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by

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Credit Constraints, Foreign Ownership, and Foreign Takeovers in Germany

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Abstract

In this paper we present the first evidence for a link between foreign ownership and credit constraints for Germany, one of the world's leading target countries for foreign direct investment. Furthermore, we contribute to the literature by investigating the impact of a foreign acquisition on the target firms' credit constraints for the first time. We use newly available comprehensive panel data that we constructed from information collected by the German statistical offices and from credit rating scores supplied by the leading German credit rating agency. We find foreign owned firms in German manufacturing on average to show slightly more financing restrictions than domestically owned enterprises, but this very small difference diminishes once unobserved heterogeneity is taken into account. We further demonstrate that one reason for this finding is the preference of foreign investors for targets with relatively low credit-worthiness. Although the likelihood of a foreign acquisition appears to be correlated with credit constraints, there is no impact of foreign takeovers on the credit constraints of the target firms *ex post* and therefore no support for the hypothesis that foreign takeovers ease financial frictions.

JEL Classification: F21, F23, G34

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1 Introduction

The possibility of a firm's investing is crucial for its growth and even for its chances of survival. External finance can play a major role in determining investment opportunities and thus firms which are less credit constrained may enjoy a competitive advantage. In particular, the internationalization of firms generates a demand for access to external finance because, for example, exporting or setting up an affiliate abroad requires a mass of fixed costs which have to be paid before any cash flows. Therefore, many firms rely on access to external finance and cannot use internal funds. Credit constraints can thus be a crucial barrier to internationalization and firm growth and have been the subject of many theoretical and empirical studies. Chaney (2013), Muuls (2008) and Manova (2013) introduce credit constraints into the seminal model of heterogeneous firms and trade by Melitz (2003) to discuss the role of these frictions for the decision to export. In the Chaney (2013) model, firms must pay extra costs in order to access foreign markets, and if they face liquidity constraints to financing these costs, only those firms that have sufficient liquidity are able to export. The Muuls (2008) model has the same implication: firms are more likely to be exporters if they are less credit-constrained. In the Manova (2013) model, firms that are more affected by credit constraints are less likely to participate in export markets, and if they do, they export less. A survey of the empirical work on credit constraints and exports can be found in Wagner (2012) and reveals that financial constraints are important for the export decisions of firms: exporting firms are less financially constrained than non-exporting firms. Studies that look at the direction of this link usually report that less constrained firms self-select into exporting, but that exporting does not improve the financial health of firms. For the case of Germany, exporting firms appear to be less credit constrained than non-exporters, but only to an economically insignificant extent.

Foreign direct investment (FDI), as another dimension of internationalization, has attracted significantly less attention when credit constraints are in focus. Buch, Kesternich, Lipponer, and Schnitzer (2010) develop a model predicting the role of productivity and credit constraints for both exporting and FDI. They test their

hypotheses with German data and find credit constraints to be more crucial in the case of FDI and also that financing restrictions do not matter for firms whose productivity levels are too low for international expansion. In a complementary paper, Buch et al. (2009) demonstrate that financial constraints at the parent level matter more for the extensive margin of FDI and constraints at the affiliate level matter more for the intensive margin of FDI. While the above mentioned studies use debt ratios to measure credit constraints (if a firm reports more external finance relative to internal, the less assets are available to serve as collateral for additional debt, and, hence, the more the firm is constrained), Arndt, Buch, and Mattes (2012) use a German survey in which firms self-reported their financing obstacles and find contradicting results. Namely, that financing obstacles do not play a significant role for the internationalization decision of firms in Germany. The authors reason that the links between firms and banks in Germany may be close enough to minimize information asymmetries and therefore financing obstacles.

The studies on FDI mentioned so far concentrate on German outward FDI and do not consider the aspect of inward investments. Germany is one of the most important FDI inflow destinations worldwide and was ranked sixth in terms of inward FDI stocks in 2011 (UNCTAD (2012)). Foreign owned enterprises thus possess considerable economic weight in the German economy and are generally found to be larger in terms of employees, more productive, and more R&D-intensive, among other things (Weche Gelübcke (2012)). The advantageous performance of foreign owned firms can usually be traced back to the fact that these firms benefit from their multinational network (Bellak (2004)). Multinationals are generally endowed with competitive advantages over their domestically oriented competitors, which is the reason for their international expansion or the result of their border-crossing organization. These advantages can be, for example, brand names or superior production technologies, and are available to affiliates within the organization at relatively low costs (Caves (1996)). An open question is whether foreign owned firms, which are very often affiliates of a multinational company, also enjoy an advantageous access to external finance in the host market. One reason why foreign subsidiaries could have better access to external funds may be that they belong to an international network which

could serve as collateral for external debt through access to internal funds of the parent or just due to the diversification of risk through selling not only on the domestic market. The latter point not only applies to multinational networks or business groups, but also to exporting firms. Globally oriented firms also may have access to other international financial markets beyond the domestic financial market and the internal financial market in the case of a network. This choice presumably facilitates credit access but does not necessarily have an impact on financial access in the host market. Due to their international ties, foreign firms, and internationally oriented firms in general, can adapt developments in international markets, such as changes in product standards, faster and may therefore gain easier access to domestic banks. Theoretical considerations regarding the link between foreign ownership and access to credit discussed in the literature generally point to the relatively easier access to external finance of foreign owned firms (for these arguments, see Bridges and Guariglia (2008); Beck et al. (2006); Schiantarelli and Sembenelli (2000)). However, there are also reasons for a negative relation. For example, multinational networks very often reveal a considerable degree of complexity which produces information asymmetries between the lender and the recipient and therefore may increase the costs for capital.

