Institute for Employment Research

The Research Institute of the Federal Employment Agency

IAB

IAB-Discussion Paper 3/2014

Articles on labour market issues

Regional Determinants of German FDI in the Czech Republic

Evidence from a Gravity Model Approach

Johannes Schäffler
Veronika Hecht
Michael Moritz

ISSN 2195-2663

Regional Determinants of German FDI in the Czech Republic

Evidence from a Gravity Model Approach

Johannes Schäffler (IAB)
Veronika Hecht (IAB)
Michael Moritz (IAB)

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

The “IAB-Discussion Paper” is published by the research institute of the German Federal Employment Agency in order to intensify the dialogue with the scientific community. The prompt publication of the latest research results via the internet intends to stimulate criticism and to ensure research quality at an early stage before printing.

Contents

Abstract

The attractiveness for the location of multinational firms is seen as a crucial issue for the development and prosperity of regions. This article focuses on a two-country relationship and deals with the regional distribution of German multinational firms and their affiliates in the Czech Republic. A new dataset established by the IAB covers information on the basic population of cross-border foreign direct investment (FDI) projects, thereby exceeding the number of observations in previously used databases by far. On the basis of 3,894 FDI projects the regional determinants of German cross-border investments in the Czech Republic are analysed for both the home and the host country. Alternative specifications of the gravity model are used in order to investigate the regional distribution of common investment projects that are calculated as a combination of a headquarters in a German spatial planning region and an affiliate in a Czech NUTS 3 region. Concerning the explanatory variables a distinction is made between three groups of factors: first, market size and agglomeration features of the regions; second, attributes representing the distance between the headquarters in Germany and the affiliates in the Czech Republic; and third, regional labour market characteristics. While the findings are generally in line with theoretical expectations, differences emerge between manufacturing FDI and services FDI.

Zusammenfassung

Die Standortattraktivität für die Ansiedlung multinationaler Unternehmen ist ein wesentliches Kriterium für die Entwicklung und den Wohlstand von Regionen. Dieser Artikel konzentriert sich auf eine Zwei-Länder-Beziehung und befasst sich mit der regionalen Verteilung multinationaler Unternehmen in Deutschland und deren Tochtergesellschaften in der Tschechischen Republik. Ein vom IAB neu erstellter Datensatz umfasst Informationen über die Grundgesamtheit grenzüberschreitender Direktinvestitionsprojekte, wobei die Anzahl der Beobachtungen im Vergleich zu bisher verwendeten Datenquellen bei Weitem übertroffen wird. Auf Basis von 3.894 deutschen Direktinvestitionsprojekten in der Tschechischen Republik werden die regionalen Determinanten sowohl für das Heim- als auch das Gastland analysiert. Alternative Spezifikationen des Gravitationsmodells werden genutzt, um die regionale Verteilung von gemeinsamen Investitionsprojekten zu untersuchen, die als Kombination einer Unternehmenszentrale in einer deutschen Raumordnungsregion und einer Tochtergesellschaft in einer tschechischen NUTS 3-Region berechnet werden. In Bezug auf die erklärenden Variablen wird zwischen drei Gruppen von Faktoren unterschieden: erstens, Eigenschaften, die die Marktgröße und Verdichtung der Regionen abbilden; zweitens, Merkmale, die die Distanz zwischen den Unternehmenszentralen in Deutschland und den Tochtergesellschaften in der Tschechischen Republik darstellen; und drittens, Charakteristika der regionalen Arbeitsmärkte. Während die Ergebnisse generell im Einklang mit theoretischen Erwartungen stehen, sind Unterschiede zwischen Direktinvestitionen im industriellen Sektor und Direktinvestitionen im Dienstleistungssektor erkennbar.

JEL classification: F23, R12, F15

Keywords: multinational firms; foreign direct investment; location choice; economic integration; international trade; gravity model

Acknowledgements: We would like to thank the participants of the ERSA conference in Palermo, the WIFO regional economics workshop in Vienna and the NARSC conference in Atlanta, where parts of this paper were presented, for helpful comments. We are particularly grateful to Annekatrin Niebuhr (IAB Northern Germany, Kiel) for very valuable advice and suggestions as well as to Daniel Münich (CERGE-EI, Prague), who assisted us a lot with respect to the Czech data. Any errors, however, remain our sole responsibility.

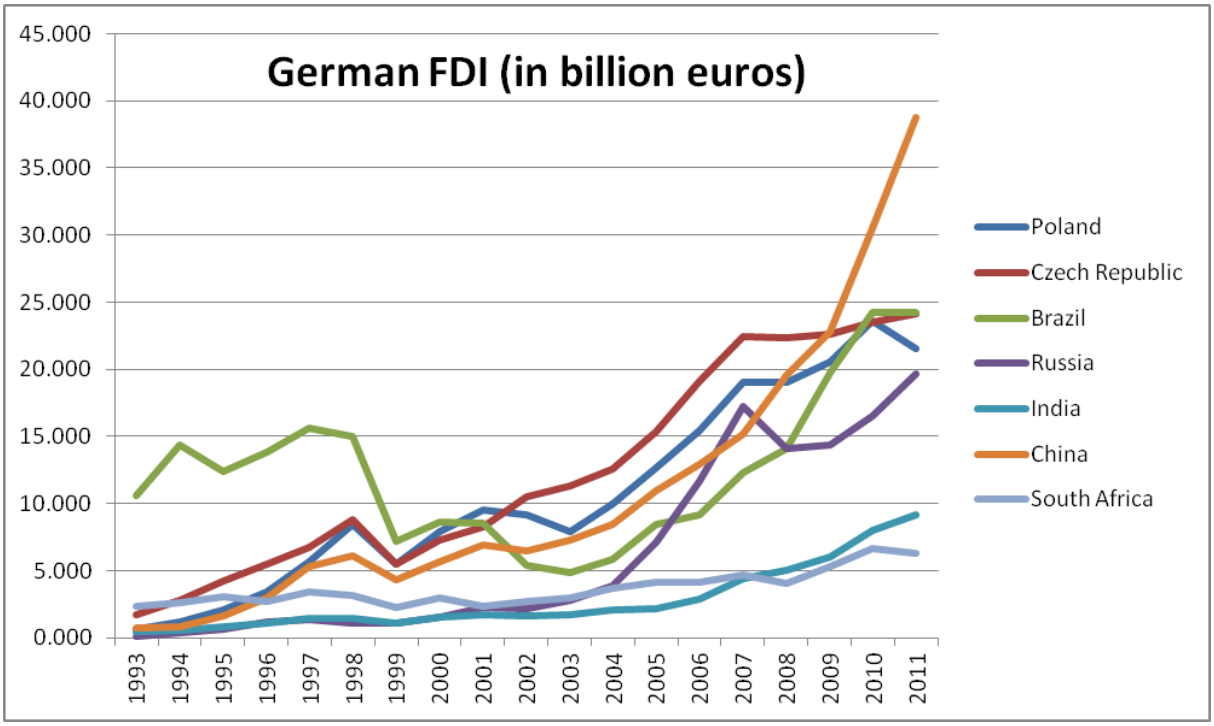
1 Introduction

Trade and foreign direct investment (FDI) have increased at unprecedented pace in the last decades, particularly in regard to transition and developing countries. Investments in the production of goods and services abroad are a widespread phenomenon that is closely related to the process of worldwide economic integration. Explanations for fast-growing FDI figures include the expansions of trade in intermediate inputs and of trade and FDI in services, largely due to the global reduction of trade barriers as well as the drastic fall of transport and communication costs. After the fall of the Iron Curtain and the opening of previously unreachable markets in Asia, a rising number of countries have been involved in this process. In general, there are two main reasons why firms become multinational. On the one hand, firms invest abroad in order to gain access to new markets which is referred to as horizontal foreign direct investment, as the activities performed in the home country are carried out at the same value chain stage in the host country. On the other hand, vertical foreign direct investments are undertaken by investors in order to realize the cost-driven fragmentation of production processes followed by the cross-border trade of intermediate goods. By all means, it can be concluded that a country enhances the attention of capital providers the more it looks attractive to invest there for both cost-cutting motives and market development.

Among the most popular targets of multinational investors, the central and eastern European countries (CEEC) have emerged as major attractors of FDI (see Barba Navaretti/Haaland/Venables 2002; Lipsey 2006, for example). Significantly lower labour costs combined with growing consumption and the spatial proximity of these countries, that transformed their economies from plan to market, made them an attractive target area for FDI especially from western European countries. This has resulted in a significant growth in FDI transactions since the beginning of the transition process, bringing financial capital, technology as well as marketing and organizational knowledge into the host countries (Resmini 2004). Attracting 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 (Blomström/Kokko 1998). As the positive externalities generated by FDI are locally linked to the location of the investment, these regions and their labour markets can particularly profit (Dinga/Münich 2010). This applies all the more for neighbouring countries as they can take advantage of the close geographic proximity. In this regard, one example of thriving FDI relations is the case of Germany and its two adjacent countries in eastern central Europe with which it shares common borders, Poland and the Czech Republic. The low distance, particularly in the borderlands, should benefit cross-border investments. Though Poland has nearly four times more inhabitants, the Czech Republic is the most important target country of German direct investment among the CEEC. Figure 1 compares the German FDI stocks in the Czech Republic and Poland, to the BRICS countries (Brazil, Russia, India, China and South Africa), that together represent almost three billion people (Deutsche Bundesbank 2013). While Brazil had the highest total of all countries observed in the 1990s, India and South Africa exhibit growing investments from Germany, although at relatively small levels. From the beginning of the new century onwards, a boom of FDI is registered for Russia, while figures

are rapidly escalating for China in the recent years. Interestingly, between the early and late 2000s, though only having a population of roughly 10 million inhabitants, the Czech Republic trumped all these much larger emerging economies in terms of FDI exceeding also the total of Poland. By 2011, the figures by the Deutsche Bundesbank feature an amount of more than €24 billion of German FDI and around 271,000 employees working for 946 German-owned firms in the Czech Republic (Deutsche Bundesbank 2013).

Figure 1: German FDI in the Czech Republic, Poland and BRICS



Source: Deutsche Bundesbank

A broad literature deals with the locational determinants of FDI. Due to a lack of data availability, there are, however, some crucial limitations that constrain the informational value of many investigations. In the existing literature various datasets are used to analyse German FDI. These data sources provide a rich basis for studying FDI relations, but, unfortunately, are selective with respect to the characteristics of the firms and/or the investment projects included. While the numbers in Figure 1 evidentially manifest the rise of German FDI for the illustrated countries, they also reveal one of the greatest impediments concerning research on cross-border FDI relations. Most suppliers of information on foreign direct investment set specific thresholds that firms have to surpass in order to be included in the dataset. As a consequence, in the available firm-level data larger firms are overrepresented, leading potentially to biased results in research studies. Surely, as regards the multinational activity of firms, it can be assumed that larger, often more productive firms more likely operate abroad as only they are able to pay the market entry costs (Helpman/Melitz/Yeaple 2004; Melitz 2003). The issue of firm size, however, is particularly important in the case of neighbouring countries, where lower transaction costs compared to distant destinations also allow smaller firms to go abroad. With regard to the database of the Deutsche Bundesbank, the reported

thresholds have been changed several times in recent years. At present, only foreign subsidiaries of German firms are included which have a balance sheet total of at least €3 million.[1] This might appear not to be very restrictive. However, taking into account that, according to the Czech Commercial Register, the firms registered by the Deutsche Bundesbank represent only about one fourth of the German FDI projects performed in the Czech Republic, it is not clear, what this bias in favour of large firms exactly implies. The shortcoming of not including the better part of small and medium-sized enterprises applies also for commercial suppliers of suitable data for scientific investigations, as the databases are usually based on balance-sheet information (see the assessment by Budd/Konings/Slaughter 2005, for example). In a nutshell, many studies on FDI are limited to larger firms, while medium and smaller affiliates have been grossly under-represented. 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. Besides the selectivity of firm-level data, there are further deficiencies in the literature on FDI, mainly arising from the lack of appropriate micro data. The most pressing topic is the restriction of many studies dealing with multinational investments to the target countries, frequently focusing solely on the manufacturing sector. As a consequence, there are few cross-border investigations that consider the overall structure of firms involved in FDI, inclusive of the service sector, and the regional dimension. For both the home and the host country, this is an important regional policy issue as the location of multinationals may contribute to the emergence of regional disparities as well as to the reinforcement of existing regional economic differences.

