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M&As, Investment and Financing Constraints

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M&As, Investment and Financing Constraints

Joel Stiebale Nicole Wößner [1]

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Abstract

We use a panel data set of European firms to analyse the effects of domestic and international M&As on target firms' investment, growth and financial constraints. Combining propensity score matching with a difference-in-differences estimator, our results indicate that upon acquisition, target firms obtain better access to external finance, are characterized by higher levels of tangible and intangible assets, and display lower dependence of investments and cash savings to the availability of internal funds. We also provide evidence that these effects are concentrated among acquisitions during the 2007-2009 financial crisis, relatively small target firms, and domestic rather than foreign acquisitions.

JEL codes: *F61, F23, G01, G34, L25, D22, D24*
Keywords: *Mergers and Acquisitions, Financial Constraints, Investment, Firm Growth, Financial Crisis, Foreign Ownership*

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1 Introduction

Mergers and acquisitions (M&As) play an increasingly important role in the world economy with a global transaction value that exceeded $4 trillion for the first time in 2015. While acquisitions can create value and spur growth of target firms, critics claim that more than 50% of previous M&A deals have failed.[1] A growing body of theoretical and empirical research has analysed how M&As affect prices, productivity, innovation, employment, and wages. Recent empirical contributions suggest that acquisitions can also affect target firms' financial constraints.[2] This is an important finding, as target firms' ability to exploit growth opportunities and undertake productivity-enhancing investments critically depends on the availability of finance.

This paper analyses the following research questions: (1) What is the impact of acquisitions on financial constraints, investment and growth of target firms? (2) Do results vary with the characteristics of target firms and types of acquisitions? (3) Are the effects different for acquisitions that took place during the recent financial crisis?

To answer these research questions, we analyse more than 700 M&As in which European firms were acquired between 2003-2012. Our balance sheet data allows us to construct various indicators which are related to investments and financing constraints, including cash savings, debt, capital stock and intangible assets. Further, we also provide evidence on the effects of M&As on other outcomes that are likely to depend on access to finance such as target firms' growth rates of employment, sales, and productivity.

There are a couple of earlier empirical studies that are closely related to our paper. Wang and Wang (2015) show that Chinese target firms' financial conditions measured as liquid assets and debt ratios improve for foreign relative to domestically acquired firms. Since the importance of financial factors and the selection of target firms might differ substantially between Chinese and European markets, these results do not necessarily apply to M&As in developed countries.[3] Erel et al. (2015) use a similar database as ours, but an earlier time period, and find that European target firms display higher levels of investment and a lower degree of financial constraints, indicated, for instance, by lower dependence of investment on the availability of internal finance. While they control for some observable characteristics at the firm- and industry-level, their empirical strategy is based on the

[1] See, for instance, `http://www.wsj.com/articles/2015-becomes-the-biggest-m-a-year-ever-1449187101` and `https://hbr.org/2016/05/so-many-ma-deals-fail-because-companies-overlook-this-simple-strategy`, accessed June 23, 2017.

[2] Erel et al. (2015) and Wang and Wang (2015) relate M&As to proxies for financing constraints. Recent contributions that analyse the effects of M&As on innovation, prices, productivity and other outcome variables include Guadalupe et al. (2012); Ashenfelter et al. (2014); Braguinsky et al. (2015); Javorcik and Poelhekke (2017), to mention a few. See section two for a detailed discussion of related literature.

[3] Previous research has also shown that acquisitions by financial companies such as private equity firms can lead to lower financing constraints and induce higher investment and innovation (Amess et al., 2016; Boucly et al., 2011), but it is unclear whether these mechanism also apply to M&As in general.

assumption of exogenous selection of acquisition targets. In the case of endogenous selection, it is challenging to identify whether acquired firms are less financially constrained due to acquisitions per se or whether acquirers select firms with better financial performance.

In this paper, we try to overcome this problem by applying propensity score matching to construct an adequate control group of non-acquired firms with similar characteristics. We then compare changes in outcome variables around the time of acquisition events between acquired firms and the control group using a difference-in-differences (DiD) estimator. Further, we contribute to the literature by including the 2007-2009 financial crisis in our analysis and compare the effects of M&As across time periods with presumably different degrees of financial constraints. Compared to earlier studies, we also analyse a broader set of outcome variables and various heterogeneous effects across characteristics of acquiring firms and acquisition targets.

Our results indicate that, on average, acquisitions lead to higher growth of assets in target firms which is consistent with M&As relaxing liquidity constraints. In line with the common perception that financial constraints are particularly relevant for intangible investment, we find that this effect is most pronounced for the growth of intangible assets. Changes in acquirers' assets around the time of acquisitions indicate that this increase cannot be explained by income shifting in which intangibles are transferred from acquirer's to target's balance sheet.

Previous research shows that the degree of cash holdings is associated with financing constraints since managers use cash as an insurance towards future financial shocks (e.g., Opler et al., 1999). Our results indicate that target firms' cash holdings fall upon acquisition while debt ratios increase which is consistent with lower vulnerability to financial shocks and improved access to external finance. Changes in these variables are concentrated among target firms of relatively small size – which are arguably more likely to be financially constrained – and in acquisitions during the 2007-2009 financial crisis.

We also estimate a positive average effect of acquisitions on the growth of capital, sales, and employment. However, these effects are only significant for acquisitions that took place during a narrowly defined financial crisis period, which indicates the importance of financial factors for the effects of acquisitions on firm growth. Controlling for endogenous selection of acquisitions targets seems to be important in our sample, as acquirers, on average, tend to invest in relatively large, productive, and financially liquid target firms, but show a partly different selection profile during the financial crisis.

To measure financial constraints more directly, we also use the matched sample to estimate investment-cash flow and cash-cash flow sensitivities and allow for heterogeneous effects between acquired and non-acquired firms before and after acquisition. Following Fazzari et al. (1988) and

Almeida and Campello (2007), these sensitivities increase with the cost premium for external finance and thus the degree of credit constraints. We find that both investment-cash flow and cash-cash flow sensitivities fall significantly after acquisitions which is, again, consistent with M&As alleviating financial constraints in target firms.

The international economics literature argues that the characteristics of acquiring and target firms can be quite different in cross-border acquisitions (see, for instance, Guadalupe et al., 2012; Nocke and Yeaple, 2007). To test whether these characteristics matter for investment and financial indicators in target firms, we perform a separate matching and DiD analysis for international and domestic M&As. The average effects of M&As in our sample are mainly driven by domestic transactions, while most changes in our outcome variables of interest are statistically insignificant for cross-border M&As. This result can be explained by a selection effect since target firms in international acquisitions are significantly larger and more productive compared to domestic acquisition targets.

The rest of this paper is organized as follows. Section 2 discusses the related theoretical and empirical literature, section 3 provides a description of the data and section 4 describes the empirical strategy. Results of the empirical analysis are presented in section 5 and section 6 concludes.

2 Related literature

Capital markets are characterized by significant agency problems and information asymmetries between management and shareholders and between a firm's management and its creditors (e.g., Jensen and Meckling, 1976; Stiglitz and Weiss, 1981; Myers and Majluf, 1984; Jensen, 1986). Due to these information asymmetries, suppliers of finance are confronted with an adverse selection problem leading to the rationing of finance and external sources of financing being more expensive than internal sources. Some profitable investment projects will thus not be undertaken due to financial constraints. M&As might alleviate target firms' liquidity constraints due to access to the acquirers' resources or relationships with financiers, higher collateral of the merged entity, or signaling to potential providers of finance (Erel et al., 2015; Boucly et al., 2011). We test this hypothesis in the empirical analysis by analyzing growth rates of target firms pre and post acquisition and investigate how investments and cash savings of target firms depend on the availability of internal finance.

Since asymmetric information problems are arguably more pronounced for investment in innovative assets than for tangible investment, and the collateral value of intangible assets is limited, financial constraints are especially relevant for the financing of research and development (R&D) and other types of intangible investments (Brown et al., 2012). Further, the riskiness of R&D makes

debt financing particularly difficult to obtain, since in contrast to equity market investors, creditors do not benefit from upside returns (Brown et al., 2009; Hsu et al., 2014). If M&As decrease financing constraints, it is likely that we see a higher increase in the accumulation of intangible compared to tangible assets.

The extent to which firms are financially constrained is likely to vary across types of firms, countries, and time periods. For instance, large firms should experience little financing constraints due to relatively high collateral, stricter reporting requirements – which reduce information asymmetries between firms and financiers – and better access to equity markets. In contrast, low collateral and the difficulty to convey information to providers of finance make it more likely that small firms have to rely on internal financial resources and have limited access to bank loans (e.g., Behr et al., 2013; Carpenter and Petersen, 2002). If acquirers alleviate financial constraints in target firms, we would thus expect higher effects for acquisition targets that are initially relatively small. In our empirical analysis, we thus estimate heterogeneous effects according to the pre-acquisition size of target firms.

Our estimation sample covers the recent global financial crisis, a period where credit constraints were particularly important and had huge impact on economic outcomes (see, e.g. Chodorow-Reich, 2014). If target firms benefit from acquisition through lower financing constraints, we should therefore see larger effects for M&As during the crisis. We are not aware of a study that compares the effects of M&As in crisis- and non-crisis periods, especially with regard to the financial channel of acquisitions.

International M&As can be quite different from domestic ones. The foreign direct investment (FDI) literature argues that due to large sunk costs of entering a foreign market, only firms with superior productivity can operate abroad profitably (Helpman et al., 2004). Part of the knowledge underlying this superior productivity might be transferred to target firms (Markusen, 2002; Ekholm and Hakkala, 2007; Arkolakis et al., 2013) and lead to improved profitability and financial conditions, implying lower financial constraints.[4] Recently, the literature has argued that foreign acquisitions might be driven by liquidity of multinational firms (Alquist et al., 2014) and benefit target firms due to lower financing costs (e.g., Wang and Wang, 2015). It is likely that the effects of cross-border acquisitions depend on the timing of acquisitions as well. For instance, financial shocks and changes

[4]The productivity advantage of multinationals has, for instance, been related to management practices (e.g. Bloom and van Reenen, 2010) and differences in innovation and knowledge (e.g., Guadalupe et al., 2012). Besides knowledge transfer, foreign acquisitions might also benefit acquisition targets due to access to new markets (Guadalupe et al., 2012) or complementary assets of the acquiring firm (e.g., Nocke and Yeaple, 2007, 2008). Several empirical studies have documented significant performance gains in the form of productivity improvements in target firms after international M&As (e.g. Arnold and Javorcik, 2009; Chen, 2011; Guadalupe et al., 2012) while other scholars have argued that the effects of cross-border M&As are not that different from other ownership changes (e.g. Gugler et al., 2003; Fons-Rosen et al., 2013; Wang and Wang, 2015). There is a large literature on the effects of M&As on efficiency-related outcomes which either analyses domestic transactions or does not explicitly distinguish between domestic and international M&As. This literature indicates that domestic acquisitions can lead to productivity gains as well (e.g., Maksimovic and Phillips, 2001; David, 2013; Braguinsky et al., 2015).

in local demand during the 2007-2009 financial crisis differed across types of firms and countries.

A number of empirical studies show that foreign owned firms are less likely to be financially constrained than domestic firms (Bridges and Guariglia, 2008; Guariglia and Mateut, 2010; Harrison and McMillan, 2003), are less affected by local currency devaluations that increase debt (Desai et al., 2008) and display higher growth rates compared to domestically owned firms during the years of the financial crisis (Alfaro and Chen, 2012). However, these studies analyse cross-sectional differences in foreign ownership and therefore cannot isolate the causal effects of foreign acquisitions. Alquist et al. (2014) provide evidence that multinationals particularly target domestic firms in financially dependent industries and in countries with low levels of financial development. However, the authors only analyse financial factors as a determinant of FDI and foreign acquisitions, not whether financial constraints in target firms are indeed reduced as a result of being acquired. There is not much evidence on the effects of foreign acquisitions on target firms' liquidity or financial constraints. A notable exception is Wang and Wang (2015) who analyse the effects of international acquisitions in China before the years of the financial crisis.

