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**Article — Published Version**

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Review of World Economics

**Provided in Cooperation with:**

Springer Nature

*Suggested Citation:* Frey, Rainer; Goldbach, Stefan (2024) : Internationalisation as a boost for many firms: evidence from Germany, Review of World Economics, ISSN 1610-2886, Springer, Berlin, Heidelberg, Vol. 161, Iss. 3, pp. 911-963,  
<https://doi.org/10.1007/s10290-024-00567-z>

This Version is available at:

<https://hdl.handle.net/10419/330753>

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# Internationalisation as a boost for many firms: evidence from Germany

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Accepted: 1 October 2024 / Published online: 2 December 2024  
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## Abstract

The advantages of globalisation have been increasingly called into question, and protectionist tendencies have entered the stage. So what experiences have firms had after going international in an open economy over the past years? With respect to foreign investor takeovers of initially national firms, we see predominantly positive effects for acquired manufacturing firms in terms of productivity, sales and expenditures on the labour force – likely due to higher employment – in the short and long term. Looking at the results, firm size matters: positive effects are stronger among large firms. In the case of firms starting to invest abroad, positive effects are very rare and limited to short-term sales of acquiring small manufacturing firms. All in all, the largely positive evidence is generally supportive of internationalisation and thus largely contradicts the negative views sometimes present in the public sphere, though even unaffected firms may see themselves as relative losers.

**Keywords** Globalisation · Firm acquisition · M&A · Productivity · Sales · Intangible assets · Knowledge · Technology · Labour costs · Employment · Wages · Firm heterogeneity

**JEL Classification** D22 · D24 · F23 · G34

## 1 Introduction

In the past, globalisation was largely seen as increasing the welfare of all countries involved. However, more recently, some governments have shifted the focus to potential negative effects. In this context, more emphasis is placed on issues

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such as cross-border technology transfer to the detriment of the target firm,<sup>1</sup> local divestment and labour layoffs, or public security risk through new foreign owners in mergers and acquisitions (M&A) transactions. These considerations played a role in European countries introducing new laws that enable governments to forbid foreign takeovers (see European Union (2019)). Similarly, countries such as the United States have introduced trade restrictions, citing potentially unfair competition while attracting foreign investment through subsidies (Inflation Reduction Act). Conversely, however, limitations imposed on foreign acquirers can lead to foreign governments introducing countermeasures targeting domestic investment abroad.

With national restrictions, firms risk the potentially substantial profits from forming multinationals or being part of a multinational group. While in the case of vertical foreign direct investment (FDI), firms distribute the production process across several countries to profit from an international division of labour,<sup>2</sup> horizontal FDI is driven by the development of new markets for a firm's products.<sup>3</sup> By engaging in FDI, firms especially intend to increase their efficiency. Addressing the effects of firms' ownership changes on economic efficiency, as one early example of ample studies in the manufacturing sector, Lichtenberg and Siegel (1987) analyse the strong increase in M&A in the United States back in the 1970s and 1980s, with significant productivity gains in the years after ownership change.<sup>4</sup>

So does globalisation only have positive effects while restrictions do harm to firms? To answer this question, we need to take a more detailed look at different firm types and various economic indicators. In particular, our study addresses potential internationalisation effects for heterogeneous firms with respect to productivity, sales, and intangible assets. The stock of intangible assets represents different kinds of knowledge and brand reputation and is likely accompanied by positive longer-term productivity and competitiveness implications.<sup>5</sup> Finally, we use labour costs

<sup>1</sup> Gerstenberger (2018) addresses this discussion with respect to German companies acquired by Chinese firms. More generally, with respect to the performance of firms acquired by Chinese investors, see Fuest et al. (2021).

<sup>2</sup> For the distinction between vertical and horizontal FDI, see Helpman (1984) and Markusen (1984).

<sup>3</sup> Farrell and Shapiro (1990) show that horizontal mergers can increase welfare – but in combination with significant increases in market concentration, negative effects may arise due to higher sales prices. Caves (1974) sees FDI as a source of allocative and technical efficiency for the host country.

<sup>4</sup> In addition, according to Helpman et al. (2004), the most productive firms engage in foreign activities.

<sup>5</sup> Intangible assets include components such as software, intellectual property, brands and innovative business processes. Their characteristics facilitate profiting from economies of scale, and legal titles like patents and copyrights make it possible to secure competitive advantages vis-à-vis competitors. This may result in higher productivity, market power and market concentration (see Crouzet and Eberly (2019)). Davies and Markusen (2020) also report positive effects and observe that multinationals provide their foreign affiliates with knowledge-based assets. Thus, after investing abroad, a technology transfer within the newly formed multinational may take place (see Teece (1977)) and there lies an especially strategic motive for expanding intangible assets.

to proxy employment and wages – knowing that this is a rather crude measure.<sup>6,7</sup> The literature documents the general relevance of these variables: following a foreign acquisition, Guadalupe et al. (2012) find a substantial increase in sales and productivity and a greater likelihood of innovating for the acquired firms.<sup>8</sup> In Stiebale and Vencappa (2018), the productivity effect seems especially large for small firms. Arnold and Javorcik (2009) find that target firms have higher productivity as a result of restructuring where acquired plants increased investment, employment and wages.<sup>9</sup> Aitken et al. (1996) estimate positive wage effects for foreign-owned firms in the United States, Mexico and Venezuela. With respect to knowledge transfer/innovation, Javorcik and Poelhekke (2017) provide empirical support for continuous injections of headquarter services into foreign plants.

We add substantially to this literature by addressing firm heterogeneity. In doing this, the analysis may detect firm types that profit but also those that do not profit or are even negatively affected, such as in the case of labour force layoffs or shifts of intangible assets within the firm conglomerate across borders (“technology theft”) – events that may bring with them negative attitudes towards globalisation. First, to our knowledge, our study is unique as we separately address the manufacturing and the services sectors: previous studies were mostly limited to the manufacturing sector, e.g. Guadalupe et al. (2012) for Spanish firms, Bircan (2019) for Turkish plants and Stiebale and Vencappa (2018) for Indian firms, or they covered all sectors within one sample (e.g. Hijzen et al. (2013) for several countries). We see a separate analysis of the services sector as appropriate, as the services sector has rapidly gained international economic relevance over the last few decades.

Second, we investigate the short and long-term effects of internationalisation on firm performance to understand the dynamics after a firm acquisition. Depending on the performance variable, effects are expected in the short term already (e.g. sales may increase rather quickly) or more in the long term (e.g. productivity, intangible assets or employment/wages). We define our short-term horizon as the time span within the year of the acquisition. Meanwhile, our long term comprises the first three years after the acquisition.<sup>10</sup> In the case of our variable intangible assets – where an increase may ultimately also result in higher productivity, competitiveness and

<sup>6</sup> Our dataset contains far more data on labour costs than, for example, employment. Thus, in our approach, we use total labour costs as a combined measure of employment and wages. The reasons for an increase in labour costs may be higher wages or more employment, *ceteris paribus*.

<sup>7</sup> There may also be some interdependencies between these variables: Conyon et al. (2002) find wage increases due to higher productivity. Egger and Kreickemeier (2013) argue that international companies are more competitive and are thus able to pay higher wages. Koch and Smolka (2019) provide evidence that the acquired firms hire highly skilled workers and provide worker training, which results in higher competitiveness.

<sup>8</sup> Complementarily, Bertrand and Zitouna (2008) observe an increase in productivity but not in profits after a merger. They conclude that firms may redistribute efficiency gains within the firm conglomerate.

<sup>9</sup> For establishments in the United States, Davis et al. (2014) show that private equity buyouts may yield positive effects for some plants but negative labour effects for other plants, thereby improving the operating margin materially.

<sup>10</sup> Egger et al. (2020) find that post-acquisition wage effects take a total of four years to develop and remain constant thereafter. We look only at the first three years after the acquisition, as a further extension of the time horizon comes with a sizeable decrease in observations.

market power – we potentially capture further positive effects that are felt even beyond our three-year time horizon.

Third, we allow for potential differences in firm size like, for example, Stiebale and Vencappa (2018), who document positive productivity effects concentrated on small (target) firms.<sup>11</sup> With respect to large mergers, Gugler et al. (2003) find that profits may also increase through higher market power over a longer time horizon. However, we cannot consider the structural implications arising from changes in the market structure within our approach.<sup>12</sup>

Finally, we contribute to the large empirical literature that deals with the effect of outward FDI on domestic economic activity. Desai et al. (2009) find for US manufacturing firms that outward FDI increases domestic investments and wages. Goldbach et al. (2019) confirm the findings of investments for German firms using the Microdatabase Direct investment (MiDi) compiled by the Deutsche Bundesbank. However, they only focus on outward FDI, while we examine the effects of internationalisation in both directions. Other empirical papers also use the MiDi, e.g. Becker and Mündler (2010) examine potential intra-group labour substitution for German manufacturing multinational firms. Our analysis deviates from their approach because we concentrate on German firms engaging in FDI for the first time. By contrast, Becker and Mündler (2010) mostly focus on multinational firms, which have already foreign affiliates. Another example is Conteduca and Kazakova (2018). They even use a variable (“em1”=reason for initial report) from the MiDi that reports the entry mode. However, this information is optional (not mandatory) and often not provided. That is why we decided to use an alternative identification strategy that relies on matching between the Deutsche Bundesbank’s balance sheet database for German firms (JANIS) and MiDi.<sup>13</sup>

When we address both inward and outward FDI within one setting at the micro level, we use data from Germany, a large open economy. At the end of 2019, the consolidated FDI stocks of German multinationals abroad amounted to €1.4 trillion. The FDI holdings of foreign parent companies in affiliates located in Germany stood at €0.6 trillion and are thus also important from an economic perspective. The existing literature mostly investigates the effects on firms stemming from an ownership change to a foreign investor, e.g. Harrison and Lipsey (1996), Guadalupe et al. (2012), while Ashraf et al. (2016) focus on firm productivity and Bertrand et al. (2012) concentrate on research and development. One exception is Szücs (2014), who addresses the involvement of both M&A acquirers and targets and finds that the targets’ R&D decreases and the acquirers’ R&D-to-sales intensity drops due to

<sup>11</sup> Deviating from their approach, we use the sum of tangible and intangible assets as a size measure instead of “sales”. We expect this to be more appropriate for our study, which deals with different sectors.

<sup>12</sup> If large firms strengthen an already strong position, it may have implications for overall competition in a sector. The prosperity of the economy as a whole does not necessarily increase. If small firms are busy catching up, it initially might not have the same implications for competitors. In addition, in the long term, firms can also profit from technological clusters abroad through local spillovers (see Jaffe et al. (1993)).

<sup>13</sup> We conducted a robustness check with an alternative identification strategy that relies on the mode of entry. Since this information is often not provided, we do not have enough observations in the treatment group for a meaningful interpretation of these results.

strongly increasing sales. However, he does not account for heterogeneity.<sup>14</sup> Thus, we add to the extremely small number of studies that also look at domestic firms' potential opportunities through going global.<sup>15</sup> This is important as, to give an example, in light of national protectionist tendencies with respect to cross-border takeovers, reciprocal actions by other countries could, in turn, jeopardise domestic firms' investment opportunities abroad.

For our analysis, we match German micro data for FDI with firm balance sheet data. These datasets are provided by the Deutsche Bundesbank. This allows us to rely on official values provided by firms. In addition, the data also allows for clear identification of purely national firms and of firms that go international. For investments undertaken by German firms abroad, we use total outward FDI, which includes M&A as well as greenfield investment.<sup>16</sup> As both types of investment may result in the internationalisation of initially domestic firms, we thus obtain a complete picture of the associated internationalisation effects, although we cannot distinguish between the contributions of the two types.<sup>17</sup>

To account for a potential selection bias in our empirical analysis, like many authors, e.g. Guadalupe et al. (2012) and Stiebale and Vencappa (2018), we first address the acquisition decision and then conduct propensity score matching to estimate the likelihoods of firms being chosen for acquisition. In doing this, Guadalupe et al. (2012) find for Spanish manufacturing firms that acquisitions are focused on the most productive firms within industries in the acquirers' interest of increasing innovation and productivity. This two-stage procedure allows for weighted dynamic difference-in-differences (DiD) estimations of post-acquisition effects.<sup>18</sup>

All in all, our outcome for internationalisation effects shows that in the aftermath of an acquisition in the manufacturing sector, firms experience positive effects on productivity, sales and expenditure on the labour force in the short and long term – with the long-term effects generally being stronger for larger firms. In the services

<sup>14</sup> Another strand of literature looks at effects in the host and home countries of FDI, e.g. Harms and Méon (2018). Chen (2011) finds higher productivity gains, sales and employment only when the foreign parents come from industrial countries rather than developing countries. Hijzen et al. (2013) show that wage effects are larger in developing countries.

<sup>15</sup> With respect to German investment abroad, we only address German firms investing for the first time in other countries. In addition, the parent companies of already existing multinationals may also profit from entering further foreign markets. In general, if only some countries introduce restrictions, investors may circumvent these policies via other destination economies.

<sup>16</sup> Though the Bundesbank data form permits users to differentiate between greenfield investment and M&A, this optional field is usually left empty. Studies relying on these data are very rare, e.g. Bialek and Weichenrieder (2021) with a focus on FDI regulation or Conteduca and Kazakova (2018).

<sup>17</sup> Nocke and Yeaple (2007) emphasise the relevance of firms' choice of investment type. Hennart and Park (1993) find that Japanese investors use M&A in the case of relatively weak competitive advantages; otherwise greenfield investment is a more efficient way to transfer advantages. Davies et al. (2018) find greenfield investment more reliant on firms' own capacities, on the origin country's comparative advantages and the destination country's taxes.

<sup>18</sup> Balsvik and Haller (2010) furthermore conclude that foreign firms pick large, high-wage and high-productivity firms, which is also largely corroborated by the literature. In addition, Frey and Hussinger (2011) show that target firms are deliberately chosen to increase the technological competency of the group as a whole. Crouzet and Eberly (2019) even see a shift in relevance from physical to intangible assets in the United States over time.

sector, the major effects broadly disappear. The sales effect is limited to the short term. For intangible assets, the positive/negative effect depends on firm size. In case of firms that start investing abroad, positive effects are very rare and limited to the short-term sales of small manufacturing firms. Again, we find no evidence that firms restructure at the expense of the labour force at home. Thus, our results underline that cross-border investments often strengthen firms and make them more competitive – though there are also numerous firms that are left behind and, in very rare cases, negatively affected. Additionally, participation in international business is not random: larger firms are more likely to be chosen as targets.

