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R&D spending, stock market valuation & profitability

The effect of mergers and acquisitions in technology-intensive industries

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ABSTRACT:

Firms pursue growth internally via research & development activities and externally through mergers and acquisitions. There is a trade-off between them, and optimal allocation is crucial to company's long-term profitability and competitiveness. This study investigates the relationship between mergers & acquisition and research & development. More specifically, the aim is to examine how these strategic decisions affect stock market valuation and long-term profitability of the acquiring firm in technology-driven industries.

A sample of 401 US technology acquirer between 2010-2018 is constructed to test the linkage between M&As and R&D on stock market valuation and profitability. Previous studies report the positive effect of technology mergers to acquiring firm's valuation and profitability. Hence, the first hypothesis states that acquiring a technology firm increases the current market valuation of technology acquirer's R&D spending. Second hypothesis continues by examining whether M&As strengthen the linkage between acquirer's current R&D spending and its future profitability.

The stock market response towards R&D spending is found to be positive after M&As. That indicates that investors expect the merger to intensify the R&D activities of the acquiring firm leading to better performance in future. However, the expectations are not always fulfilled since the acquirer's R&D spending in the year of the M&A is not reflected more strongly in its future profitability than in other years. It is also found that the overall R&D spending of the acquirer decreases after M&As. These results illustrate the shift from so called scale deals to scope deals, where the mergers are motivated by access to new markets or product lines. It is suggested that due to more complex nature of the scope deals the post-merger integration problems may be pronounced.

KEY WORDS: Mergers & Acquisition, Research & Development, Stock Market Valuation

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1 Introduction

Sustainable growth is a crucial component in creating shareholder value. It can be pursued internally via research and development activities or inorganically through mergers and acquisitions. During recent decades mergers and acquisition activity has been increasing and gaining popularity. In 2018 mergers and acquisition hit new records and the market shows no signs slowing down (Deloitte, 2019). A large set of megadeals have taken place among corporate giants (Platt, 2018). The popularity of M&As speaks for the fact that executives believe M&As create value. Concurrent with M&A activity increase the role of R&D has emphasized especially in western countries, since evolving technology is unlimited component in economic growth. The rapid technological development and increasing competition partly due globalization has highlighted the importance of innovation. At the turn of the decade the role of innovation and sustainable solutions is strengthened elsewhere in societies as well as civilizations has faced unprecedented challenges, like global warming and recent coronavirus pandemic.

Mergers and acquisitions are strategic decisions that take place for various reasons. Shareholder value is increased through synergy benefits, efficiency gains, diversification, eliminating the competitors and strengthening the position in the market. Especially in downturns M&As offer rapid gain and help to maintain growth. Diversification can be viewed dispersing the risks since by buying companies from different industries the acquirer is able to generate income regardless of how the parent company itself performs.

Large companies often pursue a strategy of acquisitive growth. Pitts (1997) observes that after acquisition the acquirer's R&D spending decreases. This can be due to redefining internal R&D activities and enhancing the R&D efficiency. Synergy benefits including operational efficiency speak for creative destruction, i.e. eliminating redundant and overlapping activities. The growth, improved profitability and better cost structure are among the most common reason for mergers and acquisitions (Ali-Yrkkö, 2002). The aim later is to investigate the impact of M&As to R&D output as well.

Acquisition are likely to benefit companies. Incompetent management is replaced and resources are put in more efficient use. Large acquirers can also help the target companies to commercialize their innovation faster. Acquirers, in turn, get access to new technology, intellectual property or new markets, channels or product lines. However, the executives are not always aware of the trade-off between M&As and R&D. Investments in acquisition often serve as a substitute for investments in R&D. The more dependent the company is from innovation, the more it should consider the long-term effects and target selection (Hitt et al., 1991.) Part of M&As turn out to be unprofitable resulting shareholder value decrease, inefficiencies, and under-utilization of capacity in economy. Studies report that M&A activity is sometimes based on questionable motives (Hitt, Keats & DeMarie, 1998). These include company managers' personal incentives which are later presented more in detail. Poorly planned and executed mergers and acquisitions may backfire by impairing companies' competitiveness and long-term profitability. Therefore, it is crucial to consider the deals carefully and ensure the smooth implementation to avoid post-merger integration problems.

