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**IMPACT OF MERGERS AND
ACQUISITIONS ANNOUNCEMENT
ON THE STOCK PRICE OF LISTED
COMPANIES**

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1. Introduction

Mergers and acquisitions are a monumental episode in the life of any company. The importance involved around such events and the sheer work power expended towards completion of any action of the kind can hardly be exceeded by any other business related circumstance.

This research paper explores stock market movements of acquirers, mid cap US tech companies – with more than two billion US dollars in market capitalization - taking into account announcements of domestic North American (USA) mergers and acquisitions announcements in the last five years.

The results of the study offer a clearer perspective on the influences of events in stock prices of strong tech listed companies and the investors' perception and response. They also shed some light onto how do the players on the market view big US tech companies, their management and their ability to make advantageous decisions, or might just be another way of concluding that the tech stocks are usually surrounded by a lot of hype.

Significant abnormal returns are observed on the event day, the acquirer experiencing in average positive returns of 0.76%, statistically significant with 99% certainty. Additionally, excess returns can be earned by trading tech stocks around announcement date, as the cumulative abnormal returns for event windows $[-10,10]$ and $[-20,0]$ through generalized sign test, show positive significant abnormal returns of 0.87% and 2.11% respectively.

Mergers and acquisitions are under strict regulation in the United States and require the meeting of several approvals from Federal Trade Commission, the Department of Justice and in some cases – whenever a company has significant operations in another country – even from other countries' regulators (e.g. European Commission). Regulators' primary objective is to prevent the creation of monopolies, which the American government first began to control under the Sherman Act of 1890.

Because of their difficulty in completion there is a level of uncertainty surrounding M&As and regarding the number of attempted mergers and acquisitions there actually are a year, since they are frequently kept secret, in some cases even from the employees. When mergers and acquisitions are go through to the public, it is in general a positive thing for shareholders. By merging forces, the newly found company should be able optimize costs while maintaining revenue, resulting in a better profit yielding. Another aspect is that if a company joins up with a competitor, the two will now have more market power and an increased market share.

The tech industry in US is a high profile one, one that brings much attention to itself and that is shaping to be one of the leading ones in due time.

The North American economy is known for its free enterprise system and this is clearly seen in the way their stock market performs. The New York Stock Exchange (NYSE) and “National Association of Securities Dealers Automated Quotations” or just Nasdaq Stock Market, as it is nowadays recognized, are the two largest stock exchanges in the world with a total market capitalization of US\$19 billion and US\$6.8 billion respectively. The monthly trade volume reaches US\$1-1.5 billion for each and only Shanghai Stock Exchange disputes this amount. With such a powerful and liquid market, the information is found everywhere, therefore market efficiency is high.

Moreover, the US economy was arguably vastly helped by their patent laws, which helped inventors and creators flourish alongside their ideas, profit from them and help their community and the country as a whole. Although the oldest known forms of patents have their roots as far as the medieval ages in highly commercial regions such as Venice, United States of America tried to take it one step further even from the beginnings, and, in 1787 on September 17 The Constitution of the United States firstly adopted a provision for protecting intellectual rights:

With the full support of the legislation, American entrepreneurial spirit roared towards what we know today, towards the General Electric, towards the International Business Machines, towards the Hewlett Packard, towards the Silicon Valley and beyond.

In this research, event study methodology has been used. Event studies can enable us to estimate and quantify asset prices’ reaction to announcements of corporate and economic events having new information regarding the underlying asset.

Event studies have a long history. The first published study is quite possibly James Dolley’s (1933). In his research, he observes the price effects of stock splits, studying price changes at the time of the split. Using a sample of 95 splits from 1921 to 1931, he found that the price increased in 57 of the cases and the price declined in only 26 instances.

Predominantly, the academic focus is usually not targeted when studying mergers and acquisitions announcements’ impacts. The literature focuses on general arrays of companies, not from specific industries, but rather from specific countries at most. This paper aims to particularize the impacts of announcements on the stock prices.

This paper wants to test this efficiency in the context of mergers and acquisitions announcements alongside with their impact on the stock prices of listed tech companies, the companies that are now the pinnacle of entrepreneurship, using event study methodology.

In the following chapters, the existing literature findings and aspects will be presented in chapter 2, in conjunction with the empirical study conducted on the sample of choice in chapter 3 and in the final chapter conclusions will be drawn according to the results and examine limitations and future research.

2. Literature Review

2.1. Market Efficiency

Basic security investing is a game of good news versus bad news. If good news related to a certain stock comes out (for instance a successful medical trial for a pharmaceutical company), immediately afterwards each and every one would suddenly want to buy the stock, to be able to gain from the potentially newly generated larger earnings.

Efficient-market hypothesis (EMH) is a theory established by Professor Eugene Fama in 1970 in economics of finance that affirms that an asset's prices fully reflect all available information. As a direct consequence, players of financial markets assume it is impossible to "beat the market" with consistency while holding risk constant since prices on the market should only react to novel information or changes in discount rates (Fama, 1965).

Moreover, the nature of information that has an impact is not limited to financial news alone. True or rumored news from political, economic and social spectrum will be reflected in the price of a financial asset. In addition, another important matter to take into consideration is the perception of the news. New academic studies emerge, such as behavioral finance, which look at the effects of investor psychology on stock picking and pricing, and that reveal that players of the market are subject to many biases and fallacies (e.g. confirmation bias, loss aversion, survivorship bias). For instance, the passing of Sarbanes-Oxley Act of 2002, requiring greater financial reporting transparency for public companies generated a decline in equity market volatility after the quarterly reports were passed in accordance to the new regulations. The investors deemed the financial statements to be more credible, and thus it made the market more efficient (Stephen and de Jong, 2012).

This concept is also classically represented in Harry Markowitz's efficient frontier (1952). Markowitz proposes that there are assets or combination of assets¹ referred to as "efficient" that have the highest expected level of return for their level of risk - the standard deviation of the returns (Elton and Gruber, 2011). This implies that for an increase in the expected level of return the investor must accept an increased level of risk - no "free lunch".

¹ i.e. portfolios

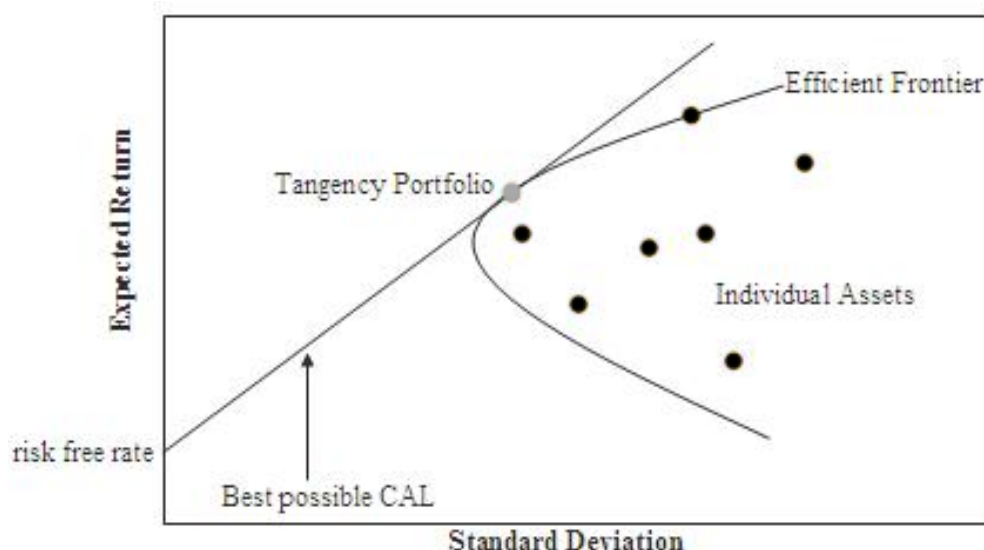


Figure 1.1 Efficient Frontier

Its upward sloped element is the efficient frontier when there is no risk-free asset available. For a risk-free asset, the straight line is the efficient frontier. There is no higher expected return above the straight line for the same amount of risk

Source: Markowitz, H.M. (March 1952). "Portfolio Selection". *The Journal of Finance*. 7 (1): 77–91

In Fama's and French's study (2009), the rational markets beliefs were confirmed, concluding that the abnormal returns of US mutual funds are significantly similar to the expected returns if any of the fund managers had no skill.

Fama (1970) extended and refined his research, coming with the definitions for three forms of financial market efficiency:

- Weak

The perspectives of players in the market and academicians vary. Those who think that the degree the market is in is the weak form believe that active trading² can generate abnormal profits.

In the weak-form efficiency, assets' future prices cannot be predicted by analyzing information and prices from the past. It is the definition of the saying "past performance is not an indicative of future results". This is in a sense a contradiction, because you need to start from somewhere to build your investment thesis and/or strategy, and since we are not Nostradamus or we do not have any kind of insider information, past information is the clear choice.

² Or „day trading” – trading speculatively in nature, within short periods, usually daily

Technical analysis³ will not consistently generate abnormal returns under the weak-form efficiency assumption. There are no patterns in prices of assets. This means that future price movements are generated by information not previously contained in the series. Some sorts of fundamental analyses⁴ still manage to give an edge to investors in generating excess returns.

- Semi-strong

Semi-strong efficiency EMH falls somewhere in the middle. This form is implying that all public information is integrated in the current price of an asset. Not even fundamental analyses can generate excess returns now.

The assumption is that the prices respond to new information very quickly and in an unbiased manner, and such no excess returns can be yielded by trading according to that information.

- Strong.

In this form, asset prices price in all information, public or private, making it impossible to earn excess returns. The legislative barriers render strong efficiency impossible, such as anti-insider trading laws.

Passive investors generally agree with Fama's belief that the market is strongly efficient.

Anomalies

Economist Eugene Fama argues that securities trade at their fair value, and such it is impossible for investors to purchase stocks that are undervalued or sell securities for inflated prices.

Generally, there are people who do not believe in the efficient market hypothesis because of the fact that active traders continue operating. If there are little to no possibilities to earn excess returns, then there should exist no reason to become an active trader. Moreover, the fees charged by active fund managers are seen as evidence that the EMH is not correct, because it specifies that an efficient market has low transaction costs.

