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Foreign and Domestic Takeovers in Germany: First Comparative Evidence on the Post-acquisition Target Performance using new Data

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Abstract:

This study provides the first comparative evidence of foreign and domestic acquisitions in Germany. A propensity score matching approach combined with a difference-in-difference estimator were performed separately for foreign and domestic acquisitions to account for a general takeover effect. The study is based on new high-quality panel data for manufacturing enterprises, provided by German official statistics. The results indicate a negative impact of foreign takeovers on employment and no productivity improvements for the period 2007 to 2009. This evidence contradicts existing empirical studies for Germany which find significant productivity improvements and no changes in terms of employment. These findings are of particular interest to Germany as one of the most important FDI inflow destinations worldwide. They contribute to the foreign ownership performance premium literature as well as improving the understanding of foreign acquisition consequences, a subject of utmost topicality.

JEL-classification: F21, F23, G34

Keywords: post-acquisition performance, foreign takeover, manufacturing, treatment analysis, Germany

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1 Introduction

This study provides the first comparative evidence of foreign and domestic acquisitions in Germany. In the attempt to isolate the causal effect of foreign ownership on firm performance, most studies fail to consider a general takeover effect. This study addresses this gap by providing the first comparison of both types of takeover in a treatment analysis framework using new high-quality panel data from German official statistics.

The results for German manufacturing indicate a negative impact of foreign takeovers on employment and no productivity improvements. These findings contradict existing empirical studies for Germany which find significant productivity improvements and no changes in terms of employment. The findings are of particular interest to Germany as one of the most important foreign direct investment (FDI) inflow destinations (UNCTAD, 2011), in which foreign-owned firms accounted for 13 percent of the total non-financial sector employment in 2007 (Nahm et al., 2011).

Foreign-owned multinational enterprises are generally found to enjoy performance advantages over their domestic counterparts. For example, they are larger, more productive, pay higher average wages, and are more engaged in R&D and exporting. This superiority of foreign multinationals leads to their costly attraction not only in developing, emerging, and transition economies, but also in industrialized countries such as Germany.[1]

Most empirical studies in the area of performance differentials suffer from a selection bias. A further issue is the general evaluation problem arising from the fact that treatment analyses in non-experimental social sciences generally lack a proper control group. This is because it is impossible to observe the counterfactual situation, meaning the treated units if they had not been treated. To overcome these shortcomings and to achieve statements about the causal link between foreign ownership and firm performance, it has become popular to apply econometric methods from program evaluation to ownership changes of firms. However, surveying the literature on foreign acquisitions and ex post target performance reveals ambiguous and country-specific results. The evidence for Germany is scarce.

This study performs separate propensity score matching analyses with difference-in-difference estimates of average treatment effects on the treated (ATT) for both foreign and

[1] See www.gtai.de for detailed information on strategies and measures.

domestic takeovers in German manufacturing. The question to answer is whether post-takeover effects apply exclusively to foreign acquisitions or if they also occur ex post domestic takeovers. Ignoring this aspect may cause severe policy failures. The outcome variables of interest are productivity, employment, average wages and export intensity. Especially employment and wage effects attract great public interest. For instance, job loss is a wide-spread fear if it comes to foreign takeovers in Germany.

The paper, thereby, on the one hand, contributes to the foreign ownership performance premium literature in assessing the role of foreignness in superior performance with a special focus on causality. Beyond that, on the other hand, the analysis of foreign acquisitions in Germany is of interest itself as the public debate demands reliable empirical evidence. For example, the number of Chinese takeovers has grown dramatically in the German manufacturing sector over the last years and debate on this growth often involves expressions of fear due merely to ignorance, inter alia, about the consequences of foreign takeovers (Sohm, Linke, and Klossek, 2009).

The paper proceeds as follows: Section 2 provides a brief literature survey; Section 3 presents the methodological strategy of propensity score matching in combination with a difference-in-difference estimation; Section 4 introduces the new database and the definition of variables. The results are reported and discussed in Section 5, while Section 6 offers a sensitivity analysis and Section 7 is the conclusion.

2 Acquisitions and *ex post* target performance

Foreign-owned enterprises are generally found to enjoy performance advantages over their domestic counterparts. For example, they are larger, more productive, pay higher average wages, and are more engaged in R&D and exporting.[2] An obvious reasoning for this performance gap stems from MNE theory and claims that foreign-owned firms, MNEs by definition, are endowed with specific comparative advantages, such as a superior production technology or organizational superiority (e.g., Caves, 1996; Dunning, 1988; and Casson, 1987). Additionally, recent work in trade theory shows that only the most productive firms undertake

[2] For an overview of the foreign performance premium literature, see Bellak (2004) and Barba Navaretti and Venables (2004). For Germany see for example Temouri, Driffield, and Añón Higón (2008), Mattes (2010) and Weche Gelübcke (2011a).

FDI and become foreign owners (Helpman, Melitz, and Yeaple, 2004).

Most studies in the field of performance differentials suffer from a selection bias. For example, if a certain number of foreign-owned firms enter the market not through greenfield investments but by the acquisition of established domestically owned firms, which reported an above-average performance even before the foreign takeover, a causal effect of foreign ownership on firm performance cannot be assumed, but rather vice versa.[3] A further issue is the general evaluation problem and refers to the fact that treatment analyses in non-experimental social sciences generally lack a proper control group. This is because it is impossible to observe the counterfactual situation, meaning the treated units if they had not been treated. To overcome these shortcomings and to achieve statements about the causal link between foreign ownership and firm performance, it has become popular to apply econometric methods from program evaluation to ownership changes of firms, if suitable panel data is available.

Surveying the literature on foreign acquisitions and *ex post* target performance reveals ambiguous results. It appears that foreign takeovers bear the potential to improve the productivity of a target firm through several channels. These can be, for example, a disciplining effect on an inefficient management or the realization of synergies and enhanced competitiveness through re-structuring and participation in the advantages of the new multinational owner (a summary can be found in Bellak, Pfaffermayr, and Wild, 2006).

Empirical evidence is provided for the UK, for example, by Conyon, Girma, Thompson, and Wright (2002), who find a labor productivity increase of 13 percent while average wages rise by 3.4 percent. Harris and Robinson (2002), instead, find total factor productivity slightly declining after foreign takeovers in the UK. Girma and Görg (2007a) show that productivity losses indeed appear in the short-run, but positive effects dominate 2 years after the takeover. Ilmakunnas and Maliranta (2004), Arnold and Javorcik (2009), and

[3] Recent evidence for Germany can be found, for example, in Andrews, Bellmann, Schank, and Upward (2009) and Weche Gelübcke (2012). The majority of international studies find that foreign investors select overperforming takeover targets, such as Hagemeyer and Tyrowicz (2012) for Poland, Harris and Robinson (2002) for the UK, Huttunen (2005) for Finland, Salis (2008) for Slovenia, and Oberhofer, Stöckl, and Winner (2012) for 16 European countries. Lichtenberg and Siegel (1987) and Chen and Su (1997) for the US, as well as Gioia and Thomson (2004) for Denmark, find a preference for underperforming targets. Castellani and Zanfei (2004) and Karpaty (2007) find no support for a selection of particularly over- or underperforming targets.

Karpaty (2005) support the productivity-improving impact of foreign ownership in Finland, Indonesia, and Sweden. However, the time dimension seems to play a crucial role: while foreign takeovers in Indonesia affect productivity measures even in the year of acquisition, a positive effect on Swedish targets appears with a lag of 3 years. Additionally, a distinction between horizontal and vertical acquisitions in Sweden reveals only the latter type to have a positive impact on productivity (Bandick, 2011). Other studies find no significant impact in any direction, such as Fabling and Sanderson (2011) for New Zealand, Salis (2008) for Slovenia, and Bellak et al. (2006) for Austria.

