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How do M&As drive performance of acquiring tech firms? Evidence from the US

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Abstract

In our study, we aim at understanding what drives acquirer in tech M&As. We examine a sample of 3,813 M&A transactions by US publicly-traded technological firms from 1991 to 2019. Since bidders[1] and deals characteristics vary largely, we test for any significant effect in abnormal announcement returns. Results suggest that the acquirer's shareholders gain when engaging in M&As with a private or subsidiary target, regardless of the size. However, they lose when buying a public firm, except when the transaction is paid for with cash. Further, a good performer is an acquiring-tech firm that shows financial strength in its liquidity, operational strength in its efficiency, and substantial growth prospects. In contrast, a poor performer is a bidder that is overvalued, highly levered and employs a high level of R&D spending. These results are consistent with the signalling, information asymmetry, size effect and free cash flow hypothesis.

This thesis is a part of the MSc programme at BI Norwegian Business School. The school takes no responsibility for the methods used, results found, or conclusions drawn.

[1] In our paper, we use the notion of "bidder" and "acquirer" interchangeably, assuming all deals are completed.

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Introduction and motivation

Our study focuses on understanding how Mergers and Acquisitions (M&As) drive performance for US tech firms and which factors have a significant effect on these acquisitions. We examine gains to the bidding firm shareholders around the acquisition announcement of publicly-traded US tech companies. The acquired companies that we consider are public, private, and subsidiary targets, which may be domestic or international. The objective of this study is to understand how gains around M&A announcement dates behave, whether companies incur a gain or a loss. We also look at the most relevant and reliable characteristics of the companies and deals that can have an impact on bidder's performance.

Generally, M&As have been subject of extensive literature and studies done in the field of financial economics. There is a growing number of publications and interest in understanding the effects and causes they have on firm performance and valuation. While the explanations have not been exhaustive, they show potential to be continued in the future. Our study aims to contribute and build on past studies, while focusing exclusively on the technological industry. The goal is to learn why tech firms engage in M&A activity quite extensively in the past decades.

We observe that the effect of M&As depends on various factors such as: method of financing (Martin, 1996), the target type (Chang, 1998), firm size (Moeller, Schlingemann, & Stulz, 2004), market valuation (Rhodes-Kropf & Viswanathan, 2004), and frequency of acquisitions (Fuller, Netter, & Stegemoller, 2002). There are also studies that, instead of looking at the market reaction around the announcement date, prefer to investigate long term post-acquisition performance such as Rau & Vermaelen (1998), Loughran and Vijh (1997), and Ang and Cheng (2006).

These issues are of paramount importance, as companies have shown much more interest in M&A for the past two decades. The industry has seen some noticeable and significant trends, changes and opportunities. The potential of having a better grip and understanding of how acquirer performance changes can prove to be useful for the future decision-making. There has been a high need for digital and technological changes during the past decades, hence we are interested in the technology industry and the effects on bidder's performance. Thus, M&As in the tech industry have the possibility to improve businesses, enhance efficiency

involving economies of scale, increase market power (monopolies, oligopolies), boost innovation, and create opportunities for diversification. All these reasons are in the interest of companies but also the society at large, as they can be part of the digitalization trend by supporting growth and improvements.

According to Koh and Venkatranam (1991), innovative-driving M&As are a result of growth seen in the technological industry. Acquirers engage in M&As with target firms that hold attractive technology-related assets. These types of assets are desirable to incorporate in acquirer knowledge base (Ahjula and Katila, 2001). Technological M&As aim at growing acquirer competitive advantage through increasing the innovation output. Innovation-driven M&As are also faster and cheaper than developing innovation internally. Many researches prove that the market perceives M&As positively (Hansen, 1987; Travlos, 1987; Bradley, Desai, and Kim, 1988; Amihud, Lev, and Travlos,1990; Brown and Ryngaert, 1991; Servaes, 1991). High enthusiasm in the industry may be non-credile. This, combined with the uncertainty present, can destroy the growth potential of these technological M&As (Kohers and Kohers, 2001). An example is the satudy from Gantumur and Stephan (2011), where the acquirer gains significant increases in innovation performance. Innovation and productivity present a positive relationship, as proven by Ortega-Agile and Potters (2011), since M&As can give rise to economies of scale and scope in R&D.

In one of their investigations, Ernst and Young (EY) finds that the technology industry is experiencing high M&As valuation (Casey & W., 2018). These are driven by PE investments and companies looking for growth, expansion or reshaping their capabilities (Appendix A). These M&As are steered by the need to access innovation and new technologies. EY also underlines that companies from outside this industry add key tech capabilities and knowledge to their firms through M&As, recognizing their importance and being forced to acquire tech and knowledge for future growth. Barak Ravid, EY-Parthenon Global Technology, Media and Telecommunications Co-Head, emphasizes that “Non-tech acquirers are responding to the urgency of digital transformation with the fastest route available — M&A.” (Casey & W., 2018).

We apply our research question to the technology industry. Boston Consulting Group (BCG) reports, in their 2017 M&A Report, that approximately

70% of tech deals in 2016 involved buyers from other industries (Kengelbach, 2017). The same report mentions that the proportion of deals involving tech has been rising. In 2017, "one in five transactions had a clear link to some form of technology, and the value of these deals as a percentage of the overall market is even greater" (Appendix B). According to KPMG M&A Predictor (Lam & Ditty, 2018), strong performance is expected to continue with increased capacity for M&As (Appendix C). Another report, done by J.P. Morgan (2017), states that "Technology premiums remain healthy with buyers seeking growth and strategic repositioning amid an improving but still uncertain macro environment.". This brings to light the variability and uncertainty we might see in this industry, but also good outcomes generated through these M&As.

With the increase in volume, importance and popularity of M&As in the tech industry, we try to explain key drivers of performance by making use of different theoretical frameworks, relevant literature and models. Potential long run benefits of M&As in the technological industries may bring value-creation that can be seen in short term abnormal returns. Earlier research proves that bidders have positive significant abnormal returns from the announcement of M&A activity in technological industries. We will analyse and compare previous empirical studies, theories and our findings to ascertain whether they hold or not under different circumstances. We use event studies in doing so because we wish to understand the effects of information and different characteristics on the behaviour of stock returns in the market.

Theoretical framework

In this section we develop the theoretical framework and continue by explaining concepts that will build the foundation of our study and help us to derive and interpret our hypotheses.

M&A theory

M&As are complex processes which cannot be easily generalized, analysed and explained. However, many factors or elements of this process are pretty standard, such as choosing the date or time range of the transaction, method of payment, deal type, etc. and extensively analysed by researchers. The most common

types of M&A found are horizontal, vertical and conglomerate, where each present different motives of engagement (efficiency, market power, differentiation, competitive strategy).

As mentioned above, a main motivation for engaging in M&As is the potential of synergies created, where the common value overpasses the individual values of the firms. Some researches show that companies involved in M&As underperform with high rates of failure (Gomes, 2013), or that large firms offer larger premiums than small firms and enter with negative dollar synergy gains (Moeller, Schlingemann, & Stulz, 2004). Alternatively, Bradley et al. (1988) states that, on average, M&As have a synergy gain in the 1970s and 1980s.

Some archetypes for creating value through M&As are mentioned in Koller, Goedhart, & Wessels (2015) and the rationale should be to: improve performance of target, consolidate to remove excess capacity from the industry, create market access for target or buyer's products, acquire skills or technology more quickly than if they would have been built in house, exploit industry-specific scalability of firm and pick early winners to develop their business. Weitzel and McCarthy (2011) talk about M&A performance theories based on outcome and motives (Appendix D).

Value creation theories

Value creation or increasing theories are based on the aforementioned idea of positive and value creating synergies. Not all reasoning for engaging in an M&A is straightforward. Acquirers would choose to do this when expected to gain from the M&A, yet, there is the possibility of incurring a loss because of a more complex strategic motive. However, these theories are concerned with long term, overall gains from M&As.

The theory of efficiency looks at efficiency gains from operating synergies. It refers to a combination of assets and capabilities, cost reducing and revenue increasing synergies, and economies of scale or of scope. Some examples relevant to our study would be technological advancements in distribution channels, production and innovation. M&As are often motivated by the need for technology and knowledge in order to secure a competitive advantage. There are also financial synergies (Trautwein, 1990) obtained through diversification strategies to reduce

firm's riskiness (Gaughan, 2010). M&As also serve the purpose to increase bidders' size in order to get cheaper financing.

*The theory of market powe*r refers to gaining more market power. Acquirers can get more consumer surplus and greater margins by increasing the price. There is also a competitive note to this, as a long-term source of gain can come from market power giving more control over market activity and entrants. This is also relevant to our topic, since big tech giants like Microsoft, Intel, IBM, Alphabet, tend to be fewer and have greater market share and popularity within the consumer pool.

Value destruction theories

Value destruction or decreasing theories refer to negative effects and loss of value for companies due to M&As. These theories are based on intentional or unintentional actions that can lead to a loss in value, compared to expectations.

The theory of managerial hubris is consistent with managers having good intentions but overpaying because of overconfidence in their abilities (Roll, 1984) and leaving the acquirer with the winner's curse[2]. The empirical evidence is consistent with managerial hubris playing more of a role in the decisions of large firms, than small ones (Moeller, Schlingemann, & Stulz, 2004). Other empirical studies of management overconfidence in acquiring companies shows that managers paying high premiums tend to use cash, whereas the use of stock is negatively related to high premiums (Malmendier & Tate, 2008; Ismail, 2011).

The theory of overpayment follows the study of the winner's curse from Varaiya and Ferris (1987). It states that the expected gains from the acquisitions of the target are lower than the premium paid by acquirers and can lead to negative associations between premiums and returns (Sirower, 1997). Cash financing has the possibility to mitigate the risk of this curse and generate a significant return of around 2%, while equity financing can bring a loss of 0.9% according to Franks et al. (1988).

[2] Winner's curse is a phenomenon in common value auctions of overpaying due to incomplete information.

The theory of managerial discretion states that excess liquidity or free cash flow drives unsuccessful M&As (Jensen M., Agency Costs of Free Cash Flow, Corporate Finance and Takeovers, 1986). Managers with good intentions would make sub-optimal investment decisions since they are more pressured to pursue high NPV projects than financially constrained companies (Weitzel & McCarthy, 2011).

The theory of managerial entrenchment (Shleifer & Vishny, Management Entrenchment: The Case of Manager-specific Investments, 1989) follows the idea that managers pursue M&As that end up failing because of their intentional decisions and interest in avoiding replacement. Instead of following value-creating objectives, this agency problem may lead to value-destruction.

The theory of empire-building complements the previous idea. Managers will aim at increasing the firm size as compensation is positively correlated with the firm's market capitalisation.
The company may, therefore, grow beyond its optimal size which is not maximizing shareholders' value. Management is physically uncapable to efficiently focus on many business units with various activities.

Information asymmetry theory

The information asymmetry theory is classified as a signalling model and proposes that imbalances in the information held by different parties can lead to inefficient outcomes in the market. Myers and Majluf (1984) show that, due to information asymmetry, managers from acquiring firms can have more insights on the value of the company and act in favour of old shareholders.

Jensen (1986) reveals how acquirers choose the method of payment, stock for overvalued firms and cash for undervalued firms. Stock payments will signal to the market that the acquirer company is overvalued and generate negative response from investors. Stock payments make possible the sharing of risk in the case of losses, with the new shareholders captured from the target. The opposite holds true for payments in cash, indicating undervaluation.

Hansen (1987) states that when acquirers have less information and there is uncertainty around the valuation of the target, they prefer to finance with stock.

Empirical evidence from Travlos (1987) supports the idea that cash payments earn positive abnormal returns of 0.29%, whereas stock payments earn a negative abnormal return of 0.69%, because of information asymmetry.

Efficiency markets theory

There have been many studies on the price movements due to firm-related events, such as M&As. Fama, Fisher, Jensen and Roll (1969) affirm that the market is efficient when the stock prices are rationally priced and adjusted for all new information present in the market. Fama (1970) continues further by introducing the three types of efficient market hypothesis, dependant on the type of information.

The weak form declares that stock prices reflect historical prices and past information. Semi-strong form states that stock prices incorporate all publicly available information. Lastly, the strong form of market efficiency presumes that stock prices reflect both publicly and privately available information. Thus, in efficient markets, investors would not have excess returns. There are many critics of this theory which support the idea of 'bandwagon effect', where people tend to follow the actions of others in the short run. Burton G. Malkiel (2003) infers that financial markets are more efficient and less predictable than what is expected.

Schumpeter's "creative destruction" concept

Another relevant theory is the idea of strong firms being engines of technological progress forwarded by Joseph Schumpeter (Schumpeter, 1943). He coined the idea of "creative destruction", which assumed that new systems can reconfigure themselves in the light of extraordinary events (e.g. financial crisis) to help new and wealth-increasing practices and abandon the value-destroying ones. Schumpeter is relevant in the case of technological advancements where M&As play a big role. Acquiring companies get a hold of new or improved technology because of financial capacity to pursue profitable and innovative projects.

Literature review

We found that empirical literature regarding M&As has been shown to be extensive, but not exhaustive. Many of the factors included in our paper are covered by literature but there is still need for more study to be made on. Theory has shown that M&As have a positive effect on performance, but empirical evidence has given researchers different results. A shift in the quality of deals has been noticed by Alexandridis, Antypas, & Travlos (Value creation from M&As: New evidence, 2017). Research on the topic of M&As, and specifically on acquirer's performance, conveys a fragmented finding, as M&As are deemed to be complex (Gomes, 2013). Our literature review looks at different studies and highlights some key drivers of performance, such as method of payment, size of acquirer, type of target and more. We explain what we have learned from literature by evaluating differences and similarities in these findings, and whether they hold for our hypotheses.

Method of payment

The method of financing employed in these studies are: equity (stock), cash or a combination of the two. Moeller et al. (2004) states that there is a positive abnormal return irrespective of form of financing and that dollar abnormal return is significantly negative for equity. For each type of target firm, public, private or subsidiary, they find significant differences between large and small acquirer return effects. Thus, small acquirers show a 2% excess and significant positive abnormal return, with the exception of acquiring public targets with equity. For large acquirers and all target types, they found a negative abnormal return. Fuller et al (2002) show that the variation in the acquirer firm's return is due to characteristics in the method of payment, among other factors.

Depending on the type of target company, they have different results on how these methods affect acquirer firm returns. For public target firms, there is a significant negative effect for stock and insignificant effect for the other methods, while Moeller et al. (2004) find a significant negative abnormal return, except for cash which is insignificant and positive. This is consistent with the findings of Travlos (1987), while Fuller et al (2002) returns to acquirers are positive for cash, negative for stock and does not show much change for the combinations. Furthermore, for private and subsidiary targets, Fuller et al. (2002) and Moeller et al. (2004) find that the effect is significantly positive, irrespective of method, and that it is greater for the use of equity than cash (highest being paying with equity or

combination as also in the results of Chang (1998). The difference in results can be due to a liquidity effect, as public companies are more easily tradable, making private and subsidiaries less attractive. There is little research for private targets and close to none for subsidiaries on the effect of the method of payment on acquirer returns.

Myers and Majluf (1984) state that a bid made with stock would show that the bidder thinks of their stock as overvalued. Martin (1996) also finds that stock offers are more likely to be used than cash if there is more uncertainty about the bidder. Targets know and will not accept stock, making high valued bidders to use cash and signal their value to the market, as proved by Fishman (1989), Hansen (1987), Berkovitch and Narayanan (1990), and Eckbo, Giammarino, and Heinkel (1990), Eckbo and Thorburn (2000). These cash offers will have higher abnormal returns at bid announcement than the stock offers (Travlos (1987), Fishman (1989), Brown and Ryngaert (1991) and Martin (1996)).

When having insecurities on target value, bidder should not offer cash, but stock, in order to not overpay, since the target will only agree to an offer beyond true value. This idea agrees with Hansen's (1987) hypothesis that bidder with less information on target value should always offer stock. Hansen (1987) and Eckbo and Thorburn (2000) address the uncertainty in target valuation and state that bidders offer stock because they have a "contingency pricing effect" and would rather share the risk of overpaying.

Size effect and relative size

Moeller et al. (2004) prove the existence of a size effect in acquiring companies, which is robust to deal and firm characteristics and not proven to reverse over time. Small firms seem to have better returns when making an acquisition announcement, compared to large acquisition firms. The size effect is the difference between abnormal returns of small and large acquiring firms. From the research of Travlos (1987), Loderer and Martin (1992), Fuller et al. (2002), Moeller et al. (2005) (2004), Betton, et al. (2008) and Alexandridis et al. (2013), the general finding is that large public acquisitions have been destroying acquiring shareholders wealth more often than they create.

Previous literature looks at the relative size of the target compared to the acquirer to find the effects on acquirer's return. Acquirer returns are higher, when

the relative size of private and subsidiary targets increases, and lower when the relative size of public targets increases. Fuller et al. (2002) explains that when the relative size of private targets increases, there is a higher likelihood of bondholder formations and acquirer value increases due to monitoring. These results are also consistent with the findings of Shleifer and Vishny (2001). Overall, Alexandridis et al. (2017) and previous literature show that there is a "significant increase to the acquiring-firm size which grows at a faster pace than the target size causing a decrease in the deal relative size".

Acquiring firm performance

Moeller et al. (2004) investigate different hypothesis for why the abnormal return of announcing an acquisition for acquiring firms may be negative. We find this to be consistent with Roll's (1986) idea of hubris and the findings of Travlos (1987), Myers and Majluf (1984) mentioned above in the methods of payment. However, the free cash flow, overvaluation and arbitrageur hypothesis have little support or are inconsistent (Appendix E). Literature commonly uses event study methods to estimate the effects of M&A activity on acquiring firm performance. Following Brown and Warner's (1985) market model, the cumulative abnormal returns (CARs) are used recurrently.

Target status: public, private, or subsidiary

Evidence from literature highlights that lower abnormal returns are associated with public acquisitions, such as Travlos (1987), Loderer & Martin (1992), Fuller, Netter, & Stegemoller (2002), Moeller, Schlingemann, & Stulz (2005), Moeller, Schlingemann, & Stulz (2004), Betton (2008), and Alexandridis, Fuller, Terhaar, & Travlos (2013). Some studies, pre-2009, Fuller et al (2002), Chang (1998) and Moeller et al. (2004) find that the effect is significantly positive for private and subsidiary targets.