³ An analysis methodology for forecasting the direction of prices through the study of past market data, primarily price and volume (Kikpatrick and Dahquist, 2006)

⁴ The extensive analysis of a company's internal and external environment, financial statements, market, management or overall economy situation

While event studies of stock splits are not contradictory with the efficient market hypothesis (Fama, Fisher, Jensen, and Roll, 1969), other empirical researches have found inadvertencies with the efficient-market hypothesis.

Early examples, such as Nicholson (1968), Basu (1977) and Rosenberg, Reid and Lanstein (1985) conclude that small neglected stocks and shares with low book to market ratios (also known as value stocks) tended to achieve abnormally high returns in the long run comparative to what could be explicated by the Capital Asset Pricing Model (CAPM).

The CAPM was introduced by Jack Treynor, William F. Sharpe, John Lintner and Jan Mossin independently, building on the earlier work of Harry Markowitz on diversification and modern portfolio theory. Sharpe, Markowitz and Merton Miller accepted together the 1990 Nobel Memorial Prize in Economics for the contribution to the field of financial economics. French (2003) describes its computation as following

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) \quad (1)$$

where

$E(R_i)$ is the expected return on the capital asset,

R_f is the risk-free rate of interest (government bonds),

β (beta) is the measure of the systematic risk, or the ratio of expected excess asset returns to the expected excess market returns, or also,

$$\beta_i = \frac{Cov(R_i, R_m)}{Var(R_m)} = \rho_{i,m} \frac{\sigma_i}{\sigma_m} \quad (2)$$

$E(R_m)$ is the expected return of the market,

$E(R_m) - R_f$ is known as the market premium.

In the real world of investment, however, there are some arguments against the EMH. Investors such as Warren Buffett, who have beaten the market, exist. Warren Buffet investment strategy focuses on undervalued stocks. His mentor was Benjamin Graham, an investor and professor at Columbia University and at University of California, who is known as the “father of value investing”. His primary focus was on fundamental analyses that yield stocks that appear underpriced (Graham and Dodd, 1934). Portfolio managers who have better records of accomplishment than others do and investment institutions with more renowned research analysis than others are other examples of anomalies. Clearly, performance cannot be purely random and market unbeatable.

Another counterargument for the efficient market hypothesis is that certain patterns can be established and observed. For instance, the January effect is a pattern that indicates higher returns incline to be earned in the first month of the year (Keim, 1983) and the weekend effect is the inclination for asset returns to have a cyclic pattern, on Monday being inferior than those of the directly prior to Friday are (French, 1980).

Conclusions

This subchapter was a preliminary step towards understanding how markets function, therefore how market responds to merger and acquisitions announcements and newly presented information.

While the opinions are split among players of the market and academicians, one thing that must be understood is that markets have an inherently random part. Markets are not entirely rational, therefore when studying events impacts on the asset prices one must take into consideration the naturally occurring randomness.

Although no clear statement can be made regarding the form of market efficiency today's markets embody, some signs point out to the fact that the semi-strong efficient market hypothesis is the plausible one. A study from 2008 tests the market efficiency concerning mergers and acquisitions announcements and their effects on the stock prices. It was done on twenty mergers, and the evidence found supports semi-strong market efficiency along with a positive average gain in the sample of acquiring companies during the event period (Gersdoff and Bacon, 2008).

While this paper does not study the market efficiency in respect to mergers and acquisitions announcements, we have to consider the ramifications of the efficient market hypothesis.

2.2. Mergers and Acquisitions

The definition of a merger is when “two or more enterprises cease to be distinct enterprises and agree to combine their equity capital to form a single new company” (Hussey, 1999). An acquisition is when “one company buy sufficient shares in another company to give the purchaser control of that company” (Hussey, 1999). Unlike a merger, an acquisition does not have to be a mutual decision between the board and shareholders. It is up to the target company's shareholders to accept or reject the bid from the acquirer.

Essentially, mergers and acquisitions are transactions in which the ownership of companies are transferred or combined.

From a legal perspective, a merger is a legal association of two entities into one entity, while an acquisition ensues when one entity takes ownership of another entity's stock, equity interests or assets. Both sorts of transactions normally result in the consolidation of assets and liabilities under one entity from a commercial and economic point of view, and the distinction between a "merger" and an "acquisition" is blurry. A transaction legally structured as an acquisition may have the effect of placing one party's business under the indirect ownership of the other party's shareholders, while a transaction legally structured as a merger may give each party's shareholders partial ownership and control of the combined enterprise.

A deal may be figuratively called a "merger of equals" if both companies' management agree that joining up is in the best interest of their companies likewise, whereas when the deal is considered unfriendly (that is, when the management of the target company opposes the deal) it might be considered an "acquisition" (Berk and DeMarzo, 2014).

The term "merger" is commonly used, but it comprises several types of transactions that vary by the connection between the two companies and by the modality of payment used to close the deal.

By the functional roles in market dynamics, we can observe:

- Horizontal mergers – two businesses within the same sector decide to merge. Synergy can be obtained through increased market share, cost savings and/or new market opportunities
- A vertical merger – the acquirement of a supplier or client. Usually it targets optimizing operating costs and economies of scale
- Conglomerate – Unrelated businesses in any meaningful way. The usual objective is diversification in goods and/or services.

By business outcome, usually concerning brand identity, company's purpose and/or corporate governance, the following types emerge:

- Statutory merger – The acquirer continue its operations whereas the target company dissolves. The main objective is usually asset and capital transfer without any additional maintenance needed.
- Consolidated merger – A new business entity is formed through the combining of the two companies. Both the acquirer and the acquired companies are dissolved as a result of the process.

Additionally, there can be observed mergers that fit in the two following type:

- Strategic merges – Long term holding of acquired company. This form of mergers aim for synergies in the long run, either by increasing the market share, customer

base or overall strength of new entity formed. The acquirer can be usually willing to pay a larger premium to the target company.

- Acqui-hire – These acquisitions are the ones that were initiated for the main purpose of obtaining target company's talent, rather than any other assets. More often than not, the operations of the target company are ceased in order for the work force to focus on the acquirer's projects. Most commonly used in technology sector, which is the main focus of this research paper.

Now, comparing the types of mergers and acquisitions by the types of financing we have:

- Payment by stock, or "stock swap" – The shareholders of the target company are receiving stock in the acquirer's company, switching their old stock in the now acquired company, for new stock, in the acquirer company or the newly merged entity. The issuance of stock is usually proportionally to the valuation of the acquired.
- Payment by cash – This is usually the case for acquisitions, since the shareholders of the acquired company are no longer in the scheme of things, and the target company comes under the control of acquirer's shareholders.

Moreover, deals differ by the type of financing of the two above-mentioned favored financing options. If the bidder prefers the cash option, there are three key financing choices:

- Cash on hand – excess cash or unused debt capacity. There are no major transaction costs but the action may decrease credit rating
- Issue of debt – It usually increases cost of debt and decreases credit rating. Transaction costs occur in a more significant manner.
- Issue of stock – Can improve debt rating and will reduce cost of debt. Transaction costs are on par with the issuance of debt

If the bidder prefers the stock payment, the following financing options exist:

- Issue of stock - Effects and transaction costs are illustrated above. If the deal is effectuated with stock instead of cash, then it is not liable to taxation. There is simply an exchange of share certificates.
- Shares in treasury – Same effects as the issuance of stock. Transaction costs are not significant if the shares do not have to be purchased from market. If it is the case of the latter, brokerage fees will apply.

Acquirers tend to purchase with stock when their belief is that their shares are overvalued and with cash when they think the shares are undervalued.

Before any merger or acquisition is put in motion, due diligence is required to be able to know to a fair degree the right choice is made. Due diligence is an analysis of a business or person preceding to signing an act with a certain level of care. Although it can be a legal obligation, but the term will be more frequently related to voluntary investigations. A usual example of due diligence in numerous industries is the practice through which a potential bidder appraises a target company or its assets for an acquisition (Hoskisson, Hitt and Ireland, 2004).

Merger control is the procedure of assessment mergers and acquisitions under antitrust/competition law. Over sixty nations have adopted a system for merger control. Agencies such as the European Union's European Commission or the United States Federal Trade Commission (FTC) are usually commended with the responsibility of reviewing mergers. Merger control supervision is implemented to avert anti-competitive consequences of concentrations of market power. As such, most of the merger control procedures normally answer at least one of the questions:

- Does the concentration significantly obstruct effective competition? (EU, Germany) (European Commission, 2004)
- Does the concentration substantially diminish competition? (US, UK) (Williamson, 2002)
- Does the concentration prime to the formation or consolidation of a dominant market position? (Switzerland, Russia)

Historical Trends

The international takeover market is very dynamic, consisting of deals that amount to more than \$1 trillion per year in transaction value.

The takeover market is also characterized by merger waves — peaks of heavy activity followed by quiet troughs of few transactions. Figure 2.1 displays the time series of takeover activity from 1926 to 2012. Merger activity is more consistent during economic expansions than during contractions and, also, shows a correlation with bull markets. Numerous of the same technological and economic circumstances that lead to bull markets also incentivize managers to reshuffle assets through mergers and acquisitions. Therefore, Harford (2005) argue that the same economic activities that drive expansions are most likely, similarly, driving peaks in merger activity.

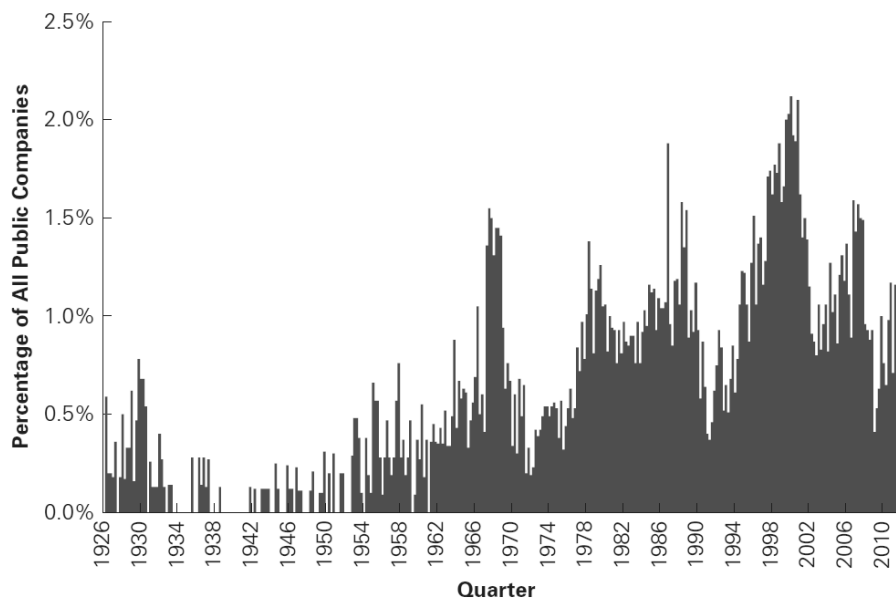


Figure 2.1 Takeover activity 1926-2012

Mergers and acquisitions seem to ensue in distinct waves

Source: Berk, J., DeMarzo, P. (2014) Corporate Finance 3e: Pearson Education.