The remainder of the paper is structured as follows. Section 2 describes our data, followed by the empirical methodology in Sect. 3. The results are presented in Sect. 4. We conduct several robustness checks in Sect. 5. Section 6 briefly concludes.

## 2 Data

To analyse the effect of FDI on domestic performance, we use two micro datasets, both provided by the Deutsche Bundesbank.<sup>19</sup> Information on foreign investors' activities in German firms (inward FDI) and on the foreign investment activities of German companies (outward FDI) is obtained from MiDi, a comprehensive annual database of German FDI positions. MiDi provides information on balance sheet items, ownership structure and additional information such as an economic sector classification of each German affiliate owned by a foreign parent company (and foreign affiliates of German parent firms). One particular advantage of MiDi is that reporting by German firms is mandatory under German federal law. Information on domestic performance and on several other parent-level variables is taken from JANIS.<sup>20</sup> This dataset is an extension of USTAN, a dataset of corporate balance sheet statistics. The data are primarily extracted from annual accounts (balance sheet, profit and loss accounts) and financial statements. We make use of firm-specific information on total sales, value added (to estimate productivity), intangible assets (to proxy firm relevant knowledge) and labour costs to capture employment and wages.<sup>21</sup> Appendix Table 6 provides an overview of the definitions of relevant firm variables. According to the balance sheet information from JANIS, intangible assets are the sum of the following positions: "concessions, industrial property and similar rights and assets as well as licences", "goodwill", "payments on account for

<sup>19</sup> The micro data are confidential and only accessible in anonymised form at the headquarters of the Bundesbank in Frankfurt, Germany.

<sup>20</sup> The data report (<https://www.bundesbank.de/resource/blob/901916/4a1c0d26040410324e8e306a41a0b971/mL/2023-14-janis-data.pdf>) highlights that "JANIS consists of individual financial statements of non-financial corporations which are provided from several sources: financial statements received by the Deutsche Bundesbank in the context of the credit assessment and from public sources like the *Bundesanzeiger*." Although the different data sources are consistent and are subject to quality checks, the raw data exhibit an unbalanced panel structure. We adjust the data to compare our findings with the literature, which distinguishes between short and long-term effects.

<sup>21</sup> The firms report their sales of foreign affiliates (from the MiDi dataset) and the sales of their domestic entities (from the JANIS dataset) independently.

intangible assets” and “internally generated industrial rights and similar rights and assets”. “Labour costs” are the sum of the positions “salaries and wages” and “social security and expenditure for company pension funds and pensions paid”. We match JANIS with MiDi and keep matched observations as well as unmatched observations. Firms that are German parent companies and German affiliates of foreign companies at the same time are excluded from the analysis in order to make a clear distinction between the effects of inward and outward investment.<sup>22</sup> In addition, we only keep firm-year observations for five years in a row.<sup>23</sup>

In the first analysis, we compare German companies that are taken over (“targets”) by foreign firms with firms that remain domestically owned. We only keep those firms in the control group that have no match with any foreign affiliate – no outward FDI – in the period considered. The second analysis compares German companies engaging in FDI for the first time (“acquirers”) with firms that remain purely domestic.<sup>24</sup> In turn, we ensure that our comparison group only consists of purely domestic firms that have no match with a foreign investor in MiDi data – no inward FDI. All in all, we end up with an unbalanced panel for the time period from 1999 to 2018, with about 1,900 German firms taken over by foreign companies, 900 domestic firms going global for the first time, 57,000 purely national companies in our control group, and 360,000 (334,000) firm-year observations in total for “target” (“acquirer”) firms.<sup>25</sup>

Table 1 presents data about the German firms involved in takeovers by foreign investors in more detail. In accordance with the literature, we concentrate on possible firm characteristics with a time lag of one year, which we consider relevant for foreign investors. In the table, the panel on the left (“no target”) presents observations for the control group, while the panel on the right (“as target”) refers to only those observations (number of firms) at the time when a foreign investor acquires a German firm. We provide summary statistics for all sectors, the manufacturing

<sup>22</sup> Looking at the original MiDi database (1999 to 2018) without any adjustments, we observe about 18,000 reporting units as German parent companies and about 41,000 domestic affiliates of foreign investors. Another approximately 2,000 firms are German parents and German affiliates (of a foreign ultimate investor) in the same year.

<sup>23</sup> For our targets and acquirers, we additionally require that they are in our data for at least two years before the takeover and for three years afterwards. This is in line with the related literature. An analysis of firms that closed within this period is not feasible. This is because it is not possible to distinguish between firm closures and missing data. The restrictions we impose do not affect the composition of industries or the regional distribution. We do see some self-selection of firms that survive over time and become larger on average (in terms of total assets, total sales and – when provided – employment). For further details, see Appendix Table 8. We also checked whether this imposed restriction affects our baseline results. Since the findings do not change much, we argue that our chosen variables in the first stage of the propensity score matching controls for this potential self-selection bias.

<sup>24</sup> “First time” refers to the change in the status within the sample period. Firms investing abroad for the first time do not necessarily need to acquire another foreign company. They can also establish a new foreign affiliate (“greenfield investment”). Our dataset does not allow us to distinguish between the two types of FDI. Nevertheless, we use the term “acquirers” throughout the paper for the sake of simplicity.

<sup>25</sup> There is a threshold of €3 million for firms’ FDI filings. Thus, we only consider FDI of some significance. However, the relative importance of the foreign investment may differ depending on the parent companies’ size.



sector and the services sector.<sup>26</sup> The sectoral distinction is retained for our estimations. We are aware that a clear assignment is rather difficult, especially for large companies as they are often active in both of these areas. Thus, we assume that the core activities reported by the firms are relevant to their foreign investments. As regards German firms going abroad for the first time, we are dealing with relatively small firms for which sectoral assignment is generally clearer. With respect to firm characteristics, Table 1 highlights differences between the treatment and control groups – with the exception of prior total factor productivity. The same conclusion can be derived from Table 2, in which firms going global for the first time are compared to companies that remain purely domestic. We account for these differences in our estimation strategy.

Table 3 presents the locations of foreign investors that acquired German companies and the destinations of investments by German firms that are investing abroad for the first time. Again, we also distinguish between the manufacturing and the services sectors. In terms of both the absolute number of firms and the volume of FDI, firms from Western Europe and North America represent the most important investors in German companies, followed by Asian investors. German firms investing abroad concentrate primarily on Western and Eastern European countries. This could relate to cross-border value chains. Asia and North America also play an essential role as destinations. In addition, we observe a much higher volume of “new” FDI in Germany than that of German companies investing abroad. To interpret these differences, we have to consider the likelihood that a large number of foreign firms already form part of a multinational that is adding a unit to its portfolio of firms. In contrast, our German investors are entering the international “playing field” for the first time.<sup>27</sup> Thus, these domestic investors are most likely smaller on average than the acquisitions of foreign firms in Germany, which is reflected in the FDI figures.

### 3 Empirical approach

In our empirical setting, we try to identify the causal effect of a change from national to foreign ownership on the target firm’s performance and of a first investment abroad on the parent company’s performance. To keep our description of the econometric procedure short but still comprehensive, we explain our approach below by solely looking at the scenario in which the foreign investor buys a domestic company; the procedure for first-time FDI by a German parent company is the same. For our analysis, we rely on a DiD approach that we combine with propensity score matching techniques.

<sup>26</sup> The manufacturing sector comprises the two-digit NACE Rev. 2 codes 10 to 35. The services sector consists of the codes 45 to 63, 68 and 69, 71 to 82, and 85 to 96. Thus, we exclude the finance sector, holdings, households and organisations as they are expected to act differently compared to the rest of the services sector.

<sup>27</sup> In our study, we do not consider already existing German multinationals expanding their international investment.

Using the DiD approach, we can isolate the effect of the internationalisation of a firm – “treated” firm – on economic indicators such as productivity and sales vis-à-vis the firms that remain “national” and serve as control companies. However, for this comparison we have to make sure that we only look at treated and untreated companies that are comparable with respect to observable firm characteristics prior to internationalisation. Thus, we first conduct propensity score matching, which provides us with a weighting scheme for our DiD estimation. Dehejia and Wahba (2002) show that in the case of many observable characteristics, we can obtain a natural weighting scheme that yields unbiased estimates of the treatment effect. This approach is quite common in the literature dealing with causal effects from firm acquisitions. Propensity score matching is often conducted in the form of radius (caliper) or nearest neighbour matching, e.g. in Blundell and Costa Dias (2000), Arnold and Javorcik (2009), Hijzen et al. (2013), Egger et al. (2020), Javorcik and Poelhekke (2017), Wang and Wang (2015) and Goldbach et al. (2019).<sup>28</sup>

One of our main variables of interest is productivity. The empirical literature employs several productivity measures; see, for example, van Biesebroeck (2008) for an overview. We apply the approach proposed by Akerberg et al. (2015). Thus, we assume the following production function presented in Eq. (1):

$$y_{ijt} = \alpha + \beta_l l_{ijt} + \beta_k k_{ijt} + \beta_m m_{ijt} + \omega_{ijt} + \varepsilon_{ijt} \quad (1)$$

where  $y$  is the output of firm  $i$  in sector  $j$  at time  $t$ ,  $l$  is labour,  $k$  is capital,  $m$  is the use of intermediate inputs,  $\omega$  is the unobserved productivity and  $\varepsilon$  is the error term.

In our estimation, we use the costs of the input factors to estimate the productivity measures. The general problem is that the firm-specific productivity is unknown and can be correlated with the other input factors. While the previously frequently applied approach of Levinsohn and Petrin (2003) inverts intermediate input demand functions that are not conditional on the labour input, Akerberg et al. (2015) suggest inverting intermediate demand functions that are conditional on the labour input. They produce consistent estimates because their approach does not suffer from the functional dependence assumptions. Furthermore, we adjust Akerberg et al. (2015) for endogenous productivity such that lagged productivity enters the first-order Markov process together with the treatment variable, as in Dorazelsi and Jaumandreu (2013) and De Loecker and Warzynski (2012). As we have information on the deflator of value added on a sector-year basis, we estimate productivity as

<sup>28</sup> Guadalupe et al. (2012), Koch and Smolka (2019), and Stiebale and Vencappa (2018) implement a propensity score reweighting estimator. In the case of a firm that appears more than once as control, they sum the weights by firm and then use this sum as weight. Stiebale and Vencappa (2018) also use propensity score matching with nearest neighbour and radius (caliper) matching as robustness checks. In addition, Chen (2011) applies multiple treatment matching, while Girma and Görg (2007) use kernel matching estimators.

**Table 1** Descriptive statistics (“targets”)

	No target				As target			
	Obs	Mean	Median	Std. Dev	Obs	Mean	Median	Std. Dev
<b>All sectors</b>								
Log sales <sub>it-1</sub>	357,815	9.13	9.26	1.97	2,142	10.54	10.54	1.56
Log fixed assets <sub>it-1</sub>	357,815	6.82	6.99	2.72	2,142	7.71	7.98	2.52
Log intangible assets <sub>it-1</sub>	357,815	2.46	1.95	2.53	2,142	4.27	4.37	2.91
Log total assets <sub>it-1</sub>	357,815	8.78	8.74	1.87	2,142	10.16	10.05	1.44
Log labour costs <sub>it-1</sub>	331,936	7.59	7.63	1.84	2,031	8.88	8.88	1.43
Log TFP <sub>it-1</sub>	323,837	3.05	2.90	2.06	1,995	4.08	4.02	1.38
Return on equity <sub>it-1</sub>	357,815	2.05	0.25	51.29	2,142	4.84	0.22	94.72
	No target				As target			
	Obs	Mean	Median	Std. Dev	Obs	Mean	Median	Std. Dev
<b>Manufacturing</b>								
Log sales <sub>it-1</sub>	119,729	9.72	9.74	1.69	1,114	10.84	10.78	1.34
Log fixed assets <sub>it-1</sub>	119,729	7.26	7.55	2.36	1,114	8.51	8.66	1.92
Log intangible assets <sub>it-1</sub>	119,729	3.29	3.22	2.59	1,114	4.87	4.80	2.67
Log total assets <sub>it-1</sub>	119,729	9.16	9.14	1.74	1,114	10.42	10.32	1.39
Log labour costs <sub>it-1</sub>	118,424	8.27	8.29	1.55	1,085	9.23	9.17	1.24
Log TFP <sub>it-1</sub>	115,908	3.56	3.55	0.59	1,077	4.49	4.43	1.18
Return on equity <sub>it-1</sub>	119,729	1.37	0.29	31.00	1,114	3.44	0.22	60.16
	No target				As target			
	Obs	Mean	Median	Std. Dev	Obs	Mean	Median	Std. Dev
<b>Services</b>								
Log sales <sub>it-1</sub>	238,086	8.83	8.99	2.04	1,028	10.21	10.22	1.70
Log fixed assets <sub>it-1</sub>	238,086	6.59	6.65	2.85	1,028	6.83	6.89	2.79
Log intangible assets <sub>it-1</sub>	238,086	2.04	1.10	2.39	1,028	3.61	3.40	3.04
Log total assets <sub>it-1</sub>	238,086	8.59	8.53	1.91	1,028	9.87	9.74	1.44
Log labour costs <sub>it-1</sub>	213,512	7.22	7.21	1.89	946	8.48	8.55	1.53
Log TFP <sub>it-1</sub>	207,929	2.76	2.52	2.26	918	3.59	3.53	1.43
Return on equity <sub>it-1</sub>	238,086	2.38	0.23	58.90	1,028	6.37	0.24	121.6

The table presents the explanatory variables (chosen or calculated from JANIS dataset) of the probit estimations (first stage of the econometric procedure) that are included in the estimations of the propensity score. “No target” refers to firm observations with no switches in the status national/international. “As target” refers to firm observations at the time when a foreign investor took over an existing German firm