The contribution of this paper to the existing literature fundamentally consists in tackling the above-mentioned research deficiencies by using a uniquely established dataset which focuses on two countries, Germany, the home country of FDI, and the Czech Republic, the host country. The starting point of the investigation is the total population of German multinationals which have affiliates in the Czech Republic, as registered in the Czech Commercial Register by the beginning of 2010. Information is available for both the location of the headquarters in Germany and of the affiliates in the Czech Republic. Adding data on regional characteristics enables the analysis of regional determinants and features of FDI location factors in the home and in the host country. Building on theoretical considerations and the existing literature, special attention is put on the role of market size and agglomeration economies, distance issues and labour market characteristics. By applying a gravity model, a particular look is taken at the differences between the manufacturing and the service sector. The estimations yield stable results for the core variables of the gravity equation. On the one hand, the economic size in terms of gross domestic product (GDP) is for both sides of the border positively related to the number of FDI projects performed in the involved regions. On the other hand, a negative relationship is observed between the number of joint projects and the transport distance between a German and a Czech region. In addition, the common border

[1] It seems plausible to assume that investments of German firms that do not reach the threshold of at least €3 million in terms of balance sheet total are easier to perform and therefore more frequent in the neighbouring Czech Republic than in countries farther away like the BRICS. Thus, the relative impact of the threshold on the recorded total sum of German FDI in the Czech Republic might also have been higher than in these countries.

region attracts transnational investment projects at an above-average level. Differences emerge after splitting the dataset into manufacturing and services FDI. Services FDI is performed above average in Czech high-wage regions, while this is not the case for projects in the Czech manufacturing sector. This result can be interpreted as reflection of an underlying divergence in the motives for the cross-border investment. Manufacturers seem to search primarily for cost-saving locations, whereas service providers mainly seek market access. Interestingly, particularly investors in Czech manufacturing industries are attracted by regions with an above-average share of high-skilled employees.

The remainder of the article is organised as follows: section 2 provides theoretical guidance in regard to cross-border investment relationships and gives an overview of the recent literature dealing with FDI in central and eastern Europe. In section 3 follows a description of the IAB-ReLOC gross sample encompassing German multinationals and their affiliates in the Czech Republic. Section 4 sheds light on the regional characteristics of German spatial planning regions and Czech NUTS 3 regions. Section 5 introduces the gravity model and the Poisson and Negative Binomial specifications used for investigating the location pattern of German headquarters and Czech affiliates. Results for the total of FDI projects, manufacturing FDI and services FDI are presented in section 6. The paper concludes with a summary of the findings and an outlook to future research in section 7.

2 Background

As the aim of this study is to analyse the regional determinants in regard to locations of German headquarters and their Czech affiliates the theoretical understanding of potential factors and the related empirical literature are highlighted now. According to Porter (2003) it is the regional differences, persisting in a way in every country, that can help to find the essential drivers of economic development. Region-specific endowments of economic factors can outplay country-specific effects for the attraction of FDI, as emphasised by Pusterla/Resmini (2007) in a study on the location choice of multinational firms in four CEEC. 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/Liviano-Solis/Manjón-Antolín 2010). A standard approach in order to analyse how the characteristics of a region affect the probability to be chosen as investment location is the use of discrete choice models which go back to McFadden (1974) and are widely applied in the literature (e.g. Basile/Castellani/Zanfei 2009; Disdier/Mayer 2004; Guimarães/Figueiredo/Woodward 2000; Head/Ries/Swenson 1995, 1999; Zvirgzde/Schiller/Revilla Diez 2013). As this paper deals with information at the regional level in order to identify the determinants of FDI locations, the scope is closer to a second strand in the literature, the use of count data models (e.g. Arauzo-Carod/Viladecans-Marsal 2009; Barbosa/Guimarães/Woodward 2004; Blonigen 1997; Coughlin/Segev 2000; Wu 1999). By focusing on the spatial distribution in both the home and the host country a gravity model approach may be favoured. Originally, extended versions of Newton's law of universal gravitation were applied in order to analyse trade flows between nations or regions (see Anderson/van Wincoop 2003; McCallum 1995, for example). As trade relations can be investigated by a gravity model, so can be FDI flows (e.g. Blonigen et al. 2007; Brainard 1997;

Buch/Kleinert/Toubal 2003; Kandilov/Grennes 2012). The vast majority of studies on FDI that apply discrete choice models or count data models concentrate on the U.S. and western Europe. Investigations with respect to other parts of the world, namely popular destination regions like the CEEC, are yet scarce.

For the understanding of potential determinants of the regional distribution of multinational firms in the home and in the host country, it seems to be conducive to start with a reference on the main motives of FDI. The rise of the CEEC as target regions for FDI is not surprising as these destinations are appealing capital for both major reasons for investing abroad. On the one hand, cost savings drive investors to eastern Europe, where wages are still considerably lower than in western Europe. Concerning the two-country case in this study, in 2011 the average hourly labour costs in the industry sector amounted to €30.1 in Germany and to €10.5 in the Czech Republic (Eurostat 2012). In combination with the small distance, multinational firms are stimulated to relocate at least parts of their activities to cheaper sites in the east of the continent. For this fragmentation of the production process of goods and services the term vertical FDI has been established in the literature (Helpman 1984). On the other hand, the rising consumer potential in the eastern countries makes them interesting for market development strategies, i.e. the opening up of new markets for goods and services that are also sold in the home country, called horizontal FDI (Markusen 2002).

Previous studies have shown theoretically and empirically that agglomeration economies strongly influence the location choice of multinational firms. On the one hand, the overall economic activity in a region may generate positive externalities (Jacobs 1969; Krugman 1991). On the other hand, it is attractive for firms to locate near other firms of the same industry as they can share inputs. Furthermore, labour market pooling can provide firms with workers qualified in specific skills and, in addition, knowledge spillovers may occur between firms (Marshall 1890). Hence, concerning both the home and the host country of FDI, it can be assumed that companies should to a higher extent be found in agglomeration areas. Chidlow/Salciuviene/Young (2009) analyse location determinants of FDI in Poland by applying a factor analysis for a sample of Polish subsidiaries that are owned by foreign multinationals. While investors which were seeking for agglomeration, knowledge and market factors preferentially settled around the capital city of Warsaw, the capital lenders for which low input costs were a dominant factor favoured other regions. Industrial clustering as well as agglomeration economies play an important role in the study of Hilber/Voicu (2010) on the location choice of foreign firms in Romania. Even after including county-specific effects they find that, among others, service agglomerations increase the attractiveness of a region for FDI.

The increasing shift of services abroad can be regarded as one fundamental reason for rising FDI relations between countries. As highlighted by Feenstra (2010), manufacturing industries are not the only branches of economic activity that have experienced relocations to places outside of metropolitan areas in the high productive countries. Far less studied is the tendency to relocate service production. Amiti/Wei (2005) identify the significant advances in information and communications technology, enabling an expansion of the international division of labour. While the earliest examples for such fragmentation processes were confined to manufacturing activities (e.g. the car industry, see WTO 1998), the phenomenon has spread

to many services which became tradeable, e.g. customer service calls, developing software or preparing tax forms. Blinder (2006) has termed this development the 'third industrial revolution'. Traditionally, in the framework of international production networks vertical specialization is associated with manufacturing industries. According to a United Nations' World Investment Report a large proportion of FDI in services is performed for market-seeking motives. However, as the cross-border tradability of several services tremendously improved due to new information and communication technologies, the determinants for investments are changing (UNCTAD 2004). Some studies find evidence for differences between investments in the manufacturing and in the service sector. Based on a combination of survey and administrative data, Gauselmann/Marek (2012) investigate the pull factors of FDI in eastern Germany, Poland and the Czech Republic, identifying sectoral specialisation and the potential for knowledge spillovers as main driving forces of FDI. In addition, they find sector-specific agglomeration features for the FDI location pattern, e.g. a strong concentration of services FDI is found in capital regions. Münich et al. (2013) find differences in mother-daughter relationships of German FDI in the Czech Republic concerning the technology relatedness of Czech affiliates. While subsidiaries in the service sector exhibit similar technology levels like the mother companies, a technology gap exists in the manufacturing sector, i.e. Czech daughter firms trail their German mothers.

Besides agglomeration economies the distance between the headquarters and the affiliated firm is another factor that potentially influences the location decision. The influence of transport costs for the direct investment decision of a company is connected with the motives for direct investment, too. Taking advantage of productivity and factor price differentials is less profitable if transport costs are relatively high. Hence, a negative relationship is assumed between vertical direct investment and distance. The link between horizontal direct investment and distance is more ambiguous. On the one hand, high transport costs can foster foreign direct investment based on the market motive. 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). On the other hand, it can be assumed that the costs of building up a new plant rise with the distance, e.g. due to higher monitoring costs. Therefore, for many firms market development can be more profitable in nearby countries and regions if market entry costs are lower (Hayakawa/Matsuura 2011). Buch/Kleinert/Toubal (2003) estimate a gravity model with different FDI determinants of German companies abroad as variables to be explained. They find that the average size of the foreign partners in a country increases with distance. At the same time the number of affiliates increases with the proximity to the German market. Generally, the distance between two countries as a proxy for transport costs often exhibits a negative impact on bilateral FDI. Portes/Rey (2005) attribute this to the negative effect of distance on information costs. Buch et al. (2005) emphasise the cultural distance as an important factor influencing information and communication costs. In one of the rare studies on services, Kandilov/Grennes (2010) examine the role of geographical proximity for exports of transition countries in central and eastern Europe to western Europe compared to other low-cost exporters from Asia and South America. They find evidence that a smaller distance and minimal time zone differences constitute an advantage at least for some types of service exports. In a study that is

based on a survey to assess the attractiveness of Czech regions for foreign investors, Spilková (2007) finds that the attractiveness of a region declines with the region's distance to the capital of Prague as well as to the Bavarian border.

The relationship between distance and foreign direct investment should be of specific importance when different regions of a single target country are considered, e.g. in the case when the fundamental decision of a firm to go to a specific country has been taken and the issue is where in the host country to locate. Furthermore, if neighbouring countries are involved in FDI relations, 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. It can be assumed that border regions are especially focused on the neighbouring country. Quite naturally, border regions have a special position in countries and they should therefore also have a specific role in the integration process. A border constitutes an institution which imposes (sometimes prohibitive) transaction costs on the exchange of goods and services between regions or countries (Büttner/Rincke 2007). Integration reduces these impediments, but mental and language barriers might still play an important role, putting these regions in a particular economic situation (van Houtum 1999). One would expect that border areas are natural production sites as they have relatively low-cost access to foreign markets (Hanson 1996). On the one hand, this relationship should especially apply for vertical FDI as the proximity to the German mother company is combined with lower transportation costs for intermediate goods. On the other hand, FDI might also be attracted to nearby regions through the existence of transnational networks or a higher share of people with knowledge of the languages involved that could also be important determinants for horizontal FDI activities. Thus, low information costs and convenient conditions for network effects foster investment possibilities there. As it is evident for one of the most prominent cases exhibiting a substantial wage gap, the U.S.-Mexican borderlands, a resounding proportion of U.S. investment in the southern neighbouring country flow to factories that are situated directly across the border, the so-called maquiladoras (Bergin/Feenstra/Hanson 2009; Feenstra/Hanson 1997). The main findings are that in Mexico, trade liberalization led to a decentralization process away from the capital towards the regions near the U.S. border (Hanson 1998). In the case of Poland, Cieślik (2005a, b) explores that, after controlling for economic and social characteristics, Polish regions next to Belarus, Russia and Ukraine are less attractive for foreign investors than regions in the central and western part of the country. He concludes that this finding implies regional policy measures, e.g. the introduction of special economic zones, in order to prevent uneven regional growth. Concerning German FDI in the Czech Republic, Mühlen/Nunnenkamp (2011) find, by using a dataset that covers about 1,200 German-owned affiliates in the Czech Republic, that distance-related transaction costs are less discouraging for FDI latecomers compared to early movers that entered the Czech market in the first years after the fall of the Iron Curtain. This trend of a decreasing deterrence of distance can be explained by falling transaction costs for late-arriving investors that can build on the experiences of the pioneers.