A surge of M&A stories begin in the late 19th century United States. Yet, mergers correspond historically with the existence of enterprises. For instance, in 1708, the East India Company merged with a previous competitor to reestablish its monopoly over the Indian commerce. In 1784, the Italian Monte dei Paschi and Monte Pio banks merged as the Monti Reuniti. In 1821, the Hudson's Bay Company joined with North West Company, its rival.

As it has been mentioned in the previous chapter, there are several types of mergers, which accomplish different objectives. The first wave was characterized by a sense of dog-eat-dog market, where companies would acquire competitor in order to aggressively gain market share. The famous case of Standard Oil Co. is reminded in the short history above. The second wave switched to vertical integration, in order for corporations to exploit economies of scale, efficiency in large volume production. The third wave was characterized by companies diversifying into other fields and the main reason was to smoothen out cyclical bumps of the industry, in a word, hedge an investment portfolio. The fourth wave is one that we may remember from movies or TV shows, the vultures of capitalism that seek undervalued companies in order to acquire them and transform them and their assets as they please. As we get closer to recent times, in the fifth merger wave, corporations are already more likely to acquire targets in the same field, or related to it, targets that are complementing and strengthening the acquirer.

Conglomerate mergers, while popular in the 1960s, have mostly fallen out of favor with shareholders because of the difficulty in the generation of value when combining two unrelated businesses.

Merger of equals, as mentioned in the previous chapter, is a combination of companies of comparable sizes. Since 1991, there have been more than 600 M&A deals announced as mergers of equals with a total value of USD 2,126b as per IMAA Institute.

Since the focus of this research is the US market, in figure 2.2 the amount of deals and their value can be observed over time, from 2001 to 2014.

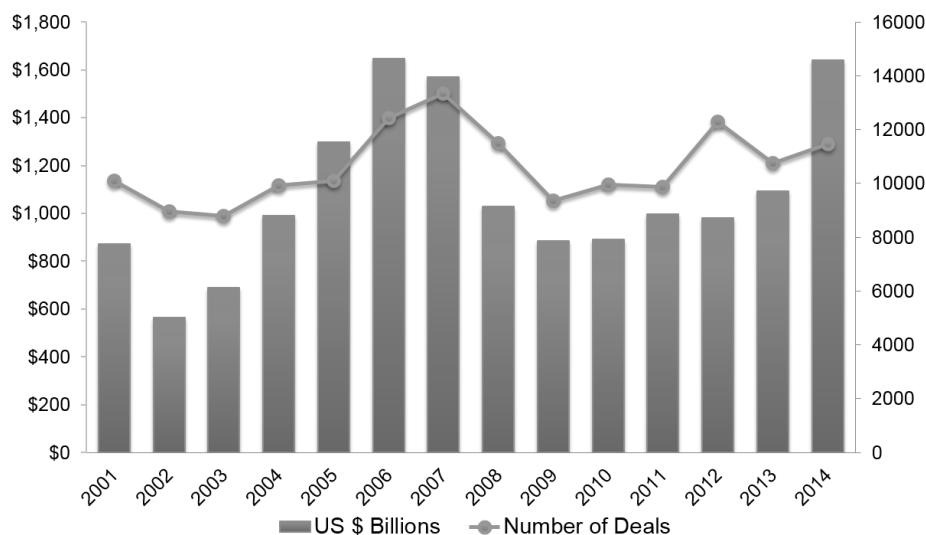


Fig. 2.2 US M&A Activity
Recent history of public takeovers
Source: Dealogic, Thompson Reuters

Motives

Companies, managements and shareholders seek to merge or to acquire for many reasons, be them of financial, strategic or risk-reducing nature.

Berk and DeMarzo (2014), as well as Johnson, Whittington, Scholes (2014) summarize the following recurring incentives:

- **Synergy** – Usually achieved through the elimination of duplication, optimization of processes and elimination of redundancies while still keeping newly acquired expertise and processes,
- **Economies of scale** – A newly merged entity can usually reduce fixed costs, increase savings from producing goods in high volume, lowering the costs of operations relative to the same revenue stream, ultimately the result being increased profit margins,
- **Economies of scope** – Efficiencies mainly linked with savings that come from combining the marketing and distribution channels of different types of related products or services,

- Revenue and/or market share increase – An horizontal merger with a significant player on the market (of the acquirer) that increases the market power of the newly formed corporation
- Cross-selling – Acquiring into complementary markets for acquirers' existing products or services
- Vertical integration – There are multiple reasons for integrating upstream or downstream. One of them is to internalize an externalized process. Usually this means that the initiating party no longer has to worry about clauses, unfair price, and contractual practices. Similarly, another company might not be content with the distribution of their products, so it may decide to take over its distribution channels.
- Geographical extension – Another risk hedging possibility if done correctly, as it increases revenue streams, whilst no longer being captive in the market the company was already present in.
- Taxation – Profitable companies have to pay taxes on that profit. One such company can buy a target company with larger tax losses, especially in the form of carryforwards. In US the IRS disallows tax breaks if it can be proven that the main reason for the transaction is tax avoidance, so in itself the taxation motive is no longer a valid sole reason.
- Hiring and expertise – Mentioning once again the acqui-hire type of deal, some acquirers use acquisitions as a tool that is alternative to the classical hiring process, especially common if the target company is a small private company and/or a startup. Usually the talent is the main appeal and asset of the target company.
- Intellectual property acquirement – Innovative patents, copyrights or trademarks can be under the property of a target company and therefore this creates a huge awareness for the interested parties
- Diversification and risk reduction – Diversifying the investment portfolio is a common advice, and it is of no lesser importance in mergers and acquisitions. It is possible that companies can hedge against downturns in some industries and create value for the shareholders in another.

Alongside with the above-mentioned reasons there are also other, less objectively planned transactions.

Management errors arise, as they are human, and humans are interested of all with the personal wellbeing. An agency cost is an economic concept relating to the fee to a "principal" (an organization, person or group of persons), when the principal chooses or hires an "agent" to act on its behalf. For the reason that the two parties have unlike interests and the agent has more information, the principal cannot directly have the guarantee that its agent is always acting in the principal's best interests (Jensen and Meckling, 1976).

Managers can also prefer to run a larger company due to the additional pay and reputation it conveys. Therefore, because of that, CEO's and top executives may execute mergers and

acquisitions that destroy value for the shareholders, since usually the compensation in stock is usually insignificant to total compensation of the executives they will tend to prefer to sacrifice company value in exchange for personal gain. This usually happens in the case of poor executive monitoring and when the remuneration is directly linked to the size of the company, which can also be called empire building (Jensen, 1986).

Overconfidence also can play a role in those errors. Psychological research has shown that it takes repeated failures for a person to change his belief that he is above average at some activity. Most CEOs perform at most one large acquisition during their tenure as CEO. Richard Roll's (1986) paper, proposes the "hubris hypothesis" to clarify takeovers, which sustains that overconfident CEOs pursue mergers that have low chance of creating value because they truly believe that their capability to manage is great enough to ensure success. The critical difference between this hypothesis and the incentive conflict discussed above is that overconfident managers are certain that they are doing the right thing for their shareholders, but irrationally overestimate their own skills. Under the incentive conflict explanation, managers know they are destroying shareholder value, but personally gain from doing so.

Public Takeovers

Things get more interesting if the target company is listed. Listed companies are subject to hostile takeovers. The process normally begins with the acquirer building a position, cautiously and subtly buying shares in the target company. Once the soon to be bidder starts to acquire shares in the open market, it is limited to purchasing 5% of the total outstanding shares before it must file with the SEC. Next, the acquirer must officially declare how many shares it possesses and whether it intends to buy the company or retain the shares only as an investment. In the case of hostile takeovers, there are a various number of takeover defense strategies, if the terms of the offer are not accepted:

- Poison pills – Target company's existing shareholders are given the right to buy additional shares at a significant discount price when certain conditions are met. Because the existing shareholders can purchase stock at less than the current market price, this option dilutes the value of the shares apprehended by the acquirer. Poison pills increase the bargaining power of the target firm when negotiating with an acquirer, because of the difficulty to finalize the transaction lacking the cooperation of the target company's board of directors.
 - Flip-in – It permits shareholders with the exception of the acquirer to purchase additional stock at a significant discount. This form of poison pill makes the takeover attempt more costly and challenging, diluting shares held by the acquirer.
 - Flip-over – Allows shareholders to purchase the bidder's shares after the merger at a discount. It is generally the more used of the two strategies.

- Golden parachutes – Benefit given to top executives if the company is the target of a hostile takeover and the executives are dismissed as a result. Those severance agreements are usually generous in order to discourage any hostile actions against the owners of the company and its management.
- Recapitalization – A target company can also choose to change its capital structure to make itself less appealing. Increasing leverage is most of the time the strategy of choice, making it a less interesting prospect because of restructuring issues.
- White knights – An individual or company that acquire businesses that are almost being completely hostile taken over by what is usually called a black knight. A white knight is typically the more preferred option than the hostile company is.
- Staggered boards – Frequently, an acquirer would try to make changes in the board of directors to gain power and an upper hand on the poison pills strategies and accept the takeover offer. To defend against such acts some public companies have staggered (or classified) boards. Generally, every director serves a three-year term, and each term is staggered so that only one third of the director seats are eligible for election each year.
- Pac-Man defense – Another tactic against hostile takeovers in which the target firm tries to acquire the company that makes the hostile takeover try. Usually, the strategy involves breaking into the “war chest” of the company, a cushion of cash set aside for unknown adverse events. It is colloquially named as the famous game, since in the game the players are able to eat a power pill and be able to eat the ghosts previously chasing them.