The degree to which different types of M&As can reduce financial constraints is likely to depend on the type of firms being acquired. While some theories suggest that acquirers tend to select firms of high productivity and size (e.g., Guadalupe et al., 2012), which are typically not very likely to be financially constrained, other scholars argue that there are incentives to invest in underperforming target firms (e.g., Neary, 2007) or that the selection profile depends on industry characteristics such as the type of capabilities that determine productivity (Nocke and Yeaple, 2007). Whether target firms are likely to face financing constraints before acquisitions, and domestic and international M&As thus have the potential to reduce these constraints, is therefore ultimately an empirical question.

3 Data

Data and sample selection We link financial data on European firms from the Amadeus database to data on domestic and international M&As between 2003 and 2012 from the Zephyr database, both provided by Bureau van Dijk. The Amadeus database contains financial information on public and private firms for 43 countries in Europe, including standardized annual accounts. We use information from unconsolidated accounts to separately identify economic activity in target firms, and match our financial variables to information from Zephyr using a common firm identifier. The Zephyr database contains M&A, IPO, private equity and venture capital deals, and provides information on various characteristics of the deal, e.g. date, deal value, deal type, stake, target and

buyer firms. By combining these two datasets, we are able to analyse financial information for target firms before and after an acquisition. In addition, we use data on firms which are not involved in M&As in the considered period to construct a control group.

The data are cleaned in the following way. First, we drop observations with implausible values, like negative employment, fixed assets, leverage, and cash holdings. Second, to deal with extreme outliers, we delete the lower and upper 0.5% quantile of each variable. In addition, we drop very small firms with a median value of operating revenue smaller than half a million euros or less than 5 employees based on all available observations per firm. Following Erel et al. (2015), we also address the concern that some firms' assets cannot be identified correctly after an acquisition if acquirers transfer some of their assets to the target firm. We therefore exclude firms with implausible large changes (changes of more than 100%) in the number of employees from one year to another from the analysis. This procedure is also applied to non-acquired firms, as large variations in employment might indicate an unreported merger. Finally, financial variables are deflated using data from the European Central Bank and Eurostat.[5]

The analysis is restricted to firms in the manufacturing sector (NACE Revision 2, 2-digit industry codes 10-33). In the main specification, we focus on completed majority acquisitions where the stake controlled rises from below to at least 50%. After restricting the sample to targets with information on all necessary variables for our empirical analysis, the final M&A sample consists of 736 deals between 2003 and 2012. Table 1 provides an overview of some deal characteristics. We refer to a cross-border deal if acquiring and target firm are located in different countries, whereas domestic deals cover M&As within the same country. The financial crisis period is defined as the period between the second half of 2007 and the end of 2009 (see, e.g., Flannery et al., 2013).[6] Almost one quarter of deals took place during the recent financial crisis. On average, 41% of M&As are cross-border, though this share is increasing over time from 32% in the pre-crisis to 47% in the post-crisis period.[7]

Construction of variables We exploit information from firms' balance sheet and profit and loss accounts to construct our outcome and control variables. Data on sales, labour and capital stock (measured as tangible fixed assets) provide information on a firm's growth path, size, and capital intensity. Financial conditions and liquidity are captured by cash and cash equivalents, working capital (current assets less current liabilities), cash flow, and leverage which we measure relative to total assets. The average wage (costs of employees divided by number of employees)

[5] We use the *Gross domestic product at market price* deflator for EU-28 countries.
[6] We also distinguish between this rather broad and a more narrow crisis period in some regressions.
[7] The distribution of target firms across countries is depicted in Table A.1 in the Appendix.

approximates the average skill level in the firm, and the share of intangible fixed assets in fixed assets is used as a proxy for R&D. To obtain a measure of total factor productivity (TFP), we apply the generalized method of moments (GMM) estimation strategy suggested by Wooldridge (2009), controlling for unobserved productivity shocks using investments (Olley and Pakes, 1996). We estimate separate production functions per 2-digit NACE industry by relating operating revenue to capital, employment and material costs. We define firm-level TFP as the residual from this regressions which is thus estimated as the deviation of productivity from the industry-specific mean. Finally, we use information on the firm's age and legal form.[8]

4 Econometric strategy

The aim of our study is to identify the causal impact of M&As on target firms' financing constraints, investment and growth. For this purpose, we combine a DiD estimator with propensity score matching.

The effect of acquisition can be formalized by the average treatment effect on the treated (ATET)

$$\beta_{ATET} = E[y^1_{t+s}|MA_t = 1] - E[y^0_{t+s}|MA_t = 1], \tag{1}$$

where y^1_{t+s} describes the observed outcome s periods after acquisition, and y^0_{t+s} the hypothetical outcome in the absence of acquisition. MA_t is a binary variable equal to one if a firm is acquired in period t and zero otherwise. The second term $E[y^0_{t+s}|MA_t = 1]$ constitutes the counterfactual situation, i.e. the firm's outcome had it not been the target of a deal. We employ a matching procedure to obtain an estimate for this unobserved outcome by constructing a comparison group of firms which are not acquired, but observationally similar to target firms. Specifically, we use propensity score matching as proposed by Rosenbaum and Rubin (1983), and exploit balance sheet data to estimate the probability of acquisition. The average outcome of the comparison group is then used to identify the mean counterfactual outcome of target firms in the absence of acquisition. To illustrate, Equation 1 can be rewritten as follows:

$$\begin{aligned}\beta_{ATET} = {} & E[y^1_{t+s}|MA_t = 1, X_{t-1}] - E[y^0_{t+s}|MA_t = 0, X_{t-1}] \\ & -(E[y^0_{t+s}|MA_t = 1, X_{t-1}] - E[y^0_{t+s}|MA_t = 0, X_{t-1}]).\end{aligned} \tag{2}$$

The first term describes the difference in observed outcomes between acquired and non-acquired firms. The second term represents a comparison between the hypothetical outcome of acquired

[8] For variable definitions see Table A.2 in the Appendix.

firms had they not been acquired and the observed outcome of non-acquired firms. The latter is the bias we aim to minimize by selecting non-acquired firms which are as similar as possible to target firms with respect to pre-acquisition characteristics X_{t-1}.

We further combine the propensity score matching with a DiD estimator (e.g. Blundell and Costa Dias, 2000). The DiD estimator compares the targets' outcome in the period before acquisition with the outcome s periods afterwards, controlling for the difference in outcomes of matched non-acquired firms:

$$\beta_{DiD} = E[y^1_{t+s} - y^1_{t-1}|MA_t = 1, X_{t-1}] - E[y^0_{t+s} - y^0_{t-1}|MA_t = 0, X_{t-1}]. \tag{3}$$

This procedure has the advantage that the assumption of selection on observables is relaxed by allowing the selection into acquisition to be correlated with time-invariant unobservable characteristics.

The estimation strategy consists of the following steps. First, we predict the probability that a firm is acquired in period t based on firm characteristics in $t-1$ using a Probit model. The sample includes both acquired firms as well as firms which are not involved in M&As in the whole period under study. By means of the estimated probability, the so-called *propensity score*, we apply one-to-one nearest neighbor matching without replacement, i.e. each acquired firm is matched to one firm in the comparison group of non-acquired firms such that the difference in propensity scores is minimized.[9] Using this matched data set, the DiD procedure involves simple ordinary least squares (OLS) regressions of the change in outcomes on the dummy for acquisition:

$$\triangle y_{it+s} = \alpha + \beta_{DiD} MA_{it} + \epsilon_{it}. \tag{4}$$

Heterogeneous effects of acquisition are calculated by testing for significance of $\hat{\beta}_{2,DiD}$ using the following specification:

$$\triangle y_{it+s} = \alpha_0 + \beta_{1,DiD} MA_{it} + \beta_{2,DiD}(MA_{it} \times small_i) + \beta_{3,DiD} small_i + \eta_{it}, \tag{5}$$

exemplified on the basis of the target firm's pre-acquisition size (proxied by a binary variable *small*). We examine effects on cash ratio, leverage ratio, capital stock, intangible assets ratio, sales and employment (all ratios are divided by the firm's total assets). To account for possible heteroscedasticity, we compute robust standard errors.[10]

Similar to Erel et al. (2015), we consider the change in cash holdings after acquisition. The idea is

[9] The choice of matching with or without replacement can be seen as a tradeoff between bias and variance. Since our sample of potential firms in the comparison group is large, we decide to perform matching without replacement.

[10] There is no need to cluster standard errors by firms since equations 4 and 5 are estimated separately by time period and therefore do not include repeated firm observations.

a precautionary motive in the presence of capital market imperfections, as described by Keynes (1936, p. 196): "To provide for contingenties requiring sudden expenditure and for unforeseen opportunities for advantageous purchases [...]", and taken up by e.g. Kim et al. (1998) and Opler et al. (1999). If the management maximizes shareholders' wealth, cash holdings are set such that their marginal benefit equals their marginal cost: holding cash is costly since it lowers the rate of return, but it is beneficial as it can be used to finance investments if external sources of financing are not available or simply too costly. Hence, as "there is no necessity to hold idle cash to bridge over intervals if it can be obtained without difficulty at the moment when it is actually required" (Keynes, 1936, p. 196), the amount of cash held by the firm should be higher the more it expects to face financing constraints in the future.[11] Consequently, if M&As reduce target firms' financing constraints, the cash ratio is expected to decrease after acquisition. Similarily, if firms obtain better access to capital markets, debt may be used as a substitute for holding liquid assets such as cash holdings.[12] Hence, in the presence of investment opportunities and financing constraints pre-acquisition, the leverage ratio should rise after a deal.[13]

We further test for increases in investment by analyzing the change in tangible and intangible fixed assets. If investments can be financed more easily as a result of improved access to finance, we expect assets to increase after a deal. This effect might be most pronounced for intangible assets, which are particularly prone to asymmetric information problems. Moreover, we analyse additional firm outcomes, namely labour and sales. Higher liquidity may reduce growth constraints, allowing target firms to hire new employees and generate higher output.

To obtain an alternative indicator of financing constraints, we estimate investment-cash flow and cash-cash flow sensitivities. Using the intuition that external finance is more costly than internal finance, a seminal paper by Fazzari et al. (1988) studies the relation between investment and internal finance in the presence of financing constraints. They argue that financially constrained firms, which rely on internal sources to finance investments, should display a positive sensitivity of investment to cash flow (as a proxy for internal funds). In contrast, investment decisions of unconstrained firms are not expected to depend on cash flow. The approach of Fazzari et al. (1988) is controversial and has been criticized extensively (e.g., Kaplan and Zingales, 1997; Erickson and Whited, 2000; Gomes, 2001; Cleary et al., 2007). The criticism involves that investment-cash flow sensitivities do

[11] Empirical work such as Opler et al. (1999) show a negative relation between access to the capital market and the amount of cash held by the firm. More recently, Hadlock and Pierce (2010) also find that firms with more cash are more likely to be financially constrained.

[12] Kim et al. (1998) test this explanation and provide evidence that the leverage ratio is negatively related to liquid assets.

[13] We argue that increased leverage after acquisition is consistent with relaxed credit constraints as firms are able to rely more on external financial funds, in line with e.g. Bellone et al. (2010) and Boucly et al. (2011). In contrast, Wang and Wang (2015) interpret a decrease in the leverage ratio and an increase in the liquidity ratio as a reduction in financing constraints.

not increase monotonically with the level of financing constraints. In addition, critics argue that a positive cash flow coefficient may partly capture the correlation between cash flow and investment opportunities. However, this indicator has been applied in several recent contributions which find positive cash flow sensitivities for constrained firms even in cases where mismeasurement of investment opportunities is a minor concern (see, for instance, Almeida and Campello, 2007; Bond and Söderbom, 2013). In addition, it has been argued that even in the presence of measurement error, *differences* in investment-cash flow sensitivities are at least a useful measure of *differences* in financing constraints across different groups of firms (see also Erel et al., 2015). Hence, if acquirers facilitate access to external finance, we expect that target firms' investment depends to a lesser extent on cash flow.