Studies report that the shareholder value increases especially in target companies, whereas the outcome for acquiring firm is more ambiguous. However, technology-oriented M&As are found to be beneficial also for the acquirers (e.g., Higgins & Rodriguez, 2006; Conn et al, 2005). Prior literature state that M&As in technology-intensive industries are strongly motivated by synergies. This is because the changes in technology-driven fields occur in a rapid phase and this increases the idiosyncratic risks. Therefore, companies seek for strategic fit and technological cooperation (Kallunki, Pyykkö & Laamanen, 2009). Hitt et al. (2001) report that technology M&As ease the access to new but complementary technology which enhances acquirer's R&D activities. The trade-off between M&As and R&D is in this regard less pronounced in high technology industries since technology M&As can be used for acquiring R&D to bridge the research gaps and to intensify the R&D processes. The synergies arising from technology are more unique and harder to replicate by competitors (Bertrand & Zuninga, 2006; Higgins & Rodriguez, 2006).

1.1 Purpose of the study

The purpose of this study is to investigate the relationship between mergers and acquisitions (later M&As) and research and development (R&D) activities, and their effect on stock market valuation of acquirer's current R&D spending and its future profitability. The aim is to assess the effects of M&As and R&D both separately and combined. The former studies show that the relationship between R&D and M&A is ambiguous and that there is trade-off between M&A and R&D to some extent as well. The goal is to find out whether M&As among technology firms can help the acquiring firm to increase its' R&D efficiency and valuation by harnessing synergies from technology-driven M&As.

Both M&A and R&D are needed in modern economy and it is important to allocate the investments optimally between those two. Mergers and acquisitions as well as research and development have both been examined and they remain timely topic. The strong standpoint has been their value creation and profitability separately rather than investigating them as combined. In this thesis the preliminary findings and conclusions are based on previous literature and established theories. There is strong evidence about the positive relationship between firm's R&D spending and its future profitability (e.g., Xu et al, 2008; Guo et al, 2007; Chan et al, 2001). When it comes to M&As and firm's performance, the prior studies yield mixed results.

The arguments favouring the technology-oriented M&As arise from the synergy theory presented by Bradley, Desai & Kim (1983). Hitt et al. (2001) suggest that the combined post-merger R&D is more efficient when both target and the acquirer are committed to R&D. Inspired by Kallunki, Pyykkö & Laamanen (2009), the following hypotheses are formed:

H1: The current market valuation of the technology acquirer's R&D spending increases when acquiring a technology target.

H2: Acquiring a technology target strengthens the linkage between technology acquirer's R&D spending and its future profitability.

These hypotheses are examined by constructing a sample of US public acquirers and M&A transactions between 2010-2018. Although it is known that the post-merger performance may be different for small and medium-sized firms than for large ones, the size of a firm in M&As is not taken into account in this thesis per se, since it is harder to observe firms that are not publicly quoted.

1.2 Structure of the study

The thesis follows the following structure: chapter two focuses on mergers and acquisitions. It presents the incentives and latest trends in M&As. It also presents theoretical framework with value-increasing and value-destroying theories and the principle-agent dilemma. The decision-making regarding M&As is analysed at firm-level and from macroeconomic perspective.

Third chapter focuses on research and development. There is discussion about characteristics of buyers and sellers and the firm-specific features affecting on R&D spending. The importance of constant development and the linkage to the competitiveness is also emphasized. The aim is also to shed light on other factors at macroeconomic level that may have influence on R&D spending. The PEST analysis is used in this examination with some modifications.

Chapter four presents the data and methodology. The sample data is collected and combined from Thomson Reuters Eikon's Datastream and Worldscope platforms. The OLS regression specifications and descriptive statistics for the variables are also presented. The following chapter presents the results. In chapter six there is discussion about the results and previous research. Lastly, chapter seven summarizes and concludes the thesis.