Employment and wage effects are other policy-relevant aspects of foreign takeovers that probably attract even more public interest. Job loss is a wide-spread fear associated with foreign takeovers because they could, due to their multinational character, shift activities and jobs abroad to realize efficiency benefits. A prominent example is the shutdown of Nokia in Bochum (Germany) (Nokia, 2008). Another case of employment dynamics is a change in the workforce composition in foreign-owned firms in the direction of a larger share of highly skilled employees, because foreign MNEs generally run more technology-intensive operations. Surprisingly, Huttunen (2005) states instead that numerous studies find no such effect at all or a decline in highly educated workers, just as she does. Another consequence of the same fact may be that the workforce is in fact cut in the name of technical efficiency. A general employment decline after foreign takeover is found, for example, by Conyon et al. (2002) in the UK and Chari, Chen, and Dominguez (2012) for emerging market acquisitions in the US. In contrast, Bellak et al. (2006) and Martins and Esteves (2008) find no significant employment reduction in Austria and Brazil, and Almeida (2007) and Fabling and Sanderson (2011) observe a post-acquisition employment increase in Portugal and New Zealand. By and large, it is difficult to evaluate whether in a particular case jobs are really destroyed or just subject to outsourcing or offshoring.

The foreign ownership pay premium has been subject to extensive empirical research and several arguments have been put forward as to why foreign MNEs might pay a higher price for the labor factor *ceteris paribus*. Foreign owners could have an increased interest in keeping firm-specific knowledge within the target, and preventing spillovers to competitors through worker turnover (e.g., Fosfuri, Motta and Rønde, 2001). According to the efficiency wage theory, foreign headquarters may need to compensate for higher monitoring costs due

to spatial distances and have a more pronounced incentive to prevent worker absences and resulting costs because of their capital intensive production (Eaton and White, 1982). It could also be the productivity advantage of foreign firms which leads to the distribution of a greater surplus among employees through the bargaining channel (Girma, Thompson, and Wright, 2002) or another way of compensating for the employers' lack of local labor market knowledge or the higher labor demand volatility and closure rates (further arguments can be found in Sjöholm and Lipsey, 2006 and Huttunen, 2005). Indeed, Fabling and Sanderson (2011), Almeida (2007) and Oberhofer, Stöckl, and Winner (2012) report post-acquisition wage increases. Csengődi and Urban (2007) and Huttunen (2005) find a gradual post-acquisition wage increase for Hungary and Finland which they trace back to on-the-job training (see also Görg, Strobl, and Walsh, 2007). Girma and Görg (2007b) do not find an overall wage increase in the UK, only for US targets and for low-skilled workers acquired by investors from non-EU countries. However, since most of the theoretical reasoning applies also to domestic firms, the foreign wage premium very often disappears if the data allows for a proper control of firm characteristics, such as the multinational status, as in Heyman, Sjöholm, and Tingvall (2007) for Sweden. No wage growth for Sweden is found by Bandick (2011) and further evidence of insignificant or very low wage effects is reported for Brazil and Portugal by Martins and Esteves (2008) and Almeida (2007).

The review of empirical evidence regarding post-acquisition performance paints an ambiguous and sometimes puzzling picture. What becomes obvious is the dependency on the specific country under consideration and presumably also the time period observed.[4] Accordingly, country-specific evidence seems indispensable. For the case of Germany, to the best of the author's knowledge, there exist only three studies dealing with foreign takeovers in a treatment analysis framework. The first is work by Andrews, Bellmann, Schank, and Upward (2009), who focus on wages and conclude with a small and sometimes insignificant effect. They use linked employer-employee data (LEED) from the German Institute for Employment Research (IAB) establishment panel and the employment statistics register of the German Federal Office of Labor, with information on plant ownership for the years 2000 and 2004. The second is by Mattes (2010) and uses a panel-dataset for the years 2000 to 2007, derived from the IAB establishment panel, with additional ownership information for

[4] Not to mention the applied econometric method, variables, and differences in data quality.

2007. The results indicate no significant effect of foreign plant takeovers either on labor productivity or on employment. Only a slight increase in export intensity can be observed. A third study by Arndt and Mattes (2010) extends the previous by focusing on TFP instead of labor productivity and using data from the Micro-database Direct Investment (MiDi) of the German Central Bank (*Deutsche Bundesbank*) and the Dafne database by the commercial data vendor Bureau van Dijk, for the period 1997 to 2003. However, the most important contribution is made by observing only foreign company takeovers which involve domestic multinationals. Thus, they are able to isolate the effect of foreignness *per se*, excluding multinationality as a determinant. In line with results by Mattes (2010), they find no employment effect but, contrary to Mattes (2010), a significant increase in productivity.

Summing up, the empirical evidence for Germany does not allow for stylized facts to be derived about the average impact of foreign acquisitions. Furthermore, a major aspect appears to be neglected in most international and all German studies: The takeover itself can imply extensive changes to the firm and thus affect performance measures (see above).[5] Consequently, an important question is whether the post-takeover effects exclusively apply to foreign acquisitions or if they also occur ex post domestic takeovers. Ignoring this aspect may cause severe policy failures. Therefore, this study explicitly takes the general performance impact of acquisitions into account by comparing foreign takeovers with domestic takeovers. Other comparative studies for manufacturing include Lehto and Böckerman (2008), who find both types of M&A leading to downsizing in Finland, but foreign takeovers to a greater extent; Bertrand and Zitouna (2008) report stronger efficiency gains for cross-border acquisitions in France in terms of productivity, although only for extra-EU transactions; Balsvik and Haller (2010) also identify an advantageous performance development, in terms of employment, wages, and labor productivity, explicitly following foreign acquisitions.

[5] For example, Conyon, Girma, Thompson, and Wright (2004) and McGuckin and Nguyen (1995) find profitability, wages, and productivity rising generally after acquisitions in the UK.

3 Empirical strategy

Non-experimental studies on the causal impact of a certain event at a given date basically have to overcome two major issues of endogeneity and the unobservability of the potential outcome. For the present case, this means that company acquisitions are not randomly assigned but rather depend on certain pre-acquisition target characteristics which may also affect the post-acquisition performance. Further, it is not feasible to measure the performance development of a takeover target if it had not been taken over, which is also known as the fundamental evaluation problem. To deal with these matters, an approach was chosen that combines propensity score matching procedures with a difference-in-difference estimator of the average treatment effect on the treated.[6] There is a set of alternative econometric approaches and an ongoing discussion on which is preferable, but all in all, if applied appropriately, results should not differ markedly.[7] The applied method is explained briefly in the following.[8]

In this study, the interest is in the performance impact of a takeover on the acquired firm. The takeover is a binary treatment which can occur ($ACQ_i = 1$) or not ($ACQ_i = 0$) and the individual treatment effect T for firm i can therefore be written as $T_i = Y_i(1) - Y_i(0)$. Since the focus is specifically on acquired firms, the parameter of interest is the average treatment on the treated (ATT):[9]

$$T_{ATT} \quad = \quad E[T|ACQ = 1] = E[Y(1)|ACQ = 1] - E[Y(0)|ACQ = 1] \tag{1}$$

The term $E[Y(0)|ACQ = 1]$ is the potential outcome for the acquired firm if it had not been acquired and is hence the unobservable counterfactual. It is now the aim of matching approaches to identify a proper control group of non-acquired firms that is comparable to the counterfactuals with respect to their pre-treatment characteristics. In order to eliminate a possible selection bias, the set of matching criteria X needs to cover all variables that affect

[6] Matching and estimations were performed by using the Stata ado-file *psmatch2* by Leuven and Sianesi (2003).

[7] For an overview and discussion, see e.g., Imbens and Wooldridge (2009), Angrist and Pischke (2009), and Blundell and Costa Dias (2000).

[8] For a more detailed description, see e.g., Caliendo and Kopeinig (2008) and Guo and Fraser (2010).