To analyse how the cash flow sensitivity of investment changes after an acquisition, we estimate:

$$I_{it} = \gamma_0 + \gamma_1 CF_{it} + \gamma_2 after_{it} + \gamma_3 (after_{it} \times CF_{it}) + \gamma_4 X_{it} + d_t + \alpha_i + u_{it}, \tag{6}$$

where I_{it} measures investment in capital (calculated as the change in tangible fixed assets plus depreciation) of firm i at year t, CF denotes cash flow, and *after* is a binary variable which takes on value one after acquisition. I and CF are scaled by the beginning-of-year capital stock. X contains control variables, for instance, sales growth as a proxy for investment opportunities and year dummies (d_t). We are primarily interested in the change of the cash flow sensitivity of investment after acquisition: if firms' financing constraints decrease after a deal, we expect γ_3 the coefficient on the interaction term between *after* and CF to be negative and statistically significant. Taking into account the criticism that the sensitivity may not monotonically increase with the level of financing constraints, the results would be most convincing if the overall sensitivity was positive and significant in the absence of an acquisition (indicated by a positive coefficient γ_1), but small and insignificant after acquisition ($\gamma_1 + \gamma_3 \approx 0$). To deal with potential unobserved heterogeneity, we apply a fixed effects (FE) estimator, and use the results of the propensity score matching, i.e. the sample includes target firms and their matched controls. Standard errors are clustered at the firm level.

A related measure of financing constraints is the sensitivity of cash to cash flow (Almeida et al., 2004). The idea is that a financially constrained firm will increase its cash holdings due to an increase in cash flow to finance investments today and in the future, while an unconstrained firm's cash holdings do not systematically vary with cash flow.[14] Since cash is a financial variable (rather than a variable capturing firm growth such as investment), the authors argue that this measure avoids some problems associated with the investment-cash flow sensitivity, for example that a positive cash

[14]Other authors, e.g. Khurana et al. (2006) and Hadlock and Pierce (2010), also provide empirical evidence that the cash flow sensitivity of cash is related to a firm's financing constraints.

flow coefficient simply captures the correlation between cash flow and investment opportunities.[15] However, they point out that the cash-cash flow sensitivity of constrained firms does not necessarily increase monotonically with the degree of financing constraints, since the degree depends on the borrowing capacity and on the size of the firms' cash flows relative to their investment opportunities (Almeida et al., 2004, p. 1785). Similar to Equation 6, we use the following equation to estimate cash-cash flow sensitivities:

$$\triangle Cash_{it} = \delta_0 + \delta_1 CF_{it} + \delta_2 after_{it} + \delta_3 (after_{it} \times CF_{it}) + \delta_4 X_{it} + d_t + \alpha_i + w_{it}, \tag{7}$$

where $\triangle Cash$ is the change in cash holdings between two consecutive years. $\triangle Cash$ and CF are scaled by beginning-of-year total assets. We use the same estimation technique and sample as for the cash flow sensitivity of investment. If financing constraints decrease after acquisition, δ_3 is expected to be negative. Again, the most clear-cut result would be a positive and significant cash flow coefficient in the absence of an acquisition (δ_1), and a small and insignificant cash-cash flow sensitivity post-acquisition ($\delta_1 + \delta_3$).

5 Results

5.1 Effect of M&As on financial variables, investment, and firm growth

Baseline specification

Results of the Probit estimation for the probability that a firm is acquired in a given period are shown in Table 2. In addition to firm characteristics, we include industry dummies at the NACE 2-digit level, year dummies, and country dummies in the estimation. Large firms with high liquidity, and firms with a high capital intensity are more likely to be acquired. In addition, public limited companies seem to be more likely to become the target of a deal. The negative coefficient for the change in sales indicates that target firms experience lower sales growth before acquisition. Higher average wages and a higher share of intangible assets also increase the probability of a deal. This is in line with the idea of *cherry-picking*, i.e. only the best performing firms within an industry are selected for acquisition (Guadalupe et al., 2012). The negative coefficient for TFP does not point in the same direction. However, as Table 3 shows, unconditional on other variables, target firms are significantly more productive than non-acquired ones. A reason for the negative coefficient for TFP

[15] However, their approach has been critized by Riddick and Whited (2009). They show in a dynamic framework that cash holdings are in fact negatively related to cash flow when accounting for measurement error in *Tobin's q*. In addition, they argue that the amount of cash savings is not only related to a firm's financing constraints, but also (and to a greater extent) to its income uncertainty.

might be that this variable is highly correlated with other included firm characteristics such as firm size, the average skill level, and the importance of intangible assets.

After performing the matching procedure, we check the balancing condition, i.e. whether conditional on the propensity score, selection into acquisition is independent of observable firm characteristics.[16] In Table 3, we report t-tests for the equality of means between treated and non-acquired (control) firms. Before matching, we observe significant differences in the firm characteristics used in the Probit estimation: acquired firms are on average larger, more capital-intensive, more innovative and more productive than non-acquired firms. Hence, there is selection of firms into acquisition, which justifies our matching approach. After matching, however, the hypothesis of equal means cannot be rejected at conventional significance levels for all variables. In addition, the mean propensity scores do not significantly differ after matching, i.e. the average probability of being acquired is very similar in both groups.

The results of DiD estimations are displayed in Table 4. They are consistent with the view that M&As reduce financing constraints and foster growth in target firms. Compared to non-acquired firms, target firms experience on average a significant decline in the cash ratio. Considering the fact that the average cash ratio of target firms is 8.7% in the year before acquisition, a decline of 1.2 percentage points in the second year after a deal implies a reduction of around 14%. The estimates are similar to Erel et al. (2015), who find that cash holdings over total assets are reduced by 1.4 to 1.7 percentage points. The decrease in the cash ratio comes along with a moderate increase in the leverage ratio. This effect is driven by a significant rise in long-term debt, suggesting that firms obtain better access to external finance after a deal.[17] Since we use unconsolidated balance sheet information, i.e. financial statements of target firms themselves (in contrast to consolidated information which includes the parent company and its other subsidiaries), the increase in debt is unlikely to be due to borrowed funds in the context of the deal financing which would appear in the acquirers' accounts (see also Boucly et al., 2011, p. 435). With regard to investment, acquired firms increase their intangible assets ratio by 0.5 to 1.2 percentage points. This corresponds to a rise in intangible assets from around 17% in the year of the deal to 40% two years afterwards when taking into account that the mean intangible assets ratio is about 3% in the pre-acquisition year.[18] In addition, we find a positive, albeit a smaller, impact on the capital stock which amounts to approximately 8.7% in the second year after a deal. The findings are qualitatively similar but

[16] Note that the common support condition is fulfilled for all acquired firms in the sample.

[17] See Table A.3 in the Appendix where we separately analyse the change in long-term debt and current liabilities, the two components of leverage.

[18] As a robustness check, we perform the DiD estimation for the log of intangible assets as an outcome variable (see Table A.3 in the Appendix). Since around 22% of acquired firms have zero intangible assets in the pre-acquisition year, the log of intangible assets is calculated as ln(Intangible Assets + 1). The estimates are highly significant and similar in magnitude.

smaller than in Erel et al. (2015) who estimate an increase in the mean firm's gross investment by 23% to 31%. While they do not distinguish between tangible and intangible fixed assets, our results indicate that the rise in investment is mainly driven by intangible assets. Moreover, we analyse changes in labour and sales, and find positive growth effects two years after acquisition.

One might be concerned that the large increase in intangible assets is related to transfer pricing and accompanied by a decrease in acquirers' intangible assets after acquisition. In Table A.4 in the Appendix, we therefore compare mean intangible assets of acquirers in the year before a deal with respective figures up to two years afterwards.[19] Our results indicate that acquirers' intangibles do not decrease upon acquisition. This result holds both for the log of intangible assets and for the ratio of intangible assets to total assets, whereat for the former we even identify a statistically significant increase. Further, as we discuss below, most of the effects are concentrated in domestic deals, hence dispelling the concern that transfer pricing drives the results.

If target firms' financial constraints are indeed decreasing after acquisition, we should see greater effects for firms which are a priori more likely to be financially constrained and suffer from underinvestment. One proxy for the cost of external funds in the literature is firm size (e.g. Hennessy and Whited, 2007; Hadlock and Pierce, 2010; Erel et al., 2015), with smaller firms presumably facing higher costs due to higher information asymmetries and lower collateral. We calculate heterogeneous effects of acquisition with regard to firm size by interacting the treatment indicator with a binary variable *small* (Equation 5). A firm is treated as small if its pre-acquisition employment is below or equal the bottom tercile of acquired and matched control firms (48 employees). Table 5 illustrates that the effect of acquisition is especially pronounced for small firms. In particular, the decrease in the cash ratio and the increase in the capital stock are high in magnitude and statistically significant for this group of firms only. We also find a stronger rise in employment for small firms. However, with regard to investments in intangible assets, we do not find large differences related to firm's size.

Cross-border versus domestic acquisitions

The effects of M&As on target firms' financing constraints are likely to differ by the acquirers' origin. Foreign-acquired firms may benefit from greater access to (foreign) capital markets, which is likely to lower their costs of external sources of financing. This is especially important if acquiring firms active in international acquisitions are those which are highly productive (e.g. Helpman et al., 2004) and financially liquid (e.g. Alquist et al., 2014). However, the potential to decrease financing constraints after acquisition depends crucially on the degree target firms are constrained before a deal.

[19] Unfortunately, we only have data on intangible assets for a limited number of acquirers: the figures in Table A.4 are based on the 27% of deals for which we have information on acquirers' intangible assets in all three years.

We distinguish cross-border and domestic acquisitions, and perform the propensity score matching and DiD estimation separately for both deal types, considering the fact that the selection profile might differ.[20] The results of the Probit regressions are shown in Table A.5 in the Appendix. As for the whole sample of target firms, large firms in terms of employment, and those with high average wages and a high share of intangible assets are more likely to be selected into both domestic and foreign acquisitions. Targets of international acquisitions are more capital-intensive and productive, while domestic-acquired firms are more liquid than non-acquired ones. DiD estimates are displayed in Table 6.[21] The results indicate that the average effects of acquisition and therefore the evidence for a reduction in financing constraints mainly stem from target firms in domestic deals: their cash ratio (leverage ratio) decreases (increases) significantly after acquisition, and we observe a substantial rise in intangible assets. For target firms in international acquisitions, there is some evidence of positive growth effects with regard to sales, pointing to another channel firms benefit from acquisition, namely the access to new markets.[22]

One explanation for these findings is that domestic acquisitions per se lead to a larger decrease in firms' financing constraints. Similar to Wang and Wang (2015), we therefore directly compare the effects of cross-border and domestic M&As, and perform another propensity score matching using domestic-acquired firms as a control group.[23] Since the matching is aimed at finding control firms with similar pre-acquisition characteristics, we are able to assess directly if the effects found in Table 6 are due to the deal type or to targets' characteristics. While the leverage ratio significantly decreases for firms in cross-border relative to firms in domestic deals, we find neither significant differences in the cash ratio nor in assets accumulation (see Table A.9 in the Appendix). However, the effect for leverage disappears when additionally controlling for pre-acquisition age and cash flow in the DID estimation, the variables which are not completely balanced between foreign-acquired and domestically acquired firms after matching.[24] Hence, the deal type does not seem sufficient to explain the differences in outcomes between international and domestic acquisitions.

