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Determinants of Bidders' Abnormal Returns in Technology Mergers and Acquisitions

Centre for Finance

Bachelor Thesis

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Abstract

We study 314 mergers and acquisitions (M&As) of European and American technology firms between 2004 and 2018. Using the standard event study methodology, this paper analyzes the abnormal returns of bidders in the event window around the M&A announcement date to investigate whether or not technology M&As create value. Following the event study, we examine which factors influence the bidders' abnormal returns. Even though previous literature has examined the determinants of abnormal returns in industry-specific M&A transactions, the technology sector has received less attention. Our findings show that the announcement effect of bidders on average reduce their shareholder value. A possible explanation for the lack of statistically significant positive abnormal returns is the competitiveness of markets for corporate control. Concerning specific determinants, our results show that higher liquidity of the bidder firm on average leads to higher abnormal returns. We also find strong evidence that the size of the transaction and the method of payment influence abnormal returns of bidders. Moreover, we find that higher efficiency of target firms generates higher abnormal returns for bidders. In conclusion, our results indicate that technology firms should aim to acquire small, efficient targets using cash-only as the preferred method of payment.

Keywords: Event Study; Technology Industry; Mergers and Acquisitions; Shareholder Value.

JEL Classifications: G14, G30, G34.

Definitions

AR	Abnormal Returns
Bidder	Acquiring Company
CAR	Cumulative Abnormal Returns
Event	M&A Announcement Date
GLS	Generalized Least Squares
M&A	Mergers and Acquisitions
OLS	Ordinary Least Squares
R&D	Research and Development
Target	Acquired Company

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1 Introduction

There has been a dramatic increase in merger and acquisition (M&A) activity in recent decades (Boone, Lie, and Liu, 2014), both in terms of volume and transaction size. According to Bloomberg (2019), the aggregate value of M&A transactions globally in 2018 was approximately \$3.1 trillion, with Europe and U.S. accounting for 80.4%. The importance of M&A transactions has been amplified by the ever-changing market landscape, in which M&As are powerful tools employed by firms to gain strategic advantages and increase shareholder value (Tamošiūnienė and Duksaitė, 2009).

However, M&As are not inherently successful and therefore not guaranteed to create value. Bidders face a difficult task of evaluating potential targets and we consider it to be vital to understand the underlying determinants of value creation in M&A transactions when making investment decisions.

The fact that some of the largest transactions in history have involved high-tech firms (Lusyana and Sherif, 2016) is indicative of the increasing significance of the technology sector. Furthermore, technology firms promote technological advancements, scientific discoveries, and efficiency gains, making them innovative leaders in today's economy (Kohers and Kohers, 2001).

The bidders' rationale for purchasing technology firms is the distinctive growth opportunities and the efficiency potential from acquiring new technology rather than developing it internally (Kohers and Kohers, 2001). Additionally, the disruptive innovation potential of technology firms (Chitkara, Gloger, and McCaffrey, 2018) makes them interesting targets for bidders. In contrast, technology firms are characterized by an inherent valuation risk due to the uncertainty regarding future cash flows and unproven developments. In addition, technology firms are coupled with issues regarding ethics, especially concerning new applications of technology that threats privacy or exploits consumers. Thus, the attractive growth prospects of technology targets can come with a high price tag (Kohers and Kohers, 2000).

The high-growth, high-risk nature of technology-based industries raises important questions about the value creation in technology M&As. In particular, the drivers of value creation in takeovers of technology firms. The purpose of this paper is to investigate M&As in the technology sector by examining transactions in Europe and the U.S. between 2004 and 2018. We seek to explain which factors influence abnormal returns of bidders in the event window around the announcement day of the transaction. Even though previous literature has examined the determinants of abnormal returns in industry-specific M&A transactions (e.g. Beitel, Schiereck, and Wahrenburg, 2004), the technology sector has received less attention. Therefore, we believe this paper could fill an important area of the M&A literature.

Our intention is that the reported findings can serve as guidance in the decision-making process of M&A transactions, in particular for the shareholders and management of the bidder firm. Furthermore, this paper contributes to a deeper understanding of value drivers in technology M&As.

2 Literature Review

The impact of M&A transactions on the value of the bidder, target, and combined entity has been the focus of numerous studies in recent years. In this section, we provide insight into the most relevant research made in the area by focusing on firstly the general M&A research and subsequently the findings that have been made in the context of technology M&A.

In general, the research on the impact of M&A on the abnormal returns is inconclusive. In terms of the hypothetical combined entity, various studies have shown that the overall gain is slightly positive (e.g. Andrade, Mitchell, and Stafford, 2001; Bradley, Desai, and Kim, 1988). A number of studies have shown that the target captures most of the value created in M&A (e.g. Mandelker, 1974; Langetieg, 1978; Dodd, 1980; Malatesta, 1983; Dodd and Ruback, 1977). While the literature is consistent in the sense that M&A destroys value for the bidding firm (e.g. Andrade, Mitchell, and Stafford, 2001; Varaiya and Ferris, 1987; Bradley, Desai, and Kim, 1988), a few studies have reported positive abnormal returns for bidders when controlling for certain variables (e.g. Moeller, Schlingemann, and Stulz, 2004; Sudarsanam, 1996; Halpern, 1973).

Although there has been extensive research in the context of technology M&A, most research has focused on whether or not M&A creates value and not what specifically determines value creation. Moreover, the results in the technology M&A literature are inconclusive. In a study consisting of bidders acquiring high-tech targets in the U.S., Lusyana and Sherif (2016) found positive abnormal returns for domestic bidders. In another key study, Kohers and Kohers (2000), who examined which factors influenced shareholder wealth for high-tech firms between 1987 and 1996, also found positive abnormal returns for bidders. However, Porrini (2004) showed negative abnormal returns for high-tech bidders in the event window. When analyzing the combined entity, Kirchhoff and Schiereck (2011) showed slightly positive abnormal returns, while Parachuri, Nerkar, and Hambrick (2006) found that the event did not create value.

Among the extensive research in the area, some studies have also examined the transaction characteristics. For example, Kirchhoff and Schiereck (2011), who analyzed the key success factors in the pharmaceutical and biotechnology industry, found that successful bidders have low R&D intensity, have outperformed their benchmark during the estimation period, and take over targets with high cash flows. Kohers and Kohers (2000) found that bidder returns were positive between 1993 and 1996 compared to the other time periods analyzed. The returns were also positive if the target was private rather than public and the relative size of bidder to target was large. Additionally, in a study of 787 transactions in the IT-industry between 1998 and 2011, Khansa (2015) found that small bidders were more successful than large bidders. The author also found that cross-border transactions generated value for bidders.

3 Theory

This section gives an overview of the most important theoretical background to this paper. The first area concerns M&As in general, in particular the definition of an M&A and the rationale for M&As. Next, we present four theories to analyze our findings.

