Corporate Acquisitions and Investment: Evidence from Europe*

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Abstract

This paper assesses how corporate M&As affect firms' investment in long-term capital. Using financial data (2009 – 2018) for 10 European countries, we compare firms that went through M&As with similar non-M&A firms before and after the event. We find that acquirers significantly decreased their fixed assets after M&As, and that the reduction was not driven by reallocation between merging parties or across different types of assets. Heterogeneity analyses based on industries reveal that the decline in investment was unlikely driven by the market power channel. Instead, acquirers appear to reduce long-term assets and increase debts to finance their acquisitions.

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1 Introduction

Competition among firms is crucial for spurring innovation and growth in the economy. Firms with market power may have incentives to reduce the supply of their goods to maintain higher prices (Harberger, 1995), which will dampen investment in capital and innovation (Aghion et al., 2005). An important policy tool the government can use to promote competition and investment is the regulation on mergers and acquisitions (M&As henceforth). However, theoretical predictions on the effects of M&As on firms' investment are ambiguous. On the one hand, M&As may allow firms to be more productive and to generate new projects, which could bring in more investment. On the other hand, M&As may allow firms to increase their market size and monopoly power, which could result in suppressing their output, investment, and employment. Therefore, how M&As will affect corporate investment is an empirical question.

In this paper, we study how corporate M&As impact firms' investment in long-term capital. We compare the outcomes of firms that went through M&As with a matched sample of non-M&A firms before and after the event. Using financial data merged with M&A data at the firm-level across 10 European countries from 2009 to 2018, we exploit a large number of M&A activities to implement a matched difference-in-differences design. Given that these countries all share a comparable set of antitrust regulations and are governed by the European Union, our main estimates pool all countries together, although we additionally explore country-level heterogeneity.

We find that acquiring firms sharply decreased their investment in fixed assets after M&As. We estimate that acquiring firms decreased their expenditures in fixed assets scaled by lagged fixed assets by 7 percentage points on average relative to non-M&A firms within five years after the event. Furthermore, we estimate that investment in different types of fixed assets decreased following the M&A event. Target firms' investment rates in fixed assets did not change much on average after M&As. Therefore, we rule out a pure reallocation channel (either between merging parties or across different types of assets) driving the reduction in investment after M&As.

Next, we consider whether changes in market power can explain the decline in investment. To study this question, we estimate markups following De Loecker and Eeckhout (2020). We find that acquiring firms' markups or TFPs did not change much, although their profit margins decreased and their leverage ratio increased significantly after M&As. In contrast, markups and TFPs rise moderately among target firms. While measuring markups is one direct way to infer market power, it does require assumptions on the production function of firms as well as the measurement of input variables. Therefore, we take a complementary approach by studying whether effects on investment are larger in M&As in which market power likely plays a larger role. For example, we explore whether the effects are larger in non-tradable sectors, the logic being that tradable industries are

close to competitive and a single merger is unlikely to impact global competition. We find that investment declines in both tradable and non-tradable M&As. We also consider the distinction between horizontal and vertical mergers, where a horizontal merger is between two firms in the same 4-digit industry. Contrary to the market power channel, we find no significant difference in investment outcomes between these two types of mergers. Taken together, our findings suggest that a recent rise in M&A activities across Europe in the last decade may have led to a decline in investment (among acquirers) and a moderate increase in markups (among targets), but the decrease in investment among M&A firms is unlikely to be driven by the rise in market power. Instead, it appears that acquiring firms reduced their size of long-term assets and increased their debts to finance their recent acquisitions of target firms.

In all of our results, the key identification assumption is that M&A firms and non-M&A firms would have followed similar trajectories in the absence of a merger or an acquisition. This may be a strong assumption in our setting. For example, M&A events may be undertaken by productive acquiring firms that will continue to expand. In this case, high investment could be correlated with M&A events, leading to an upward bias in our estimates. In contrast, it is possible that acquiring firms may buy unproductive firms in order to sell off their assets, which will appear as if the target firm is lowering investment. Lastly, spillover effects could contaminate our estimates if increased market power from an M&A event impacts all firms in an industry, and not just the merging parties.

We provide a number of tests to corroborate our findings. First, we find similar trends in investment outcomes between M&A firms and non-M&A firms prior to the M&A event. Second, we test whether the effects of an M&A on investment is different if the deal involved asset purchases as opposed to stock purchases. If the decline in investment is driven by acquiring firms' selling off assets of target firms instead of investing in target firms, we should see the bulk of the investment decline after asset purchases. However, we find larger investment declines in stock purchases. Lastly, to account for spillover effects, we conduct a heterogeneity test based on the initial level of concentration across 4-digit industries and find similar declines in investment in both highly concentrated and less concentrated industries.

While we show there are no pre-trends in investment for M&A firms, it is still possible that coinciding shocks could bias our estimates. For example, acquiring firms may face positive productivity shocks in the year of the merger, which would not be apparent in pre-trends. In this case, our estimates would be attenuated toward zero. Therefore, one may interpret our estimated effects on investment as a lower bound of the true effects. The opposite story, of coinciding negative shocks, is potentially less relevant as a firm that receives a negative shock has the option to delay the merger.

This paper contributes to a few distinct literatures. First, it contributes to the literature on the

effects of mergers and acquisitions. There is a long theoretical and empirical literature in industrial organization studying the impacts of M&As on consumer welfare (Dansby and Willig, 1979; Hart et al., 1990; Farrell and Shapiro, 1990; Nevo, 2000; Kaplow and Shapiro, 2007). While much prior work in this literature has focused on simulation of merger effects, there is a growing body of evidence that identifies effects in completed mergers, an approach often referred to "retrospective" merger analysis in industrial organization (Ashenfelter, Hosken and Weinberg, 2013, 2015; Dafny, Ho and Lee, 2019). Unlike much prior work on retrospective merger analysis, we take a broader approach by considering the impacts across a large number of M&A events and industries.

In terms of "retrospective" merger analysis, this paper is most closely related to papers that study the impacts of mergers on firm-level outcomes across many acquisitions, rather than a case study of a particular merger or acquisition. For example, Braguinsky et al. (2015) utilizes detailed firm-level data to study the effects of acquisitions in the Japanese cotton spinning industry on productivity. Most closely related to this work are papers in the United States that use firm-level data (in manufacturing industries) to estimate impacts on productivity, for example Maksimovic and Phillips (2001) and Blonigen and Pierce (2016). In particular, Blonigen and Pierce (2016) consider both productivity and market power changes separately by applying the method to estimate markups of De Loecker and Warzynski (2012). Overall, empirical findings in this literature are somewhat mixed. Braguinsky et al. (2015) and Maksimovic and Phillips (2001) document efficiency gains while Blonigen and Pierce (2016) find little evidence of increases in productivity. Relative to these papers, we focus on how M&As affect corporate investment, exploring changes in productivity and market power as potential channels and examining M&As across a wide range of countries in Europe. Lastly, Boucly, Sraer and Thesmar (2011) find that after leveraged buyouts, target firms become more profitable, grow faster, and issue more debt, using a sample of French firms between 1994 and 2004. While their findings contrast our overall results, our paper focuses on more recent years and with a broader set of M&A deals, which can lead to differences in results.

This paper also contributes to a recent literature on the relationship between market power and corporate investment. Gutiérrez and Philippon (2017) argues that declining competition in the U.S. has resulted in lower investment rates. Similarly, De Loecker, Eeckhout and Unger (2020) document a rise in market power in the U.S., which is consistent with patterns of declining competition. In this paper, we study one potential source of changing competition – changing ownership structure. While we find some evidence of increased markups after mergers (among target firms), the investment decline we find is likely also driven by other factors, given the declines are documented in mergers that likely have negligible impacts on market power.

Finally, our results contribute to the literature in corporate finance that studies negative stock-market reactions to merger announcements. Researchers have interpreted such findings as evidence

of empire building (Jensen, 1986), misaligned incentives (Morck, Shleifer and Vishny, 1988), or CEO overconfidence (Malmendier and Tate, 2005). These hypotheses of acquisition behavior imply that some M&A events may not be profit-maximizing. Our results are consistent with this interpretation, as we find declines in both investment and profit margins following M&As. The declines are concentrated in acquiring firms, consistent with the empirical evidence on the negative stock-market returns of corporate acquisitions (Betton, Eckbo and Thorburn, 2008).

The remainder of the paper is organized as follows. Section 2 describes the institutional setting. Section 3 describes our empirical strategy and data. Section 4 presents our main results. Section 5 discusses potential mechanisms and economic interpretations of our results. Section 6 concludes.

2 Institutional Background

The regulations regarding M&As are comparable across 10 European countries we study: Belgium, Finland, France, Germany, Italy, Netherlands, Poland, Spain, Sweden, and United Kingdom.[1] Each country has its own antitrust agency which oversees and regulates M&A activities and bidding processes that occur both within the country or across the border. At a broad level, all competition authorities enforce a comparable set of rules when reviewing the proposed M&As, and follow the guidelines set by the European Union. These countries may differ primarily in terms of which types of firms they grant exemptions on regulations. For example, in Finland, foreign target companies are not subject to the regulations. We include the details on regulations regarding M&As across these countries in Appendix A.

All of the countries in our sample have pre-merger notification rules to block potentially anticompetitive mergers or acquisitions. Typically, those rules are based on firm size: (1) domestic sales and (2) global sales. Each country has its own thresholds, but they are typically set higher than the thresholds in North America (Wollmann, 2019). Appendix A summarizes the rules regarding pre-merger notification rules. There have been several legislation changes on the antitrust regulations, especially regarding pre-merger notification rules, across these countries during our sample period. These legislative changes, however, generally depend on the global sales of the firm, which we do not observe in our data. Therefore, we do not exploit these changes for identification in this paper.

[1] We choose these 10 countries based on the total number of M&A events in each country within the European Union, as these countries give us enough variation to estimate the effects of M&As on firm outcomes. See Table 1 for the number of M&A transactions across these countries over time.

3 Empirical Strategy

This section describes our empirical strategy and data for estimating the impact of mergers and acquisitions on corporate outcomes.

3.1 Estimating M&A Effects on Main Outcomes

The effects of M&As on firms' investment are ex-ante ambiguous. A merger or acquisition may lead to an increase in investment if it generates efficiency gains through synergies between merging parties, which can boost their productivity (Braguinsky et al., 2015) and generate new projects. By contrast, an M&A may lead to a reduction in investment if such a takeover was initiated to reduce competition and exploit the product market power (Cunningham, Ederer and Ma, 2021), as monopolists have incentives to raise prices by reducing inputs and outputs over the long-run. Furthermore, the effects of M&As on investment may be still negative under the perfectly competitive market if the transaction was initiated by empire-building motives (Jensen, 1986) or ends up reducing firms' productivity.[2] Understanding potential mechanisms behind the impacts of M&As on firms' investment is important for policy implications.

To estimate the effects of M&As on firm-level outcomes, we implement a matched difference-in-differences design. As the first step, we match each M&A firm to a "counterfactual" non-M&A firm. To do so, we extract all M&A events in a given year and then match firms involved in these events to non-M&A firms based on observable characteristics one year prior to the M&A event. In particular, we partition firms in the same 2-digit sector and country by their total assets, operating revenue, and firm age. An M&A firm and a non-M&A firm are a match if they are in the same country, the same sector and the same decile of total assets, operating revenues, and age. If multiple potential matches are found, then we use propensity score matching as a tie breaker. A propensity score matching is a conditional measure of treatment participation given a set of observable variables (Cameron and Trivedi 2005). We use total assets, operating revenue, and firm age to estimate the propensity score, and conditioning that firms are in the same partition, the two closest in propensity score will be considered as a match. For each M&A year, we construct a panel of observations 5 years prior to the merger and 5 years after. This creates a panel of treated and control units for every M&A year. To aggregate across M&A years and compute an overall average impact, we stack these panels in our main estimation.

In the second step of our empirical procedure, we estimate a regression of the following form:

[2] By contrast, an acquisition of a productive asset can lead to cutting down inefficient investment after an M&A, which can increase productivity.

$$y_{it} = \sum_{k=-5}^{5} \beta_k \mathbb{1}\left(t_i = t^* + k\right) \times MA_i + \alpha_i + \alpha_{jst} + X_i\beta + \epsilon_{it} \tag{1}$$

where y_{it} is the outcome of interest, MA_i is an indicator for whether a firm is an M&A firm or not, $\mathbb{1}\left(t_i = t^* + k\right)$ indicates an M&A event that happened k years in the past (future) relative to the period of M&A event t^*, α_i are firm fixed effects, α_{jst} are country-by-industry-by-year fixed effects. This implies that the effects of mergers are identified off changes over time between firms in the same industry and country. While the matching procedure ensures balance within a two-digit sector, the industry-by-year fixed effects are included to further control for any industry-specific shocks in a given year. Including these fixed effects therefore controls for industry-by-country specific trends. We also include quartics in firm age in order to control for underlying financial constraints of the firms. The standard errors are clustered at the firm level.[3] We omit the year prior to the M&A event so that each β_k^{MA} shows the difference in the outcomes variable relative to the base year, which is one year before the M&A event. To summarize the impact of the M&A event overall, we denote $\sum_{k=0}^{5} \hat{\beta}_k$ as the average impact.

An alternative to this matched difference-in-differences design is to use all of the data and estimate an event-study design with staggered adoptions. However, a recent literature (Goodman-Bacon, 2018; Sun and Abraham, 2020; De Chaisemartin and d'Haultfoeuille, 2020; Borusyak, Jaravel and Spiess, 2021) finds that in two-way fixed effects designs with unit and time fixed effects, the difference-in-differences estimator (or dynamic difference-in-differences estimator) may not retrieve a weighted average treatment effect. Intuitively, standard regression-based implementations utilize "forbidden comparisons" between groups that got treated over a period of time and groups which had been treated earlier (Borusyak, Jaravel and Spiess, 2021). This issue can lead to estimates that are biased or even have the wrong sign. Instead, the matched difference-in-differences design is implemented separately for each event year, similar to Cengiz et al. (2019) that estimates separate event-specific treatment effects for 138 minimum wage changes. Identification here comes solely from differences in M&A firms and non-M&A firms over time, not from units coming in and out of treatment, therefore avoiding the negative weighting issue from standard regression-based implementations. Additionally, to provide evidence that our results are not biased due to the staggered event timing, we implement the imputation estimator of Borusyak, Jaravel and Spiess (2021) (see Appendix D).

The main identification assumption of our approach is that M&A firms and non-M&A firms would have followed similar trajectories in the absence of a merger or acquisition. This may

[3] We also do a robustness check by two-way clustering our standard errors at the 4-digit NAICS and country level, and find similar results.

be a strong assumption given that a merger is an endogenous decision by firms. For example, M&A events are likely undertaken by productive acquiring firms that will continue to expand. Furthermore, an acquirer may target an innovative firm that introduces a new technology, which would stimulate more investment. Therefore, an estimate on the impact of M&A on investment would be biased upwards if investment of the acquirer or the target would have increased even in the absence of the merger.