New evidence from Alexandridis, Antypas, & Travlos (2017) proves that public targets generate comparable gains to private targets in the US post-2009. Consequently, public firms tend to be larger and have higher media coverage. This is consistent with the reputational exposure of public acquisitions for the executives and directors making them more susceptible to improvements and shifts in corporate governance (Dahya, Golubov, Petmezas, & Travlos, 2016).

Additionally, in accordance with the predictions of the neoclassical theory of M&As (Ahern & Weston, 2007), acquiring firms engaging in public acquisitions on average create value to shareholders more than they destroy. Similarly, using non-traditional measures of value creation, recent papers highlight the significant net economic benefits from M&A activities (Bhagat, Dong, Hirshleifer, & Noah, 2005; Humphery-Jenner, Masulis, & Swan, 2016).

Mega deals

Moeller, Schlingemann and Stulz (2005) found that the total loss of acquiring-firm shareholders during the 1998-2001 period was mainly due to a small number of extremely high valuations acquisitions (called large loss deals). For over 20 years, the mega-deals represented the large majority of the M&A activity in the US. In 2015, 94% of the deals were mega (valued over $500 million), representing more than 5% of the US GDP (Alexandridis, Antypas, & Travlos, 2017). On average, during the period 1990-2007, the large deal reports a loss of $518 million for the acquiring-firm shareholders (Alexandridis, Fuller, Terhaar, & Travlos, 2013).

Boston Consulting Group, Inc (2007) demonstrates that mega deals, valued over $1 billion, destroy close to twice as much value as small deals. Bloomberg (2002) also highlights that 61% of merger mega deals destroy acquiring-firm shareholders wealth. A more recent study published by McKinsey Quarterly (2012) highlights that, on average, only large acquisitions generate negative abnormal returns in fast growing sectors. The Financial Times (2016) also indicates damage created as a result of expensive mega deals.

Investment efficiency

Richardson (2006) provides a method to measure the overall investment efficiency from M&A activity. Alexandridis et al. (2017) reuse this method and find that investment efficiency has diminished post-2009 crisis. This implies improved decision-making and optimal investment allocation during the period 2009-2015. They find that there is a shift in corporate decision-making and companies engage in more value-enhancing investments. This result is one of the authors' main findings, explaining value creation from M&As.

Valuation

Corporate Finance studies indicate the negative relationship between abnormal returns and valuation of both the target and acquiring firms (Moeller, Schlingemann, & Stulz, 2005; Dong, Hirshleifer, Richardson, & Teoh, 2003). Valuation has often used the market-to-book ratio or Tobin's q measure. Jensen (2003) confirms that high valuations lead to managers making poor acquisition decisions. Contradictory results, where there is a positive relationship between abnormal returns and Tobin's q, are presented in Lang, Stulz, and Walkling (1989) and Servaes (1991).

Furthermore, the causal effect of payment methods on firm valuation partly explains the significant decrease of equity-based consideration of payment in the post 2009 period (Dong, Hirshleifer, Richardson, & Teoh, 2006; Faccio & Masulis, 2005). The availability of corporate liquidity (FCF), reinforcing a strong profitability and historically low interests on debt, may also be contributors to the decline of equity-financing acquisitions (Alexandridis, Antypas, & Travlos, 2017).

Diversification

The study of Morck et al. (1990) finds that acquirers tend to have lower abnormal returns when diversifying. They show that smaller firms are more likely to engage in diversifying acquisitions than larger. Consistent with this, Alexandridis et al. (2017) observe a negative relation between the percentage of diversified deals and acquirer acquisition gains. Other studies show that managers have various reasons for engaging in diversifying M&As. Some of these are risks to employee job security (Amihud and Lev, 1981), the increased personal interest the manager has in specific firms (Donaldson and Lorsch, 1983) or their job being threatened (Shleifer and Vishny, 1990).

Cross-Border

Globalisation and the tendency of US companies to expand their business to emerging markets have increased the number of cross border deals. To some extent, this can explain the greater gains post-2009 (Alexandridis, Antypas, & Travlos, 2017). Technology cross-border transaction volume climbed by 119% in 2016, as companies sought diversification and entry into both stable and growth markets. Consistent with the broader M&A market, the United States technology

market displayed the strongest performance, contributing 69% of global technology M&A volume (JPMorgan Chase & Co., 2017).

Limitations

There are limitations that we need to be aware of when conducting our study. We uncover that estimating acquirer returns can be done in various ways, and each can pose some difficulties (Eckbo, Maksimovic, & Williams, 1990). We contemplate the fact that small targets, relative to acquirer size, can show little impact on returns because of their size. To avoid this problem, we choose the relative firm sizes in the data accordingly. Therefore, the same researchers pinpoint that the price reaction to the M&As will only represent the "surprise reaction" of the market.

If there is resistance from targets, the M&A process can be lengthy, making the outcome difficult to isolate the market assessment of the announcement. The announcements reveal information on expected synergies, value of the firms, overpayment and more. Another limitation that needs consideration is mentioned by Hietala, Kaplan and Robinson (2003) and explains the difficulties in assessing market reactions and measuring different effects independently. Research literature seems to be fairly scarce on M&As involving private and subsidiary targets, technological M&As and tech-related drivers.

Our study aims at having a general-to-specific approach, where we apply the theory and knowledge from the literature review on our topic of interest. We believe that, while some results may stand, there are still significant findings and questions to this research topic. What many of these studies have in common are some of the factors that they consider, methodology they use and how they conduct the analysis.

Methodology

For this study, we adopt a quantitative approach, by using secondary data and highly structured methods, with the purpose of testing our hypotheses. Our methodology will formulate the hypotheses which we will further investigate.

Performance measure

The performance measure chosen is the cumulative abnormal return. It is a traditional measure for acquirer performance, used in many of the research papers (Fuller 2002, Alexandridis 2017, Moeller Stulz 2005/2004). The computation of $CAR_{(-1,+1)}$, for the three-day announcement window (day 0 being the day of the announcement), follows Brown and Warner's (1985) market model, which is calculated over the estimation window (-248, -2).

We use this model because it is well-specified and relatively powerful in a wide variety of conditions, as Brown and Warner (1985) mentioned. Another strength of this market-based model is its direct measure of value creation and forward-looking view since stock prices are the present value of expected future prices. Weaknesses of using this measure are the assumptions required about the stock market, such as efficiency, rationality, arbitrage restrictions. It is also possible to have confounding events, which can interfere with the behaviour of our performance variable. As observed by Brown and Warner (1985), we keep in mind that the estimation of parameters from daily data is complicated by non-synchronous trading, a complication described as 'especially severe' by Scholes and Williams (1977, p. 324).

For every M&A deal, the excess return per day in the event period is estimated through the OLS market model as follows:

$$ER_{i,t} = \alpha + \beta . R_{m,t}$$
$$AR_{i,t} = R_{i,t} - ER_{i,t}$$

The estimated alpha and beta are OLS values from the estimation period. $AR_{i,t}$ is the estimated excess return of acquirer *i* at time *t*. $R_{i,t}$ is the actual return of acquirer *i* at time *t* and $ER_{i,t}$ is the expected return of acquirer *i* at time *t*. $ER_{i,t}$ is calculated through running regressions of the actual return against the associated market return.

In the model we use the index returns (Nasdaq, NYSE market, NYSE AMEX) associated with the acquiring company and for the specific period in calculating the abnormal returns. The $CAR_{(-1,+1)}$ is thus, calculated by summing up the AR over the event window of three days.

Hypotheses

Mean performance metrics through time

Firstly, we plan on conducting exploratory data analysis in order to assess drivers and trends in the period 1990-2019 that would further help us with our study. We also compute the means and medians, for the 1990-2000, 2001-2009, and 2010-2018 periods, with the purpose of checking significant changes or improvements in performance.

We highlight the differences between each period (differentials) based on t-tests for the means and Wilcoxon tests for the medians. Michael Jensen and Richard Ruback (1983) find that "corporate takeovers generate positive gains, that target firm shareholders benefit, and that bidding firm shareholders do not lose.".

Hypothesis 1: We expect mean performance metrics differential to be higher than 0 between 1990-2000, 2001-2009 and between 2010-2018, showing an improvement in gains for the acquirer, over the timespan.

Industry effects

Secondly, we examine industry effects on acquirer performance and whether they have a significant effect on our performance measure in our sample. We use the four-digit SIC codes for acquirers to get the industries, as given by Eikon. We continue to translate these SIC codes into Fama and French (1997) 48 industry classifications.

We plan on testing both means and medians to find if there is any significance in $CAR_{(-1,+1)}$ for specific industries by using t-tests on means and Wilcox tests on medians. We also check if there is a need to include these industry fixed effects in the main regression in order to control for systematic differences in performance.

Hypothesis 2: Due to industry specific dynamics, we hypothesize that industry effects infer on acquirer performance.

Multi-linear regression

Thirdly, to explain the acquisition gains, we use series of cross-sectional regressions. These regressions will help us at understanding whether gains/losses are attributed to firm, deal and/or market characteristics. The dependent variable is the acquirer $CAR_{(-1,+1)}$ and the key explanatory variables are: $Cross\ Border$, methods of payment ($Cash$, $Stock$, Mix), $Serial$, Diversification ($DIVERS$), target status ($Public$, $Private$, $Subsidiary$), acquirer size ($Small$, $Medium$, $Large$), Relative Size ($Relsize$), Tobin's Q ($TobinQ$), Market-to-Book ($Market/Book$), $Asset\ Turnover$, leverage ($Debt/Asset$), $Current\ Ratio$, Free Cash Flow (FCF), Enterprise Value-to-Sales ($EV/Sales$), R&D-to-Sales ($R\&D/Sales$) and the change in capital expenditures ($\Delta CAPEX$). Descriptions of the variables can be found in Appendix F.

Regression:

$$\begin{aligned} CAR_{(-1,+1)} = {} & \beta_0 + \beta_1\, Cross\ Border + \beta_2\, Stock + \beta_3\, Cash + \beta_4\, Serial \\ & + \beta_5\, Public + \beta_6\, Private + \beta_7\, Medium + \beta_8\, Large \\ & + \beta_9\, Relsize + \beta_{10}\, TobinQ + \beta_{11}\, Market/Book \\ & + \beta_{12}\, Asset\ Turnover + \beta_{13}\, Debt/Asset \\ & + \beta_{14}\, Current\ Ratio + \beta_{15}\, FCF + \beta_{16}\, EV/Sales \\ & + \beta_{17}\, R\&D/Sales + \beta_{18}\, \Delta CAPEX + \beta_{19}\, DIVERS + \varepsilon \end{aligned}$$

Hypothesis 3: We expect the coefficients of Cross Border, Cash, Small, Private, Subsidiary, TobinQ, Debt/Asset, Current Ratio, Asset Turnover, EV/Sales to have a positive significant effect at explaining acquirer gains.

Hypothesis 4: Whereas, we expect the coefficients of Public, Stock, Mix, Serial, Large, Market-to- Book, Relsize, FCF, R&D/Sales, Δ CAPEX, Diversification to have a negative significant effect at explaining acquirer gains.

As a result of globalisation, acquirers that engage in cross-border M&A deals are taking advantage of arbitrage opportunities in order to realize higher gains. These opportunities are motivated by expansions to new markets, potential synergies and capitalize on market conditions. Through cross-border deals, acquiring tech companies can now enhance their growth prospects and take advantage of the advantageous characteristics in foreign markets, such as less price pressure, lower competition, cheaper resources, etc.

Acquirer performance would also be expected to be influenced by the method of payment employed by and agreed to, since it signals to the market the status of the acquirer, target firm and potential synergies. We assume that M&A deals paid with cash happen when the target firm is undervalued, as well as when there is certainty around the target valuation and expected synergies. By paying with cash, the acquirers take the entire risk of expected synergies not materializing.

Conversely, M&A transactions where there is uncertainty around the target valuation or the target seems to be overvalued, will lead to payments with stock. Mitchell et al. (2004) also point out the price pressure effect on acquirer stock, when paying with stock, because of the arbitrageurs' activities (the arbitrageur hypothesis). In stock transactions, synergy risk is shared proportionally to the ownership stakes of the acquirer and target. Additionally, Stock financing dilutes the current ownership control of the investors of the acquiring firm. Amihud et al. (1990) confirmed this theory by finding that stock payment method is negatively related to inside ownership. Stock transactions are also a privileged method of payment when the acquirer is experiencing significant growth opportunities (Martin, 1996). When it comes to hybrid methods of payment (cash & stock), previous literature found that the abnormal returns are higher than stock payments but somewhat lower than cash transactions.

Boone et al. (2014) shown empirical evidence of a recent trend for mixed payment method in most of the recent M&A wave. Boone, Lie, & Liu (2014) have also found in their study that large M&A deals are commonly finance with mixed payment method. Consequently, in adequation with our hypothesis on large deals, we hypothesize that mixed payment deals will have a negative impact on the acquirer abnormal return.

From Moeller and Stulz (2004), we learn that size effect plays a role in acquirer returns. Thus, there is significant differentiation between acquirers of different sizes. Smaller companies tend to have higher returns than large acquirers. Small acquiring firms tend to have their incentives better aligned between managers and shareholders than large. In small firms, managers have also more ownership as underlined by Demsetz and Lehn (1985). Large acquirers are proven to destroy value as it is stated by Travlos (1987), Loderer and Martin (1992), Fuller et al. (2002), Moeller et al. (2005) (2004), Betton, et all. (2008) and Alexandridis et al. (2013). Furthermore, large acquirer firms' managers are more prone to hubris.

Literature shows that managers in large acquiring firms can potentially be empire-builders. These managers are known to rather focus on increasing their power and influence through inflating the firm size, than maximizing shareholders' return with an optimal firm size. Thus, managers sometimes have incentives to grow the company beyond the optimal size, since this growth increases their power and resources under control (Jensen 1986). This increase in power has been previously associated with increased compensation (Jensen 1986), as changes in compensation are positively related to growth in sales (see Kevin Murphy, 1985). Further, large firms engaging in M&As suggest to investors a lack of internal growth opportunities.

Relative size measures the relationship between the target size and the acquirer size. In our study, we interpret relative size as a control to examine to size difference between the acquirer and target and how this affects our performance measure. With the popularity of unicorns and the strong competition for market share, acquirer returns will also be affected by the market capitalization of the target, and its future growth prospects. Companies like Facebook, Google and Apple have proven to rather invest in established technologies, business models and acquisitions to foster faster-growing strategies. Nonetheless, Ravenscraft and Scherer (1987), Mueller (1985), and Eckbo (1992) show that enhanced market position through M&A does not necessarily improve performance, on the contrary it may actually worsen.

Acquirer performance has been previously shown in literature to be also affected by the type of the target. Public targets acquisitions have information readily available for correct valuation, they tend to be substantially larger, seem to

attract more media attention and have historically been more value-destroying than creating (Travlos (1987) and Loderer and Martin (1990) and more recent evidence provided by Fuller et al. (2002), Moeller et al. (2004, 2005), Betton, et al. (2008) and Alexandridis et al. (2013)).

However, information asymmetry is known to be greater in private firms. Thus, arbitrage opportunities are more easily identified making these firms suitable targets for acquisitions. Private/Subsidiary targets tend to be considered as assets in very illiquid markets as they cannot be bought and sold so easily as public, this makes them less attractive and less valuable (liquidity effect). As a result, the valuation of the target represents the liquidity discount and results in higher acquirer returns (Fuller, 2002).

In addition, conglomerate companies will sell underdeveloped subsidiaries or business units to acquirers which are interested in specializing. Ergo, acquirers would have positive returns based on this type of M&A since they can gain more from the incorporation and specialization of subsidiary targets.

Not properly diversified managers will try to diversify the company holdings in order to reduce risk to human capital at the expense of shareholders (Amihud and Lev 1981). Managers would rather allocate the firm's earnings to new diversifying business ventures than redistribute these earnings in dividends. This idea also comes from Donaldson and Lorsch, 1983, who underline that management do their best to ensure the survival of the company. Shleifer and Vishny (1990), give another good reasoning to why managers engage in diversifying M&A: poor performance of the company represents a threat to the manager's job. Through diversification this risk is mitigated as the overall volatility in performance of the firm is reduced. This action may be counterproductive for the firm and fail to maximize shareholders' return. Furthermore, diversifying M&A deals can impose a scenario in which managers or executives have overlapping positions and might become subject to confusion, costly and inefficient work. If managers and executives do not have a well-developed plan, they might be unable to focus on all business units and operations and conduct them efficiently.

Free cash flow theory supports the idea that M&As, with acquirers who are free cash flow positive, are more likely to destroy than create value. Managers can choose to engage in M&A transactions instead of paying out dividends. Therefore,

unused borrowing power and free cash flow are likely to be used in low-benefit and potentially value-destroying investments. This idea behind the agency costs of free cash flow and free cash flow theory is also supported by Harford (1999), who states that firms who accumulate excess cash are more likely to make poor acquisitions.

Empirical study shows that experienced acquirers, who make serial acquisitions, tend to be overconfident in their ability to create value through M&As. This is true when managers are prone to hubris and their decisions can lead to wealth destruction instead of value creation (e.g., Fuller et al., 2002; Conn et al., 2004; Ahern, 2008; Ismail, 2008). Managers who are overconfident in their ability to evaluate M&A deals have been part of acquirers who tend to be multiple bidders. Fuller (2002), Billet and Qian (2008) have studied and concluded that these acquirers tend to make worse acquisitions.

The "control hypothesis" of debt creation discussed by Jensen (1986) states that debt can be used as a mechanism to encourage managers to effectively pay out future cash flows. Thus, debt reduces the cash flow available for investments, motivates managers to service the debt and make the firm more efficient, which benefits the company's overall performance. We briefly mention the tax benefits of debt which have a positive effect on the acquiring company. The positive market response to debt creation in takeovers (see Robert Bruner, 1985) agrees with the notion that additional debt increases the firm's efficiency. It forces acquiring firms with high levels of cash and few high-return investment projects to maximize firms' value. This way, companies avoid wasting money on low-return projects or engaging in inadequate money practices.

Jensen's (2003) hypothesis explains that high valuations increase managerial discretion. Thus, managers face poor investments and acquisitions. This misvaluation, overvaluation implied by a high M/B, will lead to lower returns as stated by Moeller (2005) and Dong (2003). These misvaluations are proof of market inefficiencies and their influence on M&A activity. Dong et al. (2002) also find that smaller acquirers are expected to have lower M/B ratios compared to large acquirers. McCarthy (2011) and Moeller (2004) state that smaller firms have more aligned incentives between managers and shareholders, whereas large acquiring firms are more prone to overconfidence. Overvaluation hypothesis shows how overvalued acquiring companies convey to the market that the valuations are not

backed up by fundamentals and a reason for this could be the goal of acquiring assets with overvalued equity.