3.1 Definition of M&A

The term mergers and acquisitions (M&A) has various definitions and may imply a range of transactions. In this paper, we adhere to Damodaran's definition of M&As. Damodaran (2008) defines a merger as a type of acquisition in which the boards of directors of two firms agree to combine the firms into one entity. Damodaran continues to define four types of acquisitions: *consolidation*, *tender offer*, *purchase of assets*, and *buyout*. In a *consolidation*, a new firm is created, and both the bidder and target firm own stock in the new entity. A *tender offer* occurs when the bidder firm offers to buy the outstanding stock of the target at a specified price. A *purchase of assets* refers to an agreement where one firm acquires the assets of another firm. A *buyout* happens when the management, or a group of investors, buy out the firm from a public market in order to make it private.

3.2 M&A Rationale

Trautwein (1990) sheds light on the rationale for M&As by explaining a number of different motives. In particular, the author mentions the following motives: *synergies*, *target undervaluation*, *empire-building*, and *process outcomes*.

Synergies can be defined as the value created by combining two entities into one and the creation of opportunities that would not be available if these entities operated separately (Damodaran, 2005). Trautwein (1990) suggests three types of synergies: operational synergies, financial synergies, and managerial synergies. Operational synergies affect the operations of the firm and may include economies of scale, pricing power, and growth potential, which could enable the firm to offer new products and services (Damodaran, 2005; Trautwein, 1990). Financial synergies may include increased debt capacity, tax benefits, and diversification. Managerial synergies may be realized when the bidder's managers possess abilities that benefit the target firm's performance.

Valuation theory encompasses the notion of *target undervaluation*. Trautwein (1990) describes this as the bidder's managers having better information about the target's value than the stock market or the managers having unique information about possible synergies from combining the two entities.

In the *empire-building theory*, managers seek to maximize their own utility under constraints put upon them by the market instead of maximizing firm value. In this theory, growth maximization is regarded as one motive. Additionally, profit and power motives may also be possible explanations for this type of behaviour.

The *process theory* states that M&A decisions are outcomes of processes influenced by one or more of the following: individuals possessing limited information processing capabilities which may lead to incomplete evaluations, political games played between an organization's sub-units and outsiders, and organizational routines.

3.3 Efficient Market Hypothesis

The efficient market hypothesis states that an ideally efficient capital market is one in which prices always fully reflect available information. Fama (1970) describes three different forms of market efficiency: *weak form*, *semi-strong from*, and *strong form*. In the *weak form* prices only reflect historical information. In the *semi-strong form*, prices reflect all the publicly available information and in the *strong form*, prices reflect all the information, both public and private. The event study represents a test of the semi-strong form (Fama, 1991) and gives a clear picture of how prices adjust to new public information. Since we test for abnormal returns during the event window, we would, if significant results are obtained, contradict the theory of efficient markets (Fama, 1970).

3.4 Capital Structure Theories

Myers (2001) suggests three main conditional capital structure theories: the *tradeoff theory*, the *free cash flow theory*, and the *pecking order theory*.

The *tradeoff theory* postulates that firms choose their capital structure by balancing the tax advantages of debt against the cost of possible financial distress.

The *free cash flow theory*, put forth by Jensen (1986), says that firms generating cash flow in excess of that required to fund its profitable investment opportunities are more likely to engage in wasteful spending. Jensen argues that excess free cash flow increases the conflict of interest between shareholders and managers. An implication of the free cash flow theory is that firms with high levels of free cash flow are more likely to initiate takeovers and investments that destroy value. According to this theory, leverage increases the firm's value despite the threat of financial distress because it commits the firm to making future interest payments, thereby reducing excess cash flows and agency costs.

The *pecking order theory*, put forth by Myers (1984) and Myers and Majluf (1984), establishes a relationship between the cost of financing and asymmetric information. The authors present three main sources of funding available to firms: retained earnings, debt, and equity. In their paper, Myers and Majluf argue that firms prefer to use retained earnings to finance projects. If external financing is needed debt will be issued first and equity will only be used as a last resort. Retained earnings have no adverse selection problems, whereas both debt and equity are subject to adverse selection problems due to asymmetric information between the managers of the firm and the outside investors. However, equity suffers from more serious adverse selection problems and consequently has a larger risk premium than debt. From the firm's perspective, managers who believe that the equity is undervalued will prefer to use retained earnings, or debt, rather than equity. In contrast, equity will be issued only when managers believe that the equity is overvalued. Therefore, outside investors will interpret the new equity issuance as a sign of overvaluation and proceed to place a lower value to the new equity. Thus, the theory implies that equity issuance will be followed by a negative stock reaction. In the absence of other motives, the price drop upon announcement may be sufficient to deter firms from issuing equity except as a last resort.

4 Methodology

This paper applies the event study methodology to investigate the value creation in technology M&A. Besides the overall value implications, we particularly analyze the determinants of abnormal returns. To this end, we test several independent variables that may explain the value creation following prior research.

4.1 Event Studies in General

The process of evaluating price changes surrounding a certain event was first discussed by Dolley (1933). The standard event study methodology was first implemented by Ball and Brown (1968) and later Fama et al. (1969) in order to measure the effects of actions and events on the value of a firm. Since these two studies, the event study methodology has only changed marginally (Binder, 1998).

The usefulness of such a study comes from the fact that, given efficient markets, the effects of an event will be reflected immediately in security prices (MacKinlay, 1997). Furthermore, short-term event studies are the most statistically reliable methods to gauge the value implications of the announcement of M&As (Andrade, Mitchell, and Stafford, 2001).

4.2 Event Study Design

Figure 1 illustrates the event study time line. The event of interest in this study is the M&A announcement date, $\tau = 0$. We define the estimation window as $L_1 = T_1 - T_0$. The event window, $L_2 = T_2 - T_1$, is the period in which abnormal returns are calculated. Although our event under consideration is an announcement, which occurs on a given date, it is typical to set the event window length, L_2, larger than one day (MacKinlay, 1997). Finally the post-event window, in which capital markets' reactions can be analyzed, is defined as $L_3 = T_3 - T_2$.

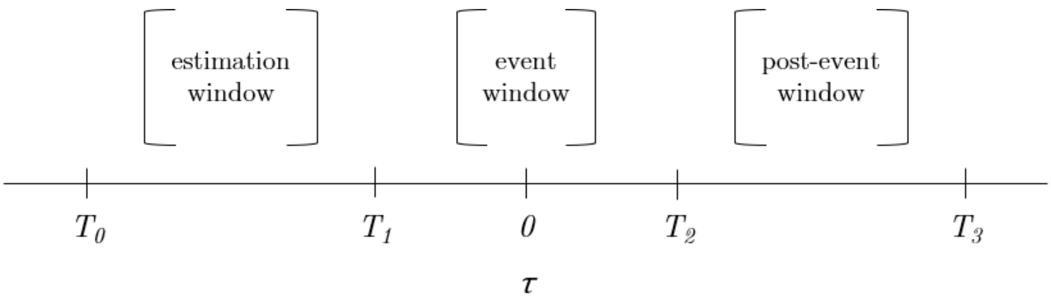

Figure 1: Event Study Time Line

For the purposes of this paper, we set the baseline estimation window, L_1, to 80 days prior to the event window. The baseline event window, L_2, is 11 days immediately surrounding the M&A announcement, i.e. five days before to five days after the announcement date, τ.