**Table 2** Descriptive statistics (“acquirers”)

	No acquirer				As acquirer			
	Obs	Mean	Median	Std. Dev	Obs	Mean	Median	Std. Dev
All sectors								
Log sales <sub>t-1</sub>	333,418	8.98	9.13	1.92	1,025	10.92	10.91	1.31
Log fixed assets <sub>t-1</sub>	333,418	6.70	6.88	2.69	1,025	8.27	8.49	2.15
Log intangible assets <sub>t-1</sub>	333,418	2.27	1.61	2.39	1,025	5.01	5.19	2.40
Log total assets <sub>t-1</sub>	333,418	8.63	8.61	1.81	1,025	10.55	10.46	1.17
Log labour costs <sub>t-1</sub>	308,515	7.46	7.50	1.79	1,004	9.30	9.39	1.27
Log TFP <sub>t-1</sub>	300,707	2.93	2.79	2.04	991	4.50	4.60	1.23
Return on equity <sub>t-1</sub>	333,418	2.03	0.26	49.75	1,025	0.52	0.26	5.90
Manufacturing								
Log sales <sub>t-1</sub>	104,963	9.49	9.52	1.58	682	11.00	10.93	1.06
Log fixed assets <sub>t-1</sub>	104,963	7.00	7.31	2.29	682	8.67	8.80	1.71
Log intangible assets <sub>t-1</sub>	104,963	2.97	2.89	2.41	682	5.14	5.21	2.14
Log total assets <sub>t-1</sub>	104,963	8.89	8.90	8.11	682	10.60	10.52	1.03
Log labour costs <sub>t-1</sub>	104,044	8.06	8.11	1.44	679	9.50	9.57	0.98
Log TFP <sub>t-1</sub>	101,542	3.34	3.38	1.39	672	4.74	4.80	0.95
Return on equity <sub>t-1</sub>	104,963	1.36	0.30	24.67	682	0.62	0.27	6.60
Services								
Log sales <sub>t-1</sub>	228,455	8.75	8.91	2.01	343	10.76	10.84	1.69
Log fixed assets <sub>t-1</sub>	228,455	6.56	6.62	2.85	343	7.47	7.53	2.65
Log intangible assets <sub>t-1</sub>	228,455	1.95	1.10	2.31	343	4.72	5.07	2.83
Log total assets <sub>t-1</sub>	228,455	8.51	8.45	1.89	343	10.45	10.28	1.41
Log labour costs <sub>t-1</sub>	204,550	7.15	7.15	1.86	325	8.88	8.96	1.64
Log TFP <sub>t-1</sub>	199,165	2.71	2.46	2.27	319	3.98	3.94	1.56
Return on equity <sub>t-1</sub>	228,455	2.33	0.23	57.73	343	0.31	0.23	4.19

The table presents the explanatory variables (chosen or calculated from JANIS dataset) of the probit estimations (first stage of the econometric procedure) that are included in the estimations of the propensity score. “No acquirer” refers to firm observations with no switches in the status national/international. “As acquirer” refers to firm observations when a German firm engages in FDI for the first time

**Table 3** Geographical distribution

	Total		Manufacturing		Services	
	Obs	Direct investment (€ mn)	Obs	Direct investment (€ mn)	Obs	Direct investment (€ mn)
Location of foreign ultimate investor						
Western Europe	1,211	24,103.27	622	15,192.63	589	8,910.65
North America	428	23,173.64	240	20,651.05	188	2,522.59
Asia	134	1,586.10	68	869.25	66	716.85
Middle East	34	347.77	23	333.06	11	14.71
Eastern Europe	23	260.10	10	56.51	13	203.58
Caribbean	14	181.17	5	73.57	9	107.60
Central and South America	10	107.57	5	74.04	5	33.54
Destinations of firms going global for the first time						
Western Europe	575	1,886.38	291	1,237.66	284	648.72
Eastern Europe	283	803.15	200	599.81	83	203.34
Asia	210	712.45	163	370.63	47	341.82
North America	210	497.83	163	410.45	47	87.38
Central and South America	28	55.23	17	30.69	11	24.54
Oceania	15	38.80	8	18.63	7	20.17
Middle East	13	29.46	7	20.97	6	8.49

The upper part of the table (“Location of foreign ultimate investor”) presents the number and volume of FDI takeovers by foreign investors in the final dataset (match of JANIS-MiDi data with at least five years of observations). The lower part (“Destinations of firms going global for the first time”) presents the number and volume of outward FDI by German firms. In both cases, the number of acquisitions differs from the sum of observations across all countries. On the one hand, we do not have data on all ultimate investors; on the other hand, firms going abroad may enter several countries at once

proposed by the major articles for each two-digit NACE 2 sector level separately.<sup>29</sup> In doing so, we allow for different underlying production functions across sectors.<sup>30</sup>

Before we can address the performance of productivity, sales, intangible assets and labour costs after an acquisition using our DiD estimation, we first have to examine whether firms acquire targets that already display a specific pattern with respect to the variables we wish to explain. If so, we observe cherry-picking, which we would have to take into account. Therefore, we estimate the probability of a firm taking part in internationalisation conditional on different firm characteristics. Our choice of controls is largely in line with the seminal article of Guadalupe et al. (2012). Their main controls are productivity, sales, firm size, wage and capital. For wages, however, we have to turn to labour costs, as wages

<sup>29</sup> To do this, we transform our three input factors (labour costs, capital costs and intermediate input costs) using yearly price deflators.

<sup>30</sup> As we address productivity in the context of FDI, we are interested in the value added and its relation to capital and labour and thus apply the ACF approach. Conversely, particularly in the field of trade, gross output models of production have gained relevance (see Ghandi et al. (2020)). Appendix Table 7 provides the definitions of the used variables from JANIS.

are missing from our data. Additionally, as we are interested in the internationalisation effects on intangible assets, we split capital into tangible and intangible assets. Thus, our approach is also largely in line with Stiebale and Vencappa (2018), where innovation, capital and capital per employee are included in addition to productivity, sales and sales growth. Furthermore, we also include profitability in the form of return on equity (see, for example, Gugler et al. (2003)). In addition, we allow for heterogeneity with respect to firm size as in Stiebale and Vencappa (2018). We define the binary variable “small” as firms with a lower than the median sum of tangible and intangible assets (see the end of Sect. 3 for the precise definition of “small”).<sup>31</sup>

To address the relevance of these variables for the choice decision and to obtain the propensity scores, we estimate the probability of firm  $i$  being acquired at time  $t$  with the following probit model for the manufacturing and the services sectors separately:

$$P(F_{it} = 1) = \alpha + \theta X_{it-1} + \vartheta \Delta Y_{it-1} + \tau_s + \rho_t + \varepsilon_{it} \quad (2)$$

where  $F_{it} = 1$  stands for a foreign acquisition in period  $t$  and  $F_{it} = 0$  for firms remaining in domestic ownership in period  $t$ ; in both scenarios, we condition on firms that survive at least up to  $t+2$ .<sup>32</sup>  $X_{it-1}$  is the vector of exogenous variables (productivity, sales, intangible assets, labour costs, total assets, tangible assets and return on equity) and  $\theta$  is the corresponding vector of coefficients<sup>33</sup>;  $\Delta Y_{it-1}$  denotes the pre-acquisition growth in one of the performance variables of the subsequent analysis: productivity, sales, intangible assets or labour costs with its coefficient  $\vartheta$ <sup>34</sup>;  $\tau_s$  and  $\rho_t$  are sector-specific and time-specific fixed effects; and  $\alpha$  is the constant. To account for serial correlation, we cluster at the firm level.

Our results show that participation in the internationalisation process does depend on specific firm characteristics (see estimations in Table 4). After this, we can conduct propensity score matching with respect to possibly acquisition-relevant variables: firms in the treatment group are matched to those in the control group according to the smallest absolute distance in their propensity scores. Here, we conduct propensity score radius (caliper) matching (radius: 0.00075), where we set the requirement that treated and untreated firms are taken from the same two-digit

<sup>31</sup> Stiebale and Vencappa (2018) use the median of sales as a threshold. In our view, sales are less appropriate as they are likely to be more affected by the particular sector.

<sup>32</sup> The restriction of surviving for at least three years may lead to a positive bias. We also conditioned on acquired firms surviving at least one year. In general, the main results do not change. However, in our data, we cannot identify whether firms have closed or data are missing for statistical reasons.

<sup>33</sup> Although the explanatory variables are correlated, multi-collinearity does not seem to play an important role. First, we show in the results section that several variables exhibit significance in the probit regression. Multi-collinearity would result in insignificant coefficients. Second, the first stage is mostly concerned with the estimation of the propensity scores.

<sup>34</sup> Thus, we conduct separate regressions for each of the performance variables. These allow us to calculate adequate weighting schemes depending on the individual performance variable for the DiD regressions.

NACE 2 sector and the same year.<sup>35</sup> This procedure provides us with a weighting scheme that allows us to estimate the effect of a foreign acquisition on target firm performance using DiD in an appropriate way.

The propensity score matching tries to identify the best counterfactual. The main identification assumption is the conditional independence assumption (CIA). It ensures that the assignment of firms to the treatment and control groups is random. Subsequently, to assess the quality of the matching, we test the covariance balancing property. Tests of the covariance balancing show no significant differences in our chosen explanatory variables between the two groups (see exemplary Tables 9 and 10 in the Appendix).<sup>36</sup> The central identification assumption of the subsequently applied DiD estimator is the common trends assumption (CTA), which states that in the absence of the treatment, the outcome in the treatment group would have followed the same trend as in the control group. To capture this, we include the lagged pre-acquisition growth of our performance variable in our probit estimation, but we do not find significant growth differences.<sup>37</sup>

In our weighted DiD estimation, the internationalisation effects are isolated by dummies equal to 1 for years after the acquisition and equal to 0 for the untreated companies. By regressing our dependent variable on that dummy solely at the end of the acquisition year, period  $t$ , we capture a kind of short-term effect. With the accumulation of the coefficients on the dummies from a further two periods (period  $t-1$  to  $t-2$ ), a more long-term perspective is taken into account.<sup>38</sup> Thus, our regression equation for the effects of internationalisation with fixed effects becomes:

$$y_{it} = \alpha + \sum_{k=0}^2 \beta_k * F_{it-k} + \mu_i + \rho_{jt} + \varepsilon_{it} \quad (3)$$

<sup>35</sup> According to Caliendo and Kopeinig (2005), the propensity score matching estimators differ not only in the definition of the neighbourhood of treated individuals but also in the weights that are assigned to the neighbours. Caliper matching has the advantage that bad matches are avoided, which increases the match quality. We test alternative propensity score matching estimators, such as nearest neighbour matching, and obtain similar results. Additionally, at 0.00075, we defined our radius rather narrowly to ensure the balancing property conditions – the explanatory variables of treatment and control group have the same distributions – at the cost of lost observations from our treated firms. Nevertheless, robustness checks with a wider radius (0.001) – but also with an even smaller radius (0.0005) – show that the main results do not change.

<sup>36</sup> We also checked the distribution functions of the propensity scores for the different variables (productivity, sales, intangible assets and labour costs) and the various industries (manufacturing and services). The treatment and control groups are reasonably comparable since they overlap strongly (see Fig. 4 in the Appendix).

<sup>37</sup> Additionally, in graphical presentations, we can see that the slopes of pre-period growth for our performance variables are similar in both groups. Lastly, we received confirmation from DiD estimations of changes in the slope parameters.

<sup>38</sup> The effect of the treatment in period  $t-1$  ( $t-2$ ) on the outcome in  $t$  can also be interpreted as the effect of the treatment in period  $t$  on the outcome in  $t+1$  ( $t+2$ ). We aggregate these coefficients for the long-term perspective since we are interested in the “overall” effect. The coefficients from the event study in Fig. 1 just provide information about the individual effect in the specific time period.

**Table 4** Probability of being target and being acquirer

	Target		Acquirer	
	Manufacturing	Services	Manufacturing	Services
	(1)	(2)	(3)	(4)
Log total assets <sub>it-1</sub>	0.129*** (0.028)	0.195*** (0.019)	0.279*** (0.032)	0.245*** (0.025)
Log intangible assets <sub>it-1</sub>	0.026*** (0.008)	0.008 (0.007)	0.035*** (0.009)	0.053*** (0.011)
Log TFP <sub>it-1</sub>	-0.309* (0.179)	0.064 (0.061)	-0.896*** (0.164)	0.029 (0.098)
Log labour costs <sub>it-1</sub>	0.186 (0.156)	0.040 (0.054)	0.833*** (0.145)	0.039 (0.089)
Log sales <sub>it-1</sub>	0.079*** (0.030)	0.010 (0.017)	0.002 (0.033)	-0.004 (0.020)
Return on equity <sub>it-1</sub>	-0.000 (0.000)	-0.001** (0.000)	-0.000 (0.000)	-0.000*** (0.000)
Log fixed assets <sub>it-1</sub>	0.028 (0.018)	-0.132*** (0.010)	0.025 (0.017)	-0.104*** (0.015)
TFP growth <sub>it-1</sub>	0.066 (0.065)	0.077 (0.047)	-0.021 (0.090)	0.143** (0.071)
Observations	107,959	199,498	96,459	181,567

Probit estimation. The dependent variable is the binary indicator “*change*” in period  $t$ . The unit of observation is firm-year observation. The sample period is 2001 to 2018. Sector fixed effects and time-specific fixed effects are included but not reported. Robust standard errors (clustered by firm) are in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively

where  $y_{it}$  stands for our performance variables of interest: factor productivity, sales, intangible assets and labour costs of firm  $i$  in period  $t$  – all in logarithms<sup>39</sup>; the dummy  $F_{ist}$  equals 1 in the case of an acquisition and 0 otherwise;  $\mu_i$  and  $\rho_{jt}$  are firm and industry-year fixed effects; and  $\alpha$  is the constant. Due to the inclusion of firm-level fixed effects, the coefficient  $\beta$  addresses the effect through the change in ownership – not ownership itself. To account for serial correlation, we cluster at the firm level.

The estimated effects may differ not only with respect to sector and time but also with respect to firm size:

$$y_{it} = \alpha + \sum_{k=0}^2 \beta_k * F_{it-k} + \sum_{k=0}^2 \gamma_k * small_i * F_{it-k} + \mu_i + \rho_{jt} + \varepsilon_{it} \quad (4)$$

<sup>39</sup> Propensity score matching is an approach for the cross-section. Since we estimate our effects within a panel dataset, a firm can exhibit a positive weight in one year and a missing value in another year. We carry the propensity score of a firm forward if there is a missing value until the propensity score matching estimates a new weight for this firm.