[9] The notation is based on Caliendo and Kopeinig (2008).

both the treatment probability and the outcome simultaneously. If the selection bias is appropriately considered, the assignment ACQ_i and the outcome Y_i are conditionally independent given X_i ($ACQ_i \perp\!\!\!\perp (Y_i(0), Y_i(1))|X_i$). This ideal case is referred to as the Conditional Independence Assumption (CIA), which is also known as unconfoundedness or selection on observables, and generally forms a prerequisite to achieve causal effects in a treatment analysis setting. Since the focus of this study is only on treated firms and the ATT, the CIA can be weakened to $ACQ_i \perp\!\!\!\perp Y_i(0)|X_i$ (Caliendo and Kopeinig, 2008). Apart from the CIA, two more assumptions need to be regarded when estimating the ATT. Firstly, the acquisition of a single firm should not be interacted with the outcome of other firms (stable-unit-treatment-value-assumption). Although this is possible hypothetically, for instance through ownership changes of price-setting companies with a significant market power, generally this is not assumed to be the case in reality. Secondly, the data needs to be sufficiently rich to provide enough non-treated observations with the same treatment probability as the treated cases based on X_i (also referred to as overlap or common support). The most critical part by far for practitioners is to reach an analytical setting free of confoundedness. This is especially true for the case of company acquisitions, as their determining factors tend to be complex and it is not possible to derive the exact covariates from a comprehensive theory or an established empirical model. A further issue is the limitation of most data sources to only a small set of relevant variables. Therefore, in practice, researchers control for the available X rather than actually claiming to consider all confounding factors. Notwithstanding the loss of accuracy, these analyses can produce important insights, although the isolated effects should rather be labeled with something like 'approximate causality'. Due to the fact that this applies to almost every work, focus should be even more on the results' robustness. The Rosenbaum bounds approach addresses precisely this issue and allows conclusions about the extent to which the ATT may be affected by unobserved covariates that are correlated with the treatment and the outcome variables (Rosenbaum, 2005). The results of this sensitivity analysis, as well as a more detailed presentation of the Rosenbaum bounds approach, can be found in Section 6.

Instead of matching the observations with respect to all their specific pre-treatment characteristics X_i, Rosenbaum and Rubin (1983) demonstrated that a sufficient matching quality can also be reached if the procedure relies only on the units' individual treatment probabil-

ity, the propensity score ($P_i(ACQ_i = 1|X_i)$). Accordingly, the relaxed CIA can be modified to $ACQ_i \perp\!\!\!\perp Y_i(0)|P_i(ACQ_i = 1|X_i)$. Each firm's propensity score is achieved through the estimations of a binary response model of the probit type, which assumes a takeover event to be correlated with productivity, and especially extraordinarily high or low levels of productivity. Therefore, productivity is introduced to the model as quintiles to capture general non-linearities.[10] Moreover, firm size, firm age, wages, turnover, and the export intensity (again in quintiles) are accounted for in the pre-acquisition period, since all can be assumed to affect the probability of experiencing a takeover and performance measures in the post-acquisition period. Finally, to cover general differences across industries and regions, indicator variables are added on a 2-digit industry-level and for the German administrative regions (*Bundesländer*) (for the exact definition of all variables see Section 4). All variables were measured before the treatment took place and can therefore be assumed not to be directly affected by the latter.[11] Results of the assignment model estimates are reported and discussed in Section 5.1. It needs to be stressed here that the assignment model does not primarily aim at adequately modeling the acquisition event; its objective is rather to create a basis for eliminating observed and unobserved differences between treated and non-treated firms in the matching procedure.

The aim of a matching procedure is now to identify non-acquired firms which show a takeover probability (propensity score) that is comparable with their truly acquired counterparts. There are several definitions of the assignment strategy whose selection may significantly affect the results.[12] The matching algorithms used and their specific parameters are summarized in Table 1. The choice was guided by two objectives; i) to present a sufficient variety for evaluating the results' sensitivity; and ii) to yield comparability particularly with other German studies. The algorithms chosen are nearest neighbor (NN) matching and ra-

[10] The reasoning behind this is the investors' preference for targets at either the upper or lower bound of the performance range, the so-called 'cherry-picking' and 'lemon-grabbing'. Evidence for these selection mechanisms is provided by Weche Gelübcke (2012) likewise for the German manufacturing sector, although with different data.

[11] Of course, it is highly possible that company acquisitions had been anticipated and therefore indirectly shaped the pre-acquisition performance. This has to be kept in mind generally when takeovers are analyzed in a treatment analysis framework.

[12] However, the methodological dependence regarding matching algorithms applies in particular to relatively small datasets and may therefore not be of crucial importance for the study at hand (Caliendo and Kopeinig, 2008 with reference to Heckman et al., 1997).

dius matching. The former assigns the k closest units to each treated unit with respect to their propensity score. Additionally, the maximum range at which the matched neighbors are allowed to be located (caliper) can be specified. Radius matching simply includes all observations in the given propensity score range (radius). Furthermore, all matches were forced to happen only in the same 2-digit industry to account for general heterogeneities. Standard errors are estimated via bootstrapping for radius matching and for NN matching, according to Abadie and Imbens (2008).

The overlap assumption is generally fulfilled and only radius matching omits some cases from the analysis due to a missing common support (as can be seen from Tables 8-11). The most important task of the matching application, however, is the reduction of observed differences between the treated and the control group. To test the success of this step, the standardized bias (SB) is reported according to Rosenbaum and Rubin (1985),[13] and the null hypothesis stating equal means is tested via t-tests *ex post* matching (results are reported in Section 5.2).

[Table 1 about here]

For this analysis, the matching approach was combined with a modified ATT estimator according to a difference-in-difference (DiD) approach. Instead of estimating the ATT based on performance levels, as defined in (1), the differences between the takeover period ($T = 0$) and the post-takeover period ($T = 1$) are in focus (see (2)). Two more important sources of bias can thus be accounted for; firstly, other permanent differences between firms, and secondly, general time trends affecting both the treated and the untreated units, such as cyclical fluctuations. If finally the propensity score is considered, the ATT_{DiD} can be written as in (3).

$$\begin{aligned} ATT_{DiD} = \quad & [E(Y|ACQ = 1, T = 1) - E(Y|ACQ = 1, T = 0)] \\ - \quad & [E(Y|ACQ = 0, T = 1) - E(Y|ACQ = 0, T = 0)] \end{aligned} \tag{2}$$

[13] Definition of SB (Caliendo and Kopeinig, 2008 with reference to Rosenbaum and Rubin, 1985):

$$SB \quad = \quad 100 \cdot \frac{\bar{X}_1 - \bar{X}_0}{\sqrt{0.5 \cdot (V_1(X) + V_0(X))}}$$

.

$$
\begin{aligned}
ATT_{DiD} = \quad & [E(Y|ACQ=1,T=1,P(ACQ=1|X)) \\
- \quad & E(Y|ACQ=1,T=0,P(ACQ=1|X))] \\
- \quad & [E(Y|ACQ=0,T=1,P(ACQ=1|X)) \\
- \quad & E(Y|ACQ=0,T=0,P(ACQ=1|X))]
\end{aligned} \tag{3}
$$

4 Data and identification of ownership changes

The database used mainly involves two data sources. The first source is the monthly and annual reports of establishments from the manufacturing, mining, and quarrying sectors administered by the German statistical offices. Information is aggregated at enterprise level and available in the form of annual results for all German firms which employ at least 20 persons and operate in corresponding industries (for more information see Konold, 2007). This data is of particularly high quality because firms in Germany are legally required to report to these surveys. Most of the variables used are calculated from this data source, for example, productivity, firm size, average wages, export intensity, and market shares (see Table 2 for definitions).