4.3 General Procedure

We rely our event study methodology on the market model-based approach suggested by Brown and Warner (1985). Additionally, the methodology in this paper follows the suggestions by MacKinlay (1997).

The market model is a statistical model, which relates the return of any given security to the return of the market portfolio (MacKinlay, 1997). For any security i the market model is

$$R_{i,\tau} = \alpha_i + \beta_i R_{m,\tau} + \varepsilon_{i,\tau} \tag{1}$$

$$E(\varepsilon_{i,\tau} = 0) \qquad var(\varepsilon_{i,\tau}) = \sigma^2_{\varepsilon_i}$$

where $R_{i,\tau}$ and $R_{m,\tau}$ is the period-τ returns on security i and the market portfolio, respectively, and $\varepsilon_{i,\tau}$ is the error term.

An OLS-regression model is applied to estimate the model parameters α_i and β_i for each stock i. The parameters are estimated during the estimation window.

Expected returns, $\hat{R}_{i,\tau}$, are then calculated as follows

$$\hat{R}_{i,\tau} = \hat{\alpha}_i + \hat{\beta}_i R_{m,\tau}. \tag{2}$$

We proxy the market return, $R_{m,\tau}$, for the daily closing values of either the STOXX Europe 600 Technology Index or S&P 500 Information Technology Index depending on whether the security is listed in Europe or in the U.S. Both indices are capitalization weighted and include firms involved in the technology sector.

Sample abnormal returns of a stock i in the event window, $\widehat{AR}_{i,\tau}$, are calculated as the difference between the observed stock return, $R_{i,\tau}$, and the expected stock return, $\hat{R}_{i,\tau}$, in the event window

$$\widehat{AR}_{i,\tau} = R_{i,\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m,\tau}. \tag{3}$$

Sample abnormal returns for period-τ are then averaged

$$\overline{AR}_{\tau} = \frac{1}{N}\sum_{i=1}^{N} \widehat{AR}_{i,\tau}. \tag{4}$$

The conditional variance of abnormal returns, $\sigma^2(\widehat{AR}_{i,\tau})$, is calculated as follows

$$\sigma^2(\widehat{AR}_{i,\tau}) = \sigma^2_{\varepsilon_i} + \frac{1}{L_1}\left[1 + \frac{(R_{m,\tau} - \hat{u}_m)}{\hat{\sigma}^2_m}\right] \tag{5}$$

where L_1 is the length of the estimation window. The conditional variance has two components; the error variance, $\sigma^2_{\epsilon_i}$, and an additional variance due to the sampling error in α_i and β_i. The sampling error component, which is common for all event studies, leads to serial correlation of the abnormal returns even though the true disturbances are independent through time. However, as the length of the estimation window L_1 increases, the second term approaches zero and the sampling error of the parameters becomes negligible (MacKinlay, 1997).

The sample cumulative abnormal returns, $\widehat{CAR}_i$, for any interval (τ_1, τ_2) during the event window, L_2, are calculated as follows

$$\widehat{CAR}_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \widehat{AR}_{i,\tau}. \tag{6}$$

Cumulative abnormal returns can be averaged using a similar approach to equation (4) for any interval in the event window

$$\overline{CAR}(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \overline{AR}_\tau = \frac{1}{N}\sum_{i=1}^{N} \widehat{CAR}_i(\tau_1, \tau_2) \tag{7}$$

where the variance of average cumulative abnormal returns are defined as

$$var(\overline{CAR}(\tau_1, \tau_2)) = \sum_{\tau=\tau_1}^{\tau_2} var(\overline{AR}_\tau). \tag{8}$$

To test for significance, the null hypothesis is derived using the z-value that is based on the sample variance of CAR divided by the square root of the number of observations as a proxy for the unknown and unbiased standard deviation σ_ε (MacKinlay, 1997)

$$\theta_1 = \frac{\overline{CAR}(\tau_1, \tau_2)}{\sqrt{var(\overline{CAR}(\tau_1, \tau_2))}} \sim N(0, 1). \tag{9}$$

If we are able to obtain significant results, we draw the conclusion that the event has an impact on the distribution of returns.

Following the event study, an OLS-regression is applied to estimate the model parameters of the independent variables according to the basic model

$$CAR_i(-5;5) = \beta_{i,0} + \sum_{j=1}^{n} \beta_{i,j} F_{i,j} + \varepsilon_{i,j} \tag{10}$$

where CAR_i is the 11-day cumulative abnormal returns, $\beta_{i,0}$ is the regression constant, $F_{i,j}$ the independent variable $j \in \{1, ..., n\}$, $\beta_{i,j}$ the coefficient of the independent variable, $\varepsilon_{i,j}$ the error term of the regression, for each stock, i, and n the number of independent variables.

5 Data

In this section, we explain our sample selection process, discuss a few characteristics of the sample, and provide insight into the choice of independent variables.

5.1 Sample

In selecting our sample, we follow the procedure suggested by MacKinlay (1997). The sample is obtained from the Bloomberg M&A Database based on our chosen selection criteria. We require that (i) the transactions were announced between 1 January 2004 and 31 December 2019, (ii) both the target and bidder operate in the technology sector according to the Bloomberg Industry Classification System (BICS), (iii) the deal status is completed, (iv) the payment includes cash, stock or a mix of the two, (v) both the target and bidder are publicly traded and have available information on Bloomberg, (vi) both the target and bidder operate in Europe and/or the U.S., and (vii) there is an exclusive bidder of the target firm. This selection process leads to 314 transactions.

The stock price data is obtained from Bloomberg Terminal using the last traded price for each trading day. We use daily intervals based on the findings of Morse (1984). He found that using daily stock returns produce a more powerful statistic for abnormal returns. According to the author, monthly data is only preferable when there is uncertainty regarding the announcement date. However, this uncertainty is not present in our sample.

Although country-specific differences are outside the scope of this paper, we provide an overview of the geographical distribution of our sample in Table 1. As seen in the table, our sample is clearly dominated by U.S. firms. Of the total 314 transactions, U.S. firms are targets in 197 transactions and bidders in 213 transactions. Among the European countries, United Kingdom, France, and Germany represent the countries with the most frequent bidders. Most European targets come from the United Kingdom, France, Germany, and Sweden. Apart from the U.S., both United Kingdom and France have the most frequent domestic transactions.