As a third feature labour market characteristics are seen as important factors of the spatial distribution of multinational firms. As with the two previous features here, too, a distinction between vertical and horizontal FDI is obvious. As vertical FDI aims at reducing costs, varia-

bles referring to production costs should especially influence the location choice of this form of investments while for the location decision of horizontal FDI cheap labour costs should only play a minor role. It can be summarised that horizontal foreign direct investment is more likely, the lower the difference in production costs is (Markusen 2002). In contrast, vertical integration of multinationals is advantageous if production costs in the home country are high compared to potential target countries, i.e. large differences in production costs favour the cross-border vertical decomposition of production processes. Studies by Yeaple (2003) and Hanson/Mataloni/Slaughter (2001) find for certain industries in the U.S., especially for the engineering and electrical industries, a significantly negative impact of input costs of a country on the U.S. direct investment in this country. Resmini (2000) emphasises the importance of wage differentials as an essential determinant for FDI in manufacturing industries in ten CEEC. Bevan/Estrin (2004) find that, apart from market size and proximity, labour costs are the most important factor for FDI from western Europe in the CEEC. There is evidence, however, 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). Therefore, the endowment with skilled workers, but also unemployment rates can reflect the regional structure and availability of the workforce. In particular, these issues can be of importance for market development strategies, as they relate to the relative purchasing power of regions. Concerning the Czech Republic, Spilková (2007) confirms that Czech regions with a higher educational level and with higher wage levels are preferred location sites for foreign direct investment.

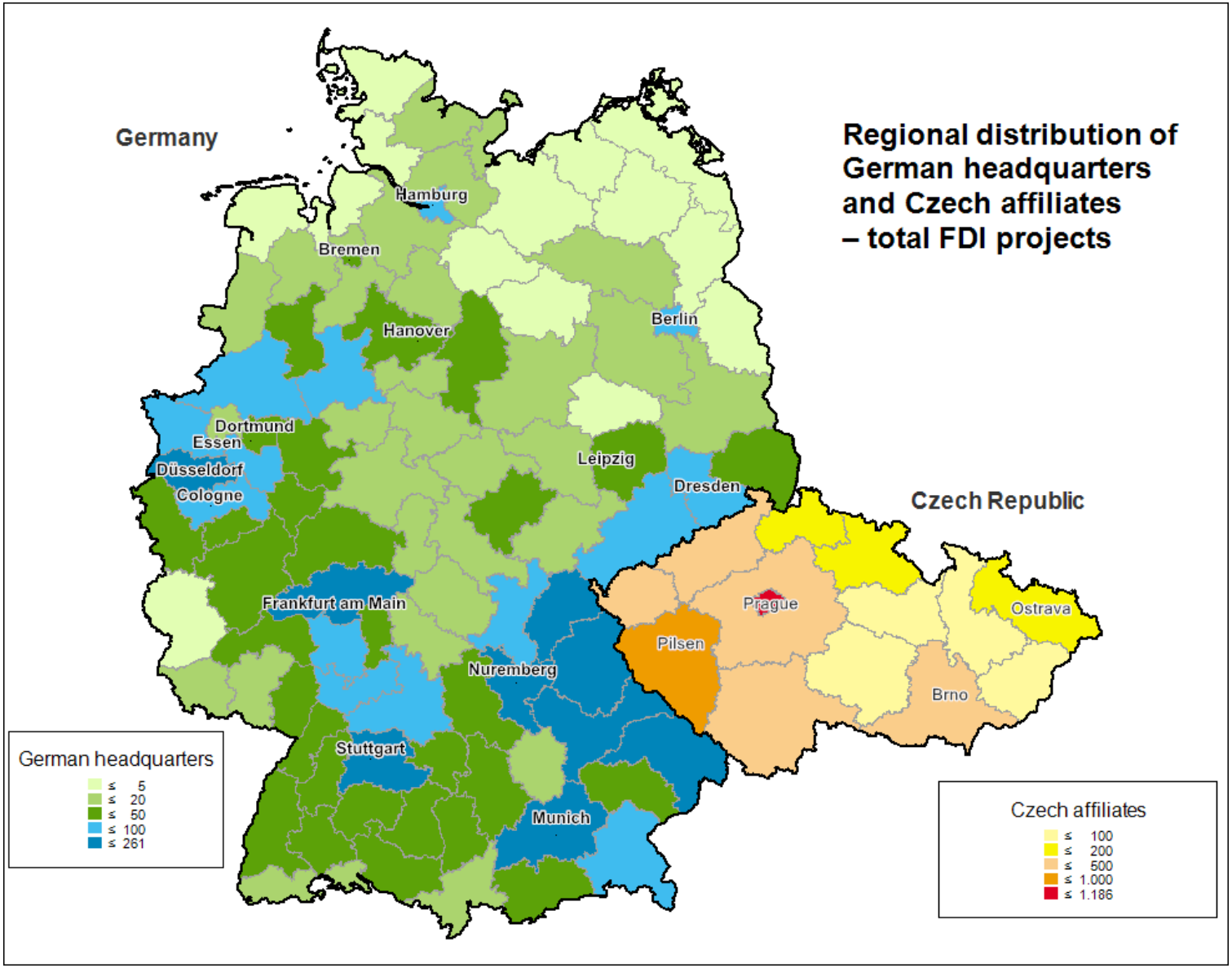
Summarizing the literature, it can be concluded that, concerning the determinants of FDI in the CEEC, a broad range of studies exists. Not least to data limitations, however, the bulk of investigations on FDI deals with the manufacturing sector and nation-to-nation comparisons, predominantly using regional information only for the receiving country. A gap exists for studies that carry out an in-depth analysis focusing on FDI relations between countries including services and considering regional differences in the investing country. The aim of this paper is to shed light on these shortcomings on the basis of hitherto unexploited data for Germany and the Czech Republic. The examination of regional FDI determinants is built on the use of a gravity model by focusing on market size and agglomeration variables, the role of distance and borderlands and labour market characteristics. Against this background the issue is addressed whether there are different regional determinants for FDI projects aimed at the Czech manufacturing sector in contrast to the Czech service sector. Before turning to the econometric analysis, a brief description of the firm-level and regional data is given in the next two sections.

3 The ReLOC-IAB Sample

In this paper, a newly established unique database is used, the gross sample of the IAB-ReLOC project comprising information on the basic population of German multinationals and their affiliates in the Czech Republic see (Hecht/Litzel/Schäffler 2013 for a comprehensive description of the data compilation process and the associated firm survey). The dataset allows to take a closer look on the regional determinants of FDI by focusing on both the home and the host country. The great advantage of the IAB-ReLOC data in comparison with other samples used for research on FDI is the number of observations and the availability of infor-

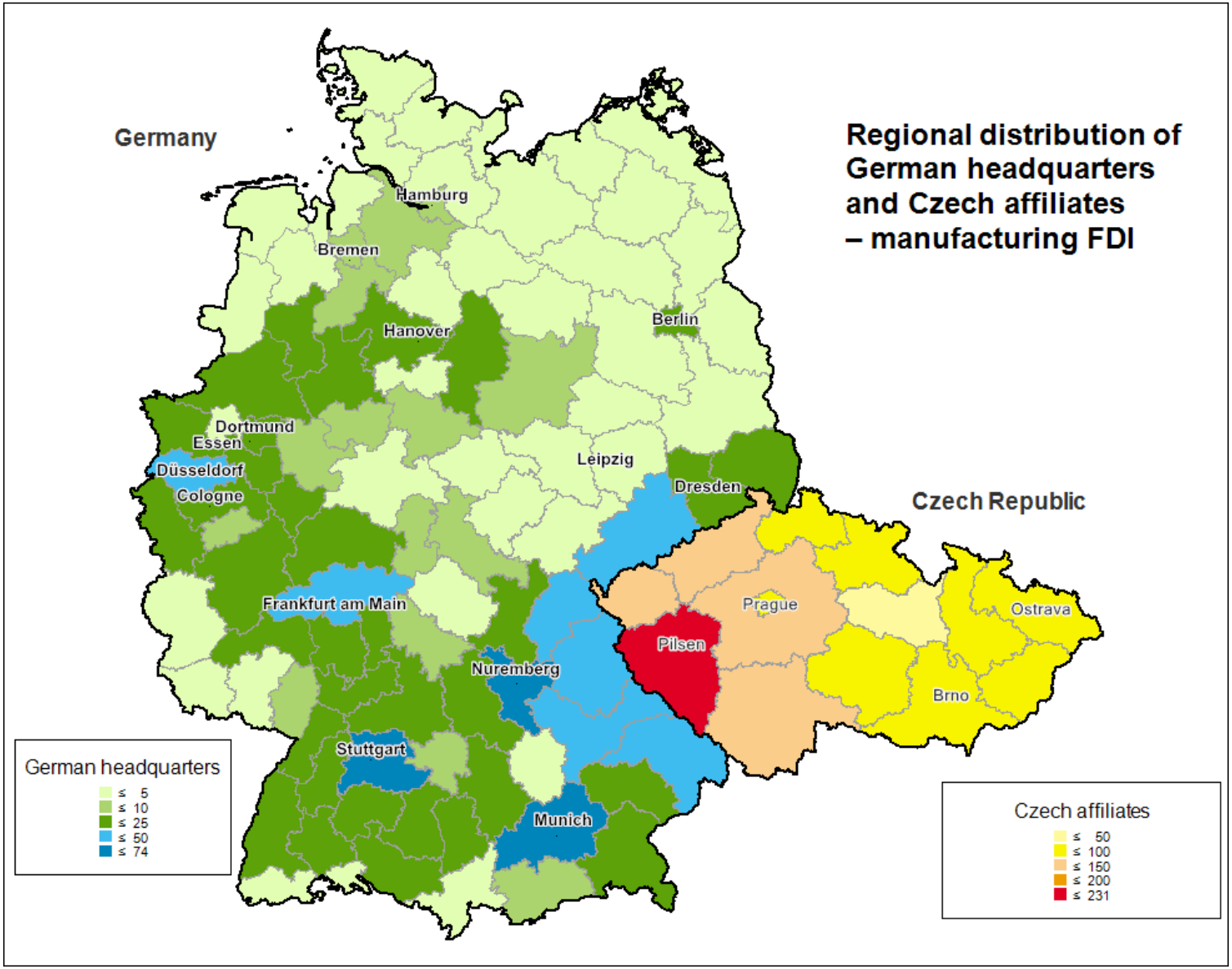
mation on both sides of the border. The original basis of the dataset is an extract of the Czech Commercial Register covering 5,700 Czech firms which are at least partly financed by a German investor (by the beginning of 2010), i.e. the total population of Czech companies with capital provided by German investors. By not taking into account the Czech firms where only a German individual person but no firms could be identified as investor, 3,894 investment projects with capital participation by a German firm of at least 25% remain. There are fewer mothers (3,378) than daughters because some German owners were involved with more than one Czech company. For the Czech part, after merging information on the sectoral affiliation of the firms which is provided by the Czech commercial data supplier ČEKIA, we are able to split the sample in FDI projects that are aimed at the manufacturing or at the service sector (including commerce). The address information of German headquarters and Czech affiliates is available in the Czech Business Register that is maintained by the Czech Statistical Office (CZSO). Figure 2 to 4 show the regional distribution of German investors in 96 spatial planning regions (*Raumordnungsregionen*) and their Czech affiliates in 14 Czech NUTS 3 regions. Figure 2 refers to the total of FDI projects, whereas Figure 3 and Figure 4 depict the distributions for the subsets of investment projects that are dedicated to the Czech manufacturing sector and the Czech service sector. The choice of the regional levels in both countries was driven by reasons of a good comparability with regard to the regional size. The headquarters of the multinationals are predominantly located in those spatial planning regions that comprise Germany's largest cities, above all the metropolitan areas of Munich, Stuttgart, Frankfurt am Main and the Rhine-Ruhr region around Düsseldorf. Apart from that, mother firms are highly concentrated in the Bavarian and Saxon borderlands. With respect to 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 strong representation of German FDI in these regions was already observed in the 1990s by Rehner (1998). As about two-thirds of the FDI projects are directed at the Czech service sector, the spatial patterns for the total of FDI projects and for services FDI appear quite similar. Distinguished differences are observable, however, in the case of manufacturing FDI. While the regions close to the Czech Republic persistently hold a strong position, the metropolitan regions of Germany's two largest cities, Berlin and Hamburg, play only a moderate role as a location for headquarters of German multinationals. 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 (*Plzeň*) has established a dominating position. 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). Table 1 shows the distribution of the regional combinations for the total of FDI projects and for FDI projects that are involved in the Czech manufacturing or service sector. Concerning the whole sample, in around 40% 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% (56%).