Microeconomic evidence on the nexus between foreign ownership and credit constraints is scarce, and most studies use data for low-income and transition economies where credit constraints need to be considered a more severe issue than in Germany. Harrison and McMillan (2003), Mickiewicz, Bishop, and Varblane (2004), Arbeláez and Echavarría (2002) all find foreign owned firms or those that belong to international networks significantly less constrained in terms of access to external finance in the Ivory Coast, Estonia, and Colombia. Poncet, Steingress, and Vandebussche (2010) use Chinese data and also stress that domestic state-owned firms do not suffer from financing obstacles but that domestic private firms do. The feature of foreign owned firms being less constrained than domestic competitors holds across country categories as demonstrated by Guariglia and Mateut (2010) and Schiantarelli and Sembenelli (2000) for the cases of the UK and Italy. Beck, Demirgüç-Kunt, Laeven, and Maksimovic (2006) go beyond a country analysis, to

consider eighty countries and also find foreign ownership to be a reliable indicator for advantageous credit access, together with firm size and age (more details on these studies are provided in Table 1). Yet, to the best of the authors' knowledge, no study on ownership and credit constraints exists for German data. The study of Arndt et al. (2012) on the role of credit constraints for the internationalization decisions of firms in Germany suggests that because of a relatively good financial market infrastructure and close ties between companies and lenders, obstacles to external finance generally are not a major issue. If this is true, foreign and domestically owned firms in Germany would show no significant differences, which would contradict the picture of an advantage in favor of foreign owned firms derived from the survey above. According to our theoretical and empirical survey, the first question we try to answer in the following analysis is whether foreign owned firms in Germany also enjoy a better access to external finance relative to German owned firms (Q1).

[Table 1 about here]

The second part of our analysis is devoted to the role of credit constraints in the process of foreign acquisitions. Ownership changes have the potential for going beyond the examination of correlations, and reaching conclusions about the causal relation between financing restrictions and foreign ownership through a treatment analysis approach. Apart from this rather methodological contribution, the observation of company takeovers and their impact on access to external finance is of interest in itself, since foreign takeovers are constantly subject to a controversial public debate that demands reliable empirical evidence. There are very few microeconomic studies on credit constraints in the context of company takeovers. Recent exceptions are by Erel, Jang, and Weisbach (2013) and Liao (2010). The former look at European acquisitions between 2001 and 2008 and conclude that takeover targets are constrained prior to being acquired and that takeovers ease financial frictions *ex post*.¹ The latter focuses on corporate block acquisitions and finds target firms to be financially constrained but to increase their investment expenditures following an acquisition. Neither study considers cross-border acquisitions separately. The second

¹ This effect cannot be observed for subsidiaries as they are generally less constrained.

part of our analysis tries to fill this research gap by providing the first evidence specifically about foreign acquisitions.

Company acquisitions, and especially cross-border acquisitions through foreign investors, are regarded as a potential way to bridge funding shortfalls in the target firms (e.g., Erel et al. (2013)). However, the purchase of a target firm in financial distress also can be to the advantage of the acquiring firm because, for instance, financial distress may signal a mismatch between the current management and its operations, and therefore inefficiencies, which could be overcome by the acquirer through exploiting a superior management (Lichtenberg and Siegel (1987) and Bellak, Pfaffermayr, and Wild (2006)). According to Akerlof (1970) and Gioia and Thomsen (2004), foreign investors may be especially attracted by so called “lemons” because they suffer additional information disadvantages due to their location abroad and try to reduce their additional risk through choosing relatively cheap targets, which could be those that face above-average credit constraints. We derive our second and third main research questions from these considerations, and ask if being credit constrained is an *ex ante* determinant of foreign takeovers in Germany (Q2) and whether the access to external finance by a German target firm is affected by being acquired by a foreign investor (Q3).

We try to answer these questions by using a unique newly constructed dataset which merges high-quality data at the enterprise level, from surveys of the statistical offices, with a credit rating score that measures the credit-worthiness of the firm, supplied by the leading German credit-rating agency *Creditreform*. We find foreign owned firms in German manufacturing on average to show slightly more financing restrictions than domestically owned enterprises, but this very small difference diminishes once unobserved heterogeneity is taken into account. We further demonstrate that one reason for this finding is the preference of foreign investors for targets with relatively low credit-worthiness. Although the likelihood of a foreign acquisition appears to be correlated with credit constraints, there is no impact of foreign takeovers on the credit constraints of the target firms *ex post* and therefore no support for the hypothesis that foreign takeovers ease financial frictions.

Our analysis is structured as follows: Section 2 describes the database and the

way the variables are constructed. The empirical analysis in Section 3 begins with the investigation of differences in credit rating scores between foreign and domestically owned firms (3.1) and proceeds with a focus on foreign acquisitions (3.2). First, we evaluate what role credit constraints play for the takeover decision (3.2.1), and, second, how a foreign acquisition impacts the target firm (3.2.2). Section 4 concludes.

2 Data and variables

We employ a unique and newly merged database which is composed from three different 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 the enterprise level and available in the form of annual results for all German firms which employ at least 20 persons and operate in the corresponding industries (for more information, see Konold (2007)). This data is of particularly high quality because firms in Germany are legally required to answer these surveys.² The sample was restricted to only firms from the manufacturing industries according to the NACE classification.

The variable of main interest, the credit constrainedness, is measured as the credit-worthiness of an individual firm, and is supplied by the leading German credit rating agency, *Creditreform*. Instead of using proxy variables such as the sensitivity of investments to cash flow or self-reported information to measure financial constraints, we use a direct credit rating score that mirrors the credit market experts' view of the creditworthiness of a firm, and which is heavily relied upon by banks and firms in their day-to-day decisions.³ The score is based on fifteen firm characteristics, including liquidity, turnover, capital structure, information about payment behavior, legal form, industry, firm age, productivity, and firm size (for details, see Rossen

² This data is confidential in the sense that all computations had to be performed via remote access within the Research Data Center of the statistical office Berlin-Brandenburg and single cases could not be identified. The accessibility of this data is described in detail by Zühlke et al. (2004).

³ For a discussion of the usefulness of investment-cash flow sensitivities in particular, see Kaplan and Zingales (1997).

(2012)). The score takes values from 100 to 600; *Creditreform* suggests that 100 to 149 should be considered as excellent, 150 to 199 as very good, 200 to 249 as good, 250 to 299 as medium, 300 to 349 as weak, 350 to 419 as being at a high risk of failure, and firms with a score of 420 or more are classified as firms that should not be considered as partners in trade and credit relations.

