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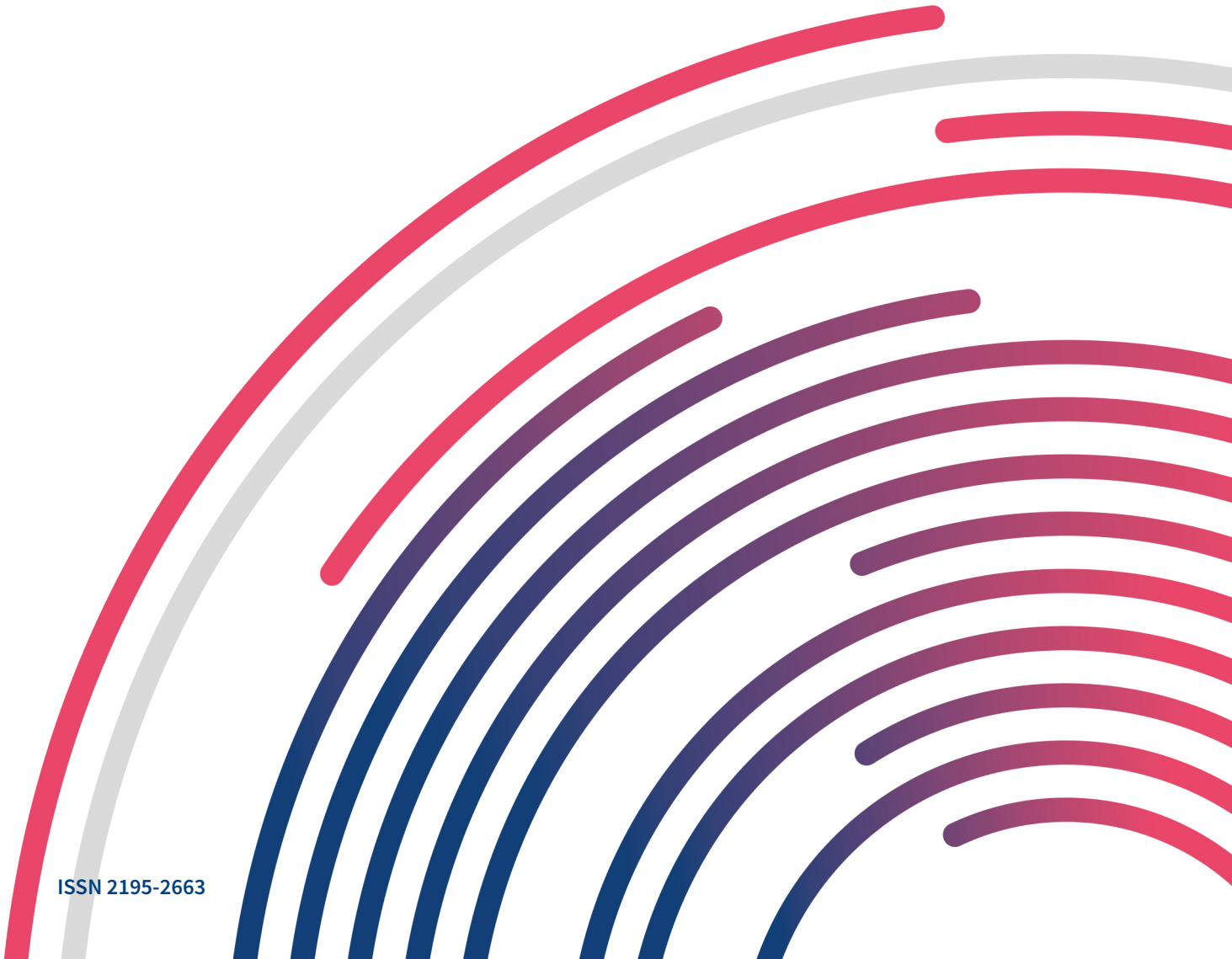
9|2021

FDI and Onshore Employment Dynamics

Evidence from German Firms with Affiliates in the Czech Republic

Konstantin Koerner, Michael Moritz, Johannes Schäffler



ISSN 2195-2663

FDI and Onshore Employment Dynamics

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Abstract

In this paper, we revisit questions about the onshore employment effects of firms that conduct foreign direct investment (FDI) in countries with substantially lower average wages. Our results derive from the use of rich administrative records on the universe of employees in German multinational enterprises (MNEs) that were active in the Czech Republic in 2010. Compared with former studies, the unique dataset in this study includes a much higher fraction of small and medium-sized firms and leads to strikingly different results for service MNEs. Applying coarsened exact matching for firms and an event-study design, we show that the domestic employment growth of MNEs decreases relative to that of non-MNEs and that the affected workers are those with low or medium educational attainment in the manufacturing sector and with medium or high educational attainment in the service sector. Regarding workers' tasks, our results do not show that FDI affects routine jobs beyond a worker's skill level.

Zusammenfassung

Wir analysieren die heimischen Beschäftigungseffekte von Unternehmen mit Niederlassungen in Niedriglohnländern. Essentiell für unsere neuen Ergebnisse ist die Nutzung administrativer Daten zur Population der deutschen multinationalen Unternehmen, die 2010 in der Tschechischen Republik tätig waren. Im Vergleich zu früheren Studien enthält der Datensatz einen sehr viel höheren Anteil kleiner und mittelständischer Unternehmen. Dadurch weichen unsere Ergebnisse insbesondere im Dienstleistungssektor von der bisherigen Literatur ab. Methodisch verwenden wir Coarsened Exact Matching, um sehr ähnliche Unternehmen zu untersuchen, welche sich ausschließlich hinsichtlich ihrer Investitionsentscheidung im Ausland unterscheiden. In einem Event-Study-Ansatz zeigen wir schließlich, dass das inländische Beschäftigungswachstum von multinationalen Unternehmen im Vergleich zu nichtmultinationalen Unternehmen abnimmt und dass im verarbeitenden Gewerbe Beschäftigte mit niedrigem oder mittlerem Bildungsabschluss und im Dienstleistungssektor Beschäftigte mit mittlerem oder hohem Bildungsniveau davon betroffen sind. In Bezug auf die Aufgaben/Tasks der Angestellten ergeben unsere Resultate keine Hinweise auf Auswirkungen von ausländischen Direktinvestitionen auf Routinetätigkeiten, die über das Qualifikationsniveau hinausgehen.

JEL

J23, F23, F66

Keywords

economic integration, foreign direct investment, labor demand, multinational firms, offshoring, skills

Acknowledgements

We are highly appreciative of the helpful comments from participants of the 29^{th} Annual Conference of the European Association of Labour Economists (EALE) in St. Gallen, the Inaugural Conference of the Asian and Australasian Society of Labour Economics (AASLE) in Canberra, and the 23^{rd} Annual Meeting of the Society of Labor Economists (SOLE) in Toronto. We are particularly grateful to Uwe Blien, Linda Borrs, Udo Brixy, Wolfgang Dauth, Johann Eppelsheimer, Hannah Illing, Joachim Möller, Katja Wolf, and Nikolaus Wolf for their valuable advice and suggestions.

1 Introduction

Multinational enterprises (MNEs) account for the bulk of foreign direct investment (FDI), and intrafirm exchanges of goods amount to approximately 30 percent of total world trade (Antras, 2003; Bernard/Jensen/Schott, 2009; Ramondo/Rappoport/Ruhl, 2016). Although the effects of such foreign activities are of high political concern, the extant literature has not yet provided a conclusive answer as to their effects on domestic labor (see the reviews by Hummels/Munch/Xiang, 2018; Feenstra, 2010, and Crinò, 2009, or Pflüger et al., 2013 for a focus on Germany). On the one hand, FDI induces positive labor market effects because it enhances MNE productivity due to intensified market access, the exploitation of international factor price differences, and greater specialization. On the other hand, offshore labor may act as a substitute for the workforce in the home country, or workers may be reallocated from high-productivity MNEs to less-productive domestic players (e.g., Grossman/Rossi-Hansberg, 2008; Egger/Kreickemeier/Wrona, 2015).

Seminal works, for instance, by Muendler/Becker (2010) on German MNEs, find that the initial expansions into Central and Eastern European countries (CEECs)—the most important FDI destination for German MNEs at the end of the 1990s—led to declining employment in the parent companies.[1] Comparing MNEs with national firms, Becker/Muendler (2008) show that the separation rate of jobs at the parent company decreases after FDI to CEECs, and adding to this, Becker/Ekholm/Muendler (2013) reveal that the task and skill composition of the German parent company is not affected by such FDI. However, one substantial caveat in all of these studies is the selection bias toward large MNEs. Because their FDI information is drawn from the MiDi-Ustan dataset from the Deutsche Bundesbank, their sample includes a selection of relatively large MNEs (see Pflüger et al., 2013).[2] Because of these thresholds, small and medium-sized enterprises (SMEs) are strongly underrepresented, which biases the results, especially for many of the small service MNEs.

We therefore revisit questions as to how the parent company's workforce evolves around the year of FDI in a formerly closed low-wage economy. Using an event-study design, we identify the onshore employment effects with respect to workers' skills (and tasks) by comparing the evolution of German MNEs around their FDI date with that of similar firms that never conducted FDI (in the following referred to as non-MNEs, control firms, or reference firms). To establish comparability between them, we apply a coarsened exact matching approach, as

[1] Using the same dataset, Jäckle/Wamser (2010) explore the effects of FDI by applying a Heckman (1978) approach and find little impact on the growth rate of German MNEs relative to firms that do not invest abroad.

[2] The reported MNEs are selected based on the size of the balance sheet: for MNEs that own at least 10 percent of foreign affiliates, the total balance sheet of those affiliates must exceed 5 million euros *or* for MNEs that own at least 50 percent of foreign affiliates, then the total balance sheet of those affiliates must exceed 0.5 million euros.

suggested by King/Nielsen (2019). Hence, we rely on the identifying assumption that in the matched sample, the FDI decision is random conditional on the covariates.

Our unique dataset is derived from the ReLOC project at the IAB and contains data on every German MNE with at least one affiliate in the Czech Republic in 2010. The choice of the Czech Republic is due to the outstanding importance of the CEECs as an offshoring or FDI destination for German firms (see Figure A1). Among the CEECs, Marin (2004: p.4) shows that the Czech Republic receives the largest share of German FDI. Furthermore, she reveals (2006: p.614) that within the CEECs, the Czech Republic is Germany's most important offshoring destination, as approximately 76 percent of the German affiliates in this country import *and* export inputs from and to their parent firms.

In a detailed and time-consuming record linkage procedure, Schäffler (2014) connects the German firms that are active in the Czech Republic to high-quality labor administration sources (IAB Integrated Employment Biographies) covering every worker subject to social security contributions in Germany. In 2008, the MNEs' parent companies employed approximately 6.6 percent of all employees in the region of former West Germany, amounting to approximately 1.7 million workers.[3] Essential for this paper, the data also include small FDI and a substantial number of SMEs (see Table A3 and the histogram in Figure A2 in the appendix), which mitigates the selectivity concerns present in former studies. Two examples illustrate the extent of this difference: first, in the sample of Becker/Muendler (2008: p.11) or Becker/Ekholm/Muendler (2013), the average MNE's onshore employment was 2,684, while it is 745 workers in our dataset.[4] Second, in 2011, the databases of Bureau van Dijk and the MiDi database contained data on approximately 1,000 Czech companies with German owners.[5] In contrast, the IAB-ReLOC database covers approximately 3,900 Czech companies with German owners ($>$2,400 German MNEs). This important data improvement is due to the direct utilization of administrative sources such as the Czech Commercial Register (Hecht/Litzel/Schäffler, 2013).

Our key findings add to previous outcomes. In accordance with the results by Muendler/Becker (2010), we show that German MNEs' employment grows significantly more slowly than that of comparable purely domestic firms. Moreover, we narrow the drivers of these

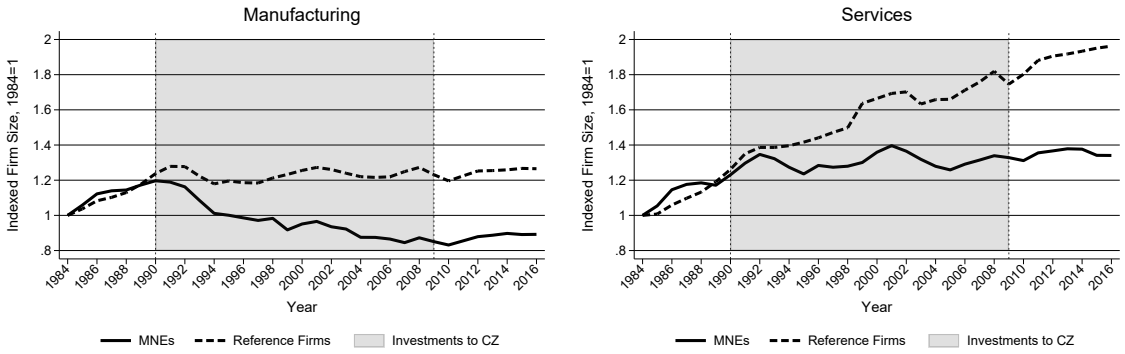
[3] Aggregated employee data are drawn from a cross-section of the IAB Integrated Employment Biographies, namely, IAB Employment Histories. In 2008, these data included a total of 25.83 million workers in West Germany.

[4] If not otherwise specified, our full sample considers only former West Germany. Both numbers include employees, apprentices, trainees, and marginal workers. Muendler/Becker (2010) use data from the USTAN database. In their sample, the average MNE employs 1,629 workers. We prefer the comparison to the sample of Becker/Muendler (2008); Becker/Ekholm/Muendler (2013), who also use comprehensive labor market data from the Federal Employment Agency (*Bundesagentur für Arbeit - BA*).

[5] The Bureau van Dijk databases include datasets such as Amadeus, Markus, Orbis and Dafne, which are also limited to rather large companies. Before launching the *Elektronischer Bundesanzeiger* in 2007, commercial data providers always had much more information about larger firms because information about their investments is published in business reports more often than is that of SMEs.

negative effects down to the i) decreasing demand for medium-skilled workers, ii) decreasing demand for low-skilled workers in manufacturing, and iii) decreasing demand for high-skilled workers in the service sector—whereas Becker/Ekholm/Muendler (2013) find no significant results for workforce composition. Adding to Becker/Ekholm/Muendler (2013), we show that aside from controlling for skill, the task demand is barely affected by FDI to the Czech Republic.