Target Country	**Bidder Country**														
	AT	BE	CH	DE	ES	FI	FR	GB	GR	IS	NL	NO	PL	SE	US	Total
AT	1															1
BE							1	2							1	4
CH				2											1	3
DE	2			4	1		1	1					1		1	11
DK															1	1
FI															1	1
FR		2		1			14	4							5	26
GB			1			1	1	11			1				21	36
GR									1							1
HU				2												2
IE															2	2
LU							1									1
MT								1								1
NL											2					2
NO				1		1				1		2			2	7
PL											1		6			7
SE								1						5	5	11
US			1	7			6	7			2	1			173	197
Total	3	2	2	17	1	2	24	27	1	1	6	3	7	5	213	314

AT = Austria, BE = Belgium, CH = Switzerland, DE = Germany, ES = Spain, FI = Finland, FR = France, GB = United Kingdom, GR = Greece, HU = Hungary, IE = Ireland, IS = Iceland, LU = Luxembourg, MT = Malta, NL = Netherlands, NO = Norway, PL = Poland, SE = Sweden, US = United States.

Table 1: Geographical Distribution of Sample

5.2 Independent Variables

In our analysis, we use two subcategories of variables, namely: transaction-specific and firm-specific variables. Table 2 presents an overview of the selected variables.

One of the variables used in our analysis is the *geographical focus* of the transaction. In our study, we use a dummy variable that takes the value 1 for cross-border transactions and 0 for domestic transactions. The geographical focus of a transaction could imply imperfections and costs in product- or factor markets, differences in regulations or government policies, and asymmetric information in capital markets (Harris and Ravenscraft, 1991). For example, Bris, Brisley, and Cabolis (2008) found that bidders benefited when acquiring target firms in countries with worse shareholder protection and accounting standards (see also Bris and Cabolis, 2008). Moreover, the abnormal returns and volume of cross-border transactions may be affected by cultural differences (Ahern, Daminelli, and Fracassi, 2012). However, neither Lowinski, Schiereck, and Thomas (2004) nor Higgins and Rodriguez (2006) could identify any significant evidence for geographical focus as a source of value creation.

Another variable considered in our study is the *method of payment* used in the transaction. To examine this, we use a dummy variable that takes the value 1 for stock-included payments and 0 for cash-only transaction. The implications of the payment method in M&A transactions have been the focus of numerous studies (e.g. Andrade, Mitchell, and Stafford, 2001; Eckbo and Thorburn, 2000; Travlos, 1987). Myers and Majluf (1984) concluded that the decision to issue shares to finance a transaction carries negative information that the bidder firm is overvalued. Thus, stock-included payments should yield lower abnormal returns than cash-only payments, all else equal (see also Hansen, 1987). In conformity, Andrade, Mitchell, and Stafford (2001) found negative abnormal returns if the bidder used at least some stock to finance the acquisition. Furthermore, Kirchhoff and Schiereck (2011, p.40) argued that cash payments are "favorable to the targets, since the acquired firm would have to bear the price risk if paid by stocks". Given prior evidence, stock-included payments might have a negative announcement effect.

We also consider the *transaction size* a relevant variable. In contrast to other studies, this paper uses the logarithm of the total reported transaction value rather than the absolute value. The reason is that our sample is biased towards small transactions and using the logarithm can transform the distribution toward normality (Feng et al., 2004). Loderer and Martin (1990) suggested that large transactions tended to be value destroying to bidders because they overpaid. This could be explained by overconfident managers (see Roll, 1986) or due to the inherent difficulties valuing high-tech firms (Kohers and Kohers, 2000). In conformity, Khansa (2015) found a significant negative relationship between the value of the transaction and abnormal returns to the bidder. In another study, Alexandriis et al. (2011) found that there is a negative correlation between the premia paid and transaction size. Nonetheless, larger transactions still destroyed value for bidders and the uncertainty regarding returns increased as a consequence of the transaction, suggesting that investors view large acquisitions as more risky projects.

An alternative measure of transaction size is the relative size of the bidder and the target. To measure this, we use the *relative market value* of bidder to target. In the case of technology firms, it is easier to integrate human capital and intellectual property of the bidder and the target in the combined entity when the relative size is larger (Masulis, Wang, and Xie, 2007). Given prior evidence, we expect smaller targets relative to bidders to create higher returns for bidder shareholders.

In accordance with Kirchhoff and Schiereck (2011), we test to see if the *sales* *performance* of the bidder or target affects bidders' returns in the technology industry. As the authors did, we examine the sales growth of targets and bidders, as well as their respective sales to asset ratios. We expect a prominent sales performance of the target as a sign of innovation capacity, which may complement the bidders own sales efforts and thus generate value to the bidding shareholders.

R&D investments are central in the technology industry and often closely tied to the sales performance of the firm. In line with prior studies (e.g. Higgins and Rodrigeuz, 2006; Sorescu, Chandy, and Prabhu, 2007; Kirchhoff and Schiereck, 2011), we measure *R&D intensity* as R&D expenditures relative to sales, both for the target and bidder. R&D investments are imperative in order to develop new products and consequently create future cash flow streams. Furthermore, the faster a firm can produce new products and bring them to market, the more likely it is to capture first-mover advantages such as reputation effects and market preemption (Deeds and Hill, 1996). R&D is therefore expected to be an important driver for M&A because it allows bidders with weaker research capacity to acquire targets with high R&D investments and thus close the gap (Kirchhoff and Schiereck, 2011; James, 2002; Deeds and Hill, 1996). However, firms with higher R&D intensity are more likely to engage in R&D outsourcing acquisitions (Higgins and Rodriguez, 2006). Additionally, bidders with low R&D intensity face greater difficulty in attracting good targets than firms with high R&D capacity (Sorescu, Chandy, and Prabhu, 2007).

Another firm-specific variable considered in our study is *liquidity*. According to Myers and Majluf (1984), a firm always increases its value through M&A when one firm's surplus slack fully covers the other firm's deficiency. This suggests that illiquid bidders acquiring targets with high financial slack generates higher abnormal return, and vice versa. However, firms with financial slack are also more likely to undergo value destroying acquisitions (Jensen, 1986). In our study, we measure liquidity for both target and bidder by calculating free cash flow to sales.

We also examine the *growth focus* of the transaction by analyzing the total growth of the target's assets prior to the transaction. The asset growth measures whether the target firm is in a positive or negative growing trend (Kirchhoff and Schiereck, 2011) and a positive trend may encourage the bidder's growth (Beitel, Schiereck, and Wahrenburg, 2004).