On the other hand, it is possible that unproductive firms become targets. Even under this case, the effects of M&As on investment for acquiring firms may be still overstated because acquirers may purchase unproductive firms for their growth potential. The only exception is when acquiring firms buy unproductive firms solely to sell pieces of their underpriced assets at higher prices. While this will mechanically attenuate the estimates on the effects of M&As on investment, our data contain information on whether a given acquisition is an asset purchase or sales purchase. In practice, we find investment declines in both types of purchases.

Another key threat to this event study design is that time-varying shocks may coincide with M&A events. For example, it is conceivable that acquiring firms face positive productivity shocks in the year of the merger, which can overstate the effects of M&As on investment. By contrast, the other case in which negative productivity shocks coinciding with the M&A events is unlikely, because firms that receive a bad shock has an option to delay the M&A event. We include 4-digit NAICS dummies interacted with year dummies to control for any time-varying industry wide productivity shocks. Relatedly, our matched difference-in-differences design addresses a potential mean-reversion from M&A firms being larger than non-M&A firms on average.

Another potential source of bias to our main estimates are spillover effects. If M&A impacts other firms in the same product market (for example, through market power effects), then our estimates will be biased towards zero. To address potential spillover effects of M&As, we conduct a heterogeneity test based on the initial level of concentration, where we define an industry as being concentrated based on total assets of firms active in that industry. Then, we consider industries where the concentration level the year prior to a merger is above the median as initially concentrated industries. The intuition is that a given merger would likely have much smaller spillover effects in initially less concentrated markets. We find investment declines in both types of industries, suggesting that spillover effects were unlikely to be the main driver behind our results.

3.2 Data and Analysis Sample

This paper uses firm financial and accounting information from the Amadeus database matched with information on merger and acquisition activities from SDC Platinum database. The matched

data set allows us to examine firm behaviors after they go through M&As and compare their investment outcomes to other firms that did not go through M&As. The data set covers from 2007 to 2019 and includes small to large firms across 10 European countries: Belgium, Finland, France, Germany, Italy, Netherlands, Poland, Spain, Sweden, and United Kingdom. We chose these countries as they give use enough variation based on the number of M&A deals in each year to conduct an event-study analysis.[4]

The firm-level data from Amadeus contain financial and accounting information for both private and publicly traded firms in Europe from 2007 to 2019.[5] They include a wide range of firm characteristics and outcome variables, which we detail in the next subsection. Importantly, they include unique identifying variables, such as firm names, addresses, phone and fax numbers, which we use along with other identifying variables (i.e., postal codes) to perform fuzzy matching with the M&A data set. As a robustness check, we also estimate results only for firms that perfectly match between the Amadeus dataset and SDC platinum.

The data set from SDC Platinum allows detailed search on mergers and acquisitions. All corporate (public or private) transactions in which at least 5% of the ownership of a company was involved are included. This data set includes names of the parties, NAICS industry codes, value of the transaction (if disclosed), and the status of the transaction (completed, pending, etc) with some identifying information such as addresses, websites, and phone numbers.

We perform fuzzy matching between the financial data and M&A data at the firm-level. We standardize name, city, address, website, email, fax and phone number of firms. Then, we perform fuzzy matching using *matchit* command in STATA which matches two variables (names of firms here) based on similar text patterns. Other variables are used to increase both quality and the number of matches (see Appendix B for more details). Since different establishments of a firm may be active in different industries, matching based on industry codes will not be perfect and a firm might get matched with an establishment that is not active in its industry.[6] Therefore, we do not use the NAICS industry code as the unique identifying variable. The average match rate over period 2007-2018 is around 62 percent, with the perfect (unique) match rate of roughly 81 percent on average during our sample period across 10 European countries. The final data set contains firm financial data matched with M&A information for 10 European countries from 2007 to 2018.

[4]Table A.3 in Appendix A shows the number of M&A deals in other European countries not included in our analysis. Except for Denmark, all other countries have a substantially lower number of M&A events relative to 10 European countries in our analysis during the sample period.

[5]The Amadeus database was accessed while David Arnold and Terry Moon were graduate students at Princeton University. To avoid potential survivorship bias due to high attrition in pre-2010 data, we downloaded the firm-level data for each year (2007, 2008, and 2009) from a licensed CD, instead of downloading everything from Wharton Research Data Service.

[6]For example, Airbus SE is a company primarily active in "Manufacturing" sector; however, it has establishments active in "Retail" and "Management of Companies and Enterprises" sectors.

Our analysis sample consists of both publicly traded (mostly large) and private (small to large) firms across 10 European countries from 2009 to 2018. To avoid potential biases that can arise from young firms that get acquired right after entering the market, we restrict our M&A sample to be present for at least 2 years before the M&A event, which restricts the first event to be in year 2009, and do a robustness check by imposing different restrictions. The share of listed firms is about 1 percent on average. The dominant sectors are manufacturing, construction, trade, information, and technology services, and we exclude financial and management sectors. In our main specification, we consider firms that completed at least one transaction (whether as an acquirer or target) as treated firms and firms without any completed transaction as control firms.

3.3 Variable Definitions

We define the key set of variables used in our empirical analysis. This includes investment rate in different types of fixed assets and measures of productivity and markups.

The key outcome variable is the investment rate in fixed assets: $\frac{I_t}{K_{t-1}} = \frac{K_t - K_{t-1}}{K_{t-1}} + \delta_t$, where I_t is the expenditure on capital K_t at time t and δ_t is the depreciation rate at time t. We do not directly observe expenditures on capital, but we observe the book value of fixed assets and their depreciation, which we use to compute the investment rate based on the accounting convention: $K_t = (1 - \delta_t)K_{t-1} + I_t$.[7]

Fixed (or non-current) assets refer to assets and properties owned by a business that are not easily converted to cash. Different categories of non-current assets include tangible assets, intangible assets, and other (financial) assets. Tangible assets are long-term resources, such as buildings, computer equipment, furniture, land, machinery, and vehicles. An adjustment for the aging of tangible assets is made based on periodic charges called depreciation, which may or may not reflect the loss of earning powers for a tangible asset. Intangible assets are economic resources that have no physical presence. They include patents, trademarks, copyrights, and goodwill. Other (financial) assets include long-term securities and bonds not intended to be liquidated in the short-term.

We also examine how the capital structure and profitability of firms change following M&As. In particular, to assess firms' sources of financing, we look at their leverage ratio, defined as total debts over total assets. Moreover, we look at a measure of profitability directly available from our data, "profit margin", defined as net profits divided by total sales.

[7] For tangible and intangible assets, we use the following measures respectively: $\frac{I_t^{tangible}}{K_{t-1}} = \frac{K_t^{tangible} - K_{t-1}^{tangible}}{K_{t-1}} + \delta_t \frac{K_t^{tangible}}{K_t^{tangible} + K_t^{intangible}}$ and $\frac{I_t^{intangible}}{K_{t-1}} = \frac{K_t^{intangible} - K_{t-1}^{intangible}}{K_{t-1}} + \delta_t \frac{K_t^{intangible}}{K_t^{tangible} + K_t^{intangible}}$. For other (financial) assets, we scale the difference in financial assets between year t and $t-1$ by lagged total fixed assets. We scale these different types of assets by total fixed assets to minimize the number of missing values.

We estimate firm's productivity following the approach by Ackerberg, Caves and Frazer (2015). In particular, we estimate a Cobb-Douglas production function with capital and labor as inputs, and materials as an intermediate input. The Cobb-Douglas production function is estimated for each four-digit NAICS and country separately. This approach assumes that each firm within a four-digit industry and country has access to the same production technology, but varies in productivity levels (see Appendix C for details). Intuitively, firms that have a high level of revenues relative to their capital and labor inputs (within their industry) will have a higher level of productivity.

Finally, we follow the cost-based method by De Loecker and Warzynski (2012) to estimate markups. This approach requires fewer inputs than the demand-based approach. In particular, the markup depends on the elasticity of output with respect to variable costs as well as the variable costs share. For the elasticity of output with respect to variable costs, we use estimates from De Loecker, Eeckhout and Unger (2020) that allow for different elasticities across two-digit NAICS codes and years. Given the elasticity estimates, this allows us to estimate firm-level markups as the output elasticity multiplied by the inverse of the variable costs (wages and material costs) share: $\hat{\theta}_{st} * \frac{Sales}{Costs\ of\ goods}$. Note that this approach is also used in De Loecker and Eeckhout (2020) to estimate markups across European countries.

3.4 Descriptive Statistics

Panel A of Table 1 reports the match rate between SDC Platinum (M&A data) and Amadeus (firm-level financial data) across countries and years of our sample. Our average match rate is 62 percent. We also report the share perfectly matched observations; on average, 81 percent of our matched sample is matched perfectly based on the unique identifying variables. Panel B of Table 1 reports the total number of M&A deals across 10 countries and for 2007-2018 period. In our sample, United Kingdom has been the most active M&A market.

Table 2 reports the average and standard deviation of important variables in our matched sample. On average, M&A firms are larger, in terms of fixed assets and operating revenue, than non-M&A firms. However, investment rates in fixed, intangible, tangible and other assets are more comparable between M&A firms and non-M&A firms. Furthermore, other outcomes, such as markups, productivity, leverage ratio, and profit margins, are similar across these two groups. Importantly, M&A firms and non-M&A firms show parallel trends in these outcomes prior to the event.

Table 3 reports the summary statistics on M&A activities across countries and years among our sample of acquirers. Overall, the majority of M&A deals was within non-tradable sectors, within the same industries (horizontal M&As), domestic, and involved in the acquisition of assets. On

average, an acquiring firm was involved in 1.3 deals per year during our sample period. Finally, the average value of a transaction in our sample is 140 million US dollars. Note that the average ownership and value of transactions were estimated using a much smaller subset of M&A firms where we can observe these variables.

4 Results

This section shows the results from the estimation of the difference-in-differences model in Section 3, and presents additional tests supporting the interpretations of the results.

4.1 The Effects of M&A on Investment

Figure 1 plots estimates of β_k^{MA} from equation (1) for investment rates of different types of fixed assets as the outcomes using our matched sample. Panel A shows that acquiring firms' and target firms' investment rates in fixed assets were following a similar pattern as those of the non-M&A firms before the M&A event. While target firms' investment stayed relatively flat after the event, acquiring firms' investment experienced an overall significant decline after the event on average, compared to those of non-M&A firms. Panels B - D show similar patterns: parallel trends prior to the event for both acquirers and tagets, and overall declines in investment rates across different types of fixed assets after M&A for acquirers.

Table 4 presents the difference-in-differences estimates on investment rates in different types of fixed assets, separately by acquiring and target firms. Column (1) shows that acquiring firms decreased their investment rate by 6.6 percentage points on average, relative to non-M&A firms, whereas target firms' investment in fixed assets did not change much on average after the event. Columns (2) - (4) show that acquirers' investment rate in tangible assets and other fixed assets (i.e., financial) decreased by 3.3 and 2.1 percentage points on average, respectively, relative to non-M&A firms, whereas targets' investment in fixed assets did not change much. Taken together, these results show that acquiring firms experienced large and significant decreases in various types of long-term assets, while target firms' investment stayed roughly flat after M&A.

4.2 The Effects of M&A on Markups, TFPs, Leverage, and Profit Margins

Figure 2 plots β_k^{MA} from estimating equation (1) with markups, TFPs, leverage ratio, and profit margins as the outcomes using our matched sample. For acquiring firms, we observe parallel

trends in these outcomes before the event. While markups and TFPs did not change much, profit margins decreased significantly and leverage ratio increased substantially after M&A relative to non-M&A firms. For target firms, we observe parallel trends in markups, TFPs, and profit margins before the event. Target firms experienced a moderate increase in markups and TFPs, without much changes in leverage ratio, while profit margins moderately decreased after M&A.

Table 5 presents the difference-in-differences estimates on markups, TFPs, leverage ratio, and profit margins, separately by acquiring and target firms. Column (1) shows that acquiring firms' markups or TFPs did not change much, whereas target firms' markups increased by 1.1 percent on average relative to non-M&A firms. Column (2) shows that acquiring firms' TFPs did not change much, whereas target firms' TFPs increased by 1.7 percentage points on average after M&A. Column (3) indicates that acquirers' leverage ratio increased by 2.3 percentage points, while targets' leverage ratio did not change much. Finally, column (4) shows that profit margins decreased by 0.9 percentage points and 0.7 percentage points for acquiring firms and target firms, respectively.

Overall, these results show that acquiring firms experienced a moderate decline in profit margins and took more on debts, while target firms experienced moderate increases in markups and TFPs, and a small decline in profit margins.

4.3 Internal Validity

We conduct several robustness checks to strengthen the internal validity of our results. First, we repeat the main analysis with different levels of winsorizing our outcome variables, by imposing different lags, and by different ways of clustering our standard errors, and find qualitatively similar results to our main findings. Second, we repeat the analysis by focusing on the perfectly matched sample and find that the results are qualitatively similar. Results from these robustness tests are reported in Appendix D.

Moreover, we run a heterogeneity test based on whether a given deal was purchasing a target's assets or shares. The intuition is that if an acquiring firm was buying a target solely to sell its underpriced assets at higher prices in the future, we should expect to see that its investment rate mechanically goes down in the medium-run for a deal where the acquirer directly bought the target's assets. Furthermore, if the investment rate decreased after a M&A because the M&A itself was an investment, then we should see that there would be a mechanical reallocation of fixed assets between acquirers and targets when the deal involves an asset purchase. Note that this would capture a particular mechanism of how M&As may lead to a reduction in investment (rather than creating a source of biases in our estimates). We find that the effects of M&As on investment rate in fixed assets were actually larger for stock purchases than for asset purchases, which suggests

that the decline in fixed assets was unlikely driven by a mechanical reallocation from selling off targets' assets (see Appendix D).

5 Potential Mechanisms and Economic Interpretations

In this section, we discuss and empirically test potential mechanisms for investment responses following an M&A event. Understanding potential mechanisms behind investment responses is important for policymakers designing an effective antitrust system. The main channel in which M&As can induce lower investment is through the product market power: firms that gain market power after M&As may have incentives to decrease investment in order to suppress output and to increase prices.

We find that the acquiring firms that decreased investment in fixed assets did not experience an increase in their markups, which is inconsistent with these firms gaining market power after M&As. While target firms experienced a moderate increase in markups, their reduction in fixed assets was insignificant, and more importantly, their profit margins decreased, which is consistent with the increases in their overhead costs. An increase in markups does not necessarily imply an increase in the market power if the markup decreased because of the rise in overhead costs (De Loecker, Eeckhout and Unger, 2020). Therefore, the results on markups and profit margins indicate that our results are unlikely driven by the market power channel. To further corroborate this conclusion, we also conduct heterogeneity analyses by sectors and industries to test the market power channel. For these additional analyses, we focus on acquiring firms (and their matched control group), as target firms showed little changes in investment overall.