An alternative explanation is related to the selection of target firms into cross-border and do-

[20] For about 3% of acquired firms (=20 deals), we have no information on whether the deal is cross-border or domestic. These observations are excluded from this analysis.

[21] Again, we apply one-to-one nearest neighbor matching without replacement using non-acquired firms as a control group. The balancing condition is tested in Table A.6 in the Appendix.

[22] We also analysed if effects for cross-border deals differ by the acquirers' country or region but did not find a systematic pattern of heterogeneous effects.

[23] As the number of potential control firms (i.e. domestic-acquired firms) is only somewhat larger than the number of treated firms (i.e. foreign-acquired firms), we allow for propensity score matching with replacement. In addition, the common support condition is imposed, i.e. foreign-acquired firms which are off common support are not included (corresponds to 30 deals in our sample). Tables A.7 and A.8 in the Appendix display the results of the Probit estimation and the propensity score matching.

[24] More precisely, we perform the DID estimation in Equation 4, while additionally controlling for the log of age and the cash flow ratio in period *t-1*, as well as their respective interaction with the treatment indicator *MA* (results available upon request).

mestic M&As. Summary statistics in Table A.8 in the Appendix show that, in the pre-acquisition year, target firms in domestic deals are significantly smaller than those in cross-border deals. The former are therefore more likely to be financially constrained before acquisition which increases the potential for reducing such constraints. As discussed before, the effect of acquisitions are particularly pronounced for small firms (which are overrepresented in domestic deals). Therefore, the different findings for domestic acquisition might be due to selection rather than the deal type per se.

Crisis versus non-crisis acquisitions

Our sample of M&As covers the recent global financial crisis, a period where credit constraints were particularly important and had huge impact on economic outcomes (see, e.g. Chodorow-Reich, 2014). If target firms benefit from acquisition through lower financing constraints, we should therefore see larger effects for M&As during the crisis.

To analyse effects of M&As during the crisis, we consider both a broad and a narrow crisis period: the broad period includes M&As between the second half of 2007 and the end of 2009, while the narrow period starts with the Lehman bankruptcy in September 2008. We perform the matching and DiD estimation separately for the three groups regarding their time of acquisition (narrow crisis, broad crisis, non-crisis period) since the motivation of parent firms to engage in an acquisition is likely to be different during an economic crisis.[25] When comparing target firms' characteristics across time periods, we see that firms differ, primarily in their TFP: those acquired during the crisis (narrow period) are equally productive than the industry average, while those involved in deals before and after the crisis are substantially more productive (about 15%) than the other firms in their industry.

Table 7 displays the results of DiD estimations for various outcomes. With the exception of the increase in intangible assets, the effects virtually disappear for M&As outside the financial crisis. For deals during the crisis, especially for the period after the Lehman bankruptcy, however, we observe a decrease in cash and a strong increase in the capital stock of about 23% two years after acquisition. In addition, compared to non-acquired firms, target firms experience a significant increase in sales and employment when taken over during the crisis. Hence, most of our effects are concentrated among M&As in crisis years, emphasizing the financial channel of acquisition which benefits target firms when financing constraints are presumably most severe.

When examining more closely the impact of M&As during the crisis, our results indicate that it is especially firms in technology-intensive industries which benefit from acquisition. In Table

[25] Again, we perform a one-to-one nearest neighbor matching without replacement. Firms not involved in M&As are used as a control group. The Probit estimations and balancing tests are given in Tables A.10, A.11 and A.12 in the Appendix.

A.13 in the Appendix, we show that the overall average effect of acquisition on the capital stock stems from target firms in high-tech industries.[26] By contrast, non-acquired firms in these industries significantly decrease their capital stock during the crisis. A similar pattern is found for the change in cash holdings, but this effect is not statistically significant. As firms in high-tech industries are likely to be particularly dependent on external finance, the findings for acquisitions during the financial crisis reinforce the idea that M&As may decrease liquidity constraints in target firms.[27]

5.2 Effect of M&As on other outcomes

Cash flow sensitivities

To provide further evidence that M&As reduce target firms' financing constraints, we present estimation results for cash flow sensitivities of investment and of cash holdings. Again, the idea is to measure how investment and cash holdings respond to changes in internal funds. According to Fazzari et al. (1988) and Almeida et al. (2004), a financially constrained firm will increase its investment respectively cash holdings due to an increase in cash flow, while an unconstrained firm's investment (respectively cash holdings) should not systematically vary with cash flow. We are interested in how these sensitivities change after acquisition. Estimates for the cash flow sensitivity of investment (Panel A) and of cash (Panel B) are shown in Table 8. In the first column, we present fixed effects regressions using all acquired and matched control firms. The coefficient on cash flow is positive and significant in both equations, indicating that firms are indeed financially constrained.

The negative estimates for the interaction term between cash flow and the dummy *after* are consistent with the view that firms' financing constraints decrease after a deal. However, the absolute value of cash flow sensitivities after acquisitions (the sum of the coefficients for CF and $CF \times after$) are still significantly different from zero (see F-tests in Table 8). Our interpretation of results, therefore, has to be treated with caution when taking into account the criticism that the relationship between cash flow sensitivities and the level of financing constraints may not be monotonous. In the second and third column, we add additional control variables, namely sales growth as a proxy for investment opportunities, and the log of total assets to control for firms' size. The results remain similar. In the fourth column, we drop the year of the deal for acquired firms to make sure that

[26] The classification is based on the aggregation of the manufacturing industry according to technological intensity by the European Commission (Eurostat), see `http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf`, accessed Jan 24, 2017. We distinguish high-technology (high tech and medium-high tech) and low-technology (low-tech and medium-low-tech) industries. To estimate heterogeneous effects by technological intensity, we exploit Equation 5 using acquired firms during the narrow crisis period and their matched controls, and replacing *small* with an indicator variable *hightech*.

[27] We do not observe heterogeneous effects by technological intensity for the sample of acquired firms over the whole sample period (see Table A.14 in the Appendix). One reason might be that high-tech firms are less financially constrained during non-crisis periods.

the findings are not solely driven by contemporaneous effects. While the interaction term between cash flow and *after* is no longer significant for the cash flow sensitivity of investment, the decrease in the cash-cash flow sensitivity after acquisition is still significant and high in magnitude. In the last column, we add a binary variable *Deal* (=1 for acquired firms, =0 for non-acquired firms), and interact it with cash flow to control for permanent differences in sensitivities that affect firms' behaviour both pre- and post-acquisition. The results are robust. All in all, the estimates in Table 8 support the previous findings that financing constraints decrease after M&As.

Total factor productivity

Previous empirical evidence shows that domestic and international M&As sometimes lead to productivity improvements in target firms (e.g. Arnold and Javorcik, 2009; Guadalupe et al., 2012; Wang and Wang, 2015). If these gains lead to higher profitability, acquired firms' improved financial conditions may simply be an indirect effect that stems from higher productivity post-acquisition. To examine whether this channel explains our previous results, we perform the DiD estimation with TFP as an outcome variable. In addition to the whole sample of target firms, productivity effects are estimated separately for cross-border and domestic acquisitions, and for firms acquired in crisis and non-crisis periods.[28] Moreover, we split firms based on their productivity in the pre-acquisition year, treating them as *low productive* if their TFP is below or equal the industry average (corresponds to 29% of acquired firms). To estimate heterogeneous effects of acquisition by initial productivity level, we exploit Equation 5 and replace the indicator of firm size *small* with a binary variable *lowprod* characterizing low productive firms. The results are illustrated in Table 9. In contrast to previous work, we do not find a significant impact of M&As on target firms' productivity on average. These findings do not change when considering different deal types, or acquisitions during and outside the recent financial crisis. Initially low productive firms, however, experience a increase in TFP of about 5% in the first and second year after acquisition. This result is consistent with productivity effects of M&As that are concentrated in low productive targets which presumably have most to learn from the superior productivity and knowledge of parent firms. All in all, our estimated productivity effects indicate that productivity improvements occur for some firms but are unlikely to be the main explanation for the relationship between M&As and financial indicators.

[28] To estimate separate productivity effects for different deal types and time periods, we draw on the results of the separate matching procedures (see Chapter 5.1).

5.3 Robustness checks

We perform several robustness checks which we apply to the baseline DiD specification. These are briefly summarized in this section and documented in the Appendix (Tables A.15 to A.19).

First, the robustness of the results towards the matching procedure is analysed. We initially stick to one-to-one nearest neighbor matching based on the propensity score, but conduct matching with replacement. In addition, regarding the propensity score estimation, we use a Logit instead of a Probit regression, and include some key variables two years before the deal to control for pre-acquisition trends.[29] We also experimented with other matching algorithms, and implement caliper matching which avoids bad matches by imposing a maximum tolerance level for the propensity score distance, radius matching which uses all non-acquired firms within a caliper as control firms, and two variants of Mahalanobis matching as well as kernel matching. With regard to Mahalanobis matching, we perform a one-to-one nearest neighbor matching on the propensity score while putting additional weight on the firm's year and country (first specification), and on the firm's year and industry (second specification), in order to rule out the concern that acquired firms are compared to control firms in different countries or industries. The main findings are not affected by this variation in matching algorithms. However, the effects on the capital stock, labour and sales are smaller and become insignificant in some specifications. Nevertheless, the general result that acquisitions spur growth in target firms still holds, whether in terms of capital, employment, or sales.

Second, our approach to combine propensity score matching with a DiD estimator is only valid if the Stable Unit Treatment Value Assumption (SUTVA) is fulfilled, i.e. if outcomes of matched non-acquired firms are not affected by acquisitions. Since we compare similar firms in terms of observable characteristics within industry, year and country, this assumption could be violated – particularly if a control firm is located in the same region within a country as the corresponding acquired firm. We therefore exclude those pairs and reestimate the DiD regression.[30] Since the results remain almost unchanged, we argue that a violation of this assumption is a minor concern in our case.

Third, our matching strategy and DiD estimates are compared to results on an unmatched sample. We perform OLS regressions similar to Equation 4; however, we do not rely on the matched data set, but use target firms and all non-acquired firms (not only matched ones). In the first OLS specification, the change in outcomes is regressed on the dummy MA, lagged firm characteristics X_{t-1} used to estimate the propensity score, and time, year and country dummies. In another

[29] The key variables include cash ratio, leverage ratio, capital stock, employment, and intangible fixed assets over fixed assets.

[30] This applies to 4 pairs of acquired and matched control firms. Unfortunately, for 276 firms (196 acquired firms, 171 control firms) we do not have information about their region.

specification, we regress the change in outcomes on the dummy MA, and apply propensity score reweighting, i.e. each acquired firm is weighted by 1 and each firm in the comparison group by $\hat{p}/(1-\hat{p})$ with $\hat{p}$ being the estimated propensity score. Standard errors are clustered at the firm-level. Our previous findings for cash ratio, leverage ratio, intangible assets ratio, sales and labour are confirmed. As in some other robustness checks, the change in the capital stock becomes smaller in magnitude and statistically insignificant.

6 Conclusion

Agency problems and information asymmetries on capital markets can lead to the rationing of finance. Firms which are financially constrained may not be able to exploit investment opportunities because their cost premium for external finance is too high. M&As may alleviate target firms' liquidity constraints since, for instance, being part of a larger organization may ease access to bank loans due to higher collateral and signaling to providers of finance. Previous literature has primarily looked at the effects of M&As on efficiency-related outcomes, but evidence on the financial channel of acquisitions is still scarce.