Figure 2: Regional distribution of German headquarters and Czech affiliates (total FDI projects)



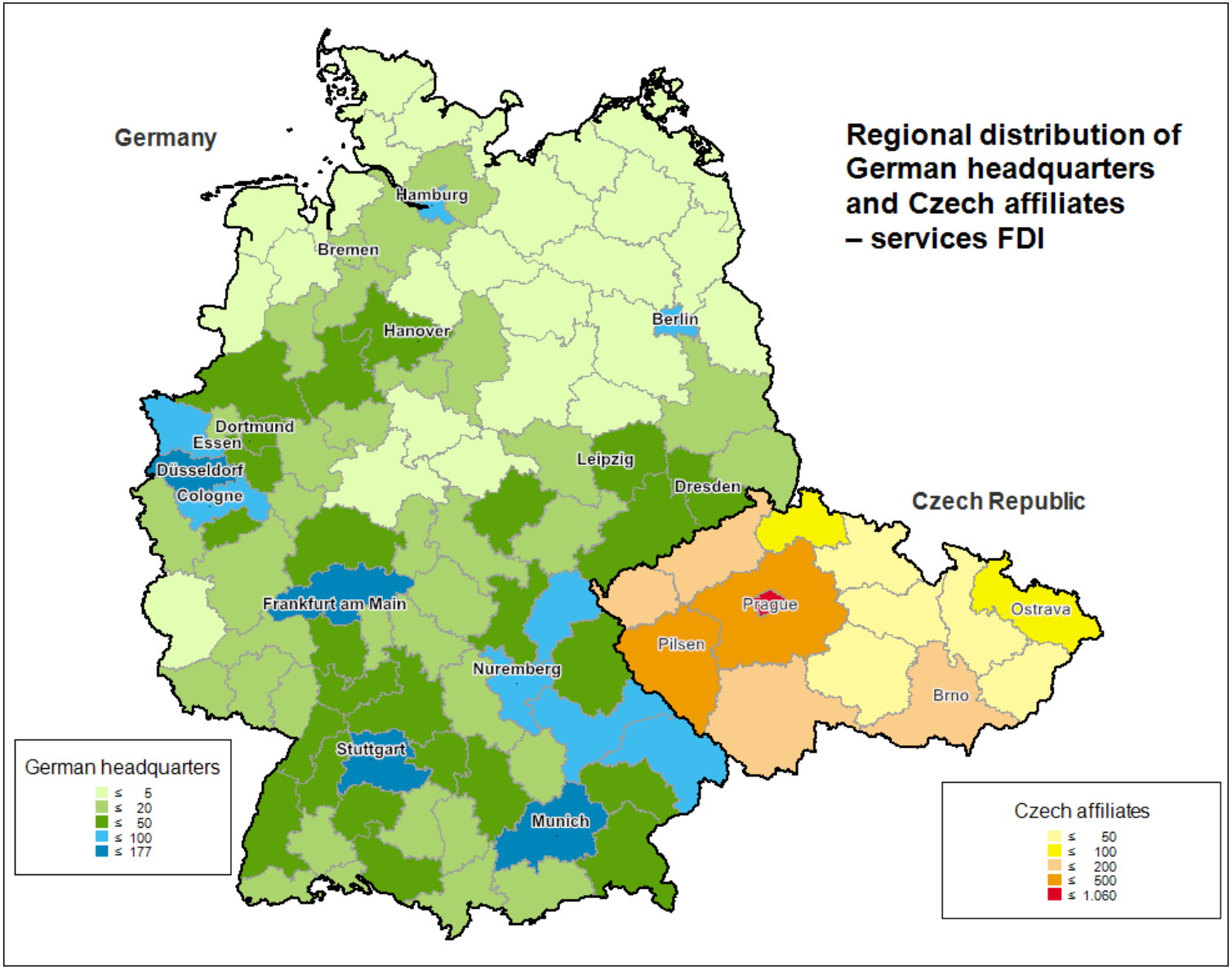
Source: Authors' own calculations from IAB-ReLOC data.

Figure 3: Regional distribution of German headquarters and Czech affiliates (manufacturing FDI)



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

Figure 4: Regional distribution of German headquarters and Czech affiliates (services FDI)



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

Table 1: Counts of FDI projects between German and Czech regions

FDI total			FDI manufacturing			FDI services		
Counts	Freq.	Percent	Counts	Freq.	Percent	Counts	Freq.	Percent
0	538	40.03	0	795	59.15	0	753	56.03
1	271	20.16	1	286	21.28	1	260	19.35
2	180	13.39	2	121	9.00	2	121	9.00
3	91	6.77	3	67	4.99	3	64	4.76
4	67	4.99	4	25	1.86	4	34	2.53
5	40	2.98	5	16	1.19	5	19	1.41
6	26	1.93	6	10	0.74	6	15	1.12
7	13	0.97	7	6	0.45	7	10	0.74
8	16	1.19	8	3	0.22	8	11	0.82
9	16	1.19	9	5	0.37	9	9	0.67
10	12	0.89	10	2	0.15	10	5	0.37
11	9	0.67	15	1	0.07	11	8	0.60
12	8	0.60	16	1	0.07	12	10	0.74
13	9	0.67	17	1	0.07	13	2	0.15
14	5	0.37	20	1	0.07	15	1	0.07
15	5	0.37	23	1	0.07	17	1	0.07
16	2	0.15	26	1	0.07	18	1	0.07
17	2	0.15	27	1	0.07	19	3	0.22
18	1	0.07	30	1	0.07	20	1	0.07
19	6	0.45		**1,344**	**100.00**	23	2	0.15
20	1	0.07				24	2	0.15
21	5	0.37				26	1	0.07
22	1	0.07				33	1	0.07
23	1	0.07				36	2	0.15
26	2	0.15				38	2	0.15
29	1	0.07				54	1	0.07
30	1	0.07				65	1	0.07
36	1	0.07				69	1	0.07
38	1	0.07				71	1	0.07
40	1	0.07				97	1	0.07
42	1	0.07				109	1	0.07
44	1	0.07					**1,344**	**100.00**
45	1	0.07						
50	1	0.07						
56	1	0.07						
62	1	0.07						
72	1	0.07						
73	1	0.07						
74	1	0.07						
91	1	0.07						
104	1	0.07						
120	1	0.07						
	1,344	**100.00**						

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

4 Regional Characteristics and Research Hypotheses

Regional data made available by the statistical offices of Germany (Federal Statistical Office Germany) and the Czech Republic (Czech Statistical Office) are merged for both the 96 German spatial planning regions and the 14 Czech NUTS 3 regions. Corresponding to the date of identifying the German multinationals in the Czech Republic, the data refer to the year 2009 providing information on a set of regional variables which are classified into three categories: first, market size and agglomeration economies, second, issues related to distance and borderlands, and third, labour market characteristics. In addition, for each of the 1,344 regional combinations the distance is computed by means of the route planning software *map & guide calculate 2009*. Distance is measured as the calculated driving time (in minutes) of a heavy-goods vehicle between the capitals of each German spatial planning region and each Czech NUTS 3 region assuming a speed of 75 km/h on motorways, 45 km/h on federal highways, 40 km/h on country roads and 30 km/h on urban roads. The summary statistics of regional variables are depicted in Table 2. German spatial planning regions and Czech NUTS 3 regions look very similar with regard to the average population and average population density of a regional unit. The differences in the economic strength between the two countries appear in the figures on GDP, GDP per capita and wages. While the employment share in the tertiary sector is to a considerable degree higher in Germany, the average unemployment rate and the share of high-skilled workers is just slightly higher in the Czech Republic. The mean driving time between a German spatial planning region and a Czech NUTS 3 region amounts to 564 minutes. Almost one quarter of the German regions are situated in eastern Germany, whereas the combinations with Prague as the target region of FDI account for 7% of all cases. With 6% of German and 29% of Czech regions belonging to the border regions, the intersection of both leads to a share of 2% of the 1,344 combinations where both the German and the Czech region are part of the borderlands.

In the following, hypotheses are derived concerning the factors which are potentially relevant for regional FDI relations. The selection of the regional variables included in the analysis coincides with the related literature, whereby only few studies use information for both the home and the host country. Hayter (1997) differentiates between three main categories of variables for the analysis of the location of economic activity: neoclassical, institutional and behavioural. This investigation of regional determinants places the first set of variables in the foreground. Behavioural factors refer to the internal or entrepreneurial nature of the firm, which are not scope of this article. As far as institutional factors are concerned it is assumed that in the case of one home and one host country the institutional conditions, e.g. the legal system, tariffs, countrywide taxes are equal throughout the country. Otherwise, data on regional taxes and investment incentives would be desirable, but are not available at the regional level applied in this study. Therefore, the focus is on regional variables that are related to firm profits and firm costs and can be subsumed under the above-mentioned three topics.

Table 2: Descriptive statistics for the 1,344 German-Czech regional combinations

	Variable	Obs	Mean	Std. Dev.	Min	Max
market size and agglomeration	GDP Germany (millions of euros)	1,344	24,969.79	23,887.94	4,227	124,527
	GDP Czech Republic (millions of euros)	1,344	10,103.64	7,998.76	3,072	35,778
	population density Germany (inhabitants/km²)	1,344	330.11	498.81	46	3,852
	population density Czech Republic (inhabitants/km²)	1,344	299.61	627.93	66	2,558
	GDP per capita Germany (euros/inhabitant)	1,344	27,203.18	5,638.97	18,416	47,541
	GDP per capita Czech Republic (euros/inhabitant)	1,344	12,485.71	4,588.16	10,000	28,800
	employment share of tertiary sector Germany	1,344	0.71	0.07	0.56	0.87
	employment share of tertiary sector Czech Republic	1,344	0.57	0.07	0.48	0.80
	Dummy East Germany	1,344	0.23	0.42	0	1
	Dummy Prague	1,344	0.07	0.26	0	1
distance	distance between German and Czech region (minutes)	1,344	564.46	167.41	83	991
	Dummy Border	1,344	0.02	0.13	0	1
	Dummy Border Germany	1,344	0.06	0.24	0	1
	Dummy Border Czech Republic	1,344	0.29	0.45	0	1
labour market	wage Germany (euros/month)	1,344	2,717.61	283.91	2,206	3,388
	wage Czech Republic (euros/month)	1,344	784.49	86.15	713	1,075
	unemployment rate Germany	1,344	0.08	0.03	0.03	0.15
	unemployment rate Czech Republic	1,344	0.10	0.03	0.04	0.14
	share of high-skilled Germany	1,344	0.09	0.03	0.04	0.18
	share of high-skilled Czech Republic	1,344	0.12	0.04	0.07	0.26
	population Germany	*1,344*	*852,862.40*	*624,671.70*	*215,678*	*3,434,581*
	population Czech Republic	*1,344*	*747,681.60*	*316,710.80*	*308,403*	*1,250,255*

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

Market size and agglomeration features

A wide range of explanatory variables in location studies refers to the impact of market size and agglomeration economies on the regional distribution of FDI (see the overview in Arauzo-Carod/Liviano-Solis/Manjón-Antolín 2010: 701 f.). For both Germany and the Czech Republic this study includes the most commonly used characteristics. The variables *GDP_GER* and *GDP_CZ* denote the regional gross domestic product (GDP, in millions of euros) in the German region of origin and the Czech destination region. Both GDP measures are incorporated in the regression as a measure of dimension and economic size of a region. Concerning *GDP_GER*, it can be assumed that, due to a higher market potential, multinational enterprises investing in the Czech Republic are to a higher extent located in regions with larger markets in terms of the GDP level. Therefore, a positive impact of this variable is expected on the number of investment projects. Similarly, Czech NUTS 3 target regions should attract more FDI projects if the gross domestic product *GDP_CZ* is larger. In cases where market access is the dominant motive for going abroad, regions with a larger market size in terms of overall GDP are supposed to have a superior potential for foreign investors.

The population densities *PopDens_GER* and *PopDens_CZ* are included in order to measure the agglomeration level of the German and Czech regions. Due to economies of scale multinationals should hypothetically be mainly located in more urbanised areas. For that reason the regional population density in Germany supposedly affects the number of cross-border investors in a positive way. Analogously, the population density of Czech NUTS 3 regions is incorporated in order to capture agglomeration effects. Due to the relatively large number of consumers, densely populated regions could act as appealing target areas for foreign investments. Population density can, however, also serve as a proxy for land price, for which, like in many previous studies, a direct measure is not available at the regional level used in this investigation. It can be assumed that the land price is highest in regions with a high population density as land is relatively scarce there compared to regions with a low population density. As a consequence, a high population density can have a negative impact on the location decision in the target country, too.