A second source of information is the Enterprise Group Database created by the German Federal Statistical Office to comply with EU regulation (EC) 716/2007. European Union legislation, since 2007, demands comparable statistics on foreign-controlled enterprises in each member state (e.g., Vergina and Grell, 2009). A foreign-controlled enterprise[14] is thereby defined as an enterprise of which more than 50 percent is owned by a legal or natural person situated abroad. Capital shares are considered as well as voting rights and other forms of control, such as indirect or effective minority control (Eurostat, 2009).[15] To be able to provide Foreign Affiliates Statistics (FATS) for Germany, the institutions in charge had to purchase information on ownership structures from the commercial data vendor Bureau van Dijk and integrate this into the national business register (*Unternehmensregister*). Therefore,

[14] The terms *foreign-controlled*, *foreign-owned*, and *foreign* are used interchangeably in this text.

[15] Indirect control refers to the fact that enterprise A is controlled by enterprise B and both are domestic companies but enterprise B is, in turn, controlled from an entity abroad. Then, enterprise A will also be foreign-controlled. Effective minority control is stated when several minority owners with shares of more than 50 percent in sum act in concert.

industry- and topic-specific surveys have recently become available for analyses related to foreign ownership (for a detailed description of this new database, see Weche Gelübcke, 2011b). The data for this study was merged within the AFiD-Project (Official Firm Data for Germany) for the available years 2007 to 2009, and analyzed via remote access due to the confidentiality of micro-data (on the AFiD-Project, see Malchin and Voshage, 2009). [16] For this analysis, observations were restricted to enterprises from the manufacturing sector in accordance with the NACE classification.

The identification of acquisitions is based on information from the Enterprise Group Database. Accordingly, a foreign takeover was identified when an enterprise was labeled as foreign-owned in t but was under domestic control in $t-1$. Domestic takeovers are units which had a domestic group head in t but were independent, foreign-owned or group heads themselves in $t-1$. Thus, in contrast to previous studies based on the IAB establishment panel, the exact event period can be identified. Due to the three-period panel structure, takeovers are detected only in the first year to keep at least two post-acquisition periods for each takeover. Because of the newness of the Enterprise Group Database, a change in ownership may be merely due to a new capital link identification (Monopolkommission, 2010). To take this into account, all subsequent analyses were performed only for takeovers which explicitly exclude false ownership changes. This becomes feasible due to the fact that in the Enterprise Group Database an enterprise does not become labeled a group head, affiliate or foreign-controlled affiliate unless a certain control link is identified. Non-labeled enterprises are assumed to be independent units. Consequently, all enterprises which became an affiliate in t but were non-labeled firms in $t-1$ have to be excluded to avoid the identification of false ownership changes.[17] Without controlling for identification failures, there are 255 foreign and 894 domestic takeovers in the data. When all possible identification errors are excluded, there

[16] All computations were programmed in Stata 12 and carried out within the Research Data Center of the statistical office Berlin-Brandenburg.

[17] The exclusion of potentially false ownership changes probably puts more weight on larger takeover targets, as the predominant part of identified ownership changes includes domestically owned firms that already belonged to a company network and are thus larger on average. On the one hand, this implies a bias in favor of larger acquisitions; on the other hand, this is a welcome bias in the sense that it reduces the impact of network effects. To be more precise, if an independent firm is taken over by a group head or multinational, changes in post-takeover performance may be due to the new participation in network effects. If the focus is on targets that enjoyed network effects even before the acquisition, this is a welcome step in the direction of comparing like with like.

are still 133 foreign and 155 domestic takeovers. Furthermore, firms with another ownership change within two years after their acquisition in 2007 were dropped from the analysis. Descriptive statistics for takeover targets and a control group of domestically owned firms, which never experienced an ownership change throughout the entire panel, are reported in Table 3.

[Table 2 about here]

5 Results

5.1 The selection of takeover targets

Foreign investors select their acquisition targets in Germany according to certain criteria and not by chance. Therefore, foreign takeover targets differ markedly from their non-acquired counterparts even before their ownership change. In 2007, foreign buyers chose German manufacturing firms that were on average larger by 234 persons (170%), paid more than 10,000 EUR higher annual wages (35%) and achieved a labor productivity which was 78,000 EUR higher (49%), compared to non-acquired German firms. In addition, they were more often and more intensively engaged in export activities (Table 3). These differences in means are statistically highly significant as the p-values from t-tests show in Table 4. Moreover, the differences appear to be prevalent along the entire distribution, as the Kolmogorov-Smirnov test statistics suggest (Table 4).[18] However, this performance superiority does not exclusively apply to firms taken over by foreign investors, since the same pattern can be seen for firms taken over by German owners. The German takeover targets even reported an average labor productivity which is 41 percent higher than for foreign takeover targets, although on weak significance levels. Only export intensity seems clearly higher for cross-border acquisition targets by 42 percent. A possible explanation for why cross-border targets are more integrated into global trade may be their greater visibility to potential buyers on foreign markets.

[18] Given two independent random samples, the non-parametric Kolmogorov-Smirnov test evaluates whether all moments of the two cumulative distribution functions of a performance measure in a case, $F_1(x)$ and $F_2(x)$, are statistically different from each other and whether one distribution dominates the other (for more details, see Conover, 1999).

A naive comparison of foreign-owned firms with their domestically owned counterparts consequently suffers a positive selection bias in favor of the former. As a certain number of foreign firms in Germany reported advantageous performance measures even before they became foreign-owned, their performance premium should thus not be attributed to their foreignness *per se*. The obvious conclusion is that foreign investors 'cherry-pick' target firms, but this must not be taken to imply that indigenous investors do not do exactly the same. The selection mechanism should therefore be assigned to company acquisitions in general.[19]

[Table 3 about here]

[Table 4 about here]

Table 5 shows results from assignment model estimations. As already mentioned in Section 3, the covariates' primary focus is not to explain the takeover event as exactly as possible, but to capture differences in firm characteristics. However, firm size, wages, and export intensity exhibit statistically significant positive correlations with foreign acquisitions. The signs of the productivity variables support the '*cherry-picking*' hypothesis, although the coefficients are statistically insignificant, which may be due to multi-collinearity with other covariates such as export intensity. Domestic takeover probability estimations again offer a similar picture with a significant coefficient of the upper productivity quintile but a less important role of export behavior.

[Table 5 about here]

6 The average impact on post-acquisition performance

In order to estimate the ATT, first of all, the matching quality needs to be evaluated. The matching success depends on how well the observable characteristics X are balanced across the treated and non-treated samples, and can thereby reduce the factors influencing the treatment probability and the outcome simultaneously. Differences between the foreign

[19] However, it remains unclear whether investors solely prefer above-average performing targets. Weche Gelübcke (2012) presents evidence for the German manufacturing sector, although using other data, whereby investors select both above- and below-average performing targets. Further it seems to be the inverse combination of rentability and profitability that raises the takeover probability rather than individual measures.

takeover targets and the control group are enormous, as demonstrated in the previous section. This can also be seen from the first row in Table 6, which gives the standardized bias (SB) for the unmatched sample. Even though there is no exact definition of when the bias is sufficiently reduced, in practice, a threshold of 3 to 5 percent is regarded as adequate (Caliendo and Kopeinig, 2008). In Table 6, most matching approaches reduce the bias to an acceptable level. Only 1-NN appears to be less successful. However, all algorithms were able to reduce the SB drastically, and exceptionally all t-values point to the fact that there are no statistically significant differences in means left after matching. For the case of domestic acquisitions, the overall picture also looks acceptable, although there remains a relatively high bias regarding productivity in most specifications (Table 7). However, again, all t-tests suggest rejecting hypotheses of significant differences in means.

[Table 6 about here]

[Table 7 about here]

The ATT was estimated in changes after takeover. The considered time period covers two post-acquisition years following the treatment year 2007.[20] Table 8 shows that average productivity went down during this period in all groups, which is not surprising since enterprises had to face severe economic slumps, especially in 2009.[21] The ATT for firms acquired by foreign investors, on the contrary, is slightly positive in most specifications. The effect of a foreign takeover on the productivity of the target firm amounts to -400 to 8,000 EUR (-0.17 to 3.23%), depending on the matching approach. This is not much, and moreover, significance levels are very low with t/z-values of less than 0.6. A different picture emerges from estimations for domestic takeovers, where the ATT is between 15,000 and 35,000 EUR (4.45 to 10.57%) with t/z-values of up to 2.84. Domestic takeover targets, therefore, appear to have developed much better than foreign targets in terms of productivity.