Figure 1: Indexed Average Firm Size of MNEs and Non-MNEs



Notes: The left (right) panel of Figure 1 illustrates the growth path of firms in the West German manufacturing (service) sector. The index considers changes in the average onshore employment of MNEs (solid line) and firms without any FDI (dotted line) around the expansion period to the Czech Republic (gray area) and does not include employment in East German plants, firm entrants, or firms that were liquidated between 1984 and 2016. The index shows an evolving growth differential of the two groups of firms after 1990.
Source: IAB-ReLOC; own calculations. ©IAB

To provide an idea of firms' evolution during the investment period, we plot the employment growth of continuing firms (no entries or exits in the observation period) in Figure 1. The growth path of MNEs (solid line) is similar to that of non-MNEs (dotted line) before the fall of the Iron Curtain but declines in the period of FDI to the Czech Republic between 1990 and 2009 (gray area). This relative decline is remarkable since similar studies, such as Becker/Ekholm/Muendler (2013: p. 97), observe 13.2 percent growth in average employment in German manufacturing MNEs (with FDI in any country and from 1998 to 2001).[6]

Several papers have compared the performance of MNEs with that of national firms. Often, their methodologies differ slightly by matching those firms via propensity scores and then applying difference-in-differences estimation. Among them, Becker/Muendler (2008) show that the workforce of German firms with FDI expansion has higher retention than that of competitors without any FDI. This finding is supported by Desai/Foley/Hines (2009) who identify positive effects of affiliate growth on employment of US parents. For Italy and France, Borin/Mancini (2016) and Navaretti/Castellani/Disdier (2010) further distinguish FDI by destination country and find positive effects on employment in the onshore part of MNEs after these have

[6] Note that the drop in average employment is not driven by the inclusion of small firms. In Figure A4, the distinction by firm size shows that small firms have grown disproportionately faster.

invested in advanced economies for the first time. In contrast, they find no effect on employment for FDI in less developed countries (similar to Harrison/McMillan, 2011 using US manufacturing MNEs). For the onshore part of Korean manufacturing MNEs, Debaere/Lee/Lee (2010) provide evidence that, after initial FDI in a less developed country, employment grows 2 percent more slowly than in non-MNEs and the drawback holds for a period of up to three years after the FDI. In contrast, investments in more advanced countries do not lower the employment growth of Korean MNEs. Hijzen/Jean/Mayer (2011) find no significant employment effects on French MNEs in the manufacturing sector that open up foreign affiliates. They also add the service sector to the analysis and find that service firms grow faster than their domestic competitors after international expansion.

Regarding the onshore composition of workers, most studies provide evidence of skill upgrading over the course of FDI; see, for example, Davies/Desbordes (2015) for 17 OECD countries, Sethupathy (2013) for the US and FDI to Mexico, Head/Ries (2002) for Japan, Hansson (2005) for Sweden, Geishecker/Görg/Maioli (2008) for Germany and the UK, and Castellani/Mariotti/Piscitello (2008) for Italian MNEs with CEECs as hosts for FDI. For German MNEs, Becker/Ekholm/Muendler (2013) exhibits skill upgrading after FDI to developed countries and for service MNEs also after FDI to developing countries. They also add workers' task profiles to the analysis, which are based on the approach by Autor/Levy/Murnane (2003) and add to the discourse of offshorability by Blinder (2009). After FDI to high-wage countries, the share of noninteractive and/or routine jobs increases, as well as the share of white-collar occupations. These effects are, however, not substantial after FDI to low-wage countries, which is in accordance with Hakkala/Heyman/Sjöholm (2014) for Swedish MNEs and Borin/Mancini (2016) for Italian MNEs.

A smaller strand of the literature highlights FDI related to research and development and other high-skilled activities. At the level of European regions, Castellani/Pieri (2013) find no effect on employment. At the firm level, using a survey of 660 German and Austrian MNEs, Marin (2004) and Marin/Schymik/Tarasov (2018) argue that these firms offshore their high-skilled jobs and managers to Eastern Europe, especially in service-related activities; Marin (2004: p. 23) provides exemplary evidence that firms "centralize and outsource some [...] headquarters activities such as accounting and personnel management to [...] subsidiaries in the Czech Republic." After revisiting the literature, we conclude that the effects of outward FDI and onshore employment are still relatively blur.

Our paper contributes to this literature in several ways. First, our results are derived from administrative data sources, which are very precise and more reliable than commercial sources or survey data. Additionally, our dataset covers the universe of German manufacturing and service MNEs active in a low-wage country for more than two decades (instead of three years as in the seminal study by Becker/Ekholm/Muendler, 2013). Especially, in the understudied service sector—with generally smaller firms—we consider the inclusion of SMEs and the miti-

gation of selection bias to be an important contribution. Second, we leverage the information on occupational classifications to complement our analyses with established task indices and explore whether these task indices (routine or noninteractive) can explain employment changes beyond the effects of workers' skills. Third, we add a coarsened exact matching approach that compares similar firms in terms of all considered characteristics and not only in the unidimensional propensity to invest abroad.

The remainder of the paper is organized as follows. The next section introduces the unique dataset, which alleviates selectivity concerns, and presents summary statistics. Section 3 explains the empirical setup for our results in Section 4. Section 5 tests the robustness of these outcomes, and Section 6 concludes the paper.

2 Data and Descriptive Statistics

Our dataset is derived from various administrative sources that are combined with firm-level information from commercial providers. Basic data processing is conducted by Schäffler (2014) and within the scope of the IAB project *Research on Locational and Organizational Change* (IAB-ReLOC).[7] The starting point is the identification of any affiliate in the Czech Commercial Register that has a direct or indirect German ownership share of at least 25 percent. We accessed the records in August 2010, and thus they comprehensively cover FDI from 1990 to the beginning of 2009.[8]

Information on German parent *firms* is drawn from the administrative data of the Federal Employment Agency, which covers the universe of *establishments* in Germany with at least one employee liable to social security contributions.[9] Since this information does not include a firm identifier, Schäffler (2014) applies a record linkage that identifies the onshore plants of German firms with affiliates in the Czech Republic.[10] Equipped with rich MNE data, we now turn to the reference firms.

[7] The IAB-ReLOC data are confidential but accessible for noncommercial researchers during a visiting stay at the IAB.

[8] 2009 and 2010 are covered incompletely due to the time lag between FDI and the notice in the commercial registers. The results are robust to the exclusion of these years.

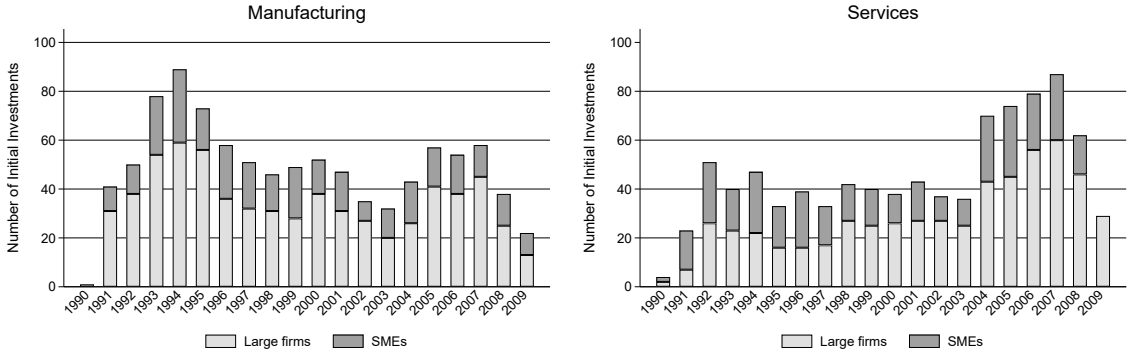
[9] Note that in our sample, we observe plants (or, synonymously, production sites or establishments) that we link to firms. FDI information, however, is available only at the firm level.

[10] The record linkage is based on the address of the company and the owner's name and is implemented in two steps: first, preprocessed names *and* addresses link the establishments to the IAB-ReLOC firms, and second, only the name identifies a company belonging to one of the IAB-ReLOC firms. The linkage is feasible due to firm names in the establishment data. This information is usually subject to restrictive privacy protection, but it was made exceptionally available for the IAB-ReLOC project.

Reference firms have neither a sister company nor direct or indirect FDI in any country. This list was compiled by *TNS Infratest* applying the same linkage procedure (see Hecht/Litzel/Schäffler, 2013). Firms' addresses and investment information were acquired from the German Commercial Register. Based on industry and size, a stratified sample was drawn from the administrative sources that oversampled large and medium-sized companies to ensure their comparability with MNEs.[11]

We then merge firms with worker-level information from IAB Integrated Employment Biographies for the period from 1986 to 2011, from which we are particularly interested in daily wages and educational attainment (skills). The latter distinguishes three types of workers: high-skilled workers who attained a university degree (of applied sciences), medium-skilled workers who attained a vocational qualification or a higher secondary degree (German Abitur), and low-skilled workers who attained neither a vocational qualification nor a higher secondary degree. To further improve data quality, we impute missing skill information using the algorithm suggested by Fitzenberger/Osikominu/Völter (2006). Since the wage data are censored at the upper earnings limits of the compulsory social security system (e.g., annual income of 66,000 euros in West Germany in 2010), we impute the wages of top-coded entries similar to Card/Heining/Kline (2013).

Figure 2: Number of German Firms that Initially Invested in the Czech Republic



Notes: Figure 2 shows the number of German parent firms that initially invested in the Czech Republic. The peak for manufacturing firms arises in 1994 after the ratification of the EU-Czech trade agreement and the accession of the Czech Republic to the General Agreement on Tariffs and Trade (GATT). In the service sector, the peak arises in 2007, 3 years after membership in the EU. Note that 2009 is not covered completely due to the time lag of reporting FDI to commercial registers. The drop in investment is thus a sample artifact rather than a structural change. Small and medium-sized enterprises (SMEs) employ up to 100 workers in the year of FDI.
Source: IAB-ReLOC; own calculations. ©IAB

Other firm-level characteristics are drawn from the IAB Establishment History Panel. These include the date of foundation, main industry and geographic location. For multisite compa-

[11] The IAB also commissioned an IAB-ReLOC Survey (at *TNS Infratest*) with information on MNEs in Germany and the Czech Republic as well as on the reference firms in these two countries. Due to the small number of respondents, we do not use the above survey in the present study. For a comprehensive evaluation of the survey, we refer to Hecht, Hohmeyer et al. (2013) (in German) and Hecht/Litzel/Schäffler (2019).

nies, we select the region or industry that accounts for the largest share of employees within the firm. East German establishments are excluded for various reasons. First, our investigation starts before their coverage in the IAB database. Second, we want to abstract from the specific circumstances of the former planned economy and its economic units. Disturbing effects arise, for instance, due to the disposition of firms by the *Treuhand* to, in particular, West German investors. Hence, aggregating establishments across East and West Germany includes employment shifts that are not driven by increasing labor demand but by access to funds or low-priced real estate. We suspect that many acquisitions of East German plants are similar to an investment in the Czech Republic. Thus, there is a tradeoff between considering a larger population and interpreting the blurred estimates of the effects of FDI in the source country. We decide to favor precise estimates since the exclusion of East German establishments comes at a relatively low cost, as only approximately 10 percent of German affiliates in the Czech Republic have an owner from East Germany (Schäffler/Hecht/Moritz, 2017).

Our full sample covers 2,410 (6,336) West German firms with (no) FDI. In the subsequent analysis, we consider only the initial entry date of the firm, which Muendler/Becker (2010) refer to as the extensive margin of offshoring. As Figure 2 illustrates, MNEs' entry dates in the Czech Republic are distributed around two peaks: one peak in the mid-1990s after the EU and the Czech Republic mutually opened up their markets for trade, which mainly saw investment by manufacturing firms, and another peak after the Czech accession into the European Union in 2004, which mainly saw investment by service firms.

Table 1 reports the main summary statistics of onshore variables in the manufacturing and service sectors, of which MNE data only consider values two years prior to FDI to show their initial properties. We want to point out important differences in terms of three aspects: i) between sectors, ii) within sectors and between MNEs and reference firms, and iii) relative to other datasets such as the MiDi dataset. i) First, the table shows that firms in the manufacturing sector are much larger than those in the service sector, where the latter includes firms with many more plants (e.g., stores). Relative to the other sector, manufacturing production is low-skill intensive, while production in service firms is high-skill intensive. ii) Second, on average, MNEs are larger, employ a larger share of high-skilled workers, pay higher wages, and grow faster in the years prior to FDI than non-MNEs. Firm characteristics are, hence, in line with studies such as Helpman/Melitz/Yeaple (2004), which shows that only productive firms conduct FDI because of its high fixed costs, or Antras/Helpman (2004), which draws theoretical links between productivity, firm size and the decision to invest abroad. iii) Third, note that despite being large compared to non-MNEs, our average MNE is still substantially smaller than the selection of MNEs in the MiDi dataset because firm size correlates positively with the size of the FDI, which is covered without any absolute lower bound in the IAB-ReLOC data. We extensively stress this improvement in the data since a relatively high fraction of German small and medium-sized enterprises invested in the Czech Republic due to the relatively low

Table 1: Characteristics of MNEs Prior to FDI and Non-MNEs in the Full Sample

	Manufacturing sector			Service sector		
Variable	MNE Mean *Median* (Std. Dev.)	Reference Mean *Median* (Std. Dev.)	Std. Bias (Var. Rat.)	MNE Mean *Median* (Std. Dev.)	Reference Mean *Median* (Std. Dev.)	Std. Bias (Var. Rat.)
Employees	1136.5 *156.5* (8935.71)	229.37 *152* (337.32)	0.144 (701.74)	447.56 *41* (4435.38)	142.74 *53* (454.73)	0.097 (95.14)
High-skilled (percent)	8.24 *5.06* (10.49)	6.39 *3.57* (9.09)	0.188 (1.33)	16.91 *7.14* (22.09)	9.35 *1.89* (17.36)	0.380 (1.62)
Med.-skilled (percent)	71.58 *72.69* (16.12)	75.27 *77.55* (16.09)	-0.230 (1.00)	75.58 *80.77* (21.79)	78.90 *86.57* (21.52)	-0.153 (1.026)
Low-skilled (percent)	20.18 *16.86* (16.69)	18.33 *14.29* (16.29)	0.112 (1.05)	7.52 *2.65* (11.45)	11.75 *4.39* (17.65)	-0.285 (0.42)
Employment growth	3.071 *2.773* (1.28)	2.836 *2.724* (1.02)	0.204 (1.58)	2.811 *2.722* (1.29)	2.661 *2.697* (1.11)	0.124 (1.35)
Wage bill	136,721 *14,707* (1,098,890)	25,300 *14,108* (58,984)	0.143 (347.08)	48,430 *4,858* (415,148)	14,090 *4,699* (46,569)	0.116 (79.47)
Plants	2.50 *1* (10.21)	1.48 *1* (2.53)	0.137 (16.31)	10.94 *1* (174.14)	2.90 *1* (10.94)	0.065 (253.16)
Firms	1,156	2,904		1,254	3,432	