2 Mergers & Acquisitions

Mergers and acquisitions serve as a strategic tool to grow and reorganize the business. The distinction between mergers and acquisitions is not always clear to the public audience and in common language the concepts are used parallelly (Jensen, 1998). Both refer to joining of two or more entities, but the two concepts can also be distinguished. Acquisition refers to takeover of another company or part of it. In merger companies join and intend to form a new entity as equal partners. Mergers and acquisitions are either friendly or hostile. Hostile M&As are accomplished through tender offer or proxy fight and are opposed by the target company's management. In both friendly and hostile M&As it is usually reasonable to retain the control in one company. One firm stands as surviving corporation while the other firm gets absorbed (Badrtalei & Bates, 2007).

2.1 Different types of Mergers and Acquisitions

Mergers and acquisitions are part of operational restructuring of the company. They can be classified by different ways, but the most common classification includes four forms. Horizontal merger or acquisition takes place when two or more companies producing similar commodities join. Vertical M&As combine different business units that belong in the same value chain. Concentric mergers comprise firms that work in the same industry but in different value chain and produce different commodities. Lastly, conglomerate M&As join companies that operate in different industries and do not have direct linkage in their business. Conglomerate mergers can be either pure or mixed; in pure mergers the companies are completely unrelated businesses and in mixed mergers the companies seek for product or market extension.

The goals of different M&A types differ. When a company enters horizontal or vertical acquisition, it aims to expand its business within the same sector and gain larger position in the markets. The advantages in concentric and conglomerate M&As are generated from diversification as the acquirer's and target firm's businesses are separated.

Horizontal and vertical are closely related to scale deals, which involve companies whose businesses overlap. Concentric and conglomerate mergers, in turn, bear resemblance to scope deals, which are M&As with distinct but related target firm (Harding, Jackson & Shankar, 2013).

Mergers and acquisitions are also often classified into asset deals and share deals. In asset deal the trade involves buying the target company's tangible and intangible assets that are important to acquirer's operations. (Immonen, 2014: 18). In share deals the acquirer purchases the shares. Share deals also have secondary market in exchanges. When the acquirer possesses more than 50 % of the target company's shares, it becomes the parent company and has control over its subsidiary's actions.

2.2 Incentives for Mergers and Acquisitions

Berkovitch and Narayanan (1993) present three major motives for M&As. Those are synergy-, agency- and hubris-based. Usually all three are involved in decision-making. Ali-Yrkkö (2001) presents that in the finance and economics literature the strongest motive found for M&As is improvements in economic performance. In addition to value increase the synergy benefits often refers to cost reductions. Merging or closing branch offices, outsourcing certain activities and intensifying the lead time in joint value chain can generate significant savings. The costs to be cut can also include expenditures related to information technology and administration (Ali-Yrkkö, 2001). Potential cost reductions can also be found from diversifying M&A. These include costs spend on trade and communications (Arrow, 1975). According to Morck, Shleifer & Vishny (1988) the motive for an acquisition determines whether it is experienced as hostile or friendly. Synergistic M&As are viewed friendly more often than disciplinary acquisitions. Mergers can also improve the financial position of companies because of possible tax advantages and because the cost of internal financing are typically lower than the cost of external financing (Myers & Majluf, 1984).

There have been previous studies examining whether M&As within technology industry help the acquirer to improve its R&D operations. Bertrand & Zuninga (2006) present that companies substitute their internal R&D activities by M&As. Higgins & Rodriguez (2006) find that within technology-driven industries acquirers aim to pursue innovation and widen their R&D activities by acquiring other technology firms. To fully utilize the acquired R&D the target company's technology must complement the acquirer's technology.

Gaining market power is also related to economic performance. Market power can be generated by several ways. Diversifying M&As, i.e., concentric and conglomerate mergers, offer a way for a parent company to diversify risks and generate income regardless of its own performance. Second, it is often more profitable for a large company to acquire competitor and obtain access to R&D and innovation rather than entering "R&D race" (Phillips & Zhdanov, 2012). In horizontal acquisition the acquirer can gain significant market power by absorbing a competitive firm. In industries with little operating companies this may lead to market leadership, even to oligopoly or monopoly (Stigler, 1950). Yet, countries have laws considering monopolies but sometimes the monopoly can come into existence naturally. Once the company is large enough, it may also be able to create barricades for entry for its future competitors by practicing predatory pricing, although this procedure is illegal according to most competition laws.