As Lang, Stulz and Walking (1989) point out, Tobin's Q shows how confident the market is about the success of the acquirer's current and anticipated projects under the management. Therefore, management performance is a determinant of this measure. Well-managed firms, with higher q, are rewarded by financial markets with higher returns. The acquiring firm will make better use of target resources and this view supports Jensen's ideas (1986) that the acquisition will create value by forcing the target to better make use of their resources. Thus, well-managed acquiring firms will implement value-increasing changes. Tobin's Q by construction also reflects the growth prospects of the firm. Consequently, an acquirer with a high Tobin's Q will reflect high anticipated growth in the foreseeable future which is also positively rewarded by investors.

A recurring component/motive of M&As is the acquisition of technological advances. High R&D spending is a process where the outcome depends on the likelihood of success of future technology and is often uncertain. An acquirer with already high R&D will signal to the market its inability or non-confidence in the success of its R&D developed internally. Hitt et al. (1990) state that acquiring firms who engage in acquisitions are more risk-averse and less interested or committed to innovation. Thus, an increase in the acquirer's R&D can discourage the firm to pursue patents or targets with knowledge and capabilities that are better or more efficient. This would translate into not exploiting acquired or acquiring technologies because increases in R&D would imply resources, energy and attention. We believe that investors would punish companies with R&D spending over sales above a benchmark (e.g. industry average). This effect would translate in value/wealth destruction for acquirers with already high R&D costs and a decrease in firm performance.

Firms characterized with low cash flow and high capital expenditures are more likely to drain the firm to credit constraint. Thus, engaging in M&As may be negatively perceived by investors as its cost of debt may rise. Resources could be more optimally use to reduce the debt burden instead of undertaking a sizeable and costly investment. The size maximization hypothesis also supports the idea that unexpected increases in capital expenditures would lead to a negative impact on the

market value of the firm. Managers seeking to increase the size of the firm will overinvest because they are prone to hubris.

Asset turnover ratio informs investors on the level of efficiency a firm operates at by looking at the level of revenue each asset generates. We expect that the greater the efficiency of the acquiring firm, the greater this firm would be able to make wise decisions in its investments to keep its efficiency level. Since this shows the ability of a firm to generate sales, acquirers require high sales performance in order to increase firm performance (Delen, Uyar 2013). Another interpretation could be that the acquirer's "know-how" in efficiency would be seen as positive in creating greater expected synergies. As a result, we predict that a high asset turnover would positively affect the acquiror's performance.

Consistent with the pecking order theory, constrained companies prefer to first use their internal funding, then issue new debt and then issue new equity (Faulkender and Wang, 2006). Shleifer and Vishny (1992) proves that liquidity had a part in driving merger waves. Harford (2005) and Eisfeldt and Rampini (2006) also believe that liquidity has been an important factor in influencing a large number of M&A deals and merger waves. Erel et al. (2017) find that higher liquidity will increase the probability for acquirers to engage in M&A transactions.

A high EV/Sales multiple can signal to the market that investors believe in the future growth and that sales will increase. On the contrary, a low ratio signals that the company has high sales relative to its value indicating low growth prospects.

Interactions analysis

Fourthly, we continue with interactions analysis of the acquirers' cumulative return for types of targets and methods of payment (Moeller Stulz 2004, see (Fuller, Netter, & Stegemoller, 2002), Table V). In this case, we are interested to see the significant differences and effects of the type of target and type of financing method over mean cumulative abnormal returns. We use t-tests on the differentials in order to test equality in means and find the levels of significance.

Hypothesis 5: We expect positive acquirer mean returns, irrespective of the method of payment.

Hypothesis 6: We expect significant differences in mean returns between small and large acquirers.

Hypothesis 7: We expect significant differences in the mean abnormal returns based on the type of target firm. For private/subsidiary targets we expect a significant positive CAR, whereas for public targets, we assume a significant negative CAR.

Hypothesis 8: We expect significant differences in the mean abnormal returns based on the type of method of payment. For private companies we assume that the highest CAR will be given by transactions completed with stock/mix. For public companies, we expect to find insignificant and positive CAR for cash payments, and for stock/mix significant and negative CARs. We also expect to find for large acquirers a significant negative CAR, irrespective of financing.

Hypothesis 9: We expect that for private/subsidiary targets, irrespective of method of payment, to convey significant and positive CARs, whereas for public targets, CAR will be significantly negative for payment of stock and insignificant for cash and mixed.

Investment efficiency

Lastly, we also run an annex analysis to test for the robustness of our results and the level of investment inefficiency through time. Whenever we observe an increase in acquiring-firm gains, we run an investment efficiency analysis. The logic behind it is that assessment of value creation through M&As does not provide much meaningful information on the optimal investment allocation.

Following Alexandridis et al. (2017) and Richardson (2006), we measure the residual investment which reflects the difference between the actual investment level and its expected level. A lower residual investment would suggest a better allocation of capital to investment opportunities.

$$INV_{i,t} = \alpha + \beta_i Q_{i,t-1} + Leverage_{i,t-1} + Cash_{i,t-1} + Company\ Age_{i,t-1} + Size_{i,t-1} + Stock\ Return_{i,t-1} + INV_{i,t-1} + FE + \varepsilon_i$$

RESINV = i, the lower i is, the more efficient is the allocation of capital for the acquiring company regarding investment opportunities.

Hypothesis 10: We expect a decrease in investment inefficiency through time. In other words, we expect acquirers to be more efficient in their investments.

Data and summary statistics

For this study we use a sample of M&A deals that come from the Thomson Reuters (Refinitiv) Eikon´s Mergers and Acquisitions Database. Our sample covers a number of 3,813 M&A deals, of which we have 952 acquirers and 2894 targets, during the period 01/01/1991 - 30/04/2019. The deals included in this sample have information over all variables and measures, and the information is collected from Datastream as a static or time-series on a daily basis.

We put restrictions on acquirers to be public and in tech-related industries, such as High-Technology, Media and Entertainment and Telecommunications. The acquirers from the sample are US listed companies on NYSE, AMEX or NASDAQ with data available on Thomson Reuters. Index returns have been collected from Yahoo Finance Database since it held more complete and updated information. Another requirement is that acquirers, post announcement, own a percentage of 50% or more of the shares in the target company.

Regarding targets, we include all national and international, irrespective of industry, as technology is used across various industries or sectors. We specifically include target firms that are public, private or subsidiary companies. Looking at the deal characteristics, we choose to take into consideration all completed deals that are equal or above $1m.

After reading through the research literature, we employ a similar approach to Martin (1996) and make the division of payment methods as follows: (1) Cash

payments: cash/cash plus debt, and liabilities; (2) Common stock payments: common stock/common stock plus options, warrants or convertible debt and preferred; (3) Combination of cash and stock payments.

Table 1 reports the distribution of acquisitions across types of target companies. Overall, the proportion of number of deals involving private targets hold a significantly larger percentage of total deals, compared to public or subsidiary, throughout time. However, at the top of the 5th merger wave and tech bubble in year 2000, the total aggregate deals value almost triple from the year before, reaching an amount of $180,287 million. This amount is comprised of 73.05%of the value coming from deals that involved public targets, 21.48% were private targets and 5.48% were subsidiary firms. We can see that while the number of private targets is larger in this period, they have a smaller aggregate value compared to deals involving public targets.

In the case of the 6th merger wave peak in 2006, the total aggregate value of $159,960 is tripled compared to the year prior but is distributed differently. We see from the table that deals with subsidiary firms account for 85.23% of total value, whereas public target deals have 8.41% and private are 6.37%. While the number of private companies is still larger than public or subsidiary, the value amount brought by subsidiary-targeted deals is exceedingly higher.

With the start of the 7th merger wave from 2010, the changes in total aggregate value are not as volatile as the previous periods. Two noticeable peaks are in 2015 with an amount of $104,085 million (doubled from the year prior) and in 2018 it adds up to $120,189 million (almost tripled from the year prior). In 2015, 60.77% of the total aggregate deal value comes from deals with public targets, 5.22% are from deals with private targets and 34% involve subsidiaries. For 2018, 74.82% of the total aggregate value is due to M&As with public firms, 17.62% private firms and 7.56% are subsidiaries. We can see in this period that the deal value involving public companies is higher and that there is a shift from subsidiary firm deals to private in the past years, with the number of private companies still dominating.

Figure 1 is characterized by the number of deals and outlines the expected merger waves, the dotcom bubble and the financial crisis. We can clearly see the 5th merger wave, peaking around the year 2000, with the highest number of M&A

deals overall and characterized by many cross-border deals and mega deals. The period around the year 2000 with a high increase in M&A activity also showcases the tech bubble which builds up and bursts with a steep decline post-2000.

The 6th merger wave, peaking around 2006, is also shown in the M&A activity figure. Alexandridis et al. (2012) discusses the drivers which are: increases in liquidity (in line with neoclassical explanations of merger waves), less overvalued acquirers, more cash deals, less corporate control, less serial acquirers, more cautious/rational decision making (especially in the aftermath of the dotcom bubble) and more frequent FCF problems (Jensen 1976). An important factor also showcased in the figure is the financial crisis of 2007-2008 and its aftermath, which undoubtedly has had an effect on the M&A activity.

An important note, as emphasized by Alexandridis et al. (2017), is that the aftermath of the financial crisis had brought big changes to the environment surrounding M&As. Such changes are government-driven reforms, high level of regulatory overhaul and surges in shareholder activism and litigation cases. This movement had the goal of adopting practices that lead to value-creation, transparency and more confidence in the public eye. These developments have had a positive effects on investment decision-making, strategic selection of targets, synergy motives, implementation of deal and the integration process that follows.

Schumpeter's (1942) idea, of modern economic systems being reconfigured via extraordinary events so that value-destroying practices and behaviors are exchanged for new and wealth-increasing ones, is supported by this example. The financial shock coming from the crisis had acted, in many ways, with favorable effects on aspects like decision-making around M&As and strengthening value-creation (Alexandridis et al. 2017).

The 7th merger wave is displayed to pan out in a more balanced manner, with a smaller number of deals that its predecessors and lower volatility in value. However, as Alexandridis et al. (2017) proves in his paper, post-2009, M&A deals seem to create more value for acquiring firm shareholders and companies are more efficient and mindful in allocating capital to investment opportunities.

The Figure 1 also helps in comparing the number of deals with different types of target companies. We can clearly see from both Table 1 and Figure 1 that

the number of private deals is significantly larger and dominates, compared to the public or subsidiary target deals. What we can learn from this is that private firms are easier to acquire as they do not necessarily have a complex ownership structure. As conventional wisdom shows, that acquirers of private companies tend to outperform those acquiring listed targets by a large margin, as Alexandridis et al (2017) also shows.

On average, our study exhibits that public deals have dominated in aggregate deal value per year. However, years 2001 and 2006 display larger amounts of aggregate deal value for M&A deals involving subsidiary companies. Since these periods are characterized by an increase in cross-border deals, we can say that many of these M&A deals might have been a way for acquirers to expand to other markets and capitalize on opportunities.

Table 1

Sample distribution

The table shows annual volume and aggregate dollar value for the entire sample and organization by type of target. The sample contain the completed deals throughout the period 1991-2018. Acquirers own at least 50% of the shares in the target firm following completion. Acquiring firms are US-traded on stock exchanges such as NYSE, Amex, Nasdaq. Target firms are public, private and subsidiary companies.

Year	All Deals	Public Deals	Private Deals	Subsidiary Deals	All Deals Value ($M)	Public Deals Value ($M)	Private Deals Value ($M)	Subsidiary Deals ($M)
1991	13	5	6	2	$1,041	$777	$192	$72
1992	22	2	13	7	$1,119	$39	$441	$639
1993	32	3	24	5	$827	$253	$511	$63
1994	46	7	28	11	$3,645	$928	$1,036	$1,681
1995	64	8	39	17	$6,338	$2,480	$1,230	$2,627
1996	81	10	58	13	$4,448	$2,481	$1,703	$264
1997	119	20	69	30	$21,147	$5,067	$2,401	$13,679
1998	159	30	100	29	$17,069	$8,812	$3,463	$4,794
1999	245	41	161	43	$65,678	$34,283	$23,504	$7,891
2000	338	57	231	50	$180,287	$131,703	$38,717	$9,867
2001	160	43	75	42	$97,480	$15,459	$6,393	$75,628
2002	149	39	77	33	$16,080	$9,493	$3,988	$2,598
2003	125	26	71	28	$23,771	$17,331	$4,020	$2,420
2004	178	27	115	36	$30,063	$20,740	$6,033	$3,290
2005	199	31	114	54	$47,199	$31,081	$9,447	$6,671
2006	206	28	133	45	$159,960	$13,448	$10,184	$136,328
2007	219	32	137	50	$63,001	$36,025	$10,226	$16,749
2008	138	31	78	29	$27,246	$19,451	$5,688	$2,107
2009	137	30	78	29	$34,902	$21,805	$11,937	$1,161
2010	161	24	101	36	$21,259	$7,881	$7,007	$6,371
2011	151	15	94	42	$25,632	$5,915	$14,833	$4,885
2012	137	24	80	33	$30,242	$17,909	$7,038	$5,294
2013	115	18	59	38	$57,962	$33,791	$8,165	$16,006
2014	143	15	94	34	$61,450	$17,759	$31,809	$11,883
2015	137	23	69	45	$104,085	$63,250	$5,436	$35,398
2016	94	21	44	29	$78,298	$57,302	$9,798	$11,198
2017	103	16	62	25	$43,838	$26,341	$11,292	$6,204
2018	113	14	70	29	$120,189	$89,923	$21,178	$9,088

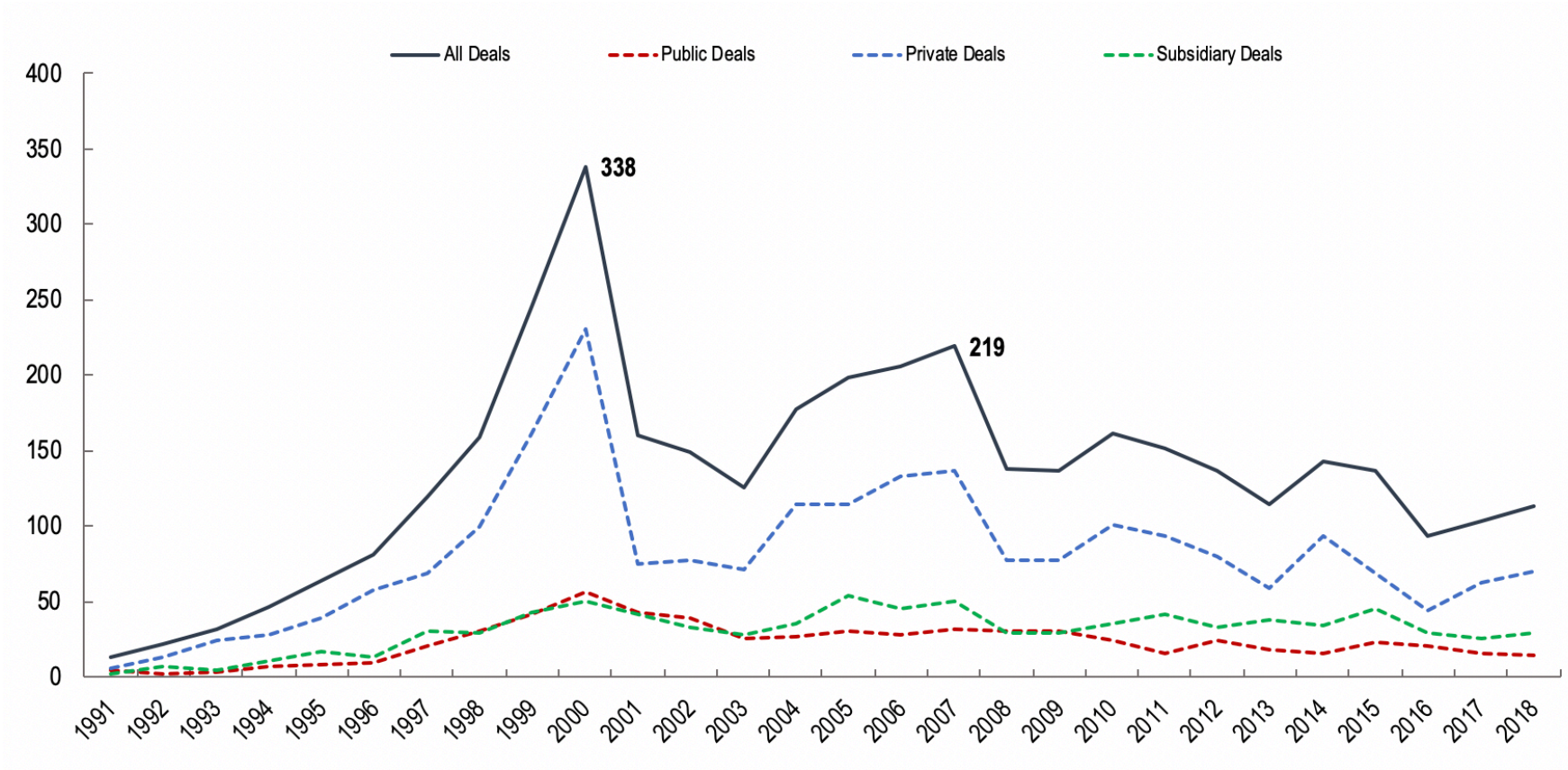


Figure 1. M&A volume activity through time

The graph depicts the volume of M&As throughout the period 1991-2018 for the public, private, subsidiary and the overall samples for comparison. Data in this figure is based on Table 1.

