German Foreign Direct Investment in the Czech Republic – An Analysis of Regional Determinants and Investment Motives using the IAB-ReLOC Data

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Table of content

List of figures

List of tables

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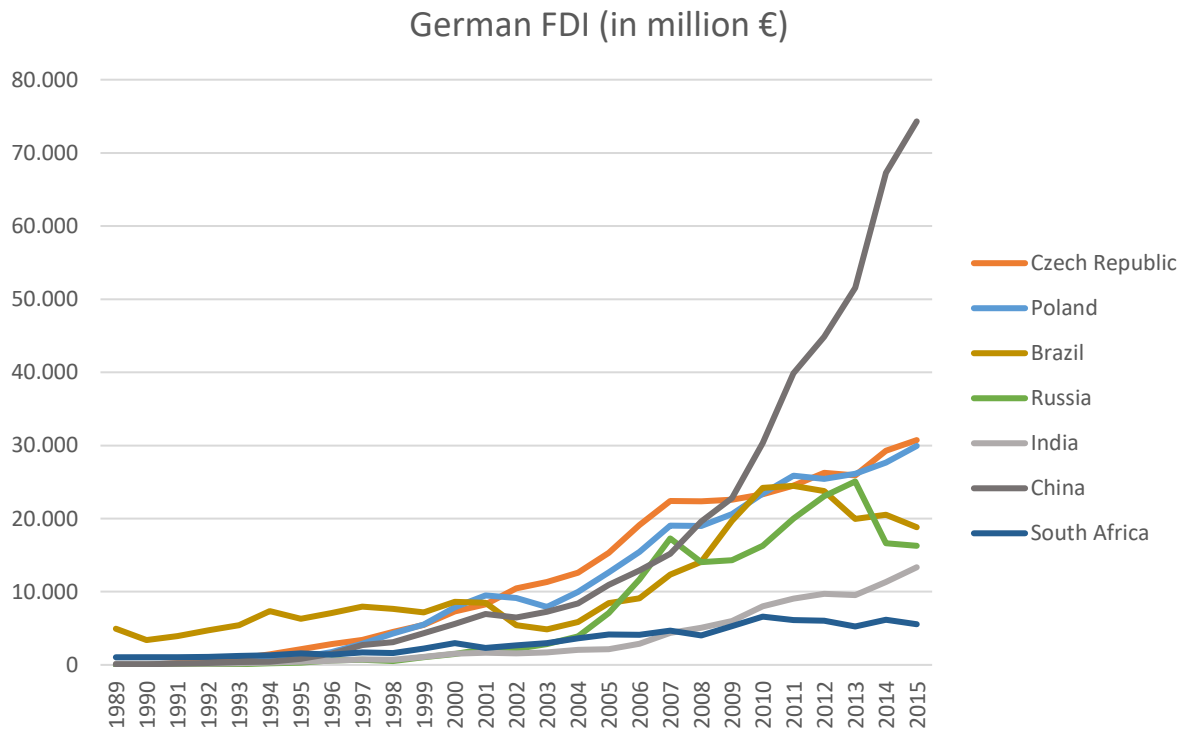
1. Introduction

With the ongoing globalisation, foreign direct investment (FDI) has become more and more important over the last decades. Due to shrinking trade impediments, better transport infrastructure and the development of new technologies, trade costs have steadily decreased which has facilitated the opportunities to invest abroad and has allowed companies to organise their production processes in new ways. This is reflected by an enormous growth in international trade (Dauth et al. 2014) as well as in FDI flows (Helpman 2006). While FDI is discussed rather controversially in the home country of FDI (for an overview see Pflüger et al. 2013, for example) with regards to the effects on the labour market, especially less developed countries and transition countries try to attract foreign investments as drivers for growth and development (Bevan/Estrin 2004; Calá et al. 2016). The reason for this is that foreign investors bring not only financial capital but also technology as well as knowledge into the host countries (Rojec/Knell 2018). Due to forward and backward linkages with the affiliates of multinational enterprises (MNEs) or the hiring of workers trained by MNEs, the new knowledge and technologies do not solely remain in the MNEs' affiliates but may also spread to local domestic companies. This may in consequence lead to an increase in productivity (Alfaro et al. 2017; Bournakis et al. 2018; Pelegrín/Bolancé 2008). There is evidence that these positive externalities of FDI are, however, spatially limited to the location of the foreign affiliate, i.e. to the host regions of FDI (Chapman/Meliciani 2018; Merlevede/Purice 2016). Thus, the location of FDI may contribute to both the emergence of regional disparities and the reinforcement of already existing regional economic differences. For both the home and the host country of FDI, the internationalisation of companies is therefore not only an interesting subject in regional economics but also an important issue concerning regional policy.

To contribute to the literature on firm internationalisation and FDI location, this thesis focuses on the special case of Germany and the Czech Republic. This pair of countries is unique in many regards. With the fall of the Iron Curtain in 1989 it was possible for the first time for foreign companies to invest in the formerly closed economies of the Central and Eastern European countries (CEECs). The significantly lower labour costs combined with spatial proximity made the CEECs attractive target countries, especially for investors from Western Europe. Germany and the Czech Republic constitute a prime example in this regard: According to Eurostat (2017), the wage cost differential between the two countries is still pronounced with average hourly labour costs of 10.20 € in the Czech Republic and 33.00 € in Germany in 2016. In the past, this gap has been even larger: In 2000, the level of labour costs in Germany was 24.60 €, i.e. 6.6 times the level in the Czech Republic with 3.70 €. These figures demonstrate not only the significant difference in the wage levels of the two countries, but in addition show that the purchasing power in the Czech Republic is growing. Thus, the Czech Republic is not only an interesting location for foreign companies that are intent on reducing their production costs but, due to the rising consumer potential, also for investments that are intended to open up new markets. Furthermore, there has also been a special interest from the Czech side to attract foreign investors. Already in 1992, i.e. almost directly after the fall of the Iron Curtain, the Czech Ministry of Industry and Trade founded the Investment and Business Development Agency CzechInvest (CzechInvest 2014a). By providing investment subsidies for investments

fulfilling special conditions with regards to the number of jobs created or the location chosen, the agency CzechInvest is intended to promote the Czech Republic as an attractive target country for FDI. These external preconditions have had a positive effect on FDI relations between the two countries. From the German perspective, the Czech Republic is, closely followed by Poland, the most important target country for German FDI among the CEECs (Deutsche Bundesbank 2018). For the year 2015, the data provided by the Deutsche Bundesbank show an amount of more than € 30 billions of German FDI and around 315,000 employees working in 963 German affiliates in the Czech Republic (Deutsche Bundesbank 2017). In the period from 2002 to 2008, the Czech Republic having only approximately 10 million inhabitants has also been a more important target country for German investors than the much larger economies of the BRICS countries (comprising Brazil, Russia, India, China and South Africa) (see Figure 1.1).

Figure 1.1: German FDI in the Czech Republic, Poland and BRICS from 1989 to 2015



Source: Deutsche Bundesbank (2018), own illustration.

From the Czech perspective, too, Germany has a very strong position when it comes to FDI relations. In 2015, Germany has been among the most important investors in the Czech Republic in terms of FDI values, only exceeded by the Netherlands and Austria (Czech National Bank 2017). According to the annual reports on FDI of the Czech National Bank (2018), the importance of Germany was even greater earlier on: From 1999 to 2012, Germany

was the second most important investor after the Netherlands[1] with regards to the FDI stock in the Czech Republic, and in 1998 Germany was the most important investor in terms of value. Concerning the total number of investing firms, Germany was, however, more important than the Netherlands as, for example, in 2000 almost a third of the total number of foreign investors in the Czech Republic came from Germany (Czech National Bank 2002).

As these descriptive figures show, foreign direct investments between Germany and the Czech Republic are of great relevance for both countries. By shedding light on the regional distribution of FDI and on the types of FDI, this thesis gives deeper insights into these FDI relations, especially from a regional economics perspective. The dissertation is structured as follows. **Chapter 2** gives a comprehensive overview of the theoretical background and of previous empirical evidence with respect to FDI location as well as to the differentiation between different types of FDI and the size of FDI. As the dissertation is organised in a cumulative way, chapters 3 to 6 consist of one original research paper each. **Chapter 3** presents the newly established dataset that is used to investigate FDI location and types of FDI in this thesis – the IAB-ReLOC data. The IAB-ReLOC data have specifically been created for an in-depth analysis of the FDI linkages between Germany and the Czech Republic – primarily with regards to the labour market effects of FDI, but this rich dataset also allows new insights into the regional aspects of FDI. Although there is a wide range of literature dealing with FDI location, existing studies are often based on datasets that face crucial limitations. Many of them are selective with respect to the characteristics of the companies and/or the investment projects included. Datasets that have often been applied in empirical research, for example the MiDi dataset of the Deutsche Bundesbank or the AMADEUS data of Bureau van Dijk, comprise only companies that surpass certain specific thresholds. This leads to an overrepresentation of larger companies and/or FDI projects in these datasets. In general, this selectivity is not particularly relevant as especially the most productive, often larger companies become multinationals (Helpman et al. 2004). In the special case of neighbouring countries, however, lower transaction costs due to geographical proximity also allow smaller firms to engage in FDI. The selectivity of the datasets with regards to firm size may therefore be problematic when it comes to analysing FDI between Germany and the Czech Republic. As the IAB-ReLOC data comprise the total population of German parent and Czech affiliated companies that were active in 2010, the dataset is not selective with respect to company size or the size of the FDI project. Compared to most datasets used in empirical research on FDI, not only the total number of FDI projects contained in the dataset is remarkable but also the information on both parent and affiliated companies is unique – comprising detailed address information for the whole sample as well as survey information and administrative data for subsamples. The

[1] According to Damborský (2016), there are several reasons why the Netherlands are such an important investor in the Czech Republic. First, the Netherlands have been an attractive location site for multinational investors due to favourable tax conditions and a friendly regulatory environment that includes a strong legal protection of companies investing abroad. Second, in 1991, the Czech Republic and the Netherlands signed a bilateral "Agreement on encouragement and reciprocal protection of investments between the Czech and Slovak Federal Republic and the Kingdom of the Netherlands" (see also Embassy of the Czech Republic in The Hague 2018). Third, the more recent increase of FDI from the Netherlands to the Czech Republic at the beginning of the 2010s is mostly driven by the investment strategies of the companies owned by Czech owners which have relocated their administrative address from the Czech Republic to the Netherlands.

description of the data generation process is the first channel through which this thesis contributes to the literature.

In addition, chapter 3 gives new insights into the nonresponse behaviour of companies. As in most firm-level datasets only information on the participating firms is available, empirical evidence on the factors determining whether a company participates in a survey or not is rare. The IAB-ReLOC data allow us to analyse which firm and interviewer characteristics influence the survey participation decision. Due to the cross-border nature of the dataset, differences in the nonresponse behaviour of German and Czech companies can be identified.

Based on this unique dataset, the main focus of this thesis is on the analysis of the regional aspects of FDI in the home country, Germany, and the host country, the Czech Republic. In **chapter 4**, the regional distribution of the German parent companies and the Czech affiliated companies is investigated from a cross-border perspective. Previously, only few studies dealing with FDI location on the regional level used information on the home as well as on the host country. However, only by taking into account information on both the location of the parent companies and the location of the affiliates, some crucial issues, for example the role of distance between headquarters and affiliates, network effects in border regions and regional wage differences, can be revealed. A gravity model approach is used to analyse the role of market size and agglomeration economies, distance and border issues, as well as labour market characteristics for the location of parent and affiliated companies. While for the two core variables of the gravity equation the expected results are obtained – the number of FDI projects increases with the economic size of a region and decreases as the distance between two regions rises – the estimations show some interesting findings concerning other regional characteristics. While the wage ratio between the German home and the Czech host region is negatively correlated with the number of joint FDI projects, the share of high-skilled employees in the Czech region is positively related to the number of FDI projects. Thus, a highly qualified workforce seems to be more important for German investors than relatively low labour costs. Another notable finding concerns the role of the common border region. Although many regions in the German-Czech border area show a rather rural character, the FDI activity in that area is at an above-average level. Interestingly, an asymmetric interconnectedness can be observed. While investors from the German border area invest at an above-average level in the close-by Czech border regions, they chose to invest in Czech regions that are located farther away from the border less frequently. The Czech border regions, in contrast, attract investors from both German border and non-border regions at an above-average level. The chapter concludes with some implications for regional policy.

While chapter 4 takes the cross-border perspective and looks at the regional distribution of FDI in the home and the host country, **chapter 5** focuses in more detail on the location choice of German FDI within in the Czech Republic. Using a nested-logit model, the influence of agglomeration economies, distance features and labour market characteristics on FDI location choice is analysed. Compared to most previous studies in this field of research, a very detailed regional level is chosen to identify the locational factors determining the location choice of the German investors within the Czech Republic. This is necessary as the impact of agglomeration economies on FDI location can only be investigated at a highly differentiated regional level.

Many previous studies have highlighted the importance of agglomeration economies for FDI location (see, for instance, Barrios et al. 2006; Guimarães et al. 2000). A special characteristic of the analysis presented in this thesis is that much emphasis is put on the measurement of German-specific agglomeration, i.e. the existence of German firms in a Czech region prior to the investment. In addition, different subgroups of investments are considered to identify differences in the location decisions with respect to investment characteristics. Although the location choice may differ depending on the underlying motive, previous studies on FDI location choice have mostly neglected these differences. The most significant finding of the paper is that the location choice of German investors in the Czech Republic is mainly influenced by agglomeration economies. Especially regions with a spatial concentration of firms operating in the same industry as the investment activity and regions that show a pre-investment agglomeration of German firms are chosen as new location.

While chapters 4 and 5 deal with the regional distribution of FDI, **chapter 6** looks at the motives for FDI and the relation between productivity and firm internationalisation. Two types of FDI are distinguished: vertical FDI (VFDI) that aims at cost reduction (Helpman 1984), and horizontal FDI (HFDI) that seeks new markets (Markusen 2002). As in many datasets, information on these two motives for FDI is not available, however, a number of indirect measures exists to distinguish between them. The most prominent one is a classification based on the industry affiliation of parent and affiliated company. If two linked companies operate in the same industry, the FDI project is classified as horizontal; if they operate in different industries, the project is classified as vertical. The paper presented in chapter 6 pursues the question as to how reliable these indirect classifications are for differentiating between the two main types of FDI. Based on the survey information included in the IAB-ReLOC data, four different classification methods are compared. A direct self-assessment of the companies with respect to the most important motive for becoming multinational is compared to a classification based on intra-firm trade and to two classifications based on the industry affiliation of parent and affiliated company. In the descriptive part, it is shown that the importance of the two types of FDI in the German-Czech case varies with the underlying classification concept. In a next step, it is analysed whether estimation results change according to the underlying classification concept. By applying a two-step Heckman procedure, the role of productivity in German-Czech FDI relations regarding the extensive margin of FDI, i.e. the process of becoming multinational, as well as the intensive margin of FDI, i.e. the size of FDI in the host country, is investigated. In doing so, our focus is on the differences between vertically and horizontally integrated firms as well as between the underlying classification concepts. The estimations reveal that productivity is not only a crucial factor for the decision to engage in FDI but also plays a significant role for the number of employees in the Czech affiliate. In addition, differences between direct and indirect classification concepts are revealed. For instance, the size of horizontal FDI is significantly influenced by productivity only in case of classifications that are based on survey responses. This result confirms theoretical expectations and previous empirical findings but contrasts clearly with the results obtained for the indirect classification methods.

To sum up, the contribution of this thesis to the literature on FDI is manifold. First, with the IAB-ReLOC data a new and unique dataset is used that comprises the total population of German parent companies and their Czech affiliates that were active in the year 2010. The analysis of the regional distribution of FDI from a cross-border perspective is the second contribution of this thesis to the literature. Light is shed on the special role of the border regions and the asymmetric FDI connections between these regions. The third contribution lies in the analysis of the location choice of German investors in the Czech Republic based on a highly disaggregated regional level. Only small regional units allow us to identify the impact of agglomeration economies on FDI location choice. Additionally, the location choice behaviour is analysed separately for different investment characteristics. And last, the thesis contributes also to the literature on FDI types. By applying different classification concepts, not only the importance of vertical and horizontal FDI projects in the context of German-Czech FDI relations is analysed, but the thesis shows that the choice of the classification concept influences estimation results.

In **chapter 7**, the most crucial findings of the thesis are summarised and the policy implications that have been elaborated based on these outcomes are outlined. In addition, an outlook to future research is given.

2. Research background

This dissertation mainly deals with two aspects of FDI: the regional distribution and location choice of FDI on the one hand and firm characteristics and FDI size on the other. To describe how the thesis fits into the literature, this chapter gives an overview of the theoretical background and of previous empirical literature on these topics.[2]

2.1 Globalisation and FDI

Within the last few decades, the importance of international trade and FDI has grown enormously. This development is closely linked to the reduction of trade barriers as well as to innovations in transport technologies and logistics. With increasing economic integration the firms' possibilities of organising their production processes have become more diverse in general. In closed economies, the relevant tasks can be produced internally or bought from other domestic firms. In integrated economies, these two channels are also available abroad (see Table 2.1). Declining transport and communication costs have facilitated international trade and thus supported the development that firms split up their production processes towards ever finer steps that are performed at various locations in different countries (Lincoln/McCallum 2018; Pflüger et al. 2013; Timmer 2016).

Table 2.1: Classification of organisational modes

Activity/task is performed…	**domestic economy**	**foreign economy**
in-house (affiliated suppliers)	domestic insourcing	**offshoring/integration (horizontal & vertical FDI)**
outsourced (non-affiliated suppliers)	domestic outsourcing	international outsourcing ("arm's-length trade")

Source: Pflüger et al. (2013).

The focus of this dissertation is on offshoring from Germany to the Czech Republic. This term relates to German firms that engage in FDI in the Czech Republic and covers different types of FDI. Traditionally, the literature has differentiated between two main motives for investing abroad (see Alfaro/Charlton 2009, for instance). One main reason why firms invest in foreign countries is to get access to new markets. This type of FDI is referred to as horizontal FDI (HFDI). By implementing a production plant on-site in the foreign country, foreign demand can be met by local production instead of exports. The second main reason for FDI is cost reduction

[2] As chapters 3 to 6 of the thesis consist of original research papers, they also contain some literature reviews. Hence, repetitions cannot be avoided.

and referred to as vertical FDI (VFDI). In this case, companies invest abroad to realise cost and/or efficiency benefits and relocate at least part of their production to foreign countries.[3]

As the distinction between different motives for FDI is relevant for all research questions addressed in this thesis, a short overview of the theoretical background of VFDI and HFDI is given in the following paragraphs. The explanation of VFDI goes back to Helpman (1984) and Helpman/Krugman (1985) and corresponds to the classic Heckscher-Ohlin model of the trade theory. In their models the authors look at a company that splits up its value added chain to different production sites in foreign countries. With this "slicing up of the value chain" (Krugman 1995), each production step is carried out in the country that provides the lowest costs for the corresponding production step. This splitting up of the value-added chain provokes, however, fragmentation costs that arise due to the increased coordination effort and the transport of intermediate goods between the various production sites. For this reason, firms profit from VFDI only if the cost-savings exceed the fragmentation costs. VFDI is mostly of unilateral nature and goes from a country that has a relative wealth of (human) capital to countries with a relatively low-waged and low-qualified workforce. It can be derived that VFDI occurs when the transport costs as well as the production costs in the target country are low.

HFDI arises accordingly to intra-sectoral trade (Krugman 1979) and is associated with economies of scale and the access to foreign markets. HFDI predominantly occurs between countries that have a similar factor endowment. The decision whether a firm serves the foreign market by exports or by on-site production is influenced by tariff, transport and production costs (Brainard 1997; Markusen/Venables 1998). Variable transport costs are associated with the export of final goods to the target country, and fixed production costs are linked to local production in the target country. Firms will therefore only invest horizontally in foreign markets when producing locally in the target country is cheaper than exporting final goods from the home country. As a consequence, the occurrence of HFDI is consequently related to high transport and transaction costs and a large target market.

Regarding the importance of these two types of FDI, many studies come to the conclusion that the greater share of foreign direct investments is of horizontal nature, but that an increase in the importance of VFDI can be observed (for an overview see Pflüger et al. 2013). For Germany, Buch et al. (2005) find that German FDI is mainly market-seeking, but that for some target regions, for example the transition economies of the CEECs, the cost-reduction motive is quite important. However, there is evidence that the relative importance of the two motives is strongly associated with the underlying classification concept. Alfaro/Charlton (2009), for instance, suggest that the prevalence of HFDI in the literature might be due to a misclassification provoked by the application of aggregated industry-level data.

[3] Other studies also take into consideration export-platform FDI. This type of FDI relates to the phenomenon that the products produced in the foreign affiliate are predominately exported to third countries and not sold in the home or the host market of FDI (see Ekholm et al. 2007 for a detailed explanation). Export-platform FDI predominantly occurs "if trade protection between destination markets (or at least a group of destination markets) is low enough relative to trade frictions between the parent and destination countries" (Blonigen et al. 2007). As such a scenario cannot be observed in the case of Germany and the Czech Republic, export-platform FDI is not included in this thesis.

2.2 Regional distribution and location choice of FDI

With the rising importance of FDI over the last decades, the interest in the regional distribution of FDI has grown, too. This is reflected in a growing number of studies dealing with FDI location (Jones 2017). However, most studies look at the regional distribution of foreign direct investment in developed countries. Despite the rising importance of the CEECs in attracting foreign capital, analyses investigating which regions the foreign capital goes to within these countries are still scarce (Medve-Bálint 2014), probably also due to missing comprehensive datasets. By focusing on the regional distribution of German FDI in the Czech Republic – both, from a cross-border perspective and with a focus on a detailed regional disaggregation – this thesis wants to contribute to closing this research gap.

In this section, the theoretical understanding of potential location factors and the related empirical literature are highlighted. According to Porter (2003), regional differences, persisting in a way in every country, can help to find the essential drivers of economic development. Also for the attraction of FDI, region-specific endowments of economic factors can outplay country-specific effects, as emphasised by Pusterla/Resmini (2007) in a study on the location choice of multinational firms in four CEECs. Various research methodologies have been applied to investigate the determinants for the location of FDI. However, two sorts of econometrics models have emerged as basic approaches in empirical studies analysing industrial location (for an overview see Arauzo-Carod et al. 2010). One standard approach to analysing how the characteristics of a region affect the probability to be chosen as an investment location is the use of discrete choice models. The other standard approach in the empirical literature on firm location choice is to apply count data models. According to Arauzo-Carod et al. (2010), the choice of the approach in a specific study depends on the focus of the analysis as well as on data availability.

Previous literature on FDI location has mainly identified three groups of location factors that influence the regional distribution of FDI projects: agglomeration economies, labour market issues and distance features. In the following paragraphs, a summary of this literature is presented.

2.2.1 Agglomeration economies

According to Glaeser (2010), agglomeration economies are benefits that arise when firms and individuals locate in close proximity to one another. These agglomeration economies strongly influence the location choice of multinational firms, as has been shown by previous theoretical and empirical studies (for a comprehensive overview see Jones 2017). In general, two types of agglomeration economies are distinguished. On the one hand, the overall economic activity in a region may generate positive externalities (Krugman 1991). These externalities are also referred to as urbanisation economies or Jacobs externalities (Jacobs 1969). On the other hand, agglomeration economies may arise when firms locate close to other firms of the same industry. These industry-specific externalities are also referred to as localisation economies or Marshallian externalities as they go back to Marshall (1898). To locate near other firms active in the same industry may be attractive for firms as they can share inputs; labour-market pooling

can provide them with workers qualified in specific skills; and, in addition, knowledge spillovers may occur.

In the literature on FDI location, a further differentiation of agglomeration economies is applied: agglomeration economies arising due to an agglomeration of domestic firms and agglomeration economies emerging due to a spatial concentration of foreign firms (Crozet et al. 2004; Guimarães et al. 2000; Smith/Florida 1994). It is assumed that agglomeration economies generated by foreign firms are generally greater than those from domestic firms. The reason for this is that a spatial concentration of foreign firms may have a signalling function for future foreign investors. By imitating the location decision of previous investors, they are, thus, able to reduce search costs. In this regard foreign firms from the same country of origin are of special importance (Ascani et al. 2017). Due to firm networks and forward- and backward-linkages, firms are better informed about the investment activities of other firms from the same country of origin than from other countries.

Agglomeration economies play a role for the location of both parent companies and affiliates. There is empirical evidence that localisation economies are important drivers for FDI location as foreign investors are mainly attracted to regions where many firms are active in the same industry as the FDI project. This is found, inter alia, by Crozet et al. (2004) for the location choice of foreign firms in Spain, by Head/Mayer (2004) for the location choice of Japanese companies in Europe, by Crozet et al. (2004) for FDI location in France and by Gauselmann/Marek (2012) for the location choice of FDI in Eastern Germany, Poland and the Czech Republic. With regards to urbanisation economies, previous studies also have identified a positive effect – concerning more the overall number of economic activity than a diversified economic structure (Basile et al. 2009). In addition, agglomeration of business-related services has been identified as important for FDI location (Guimarães et al. 2000; Hilber/Voicu 2010). The fact that foreign-specific agglomeration is an important location factor is, among others, highlighted by Head et al. (1995) for the location choice of Japanese FDI in the United States, by Hilber/Voicu (2010) for FDI location in Romania and by Spies (2010) for the location of foreign multinationals in Germany.

With respect to FDI location in the transition countries of the CEECs, it has been shown that agglomeration economies also are an important location factor. However, in these countries localisation externalities seem to be more important than a diversified economic environment (Békés 2005). The same holds true for FDI in China (Song/Cieslik 2018).

2.2.2 Labour market issues

The second group of variables influencing FDI location can be summarised as labour market characteristics. The most prominent factor in this group are labour costs. There is empirical evidence that labour costs matter in the location decisions of investors. For certain industries in the US, for example, studies by Yeaple (2003) and Hanson et al. (2001) find a significantly negative impact of a country's input costs on the US direct investment. Regarding FDI location in the CEECs, there is, on the one hand, evidence that the low labour costs in these countries constitute a locational advantage. Resmini (2000), for instance, stresses the importance of wage differentials as an essential determinant for FDI in manufacturing industries in ten

CEECs. This result is supported by Bevan/Estrin (2004) who find that labour costs are, apart from market size and proximity, the most important factor for FDI from Western Europe to the CEECs. On the other hand, there is evidence that German FDI in Eastern European countries is not only motivated by the search for lower costs but also by seeking qualified labour (Marin 2004; Spilková 2007). For Hungary, Boudier-Bensebaa (2005) has identified a significantly positive effect of unit labour costs on FDI location choice. In general, a wealth of skilled workers, but also unemployment rates, can reflect the regional structure and availability of the workforce. These issues are of particular importance for horizontal investments, as they relate to the purchasing power of regions. Concerning the Czech Republic, Spilková (2007) finds that Czech regions with a higher educational level and with higher wage levels are preferred location sites for FDI.

2.2.3 Distance and border region features

Previous research has shown that the distance between the potential location of the affiliate and the location of the parent company influences the location decision. The influence of transport costs – and thus of distance – on FDI location is linked to the investment motive. Taking advantage of productivity and factor price differentials is less profitable if transport costs are relatively high. Hence, a negative correlation between VFDI and distance can be expected. The link between HFDI and distance, in contrast, is more ambiguous. On the one hand, high transport costs can foster HFDI. The higher the transport costs, the higher the costs of serving a foreign market by exports compared to opening a production or service facility in the foreign country (Brainard 1997; Chen/Moore 2010; Egger 2008). On the other hand, the plant set-up costs could be positively correlated to distance (Markusen/Venables 2000), inter alia due to higher monitoring and communication costs and to higher cultural distance. Therefore, if market entry costs are low, HFDI can be a more profitable channel to get market access also in nearby countries than exporting would be (Hayakawa/Matsuura 2015).

Several empirical studies deal with the relationship between distance and FDI. By estimating a gravity model, Buch et al. (2003) find that with rising distance the average size of German FDI increases. The number of German affiliates in a country, however, decreases with increasing distance. In general, empirical evidence suggests a negative impact of distance on FDI (Blonigen et al. 2007; Brainard 1997; Spilková 2007). Rising information costs (Portes/Rey 2005), growing cultural distance as well as increasing information and communication costs (Buch et al. 2005) and augmenting costs for controlling agents (Huber 2003) are reasons for this negative impact of distance on FDI.

Analysing FDI relations between two neighbouring countries, the relationship between FDI and distance is of specific importance with respect to the common border region. This holds true especially for the case of Germany and the Czech Republic as the border between the two countries was impermeable for a long period of economic separation and the process of economic re-integration was then expected to start in the border regions (Gerling/Schmidt 1998). There is evidence that information costs and network effects have a positive impact on investment possibilities in border regions (Bergin et al. 2009; Hanson 1998). Moreover, as border regions have relatively low-cost access to foreign markets, they benefit especially from

economic integration (Hanson 1996). From the perspective of the home country, investing in the neighbouring country is of specific advantage for firms located near the border. In the border region of the home country, the short distance to the host country keeps transport and transaction costs low. This allows firms located close to the border to benefit from the lower production costs in the neighbouring country in an above-average way (Smallbone et al. 2012). The same holds true for the border regions in the host country: For the case of Poland, it has been shown that due to the small distance border regions are especially attractive location sites for investors from the neighbouring country (Cieślik 2005a, b). However, the specific advantages of border regions for cross-border investment do not only arise from the low transport costs. In border regions the transaction costs arising with cross-cultural communication are lower than in non-border regions. As the border regions along a permeable border represent contact zones that enable everyday encounters between different traditions and mentalities (Krätke 1996), the cultural distance between the border regions of two neighbouring countries is smaller than between non-border regions. This lowers information and communication costs (Buch et al. 2005) which, in turn, reduces the foreign-market entry costs.