All of these strategies are usually included in the bylaws of the companies as deterrent for any hostile situation.

Conclusions

Mergers and acquisitions are one of the most fundamental events in the life of a company, and they rightfully get a lot of attention in academics study.

In this chapter, some of the most important aspects concerning M&A transactions have been discussed, and how those aspects influence the way players of the market respond to the information transmitted.

The processes and ramifications are intricate and, as such, mergers and acquisitions are not always successful, and even though their main *raison d'être* should be creating value it is not always the case. Sometimes, management knowingly engage in transactions destined to fail, for personal motives, or just pure ineptitude at times. Generally, markets respond accordingly to value destruction.

The history and the trends of M&As were also analyzed, and there are periods with clear recurring characteristics, frequently called merger waves. Mergers and acquisitions can be traced as far back as commercial life itself, but significant number of deals started from late 19th century in US. Now the wave is characterized by strengthening core operations through M&As with complementary companies, in a global context. Despite the globalization phenomenon, in the next chapter will present studies that found out that cross-border transactions performed not as favorable as the domestic ones did.

Moreover, M&A activity has been shown to correlate with favorable economic conditions, and even though this is the case, in the period 2001-2014 the number of transactions fluctuated relatively little, but the amounts differed more significantly.

In the following chapter, the impact of mergers and acquisitions and their announcements on the stock prices of listed companies will be further investigated.

2.3. Impact on Shareholders' Wealth

Results of Mergers and Acquisitions

Since this paper focuses on the effects on the shareholder wealth, this chapter will summarize literature findings around the subject matter. The academic articles are generally not focused on such a small niche, and typically take into account a larger spectrum of transactions, such as all the deals in a certain country, or certain industry, regardless of market capitalization or domesticity of the transaction.

Datta, Pinches and Narayan (1992) analyze the empirical literature concerning the influence of various factors on shareholder wealth creation in mergers and acquisitions using a multivariate framework. Overall, results indicate that while the target firm's shareholders gain significantly from mergers and acquisitions, those of the bidding firm do not. Results also direct to the fact that the use of stock financing has a significant impact on the wealth of both the target and bidding firms' shareholders.

A paper on the marketing perspective of mergers and acquisitions (Rahman & Lambkin, 2015) came with a detailed study of 45 M&A deals carried out to develop a better understanding of how marketing performance is affected by mergers and acquisitions. The results show that marketing performance improved along two dimensions—sales revenue growth, and a decrease in selling, marketing and administrative costs as a percentage of sales revenue, suggesting the achievement of synergies in these areas — economies of scale and scope. However, the profit margins have not improved suggesting that the marketing cost savings are not sufficient to offset cost increases in other parts of the operations.

There are opinions that affirm acquirers choose to pay premiums that are so great that they effectively give out the value they produce to the target company's stockholders. In the end, it is understandable, because besides the presence of takeover defenses, there is competition in the takeover market, too. In the moment a bid is initiated, a signal is transmitted that there is a gain to be made when acquiring that specific target company. In conclusion, own shareholders' value must be given up in order to secure a wanted target company.

Market Reactions

The empirical studies on the effects of merger and acquisitions effects on acquirers are split mostly into those that find no statistically significant abnormal returns and those that do find some negative abnormal returns.

Looking at the studies made on the banking sector, it has been observed that target banks mostly report positive stock returns upon the announcement of a M&A operation, for instance in study conducted in 1994. In comparison with that, the results of acquirer banks are diverse and rather uncertain (Houston and Ryngaert, 1994).

Andre, Kool and L'Her (2004) observe the long-term performance of 267 Canadian mergers and acquisitions between 1980 and 2000, with and without overlapping cases. The results of the research show that Canadian acquirers significantly underperformed over the next three years, post-event period. Moreover, this study shows that the results are consistent with the extrapolation and the method-of-payment hypotheses, which states that equity financed deals underperform. Another finding is that cross-border transactions perform below par in the long run. Because this study is limited to domestic deals, it is expected that this further negate any performance influence on the returns of acquirers.

The matter of financing mergers and acquisitions has been undertaken by Fischer (2017). For acquisitions that are more credit-financed superior short-run performance resulted; takeovers financed primarily with common stock issues yielded poor announcement returns. Over the 3 years following an acquisition, the analysis revealed that capital markets efficiently price all information at the announcement. Takeovers financed with a common stock issue significantly underperform in subsequent years.

Gersdorff and Bacon (2008) argue that the result of a paired sample t-test was not satisfactory enough in order to establish the connection between merger announcements and the risk adjusted asset prices. In 2013, another study presents no statistically significant abnormal returns surrounding M&A announcements in acquirers. While Asimakopoulos and Athanasoglou (2013) hypothesize a particular movement around stock prices at the announcement day, they cannot statistically show the comprehensive explanation to establish that particular movement.

Khanal, Mishra and Mottaleb (2013) argue that the average cumulative abnormal returns of acquiring firms suggest that the market positively responded to recent M&As in the industry of US ethanol-based biofuel acquirers state. Around 4% growth on a 60-day event window was attributed to M&As using market-adjusted market portfolio. A significant positive 0.47% gain in cumulative returns in a 4-day event window and a 2.7% positive gain in a 10-day event window have been suggested as a result of this research.

Conclusions

The gains to acquiring firms are challenging to measure.

Nonetheless, some of the studies have found a slight gain in bidding companies. From management standpoints, „stockholders of acquiring firms get synergistic benefits if there is strategic fit between them”, (Lubatkin, 1983). Supporting this, Zaremba and Plotnicki (2016) illustrate strong evidence that takeovers increase acquirers' value in the short run.

At the same time, Blasko, Netter and Sinkey's findings (2000) propose negative abnormal returns or suggest no significant findings. The proposal for wealth depreciation in mergers is also in line with the result of Gopalaswamy, Acharya, and Malik (2008), which average abnormal returns were negatively found in the next two days after the announcement day and were statistically significant.

Concluding, even though there are frequently indeed M&A impacts on acquirers' abnormal returns, these impacts are not conclusive.

3. Empirical Research

3.1. Research Goals

The main goals of this paper is to examine the existence and the degree of short-term abnormal returns of the domestic acquisitions in the, mid or large cap US tech companies. The emphasis of the study is on the shareholders' value and returns of the acquiring companies.

This paper is guided by the following research question:

Is there an impact in the form of abnormal returns for the shareholders of acquirers in the proximity of M&A announcements?

The above research question can be split into the following three objectives:

1. Determine whether M&A announcements generate significant abnormal returns on the event date or not.
2. Determine if investors can earn abnormal by trading the acquiring mid and large cap tech companies around the announcement date.
3. Examine the degree and amount of abnormal returns that can be achieved by trading the acquiring mid and large cap tech companies around the announcement date.

The previous objectives can be derived into the following hypotheses:

Hypothesis 1₀: M&As announcements do not have significantly negative or positive impact on the average abnormal returns of acquiring mid and large cap tech companies on the announcement day.

Hypothesis 1₁: M&As announcements do have significant impact, negative or positive, on the average abnormal returns of acquiring mid and large cap tech companies on the announcement day.

Hypothesis 2₀: Investors in US stock markets cannot earn abnormal returns by trading the acquiring mid and large cap tech companies around the announcement date.

Hypothesis 2₁: Investors in US stock markets can earn abnormal returns by trading the acquiring mid and large cap tech companies around the announcement date.

3.2. Data

The data for the research was collected by using Bureau van Dijk's Zephyr, the most exhaustive database of international deal information, with a cover close to 1.5 million deals and rumors, as of April 2016. It has detailed deal and company information, comprehensive criteria selection when searching for data and it is updated hourly.

For the purposes of this research, the following population has been selected: the domestic deals in United States of America over the last five years⁵, acquirers being publicly listed mid or large cap companies⁶ that have their core operations in Information Technology & Communications (IT&C). In order to be able to select accurately and thoroughly the exact companies that fit the IT&C criteria, the NAICS 2012⁷ has been used. An explanation of the codes is presented in the Appendix B.

Table 3.1 Data selection

Seven criteria have been used on the database tool regarding location of interest for the study, the public status of the acquirer, time period of announcements, the market capitalization of the acquirer, the industry of the acquirer, the deal type and to have the acquisition amount disclosed. Additionally, after the database criteria are satisfied, we subtract missing historical daily stock data, the cases when multiple acquisitions happen in a single date, and the overlapping event windows.

Criterion	#
Total domestic deals by country	1,369,871
Less	37,201
<i>Country (primary addresses):</i> United States of America (US)(Acquirer AND Target)	
<i>Listed/Unlisted/Delisted companies:</i> listed acquirer	8,940
<i>Time period:</i> on and after 01/01/2012 and up to and including 01/01/2017 (completed-confirmed, completed-assumed, announced)	3,324
<i>Acquirer financials (mil USD):</i> Current market cap: min=2,000	404
<i>NAICS 2012(North American Industry Classification System) :</i> Technology (Codes 3333, 334, 3352, 3359, 3361 <only Tesla Motors Co.>, 3364, 4541, 517, 518, 51913, 51919, 5415, 6117) (Acquirer)	248
<i>Deal type:</i> Acquisition, Merger, >50% stake acquired only	243
<i>Deal amount:</i> Any, disclosed	69
<i>Less:</i> No historical stock data (1)	68
Multiple acquisitions in one announcement (2)	66
Overlapping event windows (5)	61

Source: Zephyr Database

⁵ 01.01.2012 - 01.01.2017

⁶ Companies with a market capitalization of over 2 billion USD (at 01.04.2017)

⁷ North American Industry Classification System- used by businesses and governments in Canada, Mexico, and the United States of America to categorize business entities according to the main type of economic activity

Out of the 248 M&A announcements, five cases have not been selected, since they were minority stake acquisitions. Out of the 248 mergers & acquisitions cases, one of the acquirers from data pool, namely Dell Technologies Inc.⁸ is now private⁹ and no longer present in the available historical stock prices databases. Dell technologies' stock does not exist anymore because Michael Dell, the company's founder, took the company private in 2013. However, since up to 2013 Dell was a publicly traded corporation with the symbol DELL, this deal also appeared as one of the results of the search.