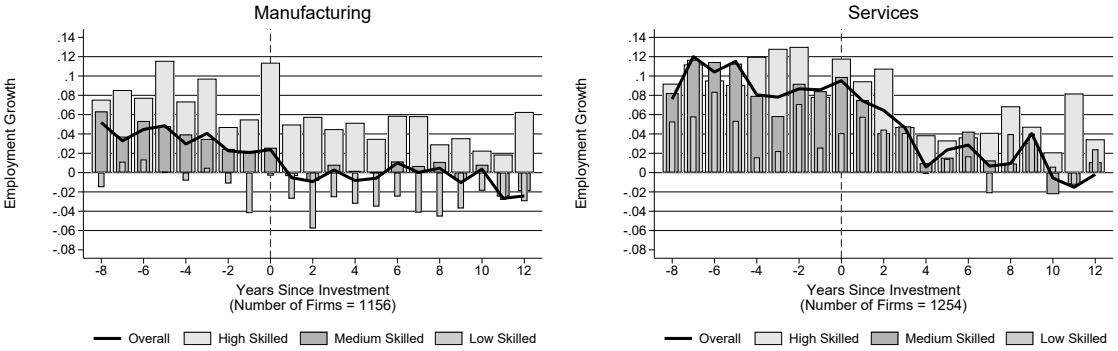
Notes: Table 1 presents the summary statistics for MNEs and non-MNEs in West Germany. MNE information is reported for the period two years prior to the investment, while non-MNE information includes observations for all years without any missing values. Employment numbers include only regular employment and not apprentices, marginal employment, or temporary workers. Employment growth is measured as the log of the employment difference over the last four years. Concerning multisite MNEs, more than 30% consist of more than one establishment in Germany. The wage bill is denoted in euros and considers average daily wages. For definitions of standardized bias and variance ratio, see footnote 14.
Source: IAB-ReLOC; own calculations. ©IAB

costs of FDI.[12] If these firms are not considered in the analysis, then the results may be substantially biased by selectivity.

Having described the data, we now turn to the analysis of the effects of FDI on firm employment. Thus far, Figure 1 has shown that relative employment evolves negatively for MNEs, which may be due not only to FDI but also to other events or influences particular to these firms, such as relocating jobs to East Germany. In Figure 3, we therefore zoom in on the evolution of manufacturing (left panel) and service (right panel) MNEs around their years of in-

[12] Moritz et al. (2020), Hecht (2017), and Buch et al. (2005: p. 59 f.) point out, that the average German affiliate in CEECs is remarkably small. On the one hand, geographic proximity contributes to low expenditures for cross-border transactions and communication. On the other hand, political developments reduce investment risks and associated costs. These are, for example, the stable political climate in Eastern Europe, the single market of the EU, and advances in the Schengen area.

Figure 3: Employment Growth by Skill Group of MNEs around the Investment



Notes: Figure 3 displays the annual employment growth around FDI for manufacturing (left panel) and services (right panel) MNEs. The black line represents the growth in all employees, whereas the bars consider the growth per skill group. For comparison, we create symmetry around zero and calculate each growth rate by considering the average employment in t and $t-1$ in the denominator of growth rate.
Source: IAB-ReLOC; own calculations. ©IAB

vestment in the Czech Republic. To ease the comparability of increases and decreases, we create symmetry around zero by using the average employment in *t* and *t-1* in the denominator of growth rates. Hence, the range of values lies between -2 and 2, instead of between -1 and +∞ (compare Davis/Haltiwanger/Schuh, 1996: p. 190).

It is striking that employment growth (black solid line) fundamentally changes immediately after investment. While prior to investment, the average MNE follows a growth path, after investment, firm employment decreases in a manufacturing MNE or grows much more slowly in a service MNE. The trend exists in both sectors and for all skill groups, although there are substantial differences in the magnitude. In manufacturing, firms annually grew between 2 and 6 percent prior to the investment, mainly due to not only the increase in high-skilled workers but also the increase in medium-skilled workers. The growth in low-skilled workers somewhat oscillated around zero. After FDI, the employment of high-skilled workers grew at a slower pace, while the number of medium-skilled workers barely changed, and low-skilled employment continuously decreased. In the service sector, the pre-FDI growth of all worker types was between 8 and 12 percent and relatively similar for high- and medium-skilled workers. The number of low-skilled workers, however, grew more slowly. After investment, growth rates fell successively to below 4 percent. The differences between skill groups were less pronounced than in the manufacturing sector.

3 Empirical Strategy

In the previous section, we pictured the chronological interrelatedness between the occurrence of FDI and the evolution of an MNE's workforce. Adverse employment effects, however, may also be driven by a general trend that correlates with the decision to conduct FDI—a concern that we mitigate using the following event-study design.

3.1 Event-Study Design

We base our estimation design on Borusyak/Jaravel (2018) and Schmidheiny/Siegloch (2019), applying a distributed-lag model with first differences:

$$\Delta \ln L_{it} = \sum_{j=-23}^{+20} \gamma_j D_{i,t}^{j} + \zeta \Delta z_{it} + \theta_t + \Delta \epsilon_{it} \tag{3.1}$$

where $\Delta \ln L_{it}$ is the change in firm i's employment in logarithms (growth rate), Δz_{it} is a vector of time-varying firm controls such as the change in the squared value of a firm's age, θ is the year fixed effect, and $\Delta \epsilon_{it}$ is the change in the error term.[13] The main interest is in the event dummies $D_{i,t}^{j}$. They are equal to one whenever firm i conducts FDI in j years from t and zero otherwise. Hence, for each MNE, the sum in (3.1) contains only a single coefficient of γ per year. The observation window reaches from 1986 to 2011, and these years also mark the borders for the maximum number of lags and leads indicated by the boundaries of the sum. For instance, if a German firm buys a Czech affiliate in 1991, then the regression may contain up to 5 lines of lags (1986-1991) and up to 20 lines of leads (1992-2011) for this firm. We choose a broad observation period because some portion of the effects may not arise immediately after the investment but rather after organizational rearrangements some years later. Therefore, we can also control for another growth scenario, for example, when firm employment initially decreases but subsequently experiences higher growth rates in the medium or long run. Observing a long preceding period helps reveal whether the investment changed an existing trend, which would be positive, for instance, if the firm acquires managers who plan and cope with the organizational changes. In the case of multiple investments in Czech affiliates, we consider only the first occasion.

Since we include the whole set of event dummies, each of them is exclusively identified by the MNEs' differences from control firms; that is, only firms without any FDI serve as references

[13] We do not consider the difference in age (nonsquared) since it renders perfectly collinear in the presence of time fixed effects and in first differences.

for identification. The coefficient of each investment dummy then indicates the difference in the employment growth between MNEs in a given year and the reference group.

The specification with first differences solves many problems related to unobserved firm characteristics that usually do not change during the sample period; these characteristics can be the location or legal form (German *AG* or *GmbH*, etc., which are similar to *Inc.* or *Ltd. Co.*, etc.) of the firm, or, in combination with time fixed effects, the linear term of a firm's age. If some change correlates with employment growth and is unrelated to the FDI decision, then we assume that it is random and does not influence our mean outcomes. If, instead, it is related to FDI, then it depicts another channel that we capture in our estimates. The latter relates to the problem of *bad controls* and is the reason for omitting a plethora of possible control variables. That is, the FDI decision may influence employment growth not only directly but also through channels such as wages, skill or task composition, the number of plants, or sales.

3.2 Coarsened Exact Matching

Although the reasons for conducting FDI are manifold, Table 1 and Helpman/Melitz/Yeaple (2004) have shown that the tendencies to invest abroad are stronger for more productive firms. If we employ our full sample, we then end up comparing the growth of MNEs with that of firms that may not have the features or resources needed to benefit from international activities. Technically, we face the problem that the full sample is not unconfounded: choosing to invest is not random conditional on the covariates. To mitigate this problem, we focus on a subsample of MNEs and reference firms with similar characteristics. Our analysis then relies on the assumption that the probability of conducting FDI is comparable among firms, and hence, assignment to the treatment is conditionally random.

As suggested by King/Nielsen (2019), we apply coarsened exact matching on a variety of characteristics that determine a firm's FDI activity. The main advantage of this approach over other methods, such as propensity score matching, is that all covariates of the matching pair are balanced and not the one-dimensional overall propensity for FDI. The main disadvantage of coarsened exact matching is the curse of dimensionality, that is, we cannot include many matching variables since each of them decreases the matching feasibility exponentially. Our matching procedure is, hence, a tradeoff between balancing firm characteristics of substantial importance for FDI, and pruning dissimilar firms, i.e., reducing the number of observations in our subsequent regressions. After continuous checks of the variables of interest, we conclude that the following procedure provides a good proportion for the number of observations and the balance of covariates:

1. Exact matching of the firm's sector (service and manufacturing) since growth rates and firm characteristics differ greatly between the sectors.

2. Exact matching of the year, which is two years prior to the investment. This adjustment provides non-MNEs with a virtual investment year, at which the conditional probability to invest is similar to that of the MNEs, but the firms randomly chose not to invest. The choice of year for the matching includes another tradeoff. A shorter period before the event can capture effects that are due to the anticipation of FDI. However, a longer matching period before the event can include firm adjustments that are not related to FDI and, hence, weaken the balancing for the identification of the labor market effect. Figure 3 suggests that two years prior to the event is sufficient for avoiding changes due to FDI.
3. Consider treatment and control firms that are inside the support region (highest value of the smaller group plus 3 percent) for each covariate. The rationale is to drop all firms with characteristics that appear only in the treatment *or* control group. In terms of employment, e.g., we drop firms that exceed the largest control firm by more than 3 percent.
4. Create 5 equally sized bins for each covariate: wage bill, number of employees, share of high-skilled workers, share of medium-skilled workers, share of low-skilled workers, number of establishments, and propensity to invest in the Czech Republic for 24 industries in West German states. The wage bill and number of employees approximate firm productivity. The skill shares, number of plants and finer industry classification capture firms' structure, while the location of firms may be of relevance if, for instance, firms closer to the border respond more strongly to FDI.
5. If firms are in exactly the same bin for each covariate, then we randomly assign a control firm to exactly one treatment firm. This results in unique one-to-one matches without replacement.

Table 2 reports the balancing of the matched sample by comparing the means and standard deviations of MNEs and reference firms and the standardized biases and variance ratios,[14] and it shows that the subsample is much more balanced than the full sample. For example, the standardized bias is below 5 percent for most of the variables (as suggested by Caliendo/Kopeinig, 2008), and the variance ratio is much closer to one. Substantial differences between firm types remain only for the number of plants in the manufacturing sector.

While the fairly balanced matching covariates reduce sources of selection bias, we still need to discuss unobserved sources that may impact both a firm's decision to invest in the Czech Republic and employment growth beyond FDI. These include, for example, product type, management intensity, or customer preferences. After explaining when firms' differences in these sources feature a higher propensity to engage in FDI, we then need to consider whether they also affect employment after FDI but beyond the FDI's effect.

[14] Standardized bias is the mean difference divided by the square root of the mean variance of the two covariates: $\frac{\mu_{treatment}-\mu_{control}}{\sqrt{\frac{\sigma^2_{treatment}+\sigma^2_{control}}{2}}}$. The variance ratio is calculated with $\frac{\sigma^2_{treatment}}{\sigma^2_{control}}$.

We start with the example of certain product types and consider those with high scale effects. These products would encourage (market) expansions by the firm and thereby increase the propensity for FDI. Since these products favor firm expansion, it is also likely that serving a larger market will raise employment growth in the domestic part of the firm. Our estimates in the following, hence, rather reflect an upper bound of MNE growth. A similar reasoning holds for high management intensity. These firms are more prone to foreign expansion since they feature relatively low costs of FDI. It is also likely that—beyond FDI—high management intensity fosters employment growth because, ceteris paribus, the firm already has a greater capacity to manage a larger workforce. In a third scenario, the customers' taste favors the firms' regional attachment to the Czech Republic and thus also the firms' propensity for FDI. Beyond the effect of the FDI, the employment effect would, again, also be positive since customers' taste is satisfied, which in turn increases their demand. Finally, we also want to highlight the findings by Helpman/Melitz/Yeaple (2004) that FDI is cost intensive. For firms in economic turmoil, these expenses will impede their international expansion. Not considering the effect of FDI, the expected growth rates of FDI-engaging firms would thus be higher than those of non-MNEs. Hence, in the subsequent analysis, we consider estimates of positive employment effects for MNEs as an upper bound, while negative employment growth instead serves as a conservative estimate.

Table 2: Characteristics of MNEs and Non-MNEs after Coarsened Exact Matching

	Manufacturing sector (886 firms)			Service sector (668 firms)		
Variable	MNE Mean (Std. Dev.)	Reference Mean (Std. Dev.)	Std. Bias (Var. Rat.)	MNE Mean (Std. Dev.)	Reference Mean (Std. Dev.)	Std. Bias (Var. Rat.)
Log employment	4.854 (1.796)	4.787 (1.554)	0.040 (1.335)	3.005 (1.983)	3.074 (1.829)	-0.036 (1.176)
High-skilled (percent)	5.67 (6.80)	5.74 (6.74)	-0.010 (1.020)	16.09 (24.00)	15.13 (22.67)	0.041 (1.121)
Med.-skilled (percent)	72.52 (17.02)	72.95 (16.21)	-0.026 (1.102)	78.04 (24.00)	78.92 (22.63)	-0.037 (1.125)
Low-skilled (percent)	21.80 (17.79)	21.30 (16.85)	0.029 (1.114)	5.87 (10.85)	5.95 (10.96)	-0.008 (0.981)
Employment growth	3.008 (1.276)	2.972 (1.137)	0.030 (1.260)	2.727 (1.234)	2.714 (1.126)	0.011 (1.200)
Log wage bill	9.369 (1.891)	9.319 (1.653)	0.028 (1.308)	7.644 (2.130)	7.599 (2.002)	0.022 (1.132)
Log number of plants	0.317 (0.642)	0.186 (0.451)	0.236 (2.030)	0.311 (0.821)	0.261 (0.680)	0.067 (1.460)

Notes: Table 2 reports the summary statistics for one-to-one matched MNEs and non-MNEs two years prior to the (virtual) investment year. The coarsened exact matching procedure considers only firms in the support region; that is, it excludes firms with characteristics that exceed the respective maximum in the other group (control or treatment) by more than 3%. Moreover, we use 5 equally sized bins per covariate and randomly match firms in the same set of bins. We evaluate the balancing quality of the matching via the standardized bias and variance ratio; i.e., the quality of the match increases with attenuated standardized biases and variance ratios close to one.