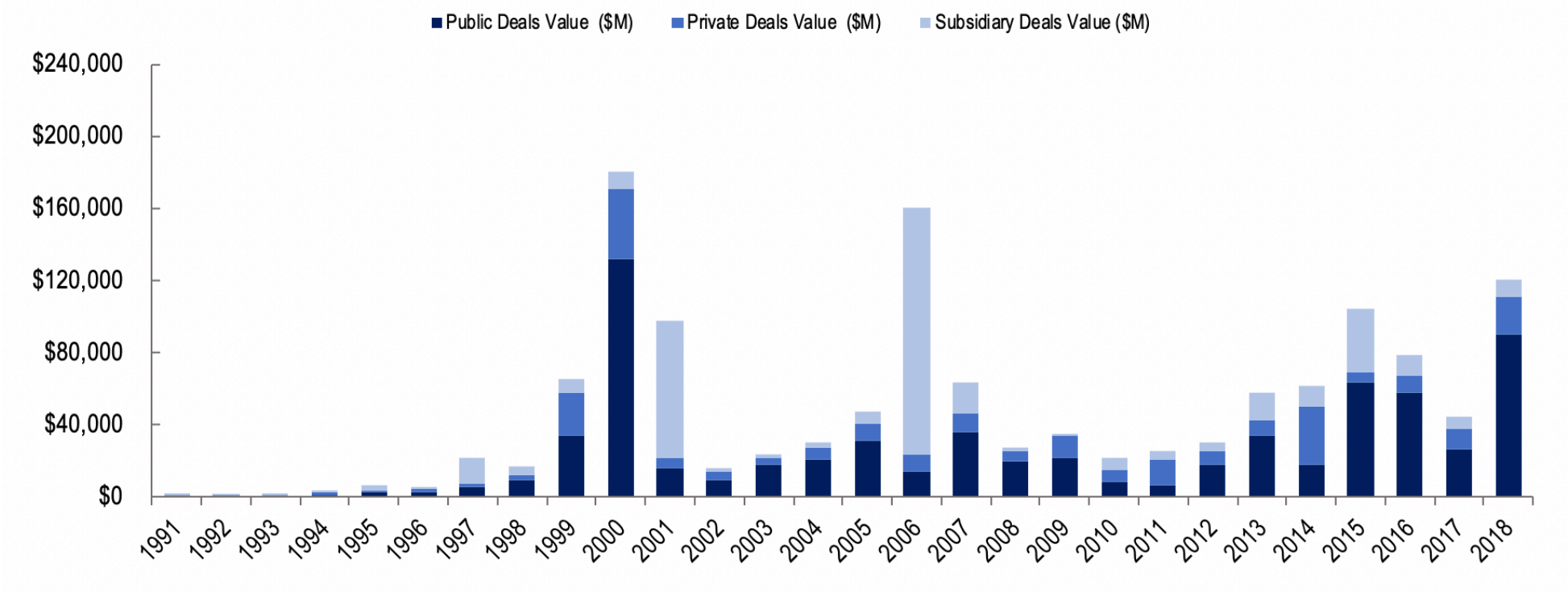


Figure 2. Deal value by target status

The figure shows how the overall aggregated deal value is split between the different target firm types in each year from Table 1.

Table 2

Mega deals descriptive statistics

Volume and aggregate deal values per year for mega deals. A mega deal is a M&A deal with a value equal or higher than $500 million.

Year	Volume	Mega Deals Value ($M)
1991	1	$548
1992	0	$0
1993	0	$0
1994	1	$1,270
1995	3	$2,822
1996	1	$1,217
1997	6	$15,164
1998	6	$8,472
1999	25	$47,069
2000	49	$153,981
2001	11	$87,781
2002	5	$7,404
2003	8	$16,826
2004	7	$20,407
2005	15	$35,720
2006	13	$143,871
2007	22	$47,016
2008	8	$18,513
2009	10	$26,851
2010	8	$7,673
2011	6	$14,169
2012	14	$20,817
2013	21	$49,506
2014	17	$51,141
2015	25	$94,492
2016	22	$72,402
2017	14	$34,688
2018	19	$107,652

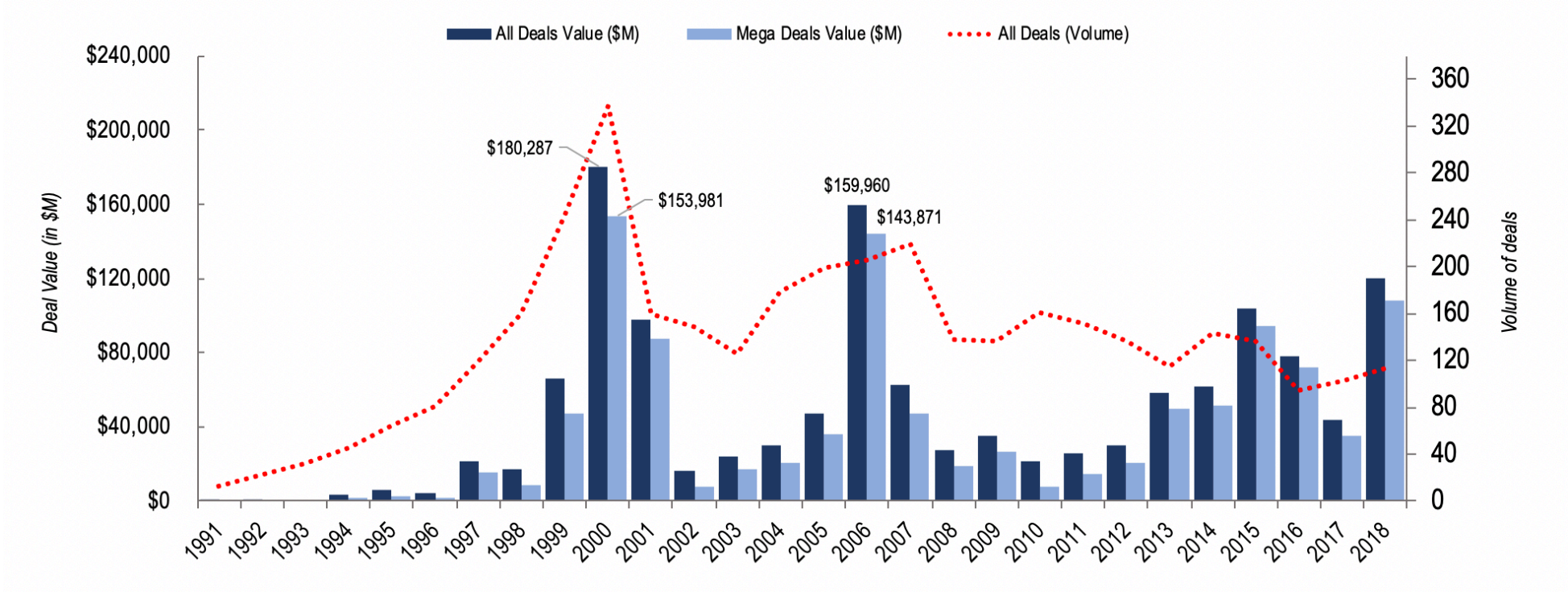


Figure 3. Total and Mega deal aggregate values per year

The figure shows the annual number of transactions and the aggregate dollar value for the total M&A sample in Table 1 and the subset of mega deals with transaction value of at least $500 million from Table 2 for each year of our sample.

Mega deals have been in the past associated with more agency problems, investor scrutiny, reputational exposure, media attention and linked to large-scale losses (Alexandridis et al. 2017). Table 2 and Figure 3 show the distribution of deals and that mega deals are responsible for a big fraction of the total aggregate value. The aggregate deal values for mega deals, total deals, and the total volume are outlined by the merger waves, the tech bubble and the deceleration post-financial crisis. Mega deals - worth at least $500 million - are a large proportion of the total aggregate deal value. 63.51% of the total aggregate deal value is coming, on average, from mega deals, accounting for 85.41% in 2000, 89.94% in 2006 and 89.57% in 2018. Thus, mega deals seem to be a big part of the total aggregate value. This proportion ranges between 27.36% and 92.47%, with exceptions in year 1992 and 1993 where there were no mega deals.

Univariate analysis

As a first step, we conclude that our time-series of $CAR_{(-1,+1)}$ are stationary by plotting our data over the period 1990-2019 and conducting a Dickey-Fuller test which rejects the null of non-stationarity at a 1% significance level. We continue by testing whether it is normally distributed through visual inspection (histogram, QQ-plot) and statistical testing (the Shapiro-Wilk test and the Kolmogorov-Smirnov test). By looking at the histogram, in Figure 4, and the QQ-plot, we can visually find a slight right skewness in the histogram and right heavy tails in the QQ-plot. The normality tests compare the sample distribution to a normal one in order to ascertain if the data shows deviations from normality. In our case, both tests reject the null hypothesis of assumed normal distribution. We use the Kolmogorov-Smirnov, which is less powerful but more general. We also use the Shapiro-Wilk test, which is a more specific normality test, provides better power and is based on correlations between data and corresponding normal scores.

Tabachinick & Fidell (2007, chp 4) provide an insight into this issue and state that we should be able to assume normality for a sample size above 30 observations. Warner and Brown (1985) also mention that daily stock and excess returns can exhibit deviations from normality (Fama, 1976). They point out that the Central Limit Theorem (Billingsley, 1979 pp. 308-319) states that the sample

excess return would converge to a normal distribution as the sample size increases. Evidence is also shown by Blattberg and Gonedes (1974).

Furthermore, we are interested in finding out if there is an improvement in acquirer performance, for each period that we look at, but also if there are significant changes from one period to another. From Table 3 we can observe that there is a significant decrease in mean $CAR_{(-1,+1)}$ from period 1990-1999 to 2000-2009, which could be expected as a big portion of the deals done in the period 2000-2009 are post tech bubble and 5th merger wave. Acquirers started to make more cautious and rational decisions related to M&A. Managers were less-optimistic, corporate control was less competitive and acquirers were less acquisitive as explained by Alexandridis et al. (2012).

Table 3 also differentiates the transactions based on the public status. M&A deals with public targets have a significant increase in mean $CAR_{(-1,+1)}$ from period 2000-2009 to 2010-2019. This significant change shows that returns in the 7th merger wave are higher than the previous one. This could be because the 7th merger wave had been considered more balanced, compared to previous waves, and due to the aftermath of the financial crisis. We see that during the period 2000-2009, deals with public targets have the higher mean return of 2.06%. M&A deals with private targets have a decreasing mean $CAR_{(-1,+1)}$ over time and show a significant decrease from period 1990-1999 to 2000-2009. In comparison, M&A deals with subsidiaries seem to have a more stable mean $CAR_{(-1,+1)}$ that remains in the range 1.41%-1.72%. Mega deals and small deals have mean returns that behave very differently. While mean returns for small deals decrease over time, mean returns for mega deals seem to create on average more losses during the period 2000-2009 compared to the other two periods.

Our study finds that the cumulative abnormal returns and its volatility have overall decreased over time as it can be seen in Figure 5. The second period 2000-2009, which coincides with the 6th merger wave, present the lowest $CAR_{(-1,+1)}$ and volatility seen in this measure. Companies are dealing with the aftermath of the dotcom boom and are scaling back on their operations, rethinking advertising strategies and, after suffering losses, transitioning towards more cautious investment positions.

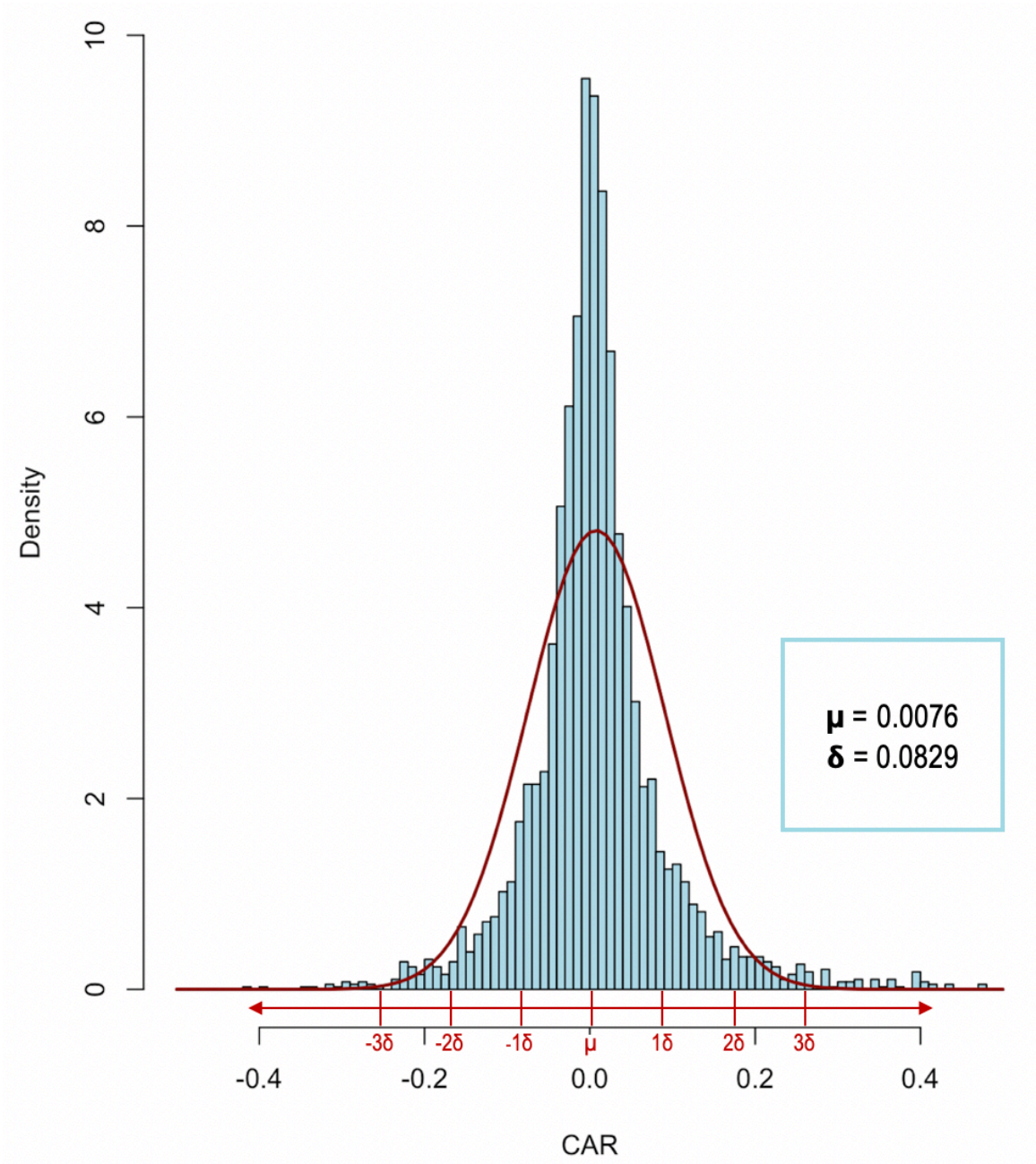


Figure 4. Histogram of CAR

Histogram of $CAR_{(-1,+1)}$ with a mean of 0.008 and the standard deviation of 0.083.

Table 3

M&A performance sorted by period

The table includes the number of deals (n), the aggregate dollar value in million dollar (AggDollarValue), the mean and median three-day cumulative abnormal return (%) for the three periods 1990-1999, 2000-2009, 2010-2019. The information is also sorted by the type of target (public, private, subsidiary). The statistical testing assumes equality in means. The table displays the small deals, which have an aggregate deal value below or equal to the 25th percentile of the entire sample, and the mega deals, which are the deals that are equal or above $500 million. The notation of *, **, *** corresponds to statistical significance of 10%, 5% and 1% respectively.

	1990-1999 (1)	2000-2009 (2)	2010-2019 (3)	(2)-(1)	(3)-(2)
All Targets					
n	781	1849	1183		
AggDollarValue ($M)	$23,696	$23,390	$4,581		
Mean	0.0142	0.0048	0.0078	-0.0094**	0.0030
Median	0.0036	0.0022	0.0031	-0.0014	0.0009
Public Targets					
n	126	344	170		
AggDollarValue ($M)	$1,118	-$47,393	-$65,659		
Mean	-0.0061	-0.0206	0.0044	-0.0145	0.0250***
Median	-0.0014	-0.0116	-0.0058	-0.0103	0.0058***
Private Targets					
n	498	1109	696		
AggDollarValue ($M)	$17,178	$46,360	$35,326		
Mean	0.0193	0.0082	0.0052	-0.0110**	-0.0030
Median	0.0074	0.0029	0.0029	-0.0045*	0.0000
Subsidiary Targets					
n	157	396	317		
AggDollarValue ($M)	$5,400	$24,423	$34,914		
Mean	0.0141	0.0172	0.0151	0.0031	-0.0021
Median	-0.0002	0.0093	0.0068	0.0095	-0.0025
Mega Deals					
n	45	151	149		
AggDollarValue ($M)	$25,270	-$30,104	-$56,986		
Mean	0.0072	-0.0083	0.0092	-0.0156	0.0175*
Median	0.0016	0.0005	-0.0031	-0.0011	-0.0036
Small Deals					
n	273	494	195		
AggDollarValue ($M)	-$6,042	$3,423	$61,646		
Mean	0.0157	0.0099	0.0068	-0.0058	-0.0031
Median	0.0005	0.0032	0.0037	0.0028	0.0005

Table 4 presents M&A activity by industry using the Fama and French (1997) 48 industry classifications. We report the mean $CAR_{(-1,+1)}$ for each industry, the number of deals per industry and the percentage deals an industry has out of our entire sample. Industries that have the highest number of deals for the period 1990-2019 are the Business Services, Electronic Equipment, Computers and Communications. We expect that these industries have a higher level of activity since they are more closely related to the tech-specific and growing trends.

For industries that have at least 10 M&A deals throughout the approximately 30-year sample period, we have tested whether the means and median are significantly different from zero with t-tests and Wilcox tests. The highest, significantly different from zero, mean $CAR_{(-1,+1)}$ is in the Wholesale and Restaurants, Hotels, Motels industries. Technology has undoubtedly made improvements in these industries as more advanced technology has been adopted. With a rise in productivity, an easier access to information and an increase in the use of digital platforms, the Wholesale and Hospitality industries have undergone major changes. The personal services industry has the lowest overall mean returns with - 5.54%, showing that the quality of personal services have always been on the basis of human interaction instead of automation and technology. This trend is however changing now, with the rise of digital services and technology advancements improving the customer experience.

Moreover, Table 5 and Figure 6 show the aggregate dollar value - gains and losses - throughout the years. We can see that, in the case of the 5th merger wave and the bust of the dotcom bubble, gains and losses are fairly offset with the largest gains and losses of our sample in 2000 of $45,291 million and - $47,459 million in 2001. The increase and steep decline in volume of M&A deals also coincides with companies behaviour and speculation around the tech bubble. The 6th merger wave is more balanced with a higher volume of deals and lower aggregate value, compared to the prior wave. The post-2009 period can be seen in Figure 6 as slightly more volatile, with significant positive peaks in 2011 and 2015. This completes the image we have from the descriptive statistics and we thus, see the $CAR_{(-1,+1)}$ amount produced as a result of the deals employed.