**Fig. 1** **a:** Event study for all firms (first row: targets; second row: acquirers; left: manufacturing sector; right: services sector). **b:** Event study for small firms (first row: targets; second row: acquirers; left: manufacturing sector; right: services sector). **c:** Event study for large firms (first row: targets; second row: acquirers; left: manufacturing sector; right: services sector)

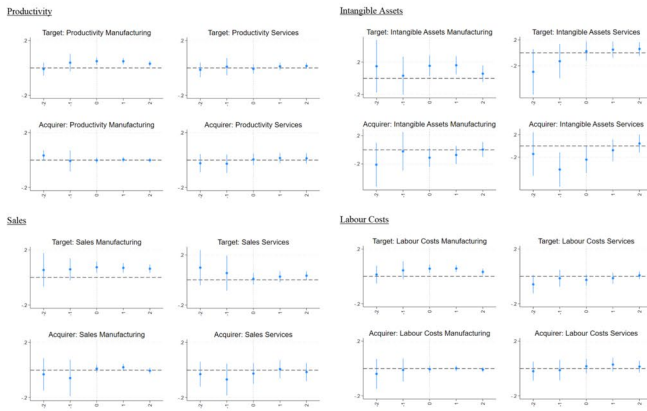
where  $small_i$  equals 1 for small firms below or equal to the median of the sum of tangible and intangible assets, and 0 otherwise. We classify the “treated” firms as small or large based on their status one year before the treatment. Since radius matching allows for multiple control observations, the status of a firm may change over time. To deal with these differences, we count the number of small and large statuses for the firms in the control group (firms with a positive weight from the propensity score matching in a specific year) over the complete time period. If the majority is small (large), we define the firm in the control group as small (large). This definition keeps the status of the treatment and control groups constant over time and we do not have to drop observations.

## 4 Results

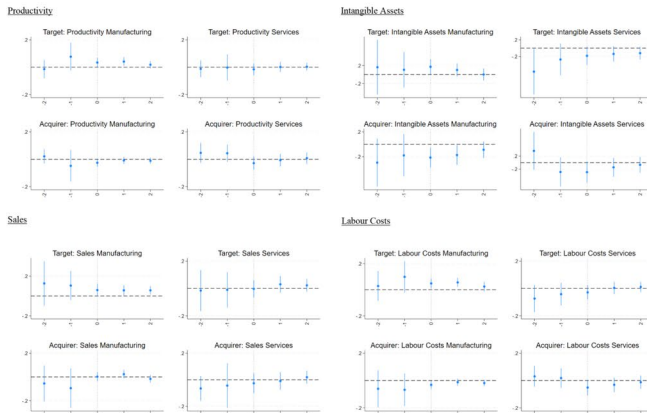
Internationalisation is like a shock to a firm and may have an impact on its economic development. Figure 1a presents the event study’s coefficient plots of total factor productivity, sales, intangible assets and labour costs for all firms.<sup>40</sup> The upper (lower) row shows the results for targets (acquirers). Furthermore, we distinguish between the manufacturing (left panel) and the services (right panel) sectors. The effects of internationalisation in the event study are plotted for the year of the event and the two subsequent years. To check the validity of the CTA, we additionally plot the two years preceding the event. The insignificant coefficients in periods  $t-2$  and  $t-1$  of Fig. 1a suggest that the CTA is not violated, with only one exception (intangible assets for acquirers in the services sector). We find no significant effect in the periods  $t$ ,  $t+1$  and  $t+2$  for acquirers (lower row), neither in the manufacturing nor the services sector for all four economic variables. Furthermore, the service sector (right panel) is, in general, not affected by the treatment. For “target” firms in manufacturing sector, however, we find some significant positive treatment effects, which are listed in panel (a) of Table 5. The incremental effects diminish over time. We estimate a significant treatment effect for productivity of 5.1% in  $t$ , 5.0% in  $t+1$  and 3.2% in  $t+2$  (sum of all coefficients: 13.3%). The effect on sales is larger: 7.7% in  $t$ , 7.2% in  $t+1$  and 6.5% in  $t+2$  (sum of all coefficients: 21.4%). Finally, being “targets” leads to higher labour costs of 5.8% in  $t$ , 5.9% in  $t+1$  and 3.4% in  $t+2$  (sum of all coefficients: 15.1%). For intangible assets, the significant effect is only existent in  $t$  (16.6%) and  $t+1$  (17.4%) but economically larger (sum of both coefficients: 33.9%). Therefore, we see that German affiliates benefit from being a “target” by foreign investors.

<sup>40</sup> The event study approach estimates Eq. (3) but starts at  $k=-2$  instead of  $k=0$ . Furthermore, instead of using Eq. (4) to distinguish between small and large firms, we use Eq. (3) for small and large firms as subsamples.

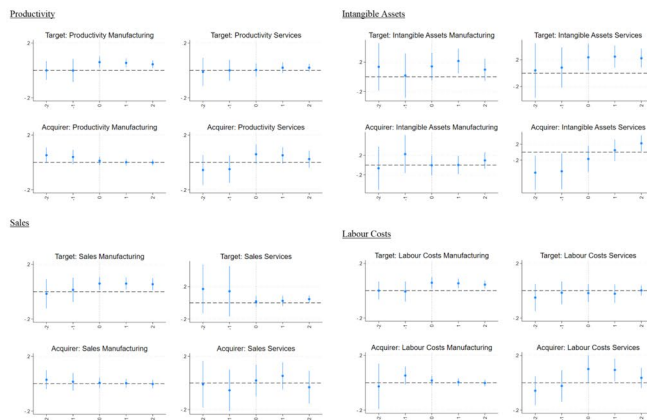
**a: Event study for all firms (first row: targets; second row: acquirers; left: manufacturing sector; right: services sector)**



**b: Event study for small firms (first row: targets; second row: acquirers; left: manufacturing sector; right: services sector)**



**c: Event study for large firms (first row: targets; second row: acquirers; left: manufacturing sector; right: services sector)**



**Table 5** Event study graph—estimated treatment effects for “targeted” firms in the manufacturing sector

	t	t + 1	t + 2	Sum of t, t + 1 and t + 2
<i>All firms</i>				
Productivity	5.1%	5.0%	3.2%	13.3%
Sales	7.7%	7.2%	6.5%	21.4%
Intangible assets	16.6%	17.4%		33.9%
Labour costs	5.8%	5.9%	3.4%	15.1%
<i>Small firms</i>				
Productivity	3.5%	4.3%		7.7%
Sales	6.2%	5.9%	5.9%	17.9%
Intangible assets	18.8%			18.8%
Labour costs	4.9%	5.8%		10.7%
<i>Large firms</i>				
Productivity	6.2%	5.5%	4.5%	16.5%
Sales	6.1%	6.1%	5.6%	17.9%
Intangible assets		24.1%		24.1%
Labour costs	6.0%	5.5%	4.6%	16.2%

Significant treatment effects of “targeted” firms in event study graphs

Figure 1b highlights the event study graphs for small firms. Since the results are similar to all firms, we concentrate on the differences between both samples. Again, most coefficients in  $t-2$  and  $t-1$  are insignificant with only one exception (intangible assets for targets in the services sector). Although, we find again only significant results in the manufacturing sector for “targeted” firms, these effects endure shorter and are quantitatively smaller. Only sales are significant in the periods  $t$ ,  $t+1$  and  $t+2$ . All other variables become insignificant in the last period compared to all firms. Since almost all coefficients are smaller, with the only exception of intangible assets in period  $t$ , we find weaker effects for small firms compared to all firms. Table 5 panel b presents the individual short-term and long-term results for all four economic variables of small firms.

Finally, Fig. 1c provides the event study graphs for large firms. As before, the CTA holds for most specifications. Only for intangible assets in the service sector for acquirers, similarly to the regressions with all firms, we find negative significant differences in pre-trends. The estimated effects for large firms are, on average, stronger and maintain also longer than for small firms. The only exception is sales, where the sum of all three periods  $t$ ,  $t+1$  and  $t+2$  is the same as for small firms. All in all, we can summarize that we find positive significant effects for “targets” in the manufacturing sector on all four economic variables. The CTA seems to hold in most cases. The overall results seems to be mainly driven by large firms.

We show the strongly related DiD regression results for the short and long term with the cumulated effects across the three years after internationalisation in Appendix Tables 11, 12, 13, 14 and 15 (with the corresponding plots in Figs. 2 and 3 for

productivity).<sup>41</sup> The interpretation of our results for small and large firms refers to the total effect of the acquisition, including the base effect plus the effect on relevant interaction terms. As before, we examine the manufacturing and the services sectors separately. In our explanations, we concentrate on the output tables as they include the cumulated effects and as they allow better comparisons of the effects across the performance variables and across the sectors through the provision of exact figures for the effects.

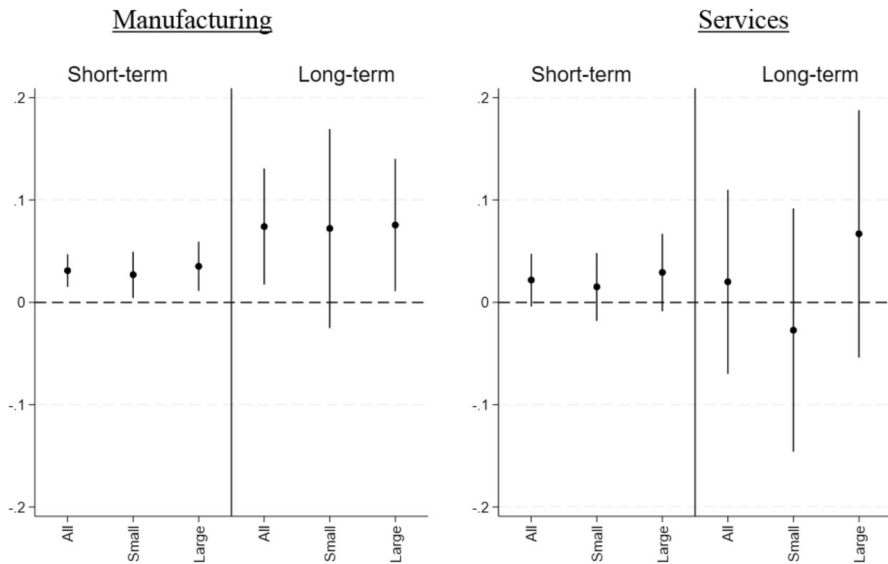
## 4.1 Firms' post-acquisition performance

### 4.1.1 Impact of ownership change on initially national firms

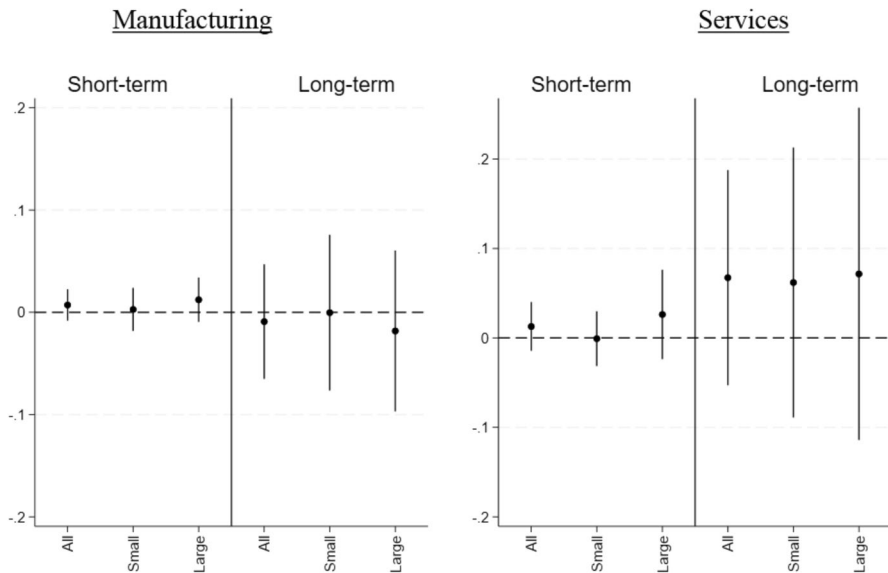
With respect to the productivity of firms in the manufacturing sector, the plots of the event study already show positive effects, especially for large firms. In accordance, our DiD regressions find – at the 1% and 5% level – significantly positive short-term and accumulated long-term effects driven by large firms (for these, the effects are significant at the 1% and 5% level) (see Appendix Table 11, columns 2 and 4). For small firms, this significant effect is only observed in the short term. Thus, the new foreign owners are capable of stimulating large firms, in particular, to increase their productivity. There may be stronger overlaps between business activities for larger firms with acquirers that may allow for efficiency gains through the implementation of better technology. We estimate productivity effects for large firms of 3.1% in the short run and 7.7% in the long run.<sup>42</sup> Our results are quantitatively rather small compared to the empirical literature. Guadalupe et al. (2012), Bircan (2019) and Arnold and Javorczik (2009) document large productivity effects of 11% for Spanish firms, 13% for Turkish plants and 13.5% for firms in Indonesia. This is reasonable since most other papers concentrate on developing countries (Turkey, India, and Indonesia). Furthermore, they address earlier periods, where globalisation was more pronounced (especially between 1985 and 2011). Furthermore, our outcome contradicts Stiebale and Vencappa (2018). They presume that small manufacturing firms are further away from the technological frontier than large ones and thus can learn more from an acquirer. They estimate productivity effects of 14.8% for small Indian firms. We only estimate effects of 2.7% in the short run and no significant long-run effects for small German firms. While our classifications of small is based on the sum of tangible and intangible assets, they refer to sales. Besides, their sample of foreign acquisitions is rather small. In the case of firms in the services sector, we only see a weakly positive short-term effect and this time only for all firms (significant at the 10% level in column 5). In the services sector, productivity growth seems to be less

<sup>41</sup> To estimate DiD in an unbiased way, we conducted the described empirical steps in Sect. 3: first, we start with probit estimations to estimate propensity scores. The following matching provides us with a weighting scheme that allows us to estimate the effect of a foreign acquisition on target firm performance using DiD in an appropriate way. Our DiD regressions below rely on Eqs. (3) and (4) from Sect. 3.

<sup>42</sup> The effects slightly differ because the event study approach includes two more treatment variables (starts with  $k=-2$  instead of  $k=0$ ). This leads to a drop in observations (and possible self-selection effects).



**Fig. 2** Effect of internationalisation on targets' total factor productivity (left: manufacturing sector; right: services sector)



**Fig. 3** Effect of internationalisation on acquirers' total factor productivity (left: manufacturing sector; right: services sector)

attainable. Thus, adjustments within a new affiliate are presumably more burdensome in the services sector, which normally prides itself with closer client relations.