Source: IAB-ReLOC; own calculations. ©IAB

4 Results

Our empirical strategy identifies how a firm's FDI decision impacts its employment around the year of investment. Therefore, a difference-in-difference approach is applied to control for time-invariant firm characteristics.

4.1 Preliminary Analysis: Employment Growth Differential of the Unmatched Sample

We now turn to the estimation of Equation (3.1) using the full sample of 164,410 unmatched firm-year observations. Despite the disadvantage that the results from this specification do not reveal the causal effect of FDI on firm employment, the evolution of the average MNE relative to an excess of dissimilar reference firms that are more representative of the remaining economy than the matched subgroup is still revealed.

Figure 4 plots the estimates (black line) and their 95 percent confidence intervals (gray area), in which we cluster standard errors at firm-year levels. The top panel shows the results for the full sample. Until investment, the confidence interval overlaps with the zero line for most years, which means that the growth of MNEs is not significantly different from the growth of reference firms. The size of the coefficients suggests that on average, MNEs tend to grow somewhat faster than do reference firms prior to investment. The investment year marks a striking turning point, after which MNEs' relative employment growth changes its trend and significantly decreases in the subsequent years of investment, ranging from -1.9 to -3.3 percent compared to the reference firms. Until 20 years after investment, we do not observe that MNEs return to their prior growth path.

In the following analysis, we focus on a ten-year window around the investment since the sample is constructed in a way that centers the MNE data around the year of investment. These years, hence, contain less noise, more precise estimates, and narrower confidence bands. Regarding employment growth after 10 years of investment, the trend never changes to become significantly positive. Therefore, in the case of German FDI in the Czech Republic, there is no evidence of an increase in firm employment in the long run. This finding is in contrast to other studies, such as Navaretti/Castellani/Disdier (2010) and Hijzen/Jean/Mayer (2011), where efficiency-seeking FDI to low-income countries has positive labor market effects in the long run, as there is a time lag until gains in productivity lead to new hires.

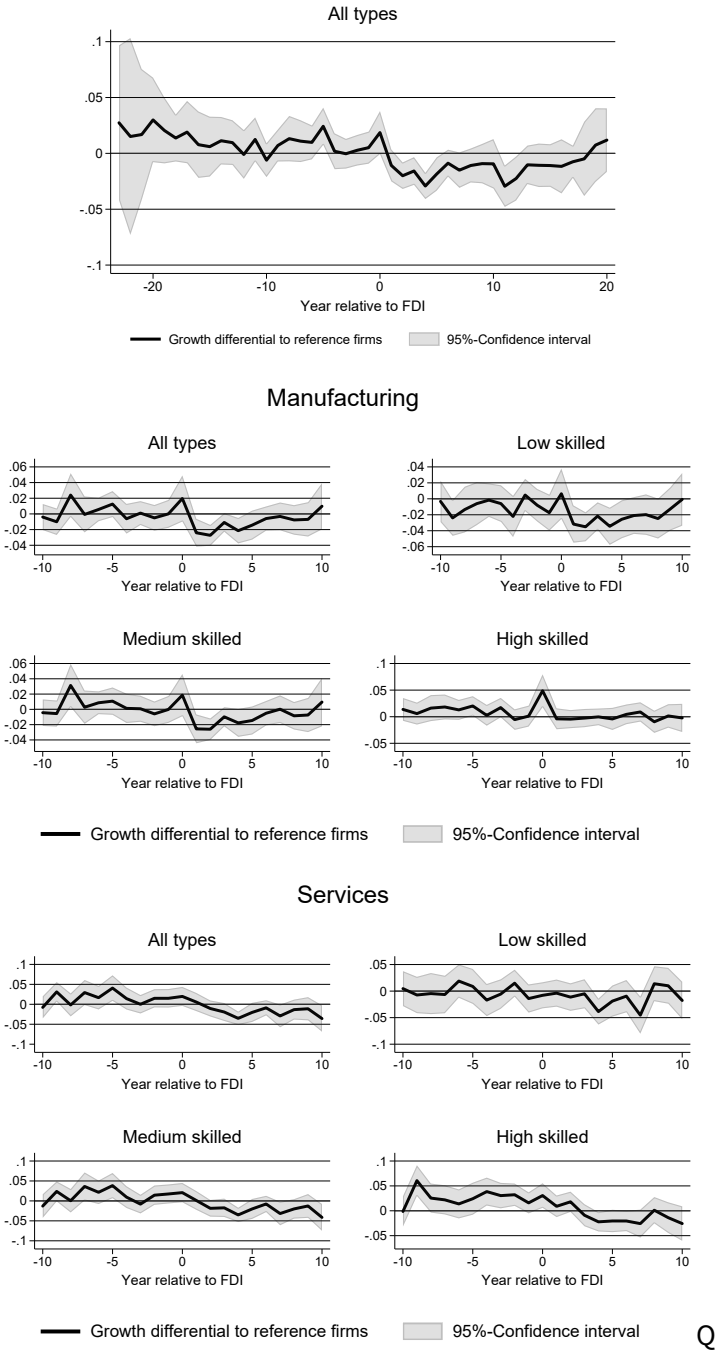
Considering insights from theory, Czech affiliates will substitute *some* types of labor of the MNE, while they complement *other* types of labor inside or outside the MNE. This substitutability is also related to the concept of the offshorability of jobs à la Blinder/Krueger (2013). They state, on the one hand, that in the service sector, the tradability of tasks depends on certain characteristics, such as the proximity of the location where the task is performed to the end customer. On the other hand, in the manufacturing sector, virtually everything can be put into boxes and sent abroad. From the outset, this sector is thus more prone to offshoring activities, and the related theory predicts trade patterns according to the comparative advantage in factors of production. Regarding the skill level of workers, this would imply that Czech affiliates substitute for low- and medium-skilled labor in German production. MNEs, however, are also able to cut prices due to the cost reductions in production, which, according to Markusen (2004), increases their sales and the labor demand for rather high-skilled headquarters activities such as management, marketing, and research and development.[15]

The bottom panels in Figure 4 depict the development in MNEs' employment within the manufacturing or service sector and separately by skill level. Within manufacturing (left panel), MNEs' employment mainly adjusts during the five years after investment. Compared to the reference firms, the annual growth of MNEs is 1.3 to 2.8 percent lower. It is evident that the effects differ with respect to workers' skills. The drop in relative employment growth is strongest for low-skilled workers (-2.3 to -3.8 percent per year) but also sizable for medium-skilled workers (down to -2.8 percent per year). High-skilled workers, however, are not considerably affected. Their employment even rises in the year prior to investment, presumably because MNEs hire managers who perform organizational restructuring.

Service MNEs react with a similar but weaker break in the existing growth path relative to the reference firms. Relative growth decreases successively until reaching -3.8 percent per year. Noticeable differences become visible in the growth across skills. While the highest adverse effects are found for medium- and low-skilled workers (up to -5.1 percent), high-skilled workers also experience annual decreases of approximately -2.3 percent relative to non-MNEs. These downturns are preceded by increases and motivate a more thorough analysis in the next subsection.

[15] In the literature, several measures have been applied to identify skill-specific effects. One is to focus on relative terms, such as skill-group shares in the total wage bill (e.g., Becker/Ekholm/Muendler, 2013; Head/Ries, 2002). Another strand of the literature uses the share of a skill group in total employment (e.g., Hijzen/Görg/Hine, 2005). However, another strand estimates the labor demand for different skill groups separately (e.g., Bajo-Rubio/Diaz-Mora, 2015; Driffield/Love/Taylor, 2009; Elia/Mariotti/Piscitello, 2009). The latter has the advantage of identifying the impact on skill-specific labor demand directly and not relative to other skill groups; thus, it is straightforwardly comparable to the estimations for total employment, allowing us to draw conclusions as to which type of labor drives overall reductions.

Figure 4: Employment Growth Differential of MNEs Compared to Non-MNEs



Notes: Figure 4 presents the growth differential between MNEs and non-MNEs for the pooled sample of West German workers and separately by sector and skill group. The gray area is the 95% confidence interval, which tests whether a coefficient is individually different from zero. If it crosses the zero line, then no significant difference between MNEs and non-MNEs is measured. Standard errors are clustered at firm-year levels (see Abadie et al., 2017). The respective output is drawn from Table A1.
Source: IAB-ReLOC; own calculations. ©IAB

4.2 Employment Growth Differential among Matched Firms

Although the previous approach already considered time-invariant heterogeneity, the estimates could still be biased by some other effect that correlates with any firm characteristic and FDI timing, which means, for instance, that the employment response of more productive firms could be affected by a technology shock that is mainly available to productive firms (due to high costs) at a similar time as FDI but is causally unrelated. As Table 1 suggests, the average MNE substantially differs from the average reference firm. We thus consider only firms paired in our matching procedure, in which each pair is similar to one another in all matching covariates. We then assume that the treatment—that is, FDI—can be conducted by all firms equally well but only a virtually random fraction of these firms—MNEs—take advantage of this possibility (Lee/Lemieux, 2010).

Since we extensively prune the data to obtain a strongly balanced subsample, our estimations lose many degrees of freedom. This reduction becomes even more rigorous when we cluster standard errors according to Abadie/Spiess (2020) at match-year levels. While the latter has ambiguous effects on standard errors, the vast reduction in degrees of freedom increases the variance and impedes the rejection of a statistical test for a given level of significance. To avoid any overinterpretation of individual outliers from the yearly estimates, we therefore consider three-year changes that average out these irregularities.

In Table 3, column 1 presents the results for the full subsample of matched firms that are, two years prior to investment, very similar in size, growth, wage bill, skill composition, location, and industry. After investment, the MNEs' growth rate suddenly decreases relative to the non-MNEs. Now, as one of the matching variables is employment growth from six to two years prior to investment, we do not observe significant differences prior to FDI. Then, the employment of MNEs grows more slowly in the initial years after FDI until six to nine years after investment. On average, MNEs' relative growth slackens by approximately 1.6 percentage points per year. Note that these estimates depict the upper bound of MNE's growth, on the one hand, because of the effects of unobserved covariates as described in Section 3, and on the other hand, because the dataset contains no information on firm trade, especially of intermediates. This channel could affect employment growth of non-MNEs similarly to FDI and hence attenuate our estimates.

Columns 2 to 9 further distinguish sectors and skill levels. It becomes apparent that manufacturing MNEs' relative growth becomes significantly negative immediately after the year of FDI. This strong and early drop suggests the relocation of some stages of production and closing of domestic plants.[16] Across skill groups, the relative growth of low-skilled workers diminishes

[16] Among (unmatched) multisite manufacturing MNEs, the average number of plants drops by 2.3 percent within 3 years after the investment. In the service sector, this number increases by 4.4 percent in the respective period. We exclude the top percentile due to the extreme behavior of the largest service MNE.

more strongly than the respective estimate for medium-skilled workers. High-skilled workers, in contrast, exhibit no change; it seems that they are not substituted by foreign labor. In the service sector, the drop in the relative growth of MNEs comes with a time lag from FDI, which may be explained by the indirect relocation of production, in which service firms successively recruit low-*wage* labor in the affiliate companies. Note that this substitution is not necessarily associated with low-*skilled* workers. In fact, the drop in the number of low-skilled workers after FDI is not statistically significant. Instead, medium-skilled workers experience the strongest relative downturn, while high-skilled workers are also less frequently recruited relative to non-MNEs.

In sum, the low-skilled intensive manufacturing sector offshores low- and medium-skilled labor, while the high-skill intensive service sector tends to offshore medium- and high-skilled labor.[17] With respect to the considered economic sector, our results thus combine outcomes from various studies. For service MNEs, production in the Czech affiliates substitutes high-skilled jobs in German parent companies, which is in line with findings by Marin (2004), i.e., the German affiliates in the Czech Republic employ a high share of high-skilled workers. Moreover, this finding could explain the nonsignificant relation between offshoring to CEECs and skill upgrading in the pooled MNE sample of Becker/Ekholm/Muendler (2013: p.102). For manufacturing MNEs, our results are in line with evidence for skill upgrading, such as Castellani/Mariotti/Piscitello (2008) for Italy, Head/Ries (2002) for Japan, and Hansson (2005) for Sweden. Regarding long-run growth, we do not observe a return of MNEs' growth rates as predicted by theories such as Rodríguez-Clare (2010) or Acemoglu/Gancia/Zilibotti (2015) (not reported in the table).

4.3 Wage-Bill Growth Differential among Matched Firms

Thus far, our estimates suggest that efficiency-seeking FDI reduces the number of workers in the parent company. To obtain a better sense of the labor-demand relationship, we now consider the overall input of labor, measured by the wage bill of all workers with social security. Table 4 shows the results for the matched sample and three-year differences. The development of all matches is similar to that of employment growth: prior to investment, the wage bill of MNEs tends to increase faster than that of reference firms. The investment date then implies a turning point, and some years after investment, the relative wage-bill growth of MNEs significantly drops until 6 years after investment.

Strikingly, the evolution within the manufacturing sector is fairly different. While Table 3 shows that a manufacturing firm's employment grows significantly more slowly after invest-

[17] In doing so, the respective jobs do not necessarily need to be located in Germany prior to FDI. It could also be that firms expand production abroad instead of in the domestic economy.