This paper provides evidence on the impact of domestic and cross-border M&As on financing constraints, investment, and growth in acquired firms. We use a panel data set of European target firms exploiting balance sheet information before and after acquisition, and combine propensity score matching with a DiD estimator. The results are consistent with the view that M&As reduce financing constraints and foster growth in target firms. Our findings indicate that, on average, acquisition targets hold less cash but increase leverage, suggesting that they obtain better access to capital markets and are less in need of liquid assets for precautionary reasons. In addition, we find higher growth of assets after a deal, and increases in employment and sales. The results vary across firm types, deal types, and the time of M&As. Some of our estimated effects are most pronounced for relatively small targets which are likely to be particularly constrained. In addition, there are stronger responses for those acquired during the recent financial crisis, highlighting the financial channel of acquisition which benefits target firms by decreasing liquidity constraints when they are most severe. Interestingly, the effects are concentrated among domestic acquisitions, while most changes in outcomes are statistically insignificant for firms acquired in international M&As. However, this finding seems to be due to firms' pre-acquisition characteristics rather than the deal type per se.

When assessing the potential benefits of acquisitions from an economic policy point of view, financial factors such as the alleviation of liquidity constraints should be taken into account. This

channel is important, since availability of finance is crucial for growth and value creation in acquisition targets. Our results indicate that an active market for corporate control may be particularly beneficial during time periods in which some firms face unusually severe credit constraints such as during the recent financial crisis.

For future research, it might be interesting to analyse the channels that lead to alleviation of financing constraints upon acquisition in more detail. This would create new insights on the motives of firms to engage in M&As and would therefore enrich the discussion on potential benefits of acquisitions. Further, it would be interesting to analyse a sample of target firms that is not limited to European countries and construct alternative measures of financial constraints.

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Tables

Table 1: M&A deals between 2003 and 2012.

	Absolute	Share (%)	Cross-border (%)
Before the crisis	248	34	32
In the crisis	178	24	43
After the crisis	310	42	47
Total	736	100	41

NOTES: For 3% of all deals it is not known if the deal is cross-border or domestic. Crisis: 07/2007-12/2009.

Table 2: Probit regression. Prediction of M&A deals.

Cash ratio	0.0730	Leverage ratio	0.1618*
	(0.1304)		(0.0846)
Working capital ratio	0.2329***	ln(Wage)	0.2278***
	(0.0861)		(0.0516)
ln(Capital)	0.0421***	Public	0.0645*
	(0.0148)		(0.0333)
ln(Labour)	0.4671***	ln(Age)	– 0.0170
	(0.0714)		(0.0185)
$\ln(\text{Labour})^2$	– 0.0280***	Intangible assets share	0.5379***
	(0.0077)		(0.0853)
$\triangle$ln(Sales)	– 0.0911*	TFP	– 0.0231
	(0.0509)		(0.0516)
Cash flow ratio	0.0285		
	(0.1536)		
Industry dummies	yes		
Country dummies	yes		
Year dummies	yes		
N	276,801		
Pseudo R^2	0.1552		

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. Number of observations N. The explanatory variables are lagged one period before the deal.

Table 3: Propensity score matching. Testing the balancing property.

	Unmatched	Mean			t-test	
	Matched	Treated	Control	%bias	t	p> |t|
Cash ratio	U	0.087	0.089	-2.0	-0.52	0.600
	M	0.087	0.083	2.7	0.53	0.599
Working capital ratio	U	0.227	0.212	6.2	1.73	0.083
	M	0.227	0.226	0.4	0.08	0.934
ln(Capital)	U	7.485	6.560	53.8	14.05	0.000
	M	7.485	7.484	0.0	0.00	0.996
ln(Labour)	U	4.487	3.514	82.0	22.57	0.000
	M	4.487	4.452	2.9	0.55	0.582
$\ln(\text{Labour})^2$	U	21.578	13.711	77.3	23.66	0.000
	M	21.578	21.207	3.7	0.65	0.517
$\triangle$ln(Sales)	U	0.019	0.023	-1.5	-0.39	0.694
	M	0.019	0.025	-2.1	-0.41	0.682
Cash flow ratio	U	0.091	0.084	6.0	1.92	0.055
	M	0.091	0.093	-1.5	-0.29	0.774
Leverage ratio	U	0.525	0.557	-14.4	-3.86	0.000
	M	0.525	0.518	2.7	0.52	0.600
ln(Wage)	U	3.304	3.203	12.5	3.61	0.000
	M	3.304	3.321	-2.2	-0.41	0.685
Public	U	0.473	0.304	35.1	9.92	0.000
	M	0.473	0.471	0.3	0.05	0.958
ln(Age)	U	2.934	2.836	12.2	3.44	0.001
	M	2.934	2.951	-2.1	-0.40	0.690
Intangible assets share	U	0.098	0.071	15.8	4.74	0.000
	M	0.098	0.109	-6.6	-1.10	0.271
TFP	U	0.116	0.058	13.4	3.75	0.000
	M	0.116	0.129	-3.0	-0.57	0.569
Propensity score	U	0.017	0.003	84.0	61.12	0.000
	M	0.017	0.017	-0.0	-0.00	0.998

Table 4: Difference-in-Difference estimation for the effect of M&As on the targets' performance.

Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Cash ratio	0.000	−0.010**	−0.012**
	(0.005)	(0.005)	(0.006)
Leverage ratio	−0.009	0.010	0.017*
	(0.007)	(0.008)	(0.010)
ln(Capital)	−0.007	0.037	0.087**
	(0.021)	(0.030)	(0.037)
Intangible assets ratio	0.005***	0.009***	0.012***
	(0.002)	(0.002)	(0.003)
ln(Labour)	0.002	0.017	0.037***
	(0.008)	(0.011)	(0.013)
ln(Sales)	−0.034**	0.025	0.058***
	(0.015)	(0.018)	(0.021)
N	1472	1472	1472

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N.

Table 5: Difference-in-Difference estimation for the effect of M&As on the targets' performance, by size.

Dependent variable	$y_t - y_{t-1}$		$y_{t+1} - y_{t-1}$		$y_{t+2} - y_{t-1}$	
Explanatory variables	MA	MA x small	MA	MA x small	MA	MA x small
Cash ratio	0.006	−0.019*	−0.001	−0.029**	−0.004	−0.026*
	(0.005)	(0.011)	(0.006)	(0.012)	(0.006)	(0.014)
Leverage ratio	−0.010	0.002	0.000	0.032*	0.008	0.029
	(0.009)	(0.014)	(0.010)	(0.018)	(0.013)	(0.022)
ln(Capital)	−0.035	0.085*	−0.019	0.167**	0.026	0.178**
	(0.024)	(0.047)	(0.034)	(0.069)	(0.042)	(0.083)
Intangible assets ratio	0.005**	0.001	0.009***	0.001	0.012***	−0.001
	(0.002)	(0.004)	(0.003)	(0.005)	(0.003)	(0.006)
ln(Labour)	−0.006	0.025	−0.002	0.060**	0.010	0.083***
	(0.009)	(0.016)	(0.013)	(0.024)	(0.016)	(0.028)
ln(Sales)	−0.022	−0.036	0.022	0.010	0.046*	0.035
	(0.017)	(0.034)	(0.022)	(0.040)	(0.025)	(0.048)
N	1472		1472		1472	

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N. The regressions also include the binary variable *small* (not presented).

Table 6: Difference-in-Difference estimation for the effect of M&As on the targets' performance. Cross-border and domestic deals.

Deal type	Cross-border			Domestic		
Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Cash ratio	0.005	−0.011	−0.004	−0.003	−0.019***	−0.021***
	(0.007)	(0.008)	(0.009)	(0.006)	(0.007)	(0.008)
Leverage ratio	−0.031***	−0.030**	−0.011	0.012	0.041***	0.045***
	(0.011)	(0.014)	(0.017)	(0.009)	(0.011)	(0.014)
ln(Capital)	−0.034	0.031	0.033	−0.002	0.047	0.066
	(0.030)	(0.043)	(0.053)	(0.026)	(0.040)	(0.046)
Intangible assets ratio	−0.001	−0.002	−0.003	0.007***	0.011***	0.014***
	(0.003)	(0.004)	(0.005)	(0.002)	(0.003)	(0.003)
ln(Labour)	0.004	0.011	0.024	0.003	0.017	0.024
	(0.011)	(0.016)	(0.021)	(0.009)	(0.015)	(0.018)
ln(Sales)	−0.039	0.000	0.061*	−0.064***	−0.007	0.004
	(0.026)	(0.031)	(0.033)	(0.019)	(0.023)	(0.027)
N	606	606	606	826	826	826

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N.

Table 7: Difference-in-Difference estimation for the effect of M&As on the targets' performance, by crisis.

Time of M&A	Narrow crisis period			Broad crisis period			Non-crisis period		
Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Cash ratio	0.001	−0.024*	−0.031**	−0.009	−0.024**	−0.024**	−0.001	−0.011*	−0.010
	(0.010)	(0.014)	(0.015)	(0.010)	(0.011)	(0.011)	(0.005)	(0.006)	(0.007)
Leverage ratio	0.000	0.021	0.033	−0.008	0.024	0.049**	−0.002	0.007	0.021*
	(0.018)	(0.023)	(0.026)	(0.017)	(0.019)	(0.021)	(0.008)	(0.009)	(0.012)
ln(Capital)	0.083	0.140*	0.234***	−0.032	0.043	0.068	−0.053**	−0.029	−0.022
	(0.061)	(0.078)	(0.090)	(0.047)	(0.059)	(0.072)	(0.024)	(0.035)	(0.043)
Intangible assets ratio	0.007	0.006	0.009	0.004	0.005	0.002	0.005**	0.009***	0.011***
	(0.005)	(0.006)	(0.008)	(0.005)	(0.006)	(0.007)	(0.002)	(0.003)	(0.003)
ln(Labour)	0.025	0.062**	0.088***	−0.006	0.010	0.038	−0.008	−0.005	0.005
	(0.019)	(0.027)	(0.030)	(0.015)	(0.022)	(0.028)	(0.008)	(0.012)	(0.015)
ln(Sales)	0.013	0.066	0.094*	−0.063*	0.046	0.058	−0.054***	−0.012	0.015
	(0.041)	(0.045)	(0.049)	(0.032)	(0.039)	(0.043)	(0.016)	(0.019)	(0.023)
N	238	238	238	356	356	356	1116	1116	1116

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N. Narrow crisis period: 09/2008 - 12/2009 , Broad crisis period: 07/2007 - 12/2009.

Table 8: The effect of M&As on the investment-cash flow and cash-cash flow sensitivity.

	(1)	(2)	(3)	(4)	(5)
Panel A: Investment					
CF	0.089***	0.083***	0.082***	0.082***	0.078***
	(0.012)	(0.012)	(0.012)	(0.013)	(0.015)
after	0.050**	0.051**	0.044**	0.050**	0.063***
	(0.021)	(0.021)	(0.022)	(0.023)	(0.022)
after x CF	−0.025*	−0.024	−0.026*	−0.023	−0.039**
	(0.014)	(0.015)	(0.014)	(0.015)	(0.019)
△ln(Sales)		0.149***	0.129***	0.149***	
		(0.031)	(0.031)	(0.032)	
ln(Total assets)			0.159***	0.146***	
			(0.024)	(0.025)	
Deal x CF					0.029
					(0.025)
N	11570	11462	11462	10781	11570
F-test	0.000	0.000	0.000	0.000	0.000
Panel B: △Cash					
CF	0.202***	0.191***	0.191***	0.184***	0.206***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.021)
after	0.006**	0.006**	0.006**	0.003	0.006*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
after x CF	−0.113***	−0.112***	−0.116***	−0.118***	−0.109***
	(0.027)	(0.026)	(0.026)	(0.030)	(0.032)
△ln(Sales)		0.016***	0.015***	0.015***	
		(0.004)	(0.004)	(0.004)	
ln(Total assets)			0.012***	0.012***	
			(0.003)	(0.003)	
Deal x CF					−0.008
					(0.032)
N	11545	11437	11436	10747	11545
F-test	0.000	0.000	0.001	0.008	0.000

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (clustered at the firm level) in parentheses. Number of observations N. *Investment* = Investment in capital stock, $\triangle Cash$ = Change in cash holdings between two consecutive years, *CF* = Cash flow, *after* = 1 after acquisition. The regressions include year dummies. (1) presents the results of a fixed effects regression using all acquired and matched control firms, (2) adds sales growth, (3) additionally adds the log of total assets as a proxy for size, (4) drops the year of the deal for acquired firms, and (5) adds a dummy *Deal* (=1 for acquired firms, =0 for non-acquired firms). *F-test*: Tests null hypothesis that the cash flow sensitivity is zero after acquisition (p-values are reported).