Internationalisation promotes sales, not only for small but also for large firms. One main motive for going global is to benefit from economies of scale. Small and large manufacturing firms profit from significantly positive short-term effects on sales (at the 1 and 5% significance level), as Appendix Table 12 shows. These positive effects are, on average, stronger for small firms. In the long term, the effects remain highly significant for small firms, while significance vanishes to some extent for large firms. It is probably the case that investing companies choose firms to create new distribution channels for their previous products – thus indicating a horizontal merger (see Markusen (1984)). In the case of large-scale mergers, market concentration effects may be intended and the sales effect on the various units of the conglomerate may be initially unclear. Again, the economic effects are smaller than in the empirical literature. Guadalupe et al. (2012) document strong effects of 18% for Spanish firms. We find 5.5% in the short run and 15.6% in the long run. For the services sector, we see positive effects in the short term for small and large firms (at the 5% level). Here, the impact is stronger for large firms.

The pattern largely changes when we turn to the effects on intangible assets (see Appendix Table 13). Here, we see no effects within the manufacturing sector. Thus, transfers of knowledge reported in the balance sheet do not seem to be relevant within the time span we address. However, the picture is different for the services sector where we find mixed results: large services firms can be seen as knowledge profiteers, experiencing positive short and long-term effects (significant at the 1% level). Thus, it appears that investors strengthen new affiliates and that they may establish new concepts (e.g. franchising). In contrast, we find significantly negative short and long-term effects for smaller firms (at the 5% level). Intangible assets could be transferred to the new parent company abroad or intangibles assets could become useless and written off. The latter could be the case for trademarks, for example.

Finally, Appendix Table 14 shows positive short and long-term effects on labour costs applying to large and small firms in the manufacturing sector (at the 1 and 5% significance level in the short term and the 5 and 10% level in the long term). Either employment or wages increased – the latter perhaps going hand in hand with the employment of more highly qualified staff. This result would be in line with Hijzen et al. (2013) who find positive wage effects through employment growth in highly skilled jobs, with no evidence of greater job insecurity. Egger et al. (2020) also provide reasons for higher wages: the application of new technologies may require worker training, which is likely to be accompanied by higher wages. Furthermore, a wage premium may be paid to protect the technological advantage of the multinational.<sup>43</sup> Thus, the fear of job losses seems to be unfounded, and the opposite may instead be true with respect to small manufacturing firms (though it is also possible that, actually, wages increased). Conversely, in the services sector, we do not find any significant results. As highlighted previously, there are many missing values for employment in the dataset. Nevertheless, we conducted a robustness check using

<sup>43</sup> According to Koch and Smolka (2019), output gains are highest when firms engage in both technology and skill upgrading at the same time. Thus, new foreign owners share profits with the highly skilled workers who are already in the plant before the acquisition (see Balsvik and Haller (2010)).

employment instead of labour costs (see Appendix Table 12). We find significantly positive results in the manufacturing sector for large firms only. Thus, the positive labour cost effects could result from higher employment. We would interpret these results with caution since we cannot rule out a potential selection bias.

Thus, our strong results with respect to the development of the performance variables of our German manufacturing target firms show that foreign investments make their new German affiliates profit for the most part. However, in the case of the services sector, the evidence is much weaker and less significant. An explicit empirical comparison of the coefficients of the two sectors shows only minor differences (see Appendix Table 11).

#### 4.1.2 Impact on firms investing abroad

Appendix Table 15 presents the coefficients of short and long-term effects of first-time FDI on productivity for the manufacturing (upper panel) and the services (lower panel) sectors.<sup>44</sup> An impact on the performance of the parent company would not come as a surprise as international investments are likely to trigger firm restructuring. On the other hand, the acquiring firm is, on average, larger than the acquired firm and its firm structure more complex. Thus, effects may be relatively smaller or may take more time to unfold.

Our results in Table 15 point to the second strand of interpretation, as most effects are insignificant. With respect to productivity, intangible assets and labour costs, we do not find any significant effects. Thus, it may be rather burdensome or at least time-consuming for an initially national enterprise to restructure in such a way as to profit either through the exploitation of economies of scale by focusing on production processes or through process innovation in the newly established cross-border value or distribution chain. Internationalisation may render the firm structure more complex.

We find at least some positive effects in the aftermath of internationalisation for sales: small firms increase their sales in the short term in the manufacturing sector (at the 5% significance level). In the services sector, we generally see no positive sales effects, indicating that the local market continues to be served by the newly acquired affiliate.

The stock of intangible assets is generally not affected by expanding abroad. The small dynamic firms participating in internationalisation probably already have some know-how in a particular area that they may intend to also exploit abroad and, at least at the starting stage of the multinational firm's creation, no further efforts

<sup>44</sup> The three different coefficients for all, small and large firms base on two different regressions. In the following, we explain how we compute them. The coefficient  $\text{Change}_{it}$  (0.031) in Appendix Table 11 column (1) is equivalent to "All" (0.007) in Appendix Table 15. This corresponds to  $\beta_0$  in Eq. (3). Appendix Table 11 column (2) distinguishes then between small and large firms. The coefficient  $\text{Change}_{it} + \text{Change}_{it} \times \text{Small}_i$  (0.027) is the total effect for small "target" firms. The corresponding effect is "Small" (0.003) in Appendix Table 15. This is equal to  $\beta_0 + \gamma_0$  in Eq. (4). The coefficient  $\text{Change}_{it}$  (0.035) is the total effect for large "target" firms. The corresponding effect is "Large" (0.012) in Appendix Table 15. This is equal to  $\beta_0$  in Eq. (4). All explanations also hold for the long-term effect, where we use instead of  $\beta_0$  and  $\gamma_0$  only, the sum of  $\beta_0 + \beta_1 + \beta_2$  and  $\gamma_0 + \gamma_1 + \gamma_2$ .

leading to fast benefits, e.g. with respect to the parent's technological stance, are observed.

In addition, we could not detect any effect on labour costs for firms starting to go abroad. Thus, at least there is no evidence of negative labour outsourcing effects that may be detrimental to the domestic labour force. Goldbach et al. (2019) find with respect to German multinationals that new foreign affiliates bring with them even more investment at home and employment increases as well. However, Lichtenberg and Siegel (1987) find that firms sell plants that are less productive. In addition, Maksimovic et al. (2011) find extensive restructuring in the aftermath of acquisitions – which is likely to increase the competitiveness of a company. For German firms engaging in FDI for the first time, we even see significantly positive employment effects though only for large companies in the manufacturing sector in the short term, as Appendix Table 17 shows.

## 4.2 Characteristics of firms taking part in internationalisation

The probit estimations, which rely on Eq. (2) from Sect. 3, are an econometric prerequisite for the DiD estimations in the preceding Sect. 4.1. We briefly look at the outcome tables from these estimations as they reveal the specific characteristics of firms participating in internationalisation.

First, the coefficients of targets' and acquirers' firm size (measured as log of total assets) in the period preceding the acquisition are significantly positive at the 1% level (see Table 4, columns (1)–(4) for both the manufacturing and the services sectors). Foreign investors may acquire German firms to benefit from their infrastructure and reputation; conversely, national firms need economic resources to enter foreign markets through FDI. Thus, large enterprises may be generally better equipped for such an undertaking. Furthermore, with respect to potential long-term effects, Gugler et al. (2003) see large firm mergers as a means to increase market power.

Turning to specific assets, we find that intangible assets are of strong relevance for targets in the manufacturing sector and for acquirer firms even in both sectors – again with a significantly positive coefficient at the 1% level. The reason for this is that knowledge or brand-based advantages can also be applied abroad. They would allow for scale effects and ultimately result in higher competitiveness. Aitken et al. (1996) observe that multinational firms possess intangible productive assets such as technological know-how, marketing and management skills, export contacts, coordinated relationships with suppliers and customers, and reputation. Additionally, the intention behind a cross-border firm buy-off may also be to harness additional knowledge to boost productivity in the future, meaning that the competitiveness of the conglomerate as a whole could increase (see also Frey and Hussinger (2011)). By contrast, we find a significantly negative coefficient for tangible assets in the case of the services sector. Thus, equipment and buildings seem to be more of a burden than an advantage for firms with international ambitions.

In a rather surprising deviation from the literature, in the case of the manufacturing sector, firms participating in the internationalisation process are less productive. Also surprisingly, firms investing abroad for the first time also seem to have other



comparative advantages. Accordingly, acquirers in this sector have higher labour costs; this may indicate higher qualification levels (see Egger et al. (2020)) or a larger labour force.<sup>45</sup>

Empirical evidence of the positive relevance of sales is limited to target firms in the manufacturing sector. Additionally, we find significantly negative results for profitability, defined as return on equity in the case of the services sector.

Finally, in our sample, the number of firms in the services sector that invest abroad is considerably lower than in the manufacturing sector (see Table 2). On the one hand, this underlines the high importance of the German manufacturing sector; on the other hand, it raises questions about the international strength of German firms in the services sector. This is even more striking given that foreign acquirers invest fairly equally in manufacturing and services firms in Germany (see Table 1).

## 5 Robustness

### 5.1 Firms' investment abroad through M&A or horizontal investment

Our empirical setup first examines acquisitions of German firms by foreign companies, followed by the other investment direction (first-time investment abroad by German firms), which encompasses M&A and greenfield investments. This raises the question as to which type of outward investment drives our baseline results. To overcome this data limitation, we provide several robustness checks with different approximations of M&A transactions.

We start with German outward transactions with other industrialised countries (see Appendix Table 18). The literature argues that firms are more likely to conduct horizontal FDI in high-income countries to serve foreign markets, while firms engage in vertical FDI in low-income countries with lower labour costs. We identify horizontal FDI in countries within the upper quartile of national GDP per capita within our total country sample. Descriptive statistics show that, within this quartile, 68% of FDI is horizontal, conducted by German firms going abroad, probably predominantly by means of M&A. We find only insignificant results, which confirms our baseline findings.

Beside the distinctions greenfield vs. M&A and horizontal vs. vertical FDI, the empirical literature proposes another way to distinguish between horizontal and vertical FDI. If the parent company and its foreign affiliate are active in the same sector, then it is more likely that the firm will engage in horizontal FDI. Engaging in different sectors is defined as vertical FDI, since firms engage in cross-border supply chains. We define horizontal FDI as a German parent company and its foreign affiliate declaring the same two-digit sector classification. According to this definition, we find results differing from our baseline estimates, especially in the manufacturing sector (see Appendix Table 19). Manufacturing firms engaging in FDI for the first time also benefit from going international. The results for this investment direction

<sup>45</sup> Additionally, Balsvik and Haller (2010) conclude that foreign firms pick large, high-wage and high-productivity firms, which is also largely corroborated by the literature.

is now similar to those for “targets” with similar signs and significance levels. Only labour costs do not seem to be affected. The different approaches to approximating horizontal FDI (or M&A), with their deviating outcomes, show that the underlying assumptions play a decisive role in the estimates.

## 5.2 Relevance of location of foreign investors for German firms

The origin of the foreign investor might play a role in the results. In additional robustness checks, we find empirical evidence of foreign investors from two different regions: Western Europe (accounts for 75% of all treatment observations) and North America (accounts for 10% of all treatment observations). According to these estimates, the results for Western European investors coincide with our baseline effects (see Appendix Table 20). We also find some evidence of investors from North America. Interestingly, the significant effects are primarily seen in the services sector.<sup>46</sup> This may not come as a surprise, as US firms are highly competitive in these sectors vis-à-vis their German counterparts. For Asian investors, the coefficients become mostly insignificant, with some negative significant effects. However, the number of observations in the treated group is very limited for this region (~90). That is why we interpret these results with caution.

## 5.3 Alternative measures for total factor productivity

The literature proposes other productivity measures as well. We compare our adjusted Akerberg et al. (2015) with endogenous productivity with two other measures that have frequently been used in the past: Akerberg et al. (2015) without endogenous productivity and Wooldridge (2009).<sup>47</sup> Appendix Tables 21 and 22 present a direct comparison of the resulting coefficients. We find that all measures yield very similar findings. Therefore, the choice of approach to estimating total factor productivity does not affect our main insights.

## 5.4 Coarsened exact matching

Propensity score matching imposes several assumptions to estimate the probability of a firm being in the treatment group (“propensity scores”). The inclusion of different explanatory variables in this first stage may affect these propensity scores, which are important for the matching approach in the second stage. Iacus et al., (2011, 2012) propose another method known as “coarsened exact matching” (CEM). Instead of estimating propensity scores, CEM matches “treated” firms with “untreated” firms, which are in the same bins of intervals for all explanatory variables. To choose bins, we examine the distributions of our central explanatory variables for propensity score matching. The log of intangible

<sup>46</sup> The regression outcomes for Northern American acquirers are available from the authors upon request.

<sup>47</sup> The productivity measure of Levinsohn and Petrin (2003), which was used in the earlier empirical literature, delivers similar results as Wooldridge (2009).

assets and the return on equity from the previous period are rather skewed. That is why we have chosen to exclude both variables from CEM.<sup>48</sup> Given the distributions of total assets, total sales, fixed assets, labour costs and productivity, we select the following four bins: minimum to 25th percentile, 25th percentile to median, median to 75th percentile and 75th percentile to maximum.

Appendix Table 23 illustrates the results of CEM for “targets”. If we compare these results with our baseline findings, we conclude that many results are similar, with some exceptions. The positive productivity effects in the manufacturing sector are now insignificant, while large firms in the services sector benefit from foreign investors.

Finally, we compare CEM with propensity score matching for German firms investing in foreign affiliates for the first time. We present the results in Appendix Table 24. Almost all coefficients are insignificant. This largely coincides with the baseline findings in Appendix Table 15.

## 5.5 Timing of treatment

The recent DiD literature discusses potential biases from heterogeneous treatment effects in pooled DiD settings with staggered designs, i.e. treatment of different groups in different periods. The standard two-way fixed effects estimator may lead to biased coefficients with the potential problem that a “treated” firm may be part of the control group in another year. This case is very rare in our sample. However, we conduct a robustness check, in which we exclude firms from our treatment group that have a weight of less than one in any year within our panel dataset. This exclusion assures that the “treated” firm is only in the treatment group throughout the whole period. Appendix Tables 25 and 26 show the results. They are similar to the baseline findings with the same signs, but with some small differences in statistical significance. Nevertheless, the overall conclusions do not change.