Table 3: Baseline Regression Results of Matched Firms

Dependent variable:	Full sample	Manufacturing sector				Service sector			
			By skill group				By skill group		
△ Log	All	All	Low	Medium	High	All	Low	Medium	High
employees	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6-3 years prior	0.011	0.018	0.004	0.021	0.038*	0.011	-0.014	0.019	0.001
	(0.57)	(1.04)	(0.16)	(1.27)	(1.83)	(0.24)	(-0.26)	(0.47)	(0.02)
3-0 years prior	0.012	-0.008	-0.033	-0.012	0.030	0.042	-0.012	0.028	0.052
	(0.77)	(-0.48)	(-1.23)	(-0.72)	(1.37)	(1.31)	(-0.35)	(0.84)	(1.53)
0-3 years after	-0.049***	-0.057***	-0.085***	-0.049***	0.018	-0.041	0.025	-0.043	0.005
	(-2.78)	(-3.23)	(-2.88)	(-2.77)	(0.88)	(-1.28)	(0.67)	(-1.30)	(0.13)
3-6 years after	-0.055***	-0.032*	-0.068**	-0.030	0.014	-0.083***	-0.053	-0.084***	-0.065*
	(-3.30)	(-1.66)	(-2.49)	(-1.55)	(0.58)	(-2.68)	(-1.37)	(-2.60)	(-1.92)
6-9 years after	-0.038*	-0.014	-0.030	-0.017	0.030	-0.055	-0.051	-0.040	-0.063
	(-1.93)	(-0.75)	(-1.37)	(-0.88)	(1.21)	(-1.25)	(-1.02)	(-0.91)	(-1.44)
Observations	9,550	5,944	5,944	5,944	5,944	3,458	3,458	3,458	3,458

Notes: The regressions of Table 3 include as controls the difference in the log-squared value of firm age, a full set of time fixed effects, and a full set of event dummies for MNEs. *t*-statistics are in parentheses. Standard errors are clustered at match-year levels (see Abadie/Spiess, 2020).
* $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.
Source: IAB-ReLOC; own calculations. ©IAB

ment, wage-bill growth shows more variance. This combination implies that the average wages of the remaining workers increase in many MNEs relative to the reference firms.

In the service sector, an increase in the relative wage-bill growth is succeeded by a more pronounced decrease that lasts until six years after investment. In particular, medium-skilled firms experience a sharp drop some years after investment, showing a -13.7 percent difference from reference firms. They are also the group with the largest decline in employment and are often associated with a routine task profile (see Goos/Manning/Salomons, 2014). We test this in the following subsection.

4.4 Routine or Noninteractive Jobs and Skills

The following section analyzes whether routine or noninteractive jobs are more prone to substitution after FDI within their skill group. This hypothesis originates from the task approach by Autor/Levy/Murnane (2003) and has been theoretically formulated in the context of offshoring by Grossman/Rossi-Hansberg (2008). Closely related empirical analyses are those of, e.g., Autor/Katz/Kearney (2006), Baumgarten/Geishecker/Görg (2013), Becker/Ekholm/Muendler (2013), and Goos/Manning/Salomons (2014).

Table 4: Regression Results for Wage Bill of Real Wages

Dependent variable:	Full sample	Manufacturing sector				Service sector			
			By skill group				By skill group		
△ Log	All	All	Low	Medium	High	All	Low	Medium	High
wage bill	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6-3 years prior	0.035	0.040**	0.055	0.050**	0.121	0.040	-0.074	0.054	0.026
	(1.50)	(2.09)	(0.91)	(2.32)	(1.53)	(0.73)	(-0.47)	(1.05)	(0.18)
3-0 years prior	0.040**	0.000	-0.045	0.003	0.047	0.098**	0.137	0.072	0.135
	(2.15)	(0.02)	(-0.68)	(0.17)	(0.60)	(2.52)	(1.05)	(1.45)	(1.20)
0-3 years after	-0.038*	-0.032	-0.041	-0.032	0.062	-0.053	0.144	-0.020	-0.110
	(-1.85)	(-1.61)	(-0.62)	(-1.44)	(0.88)	(-1.34)	(1.10)	(-0.37)	(-0.91)
3-6 years after	-0.047**	-0.015	-0.063	-0.024	0.102	-0.089**	-0.140	-0.137***	-0.125
	(-2.37)	(-0.71)	(-1.14)	(-1.06)	(1.49)	(-2.34)	(-1.07)	(-2.70)	(-0.99)
6-9 years after	-0.029	-0.021	-0.055	-0.029	0.057	-0.020	-0.081	-0.058	-0.073
	(-1.28)	(-0.91)	(-1.00)	(-1.36)	(0.75)	(-0.40)	(-0.47)	(-0.95)	(-0.49)
Observations	9,056	5,656	5,656	5,656	5,656	3,256	3,256	3,256	3,256

Notes: The regressions of Table 4 include as controls the difference in the log-squared value of firm age, a full set of time fixed effects, and a full set of event dummies for MNEs. *t*-statistics are in parentheses. Standard errors are clustered at match-year levels (see Abadie/Spiess, 2020).
* $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.
Source: IAB-ReLOC; own calculations. ©IAB

We assess whether jobs with high routine content or few face-to-face interactions have explanatory power in terms of the relative decline in an MNE's employment when we also consider worker skill level, keeping in mind that there are low-skilled jobs such as cleaning, catering, hairdressing and security services that cannot be relocated to foreign countries because they include personal interactions and physical presence. Instead, many jobs held by medium- or high-skilled workers, such as administrative clerks, highly trained specialists, programmers, or mathematicians, are easily offshorable, often because the use of computers makes jobs vulnerable to being relocated abroad since no physical presence is needed (see Blinder, 2009 and Blinder/Krueger, 2013).

Following the recommendation by Autor (2013: p. 195), we employ off-the-shelf measures and borrow the strict definition of the *nonroutine* and *interactive* indices from Becker/Ekholm/Muendler (2013).[18] To obtain a binary classification, we take the distribution of these ranking indices among all workers and then declare those jobs as *routine* or *noninteractive* that belong to the lowest 25 percent.[19] We then interact these jobs with skill to obtain three new groups of workers: low-, medium-, and high-skilled workers in routine or noninteractive jobs. According to theory, we would expect that within the skill group, those workers are particu-

[18] The measure is related to the work by Spitz-Oener (2006) and has also been applied by Baumgarten/Geishecker/Görg (2013).
[19] The threshold is based on Blinder/Krueger (2013), who find that approximately 25 percent of the workforce in the US is offshorable. We apply the same methodology as that of Baumgarten/Irlacher/Koch (2020).

larly prone to substitution with foreign labor. To test this expectation, we use these groups as dependent variables in the estimating equation of our matched sample, either by considering their number of employees or their wage bill.

Table 5 shows the results for routine jobs with respect to employment (Panel A) and the wage bill (Panel B). It is striking that employment effects by skill group not only become nonsignificant but also change their direction or become smaller in magnitude than in the regressions that ignored routine content. An exception is low-skilled workers in routine jobs in manufacturing MNEs (Panel A, column 4), which, however, still lose subproportionally to their overall skill group (Table 3, column 3). In the evolution of the wage bill (Panel B), we observe delayed decreases for this type of labor in the manufacturing sector. In the service sector, the relative wage bill of medium- and high-skilled routine jobs increases prior to FDI, possibly because of an increased demand for routine office work. Some of these gains, however, are lost in the aftermath. Note that the wage bill of low-skilled routine jobs tends to increase some years after FDI, but the strong oscillation of the coefficients casts doubt on the generalizability of this effect. Nevertheless, the identification of the specific type of affected labor is an interesting avenue for future research.

Panels A and B in Table 6 report analogous results for noninteractive jobs per skill group. Column 4 suggests that the noninteractive jobs of low-skilled manufacturing workers are slightly more affected by FDI than are those of their low-skilled colleagues (compare with Table 3). In the service sector, the growth of noninteractive jobs does not significantly differ across firm type. This result adds to Becker/Ekholm/Muendler (2013: Table 7, column 6), who show that service MNEs expand the share of interactive tasks if they hire workers offshore. In terms of wage sums, we find results similar to those in Panel B of Table 5, whereas in the service sector, noninteractive jobs of low-skilled workers experience immediate and strong negative effects that are followed by nonsignificant increases. Again, a more thorough analysis on the recomposition of the workforce in light of FDI and occupations/tasks is feasible with IAB-ReLOC data and very desirable for future research.

Table 5: FDI and the Growth of Routine Jobs by Skill Group

	Full sample			Manufacturing sector			Service sector		
Panel A	**Dependent variable: Δ log number of workers in routine jobs $\times$ skill level**								
	Low	Medium	High	Low	Medium	High	Low	Medium	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6-3 years prior	0.000	0.019	0.004	-0.004	0.014	0.014	0.010	0.033	-0.015
	(0.02)	(0.86)	(0.27)	(-0.20)	(0.59)	(0.84)	(0.20)	(0.75)	(-0.71)
3-0 years prior	-0.030	-0.029	0.006	-0.023	-0.022	-0.008	-0.039	-0.040	0.021
	(-1.37)	(-1.49)	(0.48)	(-0.80)	(-0.86)	(-0.49)	(-1.33)	(-1.30)	(1.17)
0-3 years after	-0.029	-0.036	0.006	-0.073**	-0.036	0.002	0.016	-0.033	0.011
	(-1.30)	(-1.55)	(0.47)	(-2.40)	(-1.23)	(0.09)	(0.56)	(-0.95)	(0.68)
3-6 years after	-0.034	-0.019	0.003	-0.039	-0.022	0.004	-0.032	0.005	0.002
	(-1.44)	(-0.73)	(0.19)	(-1.26)	(-0.70)	(0.20)	(-0.94)	(0.13)	(0.10)
6-9 years after	0.002	-0.020	0.030*	0.001	-0.041	0.031	0.005	0.009	0.028
	(0.09)	(-0.80)	(1.75)	(0.04)	(-1.34)	(1.35)	(0.12)	(0.21)	(1.12)
Observations	9,530	9,530	9,530	5,936	5,936	5,936	3,446	3,446	3,446
Panel B	**Dependent variable: Δ log wage bill of routine jobs $\times$ skill level**								
	Low	Medium	High	Low	Medium	High	Low	Medium	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6-3 years prior	0.060	0.067*	0.065	0.085	0.125***	0.040	0.024	-0.031	0.126
	(1.01)	(1.77)	(1.29)	(1.38)	(3.38)	(0.85)	(0.19)	(-0.37)	(1.08)
3-0 years prior	-0.019	0.102***	0.116**	-0.057	-0.005	0.038	0.027	0.261***	0.235**
	(-0.39)	(3.15)	(2.15)	(-1.04)	(-0.16)	(0.64)	(0.29)	(3.73)	(2.21)
0-3 years after	-0.093	-0.036	-0.050	-0.056	-0.012	0.014	-0.165	-0.064	-0.170*
	(-1.54)	(-1.02)	(-1.04)	(-0.83)	(-0.33)	(0.31)	(-1.48)	(-0.91)	(-1.72)
3-6 years after	0.034	-0.080***	-0.047	-0.059	-0.028	-0.036	0.201*	-0.140**	-0.062
	(0.56)	(-2.63)	(-0.87)	(-0.87)	(-1.07)	(-0.60)	(1.76)	(-2.11)	(-0.58)
6-9 years after	-0.049	-0.014	-0.111*	-0.105*	0.015	-0.072	0.039	-0.054	-0.148
	(-0.76)	(-0.35)	(-1.77)	(-1.76)	(0.43)	(-1.11)	(0.29)	(-0.52)	(-1.09)
Observations	9,032	9,032	9,032	5,646	5,646	5,646	3,242	3,242	3,242

Notes: The regressions of Table 5 include as controls the difference in the log-squared value of firm age, a full set of time fixed effects, and a full set of event dummies for MNEs. *t*-statistics are in parentheses. Standard errors are clustered at match-year levels.

* $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.

Source: IAB-ReLOC; own calculations. ©IAB

Table 6: FDI and the Growth of Noninteractive Jobs by Skill Group

Panel A	Full sample			Manufacturing sector			Service sector		
	Dependent variable: $\triangle$ log number of workers in noninteractive jobs $\times$ skill level								
	Low	Medium	High	Low	Medium	High	Low	Medium	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6-3 years prior	-0.006	0.019	0.002	-0.000	-0.002	0.014	-0.016	0.061	-0.024
	(-0.24)	(0.87)	(0.16)	(-0.02)	(-0.10)	(0.72)	(-0.32)	(1.31)	(-1.22)
3-0 years prior	-0.017	-0.020	0.010	-0.031	-0.029	-0.004	0.005	-0.002	0.026
	(-0.83)	(-1.04)	(0.72)	(-1.08)	(-1.19)	(-0.20)	(0.17)	(-0.06)	(1.50)
0-3 years after	-0.046**	-0.041*	-0.005	-0.089***	-0.037	-0.009	0.005	-0.040	-0.006
	(-2.10)	(-1.80)	(-0.38)	(-2.96)	(-1.30)	(-0.46)	(0.16)	(-1.17)	(-0.43)
3-6 years after	-0.030	-0.026	0.003	-0.065**	-0.052*	-0.007	0.015	0.020	0.013
	(-1.34)	(-1.10)	(0.20)	(-2.27)	(-1.72)	(-0.31)	(0.44)	(0.51)	(0.54)
6-9 years after	-0.006	-0.023	0.002	-0.009	-0.042*	0.011	0.009	0.028	-0.010
	(-0.30)	(-1.04)	(0.14)	(-0.36)	(-1.67)	(0.48)	(0.25)	(0.70)	(-0.53)
Observations	9,530	9,530	9,530	5,936	5,936	5,936	3,446	3,446	3,446
Panel B	Dependent variable: $\triangle$ log wage bill of noninteractive jobs $\times$ skill level								
	Low	Medium	High	Low	Medium	High	Low	Medium	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6-3 years prior	0.050	0.043	0.072	0.067	0.093**	0.064	0.023	-0.033	0.095
	(0.84)	(1.06)	(1.49)	(1.31)	(2.49)	(1.38)	(0.21)	(-0.37)	(0.87)
3-0 years prior	0.054	0.091***	0.125**	-0.009	-0.011	0.036	0.155	0.247***	0.267**
	(1.10)	(2.62)	(2.37)	(-0.20)	(-0.34)	(0.64)	(1.44)	(3.41)	(2.54)
0-3 years after	-0.114**	0.026	-0.007	-0.017	0.030	0.026	-0.266**	0.030	-0.065
	(-1.98)	(0.69)	(-0.13)	(-0.30)	(0.73)	(0.49)	(-2.36)	(0.42)	(-0.65)
3-6 years after	0.0691	-0.0621*	-0.0281	0.0002	0.0115	-0.027	0.197	-0.151**	-0.012
	(1.22)	(-1.91)	(-0.52)	(0.00)	(0.36)	(-0.44)	(1.64)	(-2.31)	(-0.12)
6-9 years after	-0.062	0.012	-0.122*	-0.087*	0.023	-0.117*	0.051	0.005	-0.090
	(-1.08)	(0.29)	(-1.94)	(-1.92)	(0.61)	(-1.81)	(0.38)	(0.05)	(-0.67)
Observations	9,032	9,032	9,032	5,646	5,646	5,646	3,242	3,242	3,242

Notes: The regressions of Table 6 include as controls the difference in the log-squared value of firm age, a full set of time fixed effects, and a full set of event dummies for MNEs. *t*-statistics are in parentheses. Standard errors are clustered at match-year levels.