5.1 Heterogeneity by Tradable vs. Non-Tradable Sectors

If the market power channel was driving the decline in investment by acquiring firms, we should observe that a decrease in investment is concentrated among non-tradable sectors relative to tradable sectors. The intuition is that an M&A would have a larger impact on firms' market power if they do not face competition outside their geographical (i.e., international) markets. We define firms as active in tradable good sectors if they fall under Agriculture, Forestry, Fishing and Hunting, Mining, Quarrying, and Oil and Gas Extraction, and Manufacturing. Firms active in other sectors (i.e., Construction, Retail, Real Estate, Services, etc) are defined as falling under non-tradable sectors (Berger, Herkenhoff and Mongey, 2021; Delgado, Bryden and Zyontz, 2014).

Figure 3 shows the results separately for tradable and for non-tradable sectors. Panels A and

B show that the effects of M&As on total fixed and tangible assets are stronger for firms in non-tradable sectors relative to firms in tradable sectors. Panels C and D show that the effects of M&As on intangible and financial assets are not statistically different between firms in non-tradable sectors and firms in tradable sectors.

Furthermore, we estimate the effects of M&As on investment separately for each sector to check where the effects are concentrated. Figure 4 presents the results separately across 8 major sectors across each investment outcome, and shows that the reduction in fixed assets was concentrated among wholesale, real estate and services sectors (classified as non-tradable in our setting). While stronger effects among non-tradable sector M&As seem consistent with the market power channel, these results could be purely driven by the sectoral heterogeneity. Therefore, we supplement this analysis by examining the industry-level heterogeneity in the next subsection.

5.2 Heterogeneity by Between vs. Within Industries

Similar to the heterogeneity analysis in the previous subsection, if the market power channel was playing a major role in the decline in investment, we may observe that a decrease in investment is concentrated among the within-industry M&As relative to between-industry M&As. The intuition is that an M&A would have a larger impact on firms' market power if they acquired another firm within the same industry (i.e., horizontal mergers). We divide our sample of all M&A firms based on the industries of the parties involved in a transaction. A merger is a within-industry merger if the industries (4-digit NAICS) of both parties are identical and it is between-industry merger if the industries are different. For firms with one transaction, we define a firm as "within" if it participated in a within-industry merger and as "between" if it participated in a between-industry merger. For firms with more than one transaction, we will consider the majority of transactions to determine the within and between indicators.

Figure 5 shows the results separately for within- and between-industry M&As. Panels A to D show that the effects of M&A across different types of fixed assets are not statistically different between firms in within-industry and firms in between-industry M&A deals. Therefore, these additional results show that the decline in investment by acquiring firms was unlikely driven by the market power channel.

5.3 Heterogeneity by Initial level of Concentration

We supplement our analysis in the previous subsection by doing a heterogeneity test based on the initial level of concentration. Here, we define an industry as being concentrated based on total

assets of firms active in that industry. Specifically, we compute the HHI using total assets for all industries.[8] Then, we consider industries where the concentration level in the year prior to a merger is above the median as initially concentrated industries. We focus on industries that have within-industry mergers. The market power story is more pronounced where two firms merge in a specific industry that is already concentrated.

Figure 6 shows the results separately for above-median concentration and for below-median concentration industry M&As. Panel A - D show that the effects of M&As on investment rate in fixed assets are not statistically different between these two types of M&As across different types of fixed assets. Therefore, we did not find support that the above-median concentration industry M&As led to a larger decline investment, inconsistent with the market power channel.

5.4 Heterogeneity by Domestic vs. Cross-border M&As

In our pooled sample across 10 European countries, cross-border M&As account for almost a quarter of total M&A deals. We test whether the effects of M&As on investment are different depending on whether a M&A deal was international rather than domestic. We define a deal as domestic if both target and acquiring firms are within the same country, and define the deal as cross-border if the parties are from different countries. Figure 7 shows that the effects of M&A on different types of fixed assets are not statistically different between domestic and cross-border M&As.

Our main specification estimates the effects of M&As on the main outcomes within a particular industry in a given country by a specific year. Therefore, our results are estimated net of any industry-by-country-by-year specific fixed effects. However, to get a sense of on which countries the effects are concentrated, we also run the same specification across each of these countries, controlling for industry-by-year fixed effects.

Figure 8 shows that the effects of M&As on fixed assets are concentrated among the following five countries: France, Germany, Poland, Spain, and the United Kingdom. According to the study by Hylton and Deng (2007), these countries have high antitrust scope indices (i.e., France (18), Germany (19), Poland (19), Spain (23), and UK (23)), which was a metric also used by Besley, Nicola and Limodio (2021) to examine how antitrust policies affect profitability in non-tradable sectors across 90 countries. Given that these countries do not have lower antitrust indices relative to other EU countries on average, it is unlikely that the decline in investment was driven by the market power channel, consistent with our previous results. Potential reasons for the country-level heterogeneity could be institutional differences or differences in firm characteristics that could gen-

[8] $HHI_{cy} = \Sigma s^2_{icy}$ where s_{icy} is the share of total assets of firm i active in industry c and year y.

erate heterogeneous investment responses to M&As. Understanding these sources of differences across countries would be an interesting avenue for future research.

6 Conclusion

In this paper, we study how corporate M&As affects firms' investment in long-term capital. We compare the outcomes of firms that went through M&As with a matched sample of non-M&A firms before and after the event. Using financial data merged with M&A data at the firm-level across 10 European countries from 2009 to 2018, we exploit a large number of M&A activities based on a pooled sample of firms across these countries, given that they all share a comparable set of antitrust regulations and are governed by the European Union. To address potential biases in our estimates due to the endogeneity of M&A decisions, we argue that our estimates likely provide lower bounds on the effects of M&As on firm's investment given their sign and the type of transactions.

Our results show economically and statistically significant drops in investment rates in fixed assets for acquiring firms. Furthermore, acquiring firms experienced a moderate decline in profit margins, and a significant increase in leverage ratio. Additional heterogeneity analyses based on sectors and industries suggest that the decline in investment was unlikely to be driven by the market power channel; instead, it appears that acquiring firms reduce long-term assets and take more debts to finance their acquisitions.

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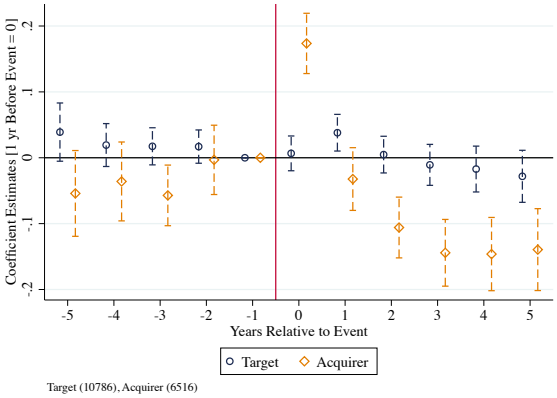
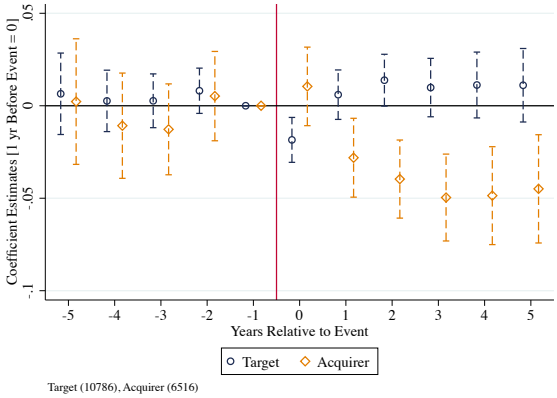
Figure 1: Effects of M&As on Investment

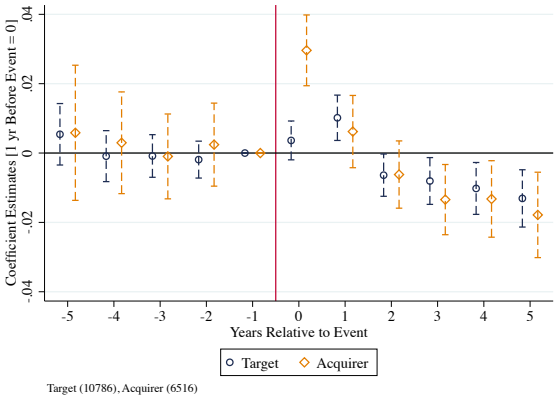
(A) Investment Rate in Fixed Assets



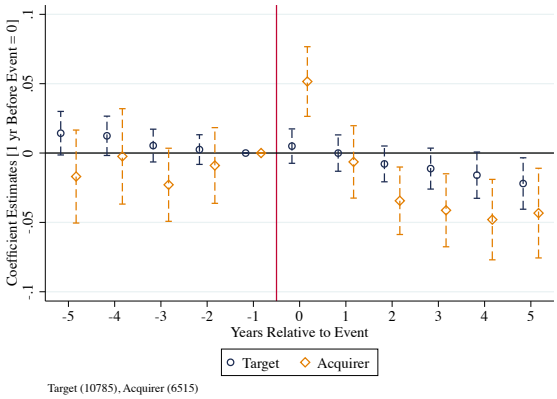
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



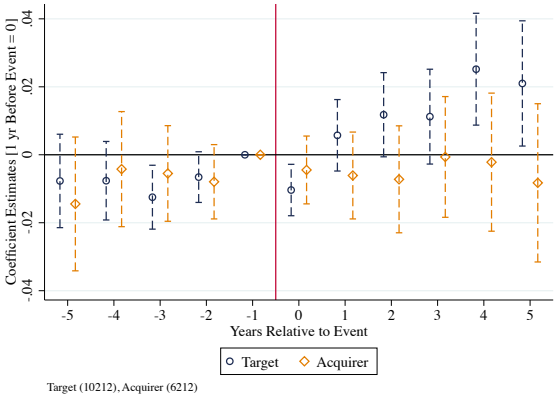
(D) Investment Rate in Financial Assets



Notes: These figures show event-study coefficient estimates for firms' investment rates in fixed assets. The dashed lines indicate 95% confidence intervals for these estimates. The solid vertical line indicates the event year. The orange dots correspond to the event study estimates for the acquiring firms and the navy blue dots indicate the estimates for the target firms. The analysis uses a matched sample across 10 European countries from 2009 to 2018.

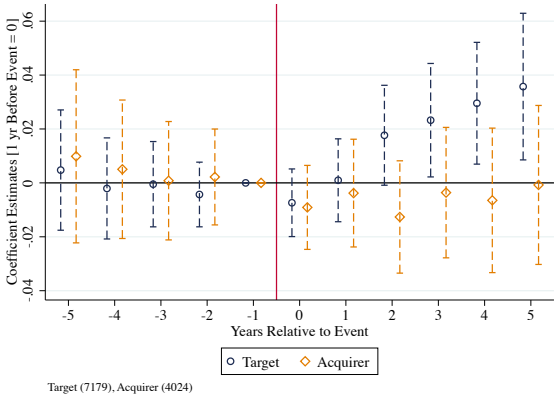
Figure 2: Effects of M&As on Markups, TFPs, Profit Margins, and Leverage

(A) Markups



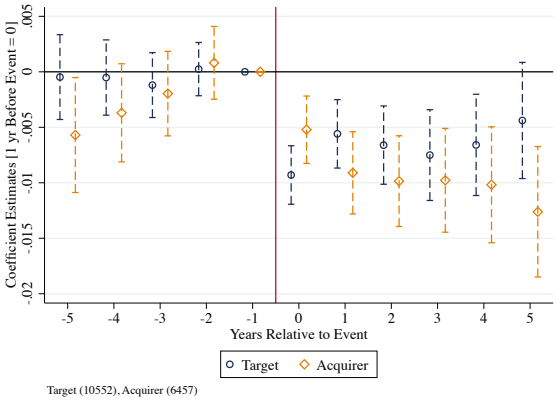
Target (10212), Acquirer (6212)

(B) TFPs



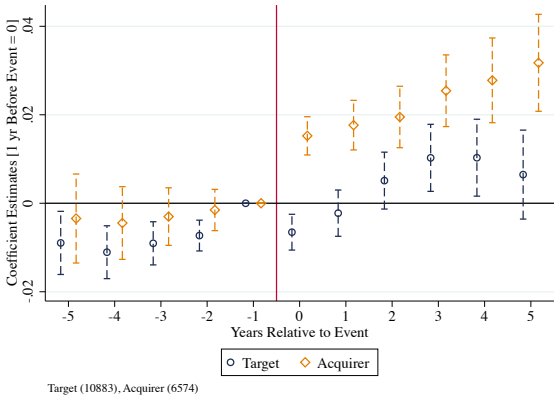
Target (7179), Acquirer (4024)

(C) Profit Margins



Target (10552), Acquirer (6457)

(D) Leverage Ratio

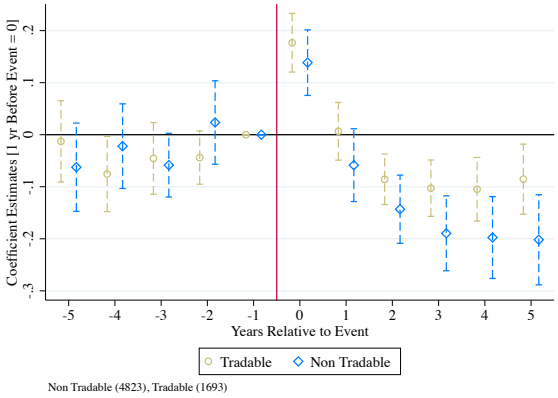


Target (10883), Acquirer (6574)

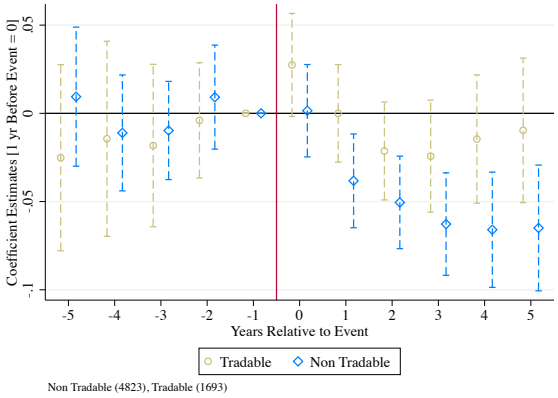
Notes: These figures show event-study coefficient estimates for various firm outcomes. The dashed lines indicate 95% confidence intervals for these coefficient estimates. The solid vertical line indicates the event year. The orange dots correspond to event study estimates for acquiring firms and the navy blue dots indicate the estimates for target firms. The analysis uses a matched sample across 10 European countries from 2009 to 2018.