The third 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 enterprise⁴ is thereby defined as an enterprise of which more than 50% 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 (2012)).⁵ To be able to provide Foreign Affiliates Statistics (FATS) for Germany, the institutions in charge have to purchase information about ownership structure from the commercial data vendor *Bureau van Dijk* and integrate this into the national business register (*Unternehmensregister*)(for details, see Weche Gelübcke (2011)).

Information from the second and third source was merged with our main database via a unique firm identifier. Since it is more likely for large firms to get rated in the *Creditreform* data, our final analytical sample consists of between 5,000 and 5,600 firms per year and relatively large firms are overrepresented in the sample (Table 2).⁶

[Table 2 about here]

Even more than twenty years after the German reunification in 1990, the eastern and western regions of Germany still differ markedly in economic terms. This has recently been confirmed by a 2011 report on Eastern Germany's economic situation

⁴ The terms *foreign-controlled*, *foreign owned*, and *foreign* are used interchangeably in this text.

⁵ 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% in sum act in concert.

⁶ Wagner (2012) also uses this database and demonstrates this overrepresentation in particular.

and perspectives, carried out by leading German research institutes (IWH (2011)). In order to take into account the differences between the two regions, we perform the first part of our analysis for each region separately. To take into account also the fact that foreign owned firms belong to a network per definition, and may thus have advantageous access to competitive advantages (cf. Section 2), we restrict the comparison group of domestically owned firms to those that are themselves part of a network.⁷ Table 2 gives the number of observations by region and group. In 2007, around 25% of the firms in the total sample were under foreign control, and this share does not change a lot over time. This is a high percentage considering the fact that among the entire population of firms in the German non-financial sector, only 1% are foreign owned (Nahm (2011)), and this can be traced back to the bias towards larger enterprises in our sample. Accordingly, the share of domestically owned independent firms is relatively low with also around 25% in the 2007 sample.

For the second part of our analysis, in Section 3.2, we identify foreign acquisitions based on information from the enterprise group database. Accordingly, a foreign takeover can be identified when an enterprise was labeled as foreign owned in t but was under domestic control in $t - 1$. Table 3 shows the number of identified foreign acquisitions in the respective year. However, because of the relative 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 analyses were performed only for takeovers which explicitly exclude potentially 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 that 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 (see Table 3).

[Table 3 about here]

⁷ Therefore, we can restrict the comparison to only dependent affiliates and take into account a general network effect. Unfortunately, we do not have data on the multinational status of the domestically owned firms, and cannot distinguish national from international networks.

Furthermore, we construct the following covariates from the monthly and annual reports of establishments from the manufacturing, mining, and quarrying sectors: The share of turnover generated abroad (*exports*), the number of employed persons as a mean of monthly reportings (*firm size*), total turnover per employee (*labor productivity*), human capital intensity as gross annual wages per employee (*wage*), and an indicator variable that takes the value 1 if a firm has reported to the survey already before 1996, and can therefore be considered as old (*firm age*).

3 Econometric analysis

3.1 Credit rating differences by ownership

3.1.1 Unconditional mean differences

Do foreign owned firms in Germany enjoy better access to external finance when compared to German owned firms as proposed by international empirical studies and suggested by theoretical considerations (see Section 1)? To answer our first question, we look at unconditional mean values of the credit rating score by enterprise group, reported in Table 4. In the pre-crisis years 2007 and 2008, the group of all domestically owned firms shows an average rating score of slightly more than 190 in western Germany and of slightly more than 200 in eastern Germany.⁸ According to the recommendation of the score provider, this means a *very good* rating for firms in western Germany and *good* credit-worthiness for firms in eastern Germany. This reflects the general differences between the eastern and western regions in Germany, although it needs to be pointed out here that the difference is only around 10 index points and one category has a range of 50 index points. In the time dimension we can also see that the score goes up in the crisis year 2009, followed by a decrease in 2010, which seems to mirror the economic situation adequately.⁹ Foreign owned firms show the same trend but are persistently better rated with a difference of between

⁸ Although the global financial and economic crisis started at the end of 2008, its major impact unfolded in the year 2009. We therefore consider 2009 as the first year of the crisis.

⁹ Remember that an increasing rating means a worsening of the credit-worthiness.

8 and 10 index points in western Germany and between 2 and 9 index points in eastern Germany in the pre-crisis and crisis years. In 2010 the difference increases in both regions to 13 and 14 index points due to a relative improvement of the German owned enterprises. However, most differences do not seem to be economically relevant and t-tests (that assume unequal variances in the two groups) reveal statistically significant differences only in eastern Germany. If we restrict the comparison group of German owned firms to only dependent ones or only exporters, the picture does not change. This similarity of all groups of German owned enterprises can be partly explained by the fact that our sample consists of disproportionately few non-exporting and independent firms (cf. Section 2).

[Table 4 about here]

3.1.2 Conditional means and unobserved heterogeneity

It is very likely that larger firms suffer less from credit constraints. One reason is, for example, that they are older and have long-term relations with their banks, which can reduce information asymmetries and increase their credit-worthiness (see Beck et al. (2006) and the references given therein). To control for this and other potential determinants of the credit rating, we estimate the model given below, where y is the credit rating score and X represents other firm characteristics, namely firm size, measured as the number of employees and number of employees squared, whether or not a firm exports, and also in which 2-digit industry an individual firm (i) operates. α is the constant and ϵ the error term. To obtain the difference between foreign owned firms and the considered control group, we further introduce a foreign ownership dummy that takes the value one if a firm is under foreign control and zero otherwise. Since we use a pooled sample, we also include year dummies to absorb general cyclical fluctuations over the considered period and indicate the respective year with a subscript t . We use a linear OLS estimator and adjust the standard errors for clustering at the firm level.

$$y_{it} = \alpha + X'_{it}\beta + \epsilon_{it} \quad (1)$$

The results are reported in Table 5: after we control for firm size, industry, and exporting, we find statistically significantly worse ratings for foreign firms by 11 (9) index points in western (eastern) Germany. The negative exporter dummy coefficients in the Model II estimates indicate that exporters are on average better rated than non-exporters, as suggested by the literature review in Section 1. At the same time, it seems that foreign ownership can be considered a more powerful indicator of credit rating differences in our data since the coefficients are higher and statistically significant at higher levels. Instead, the firm size does not seem to have a large effect on credit ratings on average.¹⁰