[20] Performance effects resulting from ownership changes may take some time before they can be recognized in the data, as shown in the literature review. This argues for the consideration of long-term changes. On the other hand, the determining factors of long-term performance changes may become much harder to handle in a treatment analysis setting. Thus, two-year changes seem to be appropriate. Anyway, the data at hand does not allow for consideration of a longer period.

[21] These numbers are not inflation-adjusted since the focus is on differences between the treated and untreated groups where the inflation bias is removed.

The average employment in takeover targets clearly decreased, regardless of the acquirer. And also the ATT of both foreign and domestic acquisitions is negative in every specification (Table 9). However, while the ATT for domestic takeovers is between 10 and 19 (3.12 to 5.93%) employees, foreign acquisitions reduced their workforce by between 18 and 39 persons. This is up to 10 percent in relation to mean employment in the takeover period. Significance levels seem sufficient in most of the specifications.

Results for average wages and export intensities are reported in Tables 10 and 11. Foreign takeovers induced an average wage increase of more than 10 percent (4,000 to 5,000 EUR) while employees in domestic takeover targets experienced just between -0.32 and 1.38 percent (-120 to 520 EUR). The ATTs for export intensities point to a slight decrease after foreign acquisition (exceptions are the 1-NN and $r_{0.002}$ specification) and a slight increase following domestic acquisition. However, both wages and export behavior are statistically insignificant at fairly low levels in almost all specifications.

[Table 8 about here]

[Table 9 about here]

[Table 10 about here]

[Table 11 about here]

With respect to the variation of matching specifications, the ATT estimates seem to be quite robust as the effects' direction is straightforward in most cases. Even the magnitude offers a relatively uniform picture which at least allows assessment of whether effects are of an economically relevant extent or not. Significance levels are much more subject to methodological variation and depend highly on the matching algorithm. An advantage of this study with regard to statistical inference is that the database covers all enterprises from the German manufacturing sector with more than 20 employees, which makes the results a strong statement, even without statistical inference. Nevertheless, the focus of this study relies on productivity and employment effects and considers conventional levels of statistical significance.

7 Sensitivity to violations of the CIA

Foreign acquisitions were, on average, followed by a decrease in employment but no significant labor productivity improvements. This finding does not seem to apply equally to domestic acquisitions. Firms acquired by domestic investors indeed also experienced a downsizing, but this was only about half the size of that in foreign takeover targets. Simultaneously, and in contrast to their foreign counterparts, labor productivity rose drastically in domestic takeover targets. These results are unequivocal. What remains unclear is whether the estimated ATTs are affected by unobserved factors which had influence on both the treatment probability and the post-treatment outcome. In other words, it is not certain that there are no violations of the CIA or unconfoundedness assumption. Since selection biases are seen as 'the most challenging analytic problem in observational studies' (Guo and Fraser, 2010: 319), a set of robustness tests are available from which the Rosenbaum bound approach was chosen for this study (for a more detailed description, see e.g., Rosenbaum, 2005 and Guo and Fraser, 2010).

The basic idea of the Rosenbaum bound approach is to identify the extent to which unobserved confounding variables would have to bias the results to jeopardize their robustness. For that purpose, a Γ-measure gives the degree to which a scenario departs from the ideal case of no additional confoundedness. A study free of the so-called hidden bias would have a Γ of 1.0, indicating an equal probability of observations to select into the treated or non-treated group (given X). As Γ rises, the odds ratio and therefore the presumed selection bias also increases. The Rosenbaum bounds now give significance levels for whether or not to reject the hypothesis stating that the ATT may result completely from hidden bias for each Γ-scenario.[22] Thus, the higher the Γ can be expected to be without violating the robustness of the ATT, the less sensitive to hidden bias the results can be expected to be.

Table 12 reports the significance levels for various Γ scenarios for all 1-NN matching specifications.[23] If the focus is only on effects which appeared to enjoy sufficient statistical significance in most specifications, the employment effects of foreign takeovers can be seen as robust to confounding factors up to a level of $\Gamma = 1.6$. The negative employment effects

[22] The ado-file *rbounds* by Gangl (2007) was used for the application in Stata.

[23] Unfortunately *rbounds* only works for pair matching specifications, but as all matching approaches give similar results in this study, it seems feasible to test the 1-NN estimations representatively.

of domestic takeovers seem less robust ($\Gamma = 1.5$) and the positive productivity effects do not seem to be robust at all.[24] Therefore, the estimated ATTs, particularly those regarding employment, are sensitive to unobserved variables which create a hidden selection bias and unfortunately the data does not allow additional variables to be taken into account. Nevertheless, the estimated effects are prevalent and of a too high magnitude to ignore them. However, the consequence from sensitivity analysis is that these effects must not be declared causal as there are most likely additional unconsidered confounding factors.

[Table 12 about here]

8 Summary and Conclusions

This study provides the first comparative evidence on the post-acquisition performance of German target firms acquired by foreign and domestic investors in order to eliminate a general takeover effect. For that purpose, a propensity score matching analysis with difference-in-difference estimates of average treatment effects on the treated (ATT) was applied for both groups separately. The panel database used covers all enterprises in German manufacturing with at least 20 employees and the time period 2007 to 2009. The main results point to an average employment decrease and no productivity improvements following a foreign acquisition. Firms acquired by German investors indeed also experienced a downsizing, but of about half the size of that in foreign takeover targets. Simultaneously, and in contrast to their foreign counterparts, productivity rose drastically in domestic takeover targets. These results contradict existing empirical studies on foreign takeovers in Germany, which find significant productivity improvements and no changes in terms of employment. Admittedly, the studies are not perfectly comparable as the productivity measures, the observed time periods, the observation units, as well as the estimated assignment models, for example, differ.

[24] Indeed, there is no exact definition of how large the Γ value needs to be for assuming a sufficiently robust ATT. For example, Robins (2002) notes that, 'although logically flawless and mathematically elegant, [Rosenbaum's approach] may be scientifically useless. The problem is as follows. Rosenbaum's sensitivity analysis model will only be useful if experts can provide a plausible and logically coherent range for the value of the sensitivity parameter [Γ] (ibid.: 309f.). This is even more difficult since Robins finds that Rosenbaum's analysis can produce paradoxical results in certain circumstances.

Nevertheless, an employment reduction in the name of efficiency improvements and an increasing competitiveness following takeovers seems highly plausible and appears to work fine for domestic acquisitions. Foreign acquirers instead appear not to be successful in that respect, which could be a consequence of some liability of foreignness. However, the individual motivations and objectives of each takeover are not known and may be extremely heterogeneous. What seems unequivocal is that there need to be differences between foreign and domestic takeovers apart from the controlled X and the sole factor of origin *per se*. For example, it may be the case that foreign investors are more likely to be motivated by specific asset-seeking strategies. For example, they may be more likely to be interested in acquiring managerial expertise or technology and technological know-how while not having a focus on German markets or the production therein. These differences demand more future research to reach conclusive answers beyond pure conjectures, but statements that claim no significant average impacts of foreign acquisitions on employment should at least be treated with caution.[25]

Conclusions regarding a general foreign performance premium should be drawn carefully from this study, as very specific cases were in focus. However, it was not found that becoming foreign-owned raises productivity or firm size, nor export intensities significantly. Only wages - although not statistically significant rose markedly (possible explanations for this can be found in Section 2). This evidence suggests a considerable selection bias in simple comparisons of foreign and domestically owned companies in the German manufacturing industries.