* $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.

Source: IAB-ReLOC; own calculations. ©IAB

5 Robustness

This section assesses the stability of our results in different time periods of initial investment, the growth differential of small MNEs, and the inclusion of East German states.

5.1 Different Time Periods of the FDI

To explore whether the years of FDI have an impact on changes in employment growth, we split the sample of matched firms into subsamples, which differ with respect to the year of initial investment in the Czech Republic (fictitious dates from matching for non-MNEs). We broadly distinguish between 3 different periods. The first period includes first-mover MNEs from 1990 to 1995, where wage differences between countries were largest and investment risk or fixed costs were relatively high. The second period is from 1996 to 2002 and can be characterized by a relatively homogeneous growth period in terms of gross output and trade, whereas the overall unemployment remains fairly similar. In the third period, from 2003 to 2008, offshoring costs to CEECs further decreased, especially for service firms that benefited from EU enlargement.

The outcomes in Table A2 suggest that the employment effect of FDI changed over time. We assume that this change is mainly related to differences in the investment climate and income level of the Czech Republic, as well as to the MNE's size/productivity. Panel A presents the results for the manufacturing sector, clearly showing that the adverse effects on low- and medium-skilled conditions occur in the beginning of the sample period. In Figure A3, we show that the average MNE size of initially investing firms decreases over time, so the effects can be related to firm size, which is a caveat that we address in the next subsection.

Panel B displays the results for the service sector. It becomes obvious that in service firms, the sample split renders most of the coefficients nonsignificant, while coefficient size remains relatively similar for most of the estimates. Hence, we conclude that the baseline specification is sensible in terms of the degrees of freedom in the specification.

5.2 Small and Mid-Sized Firms

The timing of FDI places even more emphasis on the analysis of small firms, which is one key advantage of using the IAB-ReLOC data. We therefore zoom in on the effects that small firms

have on the former results and reduce the sample of matched firms to firms that employed 2 to 100 employees in 1991. Since the estimates are similar to those in Table 3 (in terms of direction and magnitude), we report the results in Table A4 and Figure A5 and briefly explain the differences. The reduction in statistical significance is notable; it could be, c.p., due to the reduced number of observations and the resulting reduction in degrees of freedom, as in Table A2. This means that if heterogeneity remains the same in the employment responses among small firms, then we should already interpret the coefficients with lower significance levels for the effects (allow for a higher rate of alpha error, i.e., $p = 0.1$).

In the manufacturing sector, the relative drop in low- and medium-skilled workers decreased in significance, while the magnitude remained fairly similar over the total 9-year period after FDI. This still changed the educational composition of firms' workforce, especially since in the medium run (7-9 years after investment), the relative number of high-skilled workers in small MNEs grew faster than the number at comparable non-MNEs. In the service MNEs, we observe that an increase in high-skilled workers relative to non-MNEs prior to FDI is followed by a stronger and remarkable drop in the medium to long run after FDI. Low- and medium-skilled workers are similarly affected compared to our baseline specification. The effects of FDI on the employment of small service MNEs are especially noteworthy because, on average, this type of MNE grew faster than the respective non-MNEs in 1990 and especially in the 2000s (see Figure A4).

5.3 East Germany

We now test the robustness of our results to the inclusion of plants and firms in East Germany.[20] To do so, we use the estimating equation (3.1) of annual growth and up to 182,872 firm-year observations. Standard errors are clustered at firm-year levels. Figure A6 and Table A5 illustrate the evolution of the growth differences between MNEs and non-MNEs in the total labor force. Again, the year of FDI marks a remarkable turning point for relative development. Up to six years after investment, we observe significant drops in the relative growth of MNEs. With respect to sectors, the lower panels of Figure A6 affirm the previous results, although we detect two substantial differences. In particular, we observe that the effect of FDI on low-skilled workers in both sectors declines, as implied by the attenuated coefficients and weaker statistical significance. This change could be driven by the lower wage rate in East German regions and thus a lower incentive to offshore labor-intensive production. In fact, these regions themselves could act as offshoring destinations for West German firms due to lower average wages. Moreover, we spot a stronger decline in the relative number of high-skilled workers in service MNEs, affirming the results from Table 3.

[20] East German establishments have been recorded in the dataset since 1993.

6 Conclusions

We have revisited the effects of firm-level FDI on domestic employment using data on German MNEs that have invested in CEECs. Using an event-study design of coarsened and exactly matched firms, we conclude that after investment, the employment growth of German MNEs slackened for approximately 6 to 9 years compared to firms without any FDI. In sum, this slack amounted to a drop in MNEs' domestic employment of 10-14 percent. The effects, however, are uneven across sectors and depend on the educational attainment of workers. Relative to non-MNEs, MNEs in the manufacturing sector decrease the number of medium- and low-skilled jobs, while the impact on high-skilled jobs tends to be positive prior to FDI and nonsignificant thereafter. In terms of wage bills, MNEs exhibit nonsignificant differences from non-MNEs, suggesting that gains from increased productivity are shared with the remaining workforce. For service MNEs, we find drops in the relative growth of medium-skilled and some high-skilled workers (especially in small MNEs) and nonsignificant drops for low-skilled workers. Compared to the manufacturing sector, these effects come with a time lag, which may be explained by extended hiring in foreign affiliates without plant closures at home. In terms of wage sums in the service sector, we observe increases prior to investment and declines in the aftermath until 6 years after investment. The drop is particularly strong for medium-skilled workers, who make up the group of workers most commonly associated with routine tasks.

To identify the type of labor that is most susceptible to substitution by foreign labor, we analyze skill subgroups of jobs that are intensive in either routine or noninteractive tasks. Strikingly, our analysis on the relative growth of MNEs does not conclude that a job's routine content or interactivity has much explanatory power beyond what is explained by a worker's educational attainment, especially in the service sector.

Our results differ from the majority of former literature that revealed positive or no onshore employment effects after a firm's FDI to a low-wage country (e.g., Navaretti/Castellani/Disdier, 2010; Borin/Mancini, 2016; Hijzen/Jean/Mayer, 2011; Sethupathy, 2013). Our outcomes add, however, to the few findings of negative employment effects after FDI to a low-wage country such as Muendler/Becker (2010) for Germany and Debaere/Lee/Lee (2010) for South Korea. Note that the latter analyze manufacturing firms in the 1980s and 1990s, a time when South Korea was considered as an emerging economy, a possible reason why the effects are different. But why do the effects in Germany deviate from those in other developed countries? One explanation is provided by Harrison/McMillan (2011) pointing to both the complementarity and substitutability of foreign affiliates with onshore labor. Thereby, the more similar the type of workers is the higher is the substitution effect. A high substitution effect, in turn, is plausible for the case of Czech and German labor not only because of the proximity, but also, as Marin (2004) underlines, because of the relatively high skill level of workers in the

CEECs, and as Dustmann et al. (2014) and Winkler (2010) state, a similar educational system and (manufacturing) industry structure. This similarity may also explain the effects by skill group and especially the slackened growth of high-skilled workers in German service MNEs. In German manufacturing MNEs, the outcomes on skill upgrading are broadly in line with existing FDI literature. Our paper thereby adds to Becker/Ekholm/Muendler (2013: p.101 f.) who find no effects on the skill composition or the share of white-collar workers in the parent firm after increases in the affiliate employment share in the CEECs. The departure in the manufacturing sector could be due to differences in the margins of the effect. While we look at the extensive margin (initial firm expansions), Becker/Ekholm/Muendler (2013) explore the effect at the intensive margin (offshore employment). We also find relative shifts toward more interactive task profiles only in manufacturing MNEs and not, as in Becker/Ekholm/Muendler (2013) only in service MNEs. These differences could be caused by the upper tail of the index distribution instead of the lower tail, that is, by increasing the number of nonroutine or interactive jobs and not by decreasing the number of routine or noninteractive jobs. In this paper, we do also not analyze the workforce composition but directly compare the growth path of MNEs and non-MNEs in terms of the task profile by skill group. In the service sector, we also see that the selection bias is considerable and substantially changes the outcomes with respect to high-skilled workers. The skill-intensive small service MNEs from Germany potentially exploit a financial advantage that they have over Czech competitors in hiring high-skilled Czech workers at relatively low costs (compared to German wages).

Since MNEs act as a catalyst for changes in the international price of different types of labor, our paper is able to reveal labor demand changes in response to globalization. Specifically, we confirm public concerns about losses from MNEs' expansions to low-wage countries for particularly low- and medium-skilled workers, but only in the short term. Our results thereby imply several recommendations for policy makers who intend to redistribute the net gains from FDI-induced productivity enhancements. These comprise, for instance, of measures for a skill-upgrading process to react to demand shifts for different skills and to shield workers from negative impacts. Costs of the structural change can also be mitigated by decreasing labor market search frictions and by fostering (occupational) retraining.

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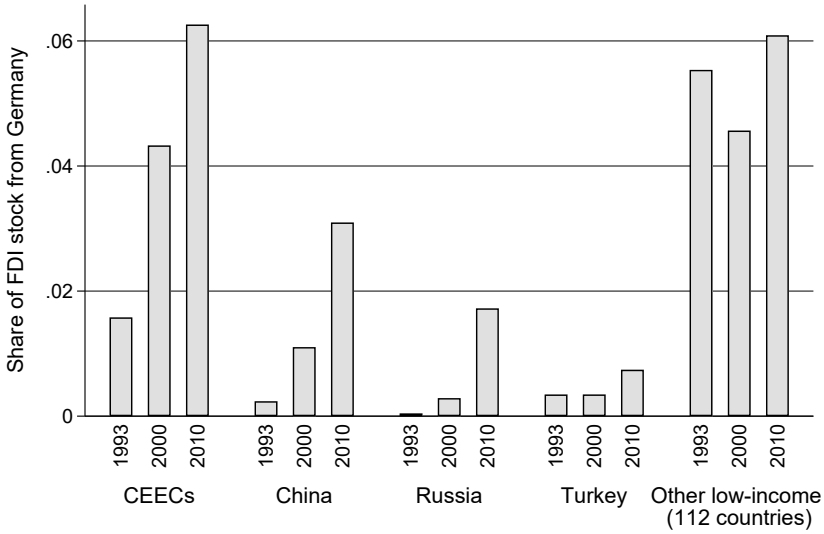
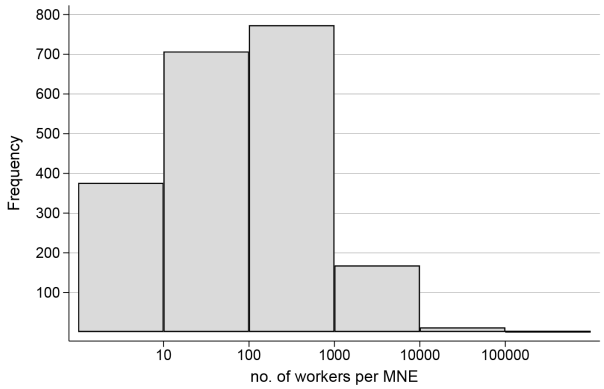
Appendix

Figure A1: Importance of CEECs as a German FDI Destination



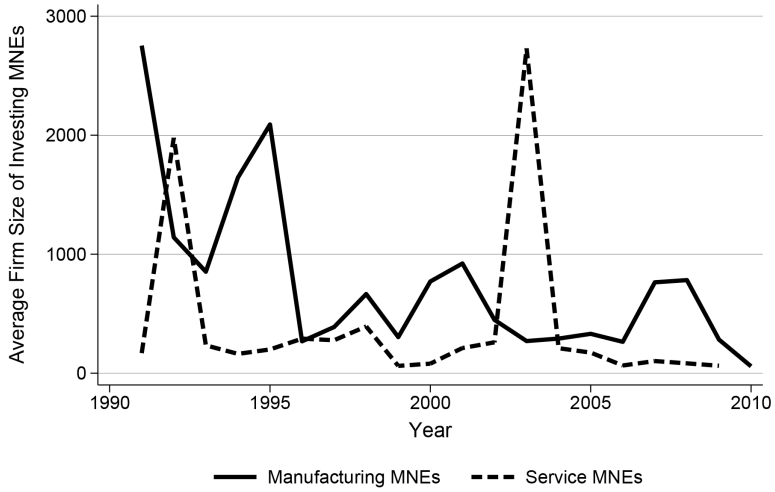
Notes: The bar chart of Figure A1 illustrates the share of German outward FDI stock to low- or medium-income countries according to the World Bank classification. Here, the CEECs comprise the Czech Republic, Hungary, Poland, and Slovakia. In addition to including all other low-income countries in the OECD dataset, the group 'other low-income countries' also contains information on important FDI destinations such as Brazil or Mexico.
Source: OECD Globalization/FDI statistics (3rd edition).