2.2.4 Further location factors

In addition to the three groups of location factors “agglomeration economies”, “labour market issues” and “distance and border region features”, there are further issues that influence FDI location. One topic investigated in previous studies is the impact of *regional policy* on FDI location. As FDI is seen as a driver for economic development, policy makers often try to attract FDI by promoting FDI and providing subsidies. However, studies analysing the effect of regional policy on FDI location find only minor positive effects. In their paper on FDI location in France, Crozet et al. (2004) show that foreign investors are mostly insensitive to regional policy measures. This finding is supported by the results of Barrios et al. (2006) that analyse the role of public incentives in attracting FDI to less developed regions in Ireland. They find that regional policy is only successful in attracting low-tech firms. For FDI location in US states, Bobonis/Shatz (2007), too, find that investment incentives have only little influence, and for FDI location in Poland, Cieślik/Ryan (2005) show that special economic zones do not play a significant role in attracting FDI. Closely linked to regional policy issues is the effect of regional *infrastructural endowment* on FDI location. It has been shown that the accessibility of a region and the availability of infrastructure positively influence the location choice of foreign investors (see, for instance, Boudier-Bensebaa 2005 for FDI location in Hungary; He 2002 for FDI location in China; Karreman et al. 2017 for Chinese FDI in Europe).

In addition, especially studies that focus on FDI location on a national level have investigated the role of the *institutional setting*. For example, Karreman et al. (2017) find that the corporate tax rate has a negative impact on the location choice of Chinese FDI in European NUTS 1 regions. This result is supported by the study of Basile et al. (2009) on the location choice of multinational enterprises in European regions. They show that a low corporate tax rate as well as an efficient legal system foster FDI location.

2.2.5 Differences in location choice with respect to investment characteristics

When analysing the location choice of FDI, most previous empirical studies have not distinguished between different investment characteristics. The majority of them has only referred to the manufacturing sector. However, the increasing shift of services abroad can be regarded as a fundamental reason for an increase in FDI relations between countries (see, among others, Duboz et al. 2016; Geishecker/Görg 2013; Helpman 2006). There are two competing explanation strategies for this rising importance of services in FDI relations: On the one hand, this phenomenon is ascribed to the fact that services are mostly non-tradeable and hence cannot be exported, but must be produced on-site in the foreign country (Riedl 2010). On the other hand, this development is explained by the significant advances in information and communication technology that enable an expansion of the international division of labour (Amiti/Wei 2005). While the earliest examples for such fragmentation processes were confined to manufacturing activities, the phenomenon has spread to the service sector. Due to the new technologies, service tasks that were untradeable in earlier times have become tradeable which allows firms to relocate not only manufacturing tasks but also specific services to foreign countries (see Crinò 2010, for example). There is some evidence that investment characteristics in the manufacturing and in the service sector differ. For German FDI in the Czech Republic, Münich et al. (2014) find differences concerning the technology orientation of Czech affiliates. In the service sector, subsidiaries exhibit similar technology levels as the parent companies. In the manufacturing sector, in contrast, there is a technology gap: While the German parent companies are mostly high-tech firms, the majority of the Czech affiliates operating in the manufacturing sector are low-tech firms. These differences could also influence the location behaviour of investors. However, studies analysing FDI location choice that distinguish between investment sectors are rare. One exception is the paper by Jones/Wren (2016) on FDI location in Great Britain. It finds large differences in the location choice of manufacturing and service FDI. For service FDI, final consumer demand is the most important location factor. This result is supported by the study of Riedl (2010) for the location choice of service FDI in the CEECs. The author finds, in addition, that only investments in the manufacturing sector are sensitive to labour cost differences across host countries. Evidence for the Czech Republic is provided by the paper of Gauselmann/Marek (2012) on FDI location. The authors find that in contrast to FDI in the manufacturing sector, FDI in the service sector prefers to locate in capital regions in Eastern Germany, Poland and the Czech Republic.

A further difference in investment characteristics that could influence the locational pattern of FDI is the motive behind the investment. As with the distinction of service and manufacturing investments, only few studies identify the locational determinants of FDI separately for the two main motives. Some evidence is provided by the study of Fukao/Wei (2008) on Japanese FDI. Their results support the theoretical exceptions: Market size and trade costs have a positive impact on the location choice of HFDI, while VFDI is negatively influenced by labour and trade costs.

In addition to investment sectors and motives, there are further differences in investment characteristics that potentially influence the location behaviour of investors, such as investment size and investment form (brownfield vs. greenfield investments). Yet, the vast majority of

previous studies focuses on all types of investments without further differentiations or on the manufacturing sector only (for an overview see Arauzo-Carod et al. 2010). This thesis contributes to the closure of this research gap as the regional distribution of German FDI in the Czech Republic is separately analysed for the manufacturing and the services sector. In the investigation of the location choice of German investors within the Czech Republic a differentiation is made between investment sectors, forms, periods, sizes and motives.

2.3 Firm heterogeneity and FDI

Although the importance of international trade and FDI has steadily increased within the last decades, only a small fraction of firms is actually engaged in exporting or FDI. Mayer/Ottaviano (2008), for instance, show that there are, compared to the overall number of firms, only few "internationalised" firms, i.e. firms that are active in exporting or FDI, and that only a few of these firms account for the bulk of aggregate exports and FDI. At the end of the 1990s and the beginning of the 2000s, empirical studies have shown that firms that are active on foreign markets either through exporting or through FDI systematically differ from firms that serve the domestic market only.

For the case of Spain, Delgado et al. (2002) compare exporting and non-exporting firms with respect to total factor productivity. They find that exporting firms are more productive than non-exporting firms. In general, there are two hypotheses why exporting firms are more productive than firms active on the domestic market only (for a comprehensive overview see Wagner 2007). First, the entry of a foreign market by exporting is linked to additional costs. These are, inter alia, provoked by transport costs, distribution and marketing costs, the need of new (higher qualified) personnel, or production costs in modifying current domestic products for foreign consumption. Only more productive firms can afford to pay these additional costs. Thus, more productive firms self-select into the group of exporting companies. Second, firms active on foreign markets learn by knowledge spillovers from other international firms and face, in addition, a stronger competition than firms that act on the national market only. Thus, exporting firms have to adopt faster new developments which, in turn, makes them more productive. In a survey of the literature on export behaviour and productivity, Wagner (2007) concludes that the hypothesis of self-selection is supported by empirical evidence. For the second hypothesis of learning-by-exporting, however, he does not find strong empirical support. Evidence on differences not only between exporting and non-exporting firms, but also on differences between firms engaged in FDI and exporting firms is provided by Head/Ries (2003). They find that companies that are engaged in FDI are larger and more productive than exporting firms. Firms operating on the domestic market only are found to be least productive and smallest.

These empirical findings on productivity differences within an industry especially concerning differences between exporting firms and domestic firms cannot be explained by the traditional trade models that are based on the assumption of one representative firm within industries. As Helpman (2006) states, earlier trade models mostly assume symmetry across firms within an industry with respect to the available technology, which implies in turn similar productivity levels

and similar participation in foreign trade. The monopolistic competition models in most cases imply that all firms export to all countries. Due to the growing empirical evidence on firm heterogeneity and its relation to a firm's participation in international trade and FDI, new theoretical models have emerged that incorporate firm heterogeneity to explain foreign-market entry (for an overview see Redding 2011). Among the most prominent contributions in this regard is the model of Melitz (2003). Helpman (2006) provides a short illustration of Melitz's model. The following summary refers to his work. According to Helpman (2006), Melitz's model of monopolistic competition with heterogeneous firms has become the cornerstone of a growing literature that examines the role of heterogeneity in international trade and FDI. The most important features of Melitz's model are an interaction between productivity differences across firms and fixed costs of exporting that arise due to distribution and servicing costs in foreign markets. A firm has to bear these fixed costs of exporting in every country to which it exports. Thus, the total fixed export costs increase according to the number of foreign countries the firm chooses to serve.

A non-technical illustration: In Melitz's model, an industry supplies a differentiated product, in which each of a continuum of firms manufactures a different brand. Each firm discovers its productivity only after it enters the industry and faces fixed production costs as well as variable production costs per output unit. It can be shown that in a closed economy firms with productivity levels below a certain threshold choose not to produce. For these firms, variable profits do not cover their fixed costs. Firms with a productivity level above the threshold supply their brands to the market. Given a certain productivity distribution, the percentage of firms that serve the domestic market and the percentage of firms with productivity above the cut-off can be calculated. In a next step, firms cannot only sell their brand on the domestic market but can also export their products to a foreign country. The demand elasticity is the same in the two markets, but the demand levels between the home and the foreign country may differ. For the shipment of products from the home to the foreign country, a firm has to pay fixed export costs to enter the foreign market. In addition, melting iceberg trading costs arise that typically include transport costs, insurance, fees, duties, and other impediments that may stem from language barriers, differences in the legal systems, and such like. Under these circumstances, a firm that sells in the domestic country can make additional profits from exporting. It can be derived from the model that firms with a productivity level under the threshold mentioned above still choose to close down as they lose money from domestic sales as well as from exporting. Firms with a productivity above the threshold make profits in the domestic market. High-productivity firms with a productivity level above a second threshold do not only make money from selling their products in the domestic market but also from exporting. Firms with intermediate productivity levels, i.e. with productivity levels between the two thresholds, get the highest profits from serving the domestic market only. As a consequence, they choose not to export. Thus, the model of Melitz (2003) replicates the sorting pattern that is observed in the empirical literature: Exporting firms are more productive than non-exporters. In addition, his model implies that exporting firms are larger than non-exporters because they have to produce for the domestic and for the foreign country.

Helpman et al. (2004) generalise the model of Melitz (2003) and integrate HFDI into it. A company has two options of serving the foreign country. It can serve the foreign market either by exporting or by establishing a second production plant in the foreign country, i.e. by HFDI. Both ways cause costs: While a firm has to pay a fixed market-entry cost and variable trade costs when exporting, it has to pay fixed costs for establishing a second plant abroad in the case of FDI. When the fixed costs for establishing a plant abroad are higher than the market-entry costs in the case of exporting and, at the same time, the production costs in the foreign country are lower than the trade costs associated with exporting, the model shows that the firm faces a proximity-concentration trade-off, which is discussed inter alia by Brainard (1997). If the firm chooses FDI instead of exporting, it gives up concentration of production, which raises its fixed costs, but it saves per-unit trade costs. Under the assumption that the costs for establishing a plant abroad are higher than the costs related to exporting which in turn are higher than the costs for serving the national market only, the model shows that the most productive firms serve the foreign market via horizontal FDI as only they can afford to pay the high costs. Lower-productivity firms serve the foreign market via export and even lower-productivity firms serve only the domestic market. As productivity is positively related to output, this sorting pattern also implies that firms engaged in FDI are larger than exporters, and exporters are larger than firms that are active on the domestic market, only (see Helpman 2006).

The hypotheses concerning firm heterogeneity arising from the model of Helpman et al. (2004) are the subject of many empirical papers. The paper of Helpman et al. (2004) itself contains an empirical analysis of the correlation between productivity and internationalisation behaviour showing that increasing heterogeneity leads to higher rates of FDI relative to exports. One of the first follow-up studies is the paper by Girma et al. (2004). Based on a sample of Irish establishments, they analyse the differences in the performance of multinational firms, exporting firms and exclusively domestic firms and find that multinational enterprises clearly outperform exporting firms and domestic firms with respect to labour productivity and financial performance. However, they do not find clear differences in plant performance between exporting and domestic firms and thus do not fully confirm the model of Helpman et al. (2004). A clear productivity ranking is, in contrast, identified by Girma et al. (2005) for the case of British firms. They find, that multinational enterprises have a higher total-factor productivity than exporting firms. These, in turn, show a higher productivity than solely domestic firms. This finding is supported by Mayer/Ottaviano (2008) who show for a sample of European countries that in terms of productivity firms engaged in FDI perform better than exporters which in turn perform better than firms that are active in the domestic market only. Further empirical studies confirming the result that only the most productive firms engage in FDI have, inter alia, been conducted by Tomiura (2007) for Japanese firms, by Arnold/Hussinger (2010) for German manufacturing firms, by Engel et al. (2013) for French firms and by Cainelli et al. (2014) for Italian manufacturing firms. Another paper that focuses on productivity differences between firms serving the national market only and exporting firms is provided by Powell/Wagner (2014). Using firm-level data for manufacturing firms in Germany, the authors confirm that the

exporter premium is positive over the whole productivity distribution even when unobserved firm heterogeneity is controlled for.

In addition to the studies on the correlation between productivity and firm internationalisation, i.e. the extensive margin of FDI, there are studies that look at the correlation between productivity and the size of the foreign investment, i.e. the intensive margin of FDI. For the US, there is empirical evidence that firms that become multinational not only differ systematically from firms that export, but that this sorting also influences the scope (number of foreign affiliates) and scale (size of affiliates) of MNEs: More productive firms extend their FDI activities to a broader range of countries and their affiliates are larger in terms of sales than those of less productive firms (Yeaple 2009). The hypothesis that more productive firms invest in more countries and that their affiliates generate more sales is confirmed by Hyun/Hur (2013) for a sample of Korean firms. For Korean FDI in China, Hur et al. (2013) show that more productive parent companies are more likely to own a larger number of affiliates in China. Based on a sample of German companies with affiliates in the Czech Republic, Görg et al. (2010) find that firm size and productivity are important drivers for the extensive as well as for the intensive margin of FDI: Larger and more productive German companies are not only more likely to invest in the Czech Republic, but they are engaged in larger FDI projects with respect to the number of employees. Raff/Ryan (2008), however, find that size and productivity matter at different steps of the internationalisation process. Using Japanese firm-level data, they show that for the extensive margin of FDI, i.e. the initial decision to invest abroad, only the productivity of the firm is decisive and not the firm's size. Larger firms, in turn, undertake on average more investment projects. In addition, there is evidence that the productivity of firms investing in multiple regions is higher than that of firms with one destination country only (Aw/Lee 2008; Wakasugi/Tanaka 2012).

The overview demonstrates that there is already a bulk of empirical studies and theoretical models dealing with the relationship between firm heterogeneity and FDI. However, despite the theoretical differentiation between vertical and horizontal investment motives and the comprehensive empirical literature on the importance of the two motives (see chapter 2.1), evidence on the relation between firm characteristics and investment motives is rare. Most of the studies analysing the relationship between firm productivity and internationalisation behaviour deal with horizontal FDI only. One exception is provided by Head/Ries (2003). They develop a model that generally yields the same predictions concerning the productivity ranking of firms as the model of Helpman et al. (2004). For VFDI, however, the productivity ranking is reversed. The least productive firms engage in VFDI when the foreign country is a low-cost production site. Another contribution is the paper by Grossman et al. (2006). They develop a model that allows heterogeneous firms to pursue different FDI strategies. Generally, the model predicts that less productive firms serve the national market only, while more productive firms invest in foreign countries. These FDI firms, however, differ: Among them, the less productive firms engage only in one sort of FDI – vertical or horizontal. The most productive firms, however, choose to engage in both types of FDI as they relocate intermediate production as well as assembly production stages. Hayakawa/Matsuura (2015) develop another model that allows firms to choose between vertical and horizontal FDI. They, too, identify a productivity

ranking: When plant setup costs differ for VFDI and HFDI, the least productive firms operate in the domestic market; more productive firms invest vertically, and the most productive firms engage in HFDI. They find empirical evidence of this order using Japanese data. A recent study that analyses differences in the determinants of FDI size between HFDI and VFDI is provided by El-Sahli et al. (2018). While they do not identify differences between HFDI and VFDI in the case of services FDI, they find differences for manufacturing firms: The investment and trade climate of the host country matters more for VFDI than for HFDI in the manufacturing sector, while institutional quality is more important for HFDI than for VFDI.

However, except for the studies of Hayakawa/Matsuura (2015) and El-Sahli et al. (2018), empirical evidence on the relationship between firm heterogeneity and engagement in HFDI and/or VFDI is rare. This research gap is certainly due to a lack of appropriate datasets that contain information on the motive for the foreign investment. By investigating the role of productivity and firm size for the extensive as well as for the intensive margin of VFDI compared to HFDI, this dissertation intends to contribute to closing this research gap.

3. Unit nonresponse at the firm level: a cross-border analysis using the IAB-ReLOC data

Joint with Nicole Litzel and Johannes Schäffler

Abstract

The labour market effects of foreign direct investments (FDI) are a topic of constant concern. However, research progress is hindered as most datasets applied in research on this topic suffer from selectivity with respect to firm size. To overcome this deficiency a unique dataset that covers the total population of German firms with FDI in the Czech Republic and their Czech affiliates has been created: the IAB-ReLOC data. Based on this dataset, two points of high relevance are addressed: First, by presenting the generation process of this unique dataset the paper wants to be a guidance for similar cross-border data compilation projects. Second, new insights in unit nonresponse in a firm-level survey are revealed. Based on multi-level logit models, the influence of firm and interviewer characteristics and of FDI features on survey participation is analysed. The main result is that apart from firm size and interviewer involvement, the response behaviour is related to the distance to the German-Czech border and to the strength of the cross-border relationship. With regards to the two latter characteristics, differences between German and Czech firms are identified.

Keywords: unit nonresponse, cross-border survey, firm-level survey, FDI, Germany, Czech Republic

JEL classifications: C81, C83, F23

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3.1 Introduction

With the ongoing globalisation in the last decades, the labour market effects of offshoring are a topic of constant debate. In developed countries, people fear job losses and wage reductions due to foreign direct investment (FDI) and the associated relocation of production units to foreign countries. Developing countries and transition countries, in contrast, try to attract foreign investors as, there, FDI is supposed to create new jobs and raise productivity. However, empirical evidence on the labour market effects of FDI is mixed (Crinò 2009). For Germany, the results of empirical studies on the effects of firm internationalisation on employment range from negative employment effects over no significant effect to positive labour market effects (see Pflüger et al. 2013; Schäffler/Moritz 2018). One short-coming of these studies is that they are based on selective datasets in which small and medium-sized firms are underrepresented. Although especially the largest and most productive firms engage in FDI (Helpman et al. 2004), there are some investment regions that are attractive investment targets for smaller firms, too. For German investors, the Central and Eastern European countries (CEECs) constitute due to the geographical proximity and the pronounced wage cost differential a prime example in this regard (Buch et al. 2005).

To contribute to the closure of this research gap, the German Institute for Employment Research (IAB) has in collaboration with the Czech Centre for Economic Research and Graduate Education (CERGE-EI) established a cross-national dataset that covers the total population of German firms that were involved in at least one Czech firm in 2010 as well as the total population of the Czech affiliates. Furthermore, for both countries a reference group that has no financial connections to foreign firms is included in the dataset. To get more detailed insights into the structures of multinational firms, the firms have been addressed within the ReLOC[4] survey. In addition, via a record linkage method, the German parent companies have been linked to the employment data of the IAB. Although initially created to investigate the labour market effects of FDI, in this paper, the IAB-ReLOC dataset is used to get insights into another crucial topic in social sciences: unit nonresponse, i.e. in the unwillingness of firms to participate in a survey.

Although data collection and availability have rapidly increased within the last decade as reflected in the discussions on big data (Japec et al. 2015), surveys are still an important instrument in social and economic research and will be necessary in the future (Wiengarten/Zwick 2018). However, the response rates in household but also in firm-level surveys have steadily been decreasing over the last decades (Rogelberg/Stanton 2007) or the effort to maintain their level has increased (Groves 2006; Petroni et al. 2004). The decline has been particularly pronounced for voluntary surveys and less so for mandatory surveys. Yet, especially these voluntary surveys are important data sources for research in social and economic sciences. A problem arises if non-participation in the survey is not random but if firms self-select into participating in the survey. This may lead to biased results. However, in many studies it is difficult to assess if and in what regard participating firms differ from non-

[4] ReLOC stands for 'Research on Locational and Organisational Change'.

participating firms as information is only available for respondents. The great advantage of the IAB-ReLOC dataset is that administrative data is available for both participating and non-participating firms. These data can be used to address the question if and in what regard participating and non-participating firms differ and, thus, to contribute to a better understanding of unit nonresponse in a firm-level survey. A special feature is that the nonresponse behaviour of German and Czech firms can be compared.

The contribution of the study to the existing literature is threefold. First, the description of the data compilation process of the IAB-ReLOC data can support the creation of similar cross-national datasets. Second, the linkage of the survey data to administrative data allows an in-depth analysis of unit nonresponse in a firm-level survey. Special is that besides interviewer and firm characteristics also information on the international involvement of the firm is included in the analysis. The third contribution of this paper relates to the cross-border nature of the IAB-ReLOC dataset: The factors provoking unit nonresponse can be identified for both German and Czech firms. This allows an international comparison of the survey participation behaviour of German and Czech companies and gives, as required inter alia by Rogelberg/Stanton (2007), new insights into this field of research.

The estimation of multi-level logit models reveals that across all subgroups firm size is positively correlated to the nonresponse probability. With regards to the interviewer characteristics, older interviewers, better educated interviewers and interviewers that are more involved in the survey are more successful in recruiting respondents. Regarding the features of the FDI project, on both sides of the border, firms that are directly linked to a company from the neighbouring country show a lower probability for nonresponse. An interesting contrast is identified with respect to the location of the companies: While in Germany firms that are located closer to the border with the Czech Republic show a lower nonresponse probability, the opposite holds for the Czech Republic: Here, firms that are located near the border to Germany have a higher nonresponse probability.

The remainder of the paper is structured as follows: Chapter 3.2 describes the data compilation process. The definition of the research units is explained in section 3.2.1 and the identification of the research units is highlighted in section 3.2.2. Section 3.2.3 gives an overview of the IAB-ReLOC survey, while in section 3.2.4 a short description of the record linkage method that was applied to link the firm-level data to the administrative establishment-level data is given. Chapter 3.3 presents the nonresponse analysis. In section 3.3.1, unit nonresponse is defined and a short overview of related literature is given. Section 3.3.2 refers to the selection of the explanatory variables. Section 3.3.3 gives a brief overview of the estimation method. In section 3.3.4, the estimation results are presented and discussed. Chapter 3.4 concludes with a summary and an outlook to future research.

3.2 The IAB-ReLOC data

In the following paragraphs, details on data generation process of the IAB-ReLOC data are provided.

3.2.1 Definition of research unit

In the context of growing globalisation, companies split up their value-added chains and international linkages become more complex and dynamic. This complicates the analysis of the labour market effects of FDI as they may differ at different organisational levels of the same economic unit. As in previous studies the different organisational levels *establishment*, *firm/company*[5] and *corporate group* are rather mixed up, much emphasis is put on an accurate definition of the research unit in the IAB-ReLOC data. This is not only important for a correct interpretation of the results but also for the interviewed units as they must know for which unit the required data should be given (Petroni et al. 2004; Willimack/Nichols 2010). The terms *firm* and *company* refer to a legal unit that can comprise more than one legally not independent *establishment* at different locations. Companies can, furthermore, be linked to a *corporate group* that comprises firms that keep their legal independence.

As the decision if, how and where a foreign investment takes place is – mostly – taken at the firm level, the research unit is defined by the company in the IAB-ReLOC data. In addition, the firm level allows to establish parallel structures in both countries. While in Germany there is both a company identifier and an establishment identifier, the latter does not in a comparable way exist in the Czech Republic. Thus, only by referring to the company level, data from both countries can be compared.

To analyse the labour market effects of offshoring, four groups of companies are included in the IAB-ReLOC data. In Germany, a group of multinational enterprises (MNEs) with FDI in the Czech Republic and a group of companies that are not engaged in FDI are distinguished. In the Czech Republic, the German affiliates are compared to a group of companies that have no foreign investor (see Table 3.1).

Table 3.1: Overview of research design

	Czech Republic	**Germany**
MNE group	• Czech firms with German equity holders (≥ 25 percent) • subsidiaries of German companies ➔ 3,875 companies with German parent company	• owners of the 3,875 Czech MNEs ➔ 3,406 German firms with Czech affiliate
Reference group	• purely Czech-owned firms ➔ 10,262 companies	German firms without • FDI • foreign affiliated company • indirect investment abroad ➔ 9,768 companies

Source: IAB-ReLOC data, authors' own illustration.

[5] The terms *firm* and *company* refer to the same organisational unit and are used interchangeably throughout this paper.

3.2.2 Identification of research units

The starting point for the data compilation process was the identification of the firms in the Czech MNE group, i.e. the Czech affiliates of German companies. To obtain a dataset containing the total population of German-Czech companies, we exploited three different sources: a dataset from the German-Czech Chamber of Industry and Commerce from the year 2008 (Deutsch-Tschechische Industrie- und Handelskammer 2008), a dataset of the Czech commercial data provider Čekia and a dataset of the commercial data provider Creditinfo. The information if a company had a German investor was derived from the Czech Commercial Register. After exploiting all these sources, 3,875 Czech companies with a German firm owning at least 25 percent of the capital have been identified.[6] This number is significantly higher than in other datasets that are used in scientific research. For instance, the AMADEUS dataset of Bureau van Dijk contained 1,150 and the MIDI dataset of the German Federal Bank 1,000 Czech companies with German owner in 2011 (Hecht et al. 2013b). As the German MNE group consists of the parent companies of the firms in the Czech MNE group, it builds on the Czech MNE group. As some German companies are engaged in more than one Czech firm, the German MNE group finally comprises 3,406 firms (Schäffler 2014).

The Czech reference group consists of firms that are neither directly nor indirectly owned by a foreign company. This information was extracted from the Creditinfo dataset. The German reference group comprises firms without any direct or indirect foreign investment and without a foreign sister company. This sample was selected from a dataset of the commercial data provider 'Heins und Partner'. To ensure that the firms in the MNE groups and in the reference groups were similar with respect to employment size and industry affiliation, stratified sampling regarding these two dimensions was applied.

3.2.3 IAB-ReLOC survey

To obtain detailed insights into the companies engaged in FDI and in the consequences of investing abroad, the identified companies were addressed in the IAB-ReLOC survey. Subject to the questionnaire was not only the employment and organisational structure of the firms but, for the MNEs, information on the motives for investing abroad and on the decision structures within the multinational company were collected (see Hecht et al. 2013a).

To achieve the highest possible response rate, data was collected via paper and pencil interviews (PAPI) as direct contact between interviewers and respondents may result in a higher participation rate than in web or telephone surveys (Groves et al. 2009). When questions could not be answered at once, the PAPI questionnaire could be left at the firm and filled in later. This is also important for large firms where often more individuals are involved in answering a questionnaire (Willimack/Nichols 2010) and results in a reduction of item

[6] Actually, 5,700 Czech companies with a German owner have been identified. Among the investors were many private persons. From that group, only those companies with a German sister company were eligible for the Czech MNE group.

nonresponse (Ellguth et al. 2014). To reduce unit nonresponse, the questionnaire could be answered via telephone or mail if required by the respondents (Tomaskovic-Devey et al. 1994).

The ReLOC questionnaires are based on two well-established instruments: the questionnaire of the IAB Establishment Panel (see Fischer et al. 2009) and the questionnaire of CORIS (see Möller/Litzel 2008). For each of the four firm groups an adapted version of the questionnaire had to be developed in the questionnaire design process. This was done in a parallel approach (see Harkness et al. 2003) in coordination with the Czech project partners from CERGE-EI and the Chair of Sociology and Empirical Social Research at the University of Erlangen-Nuremberg. The aim was to equally create and formulate as many questions and items for Germany and the Czech Republic as possible. However, the differences in language, culture and social structure make it difficult to achieve equivalence (Smith 2003; Van de Vijver/Leung 1997). In this context, the instruments developed in a parallel way work better than sequentially developed ones due to numerous discussions and feedbacks within the international team (Harkness et al. 2003). Deviations between the German and the Czech versions were necessary due to institutional differences between the two labour markets. Special effort was put on the translation procedure as especially the translation of the questionnaire may result in severe problems regarding question content. While at the beginning an English master version of the questionnaire was used for discussion within the international team, a German master version was used after the pretest. The final questionnaires were translated from a specialist translator to Czech language, retranslated to German by another specialist and then compared and corrected by the research team. To assure that the questions and items work, pretests were conducted in both countries (see Hecht et al. 2013b).

The IAB-ReLOC survey was conducted in the period between September 2010 and March 2011 by TNS Infratest Sozialforschung in Germany and by TNS ASIA in the Czech Republic. In both countries, the interviewers were native speakers to avoid communication problems and to counteract possible reservations with regards to cross-border surveys (Van de Vijver/Leung 1997). The contact to a firm was established via the highest-ranked person or her deputy. To raise the willingness to participate, the potential interview partners were provided with personalised recommendation letters of IAB (in Germany) and of CERGE-EI (in the Czech Republic) as well as of the German-Czech Chamber of Industry and Commerce (in both countries). In addition, confidentiality pledges were provided. After receiving the letter, a direct contact was established by the interviewer.

In Germany, 459 interviews were realised in the MNE group and 1,285 companies were interviewed in the reference group. In the Czech MNE group, 474 companies were interviewed and 858 interviews were realised in the Czech reference group (see Table 3.2). This corresponds to adjusted response rates of 14.9 percent in the German MNE group, 18.5 percent in the German reference group, 12.9 percent in the Czech MNE group and 19.1 percent in the Czech reference group (Hecht et al. 2013b).

3.2.4 ReLOC linkage

The data collected in the IAB-ReLOC survey is especially useful for analysing the motives for FDI, the organisational changes and the decision processes within the international company. Due to the cross-sectional character of the data, in-depth analyses regarding the labour market effects of FDI are not possible. To adequately research this topic, the firm-level dataset was linked to the IAB's establishment-level data (see Schäffler 2014). Only by identifying all establishments belonging to the German MNEs, the employment effects can be analysed in an extensive way. However, the IAB data do not contain a clear firm identifier, only the name of the company the establishment belongs to is provided.

The reason for this is that the IAB data partly come from the social insurance data. To give their social insurance declarations, all German establishments with at least one employee liable for social insurance contributions possess an establishment identifier (Betriebsnummernservice der Bundesagentur für Arbeit 2018). By assigning the establishment identifiers, the name of the establishment is recorded but no firm identifiers.

Thus, Schäffler (2014) developed a record linkage procedure to link firm- and establishment-level data of the German firms. Based on the name of the company, the establishments belonging to the same firm are identified (see Schäffler 2014). The linked dataset provides longitudinal information at establishment as well as firm level and allows an in-depth analysis of the labour market effects of FDI. What is more important for this paper is the fact that the linked data can be used to conduct a nonresponse analysis as for both the respondents and the non-respondents information on firm characteristics is available.