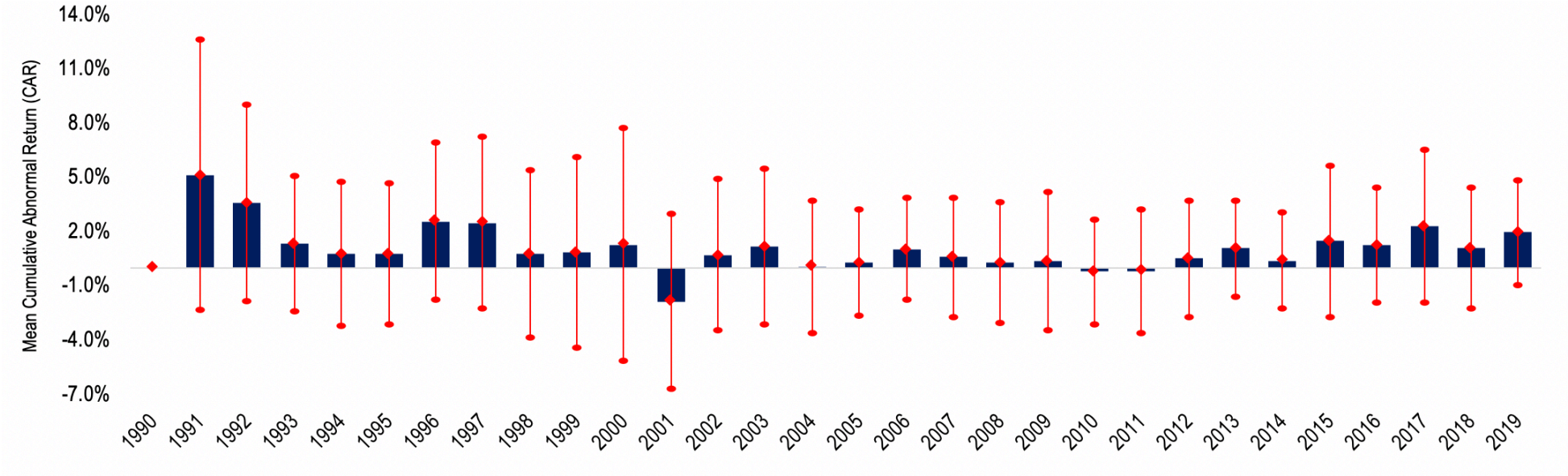


Figure 5. Sample Cumulative Abnormal Return and volatility

The figure shows the mean $CAR_{(-1,+1)}$ and standard deviation per year. It illustrates the flows of M&A activity through time and their mean performance.

Table 4

M&A Activity by industry

The sample contains all completed M&As of our sample and the table reports the number and percentage of deals in a particular industry. We have classified the deals per industry based on the four-digit SIC codes translated into the Fama and French (1997) 40 industry classification system. Values for the $CAR_{(-1,+1)}$ mean and median, t-statistic, z-statistic and the statistical significances, per industry, are also shown. The table includes the mean and median three-day cumulative abnormal return (%). We conduct significance tests, such as the t-test on mean and Wilcox test on the median, for the industries which have at least 10 deals. The notation of *, **, *** corresponds to statistical significance of 10%, 5% and 1% respectively.

Industry	Mean (%)	t-stats.	Median (%)	z-stats.	Number of deals	Proportion of total deals (%)
Food Products	-20.80	*N/A*	-20.80	*N/A*	1	0.03
Beer and Liquor	-0.81	*N/A*	-0.81	*N/A*	1	0.03
Recreation	3.99	*N/A*	0.86	*N/A*	9	0.24
Entertainment	1.33	1.202	-0.48	1145	65	1.71
Printing and Publishing	2.34**	1.936	1.62**	253	26	0.68
Consumer Goods	0.51	0.315	1.16	129	21	0.55
Medical Equipment	-4.75	*N/A*	-0.61	*N/A*	5	0.13
Pharmaceutical Products	5.75	*N/A*	5.75	*N/A*	1	0.03
Construction	-4.76	*N/A*	-4.76	*N/A*	1	0.03
Steel Works	-2.59	*N/A*	-2.21	*N/A*	7	0.18
Fabricated Products	-0.15	*N/A*	-0.25	*N/A*	3	0.08
Machinery	0.14	0.120	0.10	460	42	1.10
Electrical Equipment	-3.92	*N/A*	-3.92	*N/A*	2	0.05
Petroleum and Natural Gas	10.38	*N/A*	10.38	*N/A*	2	0.05
Communication	0.58	1.295	0.34	34392	361	9.50
Personal Services	-5.54**	-2.499	-2.75**	13	12	0.32
Business Services	0.57***	2.652	0.23**	622931	1527	40.16
Computers	0.41	1.092	0.24	55130	456	11.99
Electronic Equipment	0.83***	3.383	0.24**	266627	987	25.96
Measuring and Control Equipment	0.09	0.142	-0.14	1774	83	2.18
Business Supplies	1.53	0.690	-1.06	30	10	0.26
Transportation	-5.99	*N/A*	-3.33	N/A	3	0.08
Wholesale	3.72***	2.923	2.06***	1904	74	1.95
Retail	2.06	1.254	-0.16	181	26	0.68
Restaurants, Hotels, Motels	3.71**	2.312	1.68	399	34	0.89
Banking	-0.95	-0.554	-0.60	26	11	0.29
Insurance	5.71	*N/A*	5.48	*N/A*	3	0.08
Real Estate	-3.23	*N/A*	-3.23	*N/A*	2	0.05
Trading	4.31	1.593	1.28	114	18	0.47
Other	6.46	*N/A*	3.60	*N/A*	9	0.24

Table 5

Aggregate volume and dollar value per year

The table reports the aggregated volume and dollar value per year based on the announcement date. The aggregate dollar value is calculated as the $CAR_{(-1,+1)}$ of each acquirer times the acquirer market capitalization.

Year	Volume	Aggregate Dollar Value ($M)
1990	0	$0
1991	13	-$83
1992	22	-$210
1993	32	-$27
1994	46	-$675
1995	64	$1,102
1996	81	$7,741
1997	119	$1,185
1998	159	$5,094
1999	245	$9,569
2000	338	$45,291
2001	160	-$47,459
2002	149	-$8,883
2003	125	-$4,845
2004	178	-$3,391
2005	199	$101
2006	206	$24,910
2007	219	$14,904
2008	138	-$3,575
2009	137	$6,337
2010	161	-$17,138
2011	151	$43,646
2012	137	-$23,374
2013	115	-$19,567
2014	143	-$8,403
2015	137	$42,314
2016	94	-$10,372
2017	103	-$6,802
2018	113	-$14,005
2019	29	$18,281

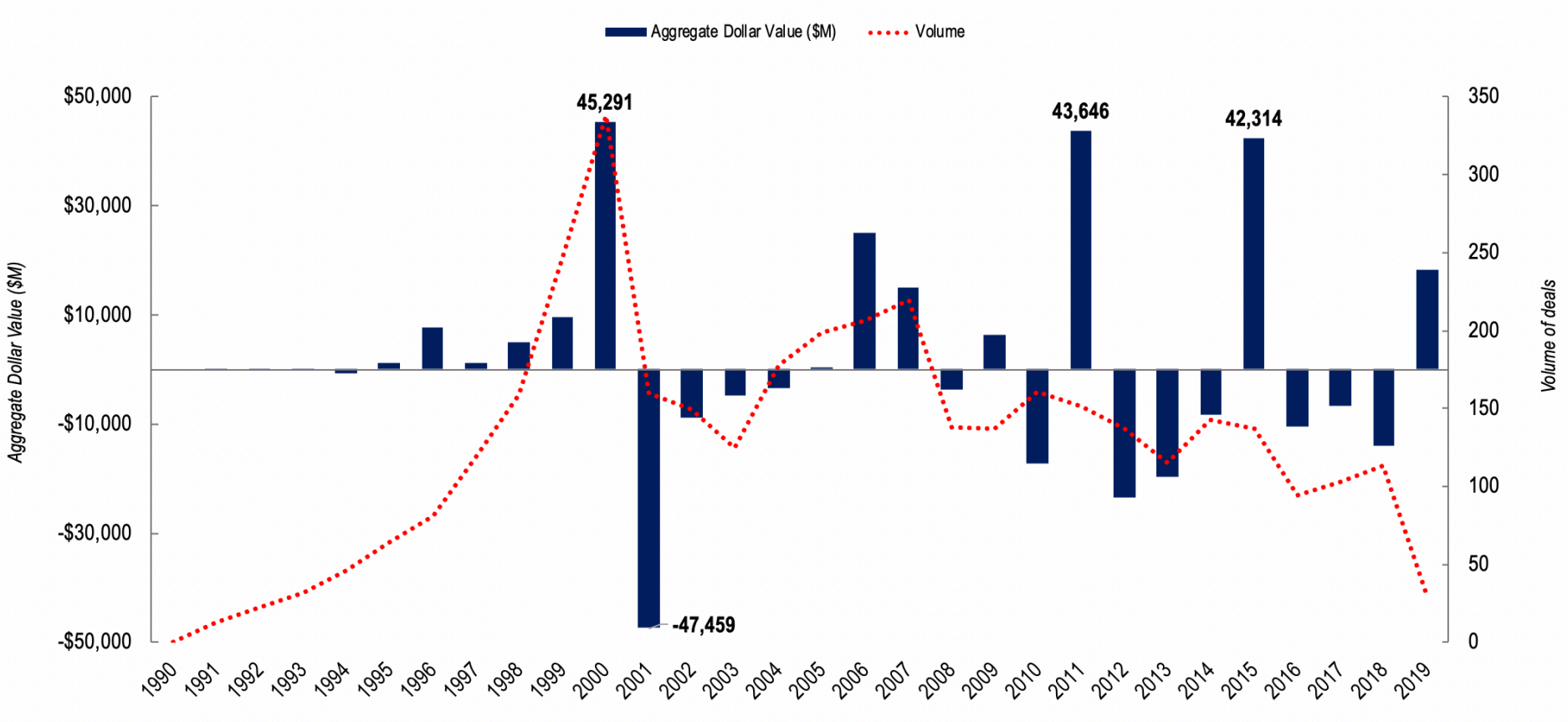


Figure 6. Aggregate dollar value (in million) and volume of deals per year

The figure is based on Table 5 and displays the positive and negative values of the aggregate dollar value for each year of our sample together with the total number of transactions

Multivariate analysis

Linear models assumptions

We continue our analysis by checking on the multivariate linear model assumptions, since we are planning on interpreting potential linear relationships between our dependent variable and the independent variables chosen. Firstly, we test the linearity assumption visually. We use scatter plots and combination charts to do a bivariate analysis to look at these relationships. Consequently, while we see some linear relationships, we also need to log some variables for which percentage relationships apply and need to be linearized, such as relative size, the current ratio and enterprise value over sales. For our dummy variables against numerical, we use a combination chart of bar plots and line chart to show the distribution of binned variables and percentage of each category.

Secondly, after running the regression, we tested the distribution of the residuals to ascertain whether they are normally distributed by using both visual and statistical testing. Visually, the histogram of the residuals shows a slight skewness to the left, the scatter plot between residuals and fitted values depicts a more or less random outlook and the normal probability plot (QQ-plot) presents left heavy tails (leptokurtosis). Statistical tests of normality, such as the Shapiro-Wilk and Kolmogorov-Smirnov tests, reject the null hypothesis of normal distribution. Thus, we conclude by visual and statistical testing that residuals are not normally distributed.

Thirdly, we check if there is multicollinearity in our data. From the correlation matrix we see moderate positive correlations between Tobin's Q - Debt to Asset, moderate negative correlations between Mix - Cash, Private - Public, Relative size - Large, Medium - Small, and strong negative correlations between Current Ratio - Tobin's Q, Stock - Cash, Subsidiary - Private, Medium - Large. We also use the variance inflation factor to measure the variance in the regression coefficients due to potential multicollinearity. We do not, however, find problematic level of inflation as the values are between 1 and 3.14. As James et al. (2014) and Bruce and Bruce (2017) state, these values are under the limit of 5 or 10 and do not impose problematic level of collinearity and thus do not need to be removed.

Fourthly, we test for heteroscedasticity of errors in the regression. We test for constant and homogenous variance by using a Breusch-Pagan-Godfrey test, an F-test and a score test. The conclusion is that there exists heteroscedasticity. We, furthermore, also test for autocorrelation in the residuals by using a Box-Pierce test and find no autocorrelation. For heteroscedasticity, we use heteroscedasticity and autocorrelation consistent (HAC) estimators of the variance-covariance matrix based on Newey-West (1987).

Short analysis on $\mathbf{CAR_{(-1,+1)}}$ by target status and deal differentiation

We infer from Table r that our sample is comprised of a larger number of small deals than mega deals. Small deals returns positive gains of $59,026 million from M&A, compared to mega deals with are aggregated to -$61,821 million. This shows that, while the mean of small deals is higher, smaller deals have been more common and profitable. Mega deals have historically been linked to large scale losses for shareholders and value destroyed as proven by different reports[3]. Alexandridis et al. (2017) find, however, that while this is true, M&A deals post-2009 have actually acquiring shareholders gaining and value creation on a large scale from these deals. While keeping this in mind, we find a lower and positive mean $CAR_{(-1,+1)}$ for mega deals compared to small deals.

We see that mega deals have a larger proportion of public targets (54.20%), which often tend to be larger target companies with higher deal values. Small deals seem to capture the dals that involve more often the private targets (71.93%) and these, as expected and seen in our sample, are smaller and value and larger in volumes. For targets that are subsidiary companies, both mega deals and small deals have a very similar proportion of around 23.60% out of all targets of that specific type. This information is aligned with the results from the descriptive statistics and univariate analysis. We conclude that small deals are, on average, returning higher CARs and are in higher proportion private deals. Mega deals, on the other hand, tend to have a lower $CAR_{(-1,+1)}$ and may incur losses or have very small gains.

[3] Boston Consulting Group, Inc. (2007) reports that mega deals with a value of more than $1 billion destroy nearly twice as much value as smaller deals. Bloomberg (2002) reports that 61% of merger deals worth at least $500 mil end up costing shareholders. In a more recent study, McKinsey Quarterly (2012) finds that only large deals are on average subject to negative abnormal returns, especially among faster growing sectors. The Financial Times (2015) also posits that expensive mega-deals are damaging for everyone, except for top executives and financial advisors. Alexandridis et al. (2013) report a striking $518 mil loss for acquiring shareholders in the average large deal between 1990 and 2007.

Table 6

Sample distribution for small and mega deals

The table displays the small deals, which have deal values below or equal to the 25th percentile of the sample, and the mega deals, which are the deals that are equal or above $500 million. The aggregated dollar values are based on $CAR_{(-1,+1)}$ and the associated acquirer market capitalization. $CAR_{(-1,+1)}$ means and medians are in percentages (%).

	Mega Deals	Small Deals
All Targets		
n	345	962
Agg. DollarValue ($M)	-$61,821	$59,026
Mean CAR	0.13	1.09
Median CAR	0.03	0.27
% of Public	54.20	4.37
% of Private	22.32	71.93
% of Subsidiary	23.48	23.70

What is acquirer size, method of payment and target public status showing us?

Our study tries to determine factors that have an effect on acquirer performance, how and the extent to which they do. While we account for other determinants in the regressions that come up next, we also do a preliminary analysis of the acquirer size, target status and method of financing. Table t focuses on mean $CAR_{(-1,+1)}$ and how abnormal returns differ between these specifications. For the full sample, in panel A, we find that overall, we have positive abnormal returns irrespective of method of financing. However, we have significant differences at the 1% level between small and large acquirer firm returns, across all methods of payment. Therefore, small acquirers present significantly higher abnormal returns (on average around 2%), compared to large acquirer companies. This is aligned with our previous findings and for both small and large acquirers, paying with stock will earn the higher mean abnormal return. Nevertheless, for the entire sample, the mix method of payment will earn acquirers the highest abnormal return, on average.

Panels B, C and D calculate the mean CARs across methods of payment and size for public, private and subsidiary targets. We calculated these values in order

to differentiate between the effects in these specific circumstances. What we can see is that in panel B is that, for public targets, abnormal returns tend to be negative with highest negative returns being for deals involving mix and stock methods of payment. Cash offers have some positive abnormal returns, yet the rest of the sample have negative mean abnormal returns. To compare the methods of payment, we find that significant differences between stock and cash across all acquirers, independent of size.

In panel C, we find that the highest abnormal returns are when the equity and mix are used as methods of payment. This is aligned with the results of Chang (1998), Fuller (200) and Moeller-Stulz (2005). Over all types of financing, we find that smaller companies earn higher mean CARs and significant differences for mix stock and cash payment method. We reiterate the finding from panel B and to compare the methods of payment, we find that significant differences between stock and cash across all acquirers, independent of size.

Turning to subsidiary targets and panel D, we find positive abnormal returns across all mean CARs. The highest CARs are for mix and stock methods of payment across all acquirers. Small acquirers have noticeably higher CARs, compared to large companies, averaging between 2-3%. In deals regarding subsidiary targets, large companies seem to have an extraordinarily high 5.73% abnormal return when the payment is made with stock. This can be explained by an over valuation of the acquirer firm's stock. Significant differences for the acquirer size are found when making the payment in cash. We also find, as Moeller-Stulz (2005), that subsidiaries are the most profitable acquisitions and they are followed by private firms.

The only negative abnormal returns for small acquirers are in the case of a public target, when payment is done by equity or a mix. Large acquirers have negative abnormal returns, except for subsidiary targeted deals and private targeted deals when the form of payment is stock or cash. For large acquirers, there is a significant difference between the means given by paying with stock or the one given by paying with cash for any type of target firm. These differences are also reported for small acquirers in all cases, except subsidiary targets.

Table 7

Announcement $CAR_{(-1,+1)}$ sorted by target status, method of payment and size

The sample contains all M&A deals for the period 1991-2019 as given by Thomson Reuters (Eikon), where publicly traded acquirer gains (at least 50% of shares) a public, private or subsidiary target, whose transaction value is at least $1 million. Small (Large) acquirers have a market capitalization equal to or less (greater) than the market capitalization of the lower (upper) 25th percentile of NYSE firms in the same year. The table includes the mean three-day cumulative abnormal return (%). The method of payment is defined as payment with cash only, stock only or a mix of both. Difference tests are based on t-tests for equality of means. The notation of *, **, *** corresponds to statistical significance of 10%, 5% and 1% respectively.