Figure 3: Effects of M&As on Investment (Tradable vs. Non-tradable Sectors)

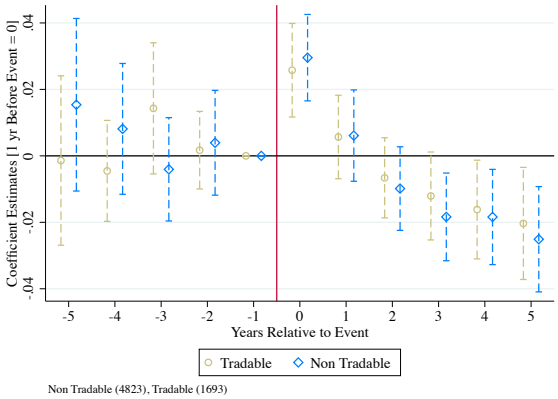
(A) Investment Rate in Fixed Assets



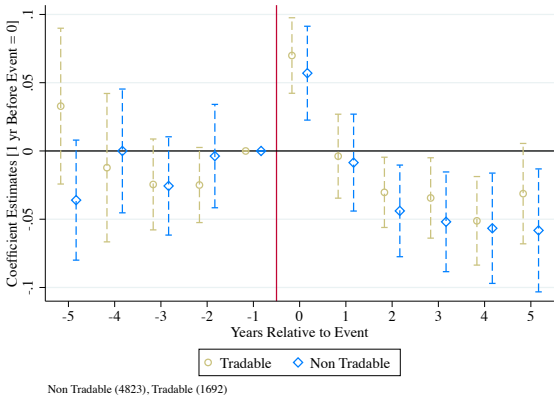
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



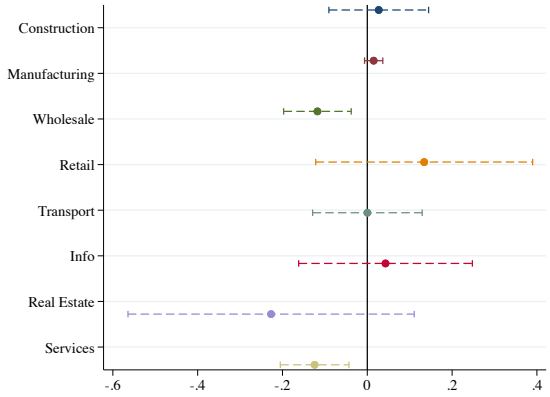
(D) Investment Rate in Financial Assets



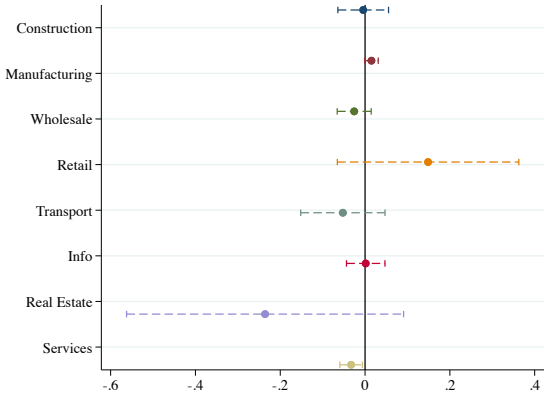
Notes: These figures show event-study coefficient estimates for firms' investment rates in fixed assets, separately for firms in non-tradable sectors and for firms in tradable sectors. The dashed lines indicate 95% confidence intervals for these coefficient estimates. The solid vertical line indicates the event year. The blue dots correspond to the event study estimates for firms active in non-tradable goods sectors and the khaki dots indicate the estimates for firms involved in tradable goods sectors. The analysis uses a matched sample across 10 European countries, which is restricted to acquiring firms and their matched control group.

Figure 4: Effects of M&As on Investment (Across Sectors)

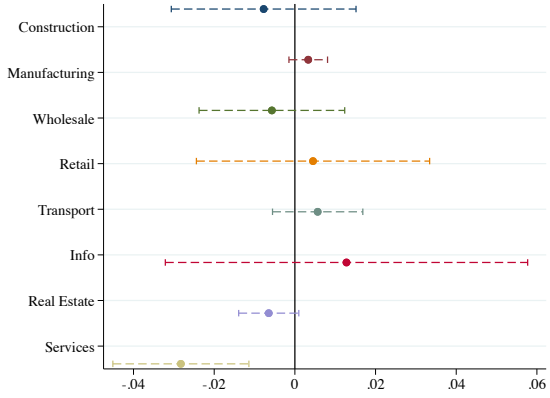
(A) Investment Rate in Fixed Assets



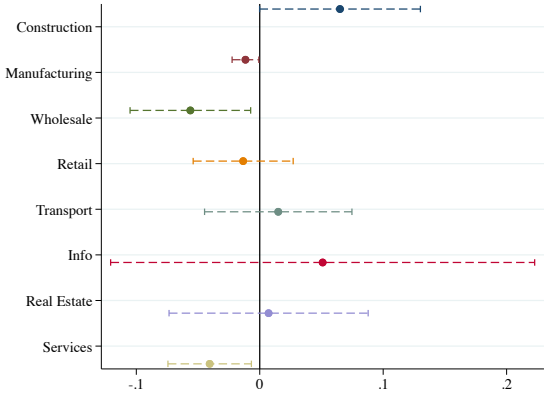
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



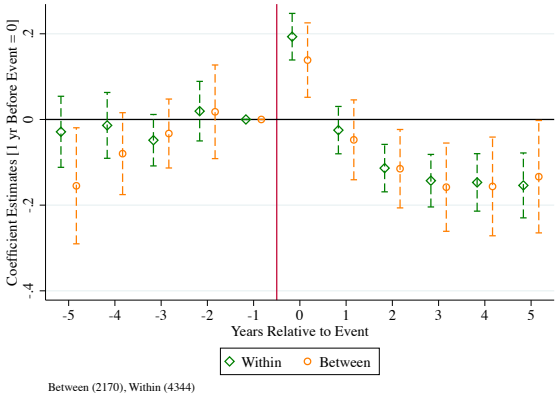
(D) Investment Rate in Financial Assets



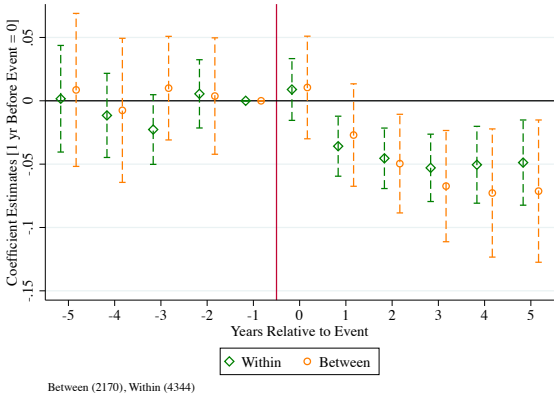
Notes: These figures show average difference-in-differences estimates on firms' investment rates in fixed assets across each sector. The dashed lines indicate 95% confidence intervals for these coefficient estimates. The analysis uses a matched sample across 10 European countries, which is restricted to acquiring firms and their matched control group.

Figure 5: Effects of M&As on Investment (Between vs. Within Industries)

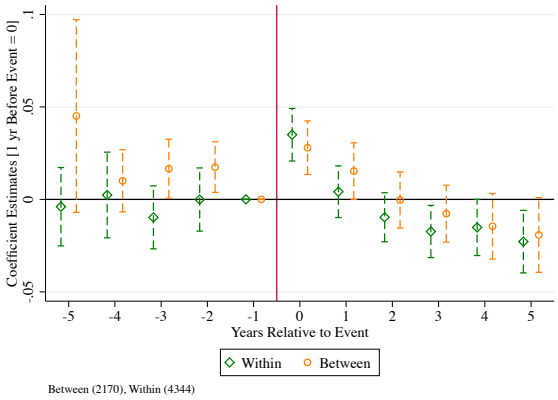
(A) Investment Rate in Fixed Assets



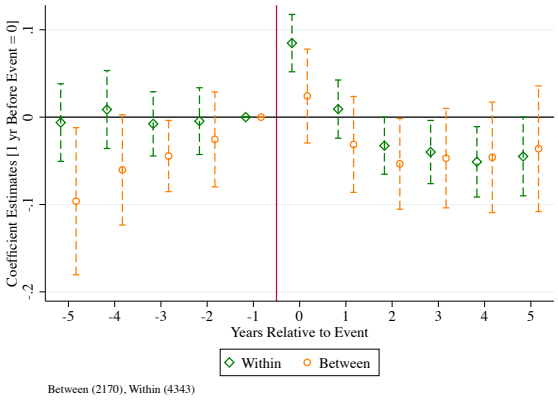
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



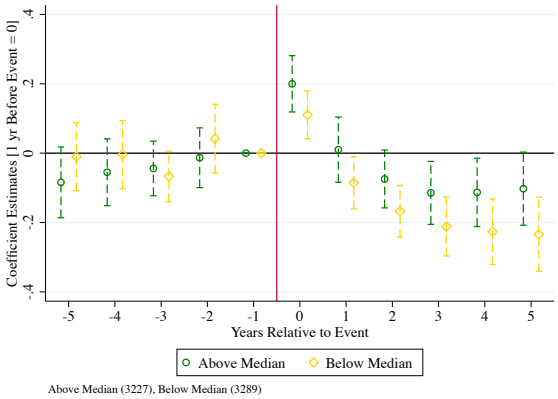
(D) Investment Rate in Financial Assets



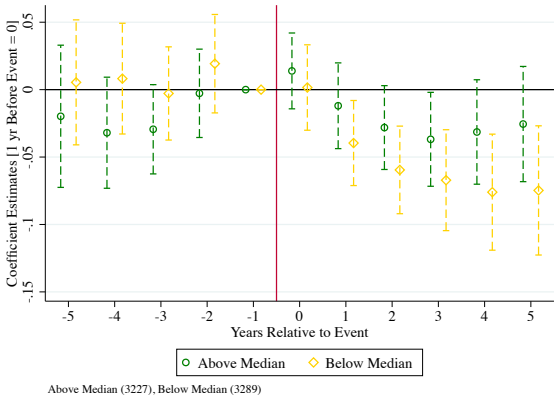
Notes: These figures show event-study coefficient estimates for firms' investment rates in fixed assets, separately for firms in the same 4-digit industries and for firms in different 4-digit industries. The dashed lines indicate 95% confidence intervals for these coefficient estimates. The solid vertical line indicates the event year. The green dots correspond to event study estimates for firms in the same 4-digit industries ("within") and the orange dots indicate the estimates for firms in different 4-digit industries ("between"). The analysis uses a matched sample across 10 European countries, which is restricted to acquiring firms and their matched control group.

Figure 6: Effects of M&As on Investment (Above- vs. Below-median concentration)

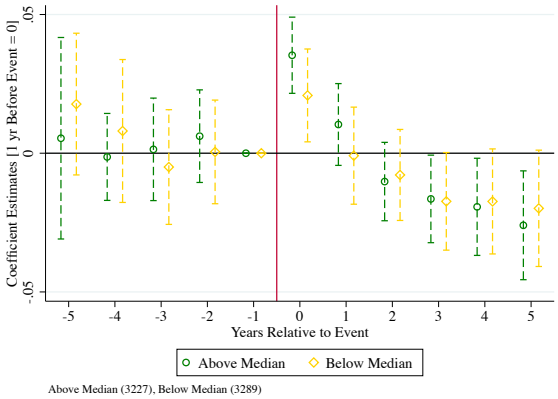
(A) Investment Rate in Fixed Assets



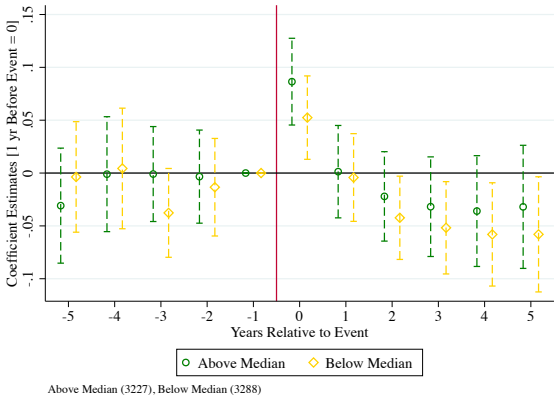
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



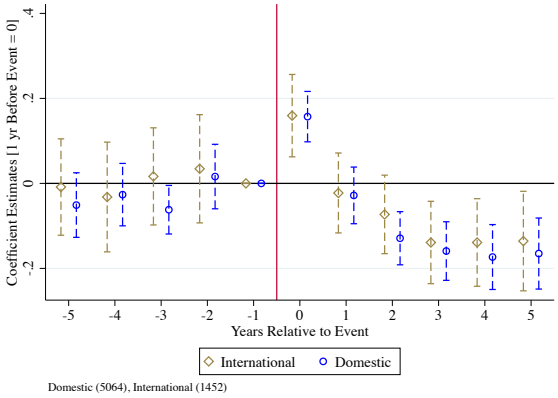
(D) Investment Rate in Financial Assets



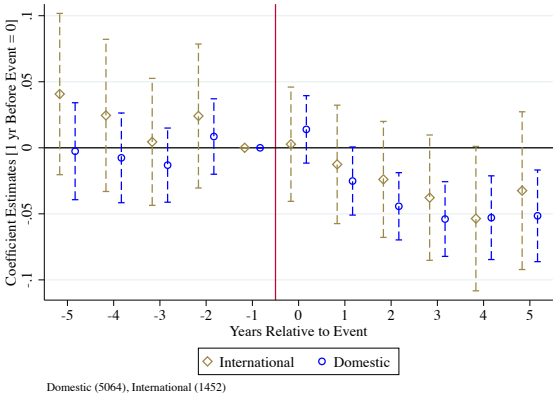
Notes: These figures show event-study coefficient estimates for firms' investment rates in fixed assets, separately for firms operating in concentrated industries and for firms operating in less concentrated industries. The dashed lines indicate 95% confidence intervals for these coefficient estimates. The solid vertical line indicates the event year. The green dots correspond to the event study estimates for firms active in concentrated industries (above-median HHI) and the yellow dots correspond to the event study estimates for firms active in less concentrated industries (below-median HHI). The analysis uses a matched sample across 10 European countries, which is restricted to acquiring firms and their matched control group.