For each of the four firm groups, Table 3.2 indicates the number of cases that have been identified, interviewed and linked to the IAB employment data.

Table 3.2: Overview of number of cases

	German MNE group	**German reference group**	**Czech MNE group**	**Czech reference group**
Identified companies	3,406	9,768	3,875	10,262
Interviewed (IAB-ReLOC survey)	459	1,285	474	858
Linked to IAB employment data	2,421	7,566		

Source: IAB-ReLOC data.

3.3 Unit nonresponse analysis

The IAB-ReLOC data offer a great opportunity to analyse the nonresponse behaviour of firms. Due to the linkage with the IAB employment data comprehensive information is available for respondents and for non-participants. As the dataset comprises companies of two countries, the question can be addressed if the nonresponse behaviour differs between German and Czech firms. In general, the analysis targets at unit nonresponse, i.e. when a company totally refuses to participate in the survey.

3.3.1 Unit nonresponse: definition

In the literature, two types of unit nonresponse are distinguished (see Janik/Kohaut 2012, for example).[7] First, unit nonresponse occurs when it is not possible to contact a survey unit. In case of our company survey this non-contact may be due to plant closure, insolvency or firm relocation. Furthermore, the information in the Czech Commercial Register might not have been up to date and/or the company might have initially indicated the wrong or incomplete address. As the research team as well as the survey institutes made a strong effort to validate the addresses in the sample, non-contact due to wrong addresses only occurred in a very limited number of cases (see Table 3.3). In a limited number of cases the respondents indicated that the firm did not belong to the research sample.[8] Some companies have not been contacted as the required quota has already been reached. We declare unit nonresponse due to non-contact as neutral nonresponse (see Table 3.3). Second, unit nonresponse may occur after the contact to the company has been established. Our analysis focuses on this type of unit nonresponse. Non-participation after the contact to the survey unit has been established was due to several reasons. Most often, the interviewers indicated that the target person was not willing to participate in the survey due to time reasons or without indicating any reasons. In a smaller number of cases, the interviewers did not get any information to contact the target person or the target person was not available. In addition, in some cases, the interview was not completed or the reasons for nonresponse were not indicated by the interviewer (see Table 3.3).

[7] Schnell (2012) distinguishes three reasons for unit nonresponse: refusal, illness and non-availability. In firm surveys, illness should play a minor role and is not considered in this study.

[8] For example, firms that were identified as MNEs but were at the time of the survey no longer engaged in FDI in the Czech Republic did not belong to the research sample.

Table 3.3: Overview of survey results

Response classification	Survey result	German MNE group	German reference group	Czech MNE group	Czech reference group
Response	Interview	368 (15.2 %)	1,074 (14.2 %)	445 (13.4 %)	857 (8.6 %)
Neutral nonresponse	Firm exists no more	57 (2.4 %)	93 (1.2 %)	307 (9.3 %)	381 (3.8 %)
	Wrong address	82 (3.4 %)	52 (0.7 %)		36 (0.4 %)
	Firm does not belong to target group	329 (13.6 %)	754 (10.0 %)	99 (3.0 %)	71 (0.7 %)
	Required number of interviews reached		1,292 (17.1 %)		2,788 (28.0 %)
Unit nonresponse	No information on target person provided	102 (4.2 %)	196 (2.6 %)	84 (2.5 %)	71 (0.7 %)
	Target person not contactable	183 (7.6 %)	173 (2.3 %)	11 (0.3 %)	80 (0.8)
	No participation due to time reasons	379 (15.7 %)	1,523 (20.1 %)	47 (1.4 %)	555 (5.6)
	Target person refuses participation	811 (33.5 %)	2,396 (31.7 %)	2,221 (67.0 %)	4,646 (46.7 %)
	No interview due to other reasons	108 (4.5 %)	8 (0.1 %)	80 (2.4 %)	439 (4.4 %)
	Interview not complete	2 (0.1 %	5 (0.1 %)	23 (0.7 %)	21 (0.2 %)
	Total number	2,421	7,566	3,317	9,945

Source: IAB-ReLOC data, linked data.

Various reasons can contribute to the occurrence of this type of unit nonresponse. In the literature, a distinction is made between influences that are non-controllable by the researchers and controllable influences (for an overview see Willimack et al. 2002).

Among the non-controllable influences, the company's external environment is to mention. Willimack et al. (2002) have found that general economic conditions may influence survey participation. In weak economic circumstances, companies are more protective and disclose information to outsiders. Another factor is the high number of surveys that especially large company are obliged to answer. Often, the workload associated with these surveys leads to unit nonresponse in voluntary surveys (Willimack/Nichols 2010). Incontrollable by the researcher is also the kind of data that is kept in business records. Furthermore, researchers usually do not have influence on the respondent selection. For survey participation and data quality, however, it is necessary that the respondent has the authority, the capacity and the motive to respond (Tomaskovic-Devey et al. 1994).

Controllable by the researcher is, in contrast, the survey design comprising sample selection and the choice of the survey mode. There is evidence, that the seriousness of the survey increases the willingness to participate (Janik/Kohaut 2012). For household surveys, the

relevance of the topic influences survey participation (Groves et al. 2004). For establishment surveys, Willimack et al. (2002) show that data availability is more important for survey participation than the topic.

Janik/Kohaut (2012) stress that not only the survey design but also the interviewer can have a considerable influence on the respondent's willingness to cooperate. In face-to-face surveys, the interviewers have to contact the respondent and gain his cooperation (West/Blom 2017). The first impression the potential respondent gets of the interviewer may facilitate or hinder survey participation. Furthermore, educational level and job experience of the interviewer – both being related to conversation techniques – can influence the participation decision of the respondents.

3.3.2 Explanatory variables

Based on existing literature, we have identified factors that potentially influence the nonresponse probability of firms. As survey design has been the same for all companies, the analysis focuses on the factors that are uncontrollable by the researcher. In both countries, for the total sample of companies firm and interviewer characteristics[9] are considered. For the two MNE groups, in addition, the characteristics of the FDI project are analysed.[10] Data availability at the German side is better than at the Czech side, what allows a more detailed analysis in Germany with a wider range of variables investigated. For the Czech Republic, a subsample of the variables analysed in Germany is examined. Table 3.5 gives an overview of the variables included in the analysis for the German firms and Table 3.6 for the Czech firms, respectively.

3.3.2.1 Firm specific characteristics

With regards to firm specific characteristics, previous studies have shown that firm size influences the nonresponse probability (for an overview see Petroni et al. 2004). With rising firm size, the number of mandatory surveys a firm has to answer increases what in return has negative consequences for the probability to participate in an additional (voluntary) survey (Willimack/Nichols 2010). Furthermore, with rising firm size the organisational structures become more complex. For large firms, the provision of the required information may be more complicated than for small or medium-sized companies (Tomaskovic-Devey et al. 1994). In addition, Tomaskovic-Devey et al. (1994) state that the individual identification with the firm decreases with rising firm size what influences the personal motivation of the respondent to participate in the survey and may cause unit nonresponse. Thus, the nonresponse probability should increase with rising firm size. We measure *firm size* as the total number of employees in 2010. The variable is included in classified form in our analysis.[11] Moreover, the

[9] Willimack et al. (2002) describe interviewer-related characteristics as controllable by the researcher. In the IAB-ReLOC survey, we provided an interviewer training, but we had no influence on interviewer selection or assignment.

[10] Other studies also include respondent-specific variables. Unfortunately, no information on the respondent is available in the IAB-ReLOC data.

[11] While in Germany, we know the exact number of employees, this information is only available to us in classified form in the Czech Republic. To establish comparability, we measure firm size in classes in both countries. The following classes are distinguished: 1-5 employees (reference category), 6-9, 10-19, 20-49, 50-99, 100-199, 200-499, 500-999 and 1000 and more employees.

organisational structure of a firm becomes more complex with a rising number of establishments belonging to the firm. As a consequence, the nonresponse probability should rise with the *number of establishments* belonging to the firm, as has been found, for instance, by Phipps/Jones (2007). As there is evidence that survey participation is influenced by economic conditions (Petroni et al. 2004; Willimack et al. 2002), we include the *employment development from 2009 to 2010* measured as the absolute change in the total numbers of employees. We assume that employment development reflects the economic circumstances of a firm and that the participation probability rises with an increasing number of employees. There is evidence that personal involvement in the survey's topic reduces unit nonresponse in household surveys (Groves et al. 2004) as well as in organisation studies (Willimack et al. 2002). We expect that MNEs and firms located closer to the German-Czech border are more interested in the topic and show a higher participation rate. To account for this, we include the information if the company belongs to the *MNE group* and the firm's *distance to the neighbouring country*. Furthermore, we control for the *age of the firm* and for *industry affiliation* (in 18 classes). In the Czech Republic, due to data restrictions, only a smaller set of variables is analysed, comprising *firm size*, *MNE group affiliation*, *distance to Germany* and *industry affiliation*.

3.3.2.2 Interviewer characteristics

Previous studies have shown that interviewers may influence survey participation (see Groves et al. 2009; Pickery/Loosveldt 2002). Especially experience in conducting interviews and a good knowledge of conversation techniques have been found to positively influence the recruiting ability (Campanelli/O'Muircheartaigh 1999; Groves et al. 2009; West/Blom 2017). To account for experience, Janik/Kohaut (2012), for example, refer to the number of years the interviewers have already been working for the specific survey institute. Unfortunately, this information is not available in our data. Thus, we include the *number of interviews* an interviewer conducted within the IAB-ReLOC survey to account for the involvement of the interviewer in the survey. Professional interviewers whose main job is interviewing probably do a better job in recruiting respondents. As there is evidence that *interviewer age* influences survey participation (West/Blom 2017), we include this variable. We suppose that the interviewer's job experience rises with increasing age what leads to a better understanding of recruiting respondents and thus to a lower nonresponse probability. However, we expect a non-linear relationship as Josten/Trappmann (2016) have found that the response quality decreases with interviewer age. Thus, we also include *interviewer age squared*. Moreover, we account for the *educational level* of the interviewers. We differentiate between low, medium and high education and expect that the nonresponse probability shrinks with rising educational level as education is linked to conversation skills. In the Czech Republic, information on the educational level of the interviewer is not available. Furthermore, we control in both countries for *interviewer gender*. However, previous studies have only found weak or no relationship between interviewer gender and recruiting success (for an overview see West/Blom 2017).

Table 3.4 gives an overview of descriptive statistics describing the interviewers that conducted the IAB-ReLOC survey. In general, more interviewers have been involved in Germany (568

vs. 247 in the Czech Republic), probably due to the larger country size. The average age of the interviewers is clearly higher in Germany (60 years) than in the Czech Republic (45 years). Furthermore, while in Germany approximately two thirds of the interviewers are male, in the Czech Republic this share is only one third. As previous studies have shown, gender and age of the interviewers do not influence survey participation. More important for recruiting respondents is the involvement of the interviewers in the survey as displayed by the number of interviews and contacts. On average, these two indicators are higher in the Czech Republic what reflects the lower number of interviewers. In Germany, 52 percent of the interviewers have a low education level, 19 percent have a medium and 28 percent have a high education level.

Table 3.4: Descriptive statistics on the interviewers

	German total sample	German MNE group	Czech total sample	Czech MNE group
Age (in years)	60.17	61.65	44.54	45.44
Male	0.64	0.64	0.32	0.33
Average number of interviews	3.07 (min: 0, max: 184)	4.27 (min: 0, max: 184)	5.39 (min: 0, max: 41)	6.22 (min: 0, max: 41)
Average number of contacts	22.26 (min: 0, max: 261)	29.2 (min: 1, max: 261)	46.47 (min: 0, max: 196)	53.38 (min: 3, max: 196)
Education level				
low	0.52	0.52		
medium	0.19	0.20		
high	0.28	0.28		
N	568	327	247	205

Source: IAB-ReLOC data.

3.3.2.3 Characteristics of the FDI project

We suppose that the characteristics of the FDI project influence the response behaviour of the two MNE groups as, inter alia, the interest in the survey topic and the permission to participate may be related to these characteristics.

A variable characterising the strength of the relationship between the German firm and the Czech affiliate is the *equity share* the German MNE holds in the Czech company. We expect the influence on nonresponse of this variable to vary between the two countries: For German MNEs, we presume that the nonresponse probability shrinks with rising equity share due to increasing decision power and better availability of information on the FDI project. For Czech MNEs, in contrast, we assume that the nonresponse probability increases with rising equity share of the German parent company due to smaller decision power and higher dependence. The same relation is expected for FDI projects that are *direct investments*[12] and for *greenfield investments* due to a higher decision power of the German MNE in these cases. Another factor

[12] The IAB-ReLOC data build on Czech firms with a direct German owner. However, there are German private persons and holding companies among the owners. For the private persons, it has been verified if they own a German company. If such a firm could be identified, this so called sister company was included in the German MNE group. Holding companies have, if possible, been replaced by the main company of the associate group. The FDI projects in which German firms replacing private persons or holding companies are involved are referred to as indirect investments.

that is related to decision power is the employment allocation on both sides of the border. We assume that the German parent company has a higher decision power when the German parent company has more employees than the Czech affiliate and has a lower decision power when the German parent company has less employees than the Czech counterpart. We test for this assumption using the categorical variable '*Employment allocation on both sides of the border*' with the categories 'same size in Germany and the Czech Republic' (reference category), 'less employees in Germany than in the Czech Republic' and 'more employees in Germany than in the Czech Republic'. Although all companies that are part of the two MNE groups are, per definition, involved in the survey topic, companies located in the border region could be more aware of the topic than companies located elsewhere. Therefore, the variable '*Location'* is included in the analysis. We assume that the nonresponse probability is lower when both the Czech and the German company parts are located in the German-Czech border region than for the other three possible combinations when, first, only the Czech affiliate is located in the border region or, second, only the German parent company is located in the border region or, third, both company parts are not located in the border region.

The *duration of the investment* (measured in years since the (first) German investor entered the Czech firm) and the information if the two linked firms are active in the *same industry* are included as control variables.

Table 3.5: Descriptive statistics for the German sample

Variable	Mean	
	MNEs	**Non-MNEs**
Firm characteristics:		
Firm size (included in classes)	703.34	197.05
No. of establishments	6.64	2.52
Employment development 2009-10	-11.34	2.80
MNE group (dummy)	1.00	0.00
Distance to Prague (in minutes driving time)	437.27	475.06
Firm in BHP 1975[13]	0.43	0.41
Firm age[14]	9.64	10.23
Interviewer characteristics:[15]		
Interviewer age (in years)	61.37	60.73
Education level:		
Low	0.52	0.56
Medium	0.21	0.18
High	0.28	0.26
No. of interviews	11.30	10.17
Sex (dummy: male=1)	0.65	0.69
Characteristics of FDI project (only for MNE group):		
Equity share	0.92	
Direct investment (dummy: yes=1)	0.64	
Greenfield investment (dummy: yes=1)	0.76	
Employment allocation on both sides of the border:		
Same size	0.12	
Less employees in GER than CZ	0.23	
More employees in GER than CZ	0.65	
Location:		
Border region GER and CZ	0.13	
Border region CZ only	0.20	
Border region GER only	0.08	
No border region	0.59	
Duration of investment (in years)	9.78	
Same industry in GER and CZ (18 classes, dummy: yes=1)	0.53	

Source: IAB-ReLOC data.

[13] The variable is necessary as the age of the company is derived from the IAB Establishment History Panel (BHP) that has been founded in 1975. The dummy variable takes the value 1 for firms that have already existed in 1975, and 0 otherwise.

[14] The variable firm age (ln) refers only to firms that were founded after 1975. The variable is set to 0 for companies that have already existed in 1975.

[15] The differences in the descriptive statistics for the interviewers between Table 3.4 and Table 3.5 are due to different numbers of cases. In Table 3.4, every interviewer is counted only once, whereas in Table 3.5 the observation level is the firm. Thus, interviewers with a higher number of interviews are included more often.

Table 3.6: Descriptive statistics for the Czech sample

Variable	Mean	
	MNEs	**Non-MNEs**
Firm characteristics:		
MNE group (dummy)	1.00	0.00
Distance to Germany (in km)	87.12	130.07
Interviewer characteristics:[16]		
Interviewer age (in years)	43.16	44.21
No. of interviews	8.04	7.98
Sex (dummy: male=1)	0.32	0.30
Characteristics of FDI project (only for MNE group):		
Equity share	0.90	
Direct investment (dummy: yes=1)	0.58	
Greenfield investment (dummy: yes= 1)	0.72	
Employment allocation on both sides of the border:		
Same size	0.11	
Less employees in GER than CZ	0.22	
More employees in GER than CZ	0.50	
Location:		
Border region GER and CZ	0.11	
Border region CZ only	0.19	
Border region GER only	0.05	
No border region	0.47	
Duration of investment (in years)	9.89	
Same industry in GER and CZ (18 classes, dummy: yes=1)	0.43	

Source: IAB-ReLOC data.

3.3.3 Estimation method

To analyse what factors contribute to unit nonresponse, a logistic random-intercept model is estimated (Josten/Trappmann 2016; Rabe-Hesketh/Skrondal 2008) as it is possible that the error terms are correlated across the observations interviewed by the same interviewer.

In a first step, we estimate the empty model to obtain the intraclass correlation coefficient (ICC) and get an impression for the importance of the interviewer effects.

$$logit\{Pr(y_{ij} = 1|x_{ij}, z_j, \zeta_j)\} = \beta_1 + \zeta_j \quad (3.1)$$

The dependent variable y takes the value of 1 if a specific company i refuses to participate in the survey and 0 otherwise. The empty model only includes a mean intercept β_1 and a random intercept ζ_j that expresses the deviation of interviewer j's intercept from β_1. Based on the estimation results of the empty model, we estimate the ICC that reflects the variance share that is generated by the interviewers (for the calculation of the ICC see Snijders/Bosker 2012, for example). A high ICC can arise when answers from respondents interviewed by the same interviewer are more similar to each other than answers from other respondents (West/Olson

[16] The differences in the descriptive statistics for the interviewers between Table 3.4 and Table 3.6 are due to different numbers of cases. In Table 3.4, every interviewer is counted only once, whereas in Table 3.6 the observation level is the firm. Thus, interviewers with a higher number of interviews are included more often.

2010). In our study, a high ICC implies that potential respondents are more similar in their decision to participate in the survey when they are recruited by the same interviewer.

In a second step, we augment the empty model by variables referring to the firm-level (X_{ij}) and variables characterising the interviewers (Z_j).

$$logit\{Pr(y_{ij} = 1|x_{ij}, z_j, \zeta_j)\} = \beta_1 + \beta_2 x_{ij2} + \cdots + \beta_k x_{ijk} + \beta_{k+1} z_{jl} + \cdots + \beta_{k+l} z_{jl} + \zeta_j \qquad (3.2)$$

As data availability differs for the two countries, the estimations are run separately for each country. In each country, one specification containing the total sample of companies is estimated and one version where only the MNEs are considered. In the latter estimations, in addition, the influence of variables characterising the FDI project is analysed. For all estimations, the melogit command in stata has been used.

3.3.4 Estimation results

The estimation results for the total sample of German firms are presented in Table 3.7 and the results for the German MNEs in Table 3.8. The respective estimation results for the Czech Republic are displayed in Table 3.9 and Table 3.10. For the total sample of German and of Czech firms, three different models are estimated. The first model examines only firm characteristics (column -1- of Table 3.7 and Table 3.9), the second model refers to interviewer characteristics only (column -2- of Table 3.7 and Table 3.9) and the third model comprises interviewer and firm characteristics (see column -3- of Table 3.7 and Table 3.9). For both MNE groups, a fourth specification where characteristics of the interviewer, of the firm and of the FDI project are included is presented (column -4- of Table 3.8 and Table 3.10). In all tables, the average marginal effects (AMEs) are indicated.[17]

With regards to interviewer effects, we obtain quite high values for the ICC in the empty model. Thus, in all four subsamples substantial interviewer effects with respect to the recruitment success can be observed. The ICC takes the value 0.2796 in the German total sample, 0.2861 in the German MNE group, 0.4270 in the Czech total sample and 0.3247 in the Czech MNE group. Especially the value in the Czech total sample is compared to previous research quite high. Based on a CAPI study, West et al. (2013) obtain an ICC of 0.11 for binary response indicators. This value is substantially lower than in this study. However, previous research has also revealed high interviewer effects: When analysing network size questions, Brüderl et al. (2013) obtain ICC values of around 0.40 and Josten/Trappmann (2016) of around 0.30. In all four subsamples, the values of the ICC are reduced when including further explanatory variables. Especially the inclusion of interviewer characteristics contributes to a reduction of the ICC.[18]

[17] The estimated coefficients are available from the authors upon request.

[18] To assess the effects of the interviewers, we have analysed how much the ICC is reduced when excluding successively every interviewer from the estimation (see Brüderl et al. 2013, for example). In Germany, the exclusion of all observations of interviewers that contacted a large number of potential respondents within the survey actually results in a significant reduction of the ICC. In the Czech Republic, this is not the case.

The estimation results for the total sample of German firms (see Table 3.7) show that firm as well as interviewer characteristics influence the nonresponse behaviour. The estimation of the full model (see column -3- of Table 3.7) reveals that larger firms have a higher probability for nonresponse than smaller firms. This outcome is in line with our hypothesis and confirms the result of Janik/Kohaut (2012) that in small firms the respondents are more likely to have the authority, the capacity and the motivation to answer the questionnaire. The negative AME of the employment development confirms our expectation that firms in bad economic conditions show a higher nonresponse probability, although this effect is rather small. With regards to our hypothesis that companies that are more interested in the survey topic have a higher participation probability, our results are ambiguous: On the one hand, firms located closer to the border have a lower nonresponse probability. On the other hand, the companies belonging to the German MNE group do not show a higher participation rate. This confirms previous research that has shown that survey topic is of little importance in business surveys (Willimack et al. 2002). In addition, we find that the nonresponse probability rises with increasing firm age and varies between industries.[19] The number of establishments that belong to a firm does not influence the survey participation. Thus, the size measured in number of employees is more relevant to the response decision than the size measured in number of establishments. Regarding the interviewer effects, the nonresponse probability decreases with rising interviewer age what confirms our assumption that older interviewers have a higher experience in conducting interviews and are more successful in recruiting respondents. In addition, the nonresponse probability decreases on average by 0.5 percentage points when the number of interviews conducted by one interviewer increases by one, what underlines the importance of interviewer experience. Finally, the results show that interviewers with a medium education level have a significantly higher probability to generate nonresponse than interviewers with a high education level. For interviewers with a low education level, the AME is also positive but misses the significance level in the full model. The gender of the interviewer has throughout all estimations no influence on nonresponse what confirms previous results (West/Blom 2017).

In the estimation for the German MNE group (see Table 3.8), firm characteristics lose importance in explaining the nonresponse behaviour. For this group, mainly the interviewer characteristics and the features of the FDI project determine the nonresponse probability. Regarding the interviewer characteristics, interviewer age, education level and the number of interviews conducted in the survey show the expected signs. In contrast to the total sample of German companies, the involvement in the survey topic seems to influence the participation decision of the German MNEs as MNEs with a direct investment in the Czech Republic have a lower nonresponse probability than firms that are indirectly linked to a Czech company. In addition, the duration of the investment has a significantly negative sign too: When the duration rises by 1 percent, the probability for unit nonresponse decreases by 2.3 percentage points. Firms with a longer investment experience in the Czech Republic might not only have a more intense relationship to their Czech affiliate but also face a better data availability. Another interesting outcome concerns the finding for the location of both the parent company and the affiliate. Within the German MNE group, the response behaviour significantly differs between

[19] The results for the industry dummies are available from the authors upon request.

MNE firms with both parent company and affiliate located in the border region to the Czech Republic and German firms that are not located in the border region. Compared to firms where the parent company as well as the affiliate are located in the border region, firms with both company parts not located in the border region show on average a 7.4 percentage points higher nonresponse probability and firms where only the Czech affiliate but not the German parent company is located in the border region show on average a 7.2 percentage points higher nonresponse probability. The AME for firms where the German parent company is located in the border region but not the Czech affiliate is not significant. This finding may be due to the circumstance that the Czech Republic is more present in every-day-life in border regions than in non-border regions. With respect to the equity share of the German parent company and the information if the FDI project is a greenfield investment our hypotheses are not confirmed. The AMEs of these variables show the expected signs but are not statistically significant. Furthermore, companies that employ more employees in the German firm than in the Czech affiliate have a higher nonresponse probability than companies with the same number of employees on both sides of the border.

Turning to the results for the total sample of Czech companies (see column -3- of Table 3.9), the assumption that nonresponse probability increases with firm size is mostly confirmed, too. While the firms with a size between 6 and 99 employees have a significantly lower nonresponse probability than the very small companies with 5 or less employees, the AMEs for the size classes from 100 employees and more are not significant. Not in line with our assumption is the result for the companies with 1 to 5 employees. However, in these very small companies there might be no account staff but the owner has to fulfil these tasks and has no time for survey participation. That a lack of staff dedicated to information processing can be a source for nonresponse has also been found by previous research (Thompson/Washington 2013; Tomaskovic-Devey et al. 1994). The variable reflecting the affiliation to the MNE group shows a significantly negative AME. Firms with a German owner have on average a 6.2 percentage points lower nonresponse probability than domestic firms. In contrast to the German result, this outcome is in line with our hypothesis that the MNEs are more interested in the survey topic and show a higher participation rate. However, the assumption that firms located near Germany have a higher participation rate, is not confirmed, as the AME for the firm's distance to Germany is significantly negative. The differences in the nonresponse behaviour between industries are not pronounced.[20] With regards to interviewer characteristics, older interviewers and those that are assigned to more respondents within the survey are more successful in recruiting respondents. This result is stable throughout all estimations – independent of the country of origin and the international integration of the companies.

Table 3.10 displays the results for the Czech MNE group. The full model in column -4- of Table 3.10 shows that, as in the German MNE group, the characteristics of the FDI project influence survey participation. That the probability for unit nonresponse increases with a higher equity share of the German owner corresponds to our assumption that decision power influences

[20] The results for the industry dummies are available from the authors upon request.

survey participation. Czech affiliates with a more dominant German owner might possess lower decision power and thus not dare to participate in the survey. That Czech affiliates that are directly linked to a German firm have a lower nonresponse probability confirms our hypotheses that these firms are, first, more interested in the survey topic and are, second, better informed about the company relation. The location of a company regarding the border region does not influence the participation decision in the Czech MNE group. The same holds for the duration of the German investment, for investment type (greenfield vs. brownfield), for industry affiliation as well as for the employment allocation on both sides of the border. Regarding interviewer characteristics, the nonresponse probability is, as in the other estimations, higher for younger interviewers and for interviewers with a smaller involvement in the survey. With regards to firm characteristics, only firm size has a significant impact on the nonresponse probability of Czech MNEs. The nonresponse probability is significantly lower for medium-sized companies as the AMEs for the size classes 20 to 49 and 50 to 99 employees are significantly negative. There is no difference in the participation behaviour between different industries (not displayed in Table 3.10).

With respect to the question if there are differences in the factors influencing the participation behaviour of German and Czech firms several points are to mention. With regards to the relation between interviewer characteristics and nonresponse probability, there is no difference between German and Czech firms. In both countries, older interviewers and interviewers that are more involved in the survey are more successful in recruiting respondents. When comparing the nonresponse behaviour of the total sample of German and the total sample of Czech firms, in both countries the participation rate is higher among the small and medium-sized companies than among the large companies. The influence of the distance variable differs between the two countries. In Germany, firms that are located closer to the Czech Republic show a lower probability for nonresponse, while in the Czech Republic the nonresponse probability decreases with rising distance to Germany. Furthermore, differences concerning the affiliation to the MNE group can be observed: In the Czech Republic, the MNEs show the expected lower nonresponse probability while in Germany, there is no significant difference between MNEs and Non-MNEs.

When turning to the analyses of the two MNE groups, further disparities are revealed. While the differences concerning firm and interviewer characteristics are negligible, interesting findings come up regarding the characteristics of the FDI project. While the equity share of the German parent company has no significant influence on unit nonresponse in Germany, Czech affiliates with a higher German equity share show a higher nonresponse probability. This might be a sign for lower decision power and/or worse data availability in the Czech firm when the German parent company is more involved. The finding supports the hypothesis of Tomaskovic-Devey et al. (1994) that survey nonresponse is higher when the decision maker is geographically removed from the interviewed firm unit. In both countries, the nonresponse probability is lower for direct FDI relations confirming our assumption that these firms are more interested in the survey topic. Another difference is reflected in the location of the MNEs: While in Germany, MNEs that are located in the border region to the Czech Republic show a lower nonresponse probability, the location has no significant effect in the Czech MNE sample.

As robustness checks, the estimations have been run for samples that have been restricted according to interviewer characteristics. All estimations have been run for samples containing, first, only interviewers with more than five contacts, second, only interviewers with at least one interview, third, only interviewers with at least two interviews and, last, only interviewers with less than 50 interviews for the two German samples and interviewers with less than 40 interviews for the two Czech samples. Furthermore, the estimations for the two German samples have been run with the same set of variables that is available for the Czech side. For all robustness checks, the results remain stable. [21]

[21] The results of the robustness checks are available from the authors upon request.

Table 3.7: Nonresponse analysis: results of multi-level logit model (nonresponse = 1) for German firms

	- 1 -	- 2 -	- 3 -
	AME	AME	AME
Firm characteristics:			
No. of employees 2010 (ref.: 1-5):			
6-9	0.0075		0.0077
10-19	0.0294		0.0285
20-49	0.0461**		0.0456**
50-99	0.0670***		0.0677***
100-199	0.0789***		0.0789***
200-499	0.0953***		0.0958***
500-999	0.1015***		0.1028***
1000+	0.1009***		0.1022***
Employment development 2009-2010	-0.0000*		-0.0000***
Firm in BHP 1975 (yes: 1)	0.0433*		0.0482*
Firm age (in years, ln)	0.0154*		0.0160*
No. of establishments (ln)	0.0078		0.0081
MNE group (yes: 1)	0.0095		0.0139
Distance to Prague (in km, ln)	0.0621***		0.0538***
Interviewer characteristics:			
Male (yes: 1)		0.0078	0.0055
Interviewer age (in years)		-0.0031***	-0.0029***
Education level (ref.: high):			
low		0.0363**	0.0258
medium		0.0653***	0.0552***
No. of interviews		-0.0054***	-0.0052***
Random part: intercept variance (ζ_i)	1.2020***	0.8143***	0.7227***
ICC	0.2676	0.1984	0.1801
No. of observations	7,261	7,328	7,261
Loglikelihood	-3147.659	-3185.5491	-3092.9407

Note: AME = average marginal effect. Significance level: * < 0.1, ** < 0.05, *** < 0.01. Control variables for industry affiliation included.