Table 9: Difference-in-Difference estimation for the effect of M&As on the targets' productivity.

	Dependent variable: TFP			
Sample	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$	N
All	−0.005	0.017	0.019	1472
	(0.010)	(0.011)	(0.012)	
Cross-border	−0.011	−0.002	0.019	606
	(0.015)	(0.016)	(0.022)	
Domestic	−0.020*	0.005	−0.005	826
	(0.011)	(0.014)	(0.014)	
Crisis	−0.004	0.018	0.000	356
	(0.019)	(0.021)	(0.023)	
Non-crisis	−0.012	0.007	0.007	1116
	(0.009)	(0.012)	(0.015)	
Low productive target	0.030	0.049**	0.052**	1472
	(0.020)	(0.020)	(0.023)	
Medium and high productive target	−0.020*	0.003	0.004	1472
	(0.012)	(0.013)	(0.014)	

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N. *Sample* covers the respective acquired firms and their matched control firms. *Crisis* describes the broad crisis period (07/2007 - 12/2009). In the last set of regressions, the presented coefficients for *Low productive target* (respectively *Medium and high productive target*) represent $\hat{\beta}_{1,DID} + \hat{\beta}_{2,DID}$ (respectively $\hat{\beta}_{1,DID}$), see Equation 5 when replacing *small* with *lowprod*.

A Appendix

Table A.1: Distribution of target countries.

Country	Country Code	Frequency	Percent
Austria	AT	2	0.27
Bosnia and Herzegovina	BA	3	0.41
Belgium	BE	46	6.25
Bulgaria	BG	11	1.49
Czech Republic	CZ	39	5.30
Germany	DE	41	5.57
Estonia	EE	4	0.54
Spain	ES	94	12.77
Finland	FI	48	6.52
France	FR	126	17.12
Croatia	HR	12	1.63
Hungary	HU	15	2.04
Italy	IT	116	15.76
Norway	NO	3	0.41
Poland	PL	11	1.49
Portugal	PT	15	2.04
Romania	RO	2	0.27
Serbia	RS	15	2.04
Sweden	SE	92	12.50
Slovenia	SI	6	0.82
Slovakia	SK	4	0.54
Ukraine	UA	31	4.21
Total		736	100.00

Table A.2: Variable definitions.

Variable	Definition
Total assets	Fixed assets + Current assets (TOAS)
Fixed assets	Total amount (after depreciation) of non-current assets (FIAS) (Intangible assets + Tangible assets + Other fixed assets)
Capital (stock)	Tangible fixed assets (TFAS)
Intangible assets	Intangible fixed assets (IFAS)
Depreciation	Total amount of depreciation and amortization of the assets (DEPRE)
Investment	Investment in tangible fixed assets (Capital - L1.Capital + Depreciation*(Capital/Fixed assets))
Cash	Cash and cash equivalents (CASH)
△Cash	Cash - L1.Cash
Cash flow	Cash flow (CF)
Current liabilities	Current liabilities of the companys (loans + creditors + other current liabilities) (CULI)
Working capital	Current assets - Current liabilities
Labour	Total number of employees (EMPL)
Sales	Total operating revenues (Net sales + other operating revenues + stock variations) (OPRE)
△Sales	Sales - L1.Sales
Long-term debt	Long-term financial debts (e.g. to credit institutions (loans and credits), bonds) (LTDB)
Leverage ratio	(Long-term debt + Current liabilities) / Total assets
Wage	Costs of employees (STAF) / Labour
TFP	Total factor productivity (deviation from industry mean); own calculation
Age	Actual year - Year of incorporation
Public	=1 if public limited company =0 otherwise

NOTES: The variables are measured annually. Source: Amadeus.

Table A.3: Difference-in-Difference estimation for the effect of M&As on the targets' performance. Additional variables.

Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Long-term debt ratio	0.010*	0.017**	0.021***
	(0.005)	(0.007)	(0.008)
Current Liabilities ratio	−0.019***	−0.007	−0.004
	(0.007)	(0.008)	(0.010)
ln(Intangible assets)	0.110*	0.301***	0.441***
	(0.059)	(0.083)	(0.099)
N	1472	1472	1472

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N. The long-term debt ratio (current liabilities ratio) is defined as long-term debt (current liabilities) over total assets.

Table A.4: Change in acquirers' characteristics after a deal.

	ln(Intangible assets + 1)			Intangible assets ratio		
	Mean	SD	T-test	Mean	SD	T-test
$t-1$	3.610	3.212		0.021	0.063	
t	3.834	3.204	0.025	0.020	0.056	0.753
$t+1$	3.922	3.197	0.021	0.020	0.054	0.847
$t+2$	3.984	3.218	0.008	0.019	0.050	0.586
N	201			182		

NOTES: Acquisition in period t. *T-test* reports the p-value of a T-test on equality of mean values in t (resp. $t+1$, $t+2$) and $t-1$. Number of observations N.

Table A.5: Probit regressions. Prediction of cross-border and domestic M&A deals.

	Cross-border	Domestic
Cash ratio	0.1599	0.0108
	(0.1940)	(0.1620)
Working capital ratio	0.0218	0.3805***
	(0.1233)	(0.1093)
ln(Capital)	0.0536**	0.0325
	(0.0214)	(0.0188)
ln(Labour)	0.4163***	0.5289***
	(0.1073)	(0.0924)
$\ln(\text{Labour})^2$	−0.0207*	−0.0389***
	(0.0112)	(0.0103)
$\triangle$ln(Sales)	−0.0504	−0.1076
	(0.0661)	(0.0686)
Cash flow ratio	−0.2287	0.2560
	(0.2263)	(0.1882)
Leverage ratio	0.1117	0.2229**
	(0.1225)	(0.1030)
ln(Wage)	0.2568***	0.1940***
	(0.0722)	(0.0682)
Public	0.0151	0.0797*
	(0.0480)	(0.0426)
ln(Age)	−0.0564**	0.0220
	(0.0255)	(0.0243)
Intangible assets share	0.5736***	0.4066***
	(0.1166)	(0.1144)
TFP	0.1117*	−0.1436**
	(0.0651)	(0.0722)
Industry dummies	yes	yes
Country dummies	yes	yes
Year dummies	yes	yes
N	275,729	276,337
Pseudo R^2	0.1504	0.1652

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. Number of observations N. The explanatory variables are lagged one period before the deal.

Table A.6: Testing the balancing property after matching. Cross-border and domestic M&A deals.

	Unmatched	Mean			t-test	
	Matched	Treated	Control	%bias	t	p> |t|
Panel A: Cross-border deals						
Cash ratio	U	0.079	0.089	-8.8	-1.44	0.150
	M	0.079	0.075	3.1	0.41	0.684
Working capital ratio	U	0.201	0.212	-4.5	-0.80	0.422
	M	0.201	0.190	4.3	0.53	0.599
ln(Capital)	U	7.856	6.558	76.6	12.67	0.000
	M	7.856	7.911	-3.2	-0.41	0.679
ln(Labour)	U	4.767	3.514	106.4	18.66	0.000
	M	4.767	4.756	0.9	0.11	0.909
$\ln(\text{Labour})^2$	U	24.127	13.712	99.5	20.11	0.000
	M	24.127	23.793	3.2	0.37	0.710
$\triangle$ln(Sales)	U	0.030	0.023	2.0	0.37	0.713
	M	0.030	0.033	-0.9	-0.10	0.919
Cash flow ratio	U	0.085	0.084	0.7	0.14	0.889
	M	0.085	0.086	-1.0	-0.11	0.910
Leverage ratio	U	0.536	0.557	-9.1	-1.58	0.113
	M	0.536	0.530	3.0	0.37	0.713
ln(Wage)	U	3.341	3.203	17.5	3.20	0.001
	M	3.341	3.332	1.2	0.15	0.879
Public	U	0.455	0.304	31.5	5.72	0.000
	M	0.455	0.465	-2.1	-0.24	0.807
ln(Age)	U	2.847	2.835	1.5	0.27	0.789
	M	2.847	2.823	2.9	0.34	0.733
Intangible assets share	U	0.112	0.071	23.6	4.66	0.000
	M	0.112	0.086	15.2	1.72	0.085
TFP	U	0.154	0.058	22.6	4.00	0.000
	M	0.154	0.147	1.8	0.20	0.844
Propensity score	U	0.008	0.001	81.7	40.39	0.000
	M	0.008	0.008	-0.0	-0.00	0.998
Panel B: Domestic deals						
Cash ratio	U	0.093	0.089	3.7	0.76	0.448
	M	0.093	0.087	4.9	0.71	0.475
Working capital ratio	U	0.244	0.212	13.1	2.73	0.006
	M	0.244	0.235	3.6	0.53	0.598
ln(Capital)	U	7.232	6.559	39.2	7.67	0.000
	M	7.232	7.175	3.3	0.49	0.627
ln(Labour)	U	4.255	3.513	63.6	12.91	0.000
	M	4.255	4.232	2.0	0.29	0.772
$\ln(\text{Labour})^2$	U	19.464	13.706	59.4	12.99	0.000
	M	19.464	19.265	2.0	0.28	0.781
$\triangle$ln(Sales)	U	0.013	0.023	-3.3	-0.64	0.520
	M	0.013	0.002	3.4	0.57	0.570
Cash flow ratio	U	0.096	0.084	10.3	2.64	0.008
	M	0.096	0.095	1.6	0.23	0.818
Leverage ratio	U	0.521	0.557	-15.9	-3.18	0.001
	M	0.521	0.509	5.7	0.85	0.396
ln(Wage)	U	3.336	3.203	17.0	3.56	0.000
	M	3.336	3.281	7.1	0.99	0.321
Public	U	0.477	0.304	36.0	7.63	0.000
	M	0.477	0.499	-4.5	-0.63	0.532
ln(Age)	U	3.012	2.836	22.2	4.63	0.000
	M	3.012	2.946	8.3	1.22	0.224
Intangible assets share	U	0.086	0.071	9.2	1.99	0.047
	M	0.086	0.080	3.4	0.46	0.644
TFP	U	0.110	0.058	12.3	2.53	0.012
	M	0.110	0.080	7.1	1.06	0.290
Propensity score	U	0.012	0.001	82.3	52.32	0.000
	M	0.012	0.012	0.0	0.00	0.999

Table A.7: Probit regression. Prediction of cross-border M&A deals. Domestic deals as control group.

Cash ratio	0.3694	Leverage ratio	– 0.3251
	(0.5939)		(0.3885)
Working capital ratio	– 0.9843***	ln(Wage)	0.3789
	(0.3703)		(0.2458)
ln(Capital)	0.0677	Public	– 0.2103
	(0.0665)		(0.1370)
ln(Labour)	0.2673	ln(Age)	– 0.1259*
	(0.3250)		(0.0721)
$\ln(\text{Labour})^2$	– 0.0092	Intangible assets share	0.1601
	(0.0337)		(0.3562)
$\triangle$ln(Sales)	0.1036	TFP	0.6802***
	(0.1827)		(0.2565)
Cash flow ratio	– 0.4777		
	(0.6060)		
Industry dummies	yes		
Country dummies	yes		
Year dummies	yes		
N	714		
Pseudo R^2	0.2412		

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. Number of observations N. The explanatory variables are lagged one period before the deal.

Table A.8: Propensity score matching. Testing the balancing property. Domestic deals as control group.