	Mix	Stock	Cash	All	Difference tests		
	(1)	(2)	(3)		(1)-(2)	(2)-(3)	(1)-(3)
Panel A: Full sample							
All	1.19	0.54	0.68	0.76	0.66	-0.14	0.52
n	874	868	2071	3813			
Small	2.15	2.40	1.72	2.03	-0.26	0.68	0.43
Large	-0.73	0.61	0.19	0.20	-1.34	0.42	-0.92
Difference	2.88***	1.79***	1.52***	1.83***			
Panel B: Public targets							
All	-1.75	-2.57	0.13	-1.11	0.82	-2.70***	-1.88**
n	107	220	313	640			
Small	-1.65	-1.70	3.86	-0.13	0.05	-5.56**	-5.51*
Large	-0.28	-2.79	-0.31	-1.09	2.51	-2.48**	0.02
Difference	-1.37	1.09	4.17**	0.96			
Panel C: Private targets							
All	1.20	1.74	0.47	0.97	-0.53	1.27**	0.74*
n	619	558	1126	2303			
Small	2.16	3.83	0.96	2.13	-1.66	2.86**	1.20
Large	-1.39	1.82	0.30	0.59	-3.21***	1.52*	-1.70
Difference	3.55***	2.00	0.66	1.53***			
Panel D: Subsidiary targets							
All	3.29	0.71	1.32	1.59	2.58*	-0.61	1.97**
n	148	90	632	870			
Small	3.60	2.48	2.49	2.74	1.12	-0.02	1.10
Large	0.73	5.73	0.42	0.83	-5.00	5.30*	0.31
Difference	2.86	-3.25	2.07***	1.90***			

Table 8

Acquirer Cumulative Abnormal Return Regression.

The table reports OLS regression coefficient estimates of $CAR_{(-1,+1)}$. Detailed variable definitions are reported in Appendix F. The estimates are displayed in percentage points. The notation of *, **, *** corresponds to statistical significance levels of 10%, 5%, and 1% respectively.

	Multivariate Regression	
	Estimate	t-stats.
(Intercept)	-0.06	-0.052
Cross Border	0.17	0.494
Stock	-0.35	-0.592
Cash	0.30	0.650
Serial	-0.17	-0.305
Diversification	0.03	0.073
Public	-2.97***	-5.712
Private	-0.37	-0.950
Medium	-1.42***	-2.669
Large	-1.02	-1.461
Relsize	0.33***	2.609
TobinQ	5.65***	4.887
Market/Book	-0.07**	-2.238
Asset Turnover	1.21***	3.577
Debt/Asset	-1.64***	-2.946
Current Ratio	1.07***	3.145
FCF	-0.51	-0.878
EV/Sales	0.88***	3.601
R&D/Sales	0.00***	-5.563
Δ CAPEX	-0.06	-0.744
Adj R^2 (%)	4.05	
n	2422	

Main regression

In Table 8, we summarise the results of our multivariate regression with the factors which we assume to have an effect on the bidder's CARs. We measure bidder returns as a function of several deal and acquirer characteristics from our sample of technology firms. As with the majority of research conducted on the returns to acquiring companies, the results should be viewed with scepticism. This is due to low explanatory power of the regression, even though the F-statistic is significant and positive.

The multivariate results presented in Table 8 suggest that the cumulative abnormal returns in our sample seem to be driven by the target status (Public), the size of the acquiring firm (Medium), the relative size of the acquisition compared to the acquirer's size (Relsize), the buyer's Tobin's Q, valuation (M/B and EV/Sales), efficiency (Asset Turnover), liquidity (Current Ratio) and technology related costs (R&D/Sales). Public targets from our sample have the largest negative effect on the abnormal return with a 2.97% effect. Medium sized and highly levered acquiring firms also negatively impact the acquiring returns by 1.42% and 1.64% respectively.

The largest effect in absolute value is Tobin's Q, with a positive yield on performance of 5.65%. As expected, the efficiency level (asset turnover) of the bidder has a relatively strong impact on the bidder's gain (1.21%). Surprisingly enough, a key component to every technological firm is their strong liquidity, which increases the performance of the acquirer, all else being equal, by 1.07%. Complementary to the absolute size of the bidder, its relative size of the deal value is also significant with a 0.33% effect.

The valuation ratio EV/Sales, which is useful to compare companies with varying capital structures, has a positive impact on the bidder's value creation (0.88%). As a reminder, EV/Sales is fundamentally driven positively by the profit margin, the growth rate and inversely by the required rate of return factors. Finally, we found a rather weak effect for the level of R&D spending (negative) and Market/Book (negative).

Interactions regressions

Interactions regression controlling for size of acquirer

To ensure that the relationships documented in Table 8 are not driven by extreme $CAR_{(-1,+1)}$ observations, we also run the regression on $CAR_{(-1,+1)}$ controlling for the bidder's size: Small (below the 25th percentile), Large (above the 75th percentile) and Medium (between the 25th and 75th percentile). The results are reported in Table 9. In Table 9, the first regression (All) regroups all the acquisitions regardless of the acquirer size. Regressions (Small), (Medium) and (Large) in Table 9 estimate regression (All) separately for small, medium and large firms, respectively. The different samples are sorted by the market capitalization of the bidder.

Across the regressions, the results are conclusive and consistent for the type of target (private and subsidiary), Tobin's Q, and the level of R&D spending. The efficiency (asset turnover), leverage (debt/asset) and valuation (EV/sales) are significantly influencing the acquirer's performance for all regressions but the second one (Large). Large bidders have specific factors/characteristics that only seem to impact them with statistical significance such as diversification (1.33%) and serial (-2.41%).

The method of payment, whether that is cash or stock, does not significantly affect the $CAR_{(-1,+1)}$ of the acquiring tech firm. The effect of Tobin's Q on medium and small size bidders is particularly large with an impact exceeding 6% on the acquiring firm stock return. For medium size acquirers, all else being equal, the leverage destroys shareholders wealth by 1.73% and by 3.67% for small size acquiring tech companies. In addition, the target status (private and subsidiary) effect is significantly greater for smaller acquiring firms (above 3%) than for large (around 2.5%). The same goes for Tobin's Q influence on stock returns.

What's interesting to notice is that for the significant variables the effect on abnormal returns is inverted to the bidder's size. In other words, the smaller the acquiring tech firm, the larger the effect on $CAR_{(-1,+1)}$ is, whether this effect is positive or negative. The only exception is the level of R&D which becomes very costly for shareholders of large acquirers. The significantly negative effect reaches 16.77%, all else remaining the same. Whereas, for medium and small tech companies, the effect is very small.

Table 9

Acquirer Cumulative Abnormal Return Regressions controlling for the bidder's size.

The table reports OLS regression coefficient estimates of $CAR_{(-1,+1)}$. Detailed variable definitions are reported in Appendix F. The estimates are displayed in percentage points. The regression Small filters for all bidders with a size equal or lower than the 25th percentile of the sample. The regression Large filters for all bidders with a size equal or higher than the 75th percentile. Finally, the regression Medium filters for all bidders with a size between the 25th percentile and 75th percentile. The estimates are displayed in percentage points. The notation of *, **, *** corresponds to statistical significance levels of 10%, 5%, and 1% respectively.

Panel (C) Acquiror Size								
	All	t-stats.	Large	t-stats.	Medium	t-stats.	Small	t-stats.
(Intercept)	-3.45***	-3.070	0.83	0.202	-5.03***	-3.112	-2.21	-0.854
Cross Border	0.11	0.323	0.15	0.268	-0.03	-0.078	1.10	0.985
Stock	-0.38	-0.637	0.74	0.622	-0.75	-0.946	-0.82	-0.548
Cash	0.23	0.496	1.06	1.126	0.63	1.039	-0.08	-0.071
Serial	-0.35	-0.635	-2.41*	-1.423	0.98	1.393	-1.18	-1.110
Diversification	0.02	0.067	1.33**	2.306	0.03	0.061	-1.14	-1.213
Private	2.70***	6.018	2.53***	3.540	3.11***	4.929	3.13**	1.975
Subsidiary	3.08***	6.027	2.25***	3.186	3.37***	4.573	3.63**	2.155
Relsize	0.37***	3.423	-0.09	-0.542	0.72***	3.625	0.50	1.196
TobinQ	5.56***	4.839	2.95*	1.653	6.30***	3.645	6.33**	2.234
Market/Book	-0.08**	-2.309	-0.04	-0.882	-0.05	-1.628	-0.34**	-2.344
Asset Turnover	1.31***	3.823	0.15	0.312	1.38***	2.866	2.45***	2.631
Debt/Asset	-1.73***	-3.110	-0.81	-0.835	-1.73**	-2.124	-3.67**	-2.378
Current Ratio	0.98***	2.935	1.00	1.447	1.53***	3.179	0.34	0.358
FCF	-0.75	-1.334	-2.97	-0.989	-1.26*	-1.835	0.56	0.570
EV/Sales	0.82***	3.370	0.81	1.614	1.02***	3.062	1.07**	2.399
R&D/Sales	0.00***	-5.229	-16.77**	-2.362	-0.17*	-1.899	0.00***	-3.363
Δ CAPEX	-0.06	-0.809	0.36	1.128	-0.11	-1.379	-0.28	-1.504
Adj R^2 (%)	3.76		7.93		4.39		4.19	
n	2422		663		1257		502	

Could the size effect be explained by the overvaluation, signalling, or agency hypotheses?

Similar to the work conducted by Moeller et al. (2004), we assess the possible explaining relationship between size effect and equity signalling, free cash flow, growth opportunities, and overvaluation hypotheses. The size effect predicts lower returns large acquirer firms but higher returns to small acquirer firms. We try to assess whether there is a link between these hypothesis and the size effect observed.

Large bidders are characterised with a higher Market/Book ratio than small bidders. Previous research papers (Dong et al., 2002) have shown evidence that this measure is a good proxy for overvaluation. We find weak evidence that overvaluation explains size: no contrary effect between large and small. We explain this finding by assuming that large tech firms (due to their high market capitalisation) are more likely to be overvalued.

Future growth opportunities are reflected in Tobin's Q estimates. We assume that large tech firms tend to be more mature with a relatively lower growth rate than small bidders. This would imply that larger abnormal returns are to be expected for small acquirers. Our data, indeed, reflects this influence by displaying an effect for small bidders twice as large as for large bidders.

The signalling hypothesis suggests that managerial behaviours predict over- or undervaluation due to information asymmetry. One example that corporate finance literature exhibits is evidence of financing methods over M&A activity. Stock transactions reflect the management perception of the firm to be overvalued and cash transactions to be undervalued. We see this phenomenon in the coefficients (stock vs. cash) on medium bidders and for the whole sample but the statistical significance is trivial.

With our FCF variable, we test for the agency costs of free cash flow based on acquirer's size. Theory suggests that firms with large free cash flows tend to initiate sub-optimal or inefficient investments (e.g. investments with a negative net present value). We find consistent results for medium size bidders at the 10% significance level.

If we assume that large tech acquirers systematically pay a higher premium for M&A transactions, we would expect bidder gains to be negatively correlated with the bidder size. This assumption would show evidence of managerial hubris for large tech firms. We, however, do not estimate the premium pay by acquirers in this paper. Consequently, we can neither confirm or deny whether this assumption is empirically true for our sample data.

Interactions regression controlling for type of target

To account for the differences in target status (public, private, and subsidiary), as shown in table 10, we run regressions for these three groups separately. However, it is important to mention that multiple bidders may have made all three types of acquisitions. In Table 10, the first regression (All) regroups all the acquisitions regardless of target status. Regressions (Public), (Private) and (Subsidiary) in Table 10 estimate regression (All) separately for public, private and subsidiary targets, respectively.

The results from the regressions reflect constantly significant coefficients for the valuation ratio EV/sales and the growth ratio Tobin's Q. Our findings suggest that the acquiring tech firm's investors reward strongly transactions involving a publicly traded company with substantial growth opportunities. This criterion fits perfectly the description of tech unicorns that undertook an IPO. This effect proxied with Tobin's Q, all things equal, significantly increases the abnormal returns by 8.7% for public targets. Comparatively, the coefficient on private targets is more than twice lower (3.78%) and somewhat lower for subsidiary with an estimate of 6.06%. EV/sales statistically significantly generates higher abnormal returns with a similar effect across regressions at around 1%.

Our findings here are consistent with the signalling hypothesis. Stock transactions lower significantly the bidder's abnormal returns, at least for public and subsidiary targets (approximately -4%). Our result for private targets paid with stock is insignificant and positive. The coefficient of the variable Relsize, which measures the size of the deal relative to the acquirer's size, implies a positive relationship between acquirer's stock return and the market value of private or subsidiary target relative to the bidder's equity value. However, the estimate is higher for subsidiaries (0.73%) than for private transactions (0.45%).

Table 10

Acquirer Cumulative Abnormal Return Regressions controlling for the target status.

The table reports OLS regression coefficient estimates of $CAR_{(-1,+1)}$. Detailed variable definitions are reported in Appendix F. The estimates are displayed in percentage points. The regression Public filters for all targets which are publicly traded. The regression Private filters for all targets privately owned. Finally, the regression Subsidiary filters for all targets which are divisions or business units of a corporation. The notation of *, **, *** corresponds to statistical significance levels of 10%, 5%, and 1% respectively.

Panel (B) Target Status								
	All	t-stats.	Public	t-stats.	Private	t-stats.	Subsidiary	t-stats.
(Intercept)	-0.37	-0.336	-4.10	-1.634	0.83	0.582	0.78	0.331
Cross Border	0.23	0.647	-0.91	-0.954	0.06	0.148	0.82	1.163
Mix	-0.26	-0.553	-2.29**	-2.143	-0.01	-0.023	0.21	0.177
Stock	-0.97**	-1.969	-3.88***	-3.976	0.99	1.619	-4.00**	-2.354
Serial	-0.35	-0.637	-0.26	-0.156	-0.17	-0.235	-0.12	-0.107
Diversification	-0.07	-0.199	-0.26	-0.357	0.27	0.585	-0.22	-0.301
Large	-1.86***	-2.675	-2.20	-1.198	-0.24	-0.278	-1.33	-1.041
Medium	-1.76***	-3.289	-1.86	-1.186	-1.03	-1.590	-1.70*	-1.757
Relsize	0.15	1.216	-0.21	-0.776	0.45**	2.413	0.73***	3.063
TobinQ	5.22***	4.532	8.70***	3.519	3.78**	2.483	6.06***	2.886
Market/Book	-0.07**	-2.153	-0.33**	-2.140	-0.08**	-2.524	-0.04	-0.878
Asset Turnover	1.29***	3.782	1.85**	2.200	1.12***	2.620	0.74	0.930
Debt/Asset	-1.40**	-2.520	-2.21*	-1.815	-0.94	-1.227	-3.05***	-2.863
Current Ratio	1.04***	3.037	1.44*	1.893	0.96**	2.100	0.72	1.149
FCF	-0.54	-0.933	0.48	0.342	-1.13	-1.395	0.98	0.967
EV/Sales	0.94***	3.835	1.18*	1.799	0.63**	2.131	1.06**	2.382
R&D/Sales	0.00***	-5.834	2.49	0.556	0.00***	-3.954	0.10	0.474
Δ CAPEX	-0.05	-0.676	0.38	1.212	-0.10	-1.206	0.26	0.928
Adj R^2 (%)	2.73		10.36		2.60		4.62	
n	2422		420		1496		506	

Furthermore, the bidder's efficiency level has a greater impact on the acquiring tech firm stock performance for public candidates (1.85%) than private candidates (1.12%). The leverage seems to lower significantly the abnormal returns for public deals (-2.21%) and subsidiary deals (-3.05%). These results are consistent with the agency costs of debt theory. We test for overvaluation with the Market/Book variable and identify, as expected by theory, that high Market to Book bidders engaging in M&As generate wealth losses for shareholders regardless of the target status. Nonetheless, the coefficient for subsidiary is insignificant.

Interactions regression controlling for method of financing

Corporate finance literature previously showed evidence of the impact of method of payment on bidder's stock return. We create different regressions in order to compare the results for each type of financing: Cash, stock, and mix. As shown in table 11, we run regressions for these three groups separately. However, it is important to mention that serial bidders may have made all three types of acquisitions.

Similar to previous findings, in Table 11, we observe robust results for Tobin's Q across the different methods of payment. The coefficients suggest that a high bidder's Tobin's Q increases the abnormal returns greatly: by 9.66% for stock transactions, by 7.77% for mix transactions and by 3.43% for cash ones, all else held equal. Publicly traded companies being bought, regardless of the payment method, end up lowering the stock returns of acquirers. This is even more so when the transaction is stock-based where the coefficient reaches a -6.55% effect on bidder's performance. By comparison, the robust estimate for mixed compensation is nearly twice higher (-3.44%). It is important to note that subsidiary targets paid with stock have a significantly lower negative impact on the acquiring firms' performance than those publicly listed (coefficient of -3.79% for subsidiary versus -6.55% for public).

Regarding EV/sales, the positive effect on the bidder's stock return remains fairly stable across the different payment methods (around 0.9%). The M/B variable analysing for overvaluation is significant for stock, and mixed transactions with a relatively low and negative impact on $CAR_{(-1,+1)}$ (around 0.15%). On this note, we see a greater gap in the influence of efficiency on the acquiring tech firm

performance between cash and stock compensation. Interestingly, the coefficient is greater for stock (1.89%) than for cash (0.68%).

Moreover, as previously found, the robust coefficients for R&D spending are rather weak showing a rather mild impact on abnormal returns. With the exception of cash transactions for which the effect is substantial (-3.69%). The estimate is, however, only significant at the 10% level. Unlike our finding for the capital expenditure growth (Cash) where the effect shows a positive relationship with $CAR_{(-1,+1)}$ below the 1% significance level (0.49%).

Absolute bidder's size seems to also have a robust effect on $CAR_{(-1,+1)}$ for cash transactions only. By interpretation, tech acquirers with a large market capitalisation paying in cash significantly destroy wealth to their shareholders. Opposingly, for cash compensation, the relative size has a positive influence on shareholders' wealth (0.39%). The results found for stock and mix are inconclusive.

As expected, the leverage has a negative relationship with acquirer's gains no matter the payment method. However, the coefficient found for mix transactions is insignificant. In the regression (Cash), the leverage effect is -1.2% and -3.48% for the regression (Stock). The burden of debt seems to be punished by investors quite considerably as opposed to liquidity which is rewarded.

Lastly, the current ratio, which measures the level of liquidity of the acquiring tech firm, generates higher abnormal returns to the bidder, all else remaining the same. We find conclusive results for cash transactions (0.63%) and for stock transactions (2.11%).

We report all our findings in a summary table (Table 12). We will build on these results in the discussion and interpretation section.

Table 11

Acquirer Cumulative Abnormal Return Regressions controlling for method of payment.