In fact, the model estimated so far does not claim at all to be an explanation model that captures all determining factors of the credit-worthiness of a firm. There may be many more factors which would have to be considered. For instance, the quality of management or the personal networks of the managers may differ greatly across firms and be important factors for external credit access. In order to take such time-invariant heterogeneities into account and to fully exploit the panel structure of our data, we, in a further step, estimate a fixed effects (FE) model. FE models use the within-variance of a firm over time to eliminate any unobserved firm-specific time-constant effect (v_i) via mean differencing, as shown below:

$$y_{it} = \alpha + X'_{it}\beta + v_i + \epsilon_{it} \quad (2)$$

$$y_{it} - \bar{y}_i = \beta(X'_{it} - \bar{X}'_i) + (\epsilon_{it} - \bar{\epsilon}_i) \quad (3)$$

The results in Table 5 show that once unobserved heterogeneity across firms in the German manufacturing is taken into account, the average differences between foreign and German firms disappears. This is true for eastern and western Germany and in terms of both statistical significance and magnitude of the point estimate.

The interpretation of the results of the FE model is not without problems. These results are based on a completely different group of enterprises than the pooled OLS estimates, because they use the within-variance of observations over time. This means that FE estimates consider only cases which experience at least one ownership

¹⁰ A reason could again be the disproportionate share of large firms in our data.

change during the observed period, namely from domestic control to foreign control or vice versa. Enterprises that do not undergo an ownership change throughout the period 2007 to 2010 are excluded. It is essential to be aware of the fact that the results rely on a very special group of enterprises, namely those that experienced a divestment or takeover and that the FE results are not transferrable to the entire sample necessarily.

[Table 5 about here]

3.1.3 Robust panel estimates

In the previous section, we took the issue of unobserved firm heterogeneity into account by estimating an FE model. Another aspect of heterogeneity is that a few firms with extremely high or low values may drive our estimates of the average effects. Reasons for the existence of those outliers might be, for example, reporting errors or idiosyncratic events, and are usually not retraceable. However, this potential source of bias should be considered when estimating averages (see Wagner (2011)). Verardi and Croux (2009) discuss several outlier-robust estimators and their usefulness with respect to different kinds of outliers. They suggest using an MM-estimator, which combines a high breakdown point and high efficiency.¹¹

Robust results for our pooled sample using the MM-estimator are given in Table 6. All coefficients for the pooled OLS estimates confirm the results from the non-robust estimates in Table 5, that there are statistically significant differences between foreign and German firms, although their already small magnitude decreases by a few index points, further reducing their economic significance.

To consider both dimensions of heterogeneity, firm fixed effects and outlier distortion, we apply a robust FE estimator developed by Bramati and Croux (2007). This estimator uses the median to eliminate the constant firm specific fixed effects,

¹¹ The breakdown point gives the level to which an estimator is resistant to outliers. For the MM-estimator, the breakdown point is at 50% (for OLS it is 0%). Since the bias increases with efficiency, the authors recommend an efficiency parameter of 0.7 to achieve an optimized combination of both low bias and high efficiency. The parameter can be set in the Stata ado file “mmregress” that is provided by Verardi and Croux (2009) and has been used for our analysis.

instead of demeaning. For example, Verardi and Wagner (2011) used this technique to estimate an exporter productivity premium and find a significant impact of outliers in their data and, hence, a vanishing of the large exporter productivity premium.¹²

The results from robust FE estimates in Table 6 show clearly that the coefficients of the foreign ownership indicator are again neither economically relevant nor statistically significant at any conventional level. Consequently, we can conclude that firms' unobserved differences are responsible for the statistically significant differences in the credit rating of foreign and domestic enterprises found in pooled OLS regressions.

[Table 6 about here]

3.2 Foreign takeovers

Foreign takeovers are of special interest for the analysis of the link between credit constraints and foreign ownership for three reasons: i) Foreign acquisitions offer the opportunity to reach conclusions about the causality of this relation and to overcome fundamental problems of non-experimental data in a treatment analysis framework. Apart from this rather methodological advantage, we can answer our second and third main research questions from Section 1, ii), whether being credit constrained is an *ex ante* determinant of foreign takeovers, and iii), whether a target firm's access to external finance is affected by an acquisition of a foreign investor. To the best of the authors' knowledge, this is the first study looking at foreign takeovers in the context of credit constraints.

3.2.1 Selectivity of investors

Company takeovers do not occur randomly, but happen for a set of purposes. Therefore, it may be the case that a target firm's credit rating is a determinant of the takeover decision. If the preferences of foreign investors regarding a target firm's credit-worthiness differ from the average, our previous estimates could suffer from a selection bias. In other words, if foreign investors show a preference for above-average

¹² Verardi and Wagner (2011) also provide the Stata ado file "xtregrob" to apply the robust FE estimator.

rated targets, this would mean that foreign owned firms could have been disadvantageously rated even before they became foreign owned, which would weaken the role of foreign ownership as a factor for a high rating score. In fact, the relation between foreign ownership and credit constraints could even be a negative one, despite our previous results, if foreign investors “lemon-grab” already badly rated enterprises. The hypothesis that foreign investors prefer targets with a relatively low credit rating finds some support in the literature as discussed in Section 1: foreign investors could seek to exploit their competitive advantages and buy firms signalling inefficiencies or try to reduce their takeover risk due to information disadvantages through buying relatively cheap targets.