	Unmatched	Mean			t-test	
	Matched	Treated	Control	%bias	t	p> |t|
Cash ratio	U	0.078	0.094	-13.2	-1.73	0.085
	M	0.078	0.074	4.0	0.52	0.601
Working capital ratio	U	0.199	0.244	-18.0	-2.38	0.018
	M	0.201	0.201	0.3	0.03	0.976
ln(Capital)	U	7.851	7.226	38.6	5.08	0.000
	M	7.761	7.724	2.3	0.26	0.794
ln(Labour)	U	4.768	4.252	43.8	5.80	0.000
	M	4.697	4.798	-8.6	-0.98	0.328
$\ln(\text{Labour})^2$	U	24.143	19.432	42.6	5.68	0.000
	M	23.406	24.540	-10.2	-1.14	0.257
$\triangle$ln(Sales)	U	0.030	0.015	4.7	0.63	0.531
	M	0.028	0.035	-2.0	-0.20	0.838
Cash flow ratio	U	0.085	0.097	-10.0	-1.30	0.194
	M	0.084	0.106	-18.0	-2.26	0.024
Leverage ratio	U	0.538	0.522	7.2	0.95	0.341
	M	0.540	0.525	6.7	0.08	0.423
ln(Wage)	U	3.338	3.338	-0.0	-0.00	0.999
	M	3.337	3.277	7.4	0.86	0.388
Public	U	0.454	0.478	-4.9	-0.65	0.517
	M	0.474	0.452	4.4	0.52	0.607
ln(Age)	U	2.846	3.019	-20.9	-2.78	0.006
	M	2.862	2.660	24.4	2.59	0.010
Intangible assets share	U	0.112	0.086	14.3	1.90	0.058
	M	0.113	0.133	-10.9	-1.08	0.281
TFP	U	0.151	0.111	9.5	1.25	0.211
	M	0.137	0.124	3.1	0.37	0.709
Propensity score	U	0.593	0.301	130.7	17.36	0.000
	M	0.555	0.555	0.1	0.01	0.992

Table A.9: Difference-in-Difference estimation for the effect of M&As on the targets' performance, by deal type. Domestic deals as control group.

Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Cash ratio	0.012	0.011	0.008
	(0.010)	(0.011)	(0.013)
Leverage ratio	−0.043**	−0.052**	−0.059**
	(0.017)	(0.020)	(0.025)
ln(Capital)	0.012	0.044	0.069
	(0.043)	(0.055)	(0.066)
Intangible assets ratio	−0.004	−0.001	−0.003
	(0.004)	(0.005)	(0.005)
ln(Labour)	0.010	0.036	0.054**
	(0.015)	(0.024)	(0.027)
ln(Sales)	0.040	0.058	0.070
	(0.034)	(0.038)	(0.044)
N	405	405	405

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N.

Table A.10: Probit regressions. Prediction of crisis and non-crisis M&A deals.

	Narrow crisis period	Broad crisis period	Non-crisis period
Cash ratio	0.2817	0.2024	0.0249
	(0.3131)	(0.2486)	(0.1531)
Working capital ratio	0.3545*	0.2563	0.2282**
	(0.1993)	(0.1657)	(0.1013)
ln(Capital)	0.0447	0.0425	0.0424**
	(0.0350)	(0.0286)	(0.0173)
ln(Labour)	0.2672*	0.3250**	0.5183***
	(0.1602)	(0.1323)	(0.0850)
$\ln(\text{Labour})^2$	−0.0054	−0.0146	−0.0333***
	(0.0170)	(0.0141)	(0.0093)
$\triangle$ln(Sales)	−0.0561	−0.0884	−0.1026*
	(0.1273)	(0.1041)	(0.0590)
Cash flow ratio	−0.1492	0.1435	0.0241
	(0.3472)	(0.2732)	(0.1859)
Leverage ratio	0.3582*	0.2074	0.1535
	(0.2017)	(0.1671)	(0.0990)
ln(Wage)	0.2199*	0.2791***	0.2111***
	(0.1161)	(0.0944)	(0.0623)
Public	0.1195	0.2021***	0.0272
	(0.0790)	(0.0666)	(0.0393)
ln(Age)	0.0721	0.0287	−0.0380*
	(0.0438)	(0.0351)	(0.0217)
Intangible assets share	0.6500***	0.4748***	0.5545***
	(0.2031)	(0.1718)	(0.0986)
TFP	−0.0884	−0.1028	0.0032
	(0.1222)	(0.0986)	(0.0616)
Industry dummies	yes	yes	yes
Country dummies	yes	yes	yes
Year dummies	yes	yes	yes
N	88,171	131,240	180,394
Pseudo R^2	0.1402	0.1267	0.1719

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. Number of observations N. The explanatory variables are lagged one period before the deal.

Table A.11: Testing the balancing property after matching. Deals in the crisis.

	Unmatched	Mean			t-test	
	Matched	Treated	Control	%bias	t	p> |t|
Panel A: Narrow crisis period						
Cash ratio	U	0.073	0.087	-11.6	-1.27	0.202
	M	0.073	0.076	-2.4	-0.19	0.847
Working capital ratio	U	0.215	0.209	2.5	0.27	0.784
	M	0.215	0.220	-2.0	-0.16	0.869
ln(Capital)	U	7.649	6.499	69.2	7.17	0.000
	M	7.649	7.622	1.6	0.13	0.899
ln(Labour)	U	4.674	3.495	97.2	11.00	0.000
	M	4.674	4.609	5.4	0.41	0.683
$\ln(\text{Labour})^2$	U	23.419	13.579	93.1	11.91	0.000
	M	23.419	22.702	6.8	0.47	0.642
$\triangle$ln(Sales)	U	-0.001	0.044	-16.4	-1.70	0.089
	M	-0.001	0.015	-5.9	-0.49	0.624
Cash flow ratio	U	0.074	0.092	-13.1	-2.06	0.039
	M	0.074	0.069	3.6	0.27	0.786
Leverage ratio	U	0.543	0.566	-9.7	-1.08	0.282
	M	0.543	0.552	-3.7	-0.28	0.780
ln(Wage)	U	3.044	3.183	-15.3	-1.87	0.062
	M	3.044	3.216	-18.9	-1.47	0.143
Public	U	0.513	0.293	45.9	5.26	0.000
	M	0.513	0.529	-3.5	-0.26	0.796
ln(Age)	U	3.039	2.813	25.3	3.17	0.002
	M	3.039	3.041	-0.2	-0.02	0.985
Intangible assets share	U	0.090	0.070	11.9	1.44	0.150
	M	0.090	0.126	-21.0	-1.30	0.194
TFP	U	-0.001	0.066	-14.8	-1.70	0.089
	M	-0.001	0.046	-10.2	-0.78	0.437
Propensity score	U	0.008	0.001	72.9	25.80	0.000
	M	0.008	0.009	-1.8	-0.10	0.923
Panel B: Broad crisis period						
Cash ratio	U	0.080	0.085	-4.7	-0.65	0.513
	M	0.080	0.082	-1.6	-0.15	0.880
Working capital ratio	U	0.222	0.203	7.7	1.05	0.293
	M	0.222	0.228	-2.5	-0.24	0.812
ln(Capital)	U	7.563	6.528	63.4	7.89	0.000
	M	7.563	7.455	6.6	0.65	0.513
ln(Labour)	U	4.628	3.533	90.7	12.39	0.000
	M	4.628	4.543	7.0	0.68	0.494
$\ln(\text{Labour})^2$	U	22.929	13.868	87.0	13.26	0.000
	M	22.929	21.827	10.6	0.96	0.340
$\triangle$ln(Sales)	U	0.030	0.065	-12.4	-1.57	0.116
	M	0.030	0.041	-4.0	-0.37	0.714
Cash flow ratio	U	0.093	0.093	0.2	0.03	0.973
	M	0.093	0.103	-7.7	-0.72	0.470
Leverage ratio	U	0.525	0.569	-19.1	-2.63	0.009
	M	0.525	0.534	-4.3	-0.39	0.693
ln(Wage)	U	3.070	3.155	-9.1	-1.35	0.176
	M	3.070	3.140	-7.5	-0.65	0.513
Public	U	0.522	0.296	47.2	6.60	0.000
	M	0.522	0.545	-4.7	-0.42	0.672
ln(Age)	U	2.969	2.792	20.6	3.01	0.003
	M	2.969	3.045	-8.8	-0.84	0.401
Intangible assets share	U	0.084	0.070	8.3	1.17	0.242
	M	0.084	0.097	-8.4	-0.69	0.489
TFP	U	0.024	0.058	-7.3	-1.03	0.303
	M	0.024	0.064	-8.6	-0.82	0.412
Propensity score	U	0.007	0.001	74.9	25.87	0.000
	M	0.007	0.007	-0.4	-0.02	0.981

Table A.12: Testing the balancing property after matching. Deals outside the crisis.

	Unmatched	Mean			t-test	
	Matched	Treated	Control	%bias	t	p> |t|
Cash ratio	U	0.089	0.091	-1.7	-0.39	0.695
	M	0.089	0.091	-1.6	-0.27	0.788
Working capital ratio	U	0.229	0.215	5.4	1.31	0.189
	M	0.229	0.220	3.5	0.57	0.567
ln(Capital)	U	7.460	6.578	50.4	11.54	0.000
	M	7.460	7.498	-2.2	-0.36	0.719
ln(Labour)	U	4.442	3.512	78.8	18.80	0.000
	M	4.442	4.451	-0.8	-0.13	0.897
$\ln(\text{Labour})^2$	U	21.148	13.692	73.9	19.56	0.000
	M	21.148	21.142	0.1	0.01	0.993
$\triangle$ln(Sales)	U	0.015	0.012	1.0	0.23	0.818
	M	0.015	0.021	-1.7	-0.33	0.744
Cash flow ratio	U	0.090	0.080	9.9	2.61	0.009
	M	0.090	0.094	-3.5	-0.58	0.563
Leverage ratio	U	0.525	0.553	-12.4	-2.87	0.004
	M	0.525	0.518	2.9	0.49	0.622
ln(Wage)	U	3.378	3.225	20.3	5.00	0.000
	M	3.378	3.339	5.2	0.84	0.399
Public	U	0.457	0.311	30.3	7.42	0.000
	M	0.457	0.455	0.4	0.06	0.952
ln(Age)	U	2.922	2.853	8.8	2.12	0.034
	M	2.922	2.966	-5.6	-0.93	0.352
Intangible assets share	U	0.102	0.072	17.1	4.52	0.000
	M	0.102	0.096	3.5	0.55	0.585
TFP	U	0.145	0.060	20.2	4.87	0.000
	M	0.145	0.147	-0.4	-0.07	0.944
Propensity score	U	0.021	0.003	93.2	55.77	0.000
	M	0.021	0.021	0.0	0.00	0.998

Table A.13: Difference-in-Difference estimation for the effect of M&As on the targets' performance, by technological intensity. Deals in the crisis.