However, although this study accounts for many sources of bias, limitations are still present. A major concern is the time period considered. General effects of the 2008 global financial and economic crisis are eliminated through the difference-in-difference estimator as they affect treatment and control groups likewise. In spite of that, firms that had been acquired by foreigners may have reacted to the crisis differently from their domestically owned counterparts. Therefore, the results may, to a certain extent, mirror the different labor demand elasticities of foreign-owned firms. Another shortcoming is the consideration

[25] For example, published in the Weekly Report of the German Institute for Economic Research (DIW) (2010). Moreover, the estimated employment effects in Arndt and Mattes (2010) are also negative in all nearest neighbor specifications but insignificant in terms of bootstrapped standard errors.

of only two post-acquisition years, which excludes the observation of long-run impacts, as found, for example, by Karpaty (2007) and Harris and Robinson (2002) (see Section 2). One more concern needs to be addressed, which is inherent in almost all empirical studies investigating acquisitions in a treatment analysis framework and which is difficult to control. It is not possible to take all confounding factors into account and, therefore, the selection-on-unobservables hypothesis could not be rejected. Consequently, ATT estimates in this context should rather be interpreted as 'approximately causal', which makes them no less important.

Finally, the results of this study show clearly that empirical research on the impact of foreign acquisitions in Germany has by no means yet reached stylized facts. This impairs informed policy decisions and a fact-based public debate about the direct consequences of economic globalization processes and thus future research is required to remedy this situation.

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Table 1: Matching algorithms

***k*-nearest neighbor matching**							
k	1	3	3	5	5	10	10
caliper	-	0.02	0.05	0.02	0.05	0.02	0.05
perfect match on industry	yes	yes	yes	yes	yes	yes	yes
radius matching							
radius					0.001	0.002	0.003
perfect match on industry					yes	yes	yes

Notes: The 1-NN specifications are without replacement, all other are performed with replacement.

Table 2: Definition of covariates

Labor productivity	Annual turnover per employee in 1,000 EUR
Firm size	Annual mean over employed persons at the end of each month
Average wages	Annual gross wage payments excluding employer contributions to social insurance per employee in 1,000 EUR
Export intensity	Share of turnover generated abroad. Include sales to trade companies but no sales to processing and exporting companies (indirect exports)
Exporter status	Indicator variable = 1 if export intensity > 0, 0 otherwise
Firm age	Indicator variable = 1 if firms was established before 1996, 0 otherwise
Turnover	Annual turnover in 1,000 EUR

Notes: All variables were calculated from the monthly and annual reports of establishments from the manufacturing, mining, and quarrying sectors.

Table 3: Means of performance in the pre-takeover period

	Foreign takeovers	*Domestic takeovers*	*Domestic control group*
	N = 133	*N = 155*	*N = 28,266*
Labor productivity (1000 EUR)	238.41 (165.21)	335.24 (650.13)	160.29 (216.66)
Employees	371.52 (655.03)	320.20 (641.64)	137.49 (1290.77)
Wage per capita (1000 EUR)	39.21 (11.09)	37.68 (11.31)	28.98 (10.69)
Export intensity (% of turnover)	41.54 (29.15)	29.19 (28.02)	18.11 (23.35)
Exporter status (% of N)	92.48	81.94	70.44

Notes: Reported are mean values with standard deviation in brackets; Ownership changes which may be due to a new identification within the Enterprise Group Database are excluded (see Section 2 for details).

Table 4: T-test and Kolmogorov-Smirnov test statistics for pre-acquisition (p-values)

		H_0	*foreign targets vs. domestic non-targets*	*domestic targets vs. domestic non-targets*	*foreign vs. domestic targets*
Labor productivity	t-test	equal means	0.0000	0.0010	0.0755
	K-S test	equal distr.	0.000	0.000	0.730
		first group <	0.988	1.000	0.639
		first group >	0.000	0.000	0.979
Employees	t-test	equal means	0.0001	0.0006	0.5040
	K-S test	equal distr.	0.000	0.000	0.093
		first group <	1.000	0.999	0.958
		first group >	0.000	0.000	0.187
Wages per capita	t-test	equal means	0.0000	0.0000	0.2470
	K-S test	equal distr.	0.000	0.000	0.325
		first group <	1.000	1.000	0.982
		first group >	0.000	0.000	0.628
Exports intensive margin	t-test	equal means	0.0000	0.0000	0.0003
	K-S test	equal distr.	0.000	0.000	0.000
		first group <	1.000	1.000	0.998
		first group >	0.000	0.000	0.000

Table 5: Assignment model estimates (probit)

	Foreign takeovers		**Domestic takeovers**	
covariate	*coefficient*	$\|z\text{-values}\|$	*coefficient*	$\|z\text{-values}\|$
Productivity_q1	-0.22	1.37	-0.19	1.38
Productivity_q2	-0.19	1.52	-0.05	0.47
Productivity_q4	0.01	0.11	0.07	0.73
Productivity_q5	0.15	1.35	0.20	2.04
Size	0.0009	3.41	0.0005	2.47
Size^2	-1.36e-07	2.69	-8.47e-08	2.22
Wages	0.02	4.62	0.02	5.10
Export intensity_q1	-0.31	2.35	-0.02	0.22
Export intensity_q2	-0.12	0.82	-0.21	0.17
Export intensity_q4	-0.03	0.26	0.13	1.41
Export intensity_q5	0.23	2.35	0.03	0.32
Turnover	-5.66e-07	0.53	1.05e-07	0.21
Turnover^2	-1.57e-13	0.21	-6.79e-14	0.41
Firm age (dummy)	-0.05	0.65	-0.04	0.62
Industry dummies	yes	yes	yes	yes
Region dummies	yes	yes	yes	yes
Observations	27,674		28,376	
McFadden's R^2	0.151		0.099	

Table 6: Matching quality (foreign acquisitions)

		productivity	*size*	*wages*	*exporter status*	*export intensity*	*turnover*	*firm age*
bias unmatched		41.3	24.1	94.9	65.4	89.6	18.4	4.4
1-NN	bias matched	-15.7	5.5	-5.5	-7.9	-4.8	0.8	9.0
	bias reduction	62.0	77.1	94.2	87.9	94.6	95.4	-104.2
	|t-value|	1.17	0.75	0.40	1.03	0.36	0.13	0.73
3-$NN_{0.02}$	bias matched	-3.1	1.8	4.7	-7.3	3.1	0.9	5.0
	bias reduction	92.6	92.5	95.1	88.9	96.6	95.2	-13.5
	|t-value|	0.27	0.23	0.36	0.93	0.23	0.14	0.41
3-$NN_{0.05}$	bias matched	-3.1	1.8	4.7	-7.3	3.1	0.9	5.0
	bias reduction	92.6	92.5	88.9	96.6	95.2	-13.5	
	|t-value|	0.27	0.23	0.36	0.93	0.23	0.14	0.41
5-$NN_{0.02}$	bias matched	-4.1	2.6	3.1	-6.3	5.7	2.3	3.4
	bias reduction	90.0	89.1	96.7	90.3	93.7	87.7	24.0
	|t-value|	0.34	0.35	0.25	0.80	0.43	0.37	0.27
5-$NN_{0.05}$	bias matched	-4.6	3.2	2.4	-6.3	5.8	2.7	3.0
	bias reduction	88.9	86.6	97.5	90.3	93.5	85.1	31.9
	|t-value|	0.37	0.43	0.19	0.80	0.44	0.45	0.24
10-$NN_{0.02}$	bias matched	-4.0	4.9	-0.7	-6.1	7.3	3.7	-0.7
	bias reduction	90.4	79.5	99.2	90.6	91.8	80.1	84.1
	|t-value|	0.33	0.67	0.06	0.78	0.55	0.61	0.06
10-$NN_{0.05}$	bias matched	-4.6	5.4	-1.3	-5.9	7.4	3.9	-1.1
	bias reduction	88.9	77.5	98.7	90.9	91.7	78.7	75.2
	|t-value|	0.38	0.75	0.10	0.75	0.56	0.65	0.09
$Radius_{0.001}$	bias matched	-1.6	-0.9	1.2	-2.1	5.5	-0.2	6.9
	bias reduction	96.1	96.5	98.8	96.8	93.9	99.1	-55.0
	|t-value|	0.13	0.15	0.09	0.24	0.40	0.03	0.54
$Radius_{0.002}$	bias matched	-4.4	4.3	0.1	0.4	6.3	1.8	4.5
	bias reduction	89.2	82.2	99.9	99.4	92.9	90.2	-1.9
	|t-value|	0.37	0.42	0.01	0.05	0.46	0.18	0.37
$Radius_{0.003}$	bias matched	-3.8	5.2	2.5	1.5	7.8	2.7	6.0
	bias reduction	90.8	78.3	97.4	97.7	91.3	85.3	-35.8
	|t-value|	0.31	0.53	0.18	0.17	0.58	0.28	0.49

Notes: The standardized bias and its reduction are given in percentages and is calculated according to Rosenbaum and Rubin (1985) as explained in Section 3; The t-tests refer to the null hypothesis stating equality of mean values in the treated group and the matched control group.

