**	0.1426	-0.2421	*	0.1440
Collective agreement	-0.1071		0.1182	-0.1013		0.1192
R&D	0.9459	***	0.1279	0.9385	***	0.1293
Value-added chain	-0.0439		0.0355	-0.0625	*	0.0362
NRC occupations	0.5136		0.4036	0.5469		0.4047
Age (ln)	0.0011		0.0600	-0.0405		0.0602
Distance to Prague	-0.0018	***	0.0004			
Bavaria				0.6990	***	0.1239
Saxony				0.1333		0.2206
Export share	1.3921	***	0.2182	1.3093	***	0.2185
Constant	-2.0616	***	0.4447	-2.6560	***	0.4441
Statistics						
Mills lambda	0.6720		0.4088	0.6801		0.4353
Observations	880			880		
Uncensored observations	230			230		

Note: */**/*** significant at the 10/5/1 percent level.
Source: Authors' own calculations from IAB-ReLOC survey & Establishment History Panel (BHP).

6.2 Vertical FDI vs. Horizontal FDI

Table 5 and Table 6 show the results for the separate consideration of vertical FDI and horizontal FDI. Four classifications of VFDI are contrasted with the four corresponding classifications of HFDI. In the first stage, the bulk of variables do not essentially differ across the classifications. The export share as exclusion variable for the selection into the MNE group is highly significant in every single estimation ver-

sion. Like in the baseline model, a higher productivity is a significant characteristic of multinational firms, independently of the underlying investment motive.[6] Concerning our control variables, firms with a R&D department have across all classifications a higher probability to be found in the MNE group. A clear distinction is noticeable with regard to economic sectors. For factor cost-saving investments in the Czech Republic, the affiliation to the manufacturing or the service sector does not play a significant role in the selection process. Concerning investments primarily motivated by market access factors, however, the coefficient for the service dummy is highly significant for all four definitions of HFDI. Thus, we can state that horizontal FDI is strongly associated with the service sector. The highly significant coefficient values for the Bavarian dummy shows the strong position of this federal state in the group of MNEs. The dummy for Saxony, in contrast, is only significant in two out of eight estimations.

The results for the second stage are for some variables straightforward across all classifications. The position of the company in the production chain shows different coefficients for vertical and horizontal FDI. The coefficient signs are negative and significant for all four VFDI measures, but for none of the HFDI measures. Hence, firms with vertical FDI tend to have larger affiliates in the Czech Republic if they are positioned lower in the production chain. This result supports the hypothesis that vertical FDI is linked to trade in intermediate inputs, and thus companies at home are positioned in earlier production stages. The two dummies for Bavaria and Saxony again show differences between the eastern and western border areas. While the location of the headquarters in Saxony is persistently insignificant for the size of FDI, Bavarian firms with slightly significant coefficient values have a larger workforce in the Czech Republic in the case of horizontal FDI. For the employment size of the Czech affiliate, distance obviously is of minor importance for vertical investments. Accordingly, the significant outcome for the role of transaction costs in the baseline specification is driven by firms that invest for reasons of market development. For this type of FDI, communication and monitoring costs are apparently a decisive factor that can be reduced if mother and daughter firms are located close to each other, at least along the Czech border with Bavaria. Generally, it can be said that a low

[6] In order to see if there is a productivity difference between VFDI and HFDI concerning the extensive margin of FDI, we estimated a multinomial logit model differentiating between domestic, VFDI (base category) and HFDI firms. While with rising productivity a firm's probability of belonging to the domestic firms relative to the VFDI firms significantly decreases, the coefficient of productivity is positive but not significant for HFDI firms. This finding indicates that concerning the extensive margin of FDI, no significant productivity difference between vertically and horizontally integrated firms can be observed. This outcome does not support the theoretical expectations of the models by Head/Ries (2003) and Hayakawa/Matsuura (2015) that predict a higher productivity for HFDI than for VFDI firms. However, our results are in line with the empirical findings of Hyun/Hur (2013) that do not identify a productivity difference between HFDI and VFDI firms, neither. The results of the multinomial logit model are available from the authors upon request.

distance is a more relevant factor for the extensive margin of FDI. Our results are in line with the findings by Buch et al. (2005) that state that many small firms prefer to locate their foreign activities in regions close by to the home country.