Tesla Motors Co. (\$TSLA) is an outstanding item in the database, since it is a car manufacturer, but many argue it is more than that, a tech giant in the making. In this paper, Tesla is considered a technology company above a motor vehicle manufacturer. By this judgement, General Motors Co. is excluded, given the fact that it falls under 3361 NAICS 2012 code but cannot be regarded as a tech corporation. With the same line of thought in mind, while code 3364 – Aerospace Product and Parts Manufacturing is present in the database criteria, The Boeing Company is also excluded, having its primary operations in aircraft manufacturing, and not primarily IT&C industry.

Approximately 50% of M&A deals in the USA are undisclosed annually according to Bell (2014) and because one goal of this paper is to be as accurate as possible, the undisclosed transactions have been ruled out of the population.

Almost all of the 61 M&A announcements have the corresponding deals completed, with the exception of AT&T Inc. acquirement of Time Warner Inc., awaiting further regulatory approval; European Commission has already granted its approval.

AT&T | Time Warner is also the outlier when considering deal values, with a whopping USD108.7 billion, about 4 times larger than the following one, and has been excluded out of the following analysis (Maddala, 1992). The analysis consists of 60 deals, excluding AT&T | Time Warner.

⁸ acquiring EMC Corporation event

⁹ i.e. not publicly listed on any stock exchange

Table 3.2 Deal amount descriptive statistics
Statistical properties of the 61 disclosed transactions' amounts.

<i>thou USD</i>		Statistic	Std. Error
Mean		1,507,473.33	554,600.56
95% Confidence Interval for Mean	Lower Bound	397,720.16	
	Upper Bound	2,617,226.50	
Median		296,500.00	
Std. Deviation		4,295,917.50	
Minimum		7,100.00	
Maximum		26,200,000.00	
Range		26,192,900.00	
Interquartile Range		845,750.00	

Source: Zephyr Database, author analysis

Out of the 61, thirty, or approximately half, are directly cash financed, twenty-four mixed financed deals and seven by stock swap only. Some of the mixed financed M&A transactions are leveraged buyouts, twelve to be concise.

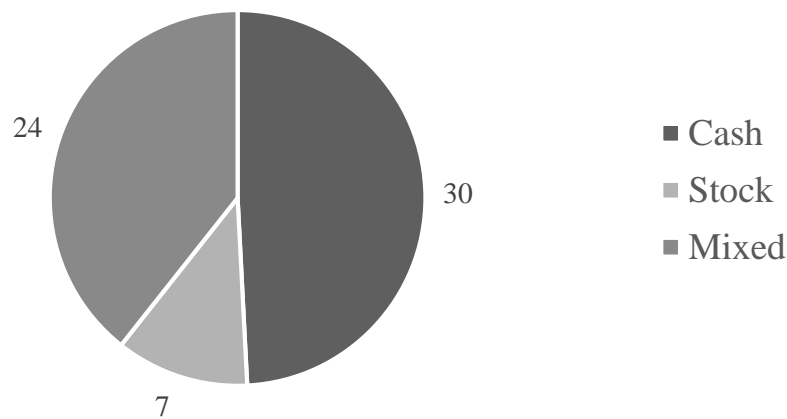


Figure 3.1 Deals by Financing

Looking at the distribution of the deal opportunities – or sub-types –, we can notice that the predominant one is the exit strategy. Given the fact that the population consists of IT&C companies this is a recurring theme in the field as CB Insights (2017) point out, tech entrepreneurs usually looking for exit opportunities.

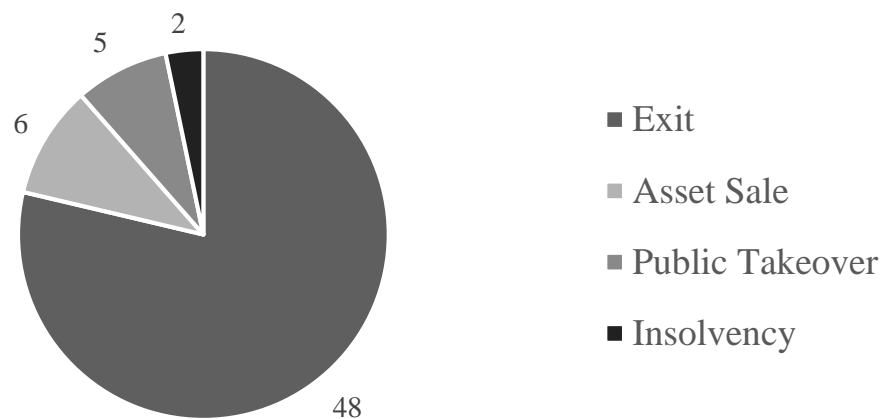


Figure 3.2 Sub-type of Deals

Alphabet Inc. (\$GOOG), made the highest number of deals, nine, alongside with Apple Inc. (\$AAPL). The following amount is Facebook Inc.'s (\$FB), with six announcements. Microsoft Corporation (\$MSFT) follows with four mergers and acquisitions transactions. Lastly, Salesforce (\$CRM) and Verizon (\$VZ), both announced three deals. The rest of the research population has announced either two or a single acquisition, as it can be seen in the Figure 4.3. Given the fact that the first four are some of the most prominent tech companies in the world and that altogether they make up almost half of the research database some information about their M&A modus operandi can be read in the following paragraphs.

Publicly, Apple is known to have acquired 70 companies as of June 2017. The real complete number of acquisitions is possibly greater as Apple does not disclose but some of its acquisitions, unless revealed by journals. Apple tends not to release financial details for most of its mergers and acquisitions. Apple's strategy is to acquire small companies that can be easily assimilated into existing developments. Forty-nine of the companies Apple has acquired were based in the United States.

As of December 2016, Alphabet has purchased over 200 companies. The majority of the firms bought by Google are based in the US, and most of these are based in or around the San Francisco Bay Area, as Silicon Valley is known as the epicenter of tech companies. Many Google products originated as services provided by companies that Google has since acquired. Larry Page, CEO has explained that prospective acquisition targets must pass a kind of "toothbrush test": Are their products potentially useful once or twice a day, and do they improve your life? (The New York Times, 2014).

Most of Facebook's acquisitions have been 'talent acquisitions' or "acqui-hires" and assimilated products are often shutdown as opposed to Alphabet's strategy. Mark Zuckerberg, Facebook CEO said, "We have not once bought a company for the company. We buy companies to get excellent people... In order to have a entrepreneurial culture one of the key things is to make

sure we're recruiting the best people. One of the ways to do this is to focus on acquiring great companies with great founders."¹⁰ Although that is the case, the acquirement of Instagram, seems to be the first exception to this rule.

Microsoft's initial public offering was held on March 14, 1986. After the IPO, Microsoft had a market capitalization of \$519.77 million. Since then, Microsoft has acquired 202 businesses, purchased stakes in 64 companies, and made 25 divestments has purchased. A hundred and seven of the companies that Microsoft bought were and are based in the US. Microsoft has not released financial information for most of these transactions.

One observation that can be immediately made is that these top tech companies are repeatedly acquiring companies that are based in the US. This could be due to preference or because there is a great concentration of companies that have as their core activity information technology in the area – e.g. Silicon Valley.

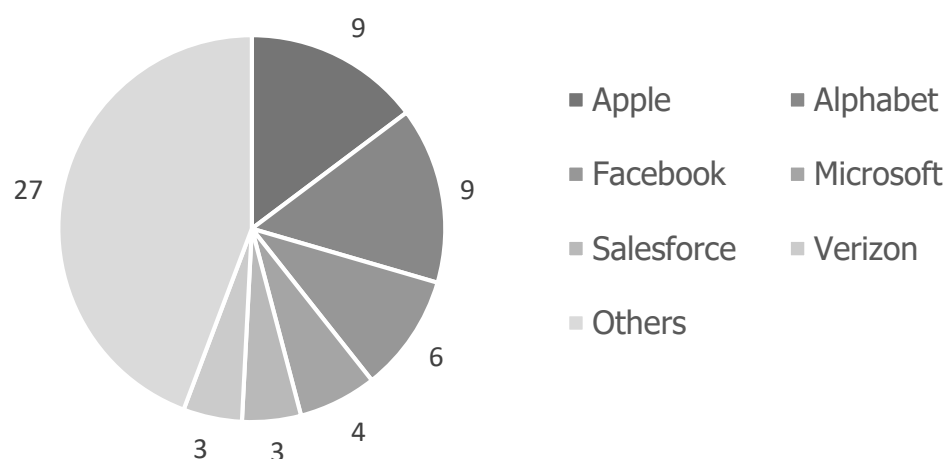


Figure 3.3 Number of Deals Announced by Acquirer

The historical stock data for each deal have been retrieved via Yahoo Finance. Alongside with each period needed, methodology explained in the following chapter, S&P500 index historical stock data was also procured, as benchmark, since the acquirers are listed companies and the methodology explained in the following chapter has been applied.

¹⁰ Zuckerberg, M., (2010), Interview for Erste&Young.

3.3. Methodology

In order to examine the effect of mergers and acquisitions announcements on the stock price of listed companies and to see if there are significant abnormal returns, event study methodology introduced by Fama (1969) and described, reviewed and summarized by MacKinley (1997), Cowan (1992) and Brown and Warner (1980 and 1985), will be employed.

Event Definition

The first task of conducting an event study is to state the definition of the event of concern and then identify the period over which the asset prices of the firms involved in this event will be examined - the event window.

The announcement day is defined as the day when the acquirer or the vendor¹¹ launches a press release, as it is difficult to identify the exact dates of rumors or speculation. The focus is not on a single, “top of the line”, news source, e.g. Wall Street Journal, in comparison to earlier studies on merger and acquisitions announcements but rather any communication channel initially used by one of the two primary parties.

Estimation Period and Event Window

The length of estimation window is asset in accordance to Armitage (1995), who detailed that when conduct research with daily studies an estimation period of 100-300 days are sufficient for satisfactory assessment of the parameters in statistical pricing models. The exact estimation window of this study is the average of the recommended interval, 200 days, essentially 220 days prior to t_0 , the event date, and up to 21 days before t_0 .

This period cannot be too lengthy because an extensive window could risk finding any potential other significant event. Conversely, if the period is excessively short, the estimation might risk not capturing the effect of the event.