Table 3.8: Nonresponse analysis: results of multi-level logit model (nonresponse = 1) for German MNEs

	- 1 -	- 2 -	- 3 -	- 4 -
	AME	AME	AME	AME
Firm characteristics:				
No. of employees 2010 (ref.: 1-5):				
6-9	0.0138		0.0081	0.0020
10-19	0.0240		0.0169	0.0106
20-49	0.0598		0.0500	0.0484
50-99	0.0468		0.0474	0.0485
100-199	0.0722*		0.0668*	0.0686
200-499	0.0856**		0.0796**	0.0777*
500-999	0.0700		0.0663	0.0632
1000+	0.0548		0.0536	0.0639
Employment development 2009-10	-0.0005		-0.0000	-0.0000
Firm in BHP 1975 (Yes: 1)	-0.0005		0.0098	0.0521
Firm age (in years, ln)	-0.0054		-0.0044	0.0066
No. of establishments (ln)	0.0270*		0.0267*	0.0282*
Distance to Prague (in km, ln)	0.0889**		0.0685**	
Interviewer characteristics:				
Male (yes: 1)		-0.0049	-0.0070	-0.0053
Interviewer age (in years)		-0.0026**	-0.0025**	-0.0021*
Education level (ref.: high):				
low		0.0354	0.0166	0.0254
medium		0.0677**	0.0540*	0.0666*
No. of interviews		-0.0037***	-0.0036***	-0.0038***
Characteristics of FDI project:				
Share of Czech affiliate (ln)				-0.0059
Direct investment (yes: 1)				-0.0527***
Duration of investment (in years, ln)				-0.0233*
Greenfield investment (yes: 1)				-0.0185
Employment allocation between German and Czech company part (*ref.: same number of employees in GER and DZ*)				
Less employees in GER than CZ				0.0372
More employees in GER than CZ				0.0500*
Same industry in GER and CZ (yes: 1)				-0.0042
Location (ref.: Border region GER and CZ):				
Border region CZ				0.0718**
Border region GER				0.0474
No border region				0.0737**
Random part: intercept variance (ζ_j)	1.2869***	0.4812***	0.3757**	0.3554**
ICC	0.2812	0.1276	0.1025	0.0975
No. of observations	1,932	1,953	1,932	1,866
Loglikelihood	-819.1544	-813.3589	-783.3408	-741.2212

Note: AME = average marginal effect. Significance level: * < 0.1, ** < 0.05, *** < 0.01. Control variables for industry affiliation included.

Table 3.9: Nonresponse analysis: results of multi-level logit model (nonresponse = 1) for Czech firms

	- 1 -	- 2 -	- 3 -
	AME	AME	AME
Firm characteristics:			
No. of employees 2010 (ref.: 1-5):			
6-9	-0.0408***		-0.0402***
10-19	-0.0382***		-0.0367***
20-49	-0.0423***		-0.0421***
50-99	-0.0563***		-0.0551***
100-199	-0.0205***		-0.0200
200-499	0.0144		0.0149
500-999	0.0223		0.0233
1000+	0.0302		0.0287
Unknown	0.0614***		0.0620***
MNE group (yes: 1)	-0.0619***		-0.0594***
Distance to GER (in km, ln)	-0.0448***		-0.0281**
Interviewer characteristics:			
Male (*yes: 1*)		0.0004	-0.0029
Interviewer age (in years)		-0.0036***	-0.0032***
No. of interviews		-0.0110***	-0.0103***
Random part: intercept variance (ζ_j)	2.6375***	0.9763***	1.0106***
ICC	0.4450	0.2288	0.2350
No. of observations	7,991	9,577	7,991
Loglikelihood	-2,517.9603	-3,150.2153	-2,456.6163

Note: AME = average marginal effect. Significance level: * < 0.1, ** < 0.05, *** < 0.01. Control variables for industry affiliation included.

Table 3.10: Nonresponse analysis: results of multi-level logit model (nonresponse = 1) for Czech MNEs

	- 1 -	- 2 -	- 3 -	- 4 -
	AME	AME	AME	AME
Firm characteristics:				
No. of employees 2010 (ref.: 1-5):				
6-9	-0.0438		-0.0425	-0.0394
10-19	-0.0540*		-0.0505*	-0.0423
20-49	-0.0757***		-0.0813***	-0.0763***
50-99	-0.0869***		-0.0863***	-0.0805**
100-199	-0.0061		-0.0095	-0.0059
200-499	-0.0027		-0.0089	-0.0108
500-999	0.0535		0.0397	0.0385
1000+	0.0766		0.0628	0.0655
Unknown	0.0935***		0.0821***	0.0790***
Distance to GER (ln)	-0.0117		-0.0128	-0.0394
Interviewer characteristics				
Male (yes: 1)		-0.0046	-0.0033	-0.0044
Interviewer age		-0.0035***	-0.0033***	-0.0032***
No. of interviews		-0.0099***	-0.0093***	-0.0095***
Characteristics of FDI project:				
Share of German investor (ln)				0.0556**
Direct investment (*yes: 1*)				-0.0269*
Duration of investment (in years, ln)				-0.0157
Greenfield investment (*yes: 1*)				0.0034
Employment allocation between German and Czech company part (*ref.: same number of employees in GER and DZ*)				
Less employees in GER than CZ				0.0122
More employees in GER than CZ				0.0042
Same industry in GER and CZ (*yes: 1*)				0.0207
Location (ref.: Border region GER and CZ):				
Border region CZ				-0.0139
Border region GER				-0.0657
No border region				-0.0192
Random part: intercept variance (ζ_j)	1.5173***	0.5020***	0.4458***	0.4342***
ICC	0.3156	0.1324	0.1193	0.1166
No. of observations	2,290	2,303	2,290	2289
Loglikelihood	-884.0752	-876.0250	-836.3157	-830.2925

Note: AME = average marginal effect. Significance level: * < 0.1, ** < 0.05, *** < 0.01. Control variables for industry affiliation included.

3.4 Conclusion

The labour market effects of FDI are a topic of constant concern. However, research possibilities are limited as most of the datasets applied in empirical research on FDI suffer from selectivity and contain only firms and/or FDI projects above a certain size threshold. To overcome these shortcomings, the IAB has created a unique dataset that allows an in-depth analysis of the labour market effects of German FDI in the Czech Republic, the IAB-ReLOC data.

The contribution of this paper is twofold: First, it gives an overview of the IAB-ReLOC data. By presenting the data generation process, guidance for similar data compilation projects is provided. The second and main focus of the paper is on the analysis of unit nonresponse in the IAB-ReLOC survey. As administrative data and information on the interviewer is available for the responding and for the nonresponding units, an in-depth analysis of the factors influencing the participation decision can be carried out. Due to missing information on the non-respondents in most firm-level datasets, previous empirical evidence in this field of research is rare. In addition, new insights into the survey participation decision of firms in a cross-border context are revealed.

The estimation of multi-level logit models shows that the probability for unit nonresponse is influenced by firm characteristics, interviewer features and – for the two MNE groups – by characteristics of the FDI project. In Germany as well as in the Czech Republic, larger firms have a higher probability to refuse survey participation and interviewers that are more involved in the survey as measured in terms of interviews conducted are more successful in recruiting respondents. Some differences in the survey participation between German and Czech firms emerge. The first pronounced difference is related to the location of the firms. In Germany, the nonresponse probability rises with the distance between the location of the company and the Czech Republic – indicating that for firms located closer to the border the survey topic is more interesting. In the Czech Republic, however, the opposite is true: firms that are located farther away from Germany show a lower probability for nonresponse. The second important finding concerns the response probability of the two MNE groups. Both the German parent companies and their Czech affiliates show a lower nonresponse probability when they are involved in a direct foreign investment compared to indirect investment forms what indicates a tighter interconnectedness of the firms. In the Czech MNE group, however, the nonresponse probability rises with the equity share the German company owns. This suggests that the decision power of a firm relates to the participation decision.

The fact that this paper has shown that unit nonresponse is not random in the dataset is not a hurdle for future research based on the IAB-ReLOC dataset. Due to the sophisticated record linkage, company level information on labour market characteristics is available for the total sample of German parent companies and can be exploited to get in-depth insights into the labour market effects of FDI comprising, for example, employment and wage effects. In addition, the IAB-ReLOC dataset offers also great opportunities for further methodological

analyses. For instance, the question comes up if the observed unit nonresponse pattern also results in a nonresponse bias.

4. Regional determinants of German FDI in the Czech Republic: new evidence on the role of border regions

Joint with Johannes Schäffler and Michael Moritz

Abstract

Using a unique dataset, the regional distribution of German multinationals and their Czech affiliates is analysed. The investigation focuses on locational factors for joint foreign direct investment (FDI) projects that can only be revealed by taking a home-host country perspective. A light is shed on the strong position of the common border region and its asymmetric interconnectedness. While the Czech border region constitutes an attractive target area for investors from all over Germany, multinational firms in the German border region show a significant preference to invest in Czech regions close by, but not so in the non-border regions in the neighbouring country.

Keywords: multinational firms, location choice, border regions, FDI, transaction costs, gravity model

JEL classifications: D23, F15, F23, R12

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4.1 Introduction

The attractiveness for the location of multinational firms is seen as a crucial issue for the development and wealth of regions. Foreign direct investment (FDI) is regarded as a conducive channel for the diffusion of productivity spillovers. Local firms in the host country may be able to improve their productivity as a result of forward or backward linkages with the affiliates of foreign multinationals, the introduction of new technologies, or the hiring of workers trained by foreign-owned firms. For both the home and the host country, the internationalisation of firms is an important regional policy issue as the location of multinationals may intensify both the emergence of regional disparities and the reinforcement of yet existing regional economic differences. This applies all the more for adjacent countries as they can take advantage of the close geographical proximity, above all in border regions. In this regard, one example of thriving FDI relations is the case of Germany and its eastern neighbour, the Czech Republic, which was in the last decades the major target for German FDI among the Central and Eastern European (CEE) countries (Moritz et al. 2017; Pflüger et al. 2013).[22]

A broad literature deals with the locational determinants of FDI. There are, however, some decisive limitations in many investigations. Firstly, many studies on FDI are restricted to the target countries. By not including information on the location of the headquarters some crucial issues, for example the role of distance between headquarters and affiliates, can only be analysed to a limited extent. Secondly, when looking at home and host countries, regional patterns formed by headquarters and foreign subsidiaries should not be disregarded. According to Porter (2003), spatial differences, persisting in a way in every country, are the essential drivers of economic development. Region-specific economic endowments, for example network effects in border regions and regional wage differences, can outplay country-specific effects for the attraction of FDI (Pusterla/Resmini 2007). Thirdly, most studies focus solely on the manufacturing sector, also for reasons of data availability. Differences between the locational determinants for investments in the manufacturing and in the service sector are largely unexplored yet (Castellani et al. 2016). The major drawback of various datasets used in the existing literature to analyse FDI, however, consists in the selectivity of the data with respect to the characteristics of the firms and/or the investment projects included. Most suppliers of data on FDI set specific thresholds that firms have to surpass to be included in the dataset. As a consequence, larger firms are overrepresented, leading potentially to biased results in research studies. The issue of firm size is particularly important in the case of neighbouring countries, where lower transaction costs compared with distant destinations also allow smaller firms to go abroad. As the findings of Buch et al. (2005) indicate that German FDI in nearby countries is provided for relatively many and relatively small companies, this issue is of vital relevance for the current study.

The contribution of this paper to the existing literature fundamentally consists in tackling the above-mentioned research deficiencies by using a uniquely established dataset that focuses on a two-country design. The starting point of the investigation is the total population of German

[22] The Czech Republic's importance as target country for German FDI is illustrated in Figure 1.1.

multinationals who have affiliates in the Czech Republic by the beginning of 2010. Information is available for the location of both the headquarters in Germany and the affiliates in the Czech Republic. Adding data on regional characteristics enables the analysis of regional determinants of FDI locations in the home and in the host country. Building on theoretical considerations and the existing literature, special attention is put on issues that may affect the common border region. By applying a gravity model, the analysis reveals that this region is, despite its mainly rural character, involved in transnational investment projects at an above-average level. The firms located in the German border regions take advantage of the investment opportunities mainly in the close-by Czech regions, while the non-border regions of the neighbouring country are significantly less frequented by them. Additionally, the Czech borderlands represent attractive destinations for investors from all over Germany.

The remainder of the article is organised as follows. Section 4.2 provides the conceptual background of the study by referring to the literature that considers the role of distance and border regions as locational determinants in multinational investment relationships. It is followed by a description of the IAB-ReLOC sample in section 4.3.1. The subsequent explanations in section 4.3.2 shed light on the regional characteristics of German and Czech regions. In section 4.4, the gravity model and the Negative Binomial specifications used for investigating the location pattern of German headquarters and Czech affiliates are introduced. Results are presented and discussed for the total of FDI projects, manufacturing FDI and services FDI in section 4.5. In section 4.6, the paper concludes with a discussion of the findings regarding their relevance for public policies and an outlook to future research.

4.2 Conceptual background and research questions

Previous research has shown that the physical distance between two countries as a proxy for transport costs, measured, for example, as linear distance or driving time, exhibits a negative impact on bilateral FDI (see Huber 2003; Portes/Rey 2005, for example). For the Czech Republic, Spilková (2007) and Hecht (2017) find that a region's attractiveness declines with its distance to Germany. However, not only physical distance but also cultural and social distance influences the location choice of FDI. Concerning the cross-border nature of neighbouring countries, the relationship between FDI and distance should be of specific importance with regards to the common borderlands. After a long period of separation among countries with different levels of development the process of economic re-integration is expected to start in border regions. A bulk of studies confirms the positive impact of information costs and convenient conditions for network effects on investment possibilities in border regions (see Bergin et al. 2009; Hanson 1998, for example).

According to market size considerations from New Economic Geography models, border regions benefit the most from increasing access to foreign markets as their geographical position becomes less peripheral. Economic entities already residing in border regions face improving conditions (Niebuhr/Stiller 2004). The border regions between the domestic and the host country feature specific advantages for the cross-border exchange of goods and services that go beyond the mere benefit of low transport costs. In regions close to the border,

transaction costs in terms of cross-cultural communication should be especially low, which makes investments attractive also for small and medium-sized companies that otherwise cannot bear high fixed costs in order to become multinational. Buch et al. (2005), for instance, emphasise the cultural distance as an important factor influencing information and communication costs. Regions along a permeable border represent contact zones that enable everyday encounters between different traditions and mentalities. Thus, in border regions typically a higher share of the population has language skills of the other country and is familiar with the local customs what reduces foreign market entry costs. The possibility of frequent face-to-face contacts helps to generate an atmosphere of trust and control which is essential for building up networks (Boschma 2005).

Furthermore, as trans-border cooperations are regarded as principal means to remove barriers (Cappellin 1993), the creation of networks received special priority in the structural policy of the European Union, in particular with the establishment of the INTERREG and PHARE programmes. The regional integration of border regions aims at improving their economic performance and at limiting economic drawbacks of market barriers. In order to foster cross-border cooperation, five Euroregions have been founded along the Czech-German border in the early 1990s comprising altogether the total area of the common border region. Initially created to improve cooperation at a political and institutional level in the spheres of spatial and infrastructural planning and environmental protection, these regions also contributed to a greater awareness of shared identity in the border regions what positively influenced the fields of economy and trade, among others (Jouen 2001).

Against this background, the following research topics for the common border regions of the integrating economies of Germany and the Czech Republic can be derived: cultural proximity and the existence of cross-border networks should especially foster FDI projects targeting from the German border region to the Czech border region. In this context the question arises how the border regions of one country are involved in FDI relations with the non-border regions of the neighbouring country. Goes the attractiveness of the Czech border region for German investors located in German non-border regions beyond the mere benefit of low distance? And do Czech non-border regions constitute attractive target regions for investors from the German border region? In general, the lowest investment activity is expected among German and Czech non-border regions.

In order to identify the impact of distance and border features, two groups of control variables that have been found to be important in FDI location choice are included in the analysis: market size and agglomeration economies; and labour market characteristics. While Hayter (1997) differentiates between neoclassical, institutional and behavioural location factors, the investigation of regional determinants places the first set of variables in the foreground. Behavioural factors refer to the entrepreneurial nature of the firm, which is not scope of this article. Concerning institutional factors, it can be assumed that in the case of a single home and a single host country, for FDI most institutional conditions are equal throughout one country. The attraction of multinational firms, of course, is potentially affected by differences in regional taxes, investment incentives and the funding of industrial zones. In Germany and the

Czech Republic, however, relevant dissimilarities either do not exist at the regional level applied in this study or are captured by variables that are part of the analysis. In both countries, business taxes are raised at nationwide or municipal level. With regards to national or European Union subsidies, the eligibility of a region rests upon economic indicators like gross domestic product (GDP) level or unemployment rate. In the Czech Republic, the funding schemes predominantly distinguish between investments in Prague and in the rest of the country. While investments in the capital region receive only little financial support, the state aid intensity in the other regions is higher and provided at similar levels. As a consequence of the lack of regional variability in terms of subsidies, the inclusion of the original variables that underlie the subsidy programmes is preferred.

In a robustness check, the issue is addressed whether there are different regional determinants for FDI projects aiming at the Czech manufacturing sector in contrast to the Czech service sector. Münich et al. (2014) find evidence for distinctive patterns of investment motives in the two main economic sectors. Due to vertical linkages, FDI in services may locate close to manufacturing industries (Jones/Wren 2016). However, the location pattern could look quite different if final consumer demand was the dominant driving force of services FDI (Riedl 2010). Moreover, the involvement of the common border region could differ between the two sectors. For German manufacturing firms, the short physical as well as cultural distance allows one to exploit the labour cost differences by splitting up their value chain and establishing plants in the Czech borderlands. By contrast, trade in intermediate or final services, if at all possible, substantially differs from the way it is executed in the manufacturing sector. Before turning to the econometric analysis, a brief description of the firm-level and regional data is now given.

4.3 Data and descriptive statistics

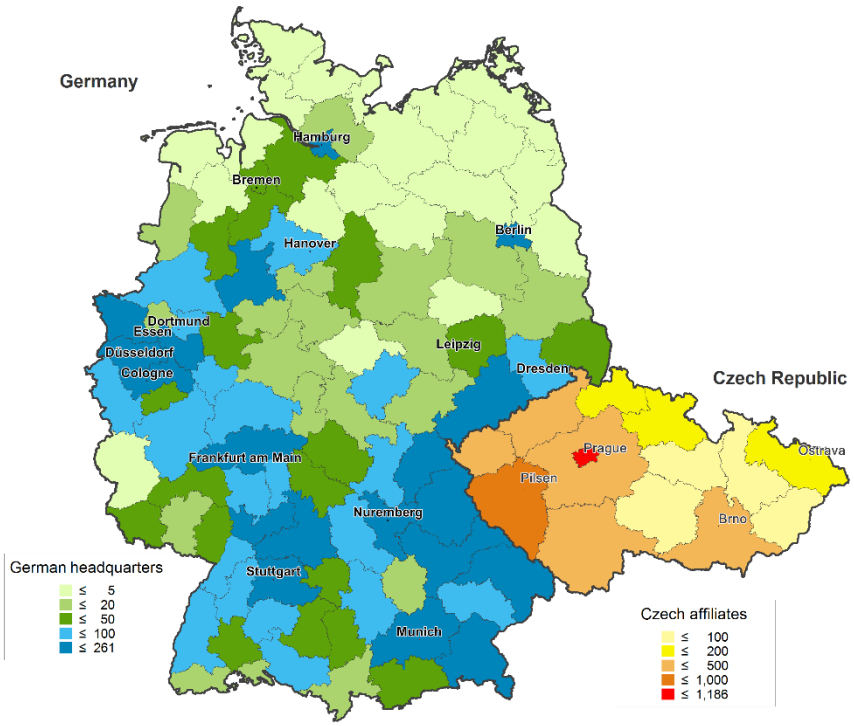
4.3.1 The IAB-ReLOC sample

This paper uses a newly established unique database: the gross sample of the IAB-ReLOC project comprising information on the total population of German multinationals and their affiliates in the Czech Republic (see Hecht et al. 2013b, for more details). The dataset allows to take a closer look at the regional determinants of FDI by focusing on both the home and the host country. In comparison with other samples, the great advantage of the IAB-ReLOC data is the number of observations, the inclusion of small and medium-sized firms and the availability of information on both sides of the border. The original basis of the dataset is an extract of the Czech Commercial Register covering 3,894 investment projects with capital participation by a German firm of at least 25 percent (by the beginning of 2010). For the Czech part, after merging information on the sectoral affiliation of the firms which is provided by the Czech commercial data supplier ČEKIA, it is possible to split the sample in FDI investments that are aimed at the manufacturing sector (1,274 FDI projects), and at the service sector including commerce (2,431 FDI projects).

Figure 4.1 to 4.4 show the regional distribution of German investors in 96 spatial planning regions and their Czech affiliates in 14 Czech NUTS 3 regions. The choice of the regional

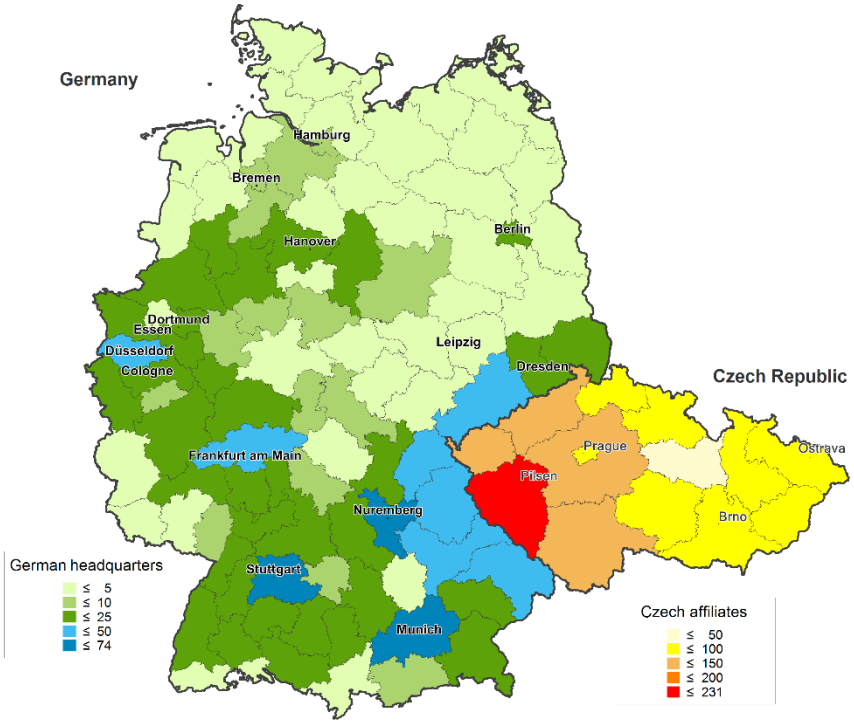
levels in both countries was driven by reasons of a good comparability with respect to the average population size. The headquarters of the multinationals are predominantly located in the metropolitan areas of Munich, Stuttgart, Frankfurt am Main and the Rhine-Ruhr region around Düsseldorf. Apart from that, parent firms are highly concentrated in the German borderlands. In the Czech Republic, the subsidiaries of the multinationals can be found particularly in the capital city of Prague and in the regions close to Germany and Austria. The spatial patterns for the total of FDI projects and for services FDI appear quite similar (see Figure 4.3). Distinguished differences are observable, however, in the case of manufacturing FDI (see Figure 4.2). While the regions close to the Czech Republic persistently hold a strong position, Germany's two largest cities, Berlin and Hamburg, play only a moderate role as a location for headquarters. Relatively few affiliates operating in the manufacturing sector are situated in Prague. Of more importance are the districts around the capital city in central Bohemia and western Bohemia, whereby the region of Pilsen has established a dominating position.

Figure 4.1: Regional distribution of German headquarters and Czech affiliates (total FDI projects)



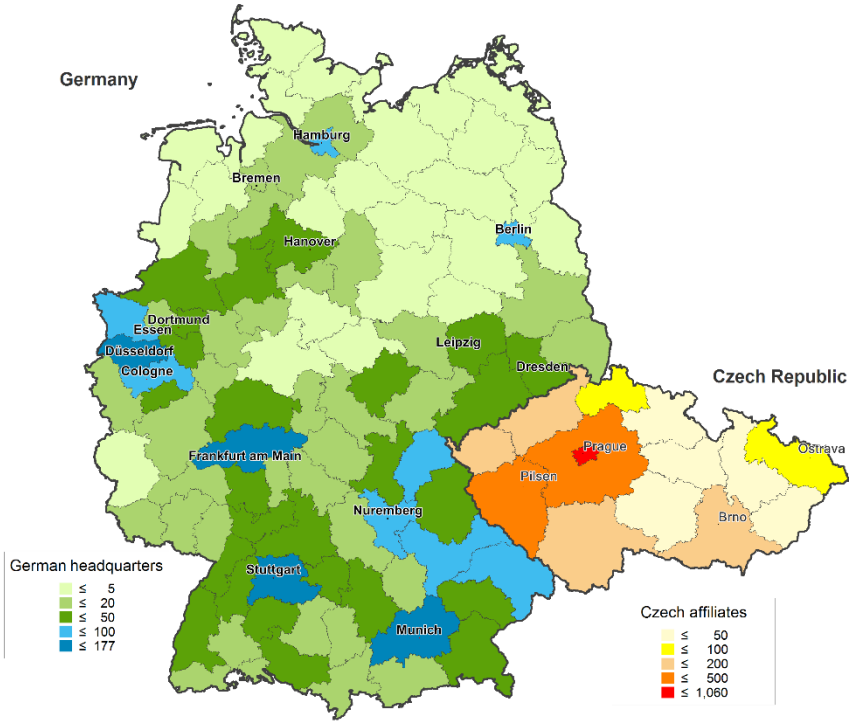
Source: Authors' own calculations from IAB-ReLOC data.

Figure 4.2: Regional distribution of German headquarters and Czech affiliates (manufacturing FDI)



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

Figure 4.3: Regional distribution of German headquarters and Czech affiliates (services FDI)



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

At the heart of the investigation are the regional combinations of German-Czech FDI projects, i.e. the number of headquarters in one of the German spatial planning regions and their affiliated companies in one of the Czech NUTS 3 regions. The number of realised FDI projects is calculated for 1,344 combinations (96 German regions of origin x 14 Czech target regions). The distribution of regional combinations ranges between zero observations and 120 FDI projects.[23] A more coherent analysis of FDI linkages reveals interesting findings on the role of the border regions (see Table 4.1). In more than 60 percent of total FDI projects, neither the German headquarters nor the Czech affiliate are located in the common border region. Conversely, in nearly 11 percent both firm units have their registered office in the borderlands. The Czech NUTS 3 regions Pilsen, South Bohemia, Karlovy Vary and Ústí nad Labem, which are situated directly at the German-Czech border, seem to be attractive destinations also for German non-border investors (around 24 percent of all projects). In contrast, the German investors from the border regions that operate affiliates in the Czech non-border regions represent quite a low share of below 5 percent of all cases. Taking a look at economic sectors, it becomes apparent that Czech border regions are more attractive for manufacturing industries compared with services.

Table 4.1: Number of FDI projects between border and non-border regions

		Czech Republic								
		Total FDI projects			Manufacturing FDI			Services FDI		
		Border	Non-border	Total	Border	Non-border	Total	Border	Non-border	Total
Germany	Border	422 (10.8%)	172 (4.4%)	594 (15.3%)	172 (13.5%)	54 (4.2%)	226 (17.7%)	214 (8.8%)	109 (4.5%)	323 (13.3%)
	Non-border	931 (23.9%)	2,369 (60.8%)	3,300 (84.7%)	415 (32.6%)	633 (49.7%)	1,048 (82.3%)	466 (19.2%)	1,642 (67.5%)	2,108 (86.7%)
	Total	1,353 (34.7%)	2,541 (65.3%)	3,894 (100%)	587 (46.1%)	687 (53.9%)	1,274 (100%)	680 (28.0%)	1,751 (72.0%)	2,431 (100%)

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

4.3.2 Regional characteristics

Regional data are taken from the statistical offices of Germany and the Czech Republic. Corresponding to the date of identifying the German multinationals in the Czech Republic, the data refer to the year 2009 providing information on three categories: *market size and agglomeration economies; labour market characteristics*; and, as the foremost topic of interest, issues related to *distance and borderlands*. The summary statistics of the regional variables are depicted in Table 4.2.

[23] Concerning the total sample, in around 40 percent of cases no FDI projects exist between a specific German and a particular Czech region. For projects in the manufacturing (service) sector the proportion of zeros increases to 59 percent (56 percent).

In the group of *market size and agglomeration economies*, the variables *GDP_GER* and *GDP_CZ* are incorporated in the regression as a measure of dimension and economic size of a region and denote the regional GDP (millions of euros) in the German region of origin and the Czech destination region. The GDP per capita (*GDPpc_GER* and *GDPpc_CZ*) represents the economic strength of a region. The figures for GDP and GDP per capita reflect the still existing differences in both market size and market strength between the two countries. The level of urbanisation is specified by the population densities *PopDens_GER* and *PopDens_CZ*. Considering localisation economies that arise from the spatial concentration of firms belonging to the same sector, the manufacturing/services ratio (*Manu/Serv_GER* and *Manu/Serv_CZ*) indicates the relative specialisation in manufacturing or service activities in the home and host regions. The ratio is calculated as the relation between the number of employees working in manufacturing industries and employees working in service industries, whereby the German regions exhibit a higher orientation on services. To account for weaker economic conditions accompanied with a lower number of headquarters in the eastern federal states compared to the western part of Germany, the dummy variable *East_Germany* is included, denoting 1 if the German spatial planning region belongs to the New Laender (including Berlin), and 0 otherwise. Eastern Germany's proximity to Poland as an alternative investment location might additionally lower the likelihood for investments in the Czech Republic. *Prague* represents the capital of the Czech Republic as one of 14 NUTS 3 regions. The dummy variable denotes 1 for combinations with the FDI target region Prague, and 0 otherwise and controls for the special position of Prague as the Czech Republic's undisputed centre of economic activities.