The GDP per capita represents a measure for the economic strength of a region. The prosperity of a region should be positively correlated to the number of cross-border investments in both the domestic and the target country. The locations of German multinationals at home are supposed to be related to the wealth of the regions of origin (*GDPpc_GER*). As far as the Czech host regions are concerned, investors should be attracted by relatively rich regions due the greater spending power of consumers (*GDPpc_CZ*).

Apart from the aforementioned variables that are considered as indicators for the regional market potential, the shares of employment in the tertiary sector are added as a measure for service agglomerations. The spatial distribution of multinational companies should be linked to the regional employment structure. Depending on the target sector of the investment (manufacturing or services) the number of FDI projects is assumed to differ with regard to the composition of the regional workforce. Having a strong position in manufacturing (services) industries implicates a comparative advantage for providing/receiving capital for manufacturing (services) activities. Regions with a relatively high share of employees in the secondary

(tertiary) sector should especially register a higher number of investors operating in the Czech manufacturing (service) sector. Therefore, the share of workers employed in the tertiary sector is included for each home and host region (*TertiarySector_GER* and *TertiarySector_CZ*).

Furthermore, two dummy variables denote the specific economic situation of two areas: *East_Germany* controls for spatial planning regions in the eastern federal states of Germany, denoting 1 if the German spatial planning region belongs to the New Laender (including Berlin), and 0 otherwise. Since the economic system in the New Laender, simultaneously as the Czech Republic, turned from plan to market just about 20 years ago, there are fewer headquarters of companies in eastern Germany compared to the western federal states. Actually, in the framework of the Council for Mutual Economic Assistance (Comecon) profound economic relations existed between the former German Democratic Republic and the Czechoslovak Socialist Republic. This head start of the New Laender over the Old Federal States in trading with the Czech Republic, however, disappeared in the early 1990s (Alecke/Mitze/Untiedt 2003). Consequently, it seems reasonable to assume that the number of investment projects of firms with headquarters in eastern Germany should be lower.

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. The metropolis constitutes the country's undisputed centre of economic activities, the most innovative Czech region (Bernard/Kostelecký/Patočková 2013), that serves as a hub for banks and financial services providers. The question is whether this particular target region attracts FDI projects by reason of its idiosyncratic characteristics (e.g. extraordinarily high standard of living, low unemployment, large proportion of high-skilled workers and the tertiary sector), or whether there is a specific capital-city effect.

Distance features

There are several measures of proximity between investment partners that are potentially relevant for FDI relations, e.g. the economic and the cultural distance, the affiliation to a trading bloc, similar political institutions etc. Taking into account the two-country case of this study, the following variables represent issues related to distance. As mentioned above, *Distance* expresses the driving time of a heavy-goods vehicle between the capital of a German spatial planning region and the capital of a Czech NUTS 3 region. Depending on the investment motives the driving time as a measure of the transport distance to the Czech destination and hence standing for trade costs has a different impact on the attractiveness of investments in the neighbouring country. Regarding investments which are executed mainly to reduce costs, a higher transport distance raises the costs for the exchange of intermediate inputs and is therefore supposed to have a negative effect on the number of investments. Concerning market development the direction of the impact is less clear. On the one hand, due to lower information and communication costs the implementation of subsidiaries should also be more attractive in nearby regions. On the other hand, German companies could be interested to gain access to consumer markets that are remote from the German-Czech border. In order to better exploit the customer potential, e.g. in the areas east of Prague, it might be advantageous for a German company to establish subsidiaries on-site compared to sup-

plying its Czech customers from locations in Germany. Thus, with respect to market motives both a negative and positive relationship between the number of FDI projects and distance are theoretically plausible.

Three dummy variables are incorporated in order to capture the potential relevance of locations in the German-Czech borderlands (for a discussion of border region issues see Topaloglou et al. 2005). In regions close to the border, transaction costs in terms of cross-cultural communication should be especially low. Typically, a higher share of the population living there has language skills of the other country and is familiar with the local customs that would reduce the foreign market entry costs. This could lead to enlarged foreign direct investments, apart from the advantageous lower transport costs that are captured by the driving time. The basic border region dummy *Border* only takes the value 1 if both German and Czech region are located in the frontier areas, and 0 otherwise. In addition, *Border_GER* and *Border_CZ* denote 1 if, in the former case only the German spatial planning region or, in the latter case only the Czech NUTS 3 region respectively, have a direct border with the other country, and 0 otherwise. Therefore, the variables control whether the borderlands are primarily affected by German-Czech FDI projects on the strength of geographically dense cross-border networks or if these regions are to an above-average extent connected to more remote areas of the neighbouring country.

Labour market features

Apart from agglomerations and distance, FDI may be attracted by factors that reflect the regional labour market situation. One essential indicator in this regard is the regional wage level. With regard to monthly gross wages per employee, higher wages in Germany (*Wages_GER*) refer to a higher productivity in the region which in turn could be correlated with the presence of a larger number of multinationals. Moreover, high labour costs in the home region could potentially increase the incentive for investors to go abroad for reasons of cost savings. Also in the Czech Republic the relationship between the location of multinational affiliates and regional wages (*Wages_CZ*) is theoretically ambivalent. While higher wages, reflecting a higher consumer purchasing power, play into the hands of multinationals that want to open up new markets, other investors are explicitly looking for low-wage sites for fragmenting their production processes.

Another attribute of the labour market of German and Czech regions is constituted by the regional unemployment rates. As for the German domestic regions a low unemployment rate (*Unemployment_GER*) stands for a favourable economic situation and potentially for the scarcity of labour supply that prompts the expansion of firm activities abroad, a negative correlation is supposed between the unemployment rate and the number of investors. Regarding the Czech Republic, the relationship is fairly ambiguous. On the one hand, high unemployment rates (*Unemployment_CZ*) signal the availability of workers that possibly attracts investors in search of cheap labour. On the other hand, high levels of unemployment are typically associated with laggard regions where weak economic structures and pending social problems rather distract investments. For both countries unemployment rates can be interpreted as a proxy for regional investment and/or tax incentives that preferably are grant-

ed in underdeveloped regions, for which, however, no data are at disposal at the corresponding regional level.

The share of high-skilled employees in a region serves as a proxy for the relative endowment with human capital that relates also to research and development activities and the innovativeness of a region. Therefore, as far as Germany is concerned, a higher proportion of high-skilled employees (*High_Skilled_GER*) should be associated with a larger number of multinational investors. The availability of a highly qualified workforce can be a locational advantage for regions in the Czech Republic competing for FDI, if foreign investors search for a creative and innovative business environment. An above-average share of high-skilled employees (*High_Skilled_CZ*) could, however, also be opposed to the demands of multinational companies. This would be the case, if less skill-intensive production steps are offshored which require a relatively large supply of low-skilled workers.

5 Estimation Method and Specifications

The econometric investigation of the central research topic of this study, the regional pattern of German mothers and Czech daughters, builds on the application of the gravity equation. In general, this approach rests on the hypothesis that the volume of trade between two regions can be explained in large parts by the size or economic strength of the regions and the distance between them. The basic form of the equation is derived from Newton's law of universal gravitation saying that the gravitational force between any two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres. Tinbergen (1962) brought this approach forward to "social physics" in order to analyse trade flows between countries. Apart from estimating trade flows, gravity equations are also an instrument for the investigation of FDI relations between countries. In a basic version of the gravity equation, it is assumed that the GDP of both exporting and importing 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. Concerning transport distance $Dist_{ij}$ between the involved countries or regions, a negative impact is supposed due to rising transport costs as distance increases. Thus, the basic equation can be written as

$$FDI_{ij} = \alpha_0 GDP_i^{\alpha_1} GDP_j^{\alpha_2} Dist_{ij}^{\alpha_3} \varepsilon_{ij}, \tag{1}$$

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

$$E\left(\varepsilon_{ij} | GDP_i, GDP_j, Dist_{ij}\right) = 1. \tag{2}$$

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

$$ln\, FDI_{ij} = ln\, \alpha_0 + \alpha_1 \ln GDP_i + \alpha_2 \ln GDP_j + \alpha_3\, ln\, Dist_{ij} + \ln \varepsilon_{ij}. \tag{3}$$

This course of action, however, gives cause for criticism. First, due to Jensen's inequality $E(\ln y) \neq \ln \mathrm{E}(y)$, the estimation of the log-linearised gravity equation produces inconsistent results in the presence of heteroscedastic error terms. Second, 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 (Santos Silva/Tenreyro 2006).

In order to tackle these problems the strategy of Santos Silva/Tenreyro (2006) suggests in the case of data situations and research questions like the present to estimate a Poisson Pseudo-Maximum Likelihood (PPML) model that is robust to heteroscedasticity and accounts for zero observations. Poisson models are classically used for dealing with count data that indicate the number of occasions of a certain event (for a detailed discussion of count data 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

$$f(\mathrm{y_i}|\mathrm{x_i}) = \frac{\mathrm{e}^{-\mu_i} \cdot \mu_i^{\mathrm{y_i}}}{\mathrm{y_i}!}, \qquad y_i = 0,1,2, \ldots \tag{4}$$

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

$$\mathrm{E}[\mathrm{y_i}|\mathrm{x_i}] = \mu_\mathrm{i} = \exp(\mathrm{x_i'}\beta). \tag{5}$$

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 β can be estimated consistently by the Maximum Likelihood Method.

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

$$\mu_\mathrm{i} = \mathrm{E}[\mathrm{y_i}|\mathrm{x_i}] = \mathrm{Var}[\mathrm{y_i}|\mathrm{x_i}] \quad \text{(equidispersion)} \tag{6}$$

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

$$\mathrm{Var}[\mathrm{y_i}|\mathrm{x_i}] = \mathrm{E}[\mathrm{y_i}|\mathrm{x_i}] \cdot \{1 + \alpha \cdot \mathrm{E}[\mathrm{y_i}|\mathrm{x_i}]\}, \tag{7}$$

a Negative Binomial model (NegBin) 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, *lnalpha* denotes the logarithmic value. If *alpha* is significantly different from zero, the equidispersion assumption is violated and the estimation of the NegBin II model is preferred. Alternatively, the estimation of a

Poisson regression with robust standard errors is favoured if *alpha* is not statistically different from zero. In both cases, the coefficients are estimated consistently and the t-statistics follow a normal distribution and can be interpreted in the usual way. Different models can be compared by means of selection criteria and the likelihood.

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 spatial planning region i ($i = 1,\ldots,96$) and a Czech affiliate being located in a specific Czech NUTS 3 region j ($j = 1,\ldots,14$). This variable takes the value zero or positive, integer values. The information on the sectoral affiliation of the Czech firms involved in the FDI projects, available from the ČEKIA database, allows a distinction between investments dedicated to the Czech manufacturing sector and to the Czech service sector in further specifications. Apart from regional GDP for both sides of the border and distance as the key components of gravity models further variables are included which refer to agglomeration economies, border region issues and labour market characteristics in order to explain regional differences in the investment pattern. The number of German-Czech FDI projects is regressed on the set of control variables that have been introduced above. The Czech variables population density, GDP per capita and the employment share in the tertiary sector, all controlling for agglomeration features, show a high correlation with the Prague dummy. Therefore, two versions of this specification are estimated after incorporating these variables into the regression model, once with and once without the observations for Prague (representing 96 combinations with German regions of origin).