Figure 7: Effects of M&As on Investment (Cross-border vs. Domestic M&As)

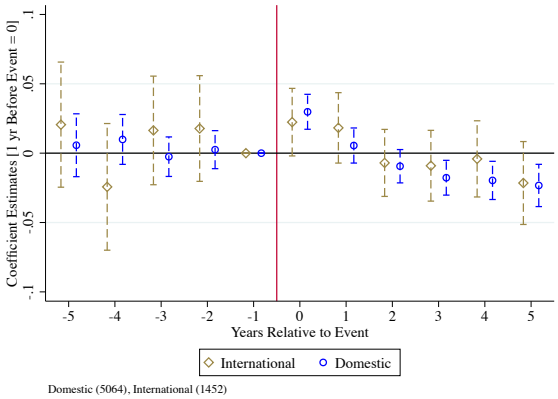
(A) Investment Rate in Fixed Assets



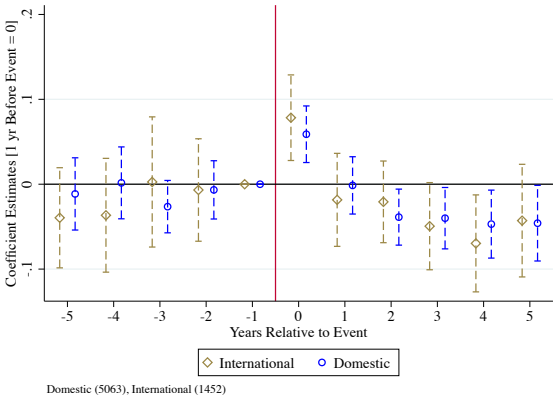
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets

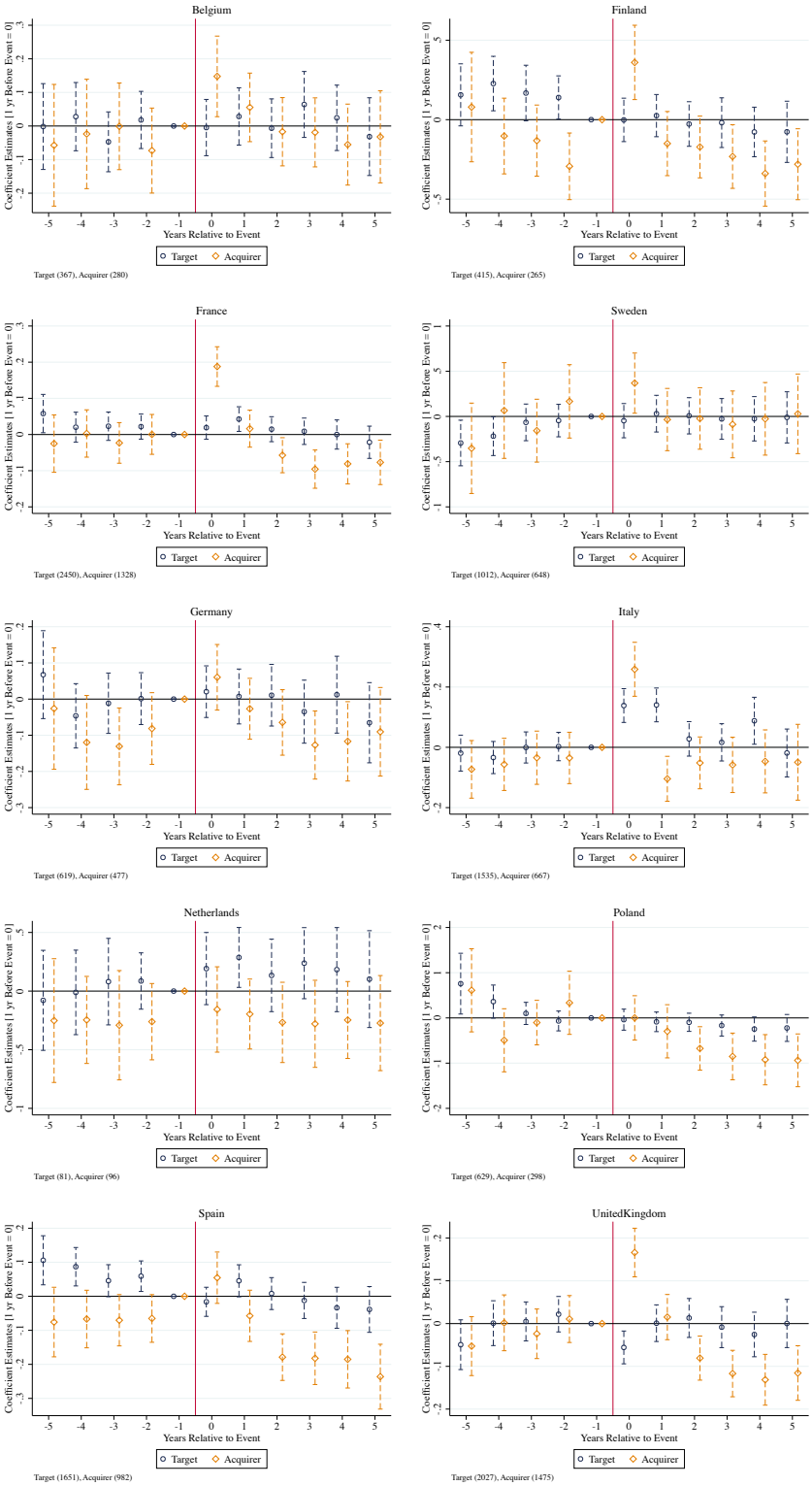


(D) Investment Rate in Financial Assets



Notes: These figures show event-study coefficient estimates for firms' investment, separately for firms involved in domestic M&A deals and for firms involved in cross-border deals. The dashed lines indicate 95% confidence intervals for these coefficient estimates. The solid vertical line indicates the event year. The blue dots correspond to the event study estimates for firms involved in domestic deals and the grey dots correspond to firms involved in cross-border deals. The analysis uses a matched sample across 10 European countries, which is restricted to acquiring firms and their matched control group.

Figure 8: Effects of M&As on Fixed Assets (Across Countries)



Notes: These figures show event-study coefficient estimates for firms' investment rates in fixed assets, separately for each country. The dashed lines indicate 95% confidence intervals for these coefficient estimates. The solid vertical line indicates the event year. The orange dots correspond to event study estimates for acquiring firms and the navy blue dots indicate the estimates for target firms.

Table 1: M&A Deals Across Countries (2007 - 2018)

Panel A: Fuzzy Match Rate (Perfect Match Rate)

	(1) Belgium		(2) Finland		(3) France		(4) Germany		(5) Italy		(6) Netherlands		(7) Poland		(8) Spain		(9) Sweden		(10) UK		(11) Average	
2007	74	(75)	69	(84)	72	(77)	70	(85)	65	(71)	69	(80)	68	(83)	69	(75)	64	(78)	75	(89)	71	(83)
2008	76	(76)	71	(84)	72	(75)	76	(85)	65	(73)	65	(76)	68	(80)	70	(58)	65	(75)	76	(89)	72	(79)
2009	75	(77)	74	(86)	71	(75)	75	(87)	70	(65)	66	(79)	73	(89)	69	(81)	63	(77)	75	(91)	72	(82)
2010	53	(84)	58	(88)	48	(82)	52	(93)	40	(37)	41	(77)	66	(91)	36	(81)	50	(82)	59	(93)	51	(86)
2011	51	(83)	59	(93)	46	(81)	54	(93)	42	(37)	41	(78)	65	(93)	38	(81)	52	(87)	62	(93)	52	(86)
2012	52	(81)	59	(86)	48	(81)	57	(92)	44	(40)	44	(73)	64	(90)	43	(77)	51	(83)	62	(92)	54	(85)
2013	54	(81)	58	(85)	48	(81)	58	(91)	49	(39)	46	(70)	60	(90)	49	(74)	53	(82)	67	(93)	56	(84)
2014	60	(83)	63	(84)	48	(79)	66	(88)	49	(39)	51	(74)	63	(87)	51	(72)	59	(83)	69	(92)	59	(83)
2015	56	(79)	62	(86)	45	(77)	68	(89)	49	(39)	51	(69)	62	(86)	54	(71)	61	(79)	72	(91)	59	(81)
2016	59	(68)	68	(85)	48	(73)	70	(89)	52	(42)	57	(68)	62	(85)	56	(71)	67	(75)	74	(91)	62	(79)
2017	68	(77)	72	(83)	54	(77)	74	(91)	56	(41)	60	(72)	67	(84)	59	(70)	69	(73)	72	(86)	65	(78)
2018	69	(78)	76	(83)	59	(76)	73	(88)	63	(42)	63	(75)	69	(85)	61	(66)	73	(75)	65	(72)	66	(74)
Average	63	(78)	66	(85)	54	(77)	66	(89)	55	(50)	55	(75)	65	(87)	55	(72)	61	(79)	69	(89)	62	(81)

Panel B: Total Number of M&A Deals

	(1) Belgium	(2) Finland	(3) France	(4) Germany	(5) Italy	(6) Netherlands	(7) Poland	(8) Spain	(9) Sweden	(10) UK	(11) Total
2007	443	426	2051	2368	970	1000	345	1201	1241	4400	15439
2008	390	452	1748	2020	976	1037	386	1437	980	3617	13891
2009	278	270	1489	1638	743	767	289	905	746	2566	10330
2010	302	324	1755	1612	730	804	378	1033	980	2986	11754
2011	318	333	1988	1893	671	863	294	1060	993	3084	12356
2012	284	253	1931	1733	545	763	224	898	881	3019	11356
2013	262	247	1830	1641	553	684	272	793	779	2737	10551
2014	316	266	2497	1855	657	737	447	1014	695	3188	12260
2015	405	275	3123	1843	900	833	691	1072	756	3408	13926
2016	413	321	3083	1957	1054	978	551	1034	840	3279	14120
2017	443	302	2556	1902	1174	926	402	1138	900	3958	14267
2018	430	313	2287	1796	1187	928	411	1253	934	4250	14320
Total	4284	3782	26338	22258	10160	10320	4690	12838	10725	40492	154570

Notes: Panel A reports the match rate between SDC Platinum (M&A data) and Amadeus (firm-level financial data). In the parentheses, we report the share of perfectly matched observations. A match is perfect if two observations match on at least one unique identifying variables (i.e., phone number, website, email, and ticker symbol). Panel B reports the total number of deals (matched and unmatched) across years and countries in our sample.

Table 2: Summary Statistics (Matched Sample)

	(1) Fixed (mil)	(2) Revenue (mil)	(3) Fixed (%)	(4) Intangible (%)	(5) Tangible (%)	(6) Other (%)	(7) Markup	(8) Productivity	(9) Leverage	(10) ProfMargin
Acquirer	60.069	120.480	0.416	0.064	0.190	0.080	2.966	6.456	0.615	0.056
	(171.049)	(278.271)	(0.458)	(0.118)	(0.224)	(0.195)	(4.852)	(4.160)	(0.225)	(0.095)
Matched Control	28.437	76.774	0.294	0.019	0.188	0.035	3.626	6.361	0.599	0.060
	(77.730)	(161.020)	(0.389)	(0.051)	(0.233)	(0.139)	(8.517)	(3.995)	(0.244)	(0.088)
Target	21.641	49.914	0.410	0.067	0.209	0.049	2.631	6.512	0.623	0.045
	(81.258)	(150.621)	(0.419)	(0.123)	(0.220)	(0.131)	(4.147)	(4.305)	(0.227)	(0.100)
Matched Control	13.581	38.785	0.290	0.019	0.192	0.028	3.176	6.274	0.601	0.055
	(46.082)	(100.798)	(0.332)	(0.046)	(0.219)	(0.102)	(6.344)	(4.272)	(0.245)	(0.084)

Notes: Sample years include 2009 – 2018. Column (1) reports the average fixed assets in million US dollars. Column (2) reports the average operating revenue in million US dollars. Column (3) to (6) report the average investment rates in total fixed assets, intangible assets, tangible assets and other (financial) assets, respectively. Column (7) reports the average markup. Column (8) reports the average total productivity factor (TFP). Column (9) reports the average leverage ratio and column (10) reports the average profit margin. "Matched Control" is the group of matched non-M&A firms.

Table 3: Summary Statistics on M&A Activities Across Countries

	(1) Per Year	(2) # Deals	(3) Non-Tradable (%)	(4) Within Indusry (%)	(5) Domestic (%)	(6) Merger (%)	(7) Asset Sought (%)	(8) Share Owned	(9) Value
Belgium	35	1.3	.75	.63	.52	.18	.65	.95	165
	(10)	(.16)	(.089)	(.092)	(.094)	(.058)	(.061)	(.029)	(335)
Finland	37	1.4	.75	.64	.78	.27	.53	.92	41
	(16)	(.22)	(.074)	(.09)	(.08)	(.1)	(.1)	(.033)	(42)
France	148	1.4	.81	.63	.84	.12	.6	.92	179
	(58)	(.17)	(.072)	(.067)	(.082)	(.049)	(.2)	(.077)	(144)
Germany	54	1.3	.65	.68	.71	.2	.59	.95	269
	(15)	(.17)	(.064)	(.11)	(.083)	(.079)	(.073)	(.022)	(338)
Italy	103	1.3	.51	.7	.78	.2	.35	.86	87
	(52)	(.14)	(.2)	(.13)	(.11)	(.084)	(.14)	(.032)	(79)
Netherlands	11	1.3	.7	.69	.5	.21	.54	.85	240
	(6)	(.27)	(.26)	(.21)	(.27)	(.16)	(.2)	(.27)	(390)
Poland	34	1.2	.66	.56	.88	.23	.27	.79	34
	(12)	(.2)	(.23)	(.092)	(.076)	(.12)	(.11)	(.068)	(50)
Spain	135	1.4	.73	.66	.84	.18	.55	.9	164
	(53)	(.13)	(.049)	(.072)	(.043)	(.038)	(.089)	(.037)	(226)
Sweden	76	1.4	.8	.64	.79	.2	.64	.93	35
	(26)	(.15)	(.092)	(.081)	(.069)	(.063)	(.086)	(.031)	(24)
UnitedKingdom	178	1.5	.8	.67	.75	.19	.6	.88	176
	(61)	(.36)	(.076)	(.12)	(.09)	(.072)	(.19)	(.26)	(186)
Average	81	1.3	.72	.65	.74	.2	.53	.89	140
	(66)	(.21)	(.16)	(.12)	(.17)	(.093)	(.18)	(.13)	(228)

Notes: This table displays summary statistics of M&A deals across countries and among acquirers in our matched sample. Column (1) reports the average number of M&A deals. Column (2) reports the average number of deals that an acquiring firm is involved in. Column (3) reports the share of M&A deals in non-tradable goods sectors. Column (4) reports the share of deals that were within the same 4-digit industries. Column (5) reports the share of domestic deals. Column (6) reports the share of deals that were mergers between two parties, rather than acquisitions of assets. Column (7) reports the share of deals that was involved in the acquisition of assets (as opposed to the acquisition of stocks). Column (8) reports the average share owned by the acquiring firm post M&A (when the deal was the acquisition of stocks). Column (9) reports the average value of transactions in million US dollars.

Table 4: Effects of M&As on Investment

	(1) Fixed	(2) Intangible	(3) Tangible	(4) Others
Acquirer	-0.066***	-0.002	-0.033***	-0.020
	(0.023)	(0.005)	(0.011)	(0.013)
R squared	0.636	0.450	0.661	0.475
Firm-Year	90879	90879	90879	90827
Target	-0.001	-0.004	0.006	-0.009
	(0.013)	(0.003)	(0.007)	(0.007)
R squared	0.580	0.460	0.612	0.474
Firm-Year	153346	153345	153345	153255

Notes: This table reports the difference-in-differences estimates for the effects of M&A on investment, separately for acquiring and target firms. The dependent variables in column (1) – (4) are investment rates in fixed assets, intangible assets, tangible assets, other (i.e., financial) assets. The standard errors are clustered at the firm level.

Table 5: Effects of M&As on Markup, TFP, Leverage, and Profit Margin

	(1) Markup	(2) Productivity	(3) Leverage	(4) ProfMargin
Acquirer	-0.005	-0.006	0.023***	-0.009***
	(0.007)	(0.010)	(0.003)	(0.002)
R squared	0.958	0.997	0.803	0.640
Firm-Year	75815	39499	98616	86776
Target	0.011*	0.017**	0.004	-0.007***
	(0.006)	(0.008)	(0.003)	(0.002)
R squared	0.955	0.997	0.768	0.616
Firm-Year	128448	71097	166996	144764

Notes: This table reports the difference-in-differences estimates for the effects of M&A on various outcomes, separately for acquiring and target firms. The dependent variables in column (1) and (2) are log(markup) and TFP. The dependent variables in column (3) and (4) are the leverage ratio and profit margins. The standard errors are clustered at the firm level.