The state of the art of staggered DiD settings are, for instance, discussed in Roth et al. (2023) or Baker et al. (2022). Both highlight the approach by Callaway and Sant’Anna (2021). We conduct a robustness check using this estimator, since it provides consistent estimates even if the parallel trends assumption is not met over longer time horizons. In addition, we include the sum of tangible and intangible assets – a measure of firm size – as a control variable in these estimations. Appendix Table 27 shows the coefficients. While the results for targets are significantly positive – in particular for sales in the services sectors – the results for the various performance variables of acquirers indicate mostly positive significant effects. All these robustness checks confirm that we find (mostly) positive effects of internationalisation, although the significance depends on certain assumptions by estimators. Nevertheless, we do not find conclusive evidence of negative consequences of internationalisation.

<sup>48</sup> If we exclude these two variables from propensity score matching, we obtain results similar to our baseline findings.

## 6 Conclusions

In our study, we can empirically confirm that the economic development of many newly formed multinationals is positive in subsequent years. When we first look at the German entities acquired by foreign firms, in the manufacturing sector firms benefit from positive productivity, sales and pay higher wages/hire more employees, mostly in both the short and long term. Our robustness regressions for employment yield significantly positive employment effects and thus point to employment as one reason for the higher labour costs. In the long term, positive productivity effects are stronger among large firms, whereas positive effects on sales are stronger among small firms. Furthermore, manufacturing firms' intangible assets remain unaffected. Heterogeneity also comes into play with respect to the sectors: in the services sector, effects on productivity and sales are small, especially in the long term. There are even no effects at all on labour costs, while the results for intangible assets are mixed: while we see an increase for the larger services firms, a decrease is observed for the smaller firms (in both the short and long term). All in all, we find that there are various positive effects stemming from the internationalisation of a firm through a takeover. In general, there is stronger evidence for larger firms. The sole negative internationalisation effect is on small service firms' intangible assets. Thus, with respect to the overwhelmingly positive effects we find, we presume that foreign investors take efforts to integrate a new affiliate into the production structure of the conglomerate. This may be reflected in the increased productivity of many of the firms and also increased labour costs that we find – with higher employment as a reason. Investors' motive may also be to establish a local presence, going along with the increased sales that we observe.

In contrast, we do not see any short or long-term effects on productivity, intangible assets and labour costs for German firms that start going abroad. It is only in the manufacturing sector that they experience a short-term positive sales effect. Though we generally did not find much positive evidence for the companies' home parent units, they may profit in the more distant future, as their motivation to carry out foreign takeovers may be to influence the market structure in a way that gives them a stronger position. This may pay out some years later. Furthermore, we do not find evidence suggesting any outsourcing of activities based in Germany to the rest of the world with an overall harmful impact on home firms. In our setting with a strongly limited data, we even find some positive employment effects for large manufacturing firms in the short run, which further supports this finding.

As a general remark on the number of observations: we have significantly more observations for German acquirers in the manufacturing sector than those in the services sector. This already indicates that the German manufacturing sector has a much stronger international position. Conversely, in the German services sector, there seems to be still substantial internationalisation potential to be exploited.

We also address the characteristics of firms involved in internationalisation and found that, in general, firms need a critical size to participate in internationalisation as a target or acquirer firm. Thus, internationalisation may also result

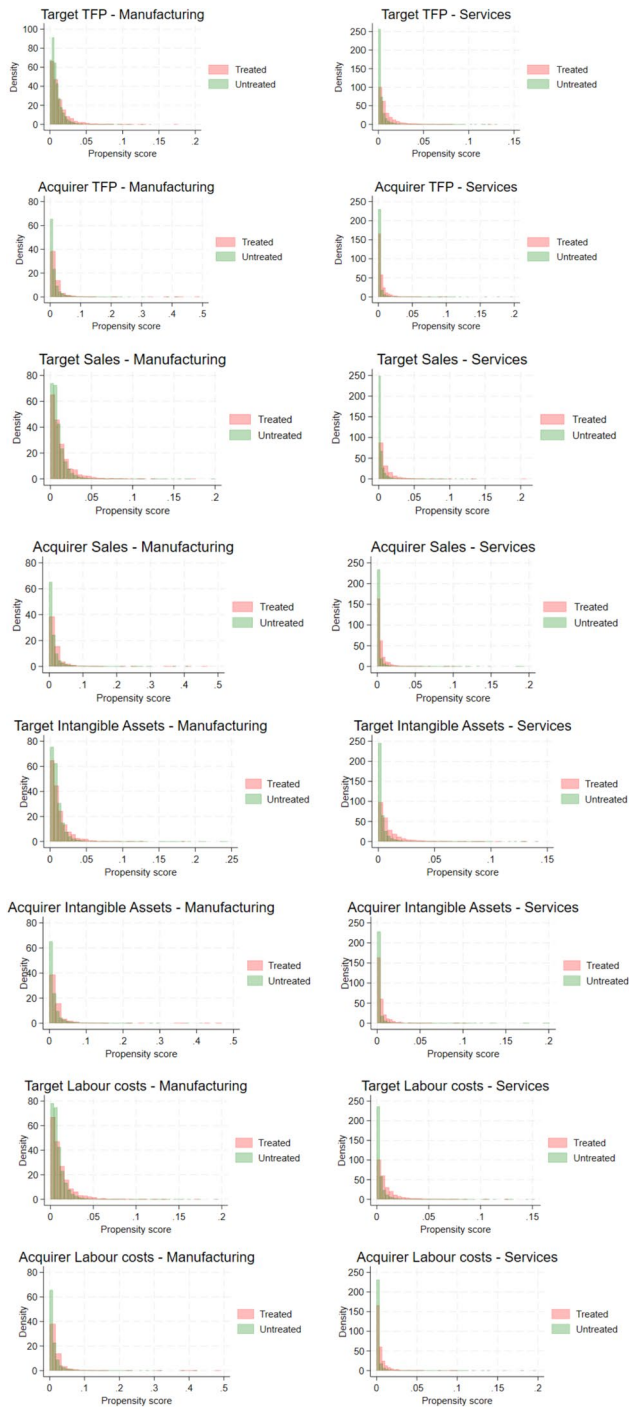
in a concentration of market power – though takeovers at the national level may even be more harmful. In the case of manufacturing firms, those firms with more intangible assets are more likely to be bought but at the same time also have a greater likelihood of acting as acquirer – the latter also applies to services firms. This probably indicates high interest in the globally competitive firms of the German “Mittelstand” and, conversely, that knowledge-based assets such as technological know-how, marketing and management skills may allow acquirers to generate scale effects abroad. Furthermore, higher labour costs of acquirers in the manufacturing sector are indicative of a larger labour force or higher wages. The latter is likely to be connected with higher qualifications.

Thus, our study provides a range of evidence showing positive effects of free capital flows for firms in the field of FDI. However, we also find that the outcome is heterogeneous, in the sense that not all firms profit and that we have to discriminate by sector, firm size and time horizon to identify the winners. In general, larger firms in the manufacturing sector that are bought by foreigners mostly profit. Furthermore, we do not see any indication that firms going abroad in the manufacturing and services sectors restructure within the new conglomerate at the expense of the labour force in their home location. This is underlined by employment, which either increases or is stable. While in the services sector large target firms can be seen as knowledge profiteers with short and long-term positive effects, smaller firms experience significantly negative effects in the short and long term. For the firms losing intangible assets, the question arises as to whether knowledge is transferred to the new parent company abroad or intangibles assets became useless and were written off. This is our sole negative outcome effect.

Thus, all in all, we fail to find evidence supporting the negative attitudes towards internationalisation sometimes present in the public sphere. Firms’ international investment probably makes them more competitive, which can become important, especially in the longer term. However, some groups of firms are unaffected by globalisation. These firms may be seen, or may see themselves, as “relative” losers of globalisation. With the same reasoning, companies that remain national and perform relatively more poorly than their international competitors may perceive globalisation as – at least relatively – disadvantageous. In addition, when internationalisation is accompanied by market concentration, other firms may be negatively affected in the long term. Competition authorities need to remain vigilant in this regard. So there are also issues that may explain some of the dissatisfaction with open capital markets. However, we were generally able to identify major benefits for firms stemming from globalisation in the form of FDI.

## Appendix

See Fig. 4 and Tables 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26 and 27.



**Fig. 4** Distributions of p-scores

**Table 6** Definition of firm variables

Variable	Definition	Position in JANIS
Log sales	Log of sales	G30000
Log fixed assets	Log of tangible assets	A13200
Log intangible assets	Log of intangible assets = log of (sum of concessions, industrial property and similar rights and assets as well as licences + goodwill + payments on account for intangible assets + internally generated industrial rights and similar rights and asset)	A13100
Log total assets	Log of total assets	A10000
Log labour costs	Log of labour costs = log of (sum of salaries and wages + social security and expenditure for company pension funds and pensions paid)	G37000
Return on equity	Operating result / equity	G45000/P21000

**Table 7** Definitions for total factor productivity

Variable	Definition	Position in JANIS
Log value added	Log (sales – expenses for raw materials and consumables and for goods purchased – expenses for services purchased)	G30000-G35100-G35200
Log cost of capital	Log of tangible assets	A13200
Log cost of intermediate goods	Log (expenses for raw materials and consumables and for goods purchased + expenses for services purchased)	G35100 + G35200
Log cost of labour	Log of labour costs	G37000

**Table 8** Sample composition of five year restriction ("targets")

	Manufacturing		Services	
	No restrictions	Restrictions	No restrictions	Restrictions
<i>Important 2-digit economic sectors</i>				
Manufacture of machinery and equipment n.e.c	203 (19.5%)	191 (19.4%)		
Manufacture of computer, electronic and optical products	119 (11.4%)	104 (10.6%)		
Manufacture of chemicals and chemical products	102 (9.8%)	86 (8.7%)		
Wholesale trade, except of motor vehicles and motorcycles			328 (35.5%)	304 (33.8%)
Computer programming, consultancy and related activities			96 (10.4%)	93 (10.3%)
<i>Firm size</i>				
Mean total assets (in thsd. €)	125,911	159,167	70,184	88,043
Mean total sales (in thsd. €)	149,767	183,559	112,431	115,544
Mean employment	459	531	304	373
<i>Geographical region</i>				
Asia	62 (6.0%)	57 (5.8%)	70 (7.6%)	47 (5.2%)
North America	123 (11.8%)	112 (11.4%)	90 (9.7%)	78 (8.7%)
Western Europe	812 (78.1%)	779 (79.0%)	737 (79.8%)	736 (81.8%)
Number of firms	1,040	986	924	900



**Table 9** Balancing property test of “targets” for total factor productivity

	Sample	Mean		<i>t</i> test	
		Treated	Control	% Bias	<i>p</i> value
Manufacturing	Unmatched	10.16	8.62	90.9	0.000
	Matched	10.20	10.18	1.4	0.688
<i>Log intangible assets<sub>it-1</sub></i>	Unmatched	4.27	2.34	70.8	0.000
	Matched	4.66	4.73	-2.5	0.551
<i>Log TFP<sub>it-1</sub></i>	Unmatched	4.08	2.92	65.5	0.000
	Matched	4.34	4.34	-0.5	0.875
<i>Log labour costs<sub>it-1</sub></i>	Unmatched	8.88	7.47	84.6	0.000
	Matched	9.08	9.09	-0.4	0.898
<i>Log sales<sub>it-1</sub></i>	Unmatched	10.54	8.94	87.4	0.000
	Matched	10.66	10.64	0.8	0.805
<i>Return on equity<sub>it-1</sub></i>	Unmatched	4.84	2.11	3.4	0.047
	Matched	0.87	1.18	-0.4	0.791
<i>Log fixed assets<sub>it-1</sub></i>	Unmatched	7.71	6.61	41.5	0.000
	Matched	8.39	8.44	-1.6	0.591
<i>TFP growth<sub>it-1</sub></i>	Unmatched	0.05	0.03	6.2	0.004
	Matched	0.04	0.04	-1.2	0.730

The standardised percentage bias is the percentage difference of the sample means in the treated and non-treated (full or matched) sub-samples as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (see Rosenbaum and Rubin (1985))

**Table 10** Balancing property test of “targets” for total factor productivity

	Sample	Mean		<i>t</i> test	
		Treated	Control	% Bias	<i>p</i> value
Services					
<i>Log total assets<sub>it-1</sub></i>	Unmatched	10.16	8.62	90.9	0.000
	Matched	9.75	9.64	6.3	0.170
<i>Log intangible assets<sub>it-1</sub></i>	Unmatched	4.27	2.34	70.8	0.000
	Matched	3.75	3.66	3.2	0.553
<i>Log TFP<sub>it-1</sub></i>	Unmatched	4.08	2.92	65.5	0.000
	Matched	3.54	3.45	4.7	0.284
<i>Log labour costs<sub>it-1</sub></i>	Unmatched	8.88	7.47	84.6	0.000
	Matched	8.47	8.36	6.1	0.209
<i>Log sales<sub>it-1</sub></i>	Unmatched	10.54	8.94	87.4	0.000
	Matched	10.30	10.23	3.6	0.422
<i>Return on equity<sub>it-1</sub></i>	Unmatched	4.84	2.11	3.4	0.047
	Matched	1.67	2.75	-1.3	0.425
<i>Log fixed assets<sub>it-1</sub></i>	Unmatched	7.71	6.61	41.5	0.000
	Matched	6.92	6.90	0.7	0.889
<i>TFP growth<sub>it-1</sub></i>	Unmatched	0.05	0.03	6.2	0.031
	Matched	0.05	0.05	2.4	0.654

The standardised percentage bias is the percentage difference of the sample means in the treated and non-treated (full or matched) sub-samples as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (formulae from Rosenbaum and Rubin (1985))