Name of Variable	Definition
Panel A: Transaction-Specific	
Geographical Focus	Binary dummy variable; 1 for cross-border transactions and 0 for domestic transactions
Method of Payment	Binary dummy variable; 1 for stock-included payments and 0 for cash-only payments
Transaction Size	Logarithm of the total reported transaction value of the target firm
Panel B: Firm-Specific	
Growth Focus	Growth of target's total assets^a
Bidder Liquidity	Bidder free cash flow^b relative to bidder sales^b
Target Liquidity	Target free cash flow^b relative to target sales^b
Bidder R&D Intensity	Bidder R&D expenditures^b relative to bidder sales^b
Target R&D Intensity	Target R&D expenditures^b relative to target sales^b
Relative Market Value	Market value of the target^b relative to market value of the bidder^b
Bidder Sales Growth	Growth of bidder's sales^a
Target Sales Growth	Growth of target's sales^a
Bidder Sales to Assets	Bidder sales^b relative to bidder total assets^b
Target Sales to Assets	Target sales^b relative to target total assets^b

^{a}31.12.$t-1$ divided by 31.12.$t-2$, where t is the announcement year; ^{b}Per December of the year prior to the announcement year, $t-1$, where t is the announcement year.

Table 2: Definition of Variables

Table 3 presents summary statistics of the independent variables. The average transaction size is €920.5 million, but evidently from the high standard deviation and the difference between the median and the average, the distribution of transaction size is skewed. Interestingly, the average target invests more in R&D than the average bidder, indicating that bidders tend to acquire targets with higher R&D intensity, in line with previous literature (James, 2002; Deeds and Hill, 1996). Bidders are clearly more liquid than targets in the average transaction. It can also be seen from the average and median figures in Table 3 that bidders are more efficient in terms of sales to assets but targets grow marginally faster.

Variable	N	Average	Median	Std. dev.	Min	Max
Panel A: Transaction-Specific						
Dummy: Geographical Focus	314	-	-	-	-	-
Dummy: Method of Payment	314	-	-	-	-	-
Transaction Size[a]	314	920.52	204.05	2,070.78	0.08	15,494.02
Panel B: Firm-Specific						
Growth Focus	309	12.06%	4.88%	36.78%	(72.94%)	292.14%
Bidder Liquidity	309	10.72%	11.32%	21.80%	(270.45%)	41.19%
Target Liquidity	308	3.43%	4.65%	17.24%	(106.41%)	42.26%
Bidder R&D Intensity	301	12.64%	12.13%	10.29%	0.00%	66.27%
Target R&D Intensity	275	16.59%	15.56%	13.50%	0.00%	99.50%
Relative Market Value	312	19.77%	8.52%	26.42%	0.03%	245.31%
Bidder Sales Growth	306	12.98%	7.73%	35.90%	(68.87%)	294.64%
Target Sales Growth	309	13.40%	4.43%	69.57%	(90.00%)	1,102.55%
Bidder Sales to Assets	308	81.05%	75.40%	37.55%	14.85%	261.34%
Target Sales to Assets	310	26.14%	9.25%	50.01%	0.0%	552.38%

[a]Values in million euros

Table 3: Characteristics of Independent Variables

5.3 Descriptive Statistics

Table 4 shows a breakdown of the transactions over time. The number of transactions increased during the first years in our sample, peaking in 2005 at 38 followed by a sharp decline in 2009, possibly as a result of the financial crisis of 2008. Interestingly, almost 70% of the transactions were announced in the first half of the time period, between 2004 and 2011. Moreover, approximately 30% of the transactions were announced in the period surrounding the financial crisis. Despite the downward trend in M&A activity, the transaction size paints a different picture. The total reported transaction value has increased since the turn of the decade, with two notable exceptions: 2013 and 2017. This indicates that fewer but larger transactions have been announced in recent years. Additionally, the portion of transactions financed by cash-only averaged 73.7% per year. Our sample shows that the portion of cash-only transactions increased steeply in the wake of the financial crisis and up until 2014. The subsequent decrease could be linked to the lower interest rate climate in recent years, making stock-financed transactions more attractive from the point of view of the bidding firm.

Year	Transaction Size[a]	Transaction Count	Cash-Only Transactions
2004	2,751.01	19	63.16%
2005	15,712.97	38	50.00%
2006	13,166.60	28	64.29%
2007	21,219.19	34	73.53%
2008	12,161.38	32	71.88%
2009	19,636.97	22	72.73%
2010	14,434.20	21	95.24%
2011	24,916.95	17	88.24%
2012	10,292.27	15	86.67%
2013	1,705.09	13	84.62%
2014	18,334.44	17	88.20%
2015	64,595.63	22	63.64%
2016	25,413.36	13	61.54%
2017	2.362.30	8	75.00%
2018	42,339.73	15	66.67%
Total	**289,042.09**	**314**	
Average	**19,269.47**	**21**	**73.69%**
Median	**15,712.97**	**19**	**72.73%**

[a]Values in million euros.

Table 4: Sample Time Trend

Table 5 provides descriptive statistics of key figures used in our study. As seen in the table, the average bidder is 25 times larger than the average target in terms of asset size and sales. Turning to free cash flow, the bidders generate on average 38 times that of targets. Overall, these results indicate that the average target is remarkably smaller than the average bidder.

Characteristics[a]	**Bidders**	**Targets**	**Ratio Target/Bidder**
Total Assets[b]			
N	311	311	
Average	12,127.55	500.37	4.13%
Standard Deviation	23,800.44	1,342.16	
Min.	2.76	0.78	
Max.	101,069.00	13,182.47	
Free Cash Flow[b]			
N	312	309	
Average	1373.26	35.66	2.60%
Standard Deviation	2951.83	123.90	
Min.	-489.51	-146.55	
Max.	23873.71	1103.44	
Total Sales[b]			
N	309	313	
Average	9,762.70	399.34	4.09%
Standard Deviation	20,395.83	1,202.14	
Min.	0.41	0.08	
Max.	93,787.12	16,170.57	
R&D Expenditures[b]			
N	304	276	
Average	736.58	44.47	6.04%
Standard Deviation	1,366.40	108.08	
Min.	0.00	0.00	
Max.	8,685.77	1,249.862	

[a]Values in million euros, unless stated otherwise; [b]Per December of the year prior to the announcement year, $t-1$, where t is the announcement year.

Table 5: Key Figures of Identified Transactions

6 Results

In this section, we provide an overview of the average stock price reactions following the M&A announcement. This allows us to answer whether or not M&A transactions create value for the bidders. Secondly, we report which factors best determine the cumulative abnormal return of bidders.

6.1 Overall Stock Price Reactions

We report the average abnormal returns for each day for our significant event windows in Table 6. Four of the ten days report positive abnormal return, albeit statistically insignificant. We find negative significant average abnormal returns for three days in the event window, i.e. three days prior to the event, one day and five days after the event. These results further support our selection of baseline event window, $[-5; 5]$.