We start our investigation with a look at the mean values of the credit rating score for several enterprise groups (Table 7). The average credit rating score of all foreign takeover targets from our panel in the year prior to their ownership change is 205. This ranks the future takeover targets as *good* and it seems unlikely that foreign investors pick particularly financially distressed firms. However, the control group of domestic firms (that never experience an ownership change throughout the panel) shows a *very good* rating with a difference of 14 index points which is statistically highly significant. This picture holds if we compare takeovers in particular years to their corresponding control group and only the pre-acquisition differences of takeovers in 2008 are not statistically significantly different from each other.¹³

[Table 7 about here]

To go beyond an unconditional mean comparison, we estimate the probability of a takeover in a non-linear binomial probit model with additional covariates to control for a set of other influencing factors. We estimate the conditional probability of whether a firm i becomes subject to a foreign acquisition ACQ in year $t+1$, dependent on firm-level characteristics X in t . The model can be written as follows, with Φ as

¹³ Descriptive statistics, the definition, and the identification of foreign takeovers are provided in Section 2. Note that, in order to keep a sufficient number of observations, we no longer distinguish between eastern and western Germany in the analysis of takeovers.

the standard normal distribution:

$$Pr(ACQ_{it+1} = 1) = \Phi(x\beta) = \Phi(\alpha + \delta X'_{it} + \epsilon_{it}) \quad (4)$$

The firm-specific covariates include the credit rating score as our variable of main interest. To account for non-linearities regarding the link between credit constraints and probability of being acquired, we include the credit rating variable as dummies that indicate in which quintile of the distribution a firm is ranked. The third quintile ($q3$) is left out and serves as the reference category. Hence, we can see whether a deviation of a firm's rating from the average category, either up or down, is of importance. As in previous regressions, we include firm size, measured as employees, and 2-digit industry dummies. Moreover, we consider other factors that may influence the takeover likelihood and which were also described in Section 2, namely labor productivity, human capital intensity, exporter status, and firm age.

The results for the pooled sample in Table 8 reveal that the credit-worthiness is only correlated with the takeover probability if it is relatively high, meaning the target firm is relatively badly rated and can be assumed to be credit constrained. Only the indicator for firms in the upper quintile ($q5$) shows a statistically highly significant and positive coefficient. In Table 8 we report the average marginal effects (AME) instead of coefficients to reach a more meaningful interpretation:¹⁴ being rated at the upper end of the credit rating scale ($q5$) increases the probability of becoming the target of a foreign acquisition in the following period by 2 percentage points relative to being averagely rated ($q3$), holding other factors constant. Although statistically highly significant, this effect appears fairly small at first glance. However, if we consider the overall acquisition rate in our sample, which is also fairly low, for example, with only slightly more than 2% in 2008 (slightly more than 1.65% in 2009 and slightly more than 2.88% in 2010),¹⁵ a change of 2 percentage points seems large.

¹⁴ An alternative would be to calculate the marginal effects at the sample mean (MEM) but since MEMs are calculated only for one specific hypothetical case, which is the sample mean, they do not seem to be appropriate in our case as we explicitly assume heterogeneous effects along the credit score distribution. For a detailed discussion of alternative ways of calculating marginal effects and application in Stata, see Williams (2012) and Cameron and Trivedi (2010: 343ff.).

¹⁵ These numbers were calculated from Table 3 in combination with Table 2.

If we look at the cross-section estimates in Table 8 that consider only acquisitions in one specific year, the picture of a positive and statistically significant correlation is supported. Finally, we can conclude that future foreign takeover targets indeed have a worse credit rating prior to their acquisition, lending support to the hypothesis that foreign investors prefer firms which are relatively more credit constrained.

[Table 8 about here]

3.2.2 The impact of a foreign takeover on a target's credit constraints

The third question we posed in the motivation of our analysis is whether a target firm's access to external finance is affected by a foreign acquisition. It is widely assumed that becoming part of an international network facilitates access to external finance (cf. Section 1). For the German case we have found that differences between domestically owned and foreign owned enterprises are rather to the disadvantage of the latter, if there are any. One reason for this finding is that foreign investors prefer to buy firms which are already rated relatively low (cf. previous section). However, it can still be the case that foreign investors reduce the credit constraints of their targets, although they do not push their credit rating score above the average. To evaluate whether a foreign takeover has any impact on the target firm's credit constraints, we estimate the following linear regression model:

$$y_i = \beta + \gamma T_i + \delta ACQ_i + \eta (T_i ACQ_i) + \epsilon_i \quad (5)$$

In this model, we consider the pre-acquisition or baseline outcome of each firm as $T_i = 0$ and the post-acquisition or follow-up outcome of each firm as $T_i = 1$. The ACQ dummy indicates whether a firm was subject to a takeover ($ACQ_i = 1$) or not ($ACQ_i = 0$), and $\hat{\delta}$ gives the difference between the treated and the non-treated group in the pre-acquisition year, while $\hat{\delta} + \hat{\eta}$ gives the difference between the two groups in the post-acquisition period. The coefficient of main interest is $\hat{\eta}$, because it gives the difference-in-differences (DiD):

$$\eta = (\bar{Y}_{ACQ=1,T=1} - \bar{Y}_{ACQ=1,T=0}) - (\bar{Y}_{ACQ=0,T=1} - \bar{Y}_{ACQ=0,T=0}) \quad (6)$$

In other words, η measures the divergence in average outcomes between the foreign takeover targets and the non-takeover targets between the two periods $T = 0$ and

$T = 1$. We estimate our model for takeovers in 2008 and 2009, since there is no post-takeover period available for the 2010 takeovers. As the baseline outcome, we use the credit rating score in the year prior to the takeover period; as the follow-up outcome, we use all available post-acquisition years to also capture changes that may not become visible directly after the acquisition but only after a lag.¹⁶

The estimates are reported in Table 9. The difference between the takeover targets in 2008 and the control group of domestically owned enterprises (that never experience a foreign takeover throughout the considered period) in 2007 are not statistically significant, as we have already seen in Table 7. However, one year after the acquisition period, the increased difference of 10 index points becomes statistically significant, and two years following the takeover the difference amounts to 14 index points. Turning to the 2009 acquisitions, there are already significant differences between the two groups before the ownership change, which increase in the post-acquisition years to 26 index points. However, our main interest does not lie with the follow-up difference but with the deviation of this difference from the baseline difference, the η estimates, to reduce unobserved heterogeneities. The DiD estimates do not show any statistically significant difference for the 2008 acquisitions. Only following the 2009 acquisitions is there a statistically significant DiD of 12 index points one year after the event, indicating that foreign takeovers in 2009 rather worsened the credit-worthiness of the acquired enterprises.