Table 6: Effects of M&As on Main Outcomes (Tradable vs. Non-tradable)

	(1) Fixed	(2) Intangible	(3) Tangible	(4) Others
Post × Treated	-0.108***	-0.006	-0.047***	-0.027
	(0.034)	(0.006)	(0.014)	(0.018)
Post × Treated × Tradable	0.075*	0.002	0.039**	0.013
	(0.041)	(0.008)	(0.019)	(0.021)
R squared	0.619	0.444	0.668	0.455
Firm-Year	90879	90879	90879	90827

Notes: This table reports the difference-in-differences estimates for the effects of M&A on investment for firms in non-tradable goods sectors, and triple-difference estimates for firms in tradable goods sectors. The dependent variables in column (1) – (4) are investment rates in fixed assets, intangible assets, tangible assets, other (i.e., financial) assets. The standard errors are clustered at the firm level. The sample is restricted to acquiring firms and their matched non-M&A firms.

Table 7: Effects of M&As on Main Outcomes (Between vs. Within Industries)

	(1) Fixed	(2) Intangible	(3) Tangible	(4) Others
Post × Treated	-0.068**	-0.007	-0.035***	-0.017
	(0.028)	(0.006)	(0.012)	(0.015)
Post × Treated × Between	-0.068	0.005	-0.009	-0.018
	(0.059)	(0.010)	(0.022)	(0.028)
R squared	0.619	0.444	0.668	0.455
Firm-Year	90879	90879	90879	90827

Notes: This table reports the difference-in-differences estimates for the effects of M&A on investment for firms active in the same 4-digit industries ("within"), and triple-difference estimates for firms active in different 4-digit industries ("between"). The dependent variables in column (1) – (4) are investment rates in fixed assets, intangible assets, tangible assets, other fixed (i.e., financial) assets. The standard errors are clustered at the firm level. The sample is restricted to acquiring firms and their matched non-M&A firms.

For Online Publication

This appendix supplements our paper "Corporate Acquisitions and Investment: Evidence from Europe" with the following sections:

- Section A provides additional institutional details.
- Section B provides details of data cleaning and fuzzy matching.
- Section C describes TFP estimation.
- Section D shows results from robustness tests.

A Institutional Details

In Appendix A, we provide additional institutional details on M&A regulations for 10 European countries in our main analysis sample.

In column "Joint" of Table A.1, ✓suggests it is a joint threshold. If the column is empty, then it means if one threshold is satisfied, then the firm has to file a pre-merger notification.

In column "Regulation" of Table A.2, the first agency is in charge of takeover bid process, and the second agency is responsible for merger control. For "Exceptions" in Germany, the Takeover Act is applicable to foreign companies whose voting shares are exclusively listed in Germany at the organized market. For "Exceptions" in Italy, small and medium firms are subject to some special rules. Takeover Directives do not apply to some public offers in EU. The concentration that has a community dimension in EU Merger Regulation is defined with turnovers.

Table A.1: Threshold changes

Country	Time	Thresholds	Value	Joint
Belgium	2009-2018	domestic combined turnover	EUR 100 million	✓
		domestic individual turnover of at least two of the undertakings concerned	EUR 40 million	✓
Finland	2009-2018	global combined turnover	EUR 350 million	✓
		domestic individual turnover of at least two of the undertakings concerned	EUR 20 million	✓
France	2009-2018	global combined turnover	EUR 150 million	✓
		domestic individual turnover of at least two of the undertakings concerned	EUR 50 million	✓
Germany	2009-2017	global combined turnover	EUR 500 million	✓
		domestic turnover of at least one participating	EUR 25 million	✓
		domestic individual turnover of at least one further participating undertaking	EUR 5 million	✓
	2017-2018	global combined turnover	EUR 500 million	✓
		domestic turnover of at least one participating	EUR 25 million	✓
		domestic individual turnover of at least one further participating undertaking	EUR 5 million	✓
		transaction value	EUR 400 million	
Italy	2009	domestic combined turnover	EUR 461 million	
		domestic individual turnover of targets	EUR 46 million	
	2009-2012	domestic combined turnover	EUR 474 million	
		domestic individual turnover of targets	EUR 47 million	
	2013-2017	domestic combined turnover	EUR 499 million	✓
		domestic individual turnover of targets	EUR 50 million	✓
	2018	domestic combined turnover	EUR 498 million	✓
		domestic individual turnover of at least two of the undertakings concerned	EUR 30 million	✓

Table A.1 (continued): Threshold changes

Country	Time	Thresholds	Value	Joint
Netherlands	2009-2018	global combined turnover	health care: EUR 55 million	✓
			pension funds: EUR 500 million	✓
		domestic individual turnover of at least two concerned undertakings	health care: EUR 10 million	✓
			pension funds: EUR 100 million	✓
	2009-2014	global combined turnover	EUR 113.45 million	✓
		domestic individual turnover of at least two concerned companies	EUR 30 million	✓
	2015-2018	global combined turnover	EUR 150 million	✓
		domestic individual turnover of at least two concerned companies	EUR 30 million	✓
Poland	2009-2014	global combined turnover	EUR 1 billion	✓
		domestic combined turnover	EUR 50 million	✓
	2015-2018	global combined turnover	EUR 1 billion	✓
		domestic combined turnover	EUR 50 million	✓
		domestic individual turnover	EUR 10 million	✓
Spain	2009-2018	domestic combined turnover	EUR 240 million	✓
		domestic individual turnover of at least two of the undertakings concerned	EUR 60 million	✓
	2009-2010	domestic market share acquired or increased	30%	
	2011-2018	domestic market share acquired or increased	50%	✓
		domestic individual turnover of targets	EUR 10 million	✓
Sweden	2008	domestic combined turnover	SEK 4 billion	✓
		domestic individual turnover of at least two of the parties concerned	SEK 100 million	✓
	2009-2018	domestic combined turnover	SEK 1 billion	✓
		domestic individual turnover of at least two of the parties concerned	SEK 200 million	✓
United Kingdom	2009-2018	domestic individual turnover of targets	GBP 70 million	
		domestic market share acquired or increased	25%	

Table A.2: Summary of Regulations

Countries	Regulation	Who is applied to	Exceptions	Timeline
Belgium	*agencies:* FSMA, Belgian Competition Authority	voluntary or mandatory public takeovers bids if securities are in Belgium, primary market is in Belgium, or registered office is in Belgium and stocks are traded on Belgian stock exchange. any public squeeze-out bid.	registered office and primary market of target outside Belgium	without pre-merger notification: 4 to 16 weeks. with permerger notification: 6 to 36 weeks
Finland	*agencies:* Financial Supervisory Authority, FCCA	public takeovers. firms listed on Nasdaq Helsinki.	foreign target firms	without pre-merger notification: 20 to 24 weeks. with pre-merger notification: 24 to 48 weeks
France	*agencies:* Autorité des Marchés Financiers, Autorité de la Concurrence	irrespective of targets corporate form. Foreign buyers of certain sectors (energy, water, defense etc.) are subject to approval by the Minister of Economy. Banking, insurance, etc. are subject to approval regardless of buyers nationality.	Listed companies have slightly different rules regarding corporate governance.	without pre-merger notification: 12 to 16 weeks. with pre-merger notification: 16 to 32 weeks

Table A.2 (continued): Summary of Regulations

Countries	Regulation	Who is applied to	Exceptions	Timeline
Germany	*regulation:* Takeover Act. *agencies:* Federal Financial Supervisory Authority, Federal Cartel Office	only applies entirely to German- registered German-traded firms.	Only part of Takeover Act is applicable if a company is registered outside Germany or is traded only outside Germany.	without pre-merger notification: 1 to 16 weeks. with pre-merger notification: 5 to 36 weeks
Italy	*regulation:* Italian Civil Code, Italian Financial Act (TUF). *agencies:* National Commission for Companies and the Stock Exchange, Italian Competition Authority	joint-stock companies traded on Italian markets. Both public and private transactions subject to Italian Civil Code. The TUF applies to listed companies.	Small/medium enterprises have special rules.	without pre-merger notification: 4 to 10 weeks. with pre-merger notification: 6 to 24 weeks
Netherlands	*agencies:* Authority for the Financial Markets, Authority for Consumers and Markets	target admitted to trading on Netherlands regulated market.	N/A	without pre-merger notification: 10 to 24 weeks. with pre-merger notification: 14 to 41 weeks
Poland	*agencies:* Polish Financial Supervision Authority, Office of Competition and Consumer Protection	Target is public company registered in Poland with shares in a Polish regulated market.	non-Polish companies not traded in Poland	without pre-merger notification: 24 to 48 weeks. with pre-merger notification: 28 to 68 weeks

Table A.2 (continued): Summary of Regulations

Countries	Regulation	Who is applied to	Exceptions	Timeline
Spain	*agencies:* Securities Exchange Commission, Competition Authority	N/A	N/A	without pre-merger notification: 6 to 12 weeks. with pre-merger notification: 10 to 32 weeks
Sweden	*agencies:* Swedish Financial Authority, Swedish Competition Authority	targets whose shares are admitted to a regulated or alternative market in Sweden.	No special rules for foreign buyers except some restrictions in energy, nuclear, and defense sectors.	without pre-merger notification: 4 to 14 weeks. with pre-merger notification: 6 to 36 weeks
United Kingdom	*agencies:* Takeover Panel, Competitions and Markets Authority	public companies registered in the UK whose shares are traded on UK markets.	Foreign buyers restricted in aviation	without pre-merger notification: 4 to 16 weeks. with pre-merger notification: 4 to 184 weeks
EU	*regulation:* Takeover Directive 2004/25/EC, Council Regulation (EC) No 139/2004 (the EU Merger Regulation) *agencies:* European Commission	Takeover Directive: (1)public offers not made by the target company itself; (2)objective of control; (3)not issued by EU member states' central banks. EU Merger Regulation: all concentrations with a Community dimension	Takeover Directive: (1)made by the target company itself; (2)do not have as their objective the acquisition of control; (3)by EU member states' central banks.	without pre-merger notification: 2 to 10 weeks. with pre-merger notification: 7 to 35 weeks.

Table A.3: M&A Deals Across Other European Countries (2007 - 2018)

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017	(12) 2018	(13) Total
Austria	222	184	152	174	184	137	139	136	161	147	118	114	1868
Bulgaria	84	112	63	30	49	44	42	45	33	42	44	37	625
Croatia	34	26	18	39	46	31	29	23	29	53	49	42	419
Cyprus	40	72	63	67	70	70	22	48	27	54	60	39	632
CzechRepublic	160	155	95	172	167	145	130	107	158	202	131	150	1772
Denmark	379	321	302	319	287	278	303	245	257	316	287	245	3539
Estonia	43	57	33	31	31	35	33	42	50	78	52	62	547
Greece	98	79	93	96	87	58	55	55	27	36	73	56	813
Hungary	93	78	41	72	38	49	57	48	57	87	123	88	831
Ireland	189	166	146	115	111	132	122	175	187	165	190	217	1915
Latvia	36	28	18	30	39	29	34	34	40	42	46	37	413
Lithuania	69	49	35	42	52	32	41	65	56	57	39	55	592
Luxembourg	45	34	39	45	52	32	40	55	80	85	83	58	648
Malta	8	4	10	2	11	5	8	10	14	21	26	18	137
Portugal	169	201	92	124	72	73	76	69	121	128	156	166	1447
Romania	112	111	55	58	60	69	68	69	54	95	116	94	961
Slovakia	27	33	13	11	13	20	16	32	24	28	21	39	277
Slovenia	27	23	6	4	7	20	20	23	46	45	30	35	286
Total	1835	1733	1274	1431	1376	1259	1235	1281	1421	1681	1644	1552	17722

Notes: This table reports the total number of deals (matched and unmatched) across years and countries that are part of the European Union, but not included in our analysis sample.

B Fuzzy Matching

In this appendix, we explain the steps to merge M&A firms from SDC Platinum database with firms from the Amadeus database.

B.1 SDC Platinum Data

First, we drop transactions with missing dates of submission from the SDC data set. Second, SDC Platinum lists a target firm and an acquiring firm for each transaction. However, the names of the parties are not always disclosed. For example, an investor group acquired "Albingia SA" in 2018 but the names of acquiring parties are not disclosed or "Animagi Oy" acquired a set of companies whose names are not disclosed. We label these undisclosed parties as *unmatchable* and do not include them in our fuzzy matching. Roughly 7% of M&A parties are labeled *unmatchable* and dropped.

Moreover, a firm may have participated in multiple transactions during the period of our study. However, information such as phone number, website, and postal code might not be reported for all of the transactions. The SDC Platinum does not have a unique identifier for firms, hence, we use firms' original (non-standardized) names to recover these unique identifying variables (UIVs). We explain below how UIVs are used in our fuzzy matching.

To perform fuzzy matching, we standardize names of the firms. This task is particularly difficult since names are in various languages such as English, French, German, Italian and Finnish. First, we remove punctuation such comma, colon, dot, and ampersand from firms' names. For example, "A. & J. VOEGEL" will turn into "A J VOEGEL" and common words such "AND", "THE", "OF" (in various languages). Second, we identify common phrases. For example, the German phrase "Gesellschaft mit beschränkter Haftung" or "GmbH" and the Swedish phrase "Aktiebolag" or "AB" are equivalent to "Ltd." used in the U.K. or "Inc." in the U.S. Third, we harmonize these common phrases. For exmaple, "Gesellschaft MBH", "Ges MBH" and "Gesell MBH" are all various formats of "Gesellschaft mit beschränkter Haftung", all of which we replace with the phrase "GMBH". As another example, "PHARMACOLOGIQUES", "PHARMACIES", "FARMACEUTICO" are all various formats "PHARMACEUTICALS", all of which we replace with the phrase "PHARM". Fourth, we remove phrases that represent the legal status of a firm but are not specific to the firm such as "PLC", "LTD", "INC" (in various languages). Fifth, we identify and harmonize phrases related to the country of the firm e.g. "ITALIENNE", "ITALIE", and "ITALIANO" are all related to Italy, and we replace them with the phrase "IT".

B.2 Amadeus Data

The Amadeus database contains financial and accounting information for both private and publicly traded firms in Europe from 2007 to 2018. We drop firms with missing values for tangible, intangible and total fixed assets. We drop firms with missing names and standardize the names of firms, as described above.

B.3 Fuzzy Matching

We perform fuzzy matching between SDC Platinum and Amadeus data using the STATA command *matchit*.[9] We tokenize standardized names by splitting on spaces. For instance, in "SEVEN NETWORKS" there are two tokens: SEVEN and NETWORKS. These match perfectly with "SEVEN NETWORKS" and "NETWORKS SEVEN" (score = 1), imperfectly with "NETWORK SEVEN" or "SEV NETWORKS" (score = 0.5) but does not match with "SEVE NET" (score = 0). The score is calculated by dividing number of matched tokens by the total number of tokens. We keep all the matches with a score equal to or above 0.5.