The stock price reaction around the M&A announcement date of bidders with a fixed estimation window of 80 days and varying event windows is summarized in Table 7. We find only two event window intervals ([-5;5] and [0;5]) that are statistically significant at the 10% significance level. Our findings show that on average there is no strong significant M&A announcement effect, although we might have cross-sectional significance. The lack of statistically significant positive abnormal stock returns could be a result of competitive markets for corporate control. Competition among bidding firms leads to a more efficient price discovery process, which results in a price of the target firm that reflects the benefits the bidder obtain from the acquisition (Travlos, 1987). Additionally, the fact that approximately 30% of the transactions in the sample were announced in the period surrounding the financial crisis, i.e. between 2007 and 2009, could be a contributing factor to the finding of negative abnormal returns.

The average stock price reaction of bidders show value decreases following the M&A transaction in all intervals. In addition, the value decreases seems to be negatively correlated with the length of the event window. However, on average, almost 50% of the observations report positive reactions following the transaction. This finding is largely consistent with previous literature (see Kirchhoff and Schiereck, 2011).

Days to event	AAR (%)	z-Value	Positive (%)
-5	-0.1201	0.983	50.00
-4	0.0714	0.138	49.36
-3	-0.1606*	-1.881	44.91
-2	-0.1885	-0.892	47.77
-1	0.0997	0.765	46.18
0	-0.2812	-1.483	48.41
1	-0.1000*	-1.764	47.77
2	0.0221	-1.022	45.86
3	-0.1681	-0.401	46.82
4	-0.1722	0.382	41.40
5	-0.1372*	-1.978	49.36

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table 6: Average AR in the Event Window

Interval	$\overline{CAR}$ (%)	Positive	Negative	t-Test	p-Value
$[-20; 20]$	-1.3106	143	171	-1.36	0.173
$[-10; 10]$	-0.5161	150	164	-0.71	0.476
$[-5; 5]$	-0.8944*	150	164	-1.73	0.085
$[-2; 2]$	-0.4479	147	167	-1.13	0.261
$[-1; 1]$	-0.2815	144	170	-0.76	0.445
$[0]$	-0.2812	147	167	-0.76	0.446
$[0; 1]$	-0.3812	151	163	-1.12	0.264
$[0; 5]$	-0.8366*	147	167	-1.92	0.056
$[0; 10]$	-0.3860	158	156	-0.69	0.489
$[0; 20]$	-0.8912	147	167	-1.24	0.217

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table 7: Average CAR of Bidder with 80-day Estimation Window

6.2 Determinants of Bidders' Abnormal Returns

6.2.1 Univariate Regressions

After analyzing the correlation matrix (see Table A.3), we conclude that some of our independent variables are significantly correlated with each other. Consequently, we calculate the variance inflation factor (VIF) in our initial regression, which indicate that our main model suffers from multicollinearity (see Table A.5).

To indirectly account for multicollinearity, we implemented an univariate analysis for each variable in accordance with Kirchhoff and Schiereck (2011). The univariate analysis is conducted by comparing and testing the tails of the sample for statistical significance. In our analysis, we use the top and bottom 40 cases. Our findings are that *Method of Payment*, *Transaction Size*, *Bidder Liquidity*, *Bidder R&D Intensity*, and *Target Sales to Assets* are all independently significant (see Table B.2)

The univariate analysis further facilitated the selection process of relevant variables in the multiple regression. The variables with significant effect in the univariate regressions have been inserted into the multiple regression.

6.2.2 Multiple Regression

In this section, we use the significant independent variables from the univariate regressions to run a multiple regression for a complete perspective on determinants of abnormal returns in technology M&A. The multiple regression analysis measures the joint effect of our set of variables on the cumulative abnormal returns of the bidders as well as the interdependence between them.

Table 8 presents an overview of the univariate regressions of our significant variables on the entire sample as well as the multiple regression. In the multiple regression, five variables explain 6.2% of the bidders' cumulative abnormal returns in the event window around the M&A announcement. Two variables are significant at 5% significance level and two variables are significant at 10% significance level.

The multiple regression suggests that the stock market reaction of the bidder is positively influenced by cash-only payments rather than stock included payments, smaller transaction size, higher target sales to assets, and higher bidder liquidity. However, bidder R&D intensity is not statistically significant in the multiple regression but in the univariate regression.

Multiple Regression $[-5; 5]$

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.0016	0.0049	-0.0140**	0.0014	-0.0110**	0.0246
	(0.0051)	(0.0173)	(0.0061)	(0.0082)	(0.0093)	(0.0209)
Method of Payment	-0.0373***					-0.0360**
	(0.0134)					(0.0162)
Transaction Size		-0.0037				-0.0054*
		(0.0030)				(0.0032)
Bidder Liquidity			-0.0664			0.0785*
			(0.0221)			(0.0460)
Bidder R&D Intensity				-0.3795**		-0.0702
				(0.0512)		(0.0538)
Target Sales to Assets					0.0101	0.0258**
					(0.0050)	(0.0124)
N	314	314	309	301	310	267
F-Stat						2.98**
Adj. R^2	0.0614	0.0009	0.0397	0.0371	0.0080	0.0624

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.
Values within parentheses are robust standard errors.

Table 8: Multiple Regression

7 Robustness Check

The initial robustness method implemented in this study is the use of different event and estimation windows. As mentioned in Section 4, our baseline estimation window is the period 80 days prior to the event window and our baseline event window is the 11-day ([-5;5]) window immediately surrounding the event. In order to test the robustness of our baseline case, we tested longer estimation windows to investigate whether this improves the accuracy of our normal returns. However, this did not change our results except the magnitude of cumulative average abnormal returns. In addition, we both expanded and shortened the event window. The use of a longer event window could potentially include confounding events and increases the exposure to market noise (Lamdin, 2001). Moreover, shortening the event window could increase the power of our test (MacKinlay, 1997). However, we did not find any different results by changing the event window.

The second robustness check derives from our analysis of the sample characteristics. In an attempt to control for specific tendencies of the sample, we set up three new models containing our significant independent variables from the univariate analysis with an additional control variable (see Table A.4). Firstly, since a majority of the transactions were announced in the first half of our time period, i.e. between 2004 and 2011, we include a time dummy. The time dummy is negatively significant at 1%, which indicates that transactions in the first half of the period report on average lower abnormal returns than those in the subsequent period. A possible explanation is effects of the financial crisis. Secondly, as our sample is dominated by U.S. firms (see Table 1), we include a U.S. dummy. Lastly, we identify that only 222 unique bidders acquired 314 targets in our sample, which indicates that a few bidders are more active than others. To control for this we include an active dummy variable. Neither the U.S. dummy nor the active bidder dummy are statistically significant. Additionally, we include two models with interaction terms, one model with interactions between method of payment and a set of dummy variables and one model with interactions between transaction size and a set of dummy variables. No model changed our initial results, which we interpret as a sign of robustness to the above sample characteristics.