Concerning our key topic, the estimation results reveal, however, that the method of classifying firms into groups of FDI types matters. Using the classifications that are based on our preferred measure, the self-assessment of the firms, and on the cross-border flow of intermediate inputs, productivity is found to be a significant determinant for the size of the affiliate in the Czech Republic for horizontal investments, but not for vertical FDI. This result is in line with the previous findings of Hayakawa/Matsuura (2015) and indicates that the theoretically predicted rising productivity from VFDI to HFDI firms might be more important for the size of FDI than for a firm's multinationality itself. However, the relation between productivity and the FDI size is reverse with the classifications referring to the industry affiliation. The indirect measures identify the productivity as slightly significant characteristic for the size of VFDI, whereas the coefficient for productivity remains insignificant for HFDI. These results are clearly contradicting theoretical expectations.

To sum up the results considering the separation into VFDI and HFDI, we find clear evidence that the classification method makes a difference with respect to key determinants of FDI, particularly concerning productivity. Surely, across the board, high productivity is found to be a major factor for the multinationality of firms. It depends on the classification measure, however, whether productivity is also identified as main characteristic at firm level affecting the size of FDI. The use of direct information from the survey data exhibits results that are considerably more in line with theoretical and empirical research than the application of approximate measures. On the one hand, the regression results for different classifications show that it is important to consider the motives behind the FDI decision for accurate interpretation. On the other hand, not only the differentiation of vertical and horizontal investments should be considered, but also the concept of classification.

Table 5
Vertical FDI

	VFDI survey		VFDI inputs		VFDI industry18		VFDI industry43	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
FDI size (number of employees in CZ, ln)								
Productivity (ln)	0.3196	0.2062	0.1786	0.2154	0.6206 *	0.3116	0.5073 *	0.2786
Number of employees (GER, ln)	0.4318 ***	0.1199	0.3194 **	0.1289	-0.0339	0.1477	0.1774	0.1258
Services	-0.6429 *	0.3836	-0.2317	0.3819	0.5425	0.4468	0.1576	0.3882
Works council	0.5283	0.3964	0.6182	0.4162	0.0190	0.5065	0.2442	0.4441
Collective agreement	-0.0882	0.3095	-0.8708 **	0.3582	-0.9101 **	0.4240	-0.9509 **	0.3917
R&D	0.5629	0.5374	1.0960 **	0.5446	2.1306 **	0.9405	1.5278 *	0.7809
Value-added chain	-0.2809 ***	0.1063	-0.2618 **	0.1230	-0.4610 ***	0.1483	-0.4748 ***	0.1301
NRC occupations	-1.6845	1.4064	-2.2318 **	1.1343	-1.3338	1.4838	-1.8838	1.3049
Age (ln)	0.0908	0.1308	0.0774	0.1684	0.6401 ***	0.2420	0.2217	0.1980
Bavaria	0.7742 *	0.4063	0.6496	0.4148	0.7078	0.5239	0.5119	0.4430
Saxony	-0.8014	0.6045	-0.1777	0.8213	-0.9048	1.2366	-1.0717	1.2462
Constant	0.1864	2.1497	0.1793	2.1914	-5.2310	3.3444	-2.5127	2.9100
Selection								
Productivity (ln)	0.2050 **	0.0807	0.1901 **	0.0748	0.2436 ***	0.0787	0.2692 ***	0.0731
Number of employees (GER, ln)	-0.0739	0.0531	-0.0733	0.0513	-0.0756	0.0516	-0.0384	0.0482
Services	-0.1599	0.1748	0.2230	0.1614	0.2166	0.1637	0.2062	0.1522
Works council	-0.3477 *	0.1855	-0.1408	0.1762	-0.2997	0.1849	-0.1680	0.1709
Collective agreement	-0.0865	0.1513	-0.1513	0.1466	-0.0628	0.1550	-0.1540	0.1439
R&D	0.9237 ***	0.1657	0.9074 ***	0.1601	1.0074 ***	0.1689	0.9115 ***	0.1531
Value-added chain	-0.0510	0.0460	-0.0683	0.0447	-0.0671	0.0459	-0.0772 *	0.0426
NRC occupations	0.2390	0.5876	0.2725	0.4971	0.9456 **	0.4655	0.8782 **	0.4441
Age (ln)	-0.0020	0.0733	0.0094	0.0736	0.0115	0.0820	-0.0340	0.0736
Bavaria	0.5810 ***	0.1574	0.6905 ***	0.1504	0.5431 ***	0.1565	0.4849 ***	0.1478
Saxony	0.2466	0.2761	0.0051	0.3034	-0.4320	0.3983	-0.6076	0.3938
Export share	1.2490 ***	0.2746	1.3637 ***	0.2617	0.9985 ***	0.2800	0.9611 ***	0.2639
Constant	-2.3869 ***	0.5910	-2.4046 ***	0.5578	-2.6883 ***	0.5967	-2.5530 ***	0.5534
Statistics								
Mills lambda	0.4155	0.5584	0.8238	0.5682	2.3039 **	0.9573	1.9059 **	0.8883
Observations	752		765		752		776	
Uncensored observations	102		115		102		126	