Concerning *labour market characteristics*, the database allows to directly consider differences between the locations of the headquarters and the affiliates. For each combination, the variable *Wage_Ratio* denotes the relation between the wage level in the German home region and the corresponding wage level in the Czech host region. On average, the wage level in German regions is 3.5 times higher than in Czech regions. The inclusion of regional unemployment rates for both countries (*Unemployment_GER* and *Unemployment_CZ*) indicates labour availability and business conditions. Besides, the Czech unemployment rate can be interpreted as a proxy for job creation and training incentives that preferably are granted in underdeveloped regions. The relative endowment of the regions with human capital is captured by the share of high-skilled employees *High_Skilled_GER* and *High_Skilled_CZ*. Both unemployment rate and share of high-skilled workers are on average slightly higher in the Czech Republic.

The following variables represent issues related to *distance and borderlands*. *Distance* is computed by means of the route planning software *map & guide calculate 2009* and measures the calculated driving time (minutes) of a heavy-goods vehicle between the capitals of each German spatial planning region and each Czech NUTS 3 region. Three dummy variables are incorporated in order to capture the potential relevance of locations in the German-Czech borderlands. The joint border dummy *Border_GER_CZ* takes the value 1 if both the German home region and the Czech target region of a FDI project are located in the frontier areas – representing a share of 2 percent of the 1,344 combinations – and 0 otherwise. The additional dummies *Border_GER* and *Border_CZ* account for the cases in which only the German region

(4 percent) and only the Czech NUTS 3 region (27 percent) is a border region, respectively, and 0 otherwise. Hence, the reference category is formed by two-thirds of the combinations where both regions are non-border regions. This set of border dummy variables examines whether the borderlands are primarily affected by German-Czech FDI projects due to the strength of geographically dense cross-border networks and whether these regions are to an above-average extent connected to more remote areas of the neighbouring country.

Table 4.2: Descriptive statistics for the 1,344 German-Czech regional combinations

	Variable	Illustration	Mean	Std. Dev.
Market size and agglomeration	GDP_GER	GDP Germany (millions of €)	24,969.79	23,887.94
	GDP_CZ	GDP Czech Republic (millions of €)	10,103.64	7,998.76
	GDPpc_GER	GDP per capita Germany (€/inhabitant)	27,203.18	5,638.97
	GDPpc_CZ	GDP per capita Czech Republic (€/inhabitant)	12,485.71	4,588.16
	PopDens_GER	Population density Germany (inhabitants/km²)	330.11	498.81
	PopDens_CZ	Population density Czech Republic (inhabitants/km²)	299.61	627.93
	Manu/Serv_GER	Manufacturing/service ratio Germany	0.30	0.14
	Manu/Serv_CZ	Manufacturing/service ratio Czech Republic	0.49	0.14
	East_Germany	Dummy East Germany	0.23	0.42
	Prague	Dummy Prague	0.07	0.26
Labour market	Wage_Ratio	Wage ratio Germany/Czech Republic	3.50	0.48
	Unemployment_GER	Unemployment rate Germany	0.08	0.03
	Unemployment_CZ	Unemployment rate Czech Republic	0.10	0.03
	High_Skilled_GER	Share of high-skilled Germany	0.09	0.03
	High_Skilled_CZ	Share of high-skilled Czech Republic	0.12	0.04
Distance and border	Distance	Distance between German and Czech region (minutes)	566.75	168.62
	Border_GER_CZ	Dummy border Germany and Czech Republic	0.02	0.13
	Border_GER	Dummy border Germany	0.04	0.21
	Border_CZ	Dummy border Czech Republic	0.27	0.44

Source: Federal Statistical Office Germany; Czech Statistical Office; authors' own calculations.

4.4 Estimation method and specifications

Determinants for the location of FDI have been discussed using various research methodologies, whereby two sorts of models have emerged as basic econometric tools in empirical investigations (for an overview, see Arauzo-Carod et al. 2010). Discrete choice models are widely applied to estimate the probability to be chosen as investment location. Since this paper considers information from home and host regions of FDI, the scope is closer to a second strand, the use of count data models. By focusing on the spatial distribution in both countries, a gravity model approach is favoured, as widely applied in the literature for the investigation of FDI flows (see Blonigen et al. 2007; Brainard 1997; Kandilov/Grennes 2012, for example). The issues of heteroscedasticity and zero observations suggest the use of Poisson and negative binomial (NegBin) models (Cameron/Trivedi 1998; Santos Silva/Tenreyro 2006).[24]

In this study, the dependent variable denotes the number of German-Czech FDI projects as a combination of having a German headquarters in a certain German region and a Czech affiliate being located in a specific Czech region. This variable takes the value zero or positive, integer values. The number of German-Czech FDI projects is regressed on the set of variables that have been introduced above. As apart from the dummies the explanatory variables enter in log form, the coefficients represent elasticities. In the first specification (1), only the regional GDP values and the distance between home and host region are included. In a next step (2), the set of regional dummy variables for the border regions, East Germany and Prague is added to the model. In the succeeding estimation version (3), labour market conditions are considered. The final specifications are characterised by the incorporation of further control variables which relate to agglomeration economies. As, for the Czech part, the additional variables population density, GDP per capita and the manufacturing/services ratio show a relatively high correlation with the Prague dummy, two versions are estimated, one with (4) and one without (5) the observations where Prague is the target region of FDI.

4.5 Results

Table 4.3 shows the results for total FDI projects that are based on negative binomial regressions. The application of the NegBin model was preferred with regards to model assumptions, whereby the outcomes of the Poisson regressions are not fundamentally different.[25] The results for the core variables of the gravity model are fairly near the theoretical basics of the model. Concerning both headquarters in the German region of origin and affiliates in the Czech target region, cross-border FDI projects are preferably located in economically large regions. The coefficient for German GDP is close to 1 in all specifications, i.e. in the case of estimation version (1) a 1 percent rise of GDP in a German region implicates an increase of 1.11 percent in cross-border FDI projects. A higher level of Czech regional GDP by 1 percent

[24] The estimation method is illustrated in detail in Appendix 4.A.

[25] The Poisson estimation results are available from the authors upon request. In order to take account of the relatively high proportion of zeros, several robustness checks were performed by estimating a Zero-Inflated Negative Binomial (ZINB) model. These results are very close to the outcome of the conventional NegBin model and are available from the authors upon request.

involves a growth in the number of FDI projects by 0.74 percent. In the final two specifications the coefficient of the Czech regional GDP decreases to around 0.4 but remains significant. Across the board, the transport distance in terms of driving time is negatively correlated with the number of investments. An increase of the driving time by 1 percent is connected with a decrease of common FDI projects of about 2 percent. Thus, proximity is a favourable factor for FDI.

What should catch the attention in all specifications beyond the basic gravity model are the results for the border dummies. The significantly positive coefficient for the common border dummy *Border_GER_CZ* means that beyond the driving time between locations of parent company and affiliate, there is a specific location advantage in the areas close to the neighbouring country with more than two times more projects compared to combinations with both the German and the Czech region not belonging to the borderlands (corresponding to 2.11 = exp(0.7473) when the full set of variables is used in specification (4)). The outcome shows the attractiveness of the Czech borderlands for nearby investors in particular, as the coefficient of the additional dummy for combinations, in which only the German headquarters is situated in the borderlands, is negatively significant. There are nearly three and a half times more investments within the common border regions than from German border regions into Czech non-border regions (corresponding to 3.49 = exp(0.7473+0.5025) in specification (4)). This result sheds a light on asymmetries with regards to the locations in the German-Czech borderlands indicating that multinationals with headquarters in the German border region are primarily investing in nearby Czech regions, but relatively few of them operate affiliates in regions farther away. In contrast to that, there is no significant difference for the Czech regions close to Germany with respect to the attraction of FDI from German non-border regions, as the pure Czech border dummy turns insignificant when all explanatory variables are included. Thus, what Buch et al. (2003) in their study on German outward FDI found out for the national level – that a common border increases the FDI flows between two countries – applies also for the regional level. Despite the long-term separation by the Iron Curtain, the common border region provides some locational advantages that go beyond the mere benefit of low transport costs. Some authors have been very critical with regards to economic integration in the borderlands of Germany and the former socialist countries (for an overview, see Leick 2012). Though the western Polish regions exhibit above-average FDI levels (Cieślik 2005b), German investments predominantly come from western German firms, resulting in a lack of trans-border cooperations within the common German-Polish border areas. This is ascribed to the structural deficiencies of the eastern German regions next to Poland (Krätke 1999; Krätke/Borst 2007). However, this finding cannot be transferred one to one to the case of the German-Czech border region. This study shows that, at least with regards to cross-border FDI flows between Germany and the Czech Republic, the common border region is more integrated than the non-border regions. The results confirm that in the context of international investment flows economic forces are able to foster the regional integration of border regions. The favourable outcome might also be related to the European Union programmes INTERREG and PHARE that supported in particular public authorities, interest associations and non-profit

organisations in peripheral regions to cooperate across borders and thus reinforced the creation of cross-border networks and cultural proximity.

Besides the role of distance and borderlands in the cross-border FDI activities of German firms, additional interesting findings can be seen by a closer look at the control variables. FDI projects with investors that have their headquarters in eastern Germany are represented significantly below average. Against the backdrop of the structural shortcomings at least in part of the eastern German regions (see also Blien et al. 2016, for example), their low commitment in the Czech Republic is not surprising. Concerning a potential capital city effect, Prague does not allure German multinational investors through individual factors that go beyond its outstanding characteristics captured by the other variables, as the coefficient for the corresponding dummy variable turns insignificant in specifications (3) and (4). With regards to agglomeration determinants, the significantly positive coefficient for the population density in Germany implies the advantageous role of agglomerative areas for multinational headquarters. For both countries, the regional GDP per capita does not yield significant results. The outcome for the manufacturing/services ratio differs between the two countries. While headquarters are concentrated in German regions with a relatively high specialisation in manufacturing, Czech regions with a relative specialisation in the service sector are to a higher extent involved in FDI projects (supporting Hilber/Voicu 2010, for the Romanian case).

Turning to the labour market variables, special attention should be put on the results for the wage ratio. The variable's coefficient is significantly negative in the final two estimations where also the agglomeration features are included. Though previous studies that included different CEE countries in the analysis identified cheap labour force as an important location determinant for FDI (Pusterla/Resmini 2007; Resmini 2000), this does not hold for locational determinants of German FDI within the Czech Republic. While the remarkably lower wage level in the Czech Republic may contribute to the German investor's basic decision to locate in the neighbouring country, a low regional wage level within the Czech Republic is not among the most crucial location factors for German investors. Unemployment rates obviously do not play a considerable role for the explanation of the regional FDI pattern both in the home and in the host country. The findings for the high-skilled share are more clear-cut in the Czech case, where a significantly positive relationship with the number of investors is found in all estimation versions. This outcome corresponds to the observation of Buch et al. (2005) and Gauselmann/Marek (2012) that the Czech Republic is an attractive target region for German multinationals due to the highly trained labour force.

When looking separately at projects in the Czech manufacturing sector and the Czech service sector, the location patterns of German headquarters and Czech affiliates evidently differ to some extent (see Figure 4.2 and Figure 4.3). Nonetheless, the estimation of a gravity model yields quite similar results for the two major economic sectors (Table 4.4).[26] This applies to distance and border issues in particular. Neither the coefficients for the distance variable nor for the border dummies reveal remarkable differences. Apart from those crucial variables,

[26] Only the results of the full specification (4) are shown. For manufacturing (services) FDI projects the estimation results for all specifications are available in Table 4.5 (Table 4.6) in Appendix 4.B.

some differences become apparent. Czech regions with a relative specialisation in the service sector attract significantly more services FDI, while the coefficient for the manufacturing/service ratio is insignificant for manufacturing FDI. The result for the Czech unemployment rate varies with the underlying sample of investment projects. While the coefficient is insignificant for services FDI, it is in all specifications positive and slightly significant in the case of manufacturing FDI. One interpretation of this result is that investors in the manufacturing sector prefer regions with a high availability of workers. Another interpretation could be that investors in the manufacturing sector are attracted by investment subsidies as in the Czech Republic the provision of job creation and training grants has been connected to regional unemployment rates (CzechInvest 2013). Concerning the wage ratio, the difference in the coefficient's value (around -2.5 for manufacturing FDI and below -4 for services FDI) indicates that services FDI is more attracted by Czech high-wage regions than manufacturing FDI. The results for the other variables are very similar in both subgroups of FDI projects. In summary, slight differences exist in the relevance of location factors for services FDI compared with the determinants for manufacturing FDI, as they are found in other studies (Jones/Wren 2016; Riedl 2010). Deviations between the two economic sectors cannot be confirmed, however, for the role of border regions.

Table 4.3: Estimation result of negative binomial regressions for total FDI projects

Total FDI projects		**1**		**2**		**3**		**4**		**5**	
		Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
Market size and agglomeration	ln_GDP_GER	1.1138***	0.0479	1.0053***	0.0415	1.1842***	0.0678	1.1220***	0.0781	1.1143***	0.0844
	ln_GDP_CZ	0.7426***	0.0487	0.7483***	0.0702	0.5536***	0.0859	0.4114**	0.1617	0.4031**	0.1621
	ln_GDPpc_GER							0.0973	0.3207	0.0009	0.3497
	ln_GDPpc_CZ							-0.5505	1.0460	-0.6742	1.0393
	ln_PopDens_GER							0.3775***	0.0687	0.3588***	0.0753
	ln_PopDens_CZ							-0.1777	0.1984	-0.1943	0.1967
	ln_Manu/Serv_GER							0.6319***	0.0913	0.7529***	0.0986
	ln_Manu/Serv_CZ							-0.8279***	0.2055	-0.8375***	0.2042
	East_Germany			-1.1753***	0.0935	-1.2758***	0.1807	-1.3109***	0.1833	-1.3700***	0.1954
	Prague			0.2790**	0.1359	-0.2370	0.2156	-0.9069	1.0621		
Labour market	ln_Wage_Ratio					-1.1677**	0.5938	-3.3867***	0.7135	-3.7094***	0.7541
	ln_Unemployment_GER					-0.0273	0.1255	-0.0742	0.1569	-0.0371	0.1693
	ln_Unemployment_CZ					0.4136**	0.1907	0.3183	0.2873	0.3776	0.2857
	ln_High_Skilled_GER					-0.2697*	0.1491	-0.0825	0.1509	-0.0628	0.1624
	ln_High_Skilled_CZ					0.9258***	0.2020	0.6581**	0.2637	0.6996***	0.2629
Distance and border	ln_Distance	-1.9472***	0.0862	-1.8930***	0.1064	-2.0659***	0.1261	-2.0080***	0.1293	-2.0355***	0.1342
	Border_GER_CZ			1.1430***	0.1905	0.9637***	0.1953	0.7473***	0.2031	0.6480***	0.2026
	Border_GER			-0.2822*	0.1485	-0.4656***	0.1522	-0.5025***	0.1489	-0.5263***	0.1607
	Border_CZ			0.1687**	0.0791	0.2252***	0.0811	0.0126	0.1167	0.0011	0.1159
	Constant	-5.0415***	0.7277	-4.2927***	0.9761	0.5517	2.2004	7.6152	10.0323	11.2239	10.1089
	N	1344		1344		1344		1344		1248	
	Pseudo-R^2	0.1648		0.2069		0.2124		0.2289		0.2065	
	Loglikelihood	-2334.0108		-2216.3431		-2200.9710		-2154.8786		-1881.7414	
	Alpha	0.7415***		0.4437***		0.3990***		0.3350***		0.3284***	

Source: Authors' own calculations from IAB-ReLOC data. *, **, *** significant at the 10%, 5%, 1% level respectively.

Table 4.4: Estimation result of negative binomial regressions for manufacturing FDI and services FDI projects

FDI projects by sector		Manufacturing FDI		Services FDI	
		Coef.	Std.Err.	Coef	Std.Err.
Market size and agglomeration	ln_GDP_GER	1.1514***	0.1061	1.1398***	0.0934
	ln_GDP_CZ	0.3638*	0.2072	0.5298**	0.2094
	ln_GDPpc_GER	-0.3727	0.4413	0.1874	0.3839
	ln_GDPpc_CZ	-1.0937	1.3300	-1.3713	1.3809
	ln_PopDens_GER	0.2924***	0.0958	0.4411***	0.0814
	ln_PopDens_CZ	-0.1638	0.2455	-0.1422	0.2779
	ln_Manu/Serv_GER	0.8773***	0.1244	0.4192***	0.1103
	ln_Manu/Serv_CZ	-0.1187	0.2605	-1.5502***	0.2596
	East_Germany	-1.4484***	0.2511	-1.4972***	0.2240
	Prague	-0.5183	1.3502	-1.8113	1.4118
Labour market	ln_Wage_Ratio	-2.5745***	0.9350	-4.1956***	0.8727
	ln_Unemployment_GER	-0.1181	0.2125	-0.0686	0.1899
	ln_Unemployment_CZ	0.6960*	0.3688	-0.1427	0.3702
	ln_High_Skilled_GER	-0.0379	0.1997	-0.0373	0.1822
	ln_High_Skilled_CZ	0.9556***	0.3349	0.7382**	0.3259
Distance and border	ln_Distance	-1.8856***	0.1630	-2.2003***	0.1581
	Border_GER_CZ	0.8274***	0.2435	0.7448***	0.2424
	Border_GER	-0.4169**	0.1937	-0.5663***	0.1820
	Border_CZ	0.0860	0.1460	0.0361	0.1529
	Constant	17.7621	12.7915	12.5711	13.0940
	N	1344		1344	
	Pseudo-R^2	0.1943		0.2638	
	Loglikelihood	-1418.2341		-1594.5861	
	Alpha	0.3345***		0.3226***	

Source: Authors' own calculations from IAB-ReLOC data. *, **, *** significant at the 10%, 5%, 1% level respectively.

4.6 Conclusions

The findings of this study reveal new insights into the regional distribution of FDI locations for the German-Czech case illustrating potential options for policy measures both in the home and in the host country. The results indicate the importance of regional interconnectedness for the location of multinationals beyond the relevance of transport costs. Surely, an improvement of traffic infrastructure could facilitate a larger cross-border FDI involvement of more remote regions. Investments from eastern German firms, for instance, could be pushed by lower transport costs to the Czech market, thereby strengthening the international competitiveness of the New Laender. In turn, bringing Czech regions in the eastern part of the country closer to Germany should enhance their attractiveness. But FDI relations are not only an issue of pure distance in terms of traffic accessibility. This concerns in particular investments from the

German borderlands, where lots of firms are apparently well engaged in FDI, but for the main part only directly across the border and not in regions farther away. Direct borders apparently foster cross-border investments of firms that otherwise possibly would not be able to invest abroad if higher transaction costs would have to be borne. Notably without providing specific investment incentives, the Czech border regions perform considerably well as destination for FDI from all over Germany. Therefore, the support of transnational networks that could be enhanced by corresponding policies at the national and at European Union level seems to be a promising option to boost the internationalisation of firms even in rather sparsely populated areas. Though the wage level in the Czech Republic is still considerably lower than in Germany, investors are not preferentially looking for location conditions where the regional wage level is as low as possible. Obviously, a well-educated labour supply in the target region is more important for promoting investments. This outcome points to the relevance for the educational system to assure educational opportunities also away from the large cities.

Nevertheless, there is enough space left for follow-up studies. The interdependence between transaction costs and the motives of firms for going abroad should be taken under closer scrutiny. Spatial autoregressive relationships could be analysed if data for smaller regional units were available. There may be differences between the location of brownfield and greenfield investments, a topic where also the time dimension could play a crucial role. Last but not least, one of the most cardinal issues for future research in international economics might be the impact of FDI on regional labour markets.

Appendix 4.A: Details on the estimation method

Determinants for the location of FDI have been discussed using various research methodologies, whereby two sorts of models have emerged as basic econometric tools in empirical investigations (Arauzo-Carod et al. 2010). Discrete choice models are widely applied to estimate the probability to be chosen as investment location (Basile et al. 2009; Disdier/Mayer 2004; Guimarães et al. 2000; Head et al. 1999; Head et al. 1995; Zvirgzde et al. 2013). Since this paper considers information from home and host regions of FDI, the scope is closer to a second strand, the use of count data models (Arauzo-Carod/Viladecans-Marsal 2009; Barbosa et al. 2004; Blonigen 1997; Coughlin/Segev 2000; Wu 1999). By focusing on the spatial distribution in both countries, a gravity model approach is favoured. Originally, extended versions of Newton's law of universal gravitation were applied in order to analyse trade flows between nations or regions (Anderson/van Wincoop 2003; McCallum 1995). As trade relations can be investigated by a gravity model, so can FDI flows (Blonigen et al. 2007; Brainard 1997; Buch et al. 2003; Kandilov/Grennes 2012).

In a basic version of the gravity equation, it is assumed that the GDP of both investing and receiving unit (country, region) i and j with respect to a specific observation, denoted by GDP_i and GDP_j, have a positive impact on the volume of foreign direct investment FDI_{ij} between the units. A negative impact of distance $Dist_{ij}$ is assumed due to rising costs as distance increases. Thus, the basic equation can be written as

$$FDI_{ij} = \alpha_0 GDP_i^{\alpha_1} GDP_j^{\alpha_2} Dist_{ij}^{\alpha_3} \varepsilon_{ij}, \qquad (4.1)$$

where α_0, α_1, α_2 and α_3 represent parameters to be estimated and the error term ε_{ij} is assumed to be statistically independent of the regressors with

$$E\left(\varepsilon_{ij} | GDP_i, GDP_j, Dist_{ij}\right) = 1. \qquad (4.2)$$

Typically, in the literature OLS is used to estimate the parameters of the log-linearised form of the gravity equation, i.e.

$$ln\, FDI_{ij} = ln\, \alpha_0 + \alpha_1\, ln\, GDP_i + \alpha_2\, ln\, GDP_j + \alpha_3\, ln\, Dist_{ij} + ln\, \varepsilon_{ij}. \qquad (4.3)$$

This course of action, however, gives cause for criticism. Firstly, due to Jensen's inequality $E(\ln y) \neq \ln \mathrm{E}(y)$, the estimation of equation (3) produces inconsistent results in the presence of heteroscedastic error terms. Secondly, in cases where there are no FDI flows between two units of observation, the zeros in the dependent variable pose a problem for the estimation of the log-linear specification. Alternative approaches like dropping the zero observations, taking $FDI_{ij} + 1$ as the dependent variable or using a Tobit model lead to inconsistent parameter estimates.

To tackle these problems Santos Silva/Tenreyro (2006) suggest to estimate a Poisson Pseudo-Maximum Likelihood (PPML) model that is robust to heteroscedasticity and accounts for zero observations in the case of data situations and research questions like the present. Poisson models are used for count data that indicate the number of occasions of a certain event (for a detailed discussion see Cameron/Trivedi 1998). An approximate Poisson distribution of the number of events exists if the probability of success is low and the number of trials is high. Y denotes a random variable indicating how many times an event occurs, thereby following a Poisson distribution with the parameter μ. In a Poisson regression model for the analysis of count data, y_i given x_i is Poisson-distributed with density

$$f(y_i|x_i) = \frac{e^{-\mu_i} \cdot \mu_i^{y_i}}{y_i!}, \qquad y_i = 0,1,2, \ldots \tag{4.4}$$

and the expected value of y_i is a function of explanatory variables

$$E[y_i|x_i] = \mu_i = exp(x_i'\beta). \tag{4.5}$$

The model implies heteroscedasticity as both the expected value and the variance of y_i is a function of the explanatory variables. The log-linear form warrants that μ_i is larger than 0. The coefficient vector $\boldsymbol{\beta}$ can be estimated consistently by the Maximum Likelihood Method.

The Poisson model assumes the equality of expected value and variance:

$$\mu_i = E[y_i|x_i] = Var[y_i|x_i] \text{ (equidispersion)} \tag{4.6}$$

If this assumption is not fulfilled, $\hat{\beta}$ will be estimated consistently, but the standard errors of $\hat{\beta}$ are biased.

Under the assumption that

$$Var[y_i|x_i] = E[y_i|x_i] \cdot (1 + \alpha \cdot E[y_i|x_i]), \tag{4.7}$$

a negative binomial (NegBin) model with corresponding variance function has to be estimated, again applying the Maximum Likelihood Method. This model is referred to as NegBin II model. Within the scope of a NegBin II model the assumption of equidispersion is tested: *alpha* indicates the absolute value of the dispersion parameter. If *alpha* is significantly different from zero, the equidispersion assumption is violated and the estimation of the NegBin II model is preferred. Alternatively, if *alpha* is not statistically different from zero, the estimation of a Poisson regression with robust standard errors is favoured. In both cases, the coefficients are estimated consistently and the t-statistics follow a normal distribution and can be interpreted in the usual way.

Appendix 4.B: Estimation result of negative binomial regressions for manufacturing FDI and services FDI projects – all specifications

Table 4.5 and Table 4.6 show the estimation result of all specifications for manufacturing FDI projects and services FDI projects.

Table 4.5: Estimation result of negative binomial regressions for manufacturing FDI projects – all specifications

Manufacturing FDI projects		**1**		**2**		**3**		**4**		**5**	
		Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
Market size and agglomeration	ln_GDP_GER	0.9681***	0.0597	0.8759***	0.0531	1.0834***	0.0903	1.1514***	0.1061	1.1465***	0.1106
	ln_GDP_CZ	0.1022	0.0711	0.4814***	0.0899	0.3342***	0.1103	0.3638*	0.2072	0.3832*	0.2086
	ln_GDPpc_GER							-0.3727	0.4413	-0.3099	0.4608
	ln_GDPpc_CZ							-1.0937	1.3300	-1.1952	1.3316
	ln_PopDens_GER							0.2924***	0.0958	0.2671***	0.1012
	ln_PopDens_CZ							-0.1638	0.2455	-0.1691	0.2455
	ln_Manu/Serv_GER							0.8773***	0.1244	0.9944***	0.1302
	ln_Manu/Serv_CZ							-0.1187	0.2605	-0.1059	0.2607
	East_Germany			-1.4340***	0.1333	-1.2401***	0.2447	-1.4484***	0.2511	-1.5105***	0.2618
	Prague			-1.0137***	0.2032	-1.3230***	0.2979	-0.5183	1.3502		
Labour market	ln_Wage_Ratio					-0.8980	0.7809	-2.5745***	0.9350	-2.5329***	0.9641
	ln_Unemployment_GER					-0.2754*	0.1665	-0.1181	0.2125	0.0091	0.2223
	ln_Unemployment_CZ					0.4987**	0.2529	0.6960*	0.3688	0.7400**	0.3694
	ln_High_Skilled_GER					-0.3510*	0.1959	-0.0379	0.1997	-0.0266	0.2085
	ln_High_Skilled_CZ					0.8097***	0.2644	0.9556***	0.3349	1.0040***	0.3357
Distance and border	ln_Distance	-1.5984***	0.1054	-1.7888***	0.1345	-1.8668***	0.1581	-1.8856***	0.1630	-1.9453***	0.1669
	Border_GER_CZ			1.0341***	0.2238	0.9153***	0.2323	0.8274***	0.2435	0.7476***	0.2449
	Border_GER			-0.1580	0.1932	-0.3210	0.1977	-0.4169**	0.1937	-0.4672**	0.2046
	Border_CZ			0.0596	0.0991	0.1277	0.1026	0.0860	0.1460	0.0789	0.1461
	Constant	-0.8567	0.9723	-1.9631	1.2516	0.2539	2.8657	17.7621	12.7915	19.1712	12.8824
	N	1344		1344		1344		1344		1248	
	Pseudo-R^2	0.1153		0.1694		0.1747		0.1943		0.1977	
	Loglikelihood	-1557.3166		-1462.1765		-1452.6849		-1418.2341		-1312.7070	
	Alpha	0.9090***		0.4812***		0.4256***		0.3345***		0.3306***	

Source: Authors' own calculations from IAB-ReLOC data. *, **, *** significant at the 10%, 5%, 1% level respectively.

Table 4.6: Estimation result of negative binomial regressions for services FDI projects – all specifications

Services FDI projects		**1**		**2**		**3**		**4**		**5**	
		Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
Market size and agglomeration	ln_GDP_GER	1.1840***	0.0565	1.0883***	0.0496	1.2721***	0.0827	1.1398***	0.0934	1.1245***	0.1054
	ln_GDP_CZ	1.0570***	0.0556	0.9636***	0.0882	0.6635***	0.1069	0.5298**	0.2094	0.5026**	0.2121
	ln_GDPpc_GER							0.1874	0.3839	0.0901	0.4383
	ln_GDPpc_CZ							-1.3713	1.3809	-1.5324	1.3815
	ln_PopDens_GER							0.4411***	0.0814	0.4441***	0.0930
	ln_PopDens_CZ							-0.1422	0.2779	-0.1834	0.2768
	ln_Manu/Serv_GER							0.4192***	0.1103	0.5214***	0.1245
	ln_Manu/Serv_CZ							-1.5502***	0.2596	-1.5652***	0.2594
	East_Germany			-1.0575***	0.1139	-1.5451***	0.2224	-1.4972***	0.2240	-1.5432***	0.2468
	Prague			0.5664***	0.1566	-0.3746	0.2542	-1.8113	1.4118		
Labour market	ln_Wage_Ratio					-1.9550***	0.7278	-4.1956***	0.8727	-4.8298***	0.9587
	ln_Unemployment_GER					0.2159	0.1531	-0.0686	0.1899	-0.0707	0.2133
	ln_Unemployment_CZ					0.3590	0.2284	-0.1427	0.3702	-0.0319	0.3698
	ln_High_Skilled_GER					-0.1462	0.1820	-0.0373	0.1822	-0.0470	0.2039
	ln_High_Skilled_CZ					1.2142***	0.2382	0.7382**	0.3259	0.7778**	0.3272
Distance and border	ln_Distance	-2.1338***	0.1051	-1.9478***	0.1295	-2.2472***	0.1546	-2.2003***	0.1581	-2.2370***	0.1675
	Border_GER_CZ			1.2746***	0.2201	1.0315***	0.2261	0.7448***	0.2424	0.5985**	0.2466
	Border_GER			-0.3686**	0.1826	-0.5933***	0.1863	-0.5663***	0.1820	-0.5851***	0.2061
	Border_CZ			0.2735***	0.0994	0.3301***	0.1021	0.0361	0.1529	0.0052	0.1529
	Constant	-8.1143***	0.8560	-7.4943***	1.2196	1.5755	2.6605	12.5711	13.0940	17.1690	13.3297
	N	1344		1344		1344		1344		1248	
	Pseudo-R^2	0.1972		0.2365		0.2457		0.2638		0.22	
	Loglikelihood	-1738.7974		-1653.7495		-1633.8167		-1594.5861		-1336.5701	
	Alpha	0.8262***		0.4747***		0.4053***		0.3226***		0.3278***	

Source: Authors' own calculations from IAB-ReLOC data. *, **, *** significant at the 10%, 5%, 1% level respectively.