6 Results

Table 3 to 5 show the results for total, manufacturing and services FDI projects. In all estimations, *alpha* is significantly different from zero. Therefore, the results presented here are based on Negative Binomial regressions, whereby the outcomes of the Poisson regressions are not fundamentally different.[2] As apart from the dummies, the explanatory variables enter the equation in log form, the coefficient values represent elasticities. In the first specification, only the core variables of the gravity model are included, i.e. the regional GDP values of Germany and the Czech Republic and the distance between home and host region (1). With respect to both countries, FDI projects are particularly arranged in economically large regions. For all samples (total FDI projects, manufacturing, services), the coefficient for German GDP is close to 1, i.e. in the case when all FDI projects are considered, a 1% rise of GDP in a German region implicates an increase of 1.11% in cross-border FDI projects performed in the corresponding Czech NUTS 3 region. A higher level of Czech regional GDP by 1% involves a growth in the number of FDI projects by 0.74%. If only investments in the Czech manufacturing sector are subject of the analysis, the coefficient is also positive, but statistically insignificant. The insignificant result, however, is formidably driven by the capital of Prague where total GDP is high, but FDI in manufacturing is ceteris paribus performed by a relatively low number of German multinationals. Across the board, the transport distance in

[2] The Poisson estimation results are available from the authors upon request.

terms of driving time exhibits a significantly negative outcome around the value of 2, indicating that proximity is a favourable factor for foreign direct investment. In the overall sample, an increase of the driving time by 1% between the German and the Czech region is connected with a 1.96% decrease of common FDI projects. To put it in a nutshell, the results for the core variables of the gravity model are fairly near the theoretical basics of the model.[3]

In a next step, besides economic size and distance also labour market conditions are considered in the regressions by including regional wage levels of both countries (2). The coefficients for the GDP variables show highly significant values at lower levels. The noticeable exemption is the result for the Czech GDP level in the case of manufacturing that becomes now significantly positive, too. The outcome for German wages is significantly positive for all groups, whereas the result for Czech wages varies with the underlying sample of investment projects. On the one hand, investment projects in manufacturing industries are predominantly located in Czech low-wage regions, exemplified by the significantly negative coefficient. On the other hand, concerning the total population of FDI projects and investments in the service sector the coefficient takes significantly positive values. This means that FDI is attracted by Czech regions with relatively high wages. This outcome is a first indication for differences in the investment strategy of firms along the lines of the economic sector they are affiliated to, manufacturing or services.

The obvious question arises as to how stable the results achieved so far are, if further variables are entered into the regression. In order to get a clearer picture of the situation on the regional labour market, unemployment rates and high-skilled shares are considered in the succeeding estimation version. Furthermore, a set of dummy variables is added to the equation. On the one hand, the descriptive figures give reason to account for the idiosyncratic economic conditions in eastern Germany and Prague. On the other hand, the specifics of the borderlands in the two countries, which impact the investment climate beyond the effect of transport distance, are reflected by respective binary variables. The results for the core variables of the gravity model do not change qualitatively (3). In contrast, the regional wage level in Germany takes in all cases now a negative value, but not at a significant level. The result for Czech wages is again ambiguous, whereby all coefficients in this estimation version are insignificant. Unemployment rates obviously do not play an overwhelming role for the explanation of the regional FDI pattern in the home country. Considering FDI in the Czech manufacturing sector, the coefficient for German unemployment rates is significantly negative at the 10 percent level, meaning that ceteris paribus the headquarters of multinationals are to a higher degree located in regions with relatively low unemployment rates. In the case of total FDI projects and manufacturing FDI the coefficient for unemployment in the Czech regions is

[3] With regard to the timing of the investment, all regressions were also run after splitting the dataset into three subsamples according to the market entry of the German firms (1990-1996, 1997-2003, 2004-2010). A weakening of the discouraging effect of distance over time, that was found by Mühlen/Nunnenkamp (2011), cannot be identified in this study. By using slightly different time periods, the coefficient of distance in the investigation of Mühlen/Nunnenkamp (2011) is, however, also significantly negative across time, whereas the size of the coefficient is smaller for FDI latecomers compared to FDI early movers. A possible explanation for the deviating findings of this study is the differing sample of firms (total population vs. mostly large and medium firms).

also marginally significant. The significant outcomes disappear, however, in the following specifications. The findings for the high-skilled share are more clear-cut in the Czech case: the negative results for the high-skilled share in German regions are partially significant but are not corroborated in the following regressions, whereas there is a clearly positive relationship between the high-skilled share in the Czech Republic and the number of investors, particularly for investments in the manufacturing sector. Not surprisingly, FDI projects with investors that have their headquarters in eastern Germany are represented significantly below average. More precisely, the number of cross-border projects that are initiated in the New Laender lies 69.66% (corresponding to $e^{\beta(EastGermany)} - 1 = \mathrm{e}^{-1.1928} - 1 = -0.6966$) below the ceteris paribus level of combinations with western German headquarters. Concerning the capital city of the Czech Republic, Prague does not allure German multinational investors through individual factors that go beyond its outstanding characteristics captured by the other control variables. As mentioned above, this becomes particularly obvious with respect to the manufacturing sector, where the coefficient for Prague is significantly negative. What should catch the attention are the results for the border dummies that stand for cultural and social distance issues, in addition to the transport distance variable. The basic border dummy captures regional combinations where both the German and the Czech region are situated in the borderlands. The significantly positive outcome means that beyond the driving time between locations of mother and daughter company, there is a specific location advantage in the areas close to the neighbour country with ceteris paribus 231.58% ($e^{1.1987} - 1 = 2.3158$) more projects compared to combinations with both the German and the Czech region not belonging to the borderlands. This can be traced back to the relatively low threshold to invest across the border caused by network and spillover effects, tacit knowledge or the above-average opportunities of transnational exchange in border regions. The significantly positive coefficient seems to reflect particularly the attractiveness of the Czech borderlands, as the additional dummy for combinations, in which only the German headquarters is situated in the borderlands, takes negative values that are in all cases at a significant level. This result sheds light on asymmetries with regard 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, as there are no significantly negative results for the pure Czech border dummy, it can be concluded that the Czech regions near the common border represent an attractive target destination for investors from all over Germany.

The final specifications are characterised by the incorporation of further explanatory variables which relate to agglomeration economies. As the additional variables population density, GDP per capita and the employment share of the tertiary sector show, for the Czech part, 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. In large part, the estimation results are very similar for the two versions. For both countries, the inclusion of regional GDP per capita does not yield significant results across the board. The significant positive coefficient for the population density in Germany implies the advantageous role of agglomerative areas for multinational enterprises. The marginally negative coefficient (at the 10 percent significance level) for population density in the Czech Republic in the case of in-

vestments in Czech services is somewhat surprising. It has to be reminded, however, that beside Prague all of the remaining 13 regional units in the host country contain larger cities and more densely populated areas, so that the informative value of this variable is rather limited. The result for the employment share in the tertiary sector differs between the two countries. The coefficient value for Germany is persistently negative at a highly significant level. This outcome can be interpreted in the sense that after controlling for GDP, wage and education levels etc. a strong representation of the services industry is ceteris paribus not a determinant for the regional accumulation of headquarters of German multinationals. In the Czech case, the regions with a higher employment share in tertiary industries are to a higher extent involved in FDI projects. This result is, quite understandably, based on investments in the Czech service sector, while the coefficient for the manufacturing sector is negative, though at an insignificant level. With regard to the other right-hand-side variables, most results do not deviate essentially from the previous outcomes. Remarkably, the outcome for regional wages is now more pronounced. In all estimations, higher wages in German regions are ceteris paribus unambiguously correlated with a lower number of headquarters. Agglomeration and productivity effects that in theory are positively connected with the location of multinational firms are apparently captured by other variables like population density and GDP. Concerning Czech wages the negative coefficient at the margin of significance in the manufacturing sector along with a significantly positive value for services points to a diverging pattern of German FDI in the Czech Republic. On the one hand, investments in manufacturing industries are possibly driven by cost-cutting motives in a large number of cases. German multinationals vertically split up the production process and offshore part of the activities to the Czech Republic in order to save labour expenses. In this context, it is noteworthy that the coefficient for the high-skilled share in the Czech regions is highly significant for FDI projects in the manufacturing sector. Thus, German multinationals are evidently searching for a cost-efficient, yet well-educated workforce. On the other hand, FDI projects in the service sector are presumably to a greater extent aimed at gaining market access. While these investments are preferably performed in regions with a high employment share in the tertiary sector, low wages are not a relevant location factor in this case. In contrast, higher wages are positive for horizontal FDI, as they display a higher consumer purchasing power.

Table 3: Estimation results 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	**1.1102*** **	0.0476	**0.7992*** **	0.0587	**1.1877*** **	0.0700	**1.1517*** **	0.0792	**1.1529*** **	0.0854
	ln GDP CZ	**0.7423*** **	0.0487	**0.4839*** **	0.1097	**0.5919*** **	0.1285	**0.6392*** **	0.1901	**0.7068*** **	0.1900
	ln PopDens GER							**0.4156*** **	0.0700	**0.4132*** **	0.0768
	ln PopDens CZ							**-0.3120**	0.2213	**-0.2994**	0.2189
	ln GDPpc GER							**0.3188**	0.3213	**0.2727**	0.3495
	ln GDPpc CZ							**-0.5920**	1.0729	**-0.8765**	1.0648
	ln Tertiary Sector GER							**-3.5722*** **	0.5026	**-4.2097*** **	0.5408
	ln Tertiary Sector CZ							**2.6106*** **	0.6965	**2.5162*** **	0.6900
	East Germany					**-1.1928*** **	0.1998	**-1.6747*** **	0.2155	**-1.8769*** **	0.2329
	Prague					**-0.1341**	0.3099	**0.5767**	1.0378		
distance	ln Distance	**-1.9624*** **	0.0867	**-1.9161*** **	0.0909	**-2.0732*** **	0.1405	**-2.1094*** **	0.1441	**-2.2044*** **	0.1507
	Border					**1.1987*** **	0.2065	**1.2219*** **	0.1948	**1.1462*** **	0.2024
	Border GER					**-0.4659*** **	0.1559	**-0.5908*** **	0.1541	**-0.6528*** **	0.1660
	Border CZ					**0.2298*** **	0.0811	**-0.0399**	0.1348	**-0.0318**	0.1333
labour market	ln Wage GER			**3.4707*** **	0.4304	**-0.9621**	0.6943	**-4.4846*** **	0.8793	**-5.3239*** **	0.9512
	ln Wage CZ			**1.6347*** **	0.6286	**0.6129**	1.4021	**0.8199**	1.4280	**0.2734**	1.4298
	ln Unemployment GER					**-0.0558**	0.1249	**0.0298**	0.1631	**0.0844**	0.1759
	ln Unemployment CZ					**0.3719***	0.1958	**0.3492**	0.2973	**0.3649**	0.2939
	ln High-Skilled GER					**-0.3247** **	0.1524	**0.0992**	0.1636	**0.1764**	0.1762
	ln High-Skilled CZ					**0.9137*** **	0.2019	**0.5462***	0.2920	**0.6465** **	0.2913
	Constant	**-4.9171*** **	0.7287	**-38.1698*** **	4.5161	**1.9159**	10.8827	**30.8659***	15.7858	**44.5637*** **	16.1214
	N	1344		1344		1344		1344		1248	
	Pseudo-R^2	0.1651		0.1781		0.2125		0.2297		0.2075	
	Loglikelihood	-2332.95		-2296.79		-2200.56		-2152.67		-1879.47	
	Alpha	0.7381***		0.6582***		0.3992***		0.3307***		0.3211***	

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

Table 4: Estimation results of Negative Binomial regressions for manufacturing FDI projects

Manufacturing FDI		(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	**0.9660*** **	0.0595	**0.6119*** **	0.0740	**1.1170*** **	0.0932	**1.2068*** **	0.1065	**1.2066*** **	0.1107
	ln GDP CZ	**0.1007**	0.0709	**0.6190*** **	0.1430	**0.5034*** **	0.1599	**0.7902*** **	0.2368	**0.8425*** **	0.2376
	ln PopDens GER							**0.3791*** **	0.0985	**0.3652*** **	0.1039
	ln PopDens CZ							**0.0033**	0.2745	**0.0161**	0.2741
	ln GDPpc GER							**-0.0788**	0.4357	**0.0065**	0.4543
	ln GDPpc CZ							**-1.8529**	1.3487	**-2.0301**	1.3483
	ln Tertiary Sector GER							**-4.8428*** **	0.6694	**-5.4674*** **	0.6996
	ln Tertiary Sector CZ							**-0.2116**	0.8787	**-0.3072**	0.8774
	East Germany					**-1.3246*** **	0.2698	**-2.2370*** **	0.2983	**-2.4217*** **	0.3147
	Prague					**-0.9230** **	0.4014	**0.5228**	1.2988		
distance	ln Distance	**-1.6165*** **	0.1060	**-1.9058*** **	0.1151	**-1.9973*** **	0.1768	**-2.2018*** **	0.1816	**-2.2957*** **	0.1864
	Border					**1.0779*** **	0.2502	**1.0956*** **	0.2351	**1.0608*** **	0.2429
	Border GER					**-0.3859***	0.2010	**-0.6031*** **	0.1986	**-0.6664*** **	0.2090
	Border CZ					**0.1306**	0.1023	**0.1978**	0.1685	**0.2014**	0.1682
labour market	ln Wage GER			**4.1213*** **	0.5434	**-1.2951**	0.9167	**-5.0335*** **	1.1760	**-5.3657*** **	1.2275
	ln Wage CZ			**-3.6424*** **	0.8899	**-1.4136**	1.7328	**-2.6658**	1.7648	**-3.1054***	1.7732
	ln Unemployment GER				6.1985	**-0.2873***	0.1654	**0.0303**	0.2217	**0.1741**	0.2321
	ln Unemployment CZ					**0.4261***	0.2561	**0.3937**	0.3770	**0.4158**	0.3763
	ln High-Skilled GER					**-0.3568***	0.1996	**0.2972**	0.2158	**0.3718**	0.2263
	ln High-Skilled CZ					**0.8410*** **	0.2635	**1.2046*** **	0.3686	**1.2841*** **	0.3693
	Constant	**-0.7174**	0.9732	**-8.45924**	6.1985	**17.5842**	13.7014	**70.7777*** **	19.8292	**77.7939*** **	20.1111
	N	1344		1344		1344		1344		1248	
	Pseudo-R^2	0.1160		0.1363		0.1764		0.1964		0.1996	
	Loglikelihood	-1556.02		-1520.37		-1449.82		-1414.56		-1309.57	
	Alpha	0.9016***		0.7779***		0.4134***		0.3156***		0.3085***	