[Table 9 about here]

So far, our analysis has revealed correlations rather than causalities and the question of whether foreign ownership is a causal determinant of credit constraints in Germany cannot be answered satisfactorily. In our case, there are two major issues that have to be met in order to reach causal results: i) The selectivity of foreign investors based on firm characteristics which may simultaneously affect the post-takeover outcome, and ii) the unobservability of the potential outcome of target firms if they had not been taken over, which is also known as the counterfactual situation.¹⁷ To

¹⁶ For the estimation of this model, we use the Stata command provided by Villa (2012).

¹⁷ For a more detailed discussion of causal effects in a treatment analysis context with non-

overcome those fundamental problems of a treatment analysis with non-experimental data, we extend our DiD approach by a kernel-based propensity score matching, as proposed by Heckman and Ichimura (1998). This procedure ideally accounts for the selection bias by considering all confounding factors that determine the takeover assignment (ACQ_i) as well as the outcome (Y_i) simultaneously, to therefore ensure a conditional independence given X_i ($ACQ_i \perp\!\!\!\perp (Y_i(0), Y_i(1)) | X_i$). In an experimental setting, one would not be interested in the differences between takeover targets and the control group of non-takeover targets, but rather in the differences between takeover targets in case they experience a takeover and takeover targets in case they do not experience a takeover. A matching procedure allows us to create a control group that substitutes for the counterfactual by considering those firms that were similar to the treated firms before the treatment according to X . Rosenbaum and Rubin (1983) demonstrated that it is sufficient to match the observations according to their individual propensity score of receiving a certain assignment. Consequently, we estimate the takeover probability with a probit model as in Section 3.2.1 and use each firms' propensity score together with the kernel density function to weight y in our DiD model for each observation i accordingly.¹⁸

[Table 10 about here]

The results in Table 10 show that after the matching, there are no statistically significant pre-acquisition differences in credit rating left for the 2009 acquisitions, pointing to a successful reduction of the pre-acquisition differences. However, if we look at the DiD estimates, increasing differences can still be observed following 2008 as well as 2009 acquisitions, but it appears that none of them is statistically significant. Therefore, the conclusion is that there is no significant impact of foreign takeovers on the target's credit constraints after accounting for other confounding

experimental data, see Imbens and Wooldridge (2009) as well as Angrist and Pischke (2009).

¹⁸ A major drawback here is that we cannot claim to consider all confounding factors to reach a conditional independence of the outcome and the assignment, mainly for two reasons: Firstly, there is no theory predicting the exact determinants of a company acquisition, and, secondly, the data is not rich enough to account for all possible confounding factors.

factors, neither a reduction nor a deterioration. This also implies that there is no evidence of a causal relation between foreign ownership and credit constraints in Germany beyond other factors.

4 Conclusion

Access to external finance can be a crucial factor for a firm's growth, internationalization, and survival. Theoretical considerations suggest that being part of a multinational company network facilitates access to external finance through, for instance, the availability of internal funds, access to financial markets abroad, and additional collateral due to risk diversification. Because of these reasons, foreign owned firms are assumed to enjoy a relatively better access to external finance than do their domestically owned competitors. This is supported by international empirical evidence, which is, however, mostly based on data for developing and transition economies.

We employ a unique and newly merged panel database for the German manufacturing sector which consists of high-quality data from German official statistics and a direct measure of firms' credit-worthiness supplied by a leading German credit-rating agency. Our results contradict the findings for other countries, in showing only a very small credit rating difference to the disadvantage of foreign owned firms in Germany. Furthermore, this difference does not hold if we take into account unobserved heterogeneity among firms in our sample (Q1). Arndt et al. (2012) offer a potential reason for this finding when they argue that the links between firms and banks in Germany may be close enough to minimize information asymmetries and therefore financing obstacles.

In the second part of our analysis, we focus on foreign company acquisitions and find that foreign investors prefer target firms with a relatively low credit rating score (Q2). This behavior is in line with the hypotheses stating that foreign investors seek opportunities to exploit their competitive advantages and aim to reduce their risk by acquiring relatively cheap firms. However, on average, the takeover targets are only marginally lower rated, and the differences are not always statistically

significant. We also evaluate the impact of a foreign takeover on a target firm's creditworthiness via difference-in-differences estimates, but cannot find any significant effect after controlling for other confounding factors (Q3). Therefore, the widely assumed relation, that foreign investors improve the access to external finance of their subsidiaries, cannot be supported for Germany.

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Table 1: Microeconomic studies on foreign ownership and credit constraints

<i>Author(s)(year)</i>	<i>Country</i>	<i>Data</i>	<i>Y</i>	<i>Method</i>	<i>Findings</i>
Arbeláez and Echavarría (2002)	Colombia	1990s	Investment over capital stock	Investment equations	firms in conglomerates and FDI firms both face fewer financial restrictions
Beck, Demirgüç-Kunt, Laeven, and Maksimovic (2006)	80 countries	1999 and 2000	Financing obstacle reportings	Ordered probit	Older, larger and foreign owned firms report less financing obstacles
Guariglia and Mateut (2010)	UK	1993-2003	Inventory investments	First-difference GMM	Smaller, younger, non-exporting, domestically owned and more risky firms exhibit higher sensitivities
Harrison and McMillan (2003)	Ivory Coast	Unbalanced panel 1974-1987	Debt to asset and interest coverage ratios as proxies	Estimation of modified Euler investment model	Foreign firms are less constrained than domestic firms and borrowing by foreign firms exacerbates domestic firm credit constraints
Mickiewicz, Bishop, and Varblane (2004)	Estonia	1995-1999	Investment over capital	Euler investment equation	Domestic companies seem to be more financial constrained than those with the presence of foreign investors. Furthermore smaller firms are more constrained
Poncet, Steingress, and Vandenbussche (2010)	China	1998-2005	Sensitivity of investments to cash flows as proxy	Euler investment model with IV	Foreign and domestic state-owned firms are not credit constrained but domestic private firms are
Schiantarelli and Sembenelli (2000)	Italy	1977-1990	cash flow in both flow of funds and investment equations	Flow of funds and investment equations	Foreign affiliates and firms of a national business group suffer less from capital market imperfections

Table 2: Number of firms by enterprise groups

	2007		2008		2009		2010	
	<i>Western</i>	<i>Eastern</i>	<i>Western</i>	<i>Eastern</i>	<i>Western</i>	<i>Eastern</i>	<i>Western</i>	<i>Eastern</i>
All firms	4,490	589	4,497	607	4,862	652	4,870	682
Foreign owned firms	1,092	159	1,141	194	1,075	177	1,162	200
All domestically owned firms	3,398	430	3,356	413	3,787	475	3,708	482
Domestically owned dependent firms	2,253	324	2,359	320	2,408	330	2,358	318
Domestically owned exporters	2,072	265	2,152	261	2,226	267	2,170	262

Notes: All firms that have credit rating score information in at least one year are included.