5. Location choice of German multinationals in the Czech Republic: the importance of agglomeration economies

Abstract

This paper analyses the location choice of German investors in the Czech Republic based on a unique dataset covering all Czech companies with a German equity holder. Using a nested logit approach the impact of agglomeration economies, labour market conditions and distance on location choice is investigated. The main result of the paper is that apart from a low distance to the location of the parent company the attractiveness of a Czech district for German investors is mainly driven by agglomeration economies. Besides localisation economies the agglomeration of German companies in a region plays a decisive role. The importance of labour market characteristics differs between investment sectors, sizes and periods.

Keywords: location choice, FDI, multinational enterprises, Germany, Czech Republic, agglomeration economies

JEL classifications: F23, R12, R30

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5.1 Introduction

Especially in less developed countries the attraction of foreign direct investment (FDI) is seen as a motor for regional development. Foreign investors bring not only financial capital but also technology as well as knowledge into the host countries (Resmini 2004). As a result of forward and backward linkages with the affiliates of multinational enterprises (MNEs), the introduction of new technologies, or the hiring of workers trained by MNEs, local firms in the FDI's host country may be able to improve their productivity (Blomström/Kokko 1998). As the positive externalities generated by FDI are locally linked to the location of the investment, thus to the host regions and their labour markets (Dinga/Münich 2010; Merlevede/Purice 2016), the location choice of FDI may contribute to the emergence of regional disparities as well as to the reinforcement of existing regional economic differences in the destination country of FDI (Hilber/Voicu 2010). Getting insights into the regional characteristics driving the attractiveness of a region for FDI location is therefore not only an interesting subject in regional economics but also an important issue concerning regional policy.

To analyse the location choice of foreign investors this study makes use of the fall of the Iron Curtain in 1989 as an important point in European economic integration. With this event, it became in the first place possible for investors from Western European countries to invest in the formerly closed economies of the Central and Eastern European countries (CEECs). The significantly lower labour costs combined with the spatial proximity made these countries an attractive FDI target. The focus in this paper is on the two neighbouring countries Germany and the Czech Republic as these constitute a prime example with regards to spatial proximity and wage costs differentials (Pflüger et al. 2013). In 2004, the year of the Czech Republic's entry to the European Union, the average hourly labour costs amounted to 26.8 € in Germany and to 5.8 € only in the Czech Republic (Eurostat 2015). In 2010, the Czech Republic has been the country that attracted with an amount of more than 23 billion € the highest German foreign direct investments (Deutsche Bundesbank 2012). German firms interested in investing in the Czech Republic were also boosted by the special efforts of the Czech Republic to attract foreign capital. In 1992, the Czech Ministry of Industry and Trade founded the Investment and Business Development Agency, CzechInvest, to promote the Czech Republic as an attractive target country for FDI (CzechInvest 2014a). From the Czech perspective, Germany and the Netherlands have been the most important investors over a long period of time (Czech National Bank 2010).

The factors determining the location choice of German investors in the Czech Republic are identified by using a nested logit setup. Three categories of regional characteristics are included: agglomeration economies, distance features and labour market characteristics. The importance of agglomeration economies for the location choice of FDI has been emphasised in many previous studies (see, among others, Barrios et al. 2006; Guimarães et al. 2000). This study puts special emphasis on the measurement of German-specific agglomeration, i.e. the existence of German firms in the region prior to the investment. By focussing on two neighbouring countries and by differentiating between different subgroups of investments the analysis of distance may bring new insights.

The contribution of this study to the existing literature on FDI location is threefold. First, with the IAB-ReLOC dataset, a unique database is used that comprises the total population of Czech companies with a German investor in the year 2010. As this database contains detailed address information, the location choice decision can be analysed at the highly disaggregated regional level of the 76 Czech districts (LAU 1 regions).[27] A shortcoming of many studies in this field of research is, however, that they focus on the investment characteristics at a national level (for example Halvorsen 2011; Head et al. 1995) or at an only slightly disaggregated regional level (see, among others, Fallon/Cook 2009; Pusterla/Resmini 2007). But when analysing the role of agglomeration economies, a high regional disaggregation is necessary as the decision-making process of companies is influenced by industrial linkages at the regional level (Krugman 1991). Second, the bulk of existing studies on location choice includes FDI from more than one country of origin. The few papers dealing with location choice of FDI from one specific country concentrate on FDI from Japan (Hayakawa/Tsubota 2014) or from France (Mayer et al. 2010). This paper contributes to the literature by analysing the location choice of FDI from a highly developed country (Germany) to a transition country (the Czech Republic). Third, the regional location determinants of FDI are separately identified for different investment characteristics such as different target industries of FDI and different investment motives. Thus, there is a distinction made between vertical FDI motivated by cost reduction (VFDI) and horizontal FDI aiming at market access (HFDI). Despite the theoretical differentiation between these two types of FDI (Helpman 1984; Markusen 2002) and the large literature on FDI motives (for an overview see Alfaro/Charlton 2009), studies on FDI location choice mostly neglect the difference between these two types of FDI. However, the utilisation of the IAB-ReLOC dataset also has some limitations: While this dataset allows detailed insights into the location choice of German investors in the Czech Republic, the focus on the two neighbouring countries at the same time restricts the generalisability of the results.

The findings of the paper indicate that the location choice of German MNEs in the Czech Republic is mainly influenced by agglomeration economies. The attractiveness of a region for German investors is especially affected by localisation economies that originate from the spatial concentration of firms belonging to the same industry as the investment and by a pre-investment agglomeration of German firms in the region. Moreover, regions that are located farther away from the location of the parent company are less attractive while the influence of labour market characteristics differs between investment characteristics. These findings complement the analysis of Schäffler et al. (2017) that examines the distribution of German-Czech FDI projects by taking a home-host-country-perspective. While they – based on a less detailed regional level – shed light on the role of the common border region and its asymmetric interconnectedness, this study here analyses on a very detailed regional level how agglomeration economies influence the location choice behaviour of German investors in the Czech Republic.

The paper is organised as follows. Section 5.2 gives an overview of related literature with a special focus on studies referring to transition economies. In section 5.3, the database is

[27] LAU stands for local administrative unit. There are 77 LAU 1 regions in the Czech Republic. For the analysis, two regions – Jeseník and Šumperk – were combined as until 1996 they were just one region.

described. In subsection 5.3.1, the advantages of the IAB-ReLOC data are highlighted and descriptive evidence on the regional distribution of German affiliates in the Czech Republic is provided. Subsection 5.3.2 refers to the regional data and the regional characteristics used to analyse the factors driving the location decision. The econometric analysis is presented in section 5.4. Subsection 5.4.1 gives an overview of the nested logit model. In subsection 5.4.2, the results for the total population of FDI as well as for different subgroups are presented. Section 5.5 sums up the main findings and shows potential for possible follow-up studies.

5.2 Literature review

With the increase in FDI in the last decades the interest in the locational determinants of FDI has grown, too. But, despite the fact that the CEECs have become more and more successful in attracting FDI over the last two decades (Medve-Bálint 2014), the bulk of studies in this field of research focuses on the location choice of FDI in developed countries. Only in recent years has the location decision in transition countries been attracting more interest.

One of the most popular studies analysing the location choice behaviour of foreign investors is the paper by Guimarães et al. (2000) focussing on the location choice of FDI start-ups in Portugal. The authors identify agglomeration economies as the most important factor driving location choice. While the agglomeration of service firms and the agglomeration of firms belonging to the same industry as the investment attract foreign investors, the agglomeration of foreign firms in a region has no significant influence. In contrast to that, Head et al. (1995) emphasize that especially foreign-specific agglomeration matters in attracting further FDI. When analysing the location choice of Japanese companies in the United States they find that the attractiveness of a state rises with the number of Japanese firms already located in the region. Other studies highlight that agglomeration effects are mainly driven by intraindustry spillovers as foreign investors are mainly attracted to regions with a high number of firms active in the same industry. This is, for example, found by Pelegrín/Bolancé (2008) for the location of foreign firms in Spain, by Head/Mayer (2004) for the location choice of Japanese companies in Europe and Crozet et al. (2004) for foreign firms in France. Besides agglomeration economies, the latter study investigates the role of regional policy in attracting FDI. Only very little evidence of any positive effect is identified. This result is in line with the findings of Barrios et al. (2006). They find that regional policy is only successful in attracting low-tech firms to the more disadvantaged areas of Ireland.

The first studies analysing the location choice of foreign investors in the transition countries of Central and Eastern Europe aimed at identifying national or sectoral rather than regional factors driving FDI location choice (Cieślik 2013). Comparing ten CEECs, Resmini (2000) finds that low labour costs are an important channel through which foreign investors are attracted. This result is confirmed by Bevan/Estrin (2004), who find that, apart from market size and proximity, labour costs are the most important factor for FDI from Western Europe in the CEECs. Kinoshita/Campos (2003) show in their study on FDI location choice in 25 transition countries that in addition to market size and labour costs, agglomeration economies (measured as the one-year lagged FDI stock) and institutional quality matter for the attraction of FDI. Another study focussing on the regional determinants of FDI location choice in the CEECs is

provided by Pusterla/Resmini (2007). In their paper on the location choice of FDI in Bulgaria, Hungary, Poland and Romania they also find that agglomeration economies are important. The location choice probability increases with the number of firms operating in the same sector and especially with the number of foreign firms operating in the same sector as the new investment. Furthermore, FDI is attracted by cheap and abundant labour as well as by regions with high market potential and good infrastructure. The regional skill level does not influence the location decision. FDI does not seem to be risk-averse, as special economic zones and lower country risk indices deter FDI. That special economic zones are not effective in attracting FDI is also found by Mucchielli/Yu (2011) in their analysis of the location choice of US and European affiliates in China and by Cieślik (2005c) focussing on foreign investments in Poland. But both studies identify a positive impact of agglomeration effects. The decisive role played by agglomeration effects is also supported by Békés (2005) and Boudier-Bensebaa (2005) for FDI in Hungary. While Békés (2005) shows that foreign investors prefer regions with a high output in the investment industry, Boudier-Bensebaa (2005) finds that foreign investors prefer regions with a high economic activity (as measured by the total number of firms active in the region) and with a high number of foreign firms prior to the investment. For FDI in Romania, Hilber/Voicu (2010) find that industry-specific foreign and domestic agglomeration (measured as the number of foreign and domestic firms in a region) as well as service agglomeration (measured as employment in the tertiary sector) increase the attractiveness of a region. That a higher service share makes a region more attractive for foreign investors has also been shown by Schäffler et al. (2017) in their study on the regional determinants of FDI in Germany and the Czech Republic. Gauselmann/Marek (2012) identify a positive impact of sectoral specialization for FDI location in East Germany, Poland and the Czech Republic. Furthermore they show that higher wages do not per se discourage foreign investors. A similar result is found by Riedl (2010) who shows that 'labour cost differences across host countries only matter for investment activities in the manufacturing sector'.

Apart of the above mentioned three-country study by Gauselmann/Marek (2012) and the paper by Schäffler et al. (2017) there is very little evidence on the locational determinants of FDI in the Czech Republic. An additional paper is provided by Rajdlová (2003). Her main finding is that foreign agglomeration attracts further investors to a region. Another study is provided by Kawai (2006). He finds that for the location of Japanese FDI in the Czech Republic the agglomeration of other Japanese and other foreign firms is important. Furthermore, Japanese FDI favours good regional infrastructure endowment and a higher regional wage level. A more qualitative study based on interviews with foreign firms finds that the attractiveness of a region declines as the region's distance to Prague as well as to the Bavarian border increases (Spilková 2007). Moreover, regions with a higher educational level and with higher wage levels are preferred.

A shortcoming of many of the presented studies on FDI in the Czech Republic is their small sample size. The results of Kawai (2006) are based on 58 investments and Rajdlová (2003) analyses the location decision of 320 investors in the period 1994 to 2002. In that period, the dataset used in this paper contains 1,745 German FDI projects in the Czech Republic. Based on a new database containing the total population of Czech firms with a German investor by

2010, this study presents an in-depth analysis of the location choice of German investors in the Czech Republic. Another shortcoming of previous studies is that they do not distinguish between different subgroups of investments. In this study, the location choice is analysed not only for the whole sample of investments, but separately for the manufacturing, the services and the trade sector. Furthermore, differentiations are made between vertical and horizontal FDI and according to investment sizes and time periods. The detailed differentiation between investment characteristics in combination with the very small regional analysis level distinguishes this study also from the paper of Schäffler et al. (2017). The authors identify the regional determinants of FDI from a cross-border viewpoint and focus on NUTS 3 regions, only. That there is no distinction made between different investment characteristics is not only a shortcoming of studies focussing on the Czech Republic only, but of the bulk of previous studies in general (Cieślik 2013). To distinguish between different investments characteristics is, however, even more important when considering that FDI is seen as the motor for regional development, as the consequences for the regional labour market may differ according to FDI characteristics.

5.3 Data and descriptive evidence

5.3.1 Company-level data

The analysis of the location choice of German multinationals in the Czech Republic is based on the IAB-ReLOC dataset. This dataset comprises information on the total population of Czech companies with a German parent company (with an equity share higher than 25 percent) in the year 2010 – namely 3,894 Czech companies. For the purpose of this study, only the 3,130 Czech affiliates founded in the period between 1994 and 2008 are considered. Originally, the information comes from the Czech Commercial Register and has been enriched by data from the Czech commercial data supplier ČEKIA as well as by the IAB-ReLOC survey.[28] As each of the 3,130 German investors can chose among 76 Czech regions, the dataset comprises 237,880 (= 3,130 * 76) observations.

One great advantage of the IAB-ReLOC dataset compared to other data sources used in scientific research is the large number of observations. For example, the Amadeus database of Bureau van Dijk contained only 1,150 Czech companies with a German owner in February 2011. Furthermore, the number of companies in the IAB-ReLOC data exceeds by far the number of companies used in the bulk of previous studies on FDI location choice in the Czech Republic. Another advantage is the detailed company-level information provided, including address, date of investment (approximated by the date the German investor has been inscribed in the Czech Commercial Register) and industry affiliation. For a subgroup of 459 investments, survey information on the investment motive is available. 56.2 percent of the respondents indicated that the main motive for investing in the Czech Republic has been market access and 40.5 percent saw cost savings as most crucial.

[28] Hecht et al. (2013b) provide an overview of the data compilation process. For a descriptive overview of the survey results see Hecht et al. (2013a).

A closer look at the data shows that German investments in the Czech Republic go mainly to three sectors: manufacturing with 33.1 percent of the German investments, trade and accommodation with 31.2 percent, and real estate and business activities with a share of 24.1 percent, respectively (see Table 5.1).

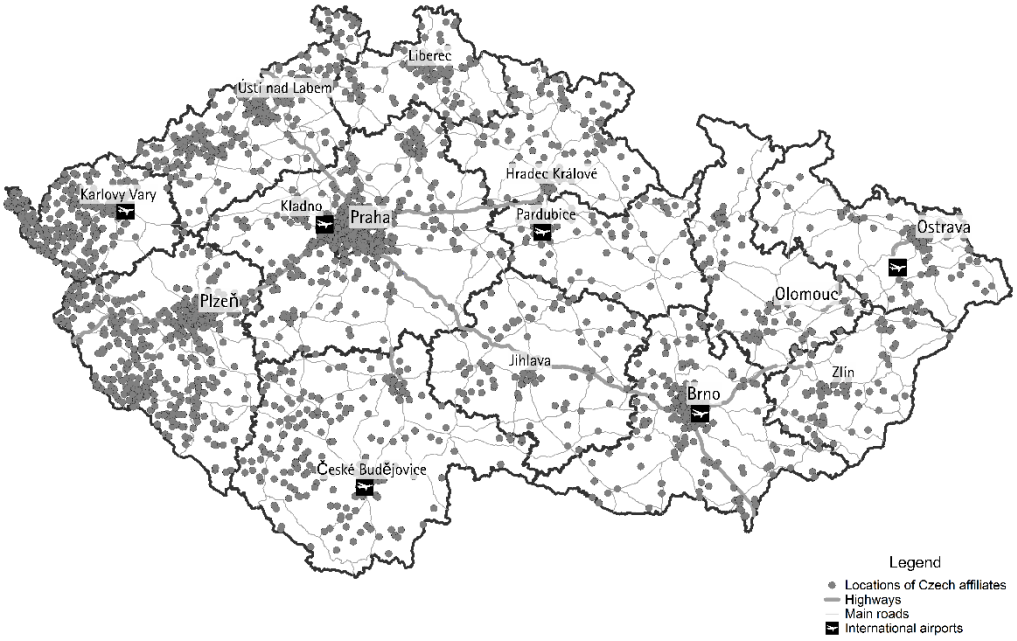
Table 5.1: Industry affiliation of Czech companies with German owner

Industry	**Share of Czech companies with German equity holder (in %)**
Agriculture	0.8
Mining and quarrying	0.2
Manufacturing	33.1
Electricity, gas and water	0.5
Construction	2.2
Trade	31.2
Accommodation	0.6
Transport, storage and communication	5.3
Financial and insurance activities	0.8
Real estate activities; business activities	24.1
Public administration	0.0
Education and health	0.5
Other services and extraterritorial organisations	0.7

Source: IAB-ReLOC data. N=3,130.

With regards to the regional distribution of German FDI in the Czech Republic, a concentration in the Czech agglomerations can be observed (see Figure 5.1). Approximately 30 percent of the German investments in the Czech Republic go to the region of Prague, the Czech Republic's capital city. A high number of German affiliates can also be found in the smaller agglomerations of Plzeň, Brno and Ostrava. Apart from that, another 30 percent of the affiliates of German companies are located in the Czech-German border region, and in particular in the Czech-Bavarian border region. This pattern is a first indication for the importance of agglomeration and distance in the location choice.

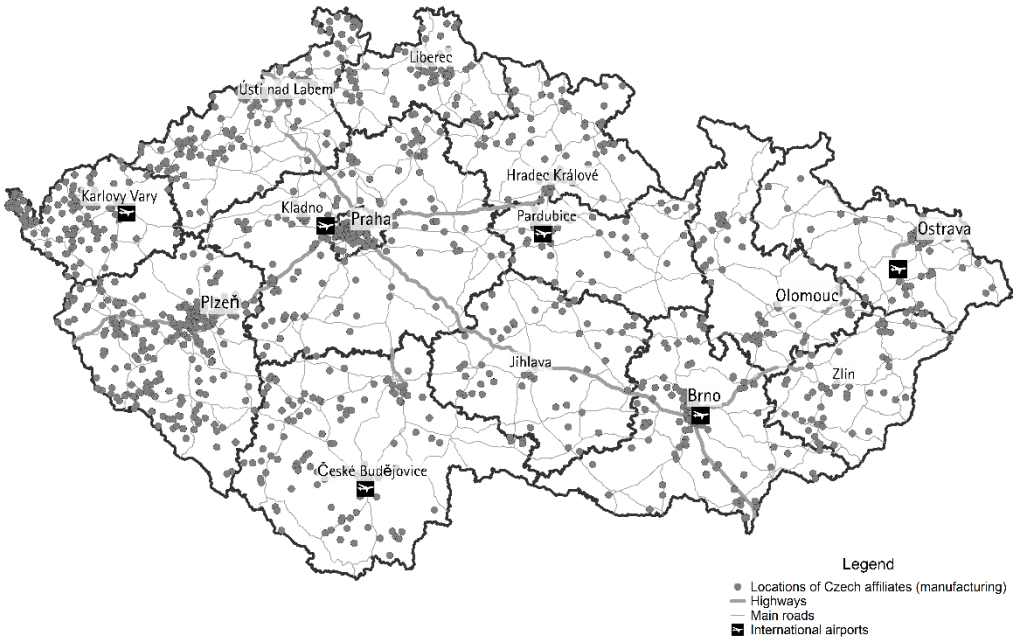
Figure 5.1: Distribution of Czech companies with German equity holder



Source: IAB-ReLOC data, N=3,130.

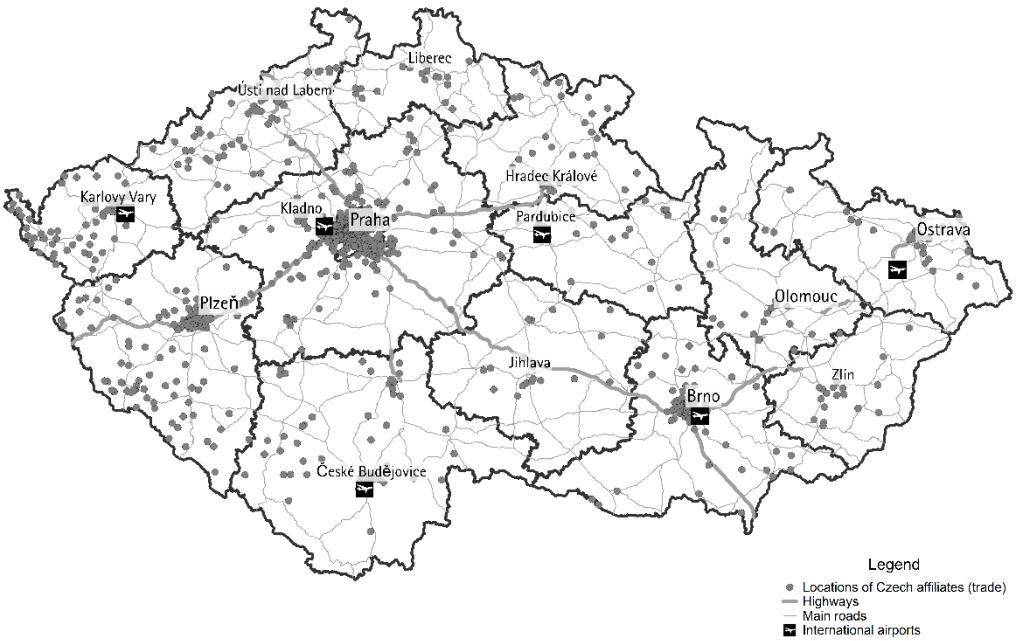
The maps of Figure 5.2, Figure 5.3 and Figure 5.4 illustrate the location pattern separately for the three main investment industries. In Figure 5.2, the locations of manufacturing investments are displayed. As with the total population of FDI, a concentration in the border region and in the agglomerations can be observed. But, compared to investments in trade (see Figure 5.3) and services (see Figure 5.4) the investments in the manufacturing sector are more evenly spread across the country. FDI in the trade and in the business services sector is evidently concentrated in Prague. 38.5 percent of all German investments in the capital city can be assigned to the business services sector. In the Czech Republic in total, this share is only 24.1 percent (see Table 5.1). A similar relation can be observed with the investments in trade. Here, the share in the Czech Republic is 31.2 percent, in the region of Prague it amounts to 41.9 percent. While in the manufacturing sector German investors also target to the regions in the east of the Czech Republic, there are only very little investments in the trade and especially in the business services sector located in the eastern part of the Czech Republic. Summing up, the maps indicate that the location choice behaviour of German investors differs between industries.

Figure 5.2: Distribution of the Czech affiliates in the manufacturing sector



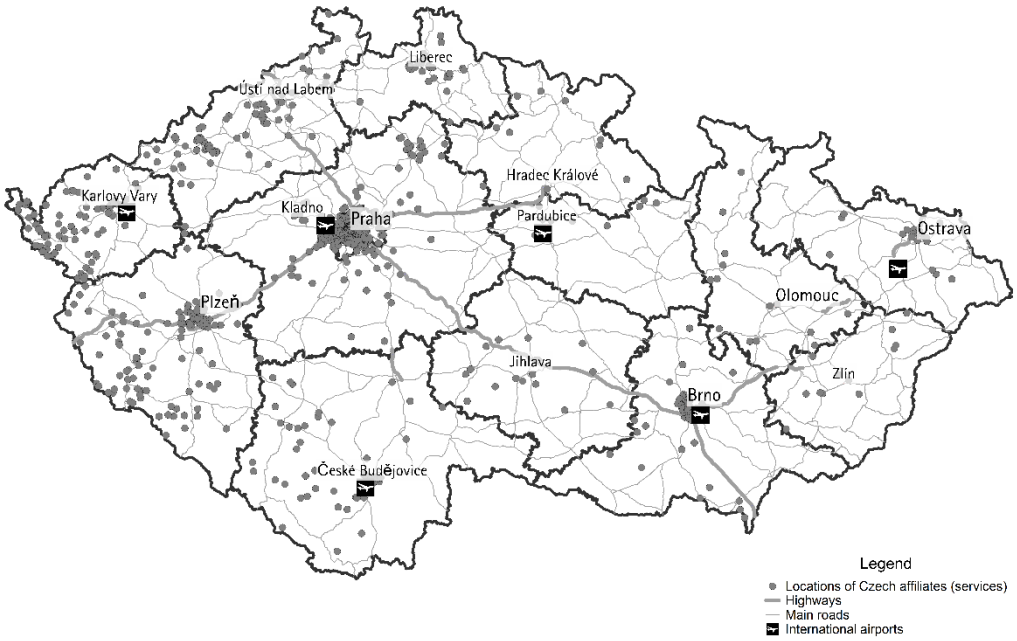
Source: IAB-ReLOC data, N=1,037.

Figure 5.3: Distribution of the Czech affiliates in the trade sector



Source: IAB-ReLOC data, N=976.

Figure 5.4: Distribution of the Czech affiliates in the services sector



Source: IAB-ReLOC data, N=944.

5.3.2 Regional characteristics

The regional investment determinants are identified based on 76 Czech LAU 1 regions. The selection of the regional variables included in the analysis is guided by previous results in this field of research as presented above. Regional data is provided by the Czech Statistical Office. The regional characteristics supposed to influence the location choice decision can be divided into three categories: agglomeration issues, distance features and labour market characteristics.

5.3.2.1 Agglomeration issues

Previous studies have shown that agglomeration economies are an important issue for a region's capability to attract FDI (see, for instance, Barrios et al. 2006; Binh 2010). To account for agglomeration economies that arise from the overall economic activity in a region, the population density is included in the model. This variable should have a positive influence on the regional attractiveness for FDI location. However, the population density could also reflect high land price as land is relatively scarce in densely populated areas compared to less populated regions. As a high land price should deter FDI, the expected sign of this explanatory variable remains ambiguous.

Another agglomeration arises through localisation economies. As they can share inputs, it is attractive for firms to locate near other firms of the same industry (Marshall 1898). Labour market pooling providing firms with workers qualified in specific skills can come up and knowledge spillovers may occur. To account for these Marshallian externalities Hoover's Localisation Index is used (as, for example, in Mucchielli/Yu 2011; Pusterla/Resmini 2007).

This index measures if a region has a comparative advantage in the industry of the investment compared to the country's average. It is calculated as follows:[29]

$$HLI_{jk} = \frac{E_{jk}}{\sum_k E_{jk}} \Big/ \frac{\sum_j E_{jk}}{\sum_j \sum_k E_{jk}} \qquad (5.1)$$

The value of the index is larger than 1, when the share of employees E working in a specific industry k in a region j is higher than in the Czech Republic, it equals 1 when this share is the same as the national share and it is smaller than 1 when the share is smaller than the national share. As the value of the index is higher in regions with a comparative advantage in an industry, this localisation measure is expected to have a positive impact on the location choice decision.

Another agglomeration effect analysed in this study is specific for German firms. Previous studies have stressed that the number of foreign firms already located in a region has a positive impact on the probability that a region is chosen by an additional foreign investor. When already a high number of foreign firms is located in a region this can have a signalling meaning for potential future investors that this location provides convenient local conditions (Rajdlová 2003). By locating in such a region, the risk and coordination costs are reduced. As this study focuses on German firms only, the number of German firms already located in a region is taken as a measure to account for foreign-specific agglomeration. This number is supposed to have a positive influence on a region's capability to attract German investors. The signalling meaning could be even stronger when firms of the same region of origin are active in a Czech region. It can be assumed that firms have more information about the investment activities of firms located close by in Germany. Due to company networks and forward- and backward linkages, information is normally exchanged faster within a region than between regions. To account for this, the foreign-specific agglomeration is split up into German companies of the same spatial planning region of origin and into German companies from other regions of origin than the investor.

Furthermore, the distance to the next economic centre is included in the analysis. All Czech cities that had more than 100,000 inhabitants at the beginning of the investigation period, thus in the year 1993, are regarded as economic centres. These are Praha, Brno, Plzeň, Ostrava, Olomouc, Hradec Králové and Liberec. This variable accounts for the possibility that it might be favourable for investors to locate near but not directly in agglomerations. In the surrounding areas, the land price is lower and accessibility may be better as no inner-city congestions occur. Nevertheless, due to the small distance, it is still possible to profit of agglomeration benefits as, for example, the availability of specific services.