A 41-day main event window¹² entirely captures the effects of an event of interest, and it is the most common event-window range (Asimakopoulos and Athanasoglou, 2013). Subsequent event windows will be taken into consideration when comparing abnormal returns and their cumulative value. The windows begins ten days prior to the event day and ends ten days after, and that is approximately two working days weeks previous and after the event. It is also recommended that the estimation window and the event window do not to overlap and this study takes that issue into account.

¹¹ Sometimes, corporations seek outside help in major events such as mergers and acquisitions (e.g. investment banks)

¹² i.e. [-20,+20]

One thing worth mentioning is that trading days are not calendar days. Active trading schedule on NYSE and Nasdaq Stock Market is in connection with the working days and accounts for nationally enacted US holidays. This means almost one year of estimation data is considered and about a month prior to and after the event exists for the observation of phenomena during event window.

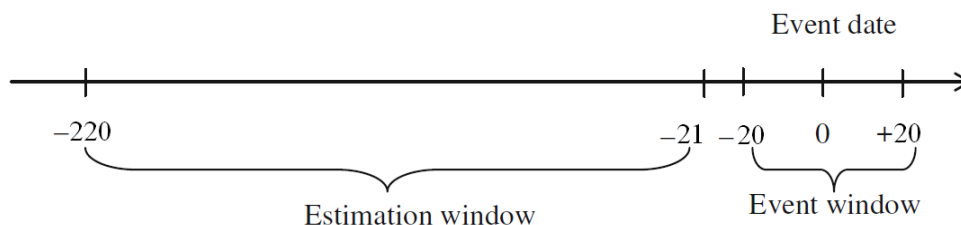


Figure 3.4 Comparable windows

Abnormal Returns and OLS Market Model

There are a number of available approaches to calculate the normal return of a given asset, and they can be roughly grouped into two categories, statistical and economic. The first category arise from statistical assumptions in connection with the behavior of the security returns and are not contingent on any economic arguments. The second one account primarily on assumptions regarding investors' behavior and are not grounded exclusively on statistical arguments.

Brown and Warner (1985) discussed several issues that should be taken into consideration when selecting an event study model. Based on their verdicts an appropriate “Excess Return Measure” will be adopted.

This study will use the statistical model called “Market Model”. This statistical framework links the return of any given asset to the return of the overall market, and it is based on the ordinary least squares (OLS) method. The use from using the market model will be contingent on the R^2 of the market model regression. The greater the R^2 is, the greater is the variance reduction of the abnormal return, and the larger is the advantage (MacKinlay, 1997).

The average R^2 of the observations in the estimation windows in this study is at 0.56, which is an average correlation between stock returns and benchmark - market index – returns.

The interval period over which parameters are projected is normally denoted as the estimation window. Otherwise, normal return model parameters are estimated from returns affected by the event.

Brown and Warner (1980) initially used monthly data, and described numerous methods to calculate abnormal activity using an event study approach. Their later work involved the use of daily data, where they describe problems relating to daily data. Brown and Warner (1985) observe

that daily data may reveal stock returns that are not normally distributed, and this raises the likelihood of daily returns exhibiting serial dependence. However, they conclude that approaches based on the OLS market model are “well specified under a variety of conditions,” as well as the use of daily price data. Additional authors (Davidson, Dutia and Cheng, 1989; MacKinlay, 1997) have confirmed that the OLS market model is sound and delivers the most precise measure of abnormal performance.

There is no need to employ the method suggested by Scholes and Williams (1977) in order to account for non-synchronous trading¹³, a complication described as ‘especially severe’ by the authors), since all the cases are trading on the same market – NYSE and NASDAQ – US market.

Therefore, the returns that would have normally occurred in the absence of the event according to OLS market model are calculated as follows

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (3)$$

where

R_{it} is the return of company “i”, at time “t” where $t = -220 \dots -21$,

α_i is the constant term for the stock “i”,

β_i is the market beta (as explained in subchapter 1.1 under the CAPM definition),

R_{mt} is the market return at time “t”,

ε_{it} is the error term.

¹³ Trading not occurring at the same time, usually difference made by time-zones and national holidays

The next step is to calculate the abnormal return, which for firm “i” and event date “t”, either t0, or any from the event window, is:

$$AR_{it} = R_{it} - E(R_{it}) \quad (4)$$

Where:

R_{it} is the actual return of the asset,

$E(R_{it})$ is the expected return of the stock calculated through the market model.

Both the return of the stock price and the return of the market are calculated logarithmically in this study

$$R_{it} = \log \frac{\text{stock price}_t}{\text{stock price}_{t-1}} \quad (5)$$

and

$$R_{mt} = \log \frac{\text{S\&P500 price}_t}{\text{S\&P500 price}_{t-1}} \quad (6)$$

To be able to derive complete readings from the announcement events, one supplementary step needs to be executed. As a succeeding step, the abnormal returns need to be aggregated through time first of all and across securities second of all (MacKinley, 1997).

The cumulative abnormal return (CAR) is a measurement of the total abnormal returns during the event window. CAR_t is the sum of all the abnormal returns from the beginning of the event window t1 until a specific day t in the window

$$CAR_t = \sum_{i=1}^t AR_{T_1+i} \quad (7)$$

Average Abnormal Returns and Cumulative Abnormal Returns (AAR/CAAR)

The average abnormal return (AARt) for each individual day in the event window is the arithmetic mean of N stocks as follows

$$AAR_t = \frac{1}{N} \sum_{i=1}^N (AR_{it}) \quad (8)$$

Where N is the number of firms.

Over an interval of two or more trading days, the cumulative average abnormal return (CAAR) is

$$CAAR_{T_1, T_2} = \frac{1}{N} \sum_{i=1}^N \sum_{t=T_1}^{T_2} (AR_{it}) \quad (9)$$

These statements are used for testing cross-sectional statistical significance for each of the event window days wanted to be tested.

The abnormal return observations must be aggregated for the event window and across observations of the event. For this aggregation, it is assumed that there is not any clustering. That is, there is not any overlap in the event windows of the included securities. The absence of any overlap and the maintained distributional assumptions imply that the abnormal returns and the cumulative abnormal returns will be independent across assets.

Statistical Significance Tests

The basis for inference in event studies is a test statistic, typically the ratio of the mean excess return to its estimated standard deviation.

There are several tests for evaluating the abnormal returns' statistical significance. Generally, they test the null hypothesis that abnormal returns are zero, but they vary in the prerequisite assumptions concerning the statistical properties of abnormal returns.

Parametric tests required the assumption that the excess returns follow a normal distribution. When this assumption is not satisfied, parametric tests are not well specified. Even though this is the case, Brown and Warner (1980) suggest upon investigation that parametric tests provide similar results to non-parametric tests.

In addition to parametric statistics, past event studies normally report a nonparametric test also. A non-parametric test is generally used in combination with a parametric test in event study to validate that outliers do not drive the results. Non-parametric statistics do not require the same level of rigorous assumptions about return distributions as parametric tests. In order to obtain sound results, one parametric cross sectional t-test (Brown and Warner 1980) and one non-parametric Generalized Sign (Cowan 1992) test has been directed.

To test whether the data set of CARs and ARs is normally distributed, a Jarque-Bera test is employed

$$JB = \frac{N}{6} \left(S^2 + \frac{(K-3)^2}{4} \right) \quad (10)$$

where

N is the sample size, S is skewness and K is kurtosis.

The value of the test is compared to the 5% critical value from a χ^2 -distribution with two degrees of freedom. The null hypothesis of normal distribution is rejected when the computed JB value is greater than the critical value from the chi-squared distribution with two degrees of freedom.

The data set in this study is normally distributed for every interval except for [-5,5] and [-10,10].

To test the null hypothesis of no impact of a merger announcement on stock price, the statistical significance of $CAR_{(t1, t2)}$ and AR_t is calculated according to Brown and Warner (1980). **The test statistic** is merely the ratio of day t average abnormal returns to its assessed standard deviation.

$$t_{cross} = \sqrt{N} \frac{AAR_t}{\sigma AAR_t} \quad (11)$$

Under the null hypothesis, the cumulative average abnormal return is equal to zero. Brown and Warner (1980) demonstrate that the cross-sectional t-test is robust to an event-induced variance increase.

Therefore, the hypotheses for the test are:

H_0 : The cumulative average abnormal return of the population in the event window is equal to zero.

H_1 : The cumulative average abnormal return of the population in the event window is different from zero.

If the absolute value of the cross sectional test statistic is larger than 1.96, then the abnormal return is significant at the 95% level (denoting that the likelihood of the abnormal return being random and insignificant is less than 5%). If the test statistic is above 2.58, its significance level is 1%.

The generalized sign test compares the proportion of positive abnormal returns around an event to the proportion from a period unaffected by the event. The generalized sign test proposed by Cowan (1992) is based on the ratio of positive cumulative abnormal returns over the event window.

The generalized sign test examines whether the number of stocks with positive cumulative abnormal returns in the event window surpasses the number expected in the absence of abnormal performance or not. The number expected is based on the fraction of positive abnormal returns in the 200-day estimation period

$$\hat{p} = \frac{1}{N} \sum_{i=1}^N \frac{1}{200} \sum_{t=1}^{200} S_{it} \quad (12)$$

where $S_{it} = \begin{cases} 1, & \text{if } AR_{it} > 0 \\ 0, & \text{otherwise} \end{cases}$

The following statistic has an approximate unit normal distribution with parameter \hat{p}

$$Z_G = \frac{w - n\hat{p}}{\sqrt{n\hat{p}(1-\hat{p})}} \quad (13)$$

where w is the number of stocks.

Under the null hypothesis, this ratio should not systematically deviate from the ratio of positive cumulative abnormal returns over the estimation window.

Consequently, the hypotheses for the test are:

H_0 : The proportion of positive returns in the event window is the same as proportion of positive returns in the estimation period

H_1 : The proportion of positive returns in the event window is different from proportion of positive returns in the estimation period

3.4. Results and Analysis

In order to test this paper's hypotheses, starting from the main event window, [-20,20], all the subsequent event windows have been tested. Average abnormal returns and cumulative average abnormal returns (CAARs) for different event windows have been analyzed for the entire population of mid and large cap tech stocks. One additional custom event window was used to conclude that investors can earn abnormal returns whilst trading around the announcement date.