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

Table 5: Estimation results of Negative Binomial regressions for services FDI projects

Services FDI		(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	**1.1820*** **	0.0564	**0.9151*** **	0.0695	**1.2576*** **	0.0855	**1.1425*** **	0.0947	**1.1379*** **	0.1068
	ln GDP CZ	**1.0571*** **	0.0556	**0.4777*** **	0.1312	**0.6026*** **	0.1599	**0.5783** **	0.2422	**0.6609*** **	0.2441
	ln PopDens GER							**0.4460*** **	0.0834	**0.4672*** **	0.0957
	ln PopDens CZ							**-0.5412***	0.3090	**-0.5239***	0.3072
	ln GDPpc GER							**0.3383**	0.3843	**0.3141**	0.4387
	ln GDPpc CZ							**-0.7561**	1.4123	**-1.1101**	1.4111
	ln Tertiary Sector GER							**-2.4125*** **	0.6084	**-2.9621*** **	0.6868
	ln Tertiary Sector CZ							**5.3736*** **	0.8840	**5.2009*** **	0.8805
	East Germany					**-1.3506*** **	0.2433	**-1.5435*** **	0.2564	**-1.7293*** **	0.2874
	Prague					**-0.4998**	0.3720	**0.1269**	1.3866		
distance	ln Distance	**-2.1494*** **	0.1058	**-1.9809*** **	0.1093	**-2.1742*** **	0.1702	**-2.1304*** **	0.1726	**-2.2462*** **	0.1849
	Border					**1.3032*** **	0.2405	**1.2881*** **	0.2257	**1.1811*** **	0.2451
	Border GER					**-0.5506*** **	0.1905	**-0.5580*** **	0.1873	**-0.6243*** **	0.2121
	Border CZ					**0.3357*** **	0.1022	**-0.1632**	0.1770	**-0.1534**	0.1762
labour market	ln Wage GER			**2.7775*** **	0.5071	**-1.3571**	0.8414	**-4.2076*** **	1.0567	**-5.3957*** **	1.2016
	ln Wage CZ			**3.4549*** **	0.7248	**2.7385**	1.7460	**3.9921** **	1.7958	**3.2639***	1.8137
	ln Unemployment GER					**0.1737**	0.1526	**-0.0052**	0.1977	**0.0104**	0.2226
	ln Unemployment CZ					**0.3631**	0.2371	**0.2358**	0.3901	**0.2552**	0.3880
	ln High-Skilled GER					**-0.2334**	0.1857	**0.0282**	0.1963	**0.0618**	0.2199
	ln High-Skilled CZ					**1.1838*** **	0.2385	**0.3245**	0.3648	**0.4496**	0.3669
	Constant	**-8.0072*** **	0.8575	**-46.1991*** **	5.1893	**-8.5639**	13.3316	**10.8752**	19.6550	**28.7203**	20.3929
	N	1344		1344		1344		1344		1248	
	Pseudo-R^2	0.1974		0.2100		0.2452		0.2643		0.2205	
	Loglikelihood	-1738.29		-1711.14		-1634.74		-1593.50		-1335.68	
	Alpha	0.8239***		0.7077***		0.4084***		0.3197***		0.3243***	

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

7 Conclusions

Many studies deal with the reasons for the rise in foreign direct investment, as the activities of multinational firms are likely to influence the interregional allocation of productive resources and wealth. Among the central and eastern European countries, the Czech Republic represents a highly appealing target country for German direct investments. On the one hand, the still existing wage gap offers an opportunity for companies to take advantage of lower costs by offshoring activities across the border. On the other hand, the rising purchasing power of Czech consumers is attractive for the opening up of new markets. In order to investigate the main determinants of FDI it is, however, crucial also to take a look at the regional level. With regard to theoretical considerations and the related literature, for both the home and the host country of FDI, market size and agglomeration economies, distance features and labour market issues should matter. The analysis of the regional determinants of FDI locations rests on the gross sample of the IAB-ReLOC project, a newly established database which covers the total population of German multinationals and their affiliates in the Czech Republic. The dataset exceeds by far the number of investors in other studies that use databases dealing with German FDI and encompasses both investments in the manufacturing and in the service sector. The contribution of this paper is not least based on the availability of information on firms and regions on both sides of the border.

In order to investigate the regional determinants for German investment projects in the Czech Republic for the home and the host country, the number of investments is calculated as regional combinations between German spatial planning regions and Czech NUTS 3 regions. As can be seen from the descriptive figures, the largest cities and the borderlands play a major role for the location of headquarters in Germany and affiliates in the Czech Republic. Regarding the host country, this result corroborates the findings by Rehner (1998) and Spilková (2007). In the econometric part of the analysis, the applied specifications of the gravity model take account for the large number of zero counts. The analysis of the data yields results with regard to the relevance and impact of regional factors on FDI activities of German multinational firms in the Czech Republic. The findings of this article broadly confirm the expected predictions. The core variables of the gravity model, GDP and distance, can be regarded as the main determinants for German-Czech FDI relations, as it was found out by Bevan/Estrin (2004) in a study on European transition economies. Concerning both headquarters in the German region of origin and affiliates in the Czech target region, cross-border FDI projects are preferably located in regions with high GDP levels. The transport distance is negatively correlated with the number of investors in a spatial planning region in combination with a Czech NUTS 3 target region. While the eastern German New Laender are significantly less engaged in investments in the neighbouring country, the status of the capital Prague as a unique centre of attraction for German investors can be explained by its idiosyncratic characteristics. The fairly sparsely populated border regions hold a particularly strong position, where, apart from the low distance, further advantages drive investments from Germany to the Czech Republic. The German borderlands are primarily home to investors that provide capital for FDI projects directly across the border, whereas investments in more remote Czech regions are performed at a below-average level. In contrast, the Czech regions close to Germany are also attracting FDI from German non-border regions at an average rate.

Concerning the sector in which the investment takes place, distinctions can be observed between the manufacturing and the service sector. Not surprisingly, investments in services flow predominantly to regions with a high employment share in the tertiary sector. With respect to regional wages, the results indicate differences in the motives behind the FDI decision. The subsidiaries of German multinationals investing in the Czech service sector are found in regions with above-average wages, suggesting that horizontal FDI is the dominant mode in this sector, i.e. investing firms are essentially interested in gaining market access. In contrast, there is no significant or a slightly negative correlation between Czech wages and the number of affiliates operating in the manufacturing sector, pointing to investors that vertically fragment their production processes for reasons of cost savings. The result of sectoral differences is in line with the findings of Münich et al. (2013) who explored a technology gap between German mother firms and Czech daughters for the manufacturing sector but not for services. Interestingly, above all German capital providers for manufacturing FDI projects are inclined to invest in Czech regions with a relatively large supply of high-skilled workers. The outcome that well-qualified labour represents an important location factor for FDI confirms the results of other studies (e.g. Gauselmann/Marek 2012; Hilber/Voicu 2010; Marin 2004; Spilková 2007). Generally, this finding is in line with the impression of Arauzo-Carod/Liviano-Solis/Manjón-Antolín (2010) stating in their review of the literature that investors prefer locations with an on average more educated, but less paid workforce.

All in all, the findings illustrate the relevance of regional aspects for firms to perform foreign direct investment. There is, however, enough space left for follow-up studies. The interdependence between transport costs and the motives of the firms for going abroad should be taken under closer scrutiny. There may be differences between the location of brownfield and greenfield investments, a topic where also the time dimension could play a crucial role. Spatial autoregressive relationships could be analysed if data for smaller regional units were available. Furthermore, considering the size of FDI projects is an important matter with respect to the regional distribution of investors and their subsidiaries. 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.

References

Alecke, Björn; Mitze, Timo; Untiedt, Gerhard (2003): Das Handelsvolumen der ostdeutschen Bundesländer mit Polen und Tschechien im Zuge der EU-Erweiterung: Ergebnisse auf Basis eines Gravitationsmodells. In: Vierteljahrshefte zur Wirtschaftsforschung, 72(4)**:** 565-578.

Amiti, Mary; Wei, Shang-Jin (2005): Fear of Service Outsourcing: Is it Justified? In: Economic Policy, 20(42)**:** 308-347.

Anderson, James E.; van Wincoop, Eric (2003): Gravity with Gravitas: A Solution to the Border Puzzle. In: The American Economic Review, 93(1)**:** 170-192.

Arauzo-Carod, Josep-Maria; Liviano-Solis, Daniel; Manjón-Antolín, Miguel (2010): Empirical Studies in Industrial Location: An Assessment of their Methods and Results. In: Journal of Regional Science, 50(3)**:** 685-711.

Arauzo-Carod, Josep-Maria; Viladecans-Marsal, Elisabet (2009): Industrial Location at the Intra-Metropolitan Level: The Role of Agglomeration Economies. In: Regional Studies, 43(4)**:** 545-558.

Barba Navaretti, Giorgio; Haaland, Jan I.; Venables, Anthony J. (2002): Multinational Corporations and Global Production Networks: The Implications for Trade Policy. Report prepared for the European Commission. Directorate General for Trade. London: Centre for Economic Policy Research (CEPR).

Barbosa, Natália; Guimarães, Paulo; Woodward, Douglas (2004): Foreign firm entry in an open economy: the case of Portugal. In: Applied Economics, 36(5)**:** 465-472.

Basile, Roberto; Castellani, Davide; Zanfei, Antonello (2009): National boundaries and the location of multinational firms in Europe. In: Papers in Regional Science, 88(4)**:** 733-748.

Bergin, Paul R.; Feenstra, Robert C.; Hanson, Gordon H. (2009): Offshoring and Volatility: Evidence from Mexico's Maquiladora Industry. In: The American Economic Review, 99(4)**:** 1664-1671.

Bernard, Josef; Kostelecký, Tomáš; Patočková, Věra (2013): The Innovative Regions in the Czech Republic and their Position in the International Labour Market of Highly Skilled Workers. In: Regional Studies**:** online first.

Bevan, Alan A.; Estrin, Saul (2004): The determinants of foreign direct investment into European transition economies. In: Journal of Comparative Economics, 32(4)**:** 775-787.

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

Blomström, Magnus; Kokko, Ari (1998): Multinational Corporations and Spillovers. In: Journal of Economic Surveys, 12(3)**:** 247-277.

Blonigen, Bruce A. (1997): Firm-Specific Assets and the Link between Exchange Rates and Foreign Direct Investment. In: The American Economic Review, 87(3)**:** 447-465.

Blonigen, Bruce A.; Davies, Ronald B.; Waddell, Glen R.; Naughton, Helen T. (2007): FDI in space: Spatial autoregressive relationships in foreign direct investment. In: European Economic Review, 51(5)**:** 1303-1325.

Brainard, S. Lael (1997): An Empirical Assessment of the Proximity-Concentration Trade-off Between Multinational Sales and Trade. In: The American Economic Review, 87(4)**:** 520-544.