Dependent variable	$y_t - y_{t-1}$			$y_{t+1} - y_{t-1}$			$y_{t+2} - y_{t-1}$		
Explanatory variables	MA	MA x hightech	hightech	MA	MA x hightech	hightech	MA	MA x hightech	hightech
Cash ratio	0.007	−0.014	0.013	−0.009	−0.033	0.029*	−0.011	−0.045	0.042**
	(0.016)	(0.020)	(0.011)	(0.018)	(0.028)	(0.016)	(0.019)	(0.030)	(0.019)
Leverage ratio	0.006	−0.015	0.015	0.025	−0.009	0.045*	0.025	0.019	0.025
	(0.024)	(0.036)	(0.019)	(0.030)	(0.047)	(0.024)	(0.034)	(0.052)	(0.028)
ln(Capital)	−0.008	0.212*	−0.170***	−0.017	0.367**	−0.294***	0.063	0.397**	−0.293***
	(0.087)	(0.118)	(0.059)	(0.108)	(0.154)	(0.096)	(0.119)	(0.179)	(0.110)
Intangible assets ratio	0.009	−0.004	−0.003	0.006	0.001	−0.006	0.010	−0.004	−0.013
	(0.006)	(0.011)	(0.008)	(0.006)	(0.013)	(0.011)	(0.008)	(0.016)	(0.012)
ln(Labour)	0.035	−0.022	−0.016	0.042	0.046	−0.044	0.065	0.053	−0.038
	(0.023)	(0.040)	(0.026)	(0.035)	(0.056)	(0.035)	(0.040)	(0.062)	(0.038)
ln(Sales)	−0.002	0.035	−0.143**	0.037	0.068	−0.035	0.087	0.017	0.077
	(0.049)	(0.085)	(0.061)	(0.055)	(0.094)	(0.063)	(0.062)	(0.100)	(0.065)
N		238			238			238	

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N. The sample covers acquired firms between 09/2008 and 12/2009 (*narrow crisis period*) and the matched control firms from the separate matching procedure by time period (see Chapter 5.1). *Hightech = 1* if firm operates in a technology-intensive industry (NACE Rev. 2, 2-digit industry codes 20, 21, 26, 27-30). 43% of acquired firms are classified as *hightech*.

Table A.14: Difference-in-Difference estimation for the effect of M&As on the targets' performance, by technological intensity. All deals.

Dependent variable	$y_t - y_{t-1}$			$y_{t+1} - y_{t-1}$			$y_{t+2} - y_{t-1}$		
Explanatory variables	MA	MA x hightech	hightech	MA	MA x hightech	hightech	MA	MA x hightech	hightech
Cash ratio	0.000	−0.002	−0.008	−0.012*	0.005	−0.004	−0.011*	−0.003	0.007
	(0.006)	(0.010)	(0.006)	(0.006)	(0.011)	(0.007)	(0.007)	(0.013)	(0.007)
Leverage ratio	−0.012	0.011	−0.006	0.001	0.029	−0.009	0.002	0.047*	−0.016
	(0.009)	(0.014)	(0.007)	(0.010)	(0.019)	(0.010)	(0.012)	(0.024)	(0.013)
ln(Capital)	−0.015	0.023	0.030	0.014	0.072	−0.024	0.064	0.072	−0.067
	(0.026)	(0.042)	(0.026)	(0.036)	(0.065)	(0.043)	(0.043)	(0.082)	(0.057)
Intangible assets ratio	0.007***	−0.004	0.000	0.010***	−0.001	0.000	0.011***	0.001	−0.002
	(0.002)	(0.004)	(0.002)	(0.003)	(0.005)	(0.003)	(0.003)	(0.006)	(0.003)
ln(Labour)	−0.008	0.029*	−0.026**	0.008	0.028	−0.011	0.038**	−0.004	0.018
	(0.009)	(0.016)	(0.011)	(0.014)	(0.023)	(0.016)	(0.017)	(0.027)	(0.018)
ln(Sales)	−0.018	−0.049	−0.006	0.029	−0.012	0.011	0.079***	−0.068	0.056*
	(0.016)	(0.035)	(0.018)	(0.022)	(0.040)	(0.025)	(0.026)	(0.046)	(0.029)
N	1472			1472			1472		

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N. *Hightech = 1* if firm operates in a technology-intensive industry (NACE Rev. 2, 2-digit industry codes 20, 21, 26, 27-30). 43% of acquired firms are classified as *hightech*.

Table A.15: Robustness check: One-to-one nearest neighbor matching on the propensity score.

Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Panel A: Matching with replacement			
Cash ratio	0.000	−0.010*	−0.011**
	(0.005)	(0.005)	(0.006)
Leverage ratio	−0.009	0.011	0.017
	(0.007)	(0.008)	(0.010)
ln(Capital)	−0.013	0.036	0.079**
	(0.021)	(0.031)	(0.037)
Intangible assets ratio	0.005***	0.009***	0.011***
	(0.002)	(0.002)	(0.003)
ln(Labour)	0.000	0.016	0.034**
	(0.008)	(0.011)	(0.013)
ln(Sales)	−0.037**	0.023	0.052**
	(0.015)	(0.019)	(0.022)
N	1449	1449	1449
Panel B: Logit estimation			
Cash ratio	0.001	−0.009*	−0.010*
	(0.005)	(0.005)	(0.006)
Leverage ratio	−0.003	0.017**	0.032***
	(0.007)	(0.009)	(0.010)
ln(Capital)	0.010	0.043	0.047
	(0.019)	(0.028)	(0.035)
Intangible assets ratio	0.005***	0.008***	0.009***
	(0.002)	(0.002)	(0.003)
ln(Labour)	0.010	0.014	0.023*
	(0.007)	(0.011)	(0.013)
ln(Sales)	−0.036**	0.006	0.030
	(0.015)	(0.018)	(0.021)
N	1472	1472	1472
Panel C: Control for pre-acquisition trends			
Cash ratio	−0.001	−0.009*	−0.014**
	(0.005)	(0.005)	(0.006)
Leverage ratio	−0.003	0.007	0.022*
	(0.007)	(0.009)	(0.011)
ln(Capital)	−0.008	0.001	0.005
	(0.021)	(0.031)	(0.037)
Intangible assets ratio	0.005***	0.010***	0.012***
	(0.002)	(0.002)	(0.003)
ln(Labour)	0.006	0.017	0.024*
	(0.008)	(0.011)	(0.013)
ln(Sales)	−0.029*	0.010	0.023
	(0.017)	(0.019)	(0.022)
N	1370	1370	1370

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N.

Table A.16: Robustness check: Matching algorithm.

Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Panel A: Caliper matching			
Cash ratio	0.000	−0.011**	−0.012**
	(0.005)	(0.005)	(0.006)
Leverage ratio	−0.009	0.011	0.018*
	(0.007)	(0.008)	(0.010)
ln(Capital)	−0.011	0.038	0.088**
	(0.021)	(0.030)	(0.037)
Intangible assets ratio	0.005***	0.009***	0.012***
	(0.002)	(0.002)	(0.003)
ln(Labour)	0.002	0.019*	0.039***
	(0.008)	(0.011)	(0.013)
ln(Sales)	−0.033**	0.027	0.061***
	(0.015)	(0.018)	(0.022)
N	1460	1460	1460
Panel B: Radius matching			
Cash ratio	−0.002	−0.013***	−0.016***
	(0.004)	(0.004)	(0.005)
Leverage ratio	0.001	0.027***	0.042***
	(0.006)	(0.007)	(0.009)
ln(Capital)	−0.033**	−0.016	0.000
	(0.016)	(0.023)	(0.027)
Intangible assets ratio	0.004**	0.005***	0.006***
	(0.002)	(0.002)	(0.002)
ln(Labour)	−0.007	−0.008	0.000
	(0.005)	(0.008)	(0.010)
ln(Sales)	−0.028**	0.035**	0.077***
	(0.013)	(0.014)	(0.016)
N	275,380	275,380	275,380

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N. The caliper is set to 0.0002.

Table A.17: Robustness check: Matching algorithm.

Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Panel A: Mahalanobis matching 1			
Cash ratio	−0.003	−0.012**	−0.016***
	(0.005)	(0.005)	(0.006)
Leverage ratio	0.004	0.019**	0.026**
	(0.007)	(0.009)	(0.011)
ln(Capital)	0.005	0.031	0.047
	(0.020)	(0.029)	(0.035)
Intangible assets ratio	0.005***	0.008***	0.008***
	(0.002)	(0.002)	(0.003)
ln(Labour)	0.008	0.016	0.032**
	(0.008)	(0.011)	(0.014)
ln(Sales)	−0.027*	0.016	0.039*
	(0.016)	(0.019)	(0.021)
N	1448	1448	1448
Panel B: Mahalanobis matching 2			
Cash ratio	−0.001	−0.012**	−0.016***
	(0.005)	(0.005)	(0.006)
Leverage ratio	−0.007	0.009	0.021*
	(0.007)	(0.009)	(0.011)
ln(Capital)	−0.024	0.001	0.019
	(0.021)	(0.029)	(0.035)
Intangible assets ratio	0.005***	0.008***	0.008***
	(0.002)	(0.002)	(0.003)
ln(Labour)	0.000	0.003	0.017
	(0.007)	(0.011)	(0.013)
ln(Sales)	−0.052***	0.006	0.010
	(0.015)	(0.019)	(0.021)
N	1448	1448	1448
Panel C: Kernel matching			
Cash ratio	−0.001	−0.012***	−0.016***
	(0.004)	(0.004)	(0.005)
Leverage ratio	0.001	0.027***	0.042***
	(0.006)	(0.007)	(0.009)
ln(Capital)	−0.033**	−0.017	−0.001
	(0.016)	(0.023)	(0.027)
Intangible assets ratio	0.004**	0.005***	0.006***
	(0.002)	(0.002)	(0.002)
ln(Labour)	−0.007	−0.010	−0.002
	(0.005)	(0.008)	(0.010)
ln(Sales)	−0.029**	0.032**	0.073***
	(0.013)	(0.014)	(0.016)
N	276,797	276,797	276,797

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N. *Mahalanobis matching 1* (respectively *Mahalanobis matching 2*) puts additional weight on the firm's year and country (respectively firm's year and industry).

Table A.18: Robustness check: Stable Unit Treatment Value Assumption (SUTVA).

Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Cash ratio	−0.001	−0.011**	−0.012**
	(0.005)	(0.005)	(0.006)
Leverage ratio	−0.009	0.011	0.017
	(0.007)	(0.008)	(0.010)
ln(Capital)	−0.003	0.040	0.089**
	(0.021)	(0.030)	(0.037)
Intangible assets ratio	0.006***	0.009***	0.012***
	(0.002)	(0.002)	(0.003)
ln(Labour)	0.001	0.017	0.037***
	(0.008)	(0.011)	(0.013)
ln(Sales)	−0.034**	0.027	0.059***
	(0.015)	(0.018)	(0.022)
N	1464	1464	1464

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N.

Table A.19: Robustness check: Estimation strategy.

Dependent variable	$y_t - y_{t-1}$	$y_{t+1} - y_{t-1}$	$y_{t+2} - y_{t-1}$
Panel A: OLS using all observations			
Cash ratio	−0.002	−0.013***	−0.016***
	(0.003)	(0.004)	(0.004)
Leverage ratio	−0.005	0.013*	0.023***
	(0.006)	(0.007)	(0.008)
ln(Capital)	−0.007	0.024	0.028
	(0.016)	(0.023)	(0.027)
Intangible assets ratio	0.005***	0.007***	0.008***
	(0.002)	(0.002)	(0.002)
ln(Labour)	0.005	0.013*	0.027***
	(0.005)	(0.008)	(0.010)
ln(Sales)	−0.033***	0.010	0.029*
	(0.012)	(0.014)	(0.016)
N	276,801	276,801	276,801
Panel B: Propensity Score Reweighting			
Cash ratio	−0.001	−0.011***	−0.014***
	(0.004)	(0.004)	(0.005)
Leverage ratio	−0.003	0.017**	0.027***
	(0.006)	(0.008)	(0.010)
ln(Capital)	−0.019	0.006	0.019
	(0.016)	(0.023)	(0.027)
Intangible assets ratio	0.005***	0.007***	0.008***
	(0.002)	(0.002)	(0.002)
ln(Labour)	−0.001	0.003	0.018*
	(0.006)	(0.009)	(0.011)
ln(Sales)	−0.036**	0.020	0.055***
	(0.014)	(0.015)	(0.017)
N	276,801	276,801	276,801

NOTES: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Acquisition in period t. Number of observations N. The estimations are performed using target firms and all non-acquired firms. In Panel A, the change in outcomes is regressed on the dummy MA, lagged firm characteristics X_{t-1}, and time, year and country dummies. In Panel B, the change in outcomes is regressed on the dummy MA, and propensity score reweighting is applied.

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