The table reports OLS regression coefficient estimates of $CAR_{(-1,+1)}$. Detailed variable definitions are reported in Appendix F. The estimates are displayed in percentage points. The regression Cash filters for all targets paid with cash only. The regression Stock filters for all targets paid with stock only. Finally, the regression Mix filters for all targets paid with a combination of cash and stock. The notation of *, **, *** corresponds to statistical significance levels of 10%, 5%, and 1% respectively.

Panel (A) Method of Payment								
	All	t-stats.	Cash	t-stats.	Stock	t-stats.	Mix	t-stats.
(Intercept)	-0.47	-0.442	0.62	0.490	-1.06	-0.366	0.15	0.067
Cross Border	0.22	0.639	0.15	0.438	-1.10	-0.861	1.20	1.285
Serial	-0.19	-0.341	0.33	0.586	-0.45	-0.248	-0.60	-0.552
Diversification	0.03	0.086	0.02	0.069	-0.27	-0.271	0.42	0.475
Public	-2.63***	-5.778	-0.39	-0.926	-6.55***	-5.313	-3.44***	-3.308
Subsidiary	0.48	1.245	0.99**	2.529	-3.79**	-2.280	1.11	0.976
Large	-1.04	-1.482	-1.41**	-2.007	1.83	0.842	-1.47	-1.182
Medium	-1.63***	-2.650	-1.54**	-2.569	-0.49	-0.324	-1.07	-1.160
Relsize	0.30**	2.429	0.39***	3.207	0.55	1.509	0.42	1.336
TobinQ	5.70***	4.964	3.43***	3.296	9.66***	3.073	7.77***	2.651
Market/Book	-0.08**	-2.300	-0.02	-0.949	-0.17*	-1.820	-0.14***	-4.753
Asset Turnover	1.11***	3.331	0.68**	1.964	1.89**	2.140	1.03	1.110
Debt/Asset	-1.63***	-2.914	-1.20**	-2.251	-3.48*	-1.869	-2.07	-1.373
Current Ratio	1.06***	3.127	0.63*	1.867	2.11**	2.257	1.20	1.581
FCF	-0.36	-0.620	-0.19	-0.290	-1.09	-0.684	-1.75*	-1.826
EV/Sales	0.81***	3.451	0.88***	3.706	0.92*	1.874	0.82	1.605
R&D/Sales	0.00***	-5.367	-3.69*	-1.795	-0.12	-1.594	0.00***	-2.972
Δ CAPEX	-0.06	-0.795	0.49***	2.657	-0.12	-1.382	-0.24	-1.435
Adj R^2 (%)	4.05		4.23		6.55		5.98	
n	2422		1348		547		527	

Table 12

Summary table: factors having an effect on $CAR_{(-1,+1)}$

The table reports only the robust relationship found in our multivariate regression analysis. A "+" sign indicates a positive relationship. On the contrary, a "-" sign indicates a negative relationship. We consider significant all estimates with a 10%, 5%, or 1% significance levels. Due to size constraint, we used short-cut names to define the variables of our multivariate regressions. M/B qualifies for the variable $Market/Book$. AT illustrates the ratio $Asset\ Turnover$. D/A is defined in the regression as $Debt/Asset$. CR represents the $Current\ Ratio$. EV/S qualifies for $EV/Sales$. Lastly, R&D/S illustrates $R\&D/Sales$. All the variables are defined in Appendix F.

	CrossBorder	Serial	Divers	Relsize	TobinQ	M/B	AT	D/A	CR	FCF	EV/S	R&D/S	CAPEX	Cash	Stock	Mix	Public	Private	Subsidiary	Small	Medium	Large
Cash				+	+	-	+	-	+		+	-	+	N/A	N/A	N/A	+		+	+	-	-
Stock					+	-	+	-	+		+	-		N/A	N/A	N/A	-	+	-			
Mix					+	-	+	-	+	-	+	-		N/A	N/A	N/A	-		-			
Public					+	-	+	-	+		+			+	-	-	N/A	N/A	N/A	-	-	-
Private				+	+	-	+		+		+	-			+		N/A	N/A	N/A	+	+	+
Subsidiary				+	+			-			+			+	-	-	N/A	N/A	N/A	+	+	+
Small					+	-	+	-			+	-		+			-	+	+	N/A	N/A	N/A
Medium				+	+	-	+	-	+	-	+	-		-			-	+	+	N/A	N/A	N/A
Large		-	+		+						+	-		-			-	+	+	N/A	N/A	N/A

Discussion and interpretation of results

Size

Our study of acquirer performance finds significant results for both, variables studied before in the literature review, and also factors which we have deemed intuitively appropriate to regress. Confirming the results of Moeller, Stulz (2004), we find the size effect also present in our study of M&A activity and acquirer performance in the tech sector. Thus, smaller acquirors tend to have higher abnormal returns, compared to larger acquirors. Small firms, as pointed out by Demsetz and Lehn (1985), seem to have their incentives better aligned between managers and shareholders. They underline that large acquirors would not show the same homogeneity and be more prone to hubris. The magnitude of the effect on $CAR_{(-1,+1)}$ of the above discussed variables is negatively related to the acquirer size, irrespective of the sign of the effect. An exception from this rule is the R&D which is positively related to the change in acquiror size. As R&D increases with the increase in the size of the acquirer, we find reasons to believe that this increase signals inefficiencies in making use of their internal R&D, preferring to put their resources and attention into M&As.

Relative Size

Literature finds relative size as significant in explaining acquiror performance. However, the sign of the coefficient varies across studies, with a positive sign from Asquith et al (1983) and for some cases in Moeller, Stulz (2004) and a negative sign in Travlos (1987) and Alexandridis et al. (2017). In our study, the acquirer $CAR_{(-1,+1)}$ increases as the relative size increases and we have a significant and positive coefficient (Benou &Madura, 2005). This is consistent with the liquidity effect found by Fuller et al (2002), where there is a positive relationship between relative size and returns from acquiring private/subsidiary firms and negative for public firms. Taking over a larger target is expected to create higher synergies (Kohers 2000 and Kohers,2001). This is more visible in the case of transactions made with cash, transactions involving medium acquirors and transactions in which the target is a private or subsidiary firm. When the financing method is cash, the management has confidence in the acquisition and believes that the synergies created post merger will be worth more and yield higher returns, as the deal size increases. Due to the liquidity effect, acquirers purchasing

private/subsidiary companies capture a price discount. Their returns are higher, the greater the relative size is.

Diversification and Serial

Our results show that diversification aids in value creation and is significant for large acquiring firms. These results are different from the expectations based on previous literature, where diversification yields lower abnormal returns to acquirers. Large acquiring firms in the tech industry are expected to have higher abnormal returns when they engage in a diversifying M&A transaction because they have the appropriate resources and opportunities to create higher synergies and tap into international markets. Another significant finding is that large acquirors have lower returns if they are serial acquirers. This is in accordance with previous literature and shows that larger firms tend to have overconfident management and larger agency problems because of the size.

Method of Payment

In relation to the methods of payment, acquisitions of public and subsidiary companies will have higher significant returns for payments made with cash and lower for payments made with stock or a combination of cash and stock (Annexe 1). However, for private companies, deals that are financed by stock will yield higher returns. This can be explained by Fuller (2002) and Myers and Majluf (1984) which underline the fact that acquirers who view their stock as overvalued (undervalued) will pay in stock (cash). Hansen's hypothesis (1987) states that payments in stock are made when the acquirer has uncertainty about the target valuation, and cash otherwise. Thus, public companies, have more information available and payments in cash are more favoured. Whereas, private companies have more uncertainty and less information available and are paid in stock. Stock payments in the case of private targets can also entail tax benefits as tax deferral options, compared to cash payments which entail immediate tax implications. Interestingly, we find that small acquirers have higher returns when paying with cash, while medium and large acquirers have lower returns when using the same method of payment. This can be a result of the size effect where larger firms are more prone to hubris (Roll, 1986), they tend to be overvalued (Myers and Majluf 1984), incentives between managers and shareholders are less aligned (Demsetz

and Lehn 1985) and they tend to be empire-builders (Jensen 1986) and have higher valuations (Dong et al.2002).

Target Status

We find that M&As involving public targets have lower significant abnormal returns, across all sizes, and have historically been value destroying as Travlos (1987) and Loderer and Martin (1990) and more recent studies of Fuller et al. (2002), Moeller et al. (2004, 2005), Betton, et al. (2008), and Alexandridis et al. (2013) state. This is due to the fact that public targets have information available and payments are made more accurately on the target value, they tend to be prone to more agency problems, investor scrutiny and reputational exposure.

Private/Subsidiary targeted deals display the liquidity effect. Since they are more illiquid assets, they have higher significant returns thanks to this liquidity discount. This is consistent across all acquiror sizes. With the size effect, smaller acquirors have higher returns than larger acquirers. Deals with private firms also have higher and significant CARs for stock payments than cash and may be due to the possibility of blockholder formation and tax implications (Fuller, 2002). Thus, blockholders will monitor acquirer management and increase the value. Subsidiary companies do not capture more value from stock transactions than the rest as many are owned by public companies with diverse ownership and less blockholder creation probability (Fuller, 2002).

Tobin's Q

Our paper finds that Tobin's Q creates positive abnormal returns, results which are consistent with Lang et al. (1989) and Servaes (1991) but not Dong et al. (2003), Moeller Stulz (2004). Existing evidence and our study show that acquiring firms with higher Q values make better acquisitions. For small acquirers, Tobin's Q has a greater effect on abnormal returns than for large acquirers, showing that smaller acquiring firms have greater growth ability than larger firms.

Public targets provide more information. It is, therefore, easier to assess their growth prospects than private companies. Thus, our results present this expectation that the effect of Tobin's q on $CAR_{(-1,+1)}$ is greater for public targeted deals than private. Since a large part of subsidiaries derive from public parents, we

can also see that subsidiaries present this feature and acquirers of subsidiaries earn higher returns for their Tobin's Q.

Lang et al. (1989) underlines the fact that Tobin's Q is determined by acquirer management performance and that high Q bidders earn significant abnormal returns while low Q bidders lose. Our paper finds that higher Q acquiring firms, which are well-managed firms, are rewarded with higher significant abnormal returns by the market. M&A activity, therefore, creates value by rewarding the efficient use of target resources.

Lang et al. (1994) and Jensen (1986) support the assumption that higher Q acquiring firms will have lower agency costs and thus imply higher abnormal returns. At the same time, low Q acquirers are believed to signal to the market that their internal investments and growth opportunities are less valuable or exhausted, and consequently, they engage in M&A activity (Lang et al 1989, McCardle and Viswanathan (1994) and Jovanovic and Braguinsky (2004)).

Market to Book

Our results are in accordance with the findings of Jensen (2003), which states that high valuations will lead to poor investments. Moeller (2005) and Dong (2003) also build on this idea of mis-valuations, showing that overvaluation given by a high M/B ratio causes lower cumulative abnormal returns around the announcement date. Therefore, losses provide information to the market that the valuation is not justified. Overvaluation and losses for acquirers are more probable when there is higher competition among bidders, which pushes up the valuation of the target (Bradley et al. 1988).

Misvaluation hypothesis shows that market inefficiencies have effects on M&A activity. Overvaluation, not corrected appropriately by the market reaction to announcement, can lead to poor returns as stated by Moeller (2005). The greater the misvaluation, the more incentivised the acquirers are to pay with stock than cash. Jung, Kim, and Stulz (1996) and Martin (1996) argue that acquirers who have greater growth opportunities will favour low leverage in order to not be constrained in the future and use equity offers to do so.

Similar to their findings, we see that small acquirers will have lower M/B ratios and a larger negative effect on the CARs. Reasons for this are that small

acquirers have less information available to the public, there is more information asymmetry and lower liquidity. McCarthy (2011) finds that smaller firms make deals in the interest of the owners, compared to large firms which have more problems related to hubris (Moeller, 2004).

Leverage

In perfect capital markets, Modigliani and Miller (1958) state that leverage should not have any impact on the firm value. However, the Modigliani and Miller (1958) theory ignores potential costs of default and bankruptcy, which increases with higher levels of debt. Jensen (1986) and Grossman and Hart (1982) reveal that debt controls for managerial discretion and incentivises managers to make efficient use of resources and productive decision-making.

Our hypothesis is based on the assumption that acquirers with higher leverage make better acquisition decisions, similar to the beliefs of Maloney et al. (1993). Adversely, our results show that leverage has a negative impact on acquirer returns in the tech sector. Higher leverage can translate to increased level of risk due to increased stock volatility. An increase in acquirer firm leverage can also give way to increased currency, interest and bankruptcy risks.

The negative relationship between leverage and acquirer $CAR_{(-1,+1)}$ can also be explained by increases in overall costs, as the level of risk-taking in investments increases (this is also known as risk-shifting from Jensen, Meckling 1976). Acquiring tech firms have been known to be less levered because it gives them more flexibility and it is an indication of operating performance strength. Increases in leverage would signal a deterioration in operating performance and lower acquirer abnormal returns.

Trade-off theory suggests that technology firms should use less debt in their capital structure as their growth opportunities are based on intangible assets and cannot be used as collateral. We find that smaller acquirers' abnormal returns are more affected by the level of leverage than large acquirers. This is consistent with the fact that smaller firms are less transparent. Consequently, lenders ask a higher interest for the risk taken resulting in a higher cost of debt for the borrowing firm. This extra debt may also be subject to more restrictive requirements, as supported by McCarthy (2011).

In the tech industry, low leverage is preferred as there is a high level of uncertainty over the expected success of the technology or innovation. Highly levered firms can experience an 'underinvestment problem', as mentioned by Myers (1977) and Stultz (1990), where raising equity for profitable investments could prove to be tough because a big part of fund would need to be allocated to bondholders instead.

Free Cash Flow

Our results show that increases in free cash flow imply lower acquirer abnormal returns, which is consistent with findings in previous literature. Jensen (1988) argues that these results are driven by empire-building management when acquisitions are made instead of payouts to shareholders (free cash flow hypothesis). Accumulated cash flows can be allocated inefficiently if managers do not approach decision-making rationally. Harford (1999) also finds that resource misallocations can lead to poor decision making, and thus, lower $CAR_{(-1,+1)}$ due to price reactions to M&A announcements.

We find that the negative impact on abnormal returns coming from free cash flow is stronger for large acquirers than for small firms. Large firms are usually further along the life cycle and can potentially have exhausted their growth opportunities. Moeller et al. (2004) suggests that for companies with low or no growth opportunities, agency costs can arise and are more apparent in large firms than small.

Asset Turnover

We provide results that are in accordance with our previously stated hypothesis that the greater the efficiency of the acquiring firm, the more beneficial investment decisions are made. Tech acquiring firms with a higher efficiency level engage significantly in value creating acquisitions. As mentioned previously, we explain the positive relationship between asset turnover and acquirer returns by the fact that acquirers possess a 'know-how' in making efficient use of target resources and generating greater expected synergies.

Current Ratio

Firms with high liquidity in the technology industry show financial strength to investors, as they do not need to take up debt or access equity for investment

purposes (Faulkender and Wang, 2006). In the tech industry, this is an indication of operational performance strength on the acquirer side. Liquidity has been believed to drive M&A activity though time (Harford (2005) and Eisfeldt and Rampini (2006), Harford (2005) and Eisfeldt and Rampini (2006)). We find that our liquidity measure, the current ratio, drives improvements in abnormal returns for acquirers, regardless of method of payment or status of target company. This finding supports the idea that acquiring firms in the tech industry earn higher abnormal returns when their liquidity proves financial and operational strength.

Enterprise Value to Sales

The fundamental drivers of EV-to-Sales are the growth rate, the profit margin and the required rate of return. This valuation ratio is positively correlated to the two first factors and negatively to the latter. Conceptually, EV/Sales enables comparisons between firms regardless of their capital structure. Our results show that a higher EV/Sales ratio will yield higher $CAR_{(-1,+1)}$ for acquiring firms. Consequently, a tech acquirer with a high EV/Sales multiple may signal to investors their confidence in future revenue growth, while a low ratio may signal a lack of future growth opportunities.

Research & Development to Sales

Our findings show that increases in R&D yield lower acquiring firm cumulative abnormal returns. We find that the larger the size of the acquirer, the more destructive the effect of R&D is on the acquirer stock performance. This inverse relationship between abnormal returns and size provides a complementary explanation to the theory of Schumpeter in the context of mergers and acquisitions. Schumpeter (1942) hypothesized that large firms are more innovative than small firms because large firms have sustained and efficient R&D programs.

Resources, energy and attention allocated to R&D implies a prevention on the acquirer side from pursuing targets with patents, knowledge and capabilities that are superior. In addition, this can also signal an inability of the acquirer to exploit technologies and resources that they already own or have recently acquired. Thus, we interpret that a tech company with high R&D engaging in M&As will signal to investors the inability or scepticism in the success of its R&D developed internally.

Acquirer Investment Efficiency

We have focused so far on effects of M&As over the cumulative abnormal return as a proxy for performance. Yet, as Alexandridis et al. (2017) state, this shows little about how acquirers allocate funds to investment opportunities. We agree on the idea that better acquisition decisions should drive them to become more efficient in investments. Thus, we conduct an annex analysis to also test the robustness of our results. We employ the same measure, of acquiring firms' residual investments, to find the level of efficiency divergence from an expected level, given the same variables used for predicting the optimal investment level (Richardson, 2006; Biddle and Hilary, 2006).

We run the following regression from our sample of 1352 acquirers for which we have data over all measures.

$$INV_{i,t} = \alpha + \beta_i Q_{i,t-1} + Leverage_{i,t-1} + Cash_{i,t-1} + Company\ Age_{i,t-1} + Size_{i,t-1} + Stock\ Return_{i,t-1} + INV_{i,t-1} + FE + \varepsilon_i$$

$$RESINV = \varepsilon_i$$

The value of the residuals from the investment efficiency equation, ε_i is the $RESINV$ measure, which reflects the inefficiency extent. The lower this measure for acquiring companies, the more efficiently they make investments. This indicates how efficient acquirers allocate capital to investment opportunities. Table 13 provides information in Panel A, which reports the above-mentioned regression results, and Panel B, which shows $RESINV$ mean and median values over the three periods (1991-2000, 2001-2010, 2011-2019) we consider and their differentials.

We observe that the level of investment inefficiency in period 2000-2009, compared to the prior period, is more pronounced and significant. Tech acquiring companies seem to be therefore doing less optimal investment allocation in the aftermath of the tech bubble and the years to follow. A decrease in acquisition performance is aligned with the idea of less efficient investments during this period, showing no improvements in decision making towards value creating and enhancing investments.