Table 3: Number of foreign takeovers

Year	2008	2009	2010
Identified ownership changes (domestic \rightarrow foreign)	140	103	202
Potential misidentifications (non-labeled \rightarrow foreign)	38	12	42
Takeovers without potential misidentifications	102	91	160

Table 4: Credit rating score by enterprise group

	2007		2008		2009		2010	
	<i>mean</i>	<i>sd</i>	<i>mean</i>	<i>sd</i>	<i>mean</i>	<i>sd</i>	<i>mean</i>	<i>sd</i>
Western Germany								
Foreign owned firms	202	43	202	40	208	40	195	40
All domestically owned firms	192***	41	193***	38	200***	41	181***	40
Domestically owned dependent firms	194***	41	194***	38	202***	40	182***	38
Domestically owned exporters	193***	41	194***	38	201***	40	182***	38
Eastern Germany								
Foreign owned firms	205	45	210	43	215	43	205	43
All domestically owned firms	203	48	202**	41	206***	40	192***	37
Domestically owned dependent firms	202	46	202**	38	206**	42	193***	37
Domestically owned exporters	202	47	201**	39	206**	43	193***	38

Notes: The numbers of observations are given in Table 2; *, **, and *** indicate the statistical significance of differences against the mean of foreign owned firms on a 10%, 5%, and 1% level according to t-tests.

Table 5: Panel estimates of credit rating scores

	Western				Eastern			
	<i>pooled OLS</i>		<i>fixed effects</i>		<i>pooled OLS</i>		<i>fixed effects</i>	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
Control group are all domestically owned firms								
Foreign owned (dummy)	11.07*** (9.71)	11.32*** (9.94)	1.76 (1.10)	1.77 (1.10)	9.08*** (3.08)	9.43*** (3.20)	-1.72 (0.69)	-1.73 (0.70)
No. of employees	-0.003*** (3.70)	-0.003*** (3.64)	-0.02*** (3.20)	-0.02*** (3.18)	-0.01*** (4.52)	-0.01*** (4.47)	-0.01* (1.76)	-0.01* (1.75)
No. of employees squared	2.22e-08*** (3.00)	2.16e-08*** (2.95)	9.68e-08*** (3.36)	9.65e-08*** (3.35)	1.24e-07*** (3.86)	1.22e-07*** (3.82)	2.46e-08 (0.38)	2.44e-08 (0.38)
Exporter (dummy)	-	-7.51*** (3.86)	-	-0.91 (0.23)	-	-5.15 (1.32)	-	-0.38 (0.07)
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
N	18,998	18,998	18,998	18,998	2,582	2,582	2,582	2,582
Control group are domestically owned dependent firms								
Foreign owned (dummy)	9.78*** (8.17)	9.94*** (8.31)	0.01 (0.00)	0.02 (0.01)	9.27*** (3.02)	9.48*** (3.06)	-0.78 (0.25)	-0.79 (0.26)
No. of employees	-0.004*** (2.61)	-0.003** (2.57)	-0.02*** (3.23)	-0.02*** (3.17)	-0.02** (2.38)	-0.02** (2.37)	-0.04** (2.29)	-0.04** (2.29)
No. of employees squared	3.57e-08** (2.13)	3.47e-08** (2.08)	2.07e-07*** (3.40)	2.05e-07*** (3.37)	1.53e-06 (1.37)	1.53e-06 (1.36)	4.51e-06*** (2.82)	4.51e-06*** (2.82)
Exporter (dummy)	-	-4.64** (2.05)	-	-2.83 (0.55)	-	-2.34 (0.59)	-	-0.59 (0.08)
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
N	13,848	13,848	13,848	13,848	2,022	2,022	2,022	2,022

Notes: Reported are estimated coefficients with |t-/z-values| in parentheses; Model I includes 2-digit industry dummies and the number of employees as well as the number of employees squared, Model II includes an exporter dummy additionally; Significance at the 10% (*), 5% (**) and 1% (***) level; Standard errors of the pooled model are adjusted for firm clusters; Standard errors for the fixed effects model are robust against heteroskedasticity and within-panel serial correlation in the ideosyncratic error term.

Table 6: Robust^a estimates (Model II)

	Western		Eastern	
	<i>pooled OLS</i>	<i>fixed effects</i>	<i>pooled OLS</i>	<i>fixed effects</i>
Control group are all domestically owned firms				
Foreign owned (dummy)	9.33*** (14.28)	-0.07 (0.31)	7.89*** (3.72)	0.11 (0.17)
No. of employees	-0.02*** (10.68)	-0.003*** (2.89)	-0.03*** (5.71)	-0.03*** (8.88)
No. of employees squared	3.19e-06*** (5.90)	1.39e-07*** (4.34)	3.12e-06*** (4.59)	5.24e-06*** (8.22)
Exporter (dummy)	-6.06*** (5.69)	0.19 (0.40)	-5.77** (2.16)	0.46 (0.47)
Industry dummies	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
N	18,998	12,724	2,582	1,788
Control group are domestically owned dependent firms				
Foreign owned (dummy)	7.01*** (10.22)	-0.33 (1.20)	6.41*** (2.73)	0.71 (0.84)
No. of employees	-0.01*** (10.56)	-0.003** (2.39)	-0.03*** (4.81)	-0.04*** (3.22)
No. of employees squared	1.59e-06*** (3.83)	7.74e-08 (0.61)	3.52e-06*** (4.01)	0.00003*** (4.16)
Exporter (dummy)	-4.04*** (3.07)	-0.32 (0.56)	-4.06 (1.41)	0.02 (0.02)
Industry dummies	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
N	13,848	9,184	2,022	1,387

Notes: ^a We used the Stata commands *mmreg* and *xtregrob* to achieve robust estimates; Reported are estimated coefficients with |t-/z-values| in parentheses; Model includes 2-digit industry dummies and the number of employees as well as the number of employees squared and an exporter dummy additionally; Significance at the 10% (*), 5% (**) and 1% (***) level; Standard errors of the pooled model are adjusted for firm clusters; Standard errors for the fixed effects model are robust against heteroskedasticity and within-panel serial correlation in the ideosyncratic error term.