To test for multicollinearity in our models, VIF-tests are carried out on both the total variables and the variables used in the main regression. As evident from Table A.5, our initial multiple regression model suffered from multicollinearity. This issue is supported by the correlations between the variables (See Table A.3). The problem is presumably due to the fact that many variables have the same numerator or denominator. For example, the sales, liquidity, and R&D variables are all based on the firm's total sales. However, after conducting our variable selection process, the results are remarkably better.

Finally we discuss a few possible limitations of our study. To start, reoccurring bidders in the sample could lead to certain degree of correlation between residuals. In this case, OLS-regressions might not be sufficient. To account for issues such as heteroskedasticity and autocorrelation, GLS-regressions can be applied instead. Additionally, OLS-regressions are sensitive to the presence of outliers and high leverage data points (Sorokina, Booth, and Thornton, 2013). As Brown and Warner (1985) demonstrate, daily stock returns are characterized by non-normality, which results in the presence of outliers. However, it is not clear to what degree this issue affects the conclusions drawn by event study research. There are robust regression methods for effective treatment of outliers, e.g. the weighted regression approach, or M-estimation, suggested by Huber (1973) or the extension, MM-estimation, put forth by Yohai (1987). The use of these methods is not in the scope of this paper and we recognize the limitations it puts on our conclusions.

8 Conclusion

This study was designed to analyze the determinants of bidders' abnormal returns in technology M&A in the hope of contributing to a deeper understanding of the drivers of value creation. Our intention is that the reported findings can serve as guidance in the decision-making process for shareholders and managers. Our results showed that stock markets were pessimistic about technology M&As. The announcement effect of bidders on average reduce their shareholder value, albeit statistically significant in only two event window intervals. The significant abnormal returns contradict the semi-strong form of the efficient market hypothesis. This finding is largely consistent with prior literature on the value implication of M&A transactions on the bidder firm. A possible explanation for the lack of statistically significant positive abnormal returns is the competitiveness of markets for corporate control.

With regards to specific determinants of bidders' abnormal returns, our results indicate several interesting findings. We found a positive relationship between bidder liquidity and abnormal returns. This result is in contrast with Jensen's (1986) free cash flow hypothesis, which says that excess cash flow increases the likelihood of managers initiating takeovers that destroy value. This contradictory result could be attributed to cash-rich bidders acquiring targets with high growth opportunities, as demonstrated by previous literature. We also found that high sales to asset ratio of target firms is a source of abnormal returns, which indicates that the stock market tends to be more enthusiastic about the expected benefits of acquiring efficient targets. Moreover, we found strong evidence that transactions financed by cash-only, rather than stock-included payments, generate higher abnormal returns, implying that stock markets strongly consider the method of payment when evaluating M&As. This result is in line with Myers' and Majluf's (1984) pecking order theory, which states that new stock issuance is a sign of firm overvaluation and thus is followed by a value decline upon announcement. Concerning the transaction size, we found that larger transactions on average generated lower abnormal returns than smaller transactions. We interpret this result as an indicator of the difficulty of post-merger integration and the uncertainty regarding the realization of synergies in larger transactions. Additionally, this result suggests that stock markets may perceive managers as overconfident and overestimate their abilities to realize managerial synergies. Due to the inherent risk in technology industries, it is also possible that stock markets consider large transactions in this industry risky projects and punish firms accordingly. Lastly, we identified that the effect of R&D investments in technology M&As have no statistically significant impact on abnormal returns, in contrast with our initial expectations. Our interpretation is that the stock markets do not rely on R&D investments as a proxy for the innovation potential of target firms.

We obtained our results from a generalized empirical study. Being limited to this, our study does not evaluate the causes behind our findings. Further research is therefore recommended in order to understand the different mechanics behind the drivers of abnormal returns in technology M&A. In particular, we believe that it would be interesting to gauge the innovation potential of target firms in light of abnormal returns of bidders. For instance, by studying the patent portfolios of targets. In addition, as technology firms are couple with ethical issues, it would be interesting to investigate the effects of unethical practices on technology M&A performance. A case study could be useful in order to evaluate both of these issues and thus obtain more detailed results and further develop more concrete recommendations regarding decision-making in technology M&A transactions.

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Appendices

Appendix A Robustness

Interval	$\overline{CAR}$ (%)	Positive	Negative	t-Test	p-Value
$[-20; 20]$	-1.0205	136	178	-1.01	0.314
$[-10; 10]$	-0.3418	153	161	-0.48	0.630
$[-5; 5]$	-0.8562*	151	163	1.67	0.096
$[-2; 2]$	-0.4794	149	165	-1.21	0.228
$[-1; 1]$	-0.2871	143	171	-0.78	0.434
$[0]$	-0.3449	151	163	-1.19	0.237
$[0; 1]$	-0.3762	150	164	-1.10	0.271
$[0; 5]$	-0.8057*	146	168	-1.85	0.066
$[0; 10]$	-0.3476	155	159	-0.63	0.530
$[0; 20]$	-0.9061	146	168	-1.29	0.199

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table A.1: Average CAR of Bidder with 100-day Estimation Window

Interval	$\overline{CAR}$ (%)	Positive	Negative	t-Test	p-Value
$[-20; 20]$	-1.6436	144	170	-1.39	0.166
$[-10; 10]$	-0.7752	149	165	-0.95	0.343
$[-5; 5]$	-0.8427*	148	166	-1.70	0.091
$[-2; 2]$	-0.4512	146	168	-1.14	0.254
$[-1; 1]$	-0.2812	147	167	-0.76	0.446
$[0]$	-0.3436	150	164	-1.18	0.240
$[0; 1]$	-0.3717	150	164	-1.09	0.277
$[0; 5]$	-0.7726*	149	165	-1.81	0.072
$[0; 10]$	-0.2937	155	159	-0.53	0.597
$[0; 20]$	-0.8431	145	169	-1.21	0.228

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table A.2: Average CAR of Bidder with 120-day Estimation Window