Table 13

Acquirer Investment efficiency

The table reports the estimates of investment efficiency based on Alexandridis et al. (2017) and Richardson (2006) for our sample. In panel A, the coefficients are from the regression of Total New Investment ($INV_{i,t}$), which is the sum of CAPEX, R&D expenditures, acquisitions minus sales in PPE and necessary maintenance (Depreciation & Amortization) for assets in place in year t for firm i, scaled by total assets in year t-1. $Q_{i,t-1}$ is the market value of the firm (market value of equity and book value of debt) over total asset value. $Leverage_{i,t-1}$ is calculated as total debt over common equity. $Cash_{i,t-1}$ is the log of 1 plus the ratio of cash and cash equivalents over total assets. $Company\ Age_{i,t-1}$ is the log of the difference between the year of the announcement and the acquirer's founding date. $Size_{i,t-1}$ is the log of total assets. $Stock\ Return_{i,t-1}$ is the total annual change in market capitalization for the firm. The dependent variable $INV_{i,t}$ is at year t, while the other independent variables are lagged terms and report values at time t-1. Industry fixed effects are included in specification and controlled for. Variables are winsorized at the 1% and 99% to remove outliers. We trace acquirer investment over the entire sample period of 1991-2019. Industry fixed effects are included in the specification. In panel B, we report means and medians of residual investment ($RESINV$), which are calculated based on the residuals from the regression in panel A in absolute value terms. Adj.R^2 (%) is the adjusted R-square and n is the number of observations. The t-tests/Wilcox tests are conducted based on equality in means/medians. The notation of *, **, *** corresponds to statistical significance of 10%, 5% and 1% respectively.

Panel A: Total new investment analysis $INV_{i,t}$	
Intercept	-7.186*
Q_{t-1}	-0.044***
INV_{t-1}	0.323***
$Leverage_{t-1}$	-0.001**
$Cash_{t-1}$	0.000*
Age_{t-1}	0.980*
$Size_{t-1}$	-0.009***
$Stock\ Return_{t-1}$	0.000*
Industry FE	Yes
Adj. R2 (%)	18.30
n	1352

Panel B: Residual investment (RESINV)					
	1990-1999	2000-2009	2010-2019		
	(1)	(2)	(3)	(2) - (1)	(3) - (2)
Mean	0.070	0.093	0.095	0.023***	0.003
Median	0.054	0.075	0.072	0.005***	-0.003
n	206	705	441		

Furthermore, the period 2010-2019 displays an increase in inefficiency, compared to the second period, when looking at the mean residuals. Nonetheless, the median shows a smaller spread of inefficiency levels across acquiring companies for the third period. Thus, our results are inconclusive and not significant, and we cannot say if there was a decrease or increase in efficiency.

The period post-2010 showed an increase in innovation, number of start-ups, improved internet access and access to smartphones, digitalization and information. While this may have increased the potential investment pool for acquirers, it has also increased the volatility of these investments, making optimal and efficient investing more challenging.

Conclusion

In this paper, we conduct an event study on shareholder cumulative abnormal returns with a 3-day interval. We study the shareholder returns around the announcement date in publicly traded technology firms that successfully purchased a target company regardless of its public status. The announcement of an M&A transaction reveals information on the bidder and the potential synergies created. It is difficult to predict and understand what drives abnormal returns for acquiring tech firms.

By controlling for target status, method of payment and acquirer's size, we can examine the variation in acquirer returns as a function of the bidder and bid characteristics. It allows us to understand what and how acquirer and deal characteristics affect significantly the stock performance in our sample.

Our findings suggest that acquirer shareholders gain when the bidding firm buys a private or a subsidiary regardless of the acquirer's size. However, the bidder shareholders lose when purchasing a publicly traded target. Additionally, bidder's gain is greater when the acquiring tech firm has sizeable growth prospects, operates at a high level of efficiency, and has a strong liquidity or low leverage.

Further, a good performer is a bidding tech firm that is not overvalued in its equity value, does not run with a high level of R&D spending, and has solid profitability margins. Acquiring tech firms should also be looking for targets of similar or larger size than they are. When purchasing a private or subsidiary, the price of these illiquid assets entails a liquidity discount resulting in a higher shareholders return.

Finally, consistent with the signalling hypothesis, when a public tech firm engages in a takeover on another publicly traded company, the financing signals the overvaluation (for stock offers) or undervaluation (for cash offers) of the target. This signalling effect has a direct impact on bidder shareholders' abnormal returns: positive for undervalued targets and negative for overvalued targets.

Annexes

Annexe 1

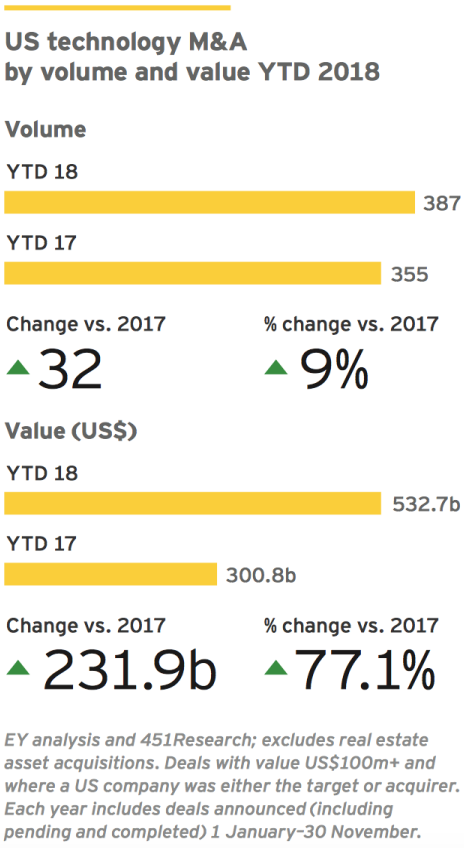
Summary table: effects of acquirer size, target status and financing method on $CAR_{(-1,+1)}$

The table summarises our robust results from our various regression analysis regarding the method of payment, the acquirer size effect and the public status of the target company. Only the effects found significant at the 10%, 5% or 1% level of significance are reported in the table. We aim at summarising the relationships between $CAR_{(-1,+1)}$, the "Target Status", the "Method of Payment", and the "Acquirer Size".

	Public			Private			Subsidiary		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Cash	+	+	+	N/A	N/A	N/A	N/A	N/A	N/A
Stock	-	-	-	N/A	N/A	N/A	N/A	-	N/A
Mix	N/A	-	N/A	N/A	N/A	N/A	N/A	+	N/A

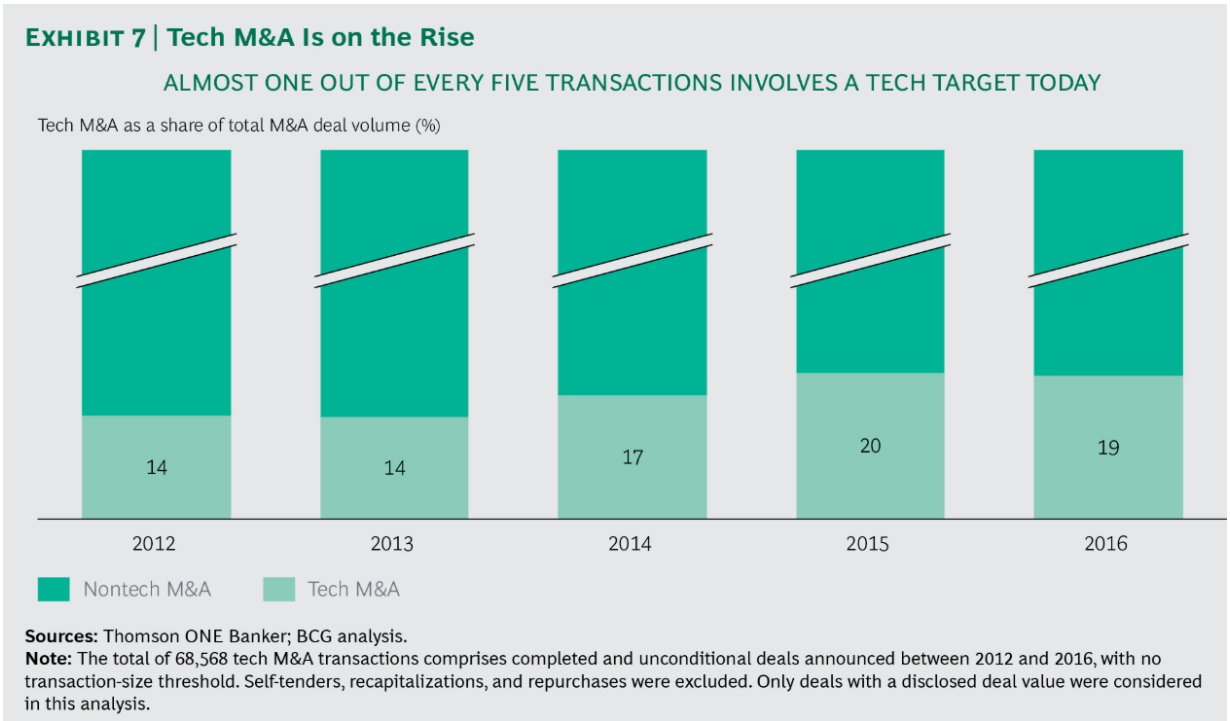
Appendices

Appendix A



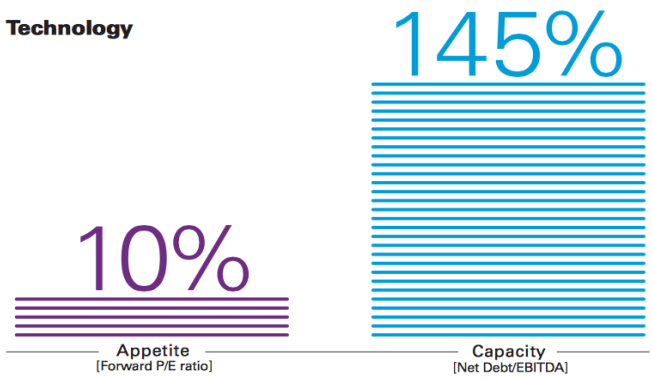
Source: EY. How US M&A will transform businesses in a changing world.

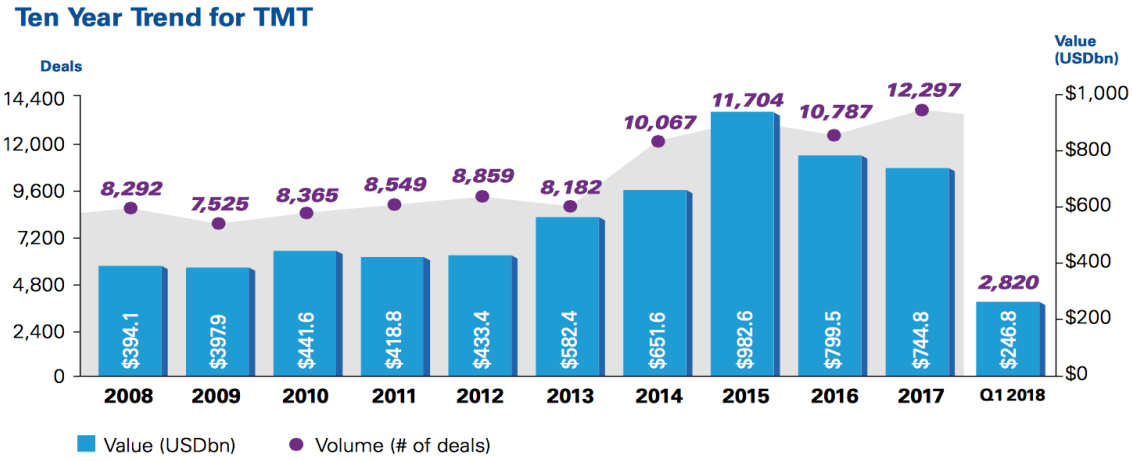
Appendix B



Source: BCG. The 2017 M&A Report: The Technology Takeover.

Appendix C





Source: KPMG. M&A Predictor 2018: Technology, Media and Telecommunications.

Appendix D

Theory	Outcome	Motive	Explanation
Value creation Value increasing theories	Gains Positive return	Efficiency	Synergies
		Market power	Customer surplus
		Corporate control (governance)	Managerial synergies
Value destruction Value decreasing theories	Losses Negative return	Hubris	Overpaying losses
		Managerial discretion	Valuation issues
		Entrenchment	Ensure manager job position
		Empire building	Increase firm size

Source: Weitzel and McCarthy (2011)

Appendix E

Roll's (1986) discusses how acquiring companies suffering of hubris may end up overpaying.	This is proved in the study and underline that larger acquirers are more prone to hubris. Smaller firms tending to give more ownership to managers and their incentives with shareholders being better aligned (Demsetz and Lehn, 1985), which will give rise to less hubris.	Consistent
Travlos et al. (1987) about acquiring firms with poor returns choosing equity as a method of payment.	Method of payment argument	Consistent
Myers and Majluf (1984) mention the equity signalling hypothesis where acquiring firms issuing this signals to the market have their assets overvalued.	Method of payment argument	Consistent
Jensen (1986) gives the free cash flow hypothesis of empire-building managements which instead of increasing shareholder payout, will make acquisitions.	More likely for large than small acquirers as low growth opportunities increase agency costs.	Little support
The overvaluation hypothesis (Dong et al., 2002) which says that high valuation acquirer firms will have lower announcement returns.	Contrasting market value of equity, the book value is not likely to be correlated with overvaluation of stock. (Large firms tend to be overvalued.)	Inconsistent
And finally, the arbitrageur hypothesis from Mitchell et al. (2004) discussing the price pressure effect on acquirer stock for acquisitions financed with equity.	Here, small acquirers, compared to large, require more efforts for arbitrageurs to use their resources, making them less likely to. Assumed market efficiency.	Inconsistent

Source: Moeller et al. (2003) motives for negative abnormal returns

Appendix F

Variables	Description
Panel 1: Acquisition Performance	
$CAR_{(-1,+1)}$	Acquirer cumulative abnormal returns over the 3 days around the acquisition announcement day. The model parameters are estimated over a window (−248, −2) relative to the announcement.
Panel 2: Acquiring-firm Characteristics	
FCF	Ratio of cash flow from operations over the book value of assets at the year-end of the fiscal year t-1. In our multivariate analysis, we dummy this ratio taking the value 1 if the acquirer ratio is above 0, 0 otherwise.
$\Delta CAPEX$	Ratio of the capital expenditures (capex) 7 days prior the announcement over the capex 250 days prior the announcement.
$Debt/Asset$	Acquirer's long- and short-term debt divided by total assets at the year-end of the fiscal year t-1. In our multivariate analysis, we dummy this ratio taking the value 1 if the acquirer ratio is above 0.3 (qualifying for high leverage), 0 otherwise.
$Small$	Dummy that takes the value of 1 if acquiring firm's equity market capitalization is below the bottom 25th percentile of our sample, 0 otherwise.
$Medium$	Dummy that take the value of 1 if the acquiring firm's equity market capitalization is between the bottom 25th percentile and top 25th percentile, 0 otherwise.
$Large$	Dummy that takes the value of 1 if acquiring firm's equity market capitalization is above the top 25th percentile of our sample, 0 otherwise.
$Market/Book$	Acquirer market cap over the total book value of equity. The latter is the sum of stockholders' equity, deferred taxed and investment tax credit (if available), and preferred stock. We use the market cap and book value of equity 7 days prior the announcement date.
$Serial$	Dummy variable that takes the value of 1 if an acquirer has consummated at least 3 deals within the 5 years prior the announcement date, 0 otherwise.
$TobinQ$	Ratio of the acquirer market cap plus total liabilities over the book value of equity plus total liabilities. We use the market cap 7 days prior the announcement date. For the book value of equity and total liabilities, we use the year-end of the fiscal year t-1.
$Asset\ Turnover$	We use Thomson Reuter DataStream built-in asset turnover ratio constructed as total sales over total assets at the year-end of the fiscal year t-1. In our multivariate analysis, we dummy this ratio taking the value 1 if the acquirer ratio is above the average asset turnover ratio of our sample, 0 otherwise.
$Current\ Ratio$	We use Thomson Reuter DataStream built-in current ratio constructed as total current assets over total current liabilities at the year-end of the fiscal year t-1. In our multivariate analysis, we use the log of this ratio.
$EV/Sales$	Ratio of the acquiring firm's Enterprise Value (EV) over the total sales 7 days prior the announcement date. In our multivariate analysis, we use the log of this ratio.
$R\&D/Sales$	Ratio of the acquiring firm's R&D spending over the total sales 7 days prior the announcement date.

Panel 3: Deal Characteristics	
$Stock$	Dummy variable that takes the value of 1 if the consideration was 100% stock, 0 otherwise.
$Cash$	Dummy variable that takes the value of 1 if the consideration was 100% cash, 0 otherwise.
Mix	Dummy variable that takes the value of 1 if the consideration was neither 100% stock, nor 100% cash, 0 otherwise.
$Cross\ Border$	Dummy variable that takes the value of 1 if the target's country is not the U.S, 0 otherwise.
$DIVERS$	Dummy variable that takes the value of 1 if Thomson Reuter Eikon Mid Industry codes of the acquirer and target are different, 0 otherwise. (Diversification)
$Relsize$	Ratio of deal value over the acquirer market capitalisation 7 days prior the announcement date. In our multivariate analysis, we use the log of this ratio.
Panel 4: Target Characteristics	
$Public$	Dummy variable that takes the value of 1 if the target is a publicly listed firm, 0 otherwise.
$Private$	Dummy variable that takes the value of 1 if the target is a private firm, 0 otherwise.
$Subsidiary$	Dummy variable that takes the value of 1 if the target is a subsidiary, 0 otherwise.
Panel 5: Investment Inefficiency Regression	
$Company\ Age$	Log transformation of the difference between the year t-1 and the year of the incorporation.
$Cash$	Log transformation of 1 plus the ratio of company cash and cash equivalents over total assets in year t-1.
$Leverage$	Ratio of company total debt over the book value of common stock in year t-1.
Q	Company book value of total assets, minus the book value of equity, plus the market value of equity, all divided by the book value of total assets in year t-1.
$Size$	Log transformation of the company's total assets in year t-1.
$Stock\ Return$	Stock returns computed as the company year-on-year difference of year-end market capitalisation for the year t-1.
INV	Sum of company's capital expenditures, R&D expenditures, and acquisitions minus sales of PPE and necessary maintenance for assets in place scaled by total assets. The estimation of the variable is based on both year t and t-1.

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