In order to have a perspective on the data used to test the hypotheses table 3.3 incorporates the resulted data from the market model analysis and the averaging of abnormal returns and cumulative abnormal returns. Also it show the statistical significance at t_i for the average abnormal returns and aggregated cumulative abnormal returns.

Table 3.3 Event window results

The table shows the average abnormal returns obtained from the market model applied to the 61 cases of M&A announcements, with an estimation window of 200 days. The event window consists of 41 days, [-20,20], around the event date. The abnormal returns are any variance from the OLS model that predicts the expected returns of an asset. Additionally, the cumulative abnormal returns have been added. A cross-sectional t-test has been applied to each day.

T	AAR	CAAR	AAR t-test	T	AAR	CAAR	AAR t-test
-20	0.003753	0.0037531	1.8372	1	-0.00322	0.0178992	-1.9621*
-19	0.001137	0.0048905	0.5183	2	-0.00292	0.0149745	-1.2458
-18	0.001833	0.0067238	0.5786	3	-0.00162	0.0133506	-0.6769
-17	-0.00017	0.0065581	-0.0693	4	-0.00146	0.011891	-0.8309
-16	0.002622	0.00918	1.4070	5	0.000926	0.0128168	0.5139
-15	0.000627	0.0098073	0.2027	6	0.000441	0.0132579	0.2409
-14	-0.00122	0.0085829	-0.5291	7	0.00422	0.0174777	1.1423
-13	0.000916	0.0094985	0.5219	8	0.000815	0.0182927	0.4438
-12	0.001893	0.0113914	0.9513	9	0.00023	0.018523	0.1233
-11	-0.00128	0.0101098	-0.5032	10	0.000295	0.0188181	0.1596
-10	0.001307	0.011417	0.5763	11	-0.00115	0.0176693	-0.5518
-9	0.00054	0.0119573	0.3793	12	-0.00105	0.0166238	-0.5259
-8	0.002231	0.0141882	0.9982	13	0.002049	0.0186725	0.9838
-7	0.001871	0.0160589	0.8992	14	0.000116	0.0187888	0.0683
-6	-7.52E-06	0.0160514	-0.0034	15	-0.00322	0.0155695	-1.1886
-5	-0.00026	0.015796	-0.0777	16	-0.00115	0.0144207	-0.6130
-4	0.00029	0.0160864	0.0938	17	-0.00291	0.0115093	-1.1283
-3	-0.00035	0.015736	-0.1807	18	-0.00292	0.0085847	-1.1223
-2	0.002049	0.0177853	1.0233	19	0.002766	0.0113512	1.0765
-1	-0.00235	0.0154314	-1.4342	20	0.000687	0.0120378	0.3343
0	0.005687	0.0211185	2.7951**				

AAR is abnormal average returns and CAAR is cumulative average abnormal returns. * denotes significance at 5% and ** at 1%, respectively for the cross-sectional t-test

From a daily perspective, the abnormal returns are statistically significant at 1% on the event date and at 5% in the immediately succeeding day. Other interesting aspect to note is that the AAR₋₂₀ is statically significant at 10%.

Applying the statistical tests the results are as follows:

Table 3.4 CAAR and event date statistical significance

For each event window the abnormal returns have been calculated using OLS market model, over 200 observations per event, and have been added up to form cumulative abnormal returns. Then cross-sectional t-test and G sign Z statistical tests are applied

Event Window	CAAR	t-statistic	p-value	Positive:Negative	G Sign Z
(-20...20)	0.88%	0.6059	0.5446	33:28	1.0476
(-10...10)	0.87%	0.8062	0.4201	37:25	1.9763*
(-5...5)	-0.32%	-0.4430	0.6578	29:32	-0.2442
(-3...3)	-0.27%	-0.5946	0.5521	31:30	0.2725
(-2...2)	-0.08%	-0.2138	0.8307	30:31	0.0141
(-1...1)	0.01%	0.0410	0.9673	30:31	0.0141
Announcement Day	AAR ₀	t-statistic	p-value	Positive:Negative	G Sign Z
0	0.76%	2.7489	0.006**	40:21	2.5977**

CAAR is cumulative average abnormal return and G Sign Z is generalized sign test. * denotes significance at 5% and ** at 1%, respectively

M&A announcements have a clear and statistically significant impact on the event day. Consequently, there is enough evidence to reject the null hypothesis and suggest that M&As do have significantly positive impact on acquirers' abnormal returns on the date of announcement.

Moreover, investors can earn abnormal returns by trading before the event date, either by trading in the ten day prior – ten day after event window or by acquiring the stock in the period before the announcement date, twenty days before it.

Investigating the effects on stock prices prior to the announcement day indicates the possibility of information leaks or rumors of the approaching event that has been spread out by insiders in M&A counterparties (De Jong, 2007). More than that, it seems that in the case of strong tech companies such rumors and leaks have a positive influence on the investors. Information leakage leads to rapid gains for the shareholders of the acquirer in the presented cases.

Generally, the abnormal returns tend to be positive, both in the case of statistically significant and non-significant circumstances. This further emphasizes the general positive outlook on the larger tech companies.

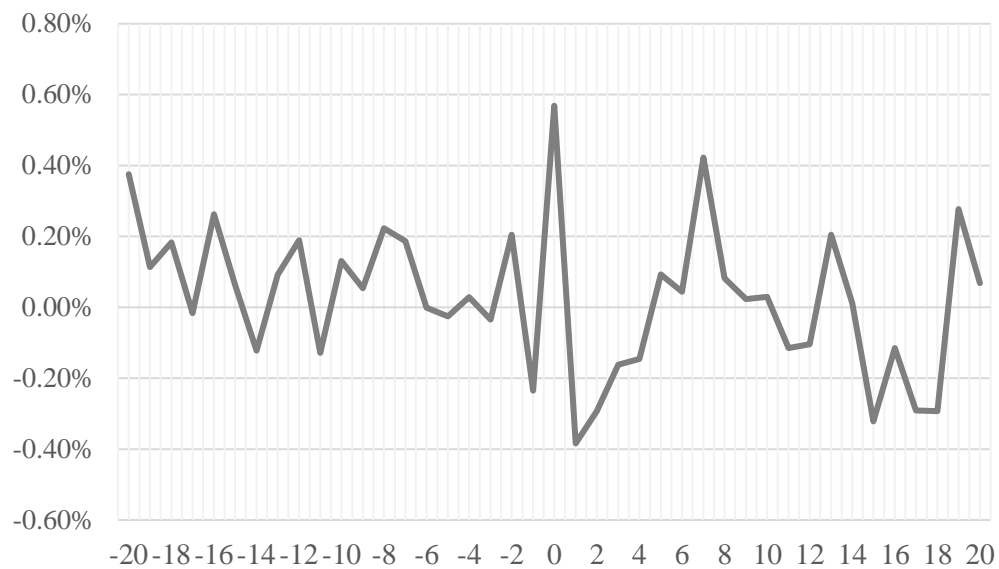


Figure 3.5 Average abnormal returns

Notable findings can be observed in the graphical interpretation of the results, and an argument can be made for strong market efficiency hypothesis, since the prices of the assets are ascending before the announcement date, and as such, they also reflect private information, not only the publicly available one, as seen in figure 3.6. A more solid statement is that the market significantly performs at least semi-strongly efficient.

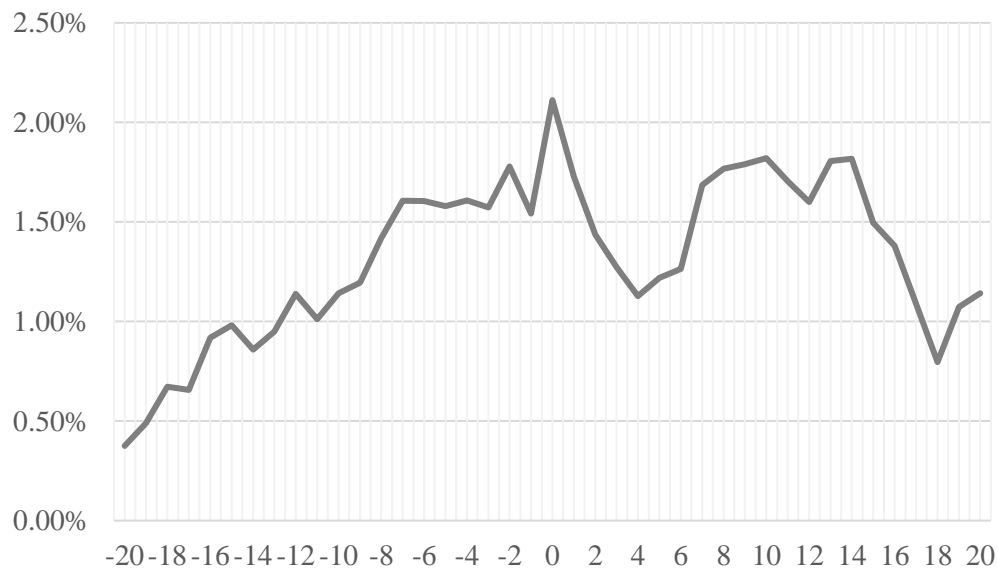


Figure 3.6 Cumulative aggregated abnormal returns

The figures provide a more intuitive framework for discussion and can facilitate conclusions that are more notable.

There is a particularly interesting phenomenon, although not significant on the particular event sub-window, which starts from the immediately following day to the announcement and continues to the fourth day afterwards. The irregularity is immediately corrected by the market in the fifth and sixth date, and that is probably why there is not statistical significance present. It is however fairly worthy of note, since there are authors who account for delays in the market reactions. Investors might act with delay if it is hard to assess the event (DeJong, 2007).

Taking everything into account, the M&A announcements do have a significant impact on the stock price of listed mid and large cap US tech companies that engage in domestic transactions and the investors can earn significant abnormal returns when trading these stocks around announcement dates.

4. Conclusions and Future Research

The results of the analysis of the 61 mid and large cap US tech companies involved in domestic mergers and acquisitions are generally in line with the overall conclusions of existing literature that covers the broad topic of bidders' abnormal return.