One incentive in M&As is to acquire resources and assets. These assets can be tangible and intangible, such as patent and employees' skills. Especially when a company wants to go international, acquiring existing company in the target country increases the capacity more rapidly than a greenfield investment and spares the acquirer from building foreign company from the scratch. Within foreign acquisition the acquirer can also obtain some practical and valuable know-how about target country's environmental factors (Ali-Yrkkö, 2001). However, at least in emerging countries self-developed resources are more prominent and advantageous than those endowed via acquisition (Yiu, Bruton & Lu, 2005). According to Jensen (1998), managers of companies compete for the rights to

control the company's resources and the stronger managers tend to become buyers as the weaker managers are persuaded to sell and give up the control. If the acquisition is based on efficiency and better performance, usually both the acquirer and the selling company gain benefits. The target company also gains when the acquirer overestimates the value of the target firm (Berkovitch & Narayanan, 1993).

Other motives originated from managerial level are rooted in principal-agent-theory. Sometimes owners (principals) and managers (agents) goals differ and even when it can be justified to separate management and ownership problems may arise (Garen, 1994). Managers may gain more financial benefits by making short-term decisions that may be harmful to the company's shareholders in the long run. Hubris-based theories differ from agency theories in a sense of personal motives. Whereas in agency theories the executives may have strong personal incentives in M&As, hubris refers to well-intentioned motives ruined by overconfidence and arrogance.

2.3 Recent Trends in M&A

Besides the incentives at firm-level, there are macroeconomic factors that effect on M&A activity, too. Mergers occur in big macroeconomic changes. Shocks caused by technological, economic, and regulatory factors drive industrial merger waves. The outcome of those waves is dependent on the current capital liquidity on the market (Harford, 2005). Political decisions such as free trade areas as well as excess capacity in the market act as driving forces in M&A activity (Ali-Yrkkö, 2002).

Mergers also occur in waves (Harford, 2005). Both cross-border and domestic M&A tend to cluster by industry and time (Xu, 2017). M&A activity has rapidly increased after 1990s. The countries with most waves are the United States, the Great Britain and France. In US there have been even 46 merger waves and most of them have emerged during recent decades. One of the main reasons for the waves and increased M&A activity is globalization and deregulation. Kleinert & Klodt (2002) present that simultaneous coincidence

of these two and their interrelation caused the fifth large merger wave, which was largely consisted of cross-border mergers. Privatization also has had an impact on the waves and alongside deregulation in certain industries that explains why mergers tend to cluster. One explanation for the M&A patterns is found from psychology. Chan & Cheung (2016) find that countries with cultural aspect of individualism and extraverted behaviour have an impact on the M&A patterns across countries. They state that there is a positive relationship between M&A activity and extraverted traits among the executives.

For now, United States remains the largest acquiring nation measured by number of deals (Institute for Mergers and Acquisitions, 2018). However, The M&A activity is growing faster in emerging markets and Asian countries are leading the developing world. Developed and developing countries do not operate apart and the balance of power between nations has shifted. The consolidation between the two markets is rapid and it is more common that the acquiring party comes from emerging country (Rothenbuecher & von Hoyningen Huene, 2012). According to Institute for Mergers and Acquisitions (2019), the value of domestic, outbound, and inbound M&As in the United States accounts for 62%, 10% and 28%, respectively. Most M&As are national but the share of inbound mergers is increasing in rapid phase.