Table 7: Matching quality (domestic acquisitions)

		productivity	*size*	*wages*	*exporter status*	*export intensity*	*turnover*	*firm age*
bias unmatched		36.3	17.9	79.2	33.0	43.0	15.4	4.5
1-NN	bias matched	1.2	1.7	7.0	-12.0	5.0	1.5	-1.3
	bias reduction	96.7	90.7	91.2	63.5	88.3	90.3	71.4
	|t-value|	0.07	0.24	0.60	1.26	0.43	0.25	0.11
3-$NN_{0.02}$	bias matched	5.8	2.6	5.4	-4.5	-1.6	3.0	-3.4
	bias reduction	84.1	85.6	93.2	86.3	96.3	80.3	23.7
	|t-value|	0.36	0.38	0.46	0.45	0.13	0.52	0.30
3-$NN_{0.05}$	bias matched	5.8	2.6	5.4	-4.5	-1.6	3.0	-3.4
	bias reduction	84.1	85.6	93.2	86.3	96.3	80.3	23.7
	|t-value|	0.36	0.38	0.46	0.45	0.13	0.52	0.30
5-$NN_{0.02}$	bias matched	9.1	3.0	5.0	-3.9	-0.8	3.2	-4.0
	bias reduction	74.8	83.1	93.7	88.2	98.0	79.4	10.3
	|t-value|	0.61	0.44	0.42	0.39	0.07	0.54	0.36
5-$NN_{0.05}$	bias matched	10.6	3.0	5.5	-3.9	-0.9	3.1	-4.4
	bias reduction	70.8	83.3	93.1	88.2	98.0	79.6	2.7
	|t-value|	0.73	0.44	0.47	0.39	0.07	0.53	0.39
10-$NN_{0.02}$	bias matched	9.7	1.7	4.0	-3.3	0.1	1.5	-4.8
	bias reduction	73.2	90.4	94.9	90.0	99.7	89.9	-7.4
	|t-value|	0.67	0.25	0.35	0.33	0.01	0.25	0.43
10-$NN_{0.05}$	bias matched	13.2	2.1	4.7	-3.3	0.3	2.0	-5.6
	bias reduction	63.6	88.3	94.0	90.0	99.2	86.8	-23.1
	|t-value|	1.02	0.30	0.41	0.33	0.03	0.33	0.49
$Radius_{0.001}$	bias matched	14.4	1.5	3.2	-3.1	4.2	2.6	-1.6
	bias reduction	60.3	91.8	95.9	90.7	90.2	83.0	64.1
	|t-value|	1.25	0.22	0.28	0.30	0.35	0.47	0.14
$Radius_{0.002}$	bias matched	14.0	-0.2	7.0	-4.5	4.4	0.8	-1.5
	bias reduction	61.4	99.1	91.2	86.5	89.7	94.8	67.5
	|t-value|	1.22	0.02	0.61	0.44	0.37	0.14	0.13
$Radius_{0.003}$	bias matched	15.4	-0.6	11.0	-2.8	5.9	-0.1	-0.5
	bias reduction	57.7	96.6	86.1	91.4	86.2	99.7	89.4
	|t-value|	1.34	0.09	0.96	0.27	0.49	0.01	0.04

Notes: The standardized bias and its reduction are given in percentages and is calculated according to Rosenbaum and Rubin (1985) as explained in Section 3; The t-tests refer to the null hypothesis stating equality of mean values in the treated group and the matched control group.

Table 8: ATT estimates of Δ productivity (1,000 EUR)

	treated	*controls*	*difference*	*std.err.*	*|t/z-value|*
foreign takeovers					
unmatched sample	-36.54	-17.71	-18.84	8.83	2.13
1-NN	-36.54	-44.23	7.71	16.16	0.48
3-$NN_{0.02}$	-36.54	-36.13	-0.41	13.60	0.03
3-$NN_{0.05}$	-36.54	-36.13	-0.41	13.11	0.03
5-$NN_{0.02}$	-36.54	-40.89	4.36	13.45	0.32
5-$NN_{0.05}$	-36.54	-41.94	5.41	12.76	0.42
10-$NN_{0.02}$	-36.54	-37.96	1.42	13.59	0.10
10-$NN_{0.05}$	-36.54	-38.69	2.15	12.77	0.17
$Radius_{0.001}$	-39.35	-39.38	0.03	11.56	0.00
$Radius_{0.002}$	-36.76	-44.09	7.33	12.83	0.57
$Radius_{0.003}$	-36.54	-40.84	4.31	12.24	0.35
domestic takeovers					
unmatched sample	-17.48	-17.49	0.02	8.15	0.00
1-NN	-17.48	-52.90	35.42	12.47	2.84
3-$NN_{0.02}$	-17.48	-32.40	14.93	13.03	1.15
3-$NN_{0.05}$	-17.48	-32.40	14.93	12.15	1.23
5-$NN_{0.02}$	-17.48	-36.99	19.51	11.70	1.67
5-$NN_{0.05}$	-17.48	-36.43	18.96	10.36	1.83
10-$NN_{0.02}$	-17.48	-36.71	19.24	11.64	1.65
10-$NN_{0.05}$	-17.48	-34.75	17.28	10.09	1.71
$Radius_{0.001}$	-15.11	-32.66	17.55	9.77	1.80
$Radius_{0.002}$	-15.47	-31.19	15.72	9.01	1.74
$Radius_{0.003}$	-15.47	-32.85	17.39	8.48	2.05

Notes: Analytical standard errors are calculated according to Abadie and Imbens (2008) for nearest neighbor matching and via bootstrapping with 200 replications for all estimations using the radius approach; For the ATT with radius matching, treated observations off support were dropped from estimations for foreign acquisitions (7 with radius 0.001, and below 3 with radius 0.002) and domestic acquisitions (5 with radius 0.001, 3 with radius 0.002, and 3 with radius 0.003).