We use unique identifying variables (UIV) such as phone number, email, website, postal code, ticker symbol if available to identify perfect matches. This helps us to improve both quality and quantity of identified matches. We define four classes of quality in our matched data with class 1 having the highest quality: (1) Identical standardized names and at least one matching UIV (2) Imperfect fuzzy-matched names with at least one matching UIV (3) Identical standardized names with no conflicting UIVs but same industry codes, and (4) Identical standardized names with conflicting UIVs. At this point, a firm might have multiple matches. We keep matches with the highest quality. If a firm has two or more matches of the same quality, we choose one randomly.

[9] See the STATA documentation for details.

C Estimating Total Factor Productivity

In this appendix, we provide details on the productivity estimation. To begin, we assume that total revenue of a firm is given by the following production function:

$$y_{jt} = \beta_0 + \beta_k k_{jt} + \beta_l l_{jt} + \omega_{jt} + \eta_{jt} \tag{2}$$

where y_{jt} is log total revenue, k_{jt} is log total capital, which we capture through the variable fixed assets, and l_{jt} is log total employment. The goal of the production function estimation for our purposes is to retrieve an estimate of $\hat{\omega}_{jt} = y_{jt} - \hat{\beta}_k k_{jt} + \hat{\beta}_l l_{jt}$ which captures the productivity of firm j at time t. To allow for different production functions across countries and industries, the estimation procedure is implemented separately for each four-digit NAICS code and country. Estimating (2) by linear regression would face well-known endogeneity issues, as η_{jt} is generally unobserved.

To circumvent this issue, we follow Ackerberg, Caves and Frazer (2015) and use a control function that allows us to control for unobserved productivity. To derive the control function, we assume the demand for materials is a function of both capital and labor. Modeling materials as a function of capital and labor and including labor as a state variable of the firm are the key distinction between Ackerberg, Caves and Frazer (2015) and earlier approaches developed by Olley and Pakes (1996) and Levinsohn and Petrin (2003), which model labor as a completely variable input which does not appear as a state variable:

$$m_{jt} = m_t(k_{jt}, l_{jt}, \omega_{jt})$$

Under an invertability condition, this allows us to invert the demand function to get productivity as a function of labor, capital and materials.

$$\omega_{jt} = m_t^{-1}(k_{jt}, l_{jt}, \omega_{jt}) = h_t(k_{jt}, l_{jt}, m_{jt})$$

The estimation procedure proceeds in two stages. In stage one, we model revenue of a firm as:

$$y_{jt} = \beta_0 + \beta_k k_{jt} + \beta_l l_{jt} + h_t(k_{jt}, l_{jt}, m_{jt})$$

Note that k_{jt} and l_{jt} appear both directly, as well as indirectly through h_t. Therefore, in the first stage, neither β_k or β_l are identified. However, the function Φ_t can be estimated by approximating

the nonparametric function with a polynomial in labor, capital and materials.

$$\Phi_t(k_{jt}, l_{jt}, m_{jt}) = \beta_0 + \beta_k k_{jt} + \beta_l l_{jt} + \omega_{jt}$$

Additionally, we assume productivity follows an exogenous first-order Markov process:

$$\omega_{jt} = E(\omega_{jt}|\omega_{j,t-1}) + \xi_{jt} = g(\omega_{j,t-1}) + \xi_{jt} = g(\Phi_{t-1} - \beta_0 - \beta_l l_{j,t-1} - \beta_k k_{j,t-1})$$

Using the first stage estimates, we can now rewrite revenue in time t as:

$$y_{jt} = \beta_0 + \beta_l l_{jt} + \beta_k k_{jt} + \tilde{g}(\hat{\Phi}_{t-1} - \beta_0 - \beta_l l_{j,t-1} - \beta_k k_{j,t-1}) + \xi_{jt} + \eta_{jt}$$

To estimate this equation requires an additional moment, as ξ_{jt} and l_{jt} are not orthogonal. A standard option is to assume lagged employment is orthogonal to the error term $\xi_{jt} + \eta_{jt}$. This implies the parameters β_l and β_k can be computed by a generalized methods of moments estimator:

$$E\left\{(\xi_{jt} + \eta_{jt})\begin{pmatrix} k_{jt} \\ l_{j,t-1} \end{pmatrix}\right\} = 0$$

which yields estimates for $\hat{\beta}_k$ and $\hat{\beta}_l$. The estimates of productivity ω_{jt} can then be retrieved as:

$$\hat{\omega}_{jt} = y_{jt} - \hat{\beta}_k k_{jt} - \hat{\beta}_l l_{jt}$$

D Robustness

In this Appendix, we provide a set of robustness tests for the main results in Section 4.

D.1 Using Different Levels of Winsorization, Lags, and Clustering

We repeat the main analysis using the same specification as in equation (1), winsorizing (bottom- and top-coding) the main outcome variable at the 1% and 99% levels, instead of at the 5% and 95% levels. Figure D.1 shows that the results are qualitatively similar to the ones in which we winsorize the main outcomes at 5% and 95% levels.

Furthermore, we impose different years of lags on our main analysis sample. Figure D.2 shows that the results from the specification where we impose 1 year of lag, and that they are qualitatively similar to the main results from the specification where we impose 2 years of lag to the event time.

Finally, we use two-way clustering at the industry-by-country level. Figure D.3 shows that the results are qualitatively similar to the ones where we cluster our standard errors at the firm-level.

D.2 Perfectly Matched Sample

We repeat the main analysis using the same specification as in equation (1) using the perfectly matched sample. Figure D.4 shows the results with the perfectly matched sample, which are qualitatively similar to the ones where we include the fuzzy matched sample. Note that within the matched sample we use for our main analysis, 81% of them are the perfectly matched sample and 19% of them are the fuzzy-matched sample.

D.3 Asset vs. Share Purchase

We run a heterogeneity test based on whether a given deal was purchasing a target's assets or shares. The intuition is that if an acquiring firm was buying a target solely to sell its underpriced assets at higher prices in the future, we should expect to see that its investment rate mechanically goes down in the medium-run for a deal where the acquirer directly bought the target's assets. Furthermore, if the investment rate decreased after a M&A because the M&A itself was investment, then we should see that there would be a mechanical reallocation of fixed assets between acquirers and targets when the deal involves an asset purchase. Note that this would capture a particular mechanism of how M&As may lead to a reduction in investment (rather than creating a source of biases in our estimates). Figure D.5 shows that the effects of M&As on investment rate in total

fixed and financial assets are larger for stock purchases than for asset purchases, which implies that the decline in fixed assets was not driven by a mechanical reallocation from selling off targets' assets.

D.4 Imputation Estimator of Borusyak, Jaravel and Spiess (2021)

A recent literature (Goodman-Bacon, 2018; Sun and Abraham, 2020; De Chaisemartin and d'Haultfoeuille, 2020; Borusyak, Jaravel and Spiess, 2021) finds that in two-way fixed effects designs with unit and time fixed effects, the difference-in-differences estimator (or dynamic difference-in-differences estimator) may not retrieve a weighted average treatment effect. The key issue in these designs is that the standard implementation by OLS uses variation in which already treated units are used as a comparison group for not-yet treated groups, a comparison Borusyak, Jaravel and Spiess (2021) calls a "forbidden comparison". This can lead to important biases when treatment effects are not constant across groups or over time. This issue motivates our primary strategy that utilized a match difference-in-differences strategy separately for each M&A cohort.

Another approach is to use the the estimator of Borusyak, Jaravel and Spiess (2021). To illustrate the approach, consider a simplified Equation (1):

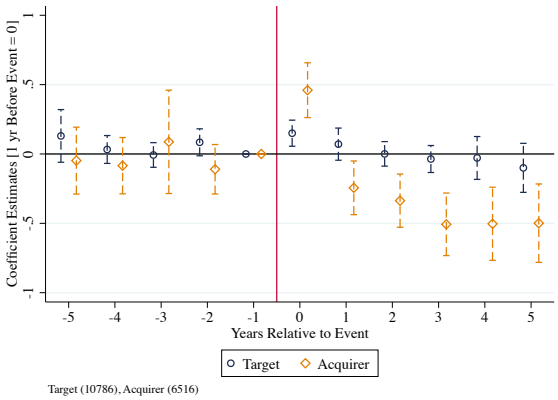
$$y_{it} = \beta \cdot MA_{it} + \alpha_i + \alpha_t + \epsilon_{it} \tag{3}$$

where MA_{it} is equal to one of the firm has gone through a merger. The imputation estimator proceeds by estimating the unit and period fixed effects, α_i and α_t, using only never-treated or not-yet-treated observations. We impute the value for y_{it} for a firm that has gone through a merger at time t as $\hat{y}_{it}(0) = \hat{\alpha}_i + \hat{\alpha}(t)$. In other words, this is the predicted value of y for this firm at time t had the firm not gone through the merger based on the firm's fixed effect and the period fixed effect. The treatment effect at time t is therefore given by the difference between the actual value of y and the imputed value $\hat{\tau}_{it} = y_{it} - \hat{y}_{it}(0)$. To yield an overall estimate, we take a simple average of $\hat{t}_{it}$ across all treated units (i.e. estimate the ATT).

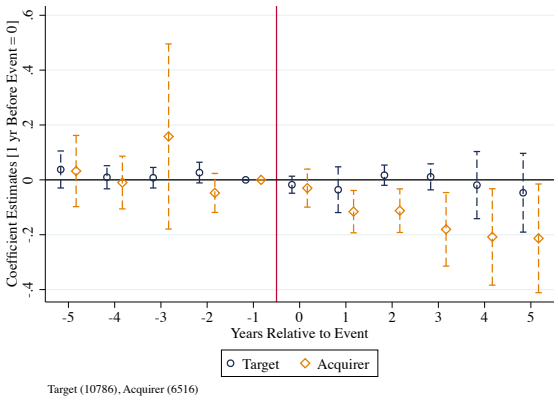
Figure D.6 implements the imputation estimator for the primary investment outcomes. In all cases, we find similar results to the main specifications in the paper that uses the matched difference-in-differences that matches separately for each cohort of M&A events. These results confirm that the main estimates are not biased by identification issues in standard event-study design implementations with staggered treatment timing.

Figure D.1: Effects of M&As on Investment (1%, 99% Winsor)

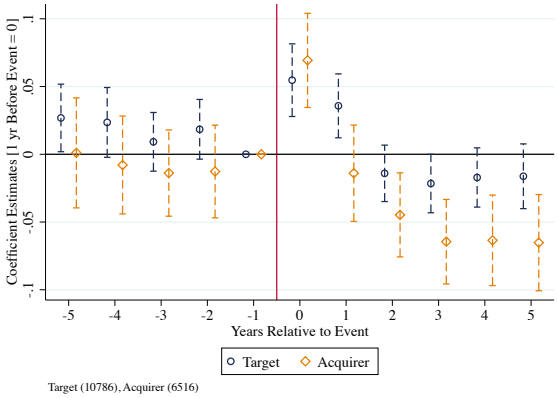
(A) Investment Rate in Fixed Assets



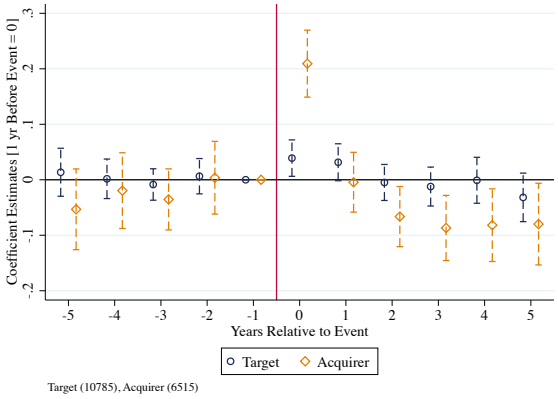
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



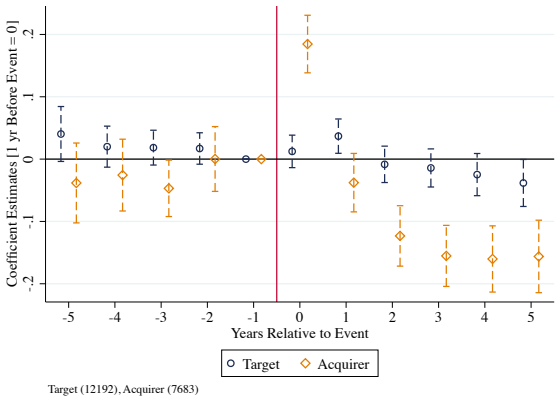
(D) Investment Rate in Financial Assets



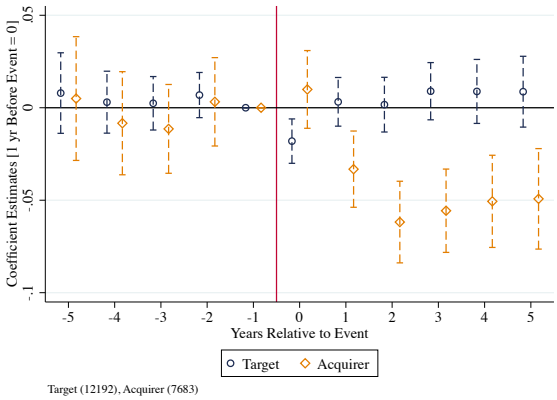
Notes: These figures show the event-study coefficient estimates for firms' investment rates in fixed assets. The main outcomes are winsorized at 1% and 99%. The dashed lines indicate 95% confidence intervals for these estimates. The solid vertical line indicates the event year. The orange dots correspond to the event study estimates for the acquiring firms and the navy blue dots indicate the estimates for the target firms. The analysis uses a matched sample across 10 European countries from 2009 to 2018.