Figure A2: Relative Frequencies of MNEs According to Size



Notes: The histogram in Figure A2 highlights the high fraction of small and medium-sized enterprises that invested in the Czech Republic. For a better comparison with Becker/Muendler (2008) and Becker/Ekholm/Muendler (2013), the number of workers include regular employees, apprentices, trainees, and marginal workers. Note that the x-axis is logarithmic, and so it graphically understates smaller firms.
Source: IAB-ReLOC; own calculations. ©IAB

Figure A3: Average Size of Investing MNEs



Notes: Figure A3 illustrates the average size per investing MNE separately for the manufacturing (bold line) and service (dotted line) sectors. For a better comparison over time, the average firm size includes only regular workers and no apprentices, trainees, or marginal workers (marginal workers are reported from 1999 onward in the IAB Establishment Panel).
Source: IAB-ReLOC; own calculations. ©IAB

Table A1: Regression Results of the Full Sample

Dependent variable:	Full sample	Manufacturing sector				Service sector			
			By skill group				By skill group		
Δ Log	All	All	Low	Medium	High	All	Low	Medium	High
employees	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6 years prior	0.0099	0.0058	-0.0015	0.0077	0.0129	0.0166	0.0188	0.0207	0.0138
	(1.28)	(0.76)	(-0.14)	(0.98)	(1.35)	(1.10)	(1.18)	(1.39)	(0.93)
5 years prior	0.0243***	0.0127	-0.0059	0.0113	0.0203**	0.0406**	0.0088	0.0351**	0.0242
	(2.86)	(1.50)	(-0.50)	(1.21)	(2.17)	(2.48)	(0.52)	(2.18)	(1.47)
4 years prior	0.0019	-0.0061	-0.0220*	0.0012	0.0026	0.0143	-0.0170	0.0084	0.0385***
	(0.23)	(-0.63)	(-1.67)	(0.12)	(0.26)	(1.02)	(-1.10)	(0.60)	(2.69)
3 years prior	-0.0003	0.0012	0.0048	0.0005	0.0172*	0.0000	-0.0057	-0.0066	0.0305**
	(-0.05)	(0.15)	(0.47)	(0.05)	(1.84)	(0.00)	(-0.40)	(-0.55)	(2.33)
2 years prior	0.0029	-0.0050	-0.0080	-0.0063	-0.0054	0.0152	0.0150	0.0127	0.0323***
	(0.41)	(-0.59)	(-0.77)	(-0.76)	(-0.55)	(1.30)	(1.15)	(1.02)	(2.82)
1 year prior	0.0052	0.0001	-0.0173	0.0002	0.0011	0.0153	-0.0139	0.0191	0.0159
	(0.71)	(0.01)	(-1.50)	(0.02)	(0.11)	(1.29)	(-1.03)	(1.57)	(1.48)
year of FDI	0.0187*	0.0197	0.0064	0.0180	0.0488***	0.0199	-0.0079	0.0182	0.0307**
	(1.90)	(1.31)	(0.40)	(1.28)	(3.09)	(1.63)	(-0.63)	(1.48)	(2.43)
1 year after	-0.0107	-0.0240***	-0.0316***	-0.0252***	-0.0039	0.0057	-0.0038	0.0014	0.0090
	(-1.47)	(-2.64)	(-2.65)	(-2.60)	(-0.39)	(0.49)	(-0.29)	(0.12)	(0.81)
2 years after	-0.0200***	-0.0273***	-0.0350***	-0.0252***	-0.0045	-0.0104	-0.0113	-0.0192*	0.0180*
	(-3.29)	(-4.01)	(-3.78)	(-3.53)	(-0.52)	(-1.01)	(-0.85)	(-1.81)	(1.73)
3 years after	-0.0158**	-0.0108*	-0.0216**	-0.0097	-0.0026	-0.0193*	-0.0050	-0.0192	-0.0090
	(-2.49)	(-1.79)	(-2.45)	(-1.51)	(-0.29)	(-1.68)	(-0.36)	(-1.62)	(-0.79)
4 years after	-0.0292***	-0.0214***	-0.0344***	-0.0173*	-0.0003	-0.0352***	-0.0386***	-0.0384***	-0.0222**
	(-4.87)	(-2.58)	(-2.89)	(-1.80)	(-0.04)	(-4.08)	(-3.09)	(-4.12)	(-2.24)
5 years after	-0.0185**	-0.0143	-0.0256**	-0.0154*	-0.0042	-0.0203*	-0.0188	-0.0206	-0.0205*
	(-2.43)	(-1.51)	(-2.11)	(-1.65)	(-0.39)	(-1.66)	(-1.26)	(-1.61)	(-1.78)
6 years after	-0.0088	-0.0059	-0.0209*	-0.0041	0.0044	-0.0089	-0.0095	-0.0079	-0.0205**
	(-1.43)	(-0.75)	(-1.78)	(-0.50)	(0.47)	(-0.91)	(-0.61)	(-0.75)	(-1.97)
7 years after	-0.0151*	-0.0032	-0.0198	0.0002	0.0089	-0.0293**	-0.0453**	-0.0348**	-0.0258*
	(-1.86)	(-0.35)	(-1.53)	(0.02)	(0.97)	(-2.01)	(-2.54)	(-2.23)	(-1.80)
8 years after	-0.0109	-0.0078	-0.0247*	-0.0091	-0.0096	-0.0134	0.0138	-0.0194	0.0011
	(-1.40)	(-0.80)	(-1.94)	(-1.00)	(-0.90)	(-1.05)	(0.82)	(-1.53)	(0.08)
9 years after	-0.0092	-0.0069	-0.0129	-0.0073	0.0015	-0.0112	0.0100	-0.0109	-0.0139
	(-1.02)	(-0.62)	(-0.93)	(-0.64)	(0.13)	(-0.75)	(0.58)	(-0.70)	(-0.88)
Observations	164,410	86,094	86,094	86,094	86,094	78,316	78,316	78,316	78,316

Notes: The regressions of Table A1 include as controls the difference of the log-squared value of firm age, a full set of time fixed effects, and a full set of event dummies for MNEs. t-statistics are in parentheses. Standard errors are clustered at firm-year levels (see Abadie/Spiess, 2020).

* $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.

Source: IAB-ReLOC; own calculations. ©IAB

Table A2: Regression Results after Sample Split by Time Periods

Dependent variable:	1990-1995			1996-2002			2003-2008		
	Panel A: Manufacturing sector								
Δ Log skilled emp.	Low (1)	Medium (2)	High (3)	Low (4)	Medium (5)	High (6)	Low (7)	Medium (8)	High (9)
6-3 years prior	0.0003	0.0333	0.0655*	0.0262	0.0285	-0.0132	0.0091	-0.0102	0.0122
	(0.01)	(1.39)	(1.77)	(0.63)	(0.91)	(-0.35)	(0.16)	(-0.24)	(0.25)
3-0 years prior	-0.0423	-0.0201	-0.0091	-0.0622	-0.0400	0.0339	0.0178	-0.0123	0.0637
	(-0.79)	(-0.71)	(-0.22)	(-1.21)	(-1.24)	(0.82)	(0.35)	(-0.34)	(1.35)
0-3 years after	-0.0379	-0.0486*	0.0272	-0.1750***	-0.0908**	-0.0009	-0.0111	0.0397	0.0611
	(-0.90)	(-1.85)	(0.74)	(-2.60)	(-2.52)	(-0.02)	(-0.20)	(0.85)	(1.40)
3-6 years after	-0.0850*	-0.0906***	0.0052	-0.0515	0.0023	-0.0005	0.0151	0.1020*	0.1090
	(-1.84)	(-2.98)	(0.13)	(-1.22)	(0.07)	(-0.01)	(0.20)	(1.95)	(1.63)
6-9 years after	-0.0187	-0.0313	0.0106	-0.0043	0.0027	0.0433	-	-	-
	(-0.50)	(-0.95)	(0.27)	(-0.13)	(0.10)	(1.16)	(.)	(.)	(.)
Observations	2,412	2,412	2,412	1,976	1,976	1,976	1,478	1,478	1,478
	Panel B: Service sector								
	Low (1)	Medium (2)	High (3)	Low (4)	Medium (5)	High (6)	Low (7)	Medium (8)	High (9)
6-3 years prior	-0.0949	0.0536	0.0874	0.0237	-0.0562	-0.0463	0.0122	0.0121	-0.0555
	(-1.55)	(0.98)	(1.23)	(0.29)	(-1.13)	(-0.67)	(0.12)	(0.16)	(-0.80)
3-0 years prior	-0.0955	-0.0127	0.0816	-0.0260	-0.0393	0.0945	-0.0166	0.0671	0.0913
	(-1.22)	(-0.25)	(1.37)	(-0.40)	(-0.53)	(1.31)	(-0.29)	(1.18)	(1.52)
0-3 years after	0.0745	0.0088	0.0446	-0.0597	-0.0388	-0.0009	0.0376	-0.0383	0.0420
	(1.06)	(0.16)	(0.78)	(-0.88)	(-0.50)	(-0.01)	(0.57)	(-0.76)	(0.74)
3-6 years after	-0.0730	-0.0726	-0.0347	-0.0558	-0.0559	-0.0282	-0.0652	-0.0474	-0.0898
	(-0.91)	(-1.46)	(-0.70)	(-0.91)	(-0.93)	(-0.45)	(-0.69)	(-0.72)	(-1.11)
6-9 years after	0.0123	0.0564	-0.0149	-0.0963	-0.0812	-0.130*	-	-	-
	(0.12)	(1.00)	(-0.25)	(-1.56)	(-1.17)	(-1.83)	(.)	(.)	(.)
Observations	1,050	1,050	1,050	1,040	1,040	1,040	1,340	1,340	1,340

Notes: The regressions of Table A2 include as controls the difference of the log-squared value of firm age, a full set of time fixed effects, and a full set of event dummies for MNEs. *t*-statistics are in parentheses. Standard errors are clustered at match-year levels (see Abadie/Spiess, 2020).

* $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.

Source: IAB-ReLOC; own calculations. ©IAB

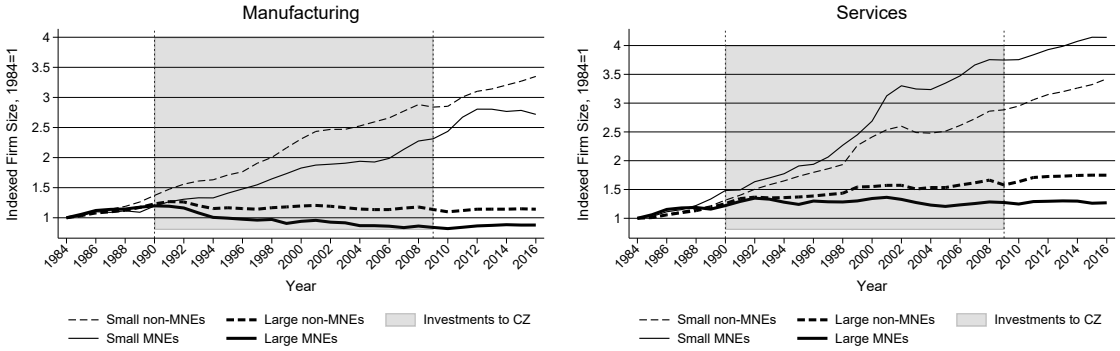
Table A3: Characteristics of Small MNEs and Non-MNEs

	Manufacturing sector			Service sector		
Variable	MNE Mean *Median* (Std. Dev.)	Reference Mean *Median* (Std. Dev.)	Std. Bias (Var. Rat.)	MNE Mean *Median* (Std. Dev.)	Reference Mean *Median* (Std. Dev.)	Std. Bias (Var. Rat.)
Employees	61.6993 *49* (77.5888)	63.1804 *49* (64.9205)	-0.0207 (1.4283)	73.6598 *37* (157.8606)	52.2729 *37* (62.4269)	0.1782 (6.3945)
High-skilled (share)	0.0740 *0.0412* (0.1056)	0.0472 *0.0194* (0.0812)	0.2851 (1.6910)	0.1393 *0.0455* (0.1935)	0.0819 *0.0128* (0.1596)	0.3235 (1.4701)
Med.-skilled (share)	0.7458 *0.7775* (0.1823)	0.7820 *0.8250* (0.1767)	-0.2018 (1.0649)	0.7889 *0.8421* (0.2021)	0.8053 *0.8824* (0.2090)	-0.0799 (0.9347)
Low-skilled (share)	0.1802 *0.1206* (0.1810)	0.1708 *0.1134* (0.1758)	0.0526 (1.0610)	0.0718 *0.0258* (0.1098)	0.1127 *0.0370* (0.1760)	-0.2792 (0.3893)
Employment growth	2.4828 *2.6110* (0.9826)	2.4588 *2.6595* (0.9947)	0.0243 (0.9758)	2.4861 *2.6595* (1.2289)	2.3922 *2.6189* (1.0353)	0.0826 (1.4090)
Wage bill	6036.8418 *4093.3047* (9535.9927)	5938.3656 *4107.2949* (7458.9710)	0.0115 (1.6345)	9536.2447 *3965.1399* (23450.5009)	5026.9067 *3078.8573* (7382.7030)	0.2594 (10.0896)
Plants	1.1558 *1* (0.6559)	1.2155 *1* (1.8929)	-0.0421 (0.1201)	2.1821 *1* (8.7157)	1.5176 *1* (2.1563)	0.1047 (16.3374)
Firms	284	835		312	1,116	

Notes: Table A3 presents the summary statistics of MNEs and non-MNEs in West Germany that employed between 2 and 100 workers in 1991. MNE information is reported for the period two years prior to investment, while non-MNE information includes observations for all years without any missing value. Employment numbers include only regular employment and no apprentices, marginal employment, or temporary workers. Employment growth is measured as the log of the employment difference over the last four years. Concerning multisite MNEs, more than 30 % consist of more than one establishment in Germany. The wage bill is denoted in euros and considers average daily wages. For the definitions of standardized bias and variance ratio, see footnote 14.