Significant abnormal returns can be observed on the event day, the shareholders of acquirer company experiencing in average positive returns of 0.76%, statistically significant at one percent. Additionally, traders can earn excess returns by trading such stocks based on leakage of information or rumors, as the cumulative average abnormal returns for event windows [-10,10] and [-20,0] through generalized sign test, show positive significant abnormal returns of 0.87% and 2.11% respectively.

Therefore we reject the first null hypothesis which states that M&As announcements do not have significantly positive or negative impact - positive in this case - on the average abnormal returns of acquiring mid and large cap tech companies on the announcement day. We also reject the second null hypothesis that implies that investors in US stock markets cannot earn abnormal returns by trading the acquiring mid and large cap tech companies around the announcement date, as the cumulative average abnormal returns are significant for the periods ten days prior to the event and ten days after it, and the twenty days that precede the announcement.

Regarding the methodological aspect, the present study has demonstrated use of parametric as well as non-parametric significance tests to check the robustness of average abnormal returns and cumulative average abnormal returns. The use of non-parametric test-statistics in conjunction with a parametric test-statistic for assessing significance levels of average abnormal return and cumulative average abnormal return has proved to be useful, since this test-statistics take into account effects due to event-induced variance and offers therefore an alternative evaluation of significance. All the methods and computations of abnormal returns were carried by using Microsoft Office Excel software.

The results of the 61 events of the study reveal findings, which are mostly in line with results of current theoretical and empirical literature. With the aim of answering the study's question, the literature review on this topic has been performed to provide a firm foundation for the empirical research. The inference of the literature review directs to contrary points of views when it comes to the effect of mergers and acquisitions on stock prices of acquiring companies.

The limitations incurred do not invalidate the findings and general outlook on the situation at hand. However, aspects such as the data absence, selected region of interest, rumors - and their credibility, as well as their influence on the performance of the acquirer – of the future events, and

The study is overall limited to the impact of mergers and acquisitions on short-run stock price performance.

Some suggestions for future research are to include and test for different types of financing, or type of deal type and sub-type. One future study can be made on the differences of impacts between domestic transactions and cross-border ones. The issue of hostility can be further addressed. If possible, a research on the information leakage and rumors affecting the impact of these events would shed more light onto this topic. Additional investigations covering a lengthier period should be applied to find relevant subsamples and consequently find possible consistency of results concerning the overall topic.

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Appendices

Appendix A: List of M&A Announcements Studied

Acquirer and Acquired Companies	Announcement Date	Deal Value (thou USD)
ACTIVISION BLIZZARD INC. acquires MAJOR LEAGUE GAMING INC.'S BUSINESS	01.01.2016	46,000
ALPHABET INC. acquires MEEBO	04.06.2012	100,000
ALPHABET INC. acquires WILDFIRE INTERACTIVE	01.08.2012	450,000
ALPHABET INC. acquires CHANNEL INTELLIGENCE	06.02.2013	125,000
ALPHABET INC. acquires WAVII	23.04.2013	30,000
ALPHABET INC. acquires FLUTTER	02.10.2013	40,000
ALPHABET INC. acquires NEST LABS	13.01.2014	3,200,000
ALPHABET INC. acquires BEPOP	11.11.2015	380,000
ALPHABET INC. acquires ORBITERA	08.08.2016	100,000
ALPHABET INC. acquires APIGEE	08.09.2016	625,000
ANALOG DEVICES INC. acquires SYPRIS ELECTRONICS LLC'S CYBER SECURITY SOLUTIONS BUSINESS AND ASSETS	16.08.2016	42,000
AO SMITH CORPORATION acquires AQUASANA INC.	08.08.2016	87,000
APPLE INC. acquires CHOMP	23.02.2012	50,000
APPLE INC. acquires AUTHENTEC	27.09.2012	356,000
APPLE INC. acquires WIFISLAM	23.03.2013	20,000
APPLE INC. acquires CUE	03.10.2013	50,000
APPLE INC. acquires TOPSY	02.12.2013	200,000
APPLE INC. acquires SWELL	29.06.2014	30,000
APPLE INC. acquires BEATS ELECTRONICS	01.08.2014	3,000,000
APPLE INC. acquires TURI INC.	05.08.2016	200,000

AT&T INC. acquires TIME WARNER INC.	22.10.2016	108,700,000
BROCADE COMMUNICATIONS SYSTEMS INC. acquires RUCKUS WIRELESS INC.	04.04.2016	1,200,000
CACI INTERNATIONAL INC. acquires L-3 NATIONAL SECURITY SOLUTIONS INC.	08.12.2015	550,000
CISCO SYSTEMS INC. acquires CLIQR TECHNOLOGIES INC.	01.03.2016	260,000
CISCO SYSTEMS INC. acquires CLOUDLOCK INC.	28.06.2016	293,000
CROWN CASTLE INTERNATIONAL CORPORATION acquires TOWER DEVELOPMENT CORPORATION	08.04.2016	461,000
CROWN CASTLE INTERNATIONAL CORPORATION acquires FPL FIBERNET HOLDINGS LLC	01.11.2016	1,500,000
CYPRESS SEMICONDUCTOR CORPORATION acquires BROADCOM CORPORATION'S WIRELESS INFRASTRUCTURE BACKHAUL BUSINESS' ASSETS	28.04.2016	550,000
E*TRADE FINANCIAL CORPORATION acquires APERTURE NEW HOLDINGS INC.	25.07.2016	725,000
ENERGIZER HOLDINGS INC. acquires HANDSTANDS HOLDING CORPORATION	24.05.2016	340,000
FACEBOOK INC. acquires INSTAGRAM	09.04.2012	1,000,000
FACEBOOK INC. acquires PARSE	25.04.2013	85,000
FACEBOOK INC. acquires BRANCH	13.01.2014	15,000
FACEBOOK INC. acquires WHATSAPP	19.02.2014	19,000,000
FACEBOOK INC. acquires OCULUS VR	25.03.2014	2,000,000
FACEBOOK INC. acquires LIVERAIL	14.08.2014	450,000
FORTINET INC. acquires MERU NETWORKS INC.	27.05.2015	44,000
FRONTIER COMMUNICATIONS CORPORATION acquires VERIZON COMMUNICATIONS INC.'S WIRELINE OPERATIONS	05.02.2015	10,540,000
INTEL CORPORATION acquires REPLAY TECHNOLOGIES INC.	08.03.2016	175,000
INTEL CORPORATION acquires NERVANA SYSTEMS INC.	09.08.2016	408,000
MICROSOFT CORPORATION acquires YAMMER	25.06.2012	1,200,000
MICROSOFT CORPORATION acquires	07.01.2014	100,000

PARATURE		
MICROSOFT CORPORATION acquires SUNRISE ATELIER INC.	04.02.2015	100,000
MICROSOFT CORPORATION acquires LINKEDIN INC.	08.12.2016	26,200,000
PROOFPOINT INC. acquires NEXGATE CORPORATION	23.10.2014	35,000
PROOFPOINT INC. acquires EMERGING THREATS PRO LLC	02.03.2015	40,000
REALPAGE INC. acquires NWP SERVICES CORPORATION	23.02.2016	70,000
REALPAGE INC. acquires ESUPPLY SYSTEMS LLC'S ASSETS	16.06.2016	7,100
SALESFORCE.COM INC. acquires STEELBRICK INC.	23.12.2015	300,000
SALESFORCE.COM INC. acquires QUIP INC.	01.08.2016	582,000
SALESFORCE.COM INC. acquires KRUX DIGITAL INC.	03.10.2016	700,000
SS&C TECHNOLOGIES HOLDINGS INC. acquires CITIGROUP INC.'S ALTERNATIVE INVESTOR SERVICES BUSINESS	18.08.2015	321,000
SS&C TECHNOLOGIES HOLDINGS INC. acquires CONIFER FINANCIAL SERVICES LLC	15.12.2016	88,500
TESLA MOTORS INC. acquires SOLARCITY CORPORATION	01.08.2016	2,600,000
TRANSDIGM GROUP INC. acquires BREEZE-EASTERN CORPORATION	19.11.2015	206,000
TRANSDIGM GROUP INC. acquires ILC HOLDINGS INC.	24.05.2016	1,000,000
VARIAN MEDICAL SYSTEMS INC. acquires PERKINELMER INC.'S MEDICAL IMAGING BUSINESS	22.12.2016	276,000
VERIZON COMMUNICATIONS INC. acquires INTEL MEDIA INC.	21.01.2014	200,000
VERIZON COMMUNICATIONS INC. acquires YAHOO HOLDINGS INC.	25.07.2016	4,475,800
VERIZON COMMUNICATIONS INC. acquires XO COMMUNICATIONS LLC'S FIBER-OPTIC NETWORK BUSINESS	22.02.2016	1,800,000
ZAYO GROUP HOLDINGS INC. acquires ELECTRIC LIGHTWAVE HOLDINGS INC.	30.11.2016	1,420,000

Appendix B: NAICS Codes Used

Industry	Codes
Manufacturing	33
Machinery Manufacturing	333
<u>Commercial and Service Industry Machinery Manufacturing</u>	<u>3333</u>
<u>Computer and Electronic Product Manufacturing</u>	<u>334</u>
Electrical Equipment, Appliance, and Component Manufacturing	335
<u>Household Appliance Manufacturing</u>	<u>3352</u>
<u>Other Electrical Equipment and Component Manufacturing</u>	<u>3359</u>
Transportation Equipment Manufacturing	336
<u>Motor Vehicle Manufacturing (Only TESLA Motors Co.)</u>	<u>3361</u>
<u>Aerospace Product and Parts Manufacturing</u>	<u>3364</u>
Retail Trade	45
Nonstore Retailers	454
<u>Electronic Shopping and Mail-Order Houses</u>	<u>4541</u>
Information	51
<u>Telecommunications</u>	<u>517</u>
<u>Data Processing, Hosting and Related Services</u>	<u>518</u>
Other Information Services	519
Other Information Services	5191
<u>Internet Publishing and Broadcasting and Web Search Portals</u>	<u>51913</u>
<u>All Other Information Services</u>	<u>51919</u>
Professional, Scientific, and Technical Services	54
Professional, Scientific, and Technical Services	541
<u>Computer Systems Design and Related Services</u>	<u>5415</u>
Educational Services	61
Educational Services	611
<u>Educational Support Services</u>	<u>6117</u>