Table 7: Mean credit ratings for foreign takeover targets

		2007	2008	2009	2010	pooled sample
Control group	n	3,548	3,548	3,548	3,548	14,192
	mean	193	193	199	180	191
	sd	41	38	41	39	40
All targets	n					313
	mean					205
	sd					51
	t-test					0.000
Target in 2008	n	92	92	92	92	
	mean	197	197	204	189	
	sd	55	48	42	42	
	t-test	0.580				
Target in 2009	n	75	75	75	75	
	mean	206	207	216	205	
	sd	50	62	46	45	
	t-test	0.036	0.052			
Target in 2010	n	146	146	146	146	
	mean	200	200	209	198	
	sd	45	38	41	43	
	t-test	0.078	0.032	0.003		

Notes: The t-test values give the p-values for testing the Nullhypothesis that the mean values of the respective target group and the control group are equal; The control group consists of firms that never experienced an ownership change throughout the entire period and only target firms are considered that provide credit score information in all years.

Table 8: Selection of takeover targets in pre-takeover year

Takeover in $t_{+1} =$	2008	2009	2010	pooled sample
Rating score $q1_t$	0.01 (1.35)	-0.002 (0.20)	-0.01 (1.03)	-0.001 (0.09)
Rating score $q2_t$	0.004 (0.35)	0.004 (0.54)	0.004 (0.44)	0.004 (0.79)
Rating score $q4_t$	0.02* (1.84)	0.008 (0.81)	-0.01 (1.33)	0.005 (0.93)
Rating score $q5_t$	0.02*** (3.76)	0.02** (2.23)	0.02* (1.95)	0.02*** (3.51)
Productivity $_t$	0.00001 (1.15)	3.28e-07 (0.06)	0.00001 (1.40)	0.00001** (2.23)
Employees $_t$	0.0001*** (2.87)	0.00003*** (5.75)	0.00001*** (3.50)	0.00003*** (3.68)
Employees 2_t	-1.96e-08** (2.55)	-3.74e-09*** (3.47)	-1.49e-08*** (3.03)	-6.11e-09** (2.30)
Wage (p.c.) $_t$	0.001** (2.53)	0.0004*** (2.87)	0.002*** (4.34)	0.001*** (3.05)
Exporter $_t$ (0/1)	-0.02 (0.17)	-0.01 (0.98)	0.001 (0.11)	-0.001 (0.22)
Age (0/1)	-0.01** (2.17)	-0.02*** (3.93)	-0.03*** (4.18)	-0.02*** (5.30)
Industry dummies $_t$	yes	yes	yes	yes
Year dummies	-	-	-	yes
N	3,556	3,529	3,605	10,868

Notes: Reported are estimated average marginal effects (AME) with |z-values| in parentheses; Statistical significance at the 10% (*), 5% (**) and 1% (***) level; Standard errors of the cross-sectional estimates are adjusted for industry clusters and those in the pooled model are adjusted for firm clusters; Industry dummies are on 2-digit level.

Table 9: Difference-in-differences estimates without covariates

Acquisition year	2008			2009	
Follow-up year	2008	2009	2010	2009	2010
Baseline difference ($\hat{\delta}$)	5.95 (0.309)	5.95 (0.327)	5.95 (0.318)	13.40*** (0.006)	13.40*** (0.005)
Follow-up difference ($\hat{\delta} + \hat{\eta}$)	6.03 (0.303)	10.02* (0.099)	13.61** (0.022)	19.39*** (0.000)	25.67*** (0.000)
Difference-in-differences ($\hat{\eta}$)	0.07 (0.993)	4.06 (0.636)	7.65 (0.364)	5.98 (0.385)	12.26* (0.069)
N	7,188	7,188	7,188	7,230	7,230
$ACQ = 1$	46	46	46	67	67
R^2	0.0003	0.005	0.026	0.009	0.029

Notes: Reported are values calculated from estimated coefficients with p-values in parentheses; Statistical significance at the 10% (*), 5% (**) and 1% (***) level; Estimates were performed using the user written stata command *diff* (Villa 2012); Considered are only those takeover targets that experience only one ownership change throughout the entire period.

Table 10: Difference-in-differences estimates using covariates

Acquisition year	2008			2009	
Follow-up year	2008	2009	2010	2009	2010
Baseline difference ($\hat{\delta}$)	10.29 (0.765)	10.29 (0.773)	10.29 (0.769)	11.49 (0.635)	11.49 (0.631)
Follow-up difference ($\hat{\delta} + \hat{\eta}$)	11.48 (0.739)	11.83 (0.740)	16.31 (0.642)	20.36 (0.400)	27.26 (0.255)
Difference-in-differences ($\hat{\eta}$)	1.20 (0.980)	1.55 (0.976)	6.02 (0.903)	8.87 (0.795)	15.77 (0.641)
N	5,438	5,438	5,438	6,916	6,916
$ACQ = 1$	44	44	44	66	66
R^2	0.0003	0.004	0.033	0.007	0.032

Notes: Reported are values calculated from estimated coefficients with p-values in parentheses; Statistical significance at the 10% (*), 5% (**) and 1% (***) level; Covariates used for the probit estimation of the propensity scores are the same pre-takeover characteristics as in previous probit estimates; Estimates were performed using the kernel matching option of the user written stata command *diff* (Villa 2012); Considered are only those takeover targets that experience only one ownership change throughout the entire period; The common support assumption is fulfilled by including only those takeover observations that were able to be matched with non-takeover targets.

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