Note: */**/*** significant at the 10/5/1 percent level.

Source: Authors' own calculations from IAB-ReLOC survey & Establishment History Panel (BHP).

Table 6
Horizontal FDI

	HFDI survey		HFDI inputs		HFDI industry18		HFDI industry43	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
FDI size (number of employees in CZ, ln)								
Productivity (ln)	0.5184 ***	0.1986	0.5062 **	0.2152	0.1183	0.1545	0.1824	0.1582
Number of employees (GER, ln)	0.3056 ***	0.1094	0.1629	0.1215	0.3650 ***	0.0972	0.3456 ***	0.1021
Services	0.9778 **	0.4229	0.0618	0.4288	-1.2862 ***	0.2974	-1.3093 ***	0.3319
Works council	0.6244 *	0.3723	0.3458	0.4475	0.9871 ***	0.3336	0.9703 ***	0.3580
Collective agreement	-0.5058	0.3232	0.1108	0.3709	-0.2569	0.2618	-0.2368	0.2828
R&D	1.3907 ***	0.5172	1.2530 **	0.6254	0.2621	0.3917	0.3791	0.4175
Value-added chain	-0.0944	0.1037	-0.0422	0.1231	-0.0126	0.0871	0.0106	0.0970
NRC occupations	-1.5240	0.9460	-1.1800	1.3693	-1.4563	1.0250	-1.1970	1.1733
Age (ln)	0.1377	0.1767	0.3730 *	0.2064	-0.0066	0.1208	0.0529	0.1389
Bavaria	0.7994 **	0.3512	0.7326 *	0.4422	0.5385 *	0.3174	0.5638 *	0.3397
Saxony	0.9974	0.6150	0.7341	0.6903	0.2238	0.4679	0.2773	0.4877
Constant	-5.1664 **	2.2220	-4.4876 *	2.6492	1.0477	1.6949	0.2503	1.7593
Selection								
Productivity (ln)	0.2956 ***	0.0685	0.3126 ***	0.0742	0.2769 ***	0.0689	0.2639 ***	0.0738
Number of employees (GER, ln)	0.0671	0.0500	0.0485	0.0535	0.0594	0.0500	0.0500	0.0535
Services	0.7912 ***	0.1551	0.6145 ***	0.1673	0.5244 ***	0.1541	0.6247 ***	0.1683
Works council	-0.1996	0.1713	-0.3403 *	0.1881	-0.2299	0.1707	-0.3489 *	0.1846
Collective agreement	-0.1092	0.1447	0.0817	0.1566	-0.0826	0.1394	0.0108	0.1503
R&D	0.8815 ***	0.1585	0.9642 ***	0.1745	0.8277 ***	0.1548	0.8907 ***	0.1709
Value-added chain	-0.0499	0.0438	-0.0221	0.0470	-0.0489	0.0429	-0.0298	0.0465
NRC occupations	0.6823	0.4436	0.7805	0.5054	0.1596	0.5189	0.0304	0.5743
Age (ln)	-0.0753	0.0763	-0.1099	0.0829	-0.0581	0.0701	-0.0270	0.0776
Bavaria	0.7217 ***	0.1471	0.7002 ***	0.1598	0.7841 ***	0.1457	0.8686 ***	0.1551
Saxony	0.0871	0.2712	0.2661	0.2750	0.4291 *	0.2337	0.6331 ***	0.2390
Export share	1.2212 ***	0.2607	1.1519 ***	0.2755	1.3657 ***	0.2507	1.4722 ***	0.2654
Constant	-3.4770 ***	0.5386	-3.6454 ***	0.5893	-3.2827 ***	0.5263	-3.6421 ***	0.5668
Statistics								
Mills lambda	1.3842 **	0.5866	0.9463	0.6381	-0.0821	0.4248	0.0227 *	0.4077
Observations	775		745		777		753	
Uncensored observations	125		95		127		103	