Table 9: ATT estimates of Δ employment

	treated	*controls*	*difference*	*std.err.*	$\lvert t/z\text{-value}\rvert$
foreign takeovers					
unmatched sample	-33.19	-1.51	-31.68	8.04	3.94
1-NN	-33.19	5.85	-39.04	13.76	2.84
3-$NN_{0.02}$	-33.19	-1.96	-31.23	15.50	2.01
3-$NN_{0.05}$	-33.19	-1.96	-31.23	12.59	2.48
5-$NN_{0.02}$	-33.19	-0.46	-32.73	16.12	2.03
5-$NN_{0.05}$	-33.19	-0.98	-32.21	13.23	2.43
10-$NN_{0.02}$	-33.19	0.04	-33.23	16.72	1.99
10-$NN_{0.05}$	-33.19	-1.49	-31.70	13.62	2.33
$Radius_{0.001}$	-18.54	-0.14	-18.41	8.57	2.15
$Radius_{0.002}$	-34.12	2.01	-36.13	15.92	2.27
$Radius_{0.003}$	-33.19	1.93	-35.12	15.42	2.28
domestic takeovers					
unmatched sample	-14.51	-1.58	-12.93	7.77	1.67
1-NN	-14.51	4.51	-19.02	6.99	2.72
3-$NN_{0.02}$	-14.51	-0.41	-14.11	6.68	2.11
3-$NN_{0.05}$	-14.51	-0.41	-14.11	6.44	2.19
5-$NN_{0.02}$	-14.51	2.96	-17.48	6.84	2.56
5-$NN_{0.05}$	-14.51	2.64	-17.15	6.65	2.58
10-$NN_{0.02}$	-14.51	-1.26	-13.25	6.55	2.02
10-$NN_{0.05}$	-14.51	-0.48	-14.04	6.22	2.26
$Radius_{0.001}$	-12.67	-2.68	-10.00	5.38	1.86
$Radius_{0.002}$	-12.75	-0.48	-12.27	5.26	2.33
$Radius_{0.003}$	-12.75	-0.06	-12.69	5.39	2.36

*Notes:*Analytical standard errors are calculated according to Abadie and Imbens (2008) for nearest neighbor matching and via bootstrapping with 200 replications for all estimations using the radius approach; For the ATT with radius matching, treated observations off support were dropped from estimations for foreign acquisitions (7 with radius 0.001, and below 3 with radius 0.002) and domestic acquisitions (5 with radius 0.001, 3 with radius 0.002, and 3 with radius 0.003).

Table 10: ATT estimates of Δ average wages (1,000 EUR)

	treated	*controls*	*difference*	*std.err.*	*|t/z-value|*
foreign takeovers					
unmatched sample	2.85	-0.31	3.16	0.90	3.53
1-NN	2.85	-1.60	4.45	4.25	1.05
3-$NN_{0.02}$	2.85	-1.29	4.14	4.10	1.01
3-$NN_{0.05}$	2.85	-1.29	4.14	4.09	1.01
5-$NN_{0.02}$	2.85	-1.35	4.21	4.18	1.01
5-$NN_{0.05}$	2.85	-1.37	4.22	4.17	1.01
10-$NN_{0.02}$	2.85	-1.38	4.23	4.00	1.06
10-$NN_{0.05}$	2.85	-1.39	4.24	3.99	1.06
$Radius_{0.001}$	3.06	-1.47	4.53	4.83	0.94
$Radius_{0.002}$	2.88	-1.66	4.53	3.99	1.13
$Radius_{0.003}$	2.85	-1.55	4.41	4.14	1.06
domestic takeovers					
unmatched sample	-0.54	-0.29	-0.25	0.79	0.31
1-NN	-0.54	-0.43	-0.12	0.72	0.16
3-$NN_{0.02}$	-0.54	-0.36	-0.19	0.63	0.30
3-$NN_{0.05}$	-0.54	-0.36	-0.19	0.62	0.30
5-$NN_{0.02}$	-0.54	-0.91	0.37	0.59	0.64
5-$NN_{0.05}$	-0.54	-0.91	0.37	0.58	0.64
10-$NN_{0.02}$	-0.54	-0.91	0.37	0.57	0.64
10-$NN_{0.05}$	-0.54	-0.94	0.40	0.56	0.71
$Radius_{0.001}$	-0.56	-1.08	0.52	0.60	0.87
$Radius_{0.002}$	-0.55	-0.86	0.31	0.60	0.51
$Radius_{0.003}$	-0.55	-0.81	0.26	0.58	0.45

Notes: Analytical standard errors are calculated according to Abadie and Imbens (2008) for nearest neighbor matching and via bootstrapping with 200 replications for all estimations using the radius approach; For the ATT with radius matching, treated observations off support were dropped from estimations for foreign acquisitions (7 with radius 0.001, and below 3 with radius 0.002) and domestic acquisitions (5 with radius 0.001, 3 with radius 0.002, and 3 with radius 0.003).

Table 11: ATT estimates of Δ export intensity (percentage points)

	treated	*controls*	*difference*	*std.err.*	*|t/z-value|*
foreign takeovers					
unmatched sample	-1.71	-0.27	-1.44	0.77	1.86
1-NN	-1.71	-1.79	0.08	1.49	0.06
3-$NN_{0.02}$	-1.71	-0.93	-0.78	1.27	0.62
3-$NN_{0.05}$	-1.71	-0.93	-0.78	1.24	0.63
5-$NN_{0.02}$	-1.71	-0.95	-0.76	1.25	0.61
5-$NN_{0.05}$	-1.71	-0.86	-0.85	1.21	0.71
10-$NN_{0.02}$	-1.71	-1.31	-0.40	1.24	0.33
10-$NN_{0.05}$	-1.71	-1.25	-0.46	1.18	0.39
$Radius_{0.001}$	-1.63	-1.39	-0.24	1.32	0.18
$Radius_{0.002}$	-1.79	-1.95	0.16	1.27	0.12
$Radius_{0.003}$	-1.71	-1.62	-0.09	1.19	0.07
domestic takeovers					
unmatched sample	0.50	-0.29	0.79	0.73	1.09
1-NN	0.50	-1.81	2.31	1.12	2.06
3-$NN_{0.02}$	0.50	-0.98	1.49	0.89	1.67
3-$NN_{0.05}$	0.50	-0.98	1.49	0.88	1.68
5-$NN_{0.02}$	0.50	-0.64	1.14	0.88	1.30
5-$NN_{0.05}$	0.50	-0.64	1.14	0.87	1.32
10-$NN_{0.02}$	0.50	-0.28	0.78	0.86	0.91
10-$NN_{0.05}$	0.50	-0.31	0.81	0.82	0.99
$Radius_{0.001}$	0.45	-0.79	1.24	0.97	1.28
$Radius_{0.002}$	0.50	-0.58	1.08	0.93	1.16
$Radius_{0.003}$	0.50	-0.57	1.07	0.87	1.24

Notes: Analytical standard errors are calculated according to Abadie and Imbens (2008) for nearest neighbor matching and via bootstrapping with 200 replications for all estimations using the radius approach; For the ATT with radius matching, treated observations off support were dropped from estimations for foreign acquisitions (7 with radius 0.001, and below 3 with radius 0.002) and domestic acquisitions (5 with radius 0.001, 3 with radius 0.002, and 3 with radius 0.003).

Table 12: Rosenbaum bounds for 1-NN ATT estimates (p-values)

	productivity		*employment*		*average wages*		*export intensity*	
Γ	sig+	sig-	sig+	sig-	sig+	sig-	sig+	sig-
foreign takeovers								
1.0	0.274	0.274	0.000	0.000	0.144	0.144	0.879	0.879
1.1	0.451	0.140	0.000	0.001	0.279	0.062	0.950	0.756
1.2	0.622	0.065	0.000	0.002	0.441	0.024	0.982	0.603
1.3	0.761	0.027	0.000	0.006	0.597	0.009	0.994	0.446
1.4	0.860	0.011	0.000	0.016	0.731	0.003	0.998	0.307
1.5	0.924	0.004	0.000	0.035	0.831	0.001	0.999	0.198
1.6	0.960	0.001	0.000	0.066	0.900	0.000	0.999	0.121
1.7	0.981	0.001	0.000	0.111	0.944	0.000	0.999	0.070
domestic takeovers								
1.0	0.052	0.052	0.000	0.000	0.834	0.834	0.466	0.466
1.1	0.134	0.016	0.000	0.001	0.675	0.931	0.666	0.274
1.2	0.260	0.005	0.000	0.004	0.495	0.975	0.815	0.142
1.3	0.415	0.001	0.000	0.014	0.329	0.992	0.909	0.066
1.4	0.572	0.000	0.000	0.034	0.199	0.998	0.959	0.028
1.5	0.708	0.000	0.000	0.071	0.112	0.999	0.983	0.011
1.6	0.814	0.000	0.000	0.127	0.059	0.999	0.993	0.004
1.7	0.889	0.000	0.000	0.203	0.029	0.999	0.998	0.002

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