Variables		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Cumulative Abnormal Returns	1.0000													
2	Geographical Focus	0.0322	1.0000												
3	Method of Payment	-0.0924	-0.1527*	1.0000											
4	Transaction Size	-0.1080	-0.0797	0.0067	1.0000										
5	Growth Focus	0.0113	-0.1098	0.0458	0.0543	1.0000									
6	Bidder Liquidity	0.0118	0.0408	-0.2323*	0.2630*	0.0890	1.0000								
7	Target Liquidity	-0.1048	0.0320	-0.0633	0.2617*	0.1434*	0.0680	1.0000							
8	Bidder R&D Intensity	-0.1034	-0.0303	0.0244	-0.0681	-0.0447	-0.1287*	-0.1164*	1.0000						
9	Target R&D Intensity	0.0001	-0.1323*	-0.0102	0.0210	-0.1585*	0.1602*	-0.4097*	0.4832*	1.0000					
10	Relative Market Value	0.0306	-0.0537	0.5131*	0.0700	-0.0299	-0.1310*	0.0638	-0.0024	-0.0857	1.0000				
11	Bidder Sales Growth	0.0353	0.0018	0.0729	0.0082	0.1400*	-0.1508*	0.0027	-0.0749	0.0776	-0.0019	1.0000			
12	Target Sales Growth	0.0543	-0.0656	0.0458	0.0937	0.2385*	0.0779	-0.2669*	-0.0382	-0.1092	0.0401	0.2613*	1.0000		
13	Bidder Sales to Assets	0.0612	-0.0021	0.0665	-0.1103	0.0225	-0.0712	0.0005	-0.361*	-0.3042*	0.1028	-0.0713	-0.0432	1.0000	
14	Target Sales to Assets	0.0644	-0.1114*	0.3746*	-0.1593*	0.0035	-0.1544*	-0.0221	0.1321*	-0.0601	0.4671*	-0.0358	0.0999	0.2900*	1.0000

* Significant at the 5% level.

Table A.3: Pearson Correlation Matrix

Multiple Regressions with New Variables $[-5; 5]$						
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.0545**	0.0244	0.0248	0.0326	0.0054	0.0055
	(0.0221)	(0.0165)	(0.0163)	(0.0171)	(0.0183)	(0.0231)
Method of Payment	-0.0357**	-0.0359**	-0.0386**	-0.0253	0.0086	0.0389
	(0.0160)	(0.0129)	(0.0130)	(0.0310)	(0.0528)	(0.0544)
Transaction Size	-0.0071**	-0.0055	-0.0046	-0.0698**	-0.0005	0.0022
	(0.0031)	(0.0028)	(0.0028)	(0.0028)	(0.0032)	(0.0039)
Bidder Liquidity	0.0802*	0.0785*	0.0817*	0.0866*	0.0827*	0.1026*
	(0.0464)	(0.0386)	(0.0386)	(0.0383)	(0.0495)	(0.0523)
Bidder R&D Intensity	-0.0790	-0.0715	0.0763	-0.0833	-0.0580	-0.1122*
	(0.0538)	(0.0529)	(0.0506)	(0.0513)	(0.0539)	(0.0610)
Target Sales to Assets	0.0263**	0.0259**	0.0250**	0.0290**	0.0263**	0.0335***
	(0.0120)	(0.0123)	(0.0123)	(0.0122)	(0.0133)	(0.0126)
Time Dummy^{a}	-0.0288***					-0.0149
	(0.0108)					(0.0117)
U.S. Dummy^{b}		0.0010				0.0538
		(0.0124)				(0.0341)
Active Bidder Dummy^{c}			-0.0165			-0.0614
			(0.0142)			(0.0574)
Method of Payment x Time Dummy				-0.0413		-0.0429
				(0.0235)		(0.0315)
Method of Payment x U.S. Dummy				0.0135		0.0414
				(0.0235)		(0.0353)
Method of Payment x Geographical Focus				0.0501*		0.0541*
				(0.0263)		(0.0316)
Transaction Size x Method of Payment					-0.091	-0.0156*
					(0.0091)	(0.0093)
Transaction Size x U.S. Dummy					-0.0012	-0.0112*
					(0.0020)	(0.0059)
Transaction Size x Active Bidder Dummy					-0.0023	0.0073
					(0.0017)	(0.0085)
N	299	299	299	299	299	299
F-Stat.	4.12***	3.24***	3.48***	3.63***	2.06*	2.58**
Adj. R^2	0.0630	0.0431	0.0475	0.0660	0.0491	0.0956

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.
[a]1 for transactions between 2004 and 2012 and 0 for transactions between 2013 and 2018; [b]1 for U.S. bidder, otherwise 0; [c]1 for bidders with 5 or more acquisitions in the sample, otherwise 0.
Values within parentheses are robust standard errors.

Table A.4: Multiple Regressions with New Variables

	All Variables		Main model	
Variable	VIF	1/VIF	VIF	1/VIF
Geographical Focus	1.11	0.9043		
Method of Payment	1.63	0.6148	1.26	0.7915
Transaction Size	1.45	0.6905	1.14	0.8804
Growth Focus	2.23	0.4485		
Bidder Liquidity	1.67	0.5981	1.25	0.8005
Target Liquidity	1.46	0.6859		
Bidder R&D Intensity	1.94	0.5156	1.03	0.9706
Target R&D Intensity	1.95	0.5127		
Relative Market Value	2.21	0.4535		
Bidder Sales Growth	1.28	0.7793		
Target Sales Growth	2.49	0.4009		
Bidder Sales to Assets	1.52	0.6599		
Target Sales to Assets	8.64	0.1158	1.29	0.7780

Table A.5: Variance Inflation Factors

Appendix B Supplementary Material

Multiple Regression of All Independent Variables $[-5; 5]$				
Variable	Coefficient	Robust Std. Error	t-value	p-value
Constant	0.0327	0.0332	0.98	0.326
Geographical Focus	0.0070	0.0123	0.57	0.568
Method of Payment	-0.0515***	0.0197	-2.62	0.009
Transaction Size	-0.0057	0.0041	-1.38	0.170
Growth Focus	0.0034	0.0271	0.12	0.901
Bidder Liquidity	0.0552	0.0586	0.94	0.346
Target Liquidity	-0.0436	0.0323	-1.35	0.179
Bidder R&D Intensity	-0.1663**	0.0773	-2.15	0.032
Target R&D Intensity	0.0884	0.0566	1.56	0.120
Relative Market Value	0.0476	0.0336	1.42	0.158
Bidder Sales Growth	0.0027	0.0280	0.10	0.924
Target Sales Growth	0.0128	0.0280	0.46	0.648
Bidder Sales to Assets	-0.0175	0.0247	-0.71	0.480
Target Sales to Assets	0.0271*	0.0154	1.76	0.080
N	263			
F-Stat.	2.17**			
Adj. R^2	0.0647			

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table B.1: Multiple Regression of All Independent Variables

Univariate Regressions of Top and Bottom Cases $[-5; 5]$					
Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.0220 (0.0230)	0.0201 (0.0204)	-0.0468* (0.0241)	0.0373 (0.0321)	-0.0379* (0.0217)
Method of Payment	-0.0906** (0.0370)				
Transaction Size		-0.0078* (0.0049)			
Bidder Liquidity			0.3274* (0.1670)		
Bidder R&D Intensity				-0.3795** (0.1675)	
Target Sales to Assets					0.0509* (0.0268)
N	80	80	78	74	79
Adj. R^2	0.0614	0.0009	0.0397	0.0371	0.0080

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.
Values within parentheses are robust standard errors.

Table B.2: Univariate Regressions