To account for the special position of Prague within the Czech Republic a dummy for the region of Prague is included. It has the value 1 for the LAU 1 region the Czech Republic's capital city

[29] The Localisation Index is calculated based on a distinction of twelve industries (see Table 5.7 in Appendix 5.A). For the calculation, the introduction of the NACE Rev. 2 classification in 2008 is considered. While the index is calculated using the former NACE Rev. 1.1 structure, the industry affiliation is based on the new structure. For the link between investment industry and index a correspondence list of the Czech Statistical Office has been used (Czech Statistical Office 2008). Sometimes, an individual adaptation has been necessary.

lies in and 0 for the remaining 75 regions. This dummy variable captures the characteristics of the capital city that are not yet contained in the other variables.[30]

5.3.2.2 Distance

Distance is another factor that potentially influences the location decision. Here, a distinction of investment motives is straightforward as the role of distance differs between motives. In case of horizontal FDI, the probability that a location is chosen should increase with larger distance between the subsidiary's potential location and the location of the parent company. Horizontal FDI occurs when it is more advantageous for a firm to supply the target market by establishing an affiliate there than by exporting from the home country. With larger distance between two locations the costs for exporting increase due to rising transport costs. Thus, the probability that a region attracts horizontal FDI increases with larger distance to the location of the parent company (Egger 2008). In case of vertical FDI, in contrast, intermediate goods are often transported between the location of the parent company and the location of the subsidiary. Thus, a large distance between the two locations is harmful due to higher transport costs. In this study, distance enters as the linear distance between the potential location of the affiliate and the location of the parent company. For each of the 76 Czech LAU 1 regions the linear distance to each of the 2,772 German investors has been calculated.[31]

The accessibility of a region is an important issue for the location choice of foreign investors (see, for instance, Hilber/Voicu 2010). Therefore, many studies include a measure for the infrastructure facilities in a region where the road and railroad network and sometimes also (international) airports are considered (see, among others, Boudier-Bensebaa 2005). Due to the low distance to Germany the availability of an international airport should not be of significant importance for the location choice of German investors but the accessibility for truck transport is more important. To capture this, the region's distance to the next motorway is included.

5.3.2.3 Labour market features

Another group of variables assumed to influence the location choice of multinational companies is related to the labour market. Vertical FDI should be especially sensitive to labour costs as its aim is cost reduction. For the location choice of horizontal FDI, in contrast, labour costs should only play a minor role.

As a measure for labour costs is not available at the LAU 1 level, the monthly average wage in the manufacturing sector is used as a proxy. Belonging to the cost side of the profit function, high labour costs should exert a negative influence on a region's attractiveness for FDI location. However, a high average monthly wage could be the consequence of a high skill level of the workforce in a region, too. There is evidence that German FDI in Eastern European countries is not only motivated by seeking lower costs but also by seeking qualified labour

[30] Another agglomeration effect discussed in the literature arises by a diversified economic environment. I tried to measure these urbanisation economies by the Herfindahl-Index. As the variable had no significant impact in any specification, I did not include it in the final estimations.

[31] As some German companies are involved in more than one Czech company, there are fewer parent companies than affiliates.

(Marin 2004; Spilková 2007). As information on qualification and skills is not available at this highly disaggregated regional level, the expected sign of the monthly average wage remains ambiguous.

A second measure of labour market features is the regional unemployment rate. The impact of this variable cannot be asserted *a priori*, either. On the one hand, a high regional unemployment rate indicates a good availability of workers and should thus attract foreign investors. On the other hand, a high regional unemployment level is a signal for economic weak regions and should thus deter foreign investors. In addition, the regional unemployment rate could also capture the effect of financial investment incentives that the Czech government offers depending on investment size and location characteristics (CzechInvest 2015). Data on these investment incentives is not available for the whole period but the financial support has been highest in the regions with the highest unemployment rates. If the subsidies have been successful in attracting FDI, the unemployment rate should consequently display a positive sign. All in all, the expected sign of the variable remains ambiguous.

Besides the provision of financial incentives, the Czech government has supported the creation of industrial zones to provide convenient infrastructure for potential national or foreign investors in the 'Industrial Zone Development Support Programme' from the year 1998 on. According to Pokorný (2009) 101 zones were built up to 2006. As they are spread all across the country, they should not contribute to differences in the regional attractiveness for FDI location. In the 'Business Real Estate and Infrastructure Support Programme' that has come into force in 2006 especially the creation of strategic industrial zones comprising at least 200 ha is supported. Up to now, there are five such areas. As their implementation lies at the end of the investigation period, their influence on the location choice of German investors cannot be analysed in this study.

There are some further characteristics that possibly influence the location choice decision as, for instance, capital costs. To address this, previous studies often included tax levels. As in the Czech Republic there are no local taxes, the tax level is the same at all potential locations (CzechInvest 2014b). Thus, it is not necessary to include capital costs in the model. It is also common to include variables measuring the market potential of the alternative locations. Unfortunately, information on regional GDP is not available for the Czech LAU 1 regions. Thus, a variable measuring the market potential cannot be included in the analysis. This shortcoming is ameliorated by the fact that the Czech Republic in total is only a small country, so that the market potential should not differ much between potential locations.

Table 5.2 gives a descriptive overview of the regional variables and their expected influence on the location choice.

Table 5.2: Descriptive overview of explanatory variables

Variable	Explanation	Expected sign	Mean	SD	Min.	Max.
Agglomeration						
Population density	Agglomeration/land price	+/-	206.41	375.86	35.92	2454.84
Localisation Index	Regional specialisation	+	0.90	0.36	0.00	3.66
Number of German companies (same region of origin)	Risk minimization	+	0.65	3.40	0.00	103
Number of German companies (other regions of origin)	Risk minimization	+	25.89	74.21	0.00	1043
Distance to next economic centre	Agglomeration	-	45.80	27.70	0.00	130.74
Prague dummy	Capital city effect	+	0.01	0.11	0.00	1
Distance						
Distance to investor (in km)	Proximity, transport costs	+/- (HFDI/VFDI)	434.60	171.38	10.04	903.94
Distance to next motorway (in km)	Accessibility	-	24.22	23.63	0.00	80.76
Labour market						
Wage (in Czech crowns)	Labour costs/qualification	-/+	13,050.63	4,717.57	4,513	28,128
Unemployment rate	Financial investment incentives, availability of workers/weak economic conditions	+/-	0.073	0.041	0.003	0.240

Source: Czech Statistical Office; author's own calculations.

5.4 Econometric analysis

5.4.1 Nested logit model

To analyse the location choice of German investors in the Czech Republic a random utility maximization (RUM) framework is applied. The assumption behind this approach is that a multinational firm locates in that location where it expects the highest profit. This assumption implies that a German investor i chooses the regional alternative j $(j = 1, 2, \dots, J)$ out of the 76 Czech districts with the highest expected profit. This means that the expected profit in the region to be selected is higher than in every other Czech region:

$$\pi_{ij} > \pi_{ik}; k \neq j, k = 1, 2, \dots, J \tag{5.2}$$

The expected profit depends on observable regional characteristics x_{ij} and on unobservable influences e_{ij}. The deterministic part of the profit function thus consists of alternative specific regressors:

$$\pi_{ij} = x'_{ij}\beta + e_{ij} \tag{5.3}$$

The probability that investor i chooses region j can be written as the probability that the expected profit in region j is higher than in every other region in the Czech Republic. Under the assumption of independent and identically distributed error terms with type I extreme value distribution (Cameron/Trivedi 2010), this leads to the conditional logit equation:

$$P_{ij} = Prob(\pi_{ij} > \pi_{ik}) = Prob(e_{ij} - e_{ik} > x'_{ik}\beta - x'_{ij}\beta) = \frac{e^{x'_{ij}\beta}}{\sum_k e^{x'_{ik}\beta}};$$

$$k \neq j, k = 1, 2, \dots, J \tag{5.4}$$

The conditional logit model goes back to McFadden (1974) and can – besides count data models (Arauzo-Carod et al. 2010) – be regarded as one standard approach in the location choice literature (see, among others, Crozet et al. 2004; Head et al. 1995; Mayer et al. 2010; Mukim/Nunnenkamp 2012). The problem with the conditional model is, however, that it imposes the strong assumption that the choice between any two pairs of alternatives is simply a binary logit model (Cameron/Trivedi 2010). Especially in the case of this study where a large number of alternatives (76 regions) is included, this independence of irrelevant alternatives (IIA) can be a too strong restriction. As Basile et al. (2009) note “this assumption would be violated if, for example, different groups of regions had similar unobservable characteristics, so that the error terms would be positively correlated across choices”. To avoid this problem a more general model that relaxes the IIA has been used in previous papers (as, for example, in Basile et al. 2009; Head/Mayer 2004; Pusterla/Resmini 2007) and is also applied in this study here: the nested logit model. By specifying a nesting structure the alternatives are split into groups with each alternative belonging to one upper nest. Errors are then correlated within nests but uncorrelated across nests.

When the J alternatives are split into K nests, the probability that investor i chooses alternative j can be written as the product of two probabilities: The conditional probability that alternative j

is chosen given that nest n has been chosen ($P_{j|n}$) multiplied with the marginal probability that nest n is chosen (P_n)[32] (a more detailed discussion of the model is, among others, given in Basile et al. 2009; Cameron/Trivedi 2010):

$$P_j = P_{j|n} \times P_n = \frac{\exp(x'_{jn}\beta)}{\sum_{j\in n}\exp(x'_{jn}\beta)} \times \frac{\exp(z'_n\alpha+\tau_n I_n)}{\sum_n \exp(z'_n\alpha+\tau_n I_{n)}} \qquad (5.5)$$

Thereby, the vectors x_{jn} and z_n display the regional characteristics of alternative j in nest n and the characteristics of the upper nest n respectively. $\mathrm{I_n} = \ln\{\sum_{\mathrm{j\in n}} \exp(\mathrm{x'_{jn}}\beta_\mathrm{j}/\tau_\mathrm{n})\}$ is the inclusive value and τ_n are the dissimilarity parameters. Although the model produces positive probabilities that sum to one for any value of τ_n, the additive random utility model restricts the values of τ_n to lie in the interval from $[0; 1]$. "Values outside this range mean the model, while mathematically correct, is inconsistent with random-utility theory" (Cameron/Trivedi 2010).

The information on the location choice comes from the IAB-ReLOC data described in detail in section 5.3. Due to data availability reasons, only investments that were made between 1994 and 2008 are included in the analysis (3,130 FDI projects).[33] As in previous studies on location choice (see, among others, Cieślik 2005c; Gonchar/Marek 2014), it is assumed that the decision where the Czech affiliate is founded is taken one year before the actual foundation of the subsidiary. Consequently, the explanatory variables are lagged one year.[34] This procedure also reduces endogeneity.

With regards to the nesting structure, a structure that differentiates between three upper nests is chosen (see Figure 5.5). The first nest represents the Czech border region to Germany and comprises all Czech districts whose centre is located within a linear distance of 50 km to the German border. The special importance of the border region for the location of German firms cannot only be seen from the maps in Figure 5.1 to Figure 5.4 but has also been confirmed in the paper by Schäffler et al. (2017). The delimitation of the other two nests is based on the historical subdivision of the Czech Republic into Bohemia, Moravia and Czech Silesia. Nest 2 comprises all districts that lie in the Bohemian part of the Czech Republic – except the ones that are already included in nest 1 – and nest 3 comprises all districts that belong to Moravia and Czech Silesia.[35]

[32] The individual subscript i that identifies each investor is not included in the formulas to simplify the notation.

[33] When splitting the sample up according to different investment characteristics, in some models one or more regions are not selected at all by German investors. In these cases, the regions that were not chosen are excluded from the analysis as otherwise computational problems may occur.

[34] As information on the employees according to industries is at the level of the Czech LAU 1 regions only available for the years 1993 to 2001, the Localisation Index for the entry years 2002 to 2008 refers to the year 2001.

[35] Structures with smaller regional units as upper nests as well as a differentiation in agglomerative areas and more rural areas have been tested. The values of the dissimilarity parameters were always bigger than 1 and thus not in line with the utility maximization model.

Figure 5.5: Nesting structure

Source: Author's own classification.

5.4.2 Results

The estimation results for the total population of German investments in the Czech Republic are presented in Table 5.3 as well as the results for different investment sectors – manufacturing, trade and services. To see if the importance of regional characteristics for the location choice changed over time, a differentiation between investment periods is presented in Table 5.4. Table 5.5 distinguishes between different investment sizes and Table 5.6, finally, between vertical and horizontal FDI. In all specifications, the explanatory variables with exception of the dummy variables are included in log form.[36] Besides the coefficients also the average marginal effects (AMEs) are reported.[37]

In all models estimated, the Likelihood Ratio Test rejects the conditional logit model against the nested logit model. In most of the estimated models, the values of the dissimilarity parameters are smaller than 1 for the nest comprising the border region and for the nest comprising the regions belonging to Bohemia, but not for the third nest. This shows, that at least within two of the three nests regions are closer substitutes than across groups.

5.4.2.1 Total population of investments

First, the results for the total population of German FDI projects in the Czech Republic are discussed (see Table 5.3). The variables reflecting agglomeration economies all show the expected signs. German investors prefer to locate in agglomerative areas as the population

[36] Where values of 0 occur, 0.1 has been added to the original value to calculate the logarithm.

[37] The calculation of the AMEs is based on the procedure presented by Cameron/Trivedi (2010).

density has a positive influence on the location choice decision. Furthermore, regions that are specialised in the sector of the investment are more attractive as the coefficient of the Localisation Index is significantly positive.[38] German agglomeration in a region influences the location choice decision in a significant and – when having a look at the subgroups – stable way. The higher the number of German companies already located in a region is, the higher is the probability that this region is chosen by a further German investor. For the total sample of investments, an increase in the number of German firms from the same region of origin as the investor by 1 percent raises the probability of that region to be chosen on average by 0.13 percentage points (AME = 0.1274) and has thus a higher impact than the number of German companies stemming from other regions (AME = 0.0987). This confirms the expectation that a higher number of German companies in a region acts as a positive signal for future investors – and that especially firms from the same region of origin matter in this regard. Regions that have been successful in attracting German companies directly after the fall of the Iron Curtain have a long-lasting advantage compared to regions that were not selected by German investors. The distance to the next economic centre enters with a negative coefficient as has been expected. Moreover, a positive capital city effect can be observed (as, among others, in Gauselmann/Marek 2012). The coefficient of the Prague dummy is significantly positive also for all subgroups. Thus, Prague exhibits additional agglomeration advantages that are not captured by the other variables included in the model.[39] The distance to the investor influences the location decision significantly negatively. Investors prefer to locate in regions that are located near their original location. As can be seen from the AME, a 1 percent increase in a region's distance to the investor lowers the probability that the investor locates in that region on average by 2.6 percentage points. Although this result is stable throughout all specifications and in line with previous findings (see, for example, Buch et al. 2005; Schäffler et al. 2017), it has not necessarily been expected with regards to theoretical considerations: for VFDI, on the one hand, distance should exhibit a negative impact as splitting up the value chain is only advantageous if transport costs between the locations are small – thus, if the distance between the locations is small. For HFDI, on the other hand, a larger distance to the destination location is assumed as advantageous as only with high transport costs between the home and the target market is the establishment of a new plant more profitable than exporting. Although the stable negative impact of distance could be interpreted as a sign for the predominance of vertical FDI, a more plausible explanation lies in the location of the economic centres within the Czech Republic. Not only the agglomeration of Prague but also other big Czech cities like Plzeň and Liberec are located near the border with Germany. Thus, even for investments that are done to get access to the Czech market (i.e., horizontal FDI), a lower distance to the target region seems to be more advantageous as many consumers can be reached by investing in Czech regions that are located near the German border. The distance to the next motorway is positively correlated to a region's probability to be chosen by a German investor. Thus, the proximity to a motorway is not a location advantage. Regarding the labour market

[38] Due to the high number of observations, coefficients are categorised as significant only when the significance level is lower than 5 percent.

[39] As the region of Prague is such an important target of German investors, the model has been run excluding all observations directed at the region of Prague. The results remain stable.

characteristics, wage, the proxy for labour costs, has a negative and slightly significant coefficient. The higher the monthly average wage in a region is, the lower is the probability that this region is selected by an investor. As can be seen from the further specifications of the estimation, this result does not hold for all subsamples but applies to specific subgroups of the total FDI population. This finding is in line with the results of Gauselmann/Marek (2012) who find that low wages do not *per se* attract FDI. The other labour market variable, unemployment rate, has a significantly negative impact on the location choice. Thus regions with a lower unemployment rate are preferred by German investors. Here, too, remarkable differences come up when different subgroups are considered as discussed below.

5.4.2.2 Investment industries

When looking at different target industries of the investments (see columns 'manufacturing', 'trade' and 'services' in Table 5.3), differences in the impact of agglomeration economies can be observed. Only investments going to the trade sector are attracted by densely populated regions. For firms investing in the manufacturing sector and the services sector the population density has no significant impact on the location decision. Although at first glance this result for the services sector is somewhat surprising, it fits quite well to the regional distribution of the service investments. As can be seen from Figure 5.4, compared to the other two main investment sectors they are very strongly concentrated in Prague and less in other bigger Czech cities. While the coefficient for the Localisation Index is significantly positive in all the three main investment industries, differences in the size of the average marginal effects show that localisation economies play a special role in the location choice of manufacturing firms (AME = 0.8034) and are of minor importance in the decision process of trading firms (AME = 0.4384). With regards to German agglomeration, the concentration of German firms from the same region of origin has a positive impact for all three main industries, whereas the agglomeration of German firms of other regions of origin than the investor only proves significant for the manufacturing sample. With regards to distance features, the distance to the investor influences the location choice of all the three main sectors in a negative way. But, as can be seen from the average marginal effects, distance is more deterring for FDI in manufacturing and services on the one hand and less deterring for trade FDI on the other hand. A last difference concerns the impact of the unemployment rate. While investments in the manufacturing and in the services sector are not influenced by this variable, regions with lower unemployment rates are attractive for investments in the trade sector. These seem to be sensitive to weak economic conditions connected to lower purchasing power. In contrast to the findings of Jones/Wren (2016) and Riedl (2010), the locational factors of manufacturing and services FDI are similar for German FDI in the Czech Republic. Differences can rather be observed between the locational factors of FDI in the manufacturing and services sectors on the one and FDI in the trade sector on the other hand. That the locational factors for the manufacturing and the services sector are quite similar supports the findings of Ramasamy/Yeung (2010). They argue that due to vertical linkages to manufacturing industries it may be profitable for services firms to locate near manufacturing firms.

5.4.2.3 Investment periods

The results presented in Table 5.4 are based on a differentiation according to investment periods. Location choice in the early years after the fall of the Iron Curtain (1994-1998), location choice in the years just before the Czech Republic's EU accession (1999-2003) and location choice in the first years of EU membership (2004-2008) is compared. It comes out that the period between 1999 and 2003 differs from the other two. Concerning the agglomeration issues, population density is not significant for investors that entered the Czech market in the period 1999-2003 but has a significantly positive impact in the period 1994-1998 as well as in the period 2004-2008. As can be seen from the coefficients for the unemployment rate and the wage, the investors in the early and the late years have been sensitive to high unemployment rates and to high regional wage levels whereas the coefficients are not significant for the years 1999 to 2003. The attractiveness of a region rises in all three periods with the number of German firms form the same region of origin active in that region. When having a look at the average marginal effects, it can be seen that the importance of the capital city characteristics of Prague has been most important in the middle time period.

5.4.2.4 Investment size

In Table 5.5 the results are presented for small investments (up to 5 employees), for medium investments (between 6 and 49 employees) and for large investments (50 and more employees), respectively.[40] Differences in the location choice concern the labour market characteristics. Small investments are discouraged by high unemployment rates. This could, on the one hand, show that especially for small investments it is disadvantageous to locate in economic weak regions. On the other hand, this result could display the strategy of investment incentives of the Czech Republic. First, investment support is only granted in regions with high unemployment rates. Second, state aid is higher for large investments as some of the incentives depend on the number of newly created jobs. The second difference concerning the labour market features refers to the regional wage level. While a high regional wage level reduces the probability that a medium investment is set up by a German investor, the effect is not significant for small and large investments. Agglomeration economies matter for all investment sizes but from the average marginal effects can be seen that the importance of regional specialisation and of capital city characteristics increases with investment size, whereas the population density has no significant impact on the location choice of large investments. While for small and large investments only the number of German investors from the same region of origin displays a significantly positive impact, the investors from other regions have a positive impact on the location choice of medium-sized investments, too.

5.4.2.5 Investment motives

By making use of the survey information a differentiation is possible between vertical and horizontal FDI (see Table 5.6). However, the results for the two main motives are quite similar. For both motives, localisation economies influence the location choice. A spatial concentration of firms of the same industry has thus a positive signalling meaning for firms seeking lower

[40] The information on investment size refers to the year 2009 and is taken from the ČEKIA database.

costs as well as for firms looking for new markets. While the distance to the next centre is only significantly negative for vertical FDI, the region's distance to the investor has a negative impact on the location choice decision for both motives – what has not been expected. As with rising distance the transport and transaction costs increase, this negative relation has been expected for vertical FDI but not for horizontal FDI. As already discussed above, this result might be explained by the fact that the economic centres within the Czech Republic are located near the border to Germany and thus in low distance to the original locations of the investors. The average marginal effects reveal that the negative effect of rising distance to the investor is larger for vertical FDI (AME = -4.1376) than for horizontal FDI (AME = -3.9806). Thus, for the quantity of the effect, the result is in line with the theoretical expectations. A look at the average marginal effects reveals in addition that Prague is a more attractive location for horizontal than for vertical FDI. This result confirms the expectations as due to market access reasons Prague should be especially attractive for HFDI.

Table 5.3: Results for total FDI and for investments in the manufacturing, the trade and the services sector

	Total investments			**Investments in**								
				Manufacturing			**Trade**			**Services**		
	Coefficient	SE	AME	Coefficient	SE	AME	Coefficient	SE	AME	Coefficient	SE	AME
Agglomeration												
Population density (ln)	**0.2489*** **	0.0431	*0.2940*	0.0956	0.0772	*0.1036*	**0.3662*** **	0.0896	*0.5531*	0.1360	0.0769	*0.1810*
Localisation Index (ln)	**0.8466*** **	0.0563	*1.0000*	**0.7416** **	0.2161	*0.8034*	**0.2904** *	0.1133	*0.4384*	**0.5449*** **	0.1142	*0.7250*
German companies (same region, ln)	**0.1078*** **	0.0098	*0.1274*	**0.1231*** **	0.0196	*0.1334*	**0.0621*** **	0.0168	*0.0938*	**0.1251*** **	0.0210	*0.1665*
Other German companies (ln)	**0.0835** **	0.0264	*0.0987*	**0.0965** *	0.0445	*0.1045*	0.0874	0.0449	*0.1320*	0.1350	0.0699	*0.1797*
Prague	**1.0758*** **	0.1084	*1.2707*	**1.1322*** **	0.3220	*1.2264*	**0.6197*** **	0.1335	*0.9357*	**0.8831** **	0.1782	*1.1750*
Distance to next centre (ln)	**-0.0910*** **	0.0228	*-0.1074*	**-0.1593** **	0.0478	*-0.1725*	-0.0306	0.0315	*-0.0463*	**-0.1095** **	0.0391	*-0.1456*
Distance												
Distance to investor (ln)	**-2.2595*** **	0.1380	*-2.6682*	**-2.5275*** **	0.2744	*-2.7363*	**-1.6355*** **	0.3054	*-2.4676*	**-2.0867*** **	0.2440	*-2.7747*
Distance to next motorway (ln)	**0.0623*** **	0.0148	*0.0736*	**0.0966** **	0.0286	*0.1046*	0.0279	0.0210	*0.0421*	**0.0567** *	0.0276	*0.0755*
Labour market												
Wage (ln)	**-0.5636** *	0.2381	*-0.6659*	-0.5239	0.4470	*-0.5674*	-0.2705	0.3661	*-0.4081*	-0.1628	0.4331	*-0.2167*
Unemployment rate (ln)	**-0.1496** **	0.0431	*-0.1767*	0.0247	0.0876	*0.0267*	**-0.2672*** **	0.0756	*-0.4034*	-0.1138	0.0760	*-0.1514*
Dissimilarity parameters												
Border region	0.8853	0.0637		1.0661	0.1396		0.5682	0.1257		0.7851	0.1175	
Bohemia	0.9529	0.0571		1.1824	0.1485		0.7619	0.1118		0.8163	0.0926	
Moravia	1.1128	0.0876		1.4031	0.1893		0.7606	0.1913		0.8992	0.1647	
LR test for IIA (tau=1)	86.72***			51.26***			41.12***			16.09***		
Number of investments	3,130			1,037			976			944		
Number of observations	237,880			78,812			72,224			64,192		
Log-Likelihood	-9,966.14			-4,023.65			-2,837.26			-2,417.54		

Source: Author's own calculation from IAB-ReLOC data.

Notes: Dependent variable: Probability that region *j* is chosen. Significance level: *** 0.1%, ** 1%, * 5%. SE denotes the standard error. AME denotes the average marginal effect and is indicated in percentage points. The AME can be interpreted as a semi-elasticity that refers to the average change in the probability of a region to be chosen (in percentage points) due to a one percentage change in the (untransformed) explanatory variable.

Table 5.4: Results according to investment periods

	Investments in								
	1994-1998			1999-2003			2004-2008		
	Coefficient	SE	AME	Coefficient	SE	AME	Coefficient	SE	AME
Agglomeration									
Population density (ln)	**0.3898*** **	0.0874	*0.4345*	0.0600	0.0754	*0.0786*	**0.3255*** **	0.0832	*0.3896*
Localisation Index (ln)	**1.0001*** **	0.1175	*1.1148*	**0.8493*** **	0.1031	*1.1136*	**0.7294*** **	0.0826	*0.8731*
German companies (same region, ln)	**0.1231*** **	0.0183	*0.1372*	**0.0923*** **	0.0164	*0.1210*	**0.1067*** **	0.0165	*0.1277*
Other German companies (ln)	0.0312	0.0354	*0.0348*	0.0622	0.0560	*0.0815*	0.1137	0.0667	*0.1361*
Prague	**0.9875*** **	0.2137	*1.1008*	**1.1472*** **	0.2028	*1.5040*	**1.0147*** **	0.1827	*1.2146*
Distance to next centre (ln)	-0.0493	0.0456	*-0.0549*	**-0.1257** **	0.0433	*-0.1648*	**-0.1132** **	0.0371	*-0.1355*
Distance									
Distance to investor (ln)	**-2.5177*** **	0.2538	*-2.8051*	**-2.1497*** **	0.2541	*-2.8165*	**-2.1717*** **	0.2245	*-2.5984*
Distance to next motorway (ln)	**0.0583***	0.0285	*0.0650*	0.0225	0.0239	*0.0295*	**0.1282*** **	0.0283	*0.1534*
Labour market									
Wage (ln)	**-0.9009***	0.4456	*-1.0026*	-0.0150	0.3968	*-0.0196*	**-0.9615***	0.4444	*-1.1473*
Unemployment rate (ln)	**-0.2221** **	0.0762	*-0.2475*	-0.1352	0.1058	*-0.1772*	**-0.2688***	0.1163	*-0.3218*
Dissimilarity parameters									
Border region	0.9788	0.1164		0.7822	0.1084		0.9022	0.1114	
Bohemia	1.0490	0.1054		0.8851	0.0989		0.9372	0.0973	
Moravia	1.2188	0.1571		1.0742	0.1552		1.1095	0.1569	
LR test for IIA (tau=1)	24.11***			45.75***			28.26***		
Number of investments	1,025			867			1,238		
Number of observations	75,850			65,025			91,612		
Log-Likelihood	-3,251.93			-2,862.27			-3,804.36		

Source: Author's own calculation from IAB-ReLOC data.

Notes: Dependent variable: Probability that region j is chosen. Significance level: *** 0.1%, ** 1%, * 5%. SE denotes the standard error. AME denotes the average marginal effect and is indicated in percentage points. The AME can be interpreted as a semi-elasticity that refers to the average change in the probability of a region to be chosen (in percentage points) due to a one percentage change in the (untransformed) explanatory variable.

Table 5.5: Results according to investment size

	Small investments			**Medium investments**			**Large investments**		
	Coefficient	SE	AME	Coefficient	SE	AME	Coefficient	SE	AME
Agglomeration									
Population density (ln)	**0.2508*** **	0.0671	*0.4256*	**0.2225***	0.0890	*0.2259*	0.1822	0.1170	*0.1712*
Localisation Index (ln)	**0.4098*** **	0.0793	*0.6956*	**1.2103*** **	0.1244	*1.2287*	**1.7450*** **	0.2082	*1.6391*
German companies (same region, ln)	**0.0633*** **	0.0143	*0.1074*	**0.1095*** **	0.0183	*0.1111*	**0.1392*** **	0.0257	*0.1307*
Other German companies (ln)	0.0524	0.0410	*0.0889*	**0.1352***	0.0583	*0.1373*	0.0792	0.0595	*0.0744*
Prague	**0.6674*** **	0.1341	*1.1329*	**1.3791*** **	0.2410	*1.4001*	**1.7700*** **	0.3578	*1.6623*
Distance to next centre (ln)	**-0.0727***	0.0296	*-0.1233*	**-0.1403****	0.0508	*-0.1424*	-0.1290	0.0678	*-0.1211*
Distance									
Distance to investor (ln)	**-1.5970*** **	0.2306	*-2.7086*	**-2.8854*** **	0.2839	*-2.9264*	**-2.3974*** **	0.3242	*-2.2501*
Distance to next motorway (ln)	**0.0637****	0.0216	*0.1082*	**0.0651***	0.0315	*0.0661*	0.0795	0.0409	*0.0746*
Labour market									
Wage (ln)	-0.1952	0.3245	*-0.3309*	**-1.0993***	0.5321	*-1.1158*	-0.2319	0.6216	*-0.2179*
Unemployment rate (ln)	**-0.2425*** **	0.0665	*-0.4115*	**-0.1925***	0.0918	*-0.1953*	-0.1441	0.1201	*-0.1354*
Dissimilarity parameters									
Border region	0.5571	0.0979		1.0431	0.1214		1.2166	0.1718	
Bohemia	0.6665	0.0851		1.1619	0.1130		1.2736	0.1665	
Moravia	0.6801	0.1400		1.4014	0.1708		1.5422	0.2220	
LR test for IIA (tau=1)	33.3***			37.52***			23.00***		
Number of investments	849			946			614		
Number of observations	62,826			70,004			46,050		
Log-Likelihood	-2,535.45			-3,000.04			2,194.58		

Source: Author's own calculation from IAB-ReLOC data.