Buch, Claudia M.; Kleinert, Jörn; Lipponer, Alexander; Toubal, Farid (2005): Determinants and Effects of Foreign Direct Investment: Evidence from German Firm-Level Data. In: Economic Policy, 20(41)**:** 52-110.

Buch, Claudia M.; Kleinert, Jörn; Toubal, Farid (2003): Determinants of German FDI: New Evidence from Micro-Data. Discussion Paper 09/03. Economic Research Centre of the Deutsche Bundesbank.

Budd, John W.; Konings, Jozef; Slaughter, Matthew J. (2005): Wages and International Rent Sharing in Multinational Firms. In: The Review of Economics and Statistics, 87(1)**:** 73-84.

Büttner, Thiess; Rincke, Johannes (2007): Labor Market Effects of Economic Integration – the Impact of Unification in German Border Regions. In: German Economic Review, 8(4)**:** 536-560.

Cameron, A. Colin; Trivedi, Pravin K. (1998): Regression Analysis of Count Data, Cambridge: Cambridge University Press.

Chen, Maggie; Moore, Michael (2010): Location decision of heterogeneous multinational firms. In: Journal of International Economics, 80(2)**:** 188-199.

Chidlow, Agnieszka; Salciuviene, Laura; Young, Stephen (2009): Regional determinants of inward FDI distribution in Poland. In: International Business Review, 18(2)**:** 119-133.

Cieślik, Andrzej (2005a): European integration, national border effects and the location of multinational enterprises in Poland: the case of new Voivodships. In: Brussels Economic Review, 48(3): 247-260.

Cieślik, Andrzej (2005b): Location Of Foreign Firms And National Border Effects: The Case Of Poland. In: Tijdschrift voor Economische en Sociale Geografie, 96(3): 287-297.

Coughlin, Cletus C.; Segev, Eran (2000): Location Determinants of New Foreign-Owned Manufacturing Plants. In: Journal of Regional Science, 40(2): 323-351.

Deutsche Bundesbank (2013): Bestandserhebung über Direktinvestitionen. Statistische Sonderveröffentlichung. Frankfurt: Deutsche Bundesbank.

Dinga, Marián; Münich, Daniel (2010): The impact of territorially concentrated FDI on local labor markets: Evidence from the Czech Republic. In: Labour Economics, 17(2): 354-367.

Disdier, Anne-Célia; Mayer, Thierry (2004): How different is Eastern Europe? Structure and determinants of location choices by French firms in Eastern and Western Europe. In: Journal of Comparative Economics, 32(2): 280-296.

Eurostat (2012): Labour costs in the EU27 in 2011. Eurostat news release 63/2012 - 24 April 2012.

Feenstra, Robert C. (2010): Offshoring in the Global Economy, Microeconomic Structure and Macroeconomic Implications, Cambridge, MA: MIT Press.

Feenstra, Robert C.; Hanson, Gordon H. (1997): Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras. In: Journal of International Economics, 42(3-4): 371-393.

Gauselmann, Andrea; Marek, Philipp (2012): Regional determinants of MNE's location choice in post-transition economies. In: Empirica, 39(4): 487-511.

Guimarães, Paulo; Figueiredo, Octávio; Woodward, Douglas (2000): Agglomeration and the Location of Foreign Direct Investment in Portugal. In: Journal of Urban Economics, 47(1): 115-135.

Hanson, Gordon H. (1996): Economic Integration, Intraindustry Trade, and Frontier Regions. In: European Economic Review, 40(3-5): 941-949.

Hanson, Gordon H. (1998): Regional Adjustment to Trade Liberalization. In: Regional Science and Urban Economics, 28(4): 419-444.

Hanson, Gordon H.; Mataloni, Raymond J., Jr.; Slaughter, Matthew J. (2001): Expansion Strategies of U.S. Multinational Firms. National Bureau of Economic Research Working Paper Series. Cambridge, MA.

Hayakawa, Kazunobu; Matsuura, Toshiyuki (2011): Trade Liberalization and FDI Strategy in Heterogeneous Firms: Evidence from Japanese firm-level data: Research Institute of Economy, Trade and Industry (RIETI).

Hayter, Roger (1997): The Dynamics of Industrial Location: The Factory, the Firm and the Production System, Chichester: Wiley.

Head, Keith; Ries, John; Swenson, Deborah (1995): Agglomeration benefits and location choice: Evidence from Japanese manufacturing investments in the United States. In: Journal of International Economics, 38(3): 223-247.

Head, Keith; Ries, John; Swenson, Deborah (1999): Attracting foreign manufacturing: Investment promotion and agglomeration. In: Regional Science and Urban Economics, 29(2): 197-218.

Hecht, Veronika; Litzel, Nicole; Schäffler, Johannes (2013): The ReLOC project – method report for implementing a cross-border company survey in Germany and the Czech Republic. IAB-Forschungsbericht 04/2013. Nürnberg: Institut für Arbeitsmarkt- und Berufsforschung.

Helpman, Elhanan (1984): A Simple Theory of International Trade with Multinational Corporations. In: Journal of Political Economy, 92(3): 451-471.

Helpman, Elhanan; Melitz, Marc J.; Yeaple, Stephen R. (2004): Export versus FDI with Heterogeneous Firms. In: The American Economic Review, 94(1): 300-316.

Hilber, Christian; Voicu, Ioan (2010): Agglomeration Economies and the Location of Foreign Direct Investment: Empirical Evidence from Romania. In: Regional Studies, 44(3): 355-371.

Jacobs, Jane (1969): The Economy of Cities, New York: Vintage.

Kandilov, Ivan; Grennes, Thomas (2010): The determinants of service exports from Central and Eastern Europe. In: Economics of Transition, 18(4): 763-794.

Kandilov, Ivan; Grennes, Thomas (2012): The determinants of service offshoring: Does distance matter? In: Japan and the World Economy, 24(1): 36-43.

Krugman, Paul R. (1991): Increasing returns and economic geography. In: Journal of Political Economy, 99(3): 483-499.

Lipsey, Robert E. (2006): Measuring the Impacts of FDI in Central and Eastern Europe. National Bureau of Economic Research Working Paper Series. Cambridge, MA.

Marin, Dalia (2004): A Nation of Poets and Thinkers: Less so with eastern Enlargement? Austria and Germany. CEPR Discussion Paper 4358.

Markusen, James R. (2002): Multinational Firms and the Theory of International Trade, Cambridge, MA: MIT Press.

Marshall, Alfred (1890): Principles of Economics, London: Macmillan.

McCallum, John (1995): National Borders Matter: Canada-U.S. Regional Trade Patterns. In: The American Economic Review, 85(3): 615-623.

McFadden, Daniel (1974): Conditional Logit Analysis of Qualitative Choice Behavior. In: Zarembka, Paul: Frontiers in Econometrics, New York: Academic Press, p. 105-142.

Melitz, Marc J. (2003): The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. In: Econometrica, 71(6): 1695-1725.

Mühlen, Henning; Nunnenkamp, Peter (2011): FDI by early movers, followers and latecomers: timing of entry by German firms during transition in the Czech Republic. In: Applied Economics Letters, 18(18): 1729-1734.

Münich, Daniel; Srholec, Martin; Moritz, Michael; Schäffler, Johannes (2013): Mothers and Daughters: Heterogeneity of German direct investments in the Czech Republic. In: Prague Economic Papers: forthcoming.

Porter, Michael (2003): The Economic Performance of Regions. In: Regional Studies, 37(6-7): 549-578.

Portes, Richard; Rey, Hélène (2005): The determinants of cross-border equity flows. In: Journal of International Economics, 65(2): 269-296.

Pusterla, Fazia; Resmini, Laura (2007): Where do Foreign Firms Locate in Transition Countries? An Empirical Investigation. In: The Annals of Regional Science, 41(4): 835-856.

Rehner, Johannes (1998): Direktinvestitionen in der Tschechischen Republik - eine empirische Wirkungsanalyse. In: WRU-Berichte, 13: 67-110.

Resmini, Laura (2000): The Determinants of Foreign Direct Investment in the CEECs: New evidence from sectoral patterns. In: Economics of Transition, 8(3)**:** 665-689.

Resmini, Laura (2004): Economic integration and industry location in transition countries. ZEI working paper, No. B 10-2004. Bonn: ZEI - Center for European Integration Studies, University of Bonn.

Santos Silva, J.M.C.; Tenreyro, Silvana (2006): The Log of Gravity. In: The Review of Economics and Statistics, 88(4)**:** 641-658.

Spilková, Jana (2007): Foreign Firms And The Perception Of Regions In The Czech Republic: A Statistical Examination. In: Tijdschrift voor Economische en Sociale Geografie, 98(2)**:** 260-275.

Tinbergen, Jan (1962): Shaping the World Economy – Suggestions for an International Economic Policy, New York: The Twentieth Century Fund.

Topaloglou, Lefteris; Kallioras, Dimitris; Manetos, Panos; Petrakos, George (2005): A border regions typology in the enlarged European Union. In: Journal of Borderlands Studies, 20(2)**:** 67-89.

UNCTAD (2004): World Investment Report: The Shift Towards Services, New York and Geneva: United Nations.

van Houtum, Henk (1999): What is the Influence of Borders on Economic Internationalisation? In: de Gijsel, Peter; Janssen, Manfred; Wenzel, Hans-Joachim; Woltering, Michael: Understanding European Cross-Border Labour Markets, Marburg: Metropolis-Verlag, p. 107-141.

WTO (1998): Annual Report, Geneva: World Trade Organization.

Wu, Fulong (1999): Intrametropolitan FDI firm location in Guangzhou, China: A Poisson and negative binomial analysis. In: The Annals of Regional Science, 33(4)**:** 535-555.

Yeaple, Stephen R. (2003): The Role of Skill Endowments in the Structure of U.S. Outward Foreign Direct Investment. In: The Review of Economics and Statistics, 85(3)**:** 726-734.

Zvirgzde, Daria; Schiller, Daniel; Revilla Diez, Javier (2013): Location choices of multinational companies in Ukraine. Search Working Paper 2/14.

Recently published

No.	Author(s)	Title	Date
11/2013	Werner, D.	New insights into the development of regional unemployment disparities	8/13
12/2013	Eggs, J.	Unemployment benefit II, unemployment and health	9/13
13/2013	Vallizadeh, E. Muysken, J. Ziesemer, Th.	Migration, unemployment, and skill downgrading: A specific-factors approach	9/13
14/2013	Weber, E. Zika, G.	Labour market forecasting: Is disaggregation useful?	9/13
15/2013	Brenzel, H. Gartner, H. Schnabel, C.	Wage posting or wage bargaining? Evidence from the employers' side	9/13
16/2013	Dengler, K.	The effectiveness of sequences of One-Euro Jobs	10/13
17/2013	Hutter, Ch. Weber, E.	Constructing a new leading indicator for unemployment from a survey among German employment agencies	10/13
18/2013	Schwengler, B.	Einfluss der europäischen Regionalpolitik auf die deutsche Regionalförderung	10/13
19/2013	Bossler, M.	Recruiting abroad: the role of foreign affinity and labour market scarcity	11/13
20/2013	Forlani, E. Lodigiani, E. Mendolicchio, C.	The impact of low-skilled immigration on female labour supply	11/13
21/2013	Singer, Ch. Toomet, O.-S.	On government-subsidized training programs for older workers	12/13
22/2013	Bauer, A. Kruppe, Th.	Policy Styles: Zur Genese des Politikstilkonzepts und dessen Einbindung in Evaluationsstudien	12/13
1/2014	Hawranek, F. Schanne, N.	Your very private job agency	1/14
2/2014	Kiesl, H., Drechsler, J.	Beat the heap	2/14

As per: 2014-02-20

For a full list, consult the IAB website
http://www.iab.de/de/publikationen/discussionpaper.aspx

Imprint

IAB-Discussion Paper 3/2014

Editorial address
Institute for Employment Research
of the Federal Employment Agency
Regensburger Str. 104
D-90478 Nuremberg

Editorial staff
Regina Stoll, Jutta Palm-Nowak

Technical completion
Jutta Palm-Nowak

Website
http://www.iab.de

Download of this Discussion Paper
http://doku.iab.de/discussionpapers/2014/dp0314.pdf

ISSN 2195-2663

For further inquiries contact the authors:

Johannes Schäffler
Telefon 0911.179 2126
E-mail johannes.schaeffler@iab.de

Michael Moritz
Telefon 0911.179 2133
E-mail michael.moritz@iab.de