Source: IAB-ReLOC; own calculations. ©IAB

Figure A4: Indexed Average Firm Size of MNEs and Non-MNEs by Initial Firm Size



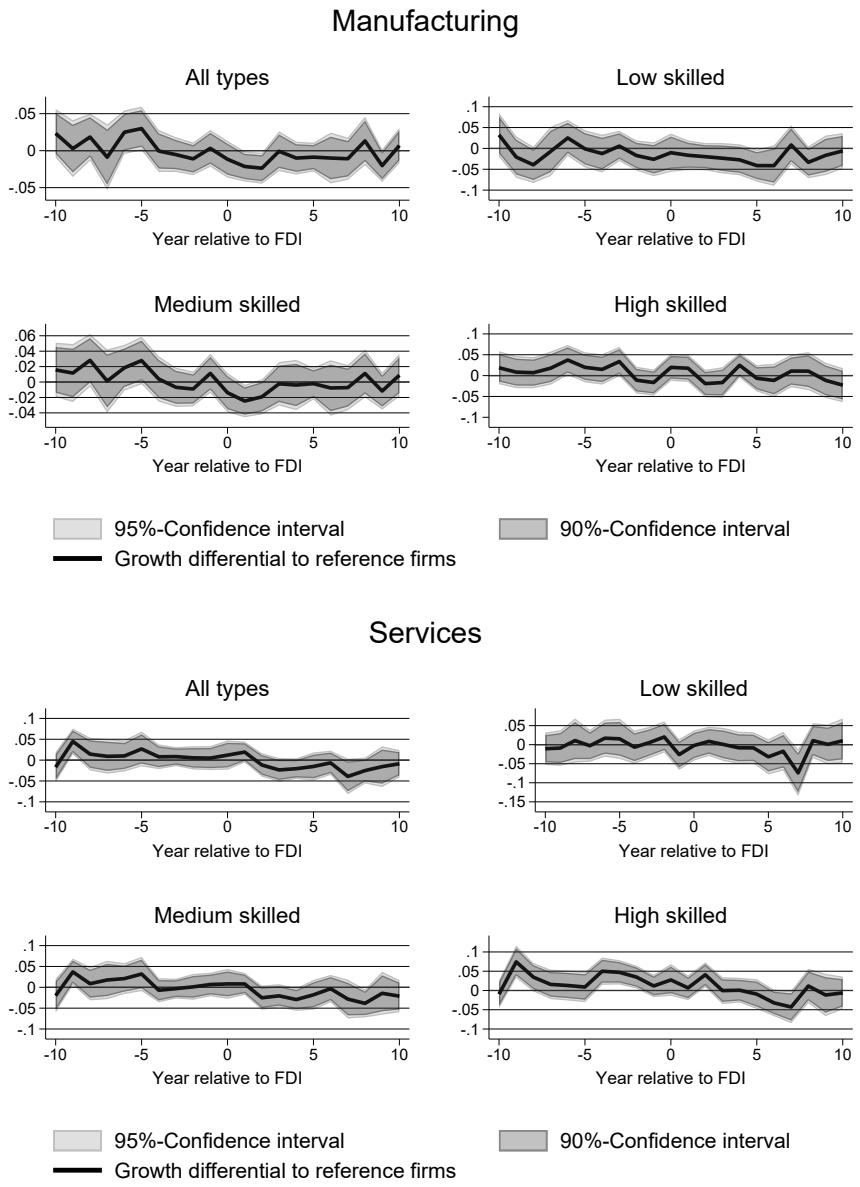
Notes: Figure A4 illustrates an evolving growth differential of firms in the West German manufacturing (left) and service (right) sectors after 1990. The index considers changes in the average onshore employment of MNEs (solid line) and firms without any FDI (dotted line) around the period of expansion to the Czech Republic (gray area). Firms above 100 employees in 1984 are drawn in bold. The table does not include employment in East German plants, firm entrants, or firms that were liquidated between 1984 and 2016.
Source: IAB-ReLOC; own calculations. ©IAB

Table A4: Regression Results of Small Matched Firms

Dependent variable:	**Full sample**	**Manufacturing sector**				**Service sector**			
		By skill group				By skill group			
Δ Log	All	All	Low	Medium	High	All	Low	Medium	High
employees	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6-3 years prior	0.0157	0.0272	-0.0039	0.0465	0.0230	0.0054	-0.0024	0.00574	0.0781*
	(0.55)	(0.68)	(-0.08)	(1.17)	(0.51)	(0.14)	(-0.04)	(0.14)	(1.71)
3-0 years prior	0.0074	0.0042	0.0399	-0.0024	0.0182	0.0069	-0.0439	-0.0178	0.0183
	(0.26)	(0.12)	(0.62)	(-0.07)	(0.44)	(0.15)	(-0.77)	(-0.37)	(0.35)
0-3 years after	-0.0494	-0.0793**	-0.0544	-0.0639*	-0.0242	-0.0114	0.0236	-0.0159	0.0249
	(-1.62)	(-2.34)	(-1.21)	(-1.77)	(-0.57)	(-0.26)	(0.39)	(-0.37)	(0.52)
3-6 years after	-0.0729**	-0.0354	-0.0811	-0.0163	0.0261	-0.1000**	-0.0700	-0.1130**	-0.0930*
	(-2.25)	(-0.77)	(-1.47)	(-0.35)	(0.45)	(-2.07)	(-1.04)	(-2.33)	(-1.92)
6-9 years after	-0.0261	0.0183	-0.0754*	0.0265	0.1060*	-0.0563	-0.0764	-0.0218	-0.1010*
	(-0.66)	(0.40)	(-1.69)	(0.64)	(1.70)	(-0.82)	(-0.95)	(-0.32)	(-1.69)
Observations	3,108	1,612	1,612	1,612	1,612	1,456	1,456	1,456	1,456

Notes: The sample of Table A4 includes matched firms that employed 2 to 100 employees in 1991. This amounts to 234 manufacturing and 214 service firms. The regressions include as controls the difference of the log-squared value of firm age, a full set of time fixed effects, and a full set of event dummies for MNEs. *t*-statistics are in parentheses. Standard errors are clustered at match-year levels (see Abadie/Spiess, 2020).
* $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.
Source: IAB-ReLOC; own calculations. ©IAB

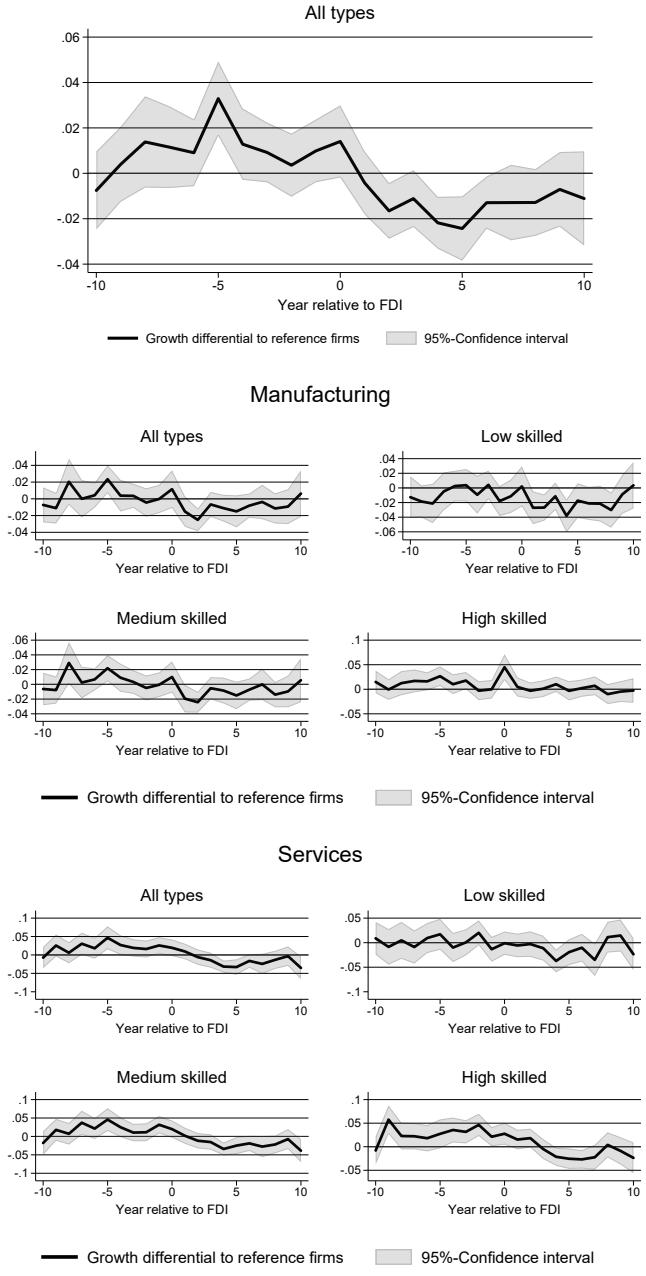
Figure A5: Growth Differential between Small MNEs and Non-MNEs



Notes: Figure A5 presents the growth differential between MNEs and non-MNEs, separately by sector and skill group. We only include firms that had 2 to 100 regular workers in 1991. The gray area is the 95% confidence interval, which tests whether a coefficient is individually different from zero. If it crosses the zero line, then no significant difference between MNEs and non-MNEs is measured. Standard errors are clustered at firm-year levels.

Source: IAB-ReLOC; own calculations. ©IAB

Figure A6: Employment Growth Differential of MNEs and Non-MNEs Incl. East Germany



Notes: Figure A6 presents the growth differential between MNEs and non-MNEs for the pooled sample and separately by sector and skill group. It also includes employment in East Germany. The gray area is the 95% confidence interval, which tests whether a coefficient is individually different from zero. If it crosses the zero line, then no significant difference between the MNEs and non-MNEs is measured. Standard errors are clustered at firm-year levels. The respective output is drawn from Table A5 in the appendix.
Source: IAB-ReLOC; own calculations. ©IAB

Table A5: Regression Results including East Germany

Dependent variable:	Full sample		Manufacturing sector				Service sector		
			By skill group				By skill group		
△ Log	All	All	Low	Medium	High	All	Low	Medium	High
employees	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6 years prior	0.0091	0.0044	0.0027	0.0056	0.0161*	0.0180	0.0094	0.0218	0.0180
	(1.21)	(0.57)	(0.25)	(0.71)	(1.73)	(1.24)	(0.60)	(1.53)	(1.26)
5 years prior	0.0329***	0.0236***	0.0038	0.0226**	0.0266***	0.0466***	0.0171	0.0417***	0.0273*
	(3.93)	(2.76)	(0.33)	(2.44)	(2.63)	(2.93)	(1.06)	(2.66)	(1.75)
4 years prior	0.0129	0.0038	-0.0093	0.0089	0.0103	0.0270**	-0.0010	0.0255*	0.0355***
	(1.60)	(0.40)	(-0.70)	(0.91)	(1.00)	(2.00)	(-0.66)	(1.86)	(2.64)
3 years prior	0.0092	0.0036	0.0043	0.0029	0.0177**	0.0191	0.0005	0.0120	0.0315**
	(1.37)	(0.49)	(0.43)	(0.35)	(2.00)	(1.59)	(0.04)	(0.99)	(2.51)
2 years prior	0.0036	-0.0044	-0.0179*	-0.0051	-0.0029	0.0161	0.0200	0.0094	0.0464***
	(0.50)	(-0.51)	(-1.72)	(-0.59)	(-0.29)	(1.37)	(1.55)	(0.75)	(3.84)
1 year prior	0.0099	-0.0002	-0.0114	-0.0002	-0.0001	0.0257**	-0.0134	0.0327***	0.0212**
	(1.40)	(-0.02)	(-0.98)	(-0.02)	(-0.01)	(2.24)	(-1.04)	(2.69)	(2.04)
year of FDI	0.0140*	0.0115	0.0021	0.0092	0.0450***	0.0194*	-0.0011	0.0175	0.0276**
	(1.73)	(1.01)	(0.15)	(0.85)	(3.33)	(1.69)	(-0.09)	(1.47)	(2.34)
1 year after	-0.0042	-0.0151	-0.0271**	-0.0192**	0.0048	0.0094	-0.0057	0.0008	0.0152
	(-0.59)	(-1.62)	(-2.37)	(-2.00)	(0.48)	(0.88)	(-0.46)	(0.07)	(1.43)
2 years after	-0.0165***	-0.0251***	-0.0269***	-0.0238***	-0.0030	-0.0059	-0.0029	-0.0122	0.0182*
	(-2.64)	(-3.62)	(-2.93)	(-3.32)	(-0.35)	(-0.56)	(-0.22)	(-1.14)	(1.78)
3 years after	-0.0111*	-0.0067	-0.0114	-0.0053	0.0012	-0.0144	-0.0112	-0.0157	-0.0049
	(-1.75)	(-0.87)	(-1.18)	(-0.70)	(0.13)	(-1.38)	(-0.87)	(-1.46)	(-0.46)
4 years after	-0.0218***	-0.0112	-0.0381***	-0.0080	0.0103	-0.0316***	-0.0373***	-0.0360***	-0.0213**
	(-3.74)	(-1.36)	(-3.31)	(-0.86)	(1.30)	(-3.83)	(-3.15)	(-4.05)	(-2.17)
5 years after	-0.0243***	-0.0150	-0.0173	-0.0160*	-0.0031	-0.0329***	-0.0193	-0.0277**	-0.0255**
	(-3.36)	(-1.53)	(-1.43)	(-1.68)	(-0.31)	(-3.06)	(-1.44)	(-2.38)	(-2.30)
6 years after	-0.0129**	-0.0081	-0.0212*	-0.0066	0.0023	-0.0162*	-0.0103	-0.0191*	-0.0268***
	(-2.20)	(-1.10)	(-1.84)	(-0.84)	(0.26)	(-1.72)	(-0.71)	(-1.81)	(-2.68)
7 years after	-0.0129	-0.0037	-0.0214*	0.0002	0.0071	-0.0244*	-0.0351**	-0.0276*	-0.0224*
	(-1.52)	(-0.35)	(-1.73)	(0.02)	(0.73)	(-1.74)	(-2.07)	(-1.84)	(-1.66)
8 years after	-0.0129*	-0.0115	-0.0302**	-0.0143*	-0.0099	-0.0133	0.0112	-0.0215*	0.0039
	(-1.71)	(-1.25)	(-2.45)	(-1.65)	(-0.95)	(-1.06)	(0.70)	(-1.72)	(0.28)
9 years after	-0.0071	-0.0092	-0.0088	-0.0097	-0.0047	-0.0033	0.0146	-0.0060	-0.0089
	(-0.85)	(-0.87)	(-0.65)	(-0.88)	(-0.44)	(-0.24)	(0.87)	(-0.43)	(-0.60)
Observations	182,872	94,969	94,969	94,969	94,969	87,903	87,903	87,903	87,903

Notes: The regressions of Table A5 include as controls the difference in the log-squared value of firm age, a full set of time fixed effects, and a full set of event dummies for MNEs. *t*-statistics are in parentheses. Standard errors are clustered at firm-year levels (see Abadie/Spiess, 2020).

* $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.

Source: IAB-ReLOC; own calculations. ©IAB

Imprint

IAB-Discussion Paper 9|2021

Publication Date
10 May 2021

Publisher
Institute for Employment Research
of the Federal Employment Agency
Regensburger Straße 104
90478 Nürnberg
Germany

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