Figure D.2: Effects of M&As on Investment (Imposing 1 Year Lag)

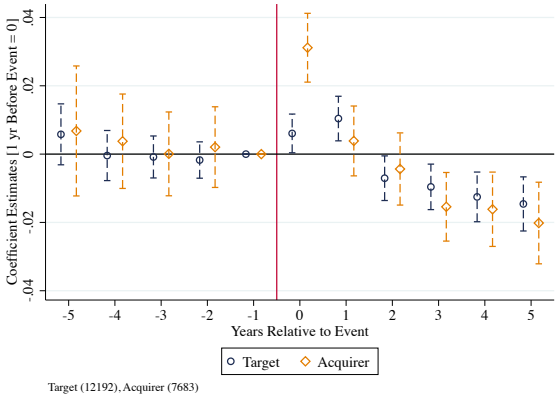
(A) Investment Rate in Fixed Assets



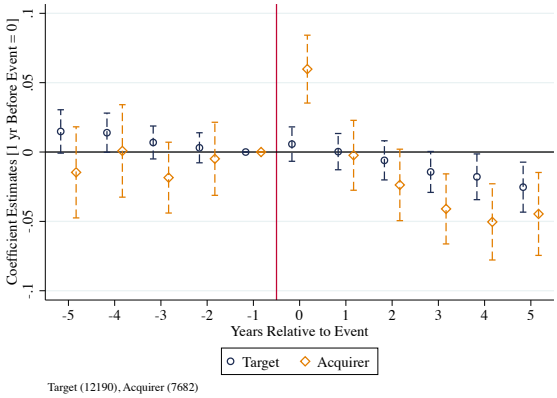
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



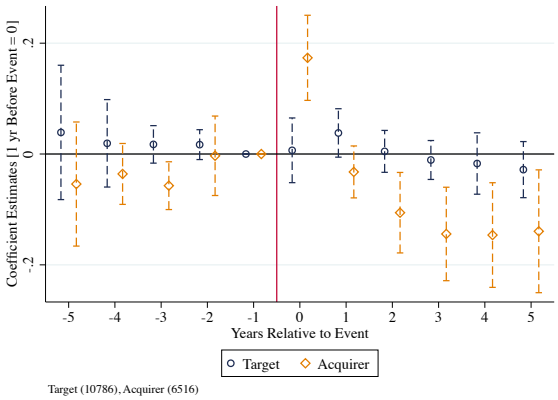
(D) Investment Rate in Financial Assets



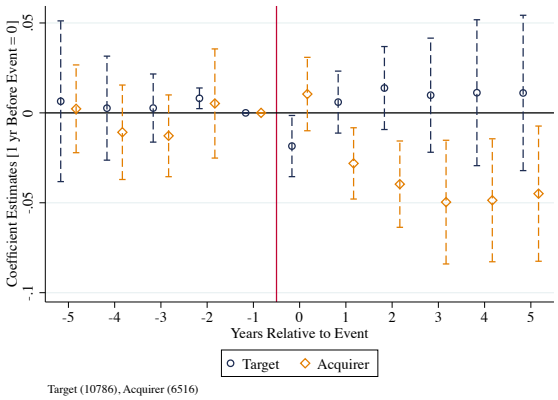
Notes: These figures show the event-study coefficient estimates for firms' investment rates in fixed assets. The main outcomes are winsorized at 5% and 95%. The dashed lines indicate 95% confidence intervals for these estimates. The solid vertical line indicates the event year. The orange dots correspond to the event study estimates for the acquiring firms and the navy blue dots indicate the estimates for the target firms. The analysis uses a matched sample across 10 European countries from 2009 to 2018.

Figure D.3: Effects of M&As on Investment (Industry-by-Country level Clustering)

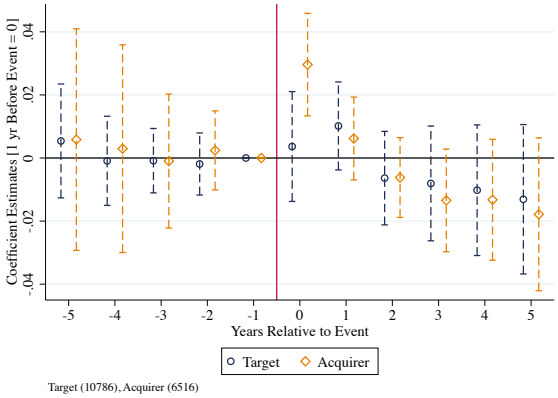
(A) Investment Rate in Fixed Assets



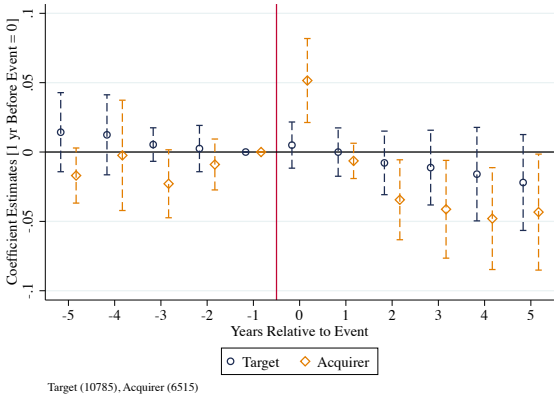
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



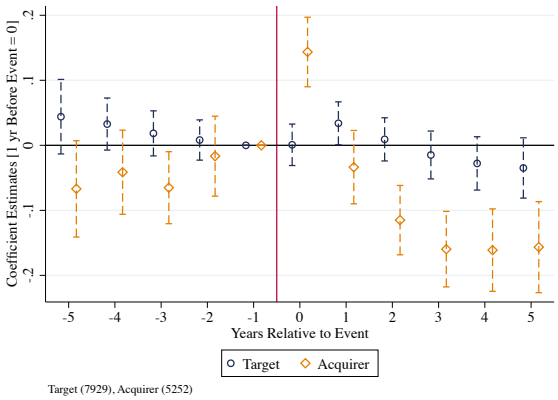
(D) Investment Rate in Financial Assets



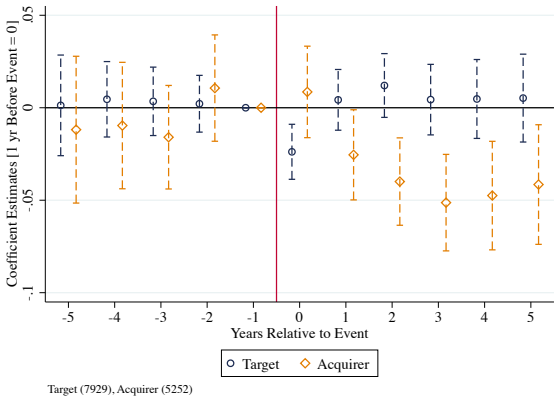
Notes: These figures show the event-study coefficient estimates for firms' investment rates in fixed assets. The main outcomes are winsorized at 5% and 95%. The dashed lines indicate 95% confidence intervals for these estimates. The solid vertical line indicates the event year. The orange dots correspond to the event study estimates for the acquiring firms and the navy blue dots indicate the estimates for the target firms. The analysis uses a matched sample across 10 European countries from 2012 to 2018.

Figure D.4: Effects of M&As on Investment (Perfectly Matched Sample)

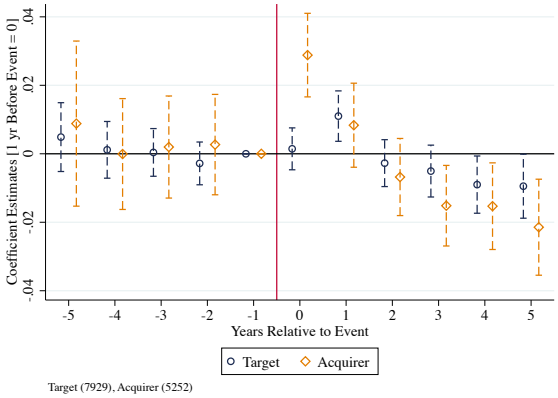
(A) Investment Rate in Fixed Assets



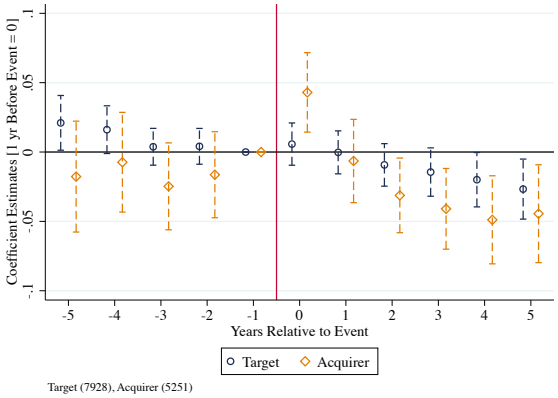
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



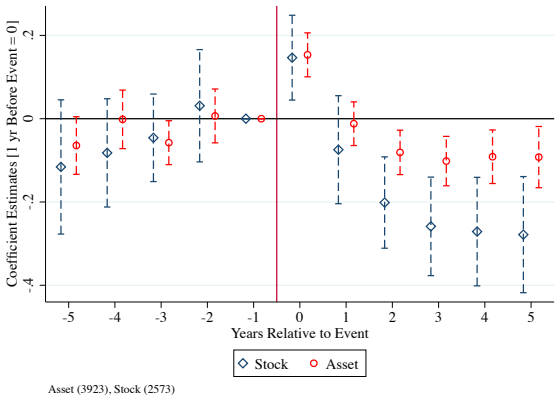
(D) Investment Rate in Financial Assets



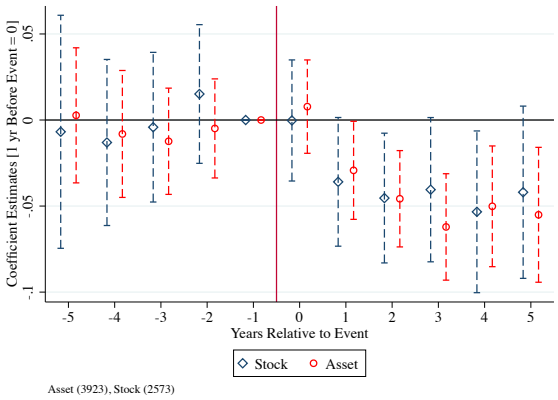
Notes: These figures show the event-study coefficient estimates for firms' investment rates in fixed assets for the perfectly matched sample. The dashed lines indicate 95% confidence intervals for these estimates. The solid vertical line indicates the event year. The orange dots correspond to the event study estimates for the acquiring firms and the navy blue dots indicate the estimates for the target firms. The analysis uses a matched sample across 10 European countries from 2009 to 2018.

Figure D.5: Effects of M&As on Investment (Asset vs. Share Purchase)

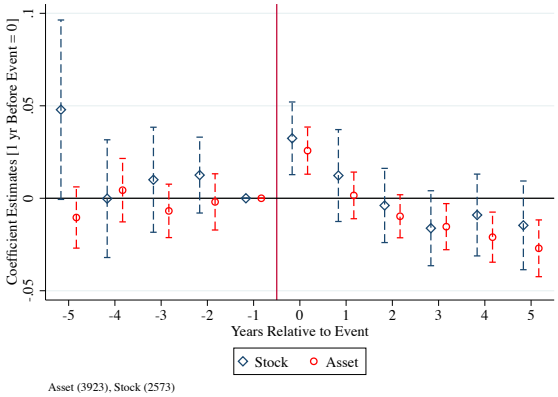
(A) Investment Rate in Fixed Assets



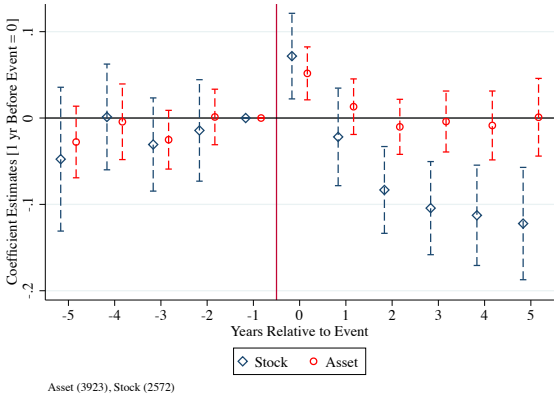
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



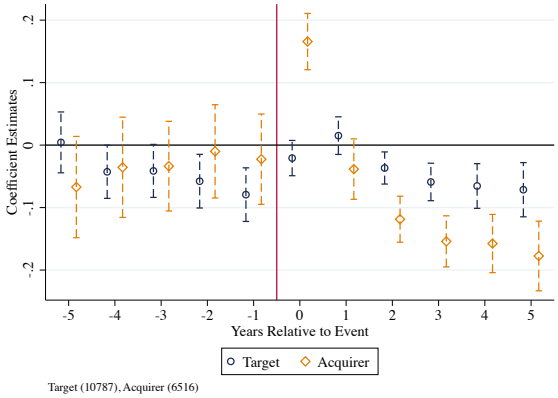
(D) Investment Rate in Financial Assets



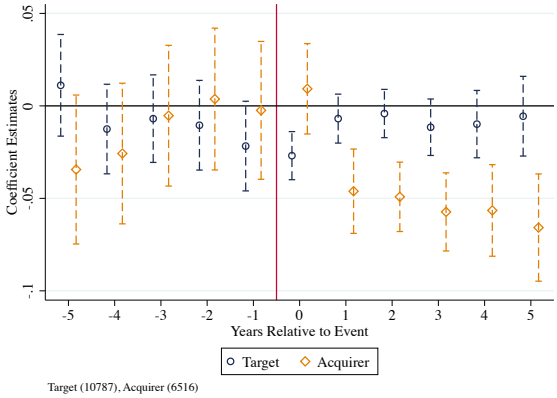
Notes: These figures show the event-study coefficient estimates for firms' investment rates in fixed assets, separately for acquiring firms involved in the acquisition of assets (red dots) and for acquiring firms involved in the acquisition of stock (blue dots). The dashed lines indicate 95% confidence intervals for these coefficient estimates. The solid vertical line indicates the event year. The analysis uses a matched sample across 10 European countries, which is restricted to acquiring firms and their matched control group.

Figure D.6: Effects of M&As on Investment following Borusyak, Jaravel and Spiess (2021)

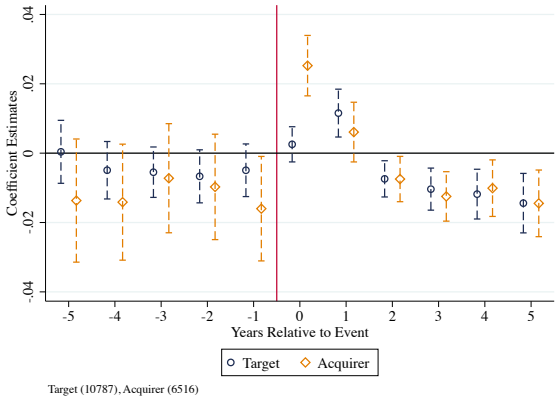
(A) Investment Rate in Fixed Assets



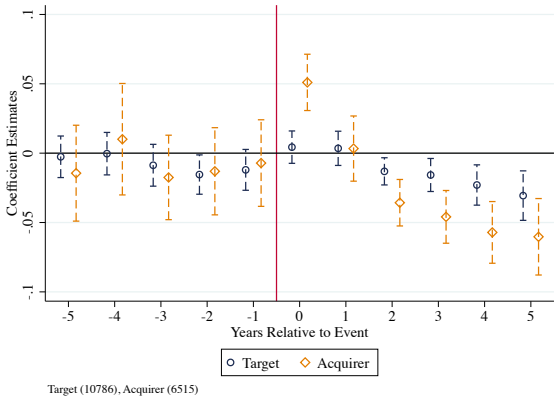
(B) Investment Rate in Tangible Assets



(C) Investment Rate in Intangible Assets



(D) Investment Rate in Financial Assets



Notes: These figures show the event-study coefficient estimates for firms' investment rates in fixed assets. The dashed lines indicate 95% confidence intervals for these estimates. The solid vertical line indicates the event year. The orange dots correspond to the event study estimates for the acquiring firms and the navy blue dots indicate the estimates for the target firms. The analysis uses a matched sample across 10 European countries from 2009 to 2018. Unlike the main estimates that estimate the coefficients by traditional OLS, these results estimate the coefficients by applying the estimator detailed in Borusyak, Jaravel and Spiess (2021).