**Table 11** Effect of internationalisation on targets' total factor productivity

	Manufacturing			Services				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Change_{it}$	0.031*** (0.008)	0.035*** (0.012)	0.030*** (0.011)	0.034** (0.014)	0.022* (0.013)	0.029 (0.019)	-0.005 (0.018)	0.008 (0.025)
$Change_{it-1}$			0.030*** (0.010)	0.025** (0.012)			0.013 (0.018)	0.026 (0.024)
$Change_{it-2}$			0.014 (0.010)	0.016 (0.011)			0.012 (0.014)	0.032 (0.020)
$Change_{it} \times Small_i$		-0.008 (0.017)		-0.008 (0.023)		-0.014 (0.025)		-0.027 (0.032)
$Change_{it-1} \times Small_i$				0.008 (0.022)				-0.028 (0.031)
$Change_{it-2} \times Small_i$				-0.003 (0.020)				-0.039 (0.026)
$Change_{it} + Change_{it} \times Small_i$		0.027** $p$ value: 0.019				0.015 $p$ value: 0.373		
$\sum_{j=0}^2 Change_{it-j}$			0.074** $p$ value: 0.011	0.075** $p$ value: 0.022			0.020 $p$ value: 0.664	0.067 $p$ value: 0.278
$\sum_{j=0}^2 Change_{it-j} + \sum_{j=0}^2 Change_{it-j} \times Small_i$				0.072 $p$ value: 0.146				-0.027 $p$ value: 0.654
Observations	124,182	124,182	103,563	103,563	290,577	290,577	236,148	236,148
Adj. R2	0.943	0.943	0.953	0.953	0.953	0.953	0.966	0.966

OLS panel estimation. The dependent variable is total factor productivity (in logs). The unit of observation is firm-year observation. The sample period is 1999 to 2018. Firm fixed effects and sector-time-specific fixed effects are included but not reported. Robust standard errors (clustered by firm) are in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively

**Table 12** Effect of internationalisation on targets' sales

	Manufacturing			Services				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Change_{it}$	0.054*** (0.012)	0.035** (0.014)	0.053*** (0.016)	0.029* (0.017)	0.056*** (0.018)	0.065** (0.027)	0.023 (0.027)	0.023 (0.037)
$Change_{it-1}$			0.049*** (0.015)	0.028* (0.017)			0.037 (0.028)	0.025 (0.041)
$Change_{it-2}$			0.043*** (0.015)	0.026 (0.018)			0.041** (0.019)	0.050* (0.029)
$Change_{it} \times Small_i$		0.037 (0.024)		0.051 (0.033)		-0.017 (0.035)		0.001 (0.046)
$Change_{it-1} \times Small_i$				0.043 (0.032)				0.022 (0.049)
$Change_{it-2} \times Small_i$				0.037 (0.029)				-0.017 (0.040)
$Change_{it} + Change_{it-j} \times Small_i$		0.073*** $p$ value: 0.000				0.048*** $p$ value: 0.041		
$\sum_{j=0}^2 Change_{it-j}$			0.145*** $p$ value: 0.000	0.082* $p$ value: 0.069			0.101 $p$ value: 0.143	0.098 $p$ value: 0.321
$\sum_{j=0}^2 Change_{it-j} + \sum_{j=0}^2 Change_{it-j} \times Small_i$				0.214*** $p$ value: 0.004				0.104 $p$ value: 0.226
Observations	126,443	126,443	105,366	105,366	301,720	301,720	244,756	244,756
Adj. R2	0.866	0.866	0.915	0.915	0.870	0.870	0.908	0.908

OLS panel estimation. The dependent variable is total sales (in logs). The unit of observation is firm-year observation. The sample period is 1999 to 2018. Firm fixed effects and sector-time-specific fixed effects are included but not reported. Robust standard errors (clustered by firm) are in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively

**Table 13** Effect of internationalisation on targets' intangible assets

	Manufacturing			Services				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Change_{it}$	0.005 (0.042)	-0.046 (0.061)	0.023 (0.055)	-0.009 (0.077)	0.042 (0.049)	0.244*** (0.073)	0.030 (0.070)	0.313*** (0.098)
$Change_{it-1}$			0.038 (0.055)	0.057 (0.077)			0.049 (0.065)	0.291*** (0.088)
$Change_{it-2}$			-0.056 (0.053)	-0.046 (0.075)			0.056 (0.060)	0.251*** (0.082)
$Change_{it} \times Small_i$		0.099 (0.088)		0.061 (0.112)		-0.394*** (0.100)		-0.586*** (0.136)
$Change_{it-1} \times Small_i$				-0.035 (0.110)				-0.506*** (0.132)
$Change_{it-2} \times Small_i$				-0.019 (0.106)				-0.416*** (0.127)
$Change_{it} + Change_{it-j} \times Small_i$		0.054 $p$ value: 0.377				-0.150** $p$ value: 0.025		
$\sum_{j=0}^2 Change_{it-j}$			0.005 $p$ value: 0.973	0.002 $p$ value: 0.992			0.136 $p$ value: 0.446	0.856*** $p$ value: 0.001
$\sum_{j=0}^2 Change_{it-j} + \sum_{j=0}^2 Change_{it-j} \times Small_i$				0.009 $p$ value: 0.966				-0.654** $p$ value: 0.011
Observations	126,310	126,310	105,270	105,270	301,266	301,266	244,350	244,350
Adj. R2	0.745	0.745	0.763	0.763	0.807	0.808	0.831	0.832

OLS panel estimation. The dependent variable is intangible assets (in logs). The unit of observation is firm-year observation. The sample period is 1999 to 2018. Firm fixed effects and sector-time-specific fixed effects are included but not reported. Robust standard errors (clustered by firm) are in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively

**Table 14** Effect of internationalisation on targets' labour costs

	Manufacturing			Services				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Change_{it}$	0.035*** (0.009)	0.037*** (0.013)	0.033*** (0.012)	0.032** (0.015)	0.020 (0.017)	0.017 (0.027)	-0.019 (0.022)	-0.024 (0.032)
$Change_{it-1}$			0.035*** (0.011)	0.025** (0.013)			-0.008 (0.022)	-0.027 (0.035)
$Change_{it-2}$			0.012 (0.012)	0.016 (0.012)			0.009 (0.016)	0.008 (0.022)
$Change_{it} \times Small_i$		-0.004 (0.020)		0.002 (0.026)		0.006 (0.034)		0.011 (0.043)
$Change_{it-1} \times Small_i$				0.019 (0.023)				0.037 (0.044)
$Change_{it-2} \times Small_i$				-0.008 (0.023)				0.004 (0.033)
$Change_{it} + Change_{it-j} \times Small_i$		0.033** $p$ value: 0.016				0.023 $p$ value: 0.251		
$\sum_{j=0}^2 Change_{it-j}$			0.079*** $p$ value: 0.009	0.073** $p$ value: 0.037			-0.018 $p$ value: 0.744	-0.043 $p$ value: 0.577
$\sum_{j=0}^2 Change_{it-j} + \sum_{j=0}^2 Change_{it-j} \times Small_i$				0.086* $p$ value: 0.099				0.008 $p$ value: 0.912
Observations	126,698	126,698	105,622	105,622	294,650	294,650	239,250	239,250
Adj. R2	0.936	0.936	0.947	0.947	0.929	0.929	0.944	0.944

OLS panel estimation. The dependent variable is labour costs (in logs). The unit of observation is firm-year observation. The sample period is 1999 to 2018. Firm fixed effects and sector-time-specific fixed effects are included but not reported. Robust standard errors (clustered by firm) are in parentheses. \*\*\*, \*\* and \* denote significance at the 1%, 5% and 10% level, respectively

**Table 15** Effect of internationalisation on acquirers' productivity, sales, intangible assets and labour costs

	Short-term effects			Long-term effect				
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets	Log labour costs
<i>Manufacturing</i>								
All	0.007 (0.008)	0.026** (0.010)	-0.058 (0.046)	0.006 (0.008)	-0.009 (0.029)	0.020 (0.035)	-0.136 (0.159)	-0.014 (0.027)
Small	0.003 (0.011)	0.033** (0.016)	-0.073 (0.055)	-0.003 (0.011)	-0.001 (0.039)	0.038 (0.050)	-0.209 (0.186)	-0.023 (0.041)
Large	0.012 (0.011)	0.018 (0.014)	-0.042 (0.074)	0.017 (0.012)	-0.018 (0.040)	0.003 (0.048)	-0.064 (0.258)	-0.005 (0.042)
Observations	67,275	68,290	68,244	68,861	56,716	57,520	57,457	57,978
Adj. R <sup>2</sup>	0.934	0.876	0.667	0.931	0.949	0.925	0.693	0.948
<i>Services</i>								
All	0.013 (0.014)	0.003 (0.025)	-0.133* (0.072)	0.020 (0.017)	0.067 (0.061)	0.020 (0.100)	-0.146 (0.245)	0.079 (0.067)
Small	-0.001 (0.016)	0.002 (0.028)	-0.103 (0.109)	-0.007 (0.018)	0.062 (0.077)	0.030 (0.101)	-0.319 (0.392)	0.022 (0.084)
Large	0.026 (0.025)	0.004 (0.041)	-0.163* (0.094)	0.046 (0.032)	0.072 (0.095)	0.010 (0.163)	-0.001 (0.304)	0.128 (0.104)
Observations	228,207	236,931	241,579	234,086	187,024	193,856	197,378	191,550
Adj. R <sup>2</sup>	0.967	0.897	0.824	0.957	0.976	0.922	0.846	0.967

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Table 16** Differences between manufacturing and services

	Short-term effects			Long-term effects				
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets	Log labour costs
<i>Targets</i>								
All	0.005 (0.016)	0.002 (0.022)	-0.060 (0.066)	0.008 (0.019)	0.053 (0.056)	0.070 (0.080)	-0.175 (0.235)	0.073 (0.063)
Small	0.008 (0.034)	0.060 (0.047)	0.407*** (0.136)	0.015 (0.045)	0.112 (0.080)	0.187* (0.107)	0.279 (0.325)	0.138 (0.093)
Large	-0.006 (0.027)	-0.033 (0.037)	-0.323*** (0.097)	-0.004 (0.038)	-0.064 (0.083)	-0.073 (0.129)	-0.954*** (0.348)	-0.034 (0.096)
Observations	410,273	421,507	420,963	415,903	336,748	345,557	345,184	341,155
Adj. R <sup>2</sup>	0.952	0.878	0.777	0.932	0.963	0.916	0.799	0.946
<i>Acquirers</i>								
All	-0.008 (0.017)	-0.037 (0.035)	0.095 (0.084)	-0.022 (0.018)	-0.079 (0.067)	-0.216* (0.130)	-0.004 (0.288)	-0.108 (0.075)
Small	-0.039 (0.037)	0.004 (0.065)	-0.142 (0.170)	-0.021 (0.045)	-0.143 (0.089)	-0.225 (0.159)	-0.105 (0.388)	-0.167* (0.096)
Large	0.012 (0.029)	-0.038 (0.058)	0.177 (0.127)	-0.013 (0.038)	-0.015 (0.099)	-0.212 (0.186)	0.104 (0.414)	-0.054 (0.115)
Observations	301,468	312,836	307,183	306,547	248,539	257,330	253,024	252,439
Adj. R <sup>2</sup>	0.957	0.857	0.730	0.934	0.968	0.913	0.755	0.949

Coefficients of interest with clustered standard errors (by firms) in parentheses





**Table 18** Horizontal FDI of German parent companies approximated by log GDP per capita (upper quartile)

	Short-term effects				Long-term effects			
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets	Log labour costs
<i>Manufacturing</i>								
All	0.003 (0.010)	0.018 (0.013)	-0.051 (0.058)	0.007 (0.011)	-0.019 (0.032)	0.021 (0.044)	-0.097 (0.181)	0.007 (0.044)
Small	-0.011 (0.014)	0.010 (0.018)	-0.058 (0.070)	-0.008 (0.014)	-0.037 (0.044)	-0.025 (0.067)	-0.214 (0.222)	-0.038 (0.050)
Large	0.018 (0.013)	0.026 (0.019)	-0.044 (0.078)	0.021 (0.017)	-0.002 (0.048)	0.060 (0.059)	0.006 (0.277)	0.046 (0.074)
Observations	65,659	67,127	66,602	67,206	55,156	56,306	55,895	56,382
Adj. R <sup>2</sup>	0.929	0.830	0.688	0.901	0.945	0.882	0.714	0.916
<i>Services</i>								
All	0.012 (0.016)	0.021 (0.029)	-0.114 (0.072)	0.008 (0.017)	0.049 (0.066)	0.095 (0.109)	-0.060 (0.240)	0.008 (0.069)
Small	0.006 (0.019)	0.004 (0.035)	-0.089 (0.112)	-0.014 (0.021)	0.086 (0.088)	0.140 (0.111)	-0.102 (0.383)	0.138 (0.094)
Large	0.018 (0.025)	0.036 (0.046)	-0.135 (0.096)	0.027 (0.029)	0.018 (0.091)	0.058 (0.173)	-0.028 (0.322)	0.002 (0.098)
Observations	229,186	239,576	244,056	232,937	187,938	195,963	199,381	190,836
Adj. R <sup>2</sup>	0.968	0.901	0.843	0.961	0.977	0.924	0.864	0.970

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Table 19** Horizontal FDI of German parent companies approximated by same sector classification of German parent company and its foreign affiliate

	Short-term effects			Long-term effects				
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets	Log labour costs
<i>Manufacturing</i>								
All	0.029*** (0.011)	0.040*** (0.014)	-0.008 (0.066)	0.018 (0.012)	0.065* (0.036)	0.111*** (0.040)	-0.173 (0.235)	0.029 (0.037)
Small	0.015 (0.014)	0.065*** (0.020)	-0.063 (0.086)	0.015 (0.014)	0.061 (0.050)	0.189*** (0.055)	-0.230 (0.276)	0.054 (0.051)
Large	0.042*** (0.016)	0.016 (0.019)	0.044 (0.098)	0.021 (0.018)	0.068 (0.048)	0.041 (0.058)	-0.122 (0.372)	0.008 (0.053)
Observations	70,293	71,095	69,073	70,383	58,743	59,306	57,664	58,756
Adj. R <sup>2</sup>	0.940	0.829	0.693	0.933	0.956	0.924	0.729	0.950
<i>Services</i>								
All	0.022 (0.016)	0.059* (0.032)	-0.126 (0.087)	0.030* (0.017)	0.048 (0.064)	0.151 (0.113)	-0.360 (0.318)	0.042 (0.070)
Small	0.002 (0.021)	0.023 (0.044)	-0.181 (0.145)	-0.002 (0.023)	0.039 (0.096)	0.071 (0.148)	-0.601 (0.546)	0.007 (0.103)
Large	0.043* (0.022)	0.092* (0.048)	-0.073 (0.096)	0.062** (0.026)	0.056 (0.088)	0.214 (0.175)	-0.163 (0.337)	0.071 (0.100)
Observations	215,673	225,981	231,042	218,780	177,627	185,566	189,282	180,083
Adj. R <sup>2</sup>	0.968	0.869	0.829	0.954	0.978	0.899	0.847	0.966