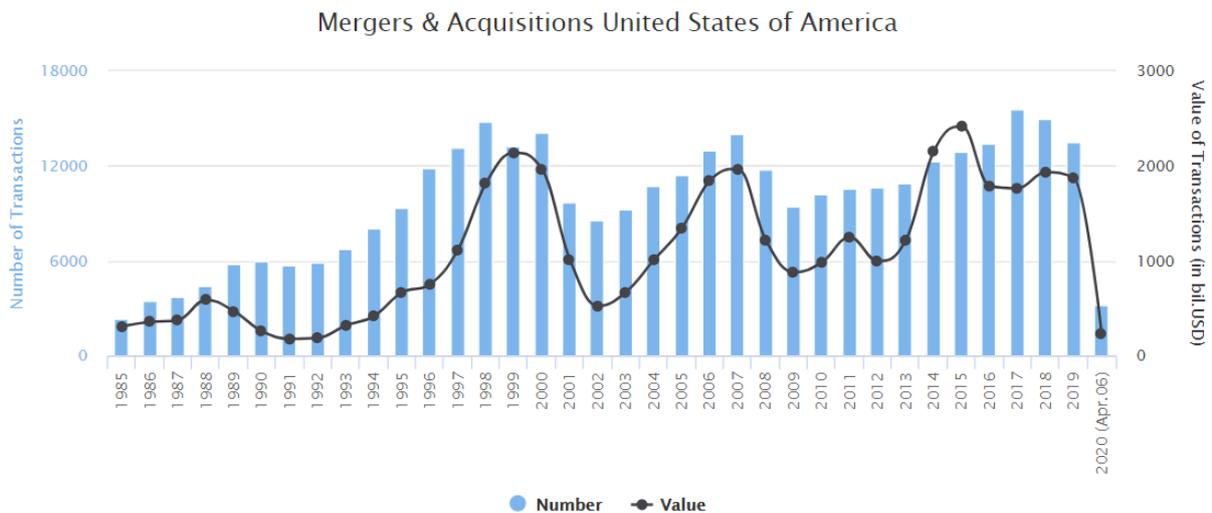


Figure 1. Mergers & Acquisitions in US 1985-2019

The figure above illustrates how the mergers occur in waves. The fifth merger begins in 1993 after the economic slump of 1990-1991 and peaks five years later. The next slump in M&As activity occur in financial crisis of 2008. The steady growth of technology M&As towards the end of examination period in this study's sample is in line with the pattern in figure 1.

The role of M&As is perhaps the most enhanced in technology-intensive industries. Haller & Johnson (2019) report that deals in tech sector has been growing 31 % annually over the past five years. There has been a shift from horizontal and vertical M&As towards concentric and conglomerate M&As. Haller & Johnson find that these so called scope deals account almost 90 % of technology M&As in 2019, and that the share of scope deals is increasing rapidly in technology-driven industries, whereas it has remained the same in other industries. This suggests that the incentives for the mergers originate more and more from gaining access to new markets or product lines.

2.4 Value increasing theories

The assumption behind value increasing theories is that M&As benefits the companies by creating synergies that increase the firm's value (Hitt et al., 2001). These synergies can be operational or related to increased market power or corporate control. Value increasing theories include theory of efficiency, theory of corporate control and theory of market power.

2.4.1 Theory of efficiency

Theory of efficiency relies on the principle that by merging operative synergies can be achieved (Weitzel & McCarthy, 2011). The merger is friendly in most cases and both

parties have similar expectations about the outcome. Therefore, both the target company and the acquirer have positive returns. The efficiency is generated from abolishing unprofitable projects, removing bottlenecks and overlapping operations and utilizing possible benefits of scaling. This coincides with the concept of creative destruction, where useless affairs are eliminated (Schumpeter, 1942). Cutting the redundant activities can lead to improved efficiency of R&D as well, even when the overall R&D budget is reduced. The acquirer gets also access to intangible assets like patents and software. That can intensify the acquirer's R&D processes resulting innovations on a faster phase. In technology M&As both the target firm and acquirer are committed in R&D since agile development in high technology industries is crucial. Synergies arise when the technology obtained in M&A is put in more efficient use through integrating it to acquirer's existing technology and through faster commercialization.