Notes: Dependent variable: Probability that region j is chosen. Significance level: *** 0.1%, ** 1%, * 5%. SE denotes the standard error. AME denotes the average marginal effect and is indicated in percentage points. The AME can be interpreted as a semi-elasticity that refers to the average change in the probability of a region to be chosen (in percentage points) due to a one percentage change in the (untransformed) explanatory variable.

Table 5.6: Results for vertical and horizontal FDI

	VFDI			HFDI		
	Coefficient	SE	AME	Coefficient	SE	AME
Agglomeration						
Population density (ln)	-0.0161	0.1755	*-0.0243*	0.1195	0.0800	*0.3691*
Localisation Index (ln)	**0.7935****	0.2631	*1.1963*	**0.4275*****	0.1065	*1.3211*
German companies (same region, ln)	**0.0663***	0.0326	*0.0999*	**0.1019*****	0.0267	*0.3149*
Other German companies	-0.0819	0.0702	*-0.1234*	-0.0567	0.0393	*-0.1752*
Prague	**1.2012***	0.5712	*1.8109*	**0.9357*****	0.2242	*2.8913*
Distance to next centre (ln)	**-0.3078****	0.1178	*-0.4640*	0.0567	0.0486	*0.1753*
Distance						
Distance to investor (ln)	**-2.7455*****	0.5575	*-4.1376*	**-1.2892*****	0.2507	*-3.9806*
Distance to next motorway (ln)	0.1110	0.0613	*0.1673*	-0.0144	0.0278	*-0.0445*
Labour market						
Wage (ln)	-1.8724	1.1891	*-2.8215*	-0.0899	0.4318	*-0.2779*
Unemployment rate (ln)	-0.0028	0.1901	*-0.0043*	-0.0804	0.0830	*-0.2483*
Dissimilarity parameters						
Border region	0.9456	0.2337		0.4260	0.0975	
Bohemia	1.0510	0.2479		0.5544	0.1013	
Moravia	1.3083	0.3282		0.4393	0.1509	
LR test for IIA (tau=1)	10.93**			16.68**		
Number of investments	188			249		
Number of observations	11,092			12,948		
Log-Likelihood	-655.85			-694.60		

Source: Author's own calculation from IAB-ReLOC data.

Notes: Dependent variable: Probability that region j is chosen. Significance level: *** 0.1%, ** 1%, * 5%. SE denotes the standard error. AME denotes the average marginal effect and is indicated in percentage points. The AME can be interpreted as a semi-elasticity that refers to the average change in the probability of a region to be chosen (in percentage points) due to a one percentage change in the (untransformed) explanatory variable.

5.5 Conclusion

After the fall of the Iron Curtain, many transition countries saw the attraction of FDI as crucial for their economic development. There is evidence that the benefits of FDI are locally concentrated to the location of the investment. Thus, the location choice of FDI may influence the interregional allocation of economic activity. Depending on the location pattern, the location choice of FDI can lead to a reinforcement or an adjustment of existing economic disparities. This paper focuses on the Czech Republic, one major attractor of FDI among the CEECs, and one of its most important investors, the neighbour country Germany. Based on the IAB-ReLOC data, a unique dataset comprising the total population of Czech companies with a German equity holder, this paper gives new insights into the regional determinants that influence the location choice of German multinationals in the Czech Republic. Including regional variables covering agglomeration issues, distance features and labour market characteristics, the location choice is not only investigated for the total sample of FDI but also for different investment characteristics.

As in other transition countries, in the Czech Republic agglomeration effects play a crucial role in the location choice decision. German investors prefer to locate in densely populated regions and in regions with a comparative advantage in the industry of the investment. Moreover, a positive capital city effect can be identified. A particularly important result concerning the contribution of FDI to regional disparities is that regions with a high number of other German companies are especially attractive for German investors. This finding is crucial as it implies a path dependency. The regions that were successful in attracting German investments at the beginning of the 1990s have an advantage for the whole investigation period. That Germany is one of the most important investors in the Czech Republic attaches even more importance to that finding.

The distance between the location of the parent company and the potential locations of the affiliates has a negative impact on the location choice as distance increases. This result is stable across all subgroups of investments and confirms previous findings.

The influence of the labour market characteristics on the location choice varies with different investment characteristics. The regional wage level has a negative influence on the attractiveness of a region only for medium-sized investments as well as for investments that took place before 1999 and after 2003. This result can be interpreted as a sign that German investments in the Czech Republic are not only driven by reasons of cost savings. As in previous studies, the regional unemployment rate is not a main factor in the location choice process. Only in some subsamples the regional unemployment rate has a significantly negative impact on the location choice. Thus, high regional unemployment rates seem to be more a sign for economic weakness than of good availability of workers.

Summing up, this paper shows that for the location choice of German FDI in the Czech Republic, agglomeration economies and distance play important roles and that the importance of labour market characteristics in the location choice process differs between investment industries, motives and sizes. As it is yet unexplored whether the consequences for the host

regions' labour markets depend on FDI characteristics, there is ample opportunity for follow-up studies.

Appendix 5.A: Details on Czech industry classification

Table 5.7: Industry sectors in the Czech Republic

A	Agriculture, hunting and forestry	AB	Agriculture
B	Fisheries and aquaculture		
C	Mining and quarrying	CDE	Manufacturing
D	Manufacturing		
E	Electricity, gas and water		
F	Construction	F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles; undifferentiated goods- and services-producing activities of household for own use	G	Wholesale and retail trade; repair of motor vehicles and motorcycles; undifferentiated goods- and services-producing activities of household for own use
H	Accommodation and food service activities	H	Accommodation and food service activities
I	Transport, storage and communication	I	Transport, storage and communication
J	Financial and insurance activities	J	Financial and insurance activities
K	Real estate activities; business activities	K	Real estate activities; business activities
L	Public administration and defence; compulsory social security	L	Public administration
M	Education	M	Education
N	Health and social care, veterinary activities	N	Health and social care, veterinary activities
O	Other public, social and personal services	OPQ	Other services and extraterritorial organisations
P	Activities of households		
Q	Activities of extraterritorial organisations and bodies		

Source: Czech Statistical Office; author's own aggregation.

6. Size of foreign direct investment and firm characteristics

Joint with Michael Moritz, Patricia Noska and Johannes Schäffler

Abstract:

This paper focuses on the role of classifying types of foreign direct investment (FDI) for analysing the determinants of cross-border investment relationships. We base our investigation on a newly established firm-level dataset of German multinational firms and their affiliates in the Czech Republic that allows various categorizations into vertical foreign direct investment (VFDI) and horizontal foreign direct investment (HFDI). Apart from data for conventional approaches to classify FDI types, the surveyed information contained herein also includes a detailed self-assessment of the firms with respect to investment motives, and specifications on intra-firm trade and the flow of intermediate inputs. In order to correct for sample selection, we apply a two-step Heckman procedure by comparing multinational firms that have an affiliate in the Czech Republic to companies without investment abroad. The results for the direct measures of FDI types confirm theoretical expectations and previous empirical literature and stand 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.

Keywords: multinational firm; firm heterogeneity; productivity; vertical FDI; horizontal FDI; employment

JEL classifications: F23, L23, L25

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6.1 Introduction

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. Due to a lack of appropriate databases, only little studies analysing the internationalisation process differentiate between the two motives. 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 include a self-assessment of the firms with respect to the main motive for investing in the neighbouring 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 the use of a well-grounded database, we shed light on the relevance of productivity in the German-Czech FDI relations. 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 margin)? Are differences observable between vertically and horizontally integrated firms? Rather than examining the causal effect of productivity on the size of FDI, we emphasise the importance of the measurement of FDI types for the interpretation of results.

For both types of FDI, the Czech Republic constitutes an attractive target country for German investors. On the one hand, a still substantial wage gap enables firms to cross the border in order to realise labour 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. 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.

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 enable us to investigate the size of FDI with respect to 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 analyse the extensive margin of FDI, i.e. the probability for selection into the group of multinational investors. The second stage examines the relationship between productivity and the intensive margin of FDI. By extending the baseline specification, the main contribution of the study is the application of different methods for the classification of FDI types.

We find evidence that productivity is not only a crucial factor for the decision to invest in the neighbouring 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.

The remaining paper is organised as follows: Chapter 6.2 examines the related literature on the relevance of productivity for the foreign market engagement of firms. Chapter 6.3 provides a description of the IAB-ReLOC data and illustrates differences to hitherto existing databases with regards to FDI. In Chapter 6.4, we present classification concepts to distinguish between VFDI and HFDI by using the information from the survey. Chapter 6.5 outlines the econometric method used for our analyses on FDI size in the Czech Republic. The empirical results are presented and discussed in Chapter 6.6. Finally, Chapter 6.7 concludes with a summary concerning the role of classifications in defining types of FDI.

6.2 Literature review

6.2.1 Firm heterogeneity and FDI

Regarding the extensive margin of FDI, since the introduction of the widely noticed model by Helpman et al. (2004) it is regarded as common knowledge that firm heterogeneity plays an important role in the internationalisation 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. Closely connected to our research are analyses that look at the correlation between firm heterogeneity and the size of FDI, i.e. the intensive margin 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 US multinational enterprises (MNEs) and shows that firms that become multinational not only differ systematically from firms that export but that this sorting also relates to 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 et al. (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 et al. (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.

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

Studies dealing with the importance of VFDI and HFDI among overall FDI 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, for example the transition economies in Central and Eastern Europe. Marin et al. (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 percent), Romania (44 percent) and Hungary (31 percent) 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 contradictory 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 et al. (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.

Investigations into the relation between firm characteristics and investment motives are, however, rare. Although many studies consider the relationship between productivity and FDI, most of them focus on HFDI and only a few studies distinguish between different types of FDI in this context. Head/Ries (2003) develop an alternative model to Helpman et al. (2004) that yields the same predictions concerning the productivity ranking of firms in the internationalisation 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 et al. (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 lack of 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 intensive margin of FDI. Referring to the literature presented above, we expect that the role of productivity in the firms' internationalisation behaviour differs between the two main motives – especially with respect to the intensive margin of FDI, measured as 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.

6.3 Data

Regarding empirical research with respect to German FDI, it has clearly been noted that progress has been hindered by the lack of appropriate data (see Pflüger et al. 2013, 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 datasets 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 proportion of the 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 the existence of many small firms in our German-Czech case, it is not clear, what this bias in favour 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 accounted for by relatively many and relatively small companies. Moreover, although many empirical studies use information at firm level, evidence regarding the motives behind FDI is quite scarce in the used datasets.

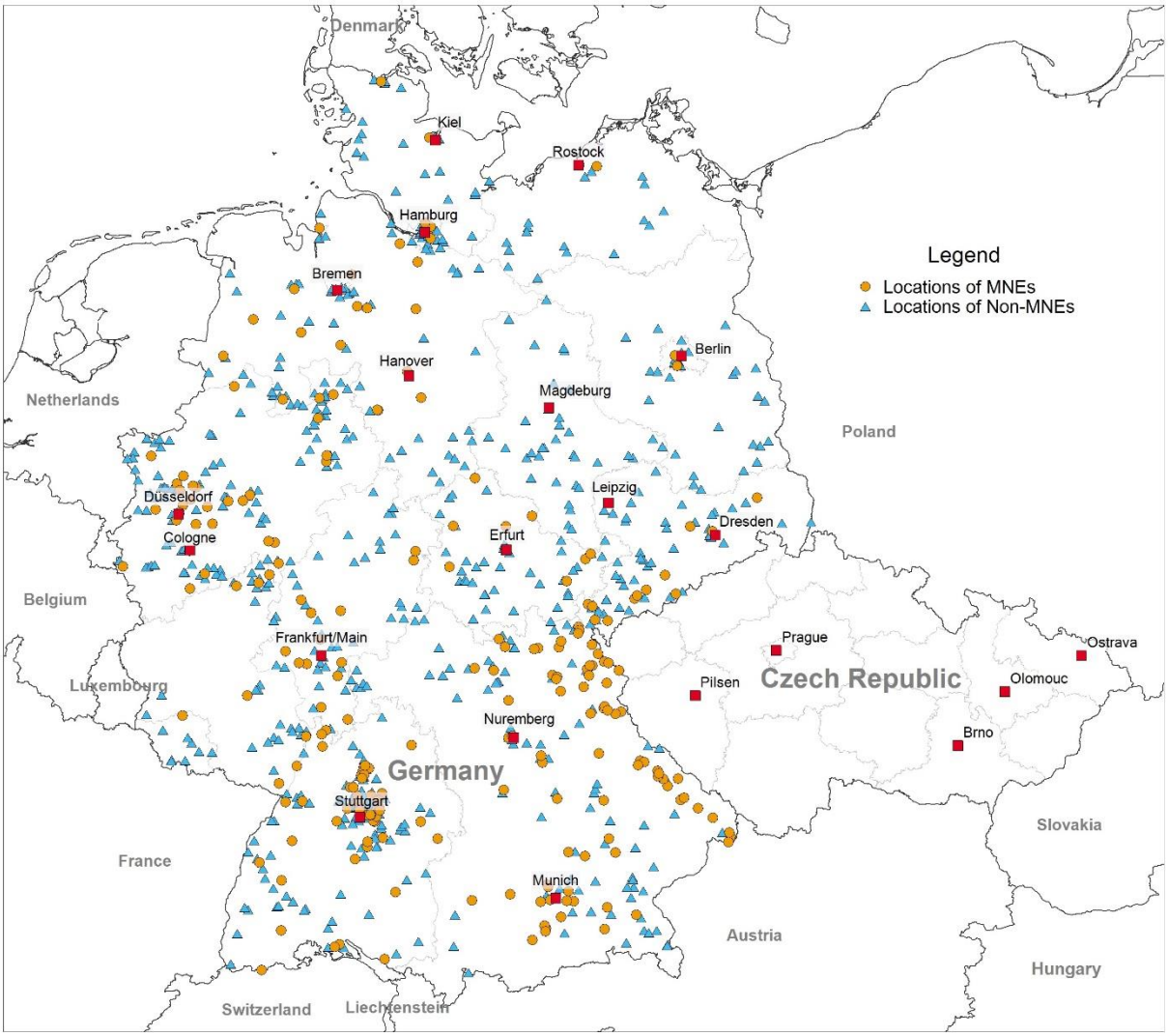
Against the background of the mentioned weaknesses of datasets used to study FDI relations, we base our investigation on the IAB-ReLOC survey, a unique micro dataset for German and

Czech firms.[41] 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 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 30. In order to merge the two datasets, 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 using 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, providing information that is hardly available for such a number of firms in other datasets. Figure 6.1 depicts the locations of both multinational and non-multinational firms.

[41] 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 et al. (2013b), and for an overview of descriptive statistics (in German), see Hecht et al. (2013a).

Figure 6.1: Locations of MNEs and Non-MNEs



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

One of the great advantages of the studied dataset is the bulk of information it comprises, especially with regards 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. In the survey, the multinational companies revealed their main motive for investing in the Czech Republic as well as information on cross-border intra-firm trade relations. Therefore, it is possible to contrast the classification of FDI types based on the responses of firms, i.e. direct measures to categorisation schemes that are commonly used in the literature, denoted as indirect measures (see Chapter 6.4 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 6.2 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 internationalisation 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 dataset we can analyse 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 parent company is not a significant factor for explaining foreign market entry, but is a decisive determinant of the FDI size abroad (see Görg et al. 2010, for example). To account for the industry affiliation of the firms we include the dummy variable services which is equal to 1 if the firm is active in the services sector and 0 otherwise, i.e. 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 labour 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).[42] Another dummy variable reflects whether a firm has a works council or not. As a works council decentralises a firm's decision power which boosts the costs of organising 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 et al. 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. 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. 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 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

[42] Moritz et al. (2017) discuss the differences between manufacturing FDI and services FDI of German multinationals in the Czech Republic.

affiliate as well as to the size of FDI (Acemoglu/Autor 2011; Goos et al. 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 et al. 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. 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 (for the role of the common border region in German-Czech FDI relations, see also Hecht 2017; Schäffler et al. 2017). 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 6.1, descriptive figures for the variables that are relevant in our study are shown.

Table 6.1: Descriptive statistics on German MNEs and Non-MNEs

	MNEs *(N=230)*		**Non-MNEs** *(N=650)*	
Variable	Mean	SD	Mean	SD
N of employees in Czech affiliate	71	161		
Turnover/employee (2009, thousand €)	475	626	246	389
N 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 occ. (2009, share)	0.10	0.13	0.06	0.13
Age (in years)	47.04	43.55	44.91	45.25
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.
Source: Authors' own calculations from IAB-ReLOC survey & Establishment History Panel (BHP).

6.4 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 to circumventing the missing evidence on the FDI motives in firm-level datasets 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 et al. 2010; Temouri/Driffield 2009). According to this approach, 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 parent firm's and the affiliate's 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 categorised 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 categorised 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), while the Czech business register reveals the main industry in which the Czech affiliate is operating. 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 (Hayakawa/Matsuura 2015; Marin et al. 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 come 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*).

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 basic 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 of the information gained in the survey, we do not have to rely only on indirect and thus potentially inaccurate measures for differentiating between VFDI and HFDI. Table 6.2 gives an overview of the number of

observations assigned to VFDI and HFDI on the basis of the four different measurement concepts. Table 6.3 presents the correlation matrix for the four different classifications.

Table 6.2: 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 6.3: 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.

6.5 Econometric analysis

The analysis on the size of FDI is based on German firms that invested in the Czech Republic. A bias may occur if 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 regression developed by Heckman (1979). This approach allows us to correct for the bias by determining the probability of 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).

$$Prob(FDI_i = 1) = \beta_1 productivity_i + \beta_2 X_i + \beta_3 exclusion_i + \varepsilon_i \quad (6.1)$$

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 dataset of the IAB-ReLOC survey and the BHP described in Chapter 6.3 (see Table 6.1). 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).

$$ln\,FDI\_size_i = \alpha_1 productivity_i + \alpha_2 X_i + \alpha_3 \lambda_i + \nu_i \qquad (6.2)$$

Analogously to Görg et al. (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 6.4.

6.6 Results

6.6.1 Baseline model

The baseline model is presented in Table 6.4 and shows the results for the estimation of the size of FDI. 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 et al. 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 of belonging to 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 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 et al. 2014, for example). The coefficient for the value-added chain being negatively significant at the 10 percent level indicates that firms engaged in lower positions are more likely multinationals. The results for the share of non-routine cognitive occupations and the age of the company are insignificant in the first stage of the estimation process. The federal states of Eastern and Western Germany that border on the Czech Republic 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 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 in terms of the number of employees in the Czech affiliates. 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 0.24 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 example). 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 parent company is highly significant with a 1 percent rise leading to a 0.23 percent larger affiliate – a result in line with the findings of Görg et al. (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 internationalise. 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. In contrast, 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 parent 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 domestically performed activities of MNEs are 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. We observe also in the second stage different results for firms in the Eastern and in the Western German border states. While Bavarian MNEs have a significantly larger workforce in their Czech subsidiaries, this is not the case for Saxon affiliates.

Table 6.4: Baseline model

Dependent variable: N of employees in CZ, ln				
	1st stage: Selection		**2nd stage: FDI size**	
	Coef.	SE	Coef.	SE
Productivity (ln)	0.2673***	0.0584	0.2401*	0.1440
N of employees (GER, ln)	0.0068	0.0408	0.2335***	0.0815
Services	0.4169***	0.1278	-0.3847	0.2567
Works council	-0.2421*	0.1440	0.6608**	0.2890
Collective agreement	-0.1013	0.1192	-0.4394*	0.2418
R&D	0.9385***	0.1293	0.8500**	0.3912
Value-added chain	-0.0625*	0.0362	-0.1881**	0.0801
NRC occupations	0.5469	0.4047	-2.2058***	0.8208
Age (ln)	-0.0405	0.0602	0.1571	0.1154
Bavaria	0.6990***	0.1239	0.5812**	0.2731
Saxony	0.1333	0.2206	0.2332	0.4755
Export share	1.3093***	0.2185		
Constant	-2.6560***	0.4441	-0.2399	1.4910
Statistics				
Mills lambda	0.6801	0.4353		
Observations	880			
Uncensored observations	230			

Source: Authors' own calculations from IAB-ReLOC survey & Establishment History Panel (BHP). *, **, *** significant at the 10%, 5%, 1% level respectively. SE = standard error.

6.6.2 Vertical FDI vs. horizontal FDI

Table 6.5 and Table 6.6 show the results for the separate consideration of vertical 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 version. Like in the baseline model, a higher productivity is a significant characteristic of multinational firms, independently of the underlying investment motive.[43] 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 regards to economic sectors. For factor cost-saving investments (VFDI) in

[43] 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.

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 significantly negative 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, transaction costs are obviously 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 parent and affiliated firms are located close to each other, at least along the Czech border with Bavaria. Generally, it can be said that low transaction costs are 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 higher productivity in HFDI firms compared to VFDI firms might be more important for the size of FDI than for a firm's multinationality itself. The relationship between productivity and the FDI size is reverse, however, for the classifications referring to the industry affiliation. The indirect measures identify the productivity as significant characteristic for the size of VFDI, whereas the coefficient for productivity remains insignificant for HFDI. These results are clearly contradicting theoretical expectations.

Table 6.5: Vertical FDI

Vertical FDI	**VFDI survey**		**VFDI inputs**		**VFDI industry18**		**VFDI industry43**	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
FDI size (N of employees in CZ, ln)								
Productivity (ln)	0.3196	0.2062	0.1786	0.2154	0.6206*	0.3116	0.5073*	0.2786
N 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 department	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
N 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 department	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	

Source: Authors' own calculations from IAB-ReLOC survey & Establishment History Panel (BHP). *, **, *** significant at the 10%, 5%, 1% level respectively. SE = standard error.

Table 6.6: Horizontal FDI

Horizontal FDI	HFDI survey		HFDI inputs		HFDI industry18		HFDI industry43	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
FDI size (N of employees in CZ, ln)								
Productivity (ln)	0.5184***	0.1986	0.5062**	0.2152	0.1183	0.1545	0.1824	0.1582
N 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 department	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
N 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 department	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	

Source: Authors' own calculations from IAB-ReLOC survey & Establishment History Panel (BHP). *, **, *** significant at the 10%, 5%, 1% level respectively. SE = standard error.

6.7 Conclusions

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 by using a newly established dataset. To sum up the results considering the separation into VFDI and HFDI, we find robust 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 rather approximate indirect measures. First, the regression results for different classifications show that it is important to consider the motives behind the FDI decision for accurate interpretation. Second, not only the differentiation of vertical and horizontal investments should be considered, but also the concept of classification. As a consequence, we conclude that by using indirect, rather coarse classification measures for types of FDI, one should be more cautious in interpreting distinguished outcomes for vertical and horizontal investments.

7. General conclusion

The ongoing globalisation in the last decades has enabled firms to organise their production processes in new ways. One essential phenomenon in this regard is the enormously rising importance of FDI which may be ascribed to the reduction of trade barriers, decreasing transport and transaction costs and the development of new technologies. This thesis makes use of the fall of the Iron Curtain in 1989 as an important event in European economic integration to shed light on two important aspects of FDI. Based on the example of German FDI in the neighbouring Czech Republic, the locational factors of FDI are analysed for the home and for the host country of FDI. In addition, the relation between FDI size and types of FDI is investigated.

To tackle these research questions, a unique dataset is used: the IAB-ReLOC data. This dataset has been established to overcome the short-comings of other datasets applied in empirical research on FDI as these mostly contain only firms and/or FDI projects above a certain size threshold. However, especially when analysing the FDI relations between neighbouring countries as there are Germany and the Czech Republic, this selectivity with respect to firm size hinders research progress. Due to geographical proximity and related lower transport and transaction costs, many small and medium-sized German firms are engaged in FDI in the Czech Republic. To account for this observation, the IAB-ReLOC data comprise the total population of German parent companies that have been financially involved in a Czech company in 2010 and on their Czech affiliates. To provide insights into methodological aspects as well as into research opportunities, the data generation process – comprising the identification of the research units, the conduction of the survey and the linkage to the establishment data of the IAB – is described. Furthermore, it is shown that the probability to participate in the IAB-ReLOC survey depends in both countries on firm size and interviewer characteristics. The firm's involvement in cross-border FDI influences the participation decision differently in the two countries. This indicates that the decision power of the firm is important for survey participation.

Using the IAB-ReLOC data this thesis investigates the regional distribution of FDI and contributes to closing various research gaps with respect to location choice of FDI. First, despite of the rising importance of FDI in the CEECs and the efforts of these countries to attract FDI, empirical studies on the location choice of FDI within these countries are still rare. As there is evidence that the benefits of FDI are spatially concentrated to the location of the investment, the location choice of FDI may influence the interregional allocation of economic activity. Depending on the location pattern of FDI, existing economic disparities can be reinforced or adjusted. Therefore, the regional distribution of FDI is not only an important topic in regional economics but also a highly relevant issue for regional policy. This dissertation reveals location factors for FDI not only in the host country but also in the home country of FDI, and gives some implications for regional policy. Second, due to limited data availability previous research on FDI has mostly considered larger firms from the manufacturing sector only. However, there is a rising importance of FDI in the services sector. The analyses provided in this thesis include the total population of German firms with FDI in the Czech Republic. By

differentiating between investment industries, forms, size categories, periods and motives, differences in the regional distribution of different subgroups of FDI projects are revealed. Third, especially with regards to the analysis of FDI location choice within the Czech Republic, small-scale regional information is used. This is crucial for identifying the role of agglomeration economies in FDI location choice.

With respect to the regional distribution of both the parent companies in Germany and the affiliates in the Czech Republic, the estimation of a gravity model shows that a large market size in the home as well as in the host region and geographical proximity foster FDI relations. The main finding of the cross-border analysis, however, is that the German-Czech border area is above average involved in FDI relations. An asymmetry is revealed: while investors located in the German border regions predominantly invest in Czech border regions but less so in Czech non-border regions, the Czech border area is an attractive target region for investors from all over Germany. This shows that the importance of regional interconnectedness for FDI location goes beyond the mere relevance of transport costs. Although an improvement of traffic infrastructure could facilitate a larger cross-border FDI involvement of more remote regions, the findings also suggest that measures that contribute to a reduction of transaction costs such as the support of transnational networks could foster FDI relations. Another notable outcome is that, against the background of a considerable wage differential between Germany and the Czech Republic, German investors are not preferentially looking for locations where the regional wage level is as low as possible within the Czech Republic. A well-educated labour force in the target region is more important for attracting investors. As a consequence, the provision of good educational opportunities in regions that lack behind could raise their attractiveness for FDI location.

By focusing on the location choice of German investors within the Czech Republic only, the dissertation provides, in addition, deeper insights into the importance of agglomeration economies for FDI location in transition countries. The results show that, when locating in the Czech Republic, German investors prefer densely populated regions and regions with a comparative advantage in the industry of the investment. Furthermore, Prague is a highly attractive location for German investors as a positive capital city effect is identified. Especially important with regards to the role of FDI location in forming regional disparities is the outcome that German-specific agglomeration is crucial for German investors: Czech regions where already a high number of German firms are located are especially successful in attracting further German investors. This finding implies a path dependency as regions that have attracted German investments at the beginning of the 1990s have a long-lasting advantage. Of special importance is that German investors in particular chose Czech regions where firms from the same region of origin are located. This finding points to the importance of company networks and knowledge spillovers between companies that are located close to each other.

In addition to the regional distribution and the location choice of FDI, this dissertation investigates the importance of the two main motives for FDI: cost reduction (also referred to as vertical FDI) and market access (also referred to as horizontal FDI). Although a bulk of

theoretical models deals with this differentiation, empirical evidence on the importance of these two types of FDI is rare as most datasets do not include information on investment motives. If at all, empirical studies differentiate between the two motives mostly on basis of indirect classification measures. Based on the data collected in the IAB-ReLOC survey, this dissertation investigates the importance of the two investment motives for the case of German FDI in the Czech Republic. According to the direct assessment of the firms interviewed in the IAB-ReLOC survey, horizontal FDI is slightly more important for investing in the Czech Republic than vertical FDI. However, this relation changes if indirect measures based on the industry affiliation of parent firm and affiliate or on intra-firm trade are applied. In addition, it is shown that not only the descriptive statistics depend on the underlying classification concept, but that estimation results with regards to the size of FDI vary with the classification measure. While the measures derived from direct survey information obtain results that are in line with theoretical expectations, the indirect classifications fail to confirm the hypotheses derived from theoretical models. Thus, special caution is required when using indirect classification concepts.

Summing up, this dissertation sheds light on the regional determinants of German FDI in the Czech Republic in the home as well as – in more detail – in the host country of FDI. The crucial role of the common border region in cross-border FDI distribution and the importance of German-specific agglomeration for the location choice of German investors in the Czech Republic is highlighted. In addition, differences in the location patterns of various subgroups of investments are identified. Nevertheless, there is enough space left for follow-up studies. First, recent developments with respect to georeferenced data allow even more detailed investigations on the role of agglomeration economies for FDI location. In addition to aggregated regional data, the real spatial distribution of economic activity, i.e. the exact location of firms, workers and consumers, can be integrated into the estimations. Second, the results of the thesis have shown that the location choice within the Czech Republic is influenced by previous location choices of other German firms, especially of those located in the same region of origin. This suggests that firm networks and knowledge spillovers are important factors in FDI location choice. To confirm or neglect this assumption, further investigations, at the best under incorporation of georeferenced data, are necessary. And last but not least, the labour market effects of FDI are still an important issue – not only in economic research but especially for regional and international policies. Currently, in many parts of the world opponents of economic integration gain support and barriers to international trade are (re-)introduced. Against this background, a deeper understanding of the consequences of international trade and FDI is necessary to put the discussion about the effects of globalisation on a scientifically founded basis. To this, the research opportunities of the IAB-ReLOC data can make an important contribution.

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