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Table 20** Foreign takeovers of German companies (investors from Western Europe)

	Short-term effects			Long-term effects				
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets	Log labour costs
<i>Manufacturing</i>								
All	0.031*** (0.009)	0.065*** (0.014)	-0.007 (0.059)	0.037*** (0.011)	0.071** (0.029)	0.188*** (0.045)	0.027 (0.170)	0.086*** (0.032)
Small	0.023* (0.012)	0.094*** (0.022)	0.009 (0.070)	0.030* (0.016)	0.049 (0.044)	0.314*** (0.077)	-0.084 (0.245)	0.068 (0.050)
Large	0.038*** (0.014)	0.033* (0.018)	-0.025 (0.069)	0.046** (0.015)	0.091** (0.036)	0.072 (0.049)	0.131 (0.227)	0.103*** (0.040)
Observations	125,298	128,495	129,485	128,132	103,991	106,471	107,349	106,305
Adj. R <sup>2</sup>	0.947	0.866	0.733	0.935	0.957	0.912	0.756	0.946
<i>Services</i>								
All	0.024* (0.014)	0.055*** (0.020)	0.064 (0.056)	0.026 (0.018)	0.036 (0.050)	0.104 (0.078)	0.173 (0.204)	-0.028 (0.059)
Small	0.012 (0.019)	0.054* (0.028)	-0.161** (0.080)	0.029 (0.021)	-0.029 (0.070)	0.090 (0.100)	-0.807*** (0.283)	-0.027 (0.074)
Large	0.037* (0.021)	0.056** (0.029)	0.287*** (0.078)	0.025 (0.028)	0.093 (0.067)	0.116 (0.103)	1.008** (0.282)	-0.030 (0.081)
Observations	289,709	300,184	300,433	293,329	235,341	243,385	243,541	238,092
Adj. R <sup>2</sup>	0.953	0.874	0.809	0.931	0.967	0.914	0.832	0.947

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Table 21** Foreign takeovers of German companies (alternative measures of productivity)

	Short-term effects			Long-term effects		
	Baseline	ACF without endogenous productivity	Wooldridge	Baseline	ACF without endogenous productivity	Wooldridge
<i>Manufacturing</i>						
All	0.031*** (0.008)	0.029*** (0.008)	0.026*** (0.007)	0.074** (0.029)	0.073** (0.029)	0.063*** (0.023)
Small	0.027** (0.011)	0.026** (0.011)	0.021** (0.009)	0.072 (0.050)	0.074 (0.048)	0.059 (0.038)
Large	0.035*** (0.012)	0.032*** (0.012)	0.030*** (0.010)	0.075** (0.033)	0.072** (0.035)	0.067** (0.028)
Observations	124,182	123,603	124,861	103,563	103,154	104,077
Adj. R <sup>2</sup>	0.943	0.947	0.954	0.953	0.957	0.963
<i>Services</i>						
All	0.022* (0.013)	0.021* (0.013)	0.015 (0.011)	0.020 (0.046)	0.015 (0.045)	0.007 (0.038)
Small	0.015 (0.017)	0.011 (0.016)	0.004 (0.014)	-0.027 (0.061)	-0.042 (0.059)	-0.054 (0.050)
Large	0.029 (0.019)	0.032* (0.019)	0.027* (0.016)	0.067 (0.062)	0.071 (0.060)	0.068 (0.051)
Observations	290,577	292,230	290,939	236,148	237,347	236,350
Adj. R <sup>2</sup>	0.953	0.943	0.955	0.966	0.958	0.967

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Table 22** German parent companies with first-time FDI (alternative measures of productivity)

	Short-term effects			Long-term effects		
	Baseline	ACF without endogenous productivity	Wooldridge	Baseline	ACF without endogenous productivity	Wooldridge
<i>Manufacturing</i>						
All	0.007 (0.008)	0.006 (0.008)	0.010 (0.007)	-0.009 (0.029)	-0.008 (0.030)	0.019 (0.025)
Small	0.003 (0.011)	-0.003 (0.012)	-0.004 (0.009)	-0.001 (0.039)	-0.012 (0.040)	-0.009 (0.033)
Large	0.012 (0.011)	0.017 (0.011)	0.027*** (0.010)	-0.018 (0.040)	-0.004 (0.042)	0.047 (0.037)
Observations	67,275	66,804	67,762	56,716	56,358	57,142
Adj. R <sup>2</sup>	0.934	0.938	0.936	0.949	0.953	0.949
<i>Services</i>						
All	0.013 (0.014)	0.013 (0.014)	0.014 (0.012)	0.067 (0.061)	0.062 (0.061)	0.049 (0.053)
Small	-0.001 (0.016)	-0.002 (0.015)	-0.002 (0.014)	0.062 (0.077)	0.053 (0.076)	0.031 (0.067)
Large	0.026 (0.025)	0.028 (0.025)	0.029 (0.022)	0.072 (0.095)	0.070 (0.095)	0.064 (0.081)
Observations	228,207	228,173	227,716	187,024	186,919	186,581
Adj. R <sup>2</sup>	0.967	0.959	0.965	0.976	0.969	0.975

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Table 23** Foreign takeovers of German companies (coarsened exact matching)

	Short-term effects			Long-term effects				
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets	Log labour costs
<i>Manufacturing</i>								
All	0.014 (0.012)	0.040*** (0.014)	0.092** (0.046)	0.023** (0.011)	0.054 (0.041)	0.094** (0.039)	0.314* (0.173)	0.093*** (0.030)
Small	0.018 (0.013)	0.066*** (0.024)	0.094 (0.073)	0.028* (0.017)	0.045 (0.047)	0.147* (0.076)	0.238 (0.270)	0.090* (0.054)
Large	0.011 (0.018)	0.019 (0.016)	0.090 (0.062)	0.018 (0.014)	0.061 (0.057)	0.059 (0.045)	0.364 (0.222)	0.096*** (0.035)
Observations	18,908	19,052	19,127	17,991	16,635	16,672	16,823	15,788
Adj. R <sup>2</sup>	0.969	0.929	0.808	0.964	0.972	0.943	0.810	0.967
<i>Services</i>								
All	0.007 (0.014)	0.039 (0.024)	0.083 (0.051)	0.006 (0.018)	0.037 (0.051)	0.181*** (0.064)	0.086 (0.202)	0.032 (0.055)
Small	-0.027 (0.018)	-0.010 (0.037)	-0.137* (0.079)	-0.028 (0.021)	-0.104 (0.071)	0.103 (0.092)	-1.135*** (0.318)	-0.070 (0.081)
Large	0.041* (0.022)	0.080*** (0.031)	0.267*** (0.065)	0.039 (0.027)	0.161** (0.068)	0.243*** (0.086)	1.045*** (0.239)	0.121 (0.072)
Observations	26,227	27,149	36,981	24,693	22,300	22,557	30,267	20,909
Adj. R <sup>2</sup>	0.968	0.892	0.868	0.956	0.971	0.938	0.865	0.963

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Table 24** German parent companies with first-time FDI (coarsened exact matching)

	Short-term effects			Long-term effects			
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets
<i>Manufacturing</i>							
All	0.002 (0.008)	0.015 (0.014)	0.027 (0.050)	0.003 (0.011)	-0.015 (0.025)	0.026 (0.037)	0.011 (0.179)
Small	0.004 (0.011)	0.032 (0.020)	0.015 (0.071)	0.013 (0.013)	-0.020 (0.041)	0.030 (0.054)	-0.048 (0.283)
Large	0.001 (0.010)	0.003 (0.020)	0.036 (0.070)	-0.005 (0.017)	-0.012 (0.032)	0.023 (0.049)	0.048 (0.233)
Observations	12,462	13,179	13,182	12,365	10,472	11,154	11,094
Adj. R <sup>2</sup>	0.962	0.903	0.786	0.954	0.970	0.943	0.782
<i>Services</i>							
All	-0.007 (0.017)	-0.002 (0.035)	-0.135 (0.086)	0.015 (0.019)	-0.025 (0.049)	0.081 (0.113)	-0.127 (0.306)
Small	-0.008 (0.016)	0.036 (0.038)	-0.051 (0.115)	-0.002 (0.021)	0.011 (0.061)	0.090 (0.142)	0.055 (0.412)
Large	-0.006 (0.022)	-0.038 (0.063)	-0.213* (0.118)	0.030 (0.030)	-0.056 (0.071)	0.073 (0.176)	-0.294 (0.422)
Observations	13,855	12,846	15,191	11,721	11,245	10,062	12,291
Adj. R <sup>2</sup>	0.984	0.884	0.881	0.976	0.986	0.889	0.880

Coefficients of interest with clustered standard errors (by firms) in parentheses



**Table 25** Foreign takeovers of German companies ("target" is never in control group)

	Short-term effects			Long-term effects				
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets	Log labour costs
<i>Manufacturing</i>								
All	0.031** (0.011)	0.060*** (0.016)	0.068 (0.057)	0.028*** (0.011)	0.076* (0.041)	0.158*** (0.061)	0.168 (0.199)	0.079* (0.041)
Small	0.031* (0.018)	0.078*** (0.026)	0.098 (0.087)	0.022 (0.020)	0.094 (0.078)	0.265*** (0.110)	0.175 (0.291)	0.092 (0.077)
Large	0.030* (0.014)	0.044** (0.019)	0.041 (0.077)	0.034*** (0.013)	0.061 (0.043)	0.074 (0.062)	0.163 (0.271)	0.068 (0.045)
Observations	118,553	120,506	120,294	120,960	98,740	100,294	100,131	100,708
Adj. R <sup>2</sup>	0.943	0.868	0.742	0.941	0.953	0.916	0.762	0.951
<i>Services</i>								
All	0.026 (0.017)	0.083*** (0.029)	0.093 (0.067)	0.021 (0.024)	-0.011 (0.063)	0.070 (0.102)	0.349 (0.250)	-0.016 (0.075)
Small	0.028 (0.023)	0.072** (0.036)	-0.155* (0.093)	0.040 (0.033)	-0.018 (0.084)	0.136 (0.123)	-0.420 (0.353)	0.061 (0.113)
Large	0.021 (0.025)	0.094** (0.042)	0.359*** (0.099)	-0.001 (0.036)	-0.003 (0.083)	0.005 (0.150)	1.091*** (0.345)	-0.103 (0.103)
Observations	285,346	296,271	295,662	289,244	231,714	240,146	239,608	234,670
Adj. R <sup>2</sup>	0.953	0.860	0.802	0.926	0.966	0.902	0.832	0.940

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Table 26** German parent companies with first-time FDI (“acquirer” is never in control group)

	Short-term effects				Long-term effects			
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets	Log labour costs
<i>Manufacturing</i>								
All	-0.005 (0.012)	0.016 (0.013)	-0.048 (0.063)	-0.007 (0.013)	-0.047 (0.041)	-0.022 (0.046)	-0.052 (0.205)	-0.060 (0.042)
Small	-0.008 (0.018)	0.019 (0.019)	0.022 (0.075)	-0.020 (0.019)	-0.036 (0.059)	-0.033 (0.074)	0.103 (0.238)	-0.078 (0.061)
Large	-0.003 (0.016)	0.015 (0.018)	-0.105 (0.100)	0.005 (0.017)	-0.057 (0.056)	-0.013 (0.057)	-0.170 (0.321)	-0.045 (0.057)
Observations	63,328	64,259	64,198	64,806	53,264	53,997	53,925	54,435
Adj. R <sup>2</sup>	0.932	0.887	0.678	0.930	0.948	0.932	0.702	0.949
<i>Services</i>								
All	0.040 (0.032)	0.033 (0.060)	-0.092 (0.107)	0.055 (0.034)	0.041 (0.115)	0.131 (0.197)	-0.015 (0.297)	0.037 (0.120)
Small	-0.029 (0.043)	-0.072 (0.086)	-0.086 (0.210)	-0.060 (0.045)	-0.041 (0.184)	-0.031 (0.259)	-0.448 (0.431)	-0.200 (0.175)
Large	0.078* (0.044)	0.087 (0.079)	-0.095 (0.122)	0.116** (0.046)	0.080 (0.145)	0.207 (0.265)	0.179 (0.385)	0.147 (0.151)
Observations	225,798	234,443	239,052	231,661	184,936	191,702	195,191	189,448
Adj. R <sup>2</sup>	0.965	0.878	0.820	0.949	0.975	0.906	0.848	0.962

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Table 27** Staggered DiD with Callaway and Sant'Anna (2021) estimator

	Manufacturing				Services			
	Log TFP	Log sales	Log intangible assets	Log labour costs	Log TFP	Log sales	Log intangible assets	Log labour costs
<i>Targets</i>								
All	-0.003 (0.009)	0.011 (0.013)	-0.080 (0.057)	-0.008 (0.011)	0.022 (0.014)	0.111*** (0.038)	0.073 (0.061)	0.023 (0.016)
Small	0.005 (0.013)	0.033* (0.018)	-0.071 (0.089)	-0.003 (0.014)	0.023 (0.017)	0.158** (0.077)	0.012 (0.087)	0.018 (0.020)
Large	-0.010 (0.012)	-0.011 (0.017)	-0.075 (0.070)	-0.012 (0.015)	0.022 (0.021)	0.072*** (0.025)	0.131 (0.084)	0.028 (0.023)
<i>Acquirers</i>								
All	0.035*** (0.011)	0.028** (0.014)	0.208*** (0.069)	0.033*** (0.012)	0.048** (0.019)	0.062 (0.044)	0.142 (0.098)	0.055** (0.026)
Small	0.053*** (0.014)	0.050*** (0.015)	0.225*** (0.078)	0.047** (0.015)	0.079** (0.035)	0.135 (0.084)	0.308** (0.138)	0.071*** (0.028)
Large	0.008 (0.015)	-0.006 (0.022)	0.157 (0.107)	0.010 (0.017)	0.018 (0.029)	-0.003 (0.048)	-0.001 (0.140)	0.035 (0.041)

Coefficients of interest with clustered standard errors (by firms) in parentheses

**Funding** Open Access funding enabled and organized by Projekt DEAL.

## Declarations

**Conflict of interest** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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