Note: */**/*** significant at the 10/5/1 percent level.

Source: Authors' own calculations from IAB-ReLOC survey & Establishment History Panel (BHP).

7 Conclusion

The central aim of this paper was to focus on the differentiation between vertical and horizontal direct investment projects and raise the awareness of the importance how to define types of FDI. We investigate the relationship between productivity and both the extensive and the intensive margin of FDI. A newly established data set is based on the IAB-ReLOC survey that after merging information from the Establishment History Panel (BHP) comprises detailed firm-level information of German multinational firms and their subsidiaries in the Czech Republic. The composed database allows us to identify the core characteristics of multinational firms in comparison to firms without affiliates abroad. The results of our in-depth analyses not only corroborate stylized facts of previous research, but contribute to the literature by original findings for the specific case of Germany and the Czech Republic.

More productive companies, firms with R&D department and firms from Bavaria, the Western German federal state bordering on the Czech Republic, are more likely to self-select into the MNE group. With regard to the motivation of firms to go abroad, we find clear-cut differences for vertical FDI and horizontal FDI, but also outcomes where the results depend on the definition of the type of FDI. While horizontal FDI is a distinct activity of service firms, the affiliate size of vertically integrated firms is evidently related to the parent company's lower position in the value-added chain. Commonly applied measures like the industry affiliation of mother and daughter firms, however, not only depend on the aggregation level of the used industry codes, but also deviate to a great extent from both the self-assessment of firms and actual intra-firm trade relations concerning their motive for going multinational. This is exemplified by the contrasting findings with respect to the role of productivity for the size of FDI in the host country. The results gained when applying classifications that are based on direct survey responses correspond to theoretical and empirical evidence on differences between types of FDI. As this is not the case for indirect, i.e. rather coarse classification measures, one should be more cautious in interpreting distinguished outcomes for vertical and horizontal FDI.

Admittedly, the analytic potential of the IAB-ReLOC data is subject to certain limitations, insofar as it was conducted up to now as a one-time survey. It would be desirable to analyze the determinants of the labor demand of multinational firms not only in a cross-section design, but over time. Progress in the compilation and creation of data sets will contribute to remove obstacles in studying issues related to foreign direct investment that become more and more relevant in a global economy.

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