However, the actual source of those benefits is ambiguous and it is under debate. Chatterjee (1986) emphasizes the difference between efficiency gains arisen from economies of scale and allocative synergies generated from strengthened market power. The majority of recently conducted studies agrees that the gains are results from increased efficiency, i.e. operative synergies (Mukherjee, Kiyamaz & Baker, 2004; Houston, James & Ryngaert, 2001; Devos, Kadapakkam & Krishnamurthy, 2008). Yet, there are dissenting opinions that speak for phenomena related to market power as explaining factor; greater consumer surplus extraction, market mispricing and power through monopoly (Banerjee & Woodrow, 1998).

2.4.2 Theory of market power

Theory of market power refers to situation in which new, merged company has more market power than they had as separate companies. This is valid especially in horizontal and vertical mergers when M&As occur within same industry and the expansion takes place within same business sector. As two smaller former companies are replaced by one larger one, the new firm can act as price settler and generate surplus from higher prices

(Weitzel & McCarthy, 2011). Another way to gain is to lower costs and final prices (Posner, 1976). The theory is more applicable in the concentrated markets and the market power is related to the size of the company. Chatterjee (1991) finds that the gain in vertical mergers is maximized when the acquirer comes from concentrated markets and target company from fragmented markets. The theory is also linked to the size of companies since the bigger firms gain more than smaller ones.

Market power theory also acknowledges synergy benefits, but unlike in efficiency theory, the benefits arise from allocative synergies. Oligopoly acts as an incentive for M&As in horizontal and vertical mergers. Porter (1980) suggests that oligopoly via vertical integration can create barricades for entry and help to maintain the market position. Oligopolies occur in several industries. However, if monopoly in the market is achieved, the confluence between efficiency theory and market power theory disappears and the newly formed monopoly starts losing its agility and capability to innovate. This is because monopolies are widely argued to be inefficient. Lowered ratio of R&D spending to the book value of equity could be a warning sign in this regard. The firm no longer faces constant pressure to outperform competitors and this can lead to inefficient business functions and under-utilization of resources.

2.4.3 Theory of corporate control

Theory of corporate control focuses on management rather than operative synergies. In the light of this theory managers of firms are seen competitors and the weaker one is replaced by a stronger leader. The winner is the one who can offer most value to the shareholders. This is somewhat dynamic process where more competent managers replace weaker ones. In this case the creative destruction is directed towards personnel. Whereas efficiency theory suggest that the synergies add extra value to assets, corporate control theory favours the view where competent management re-allocate resources that were under-utilized in target company (Weitzel & McCarthy, 2011). Mergers are successful when they result well-functioning firms that can fully utilize their assets. Solid

merger markets increase the wealth of shareholders and the whole society (Jensen & Ruback, 1983).

Takeovers are primarily hostile according to the theory of corporate control. There are controversial interpretations about the functionality of this theory. In hostile takeovers the boardroom changes typically occur regardless of the former performance (Franks & Mayer, 1996). According to Hitt et al., (1996) companies that actively sell or buy businesses are likely to innovate less internally. This may be an indicator of ill-advised target selection. Even though the management knows the importance of innovation, they often rather pursue the leadership regardless of the costs. Investing in R&D includes risk since there are no guarantee the outcome would be prolific. According to prospect theory people avoid uncertain wins and prefer short-term benefits over long-term advantages, even when the short-term wins are smaller.

2.5 Value destroying theories

Majority of mergers fail and do not increase shareholder value (Christensen, Alton, Rising & Waldeck, 2011). Similar results have been observed in other studies as well. Mergers fail for several reasons, such as flawed intentions, unfavourable macroeconomic conditions, poor communications and weak implementation. The common factor of value-destroying theories is rooted in managerial level and the theories can be classified into two groups. The first group assumes that the management of acquirer is not fully rational. The second profess the rationality but alongside personal incentives (Weitzel & McCarthy, 2011). Value destroying theories include managerial hubris, discreditation, entrenchment and empire building.

2.5.1 Hubris

Managerial hubris is a phenomenon where the value of the target firms is miscalculated (Roll 1986). This miscalculation results from overconfidence or arrogance of firm

management. Hubris is common among overconfident managers who have tendency to go blind to their deficiencies (Kroll, Toombs & Wright, 2000). They overestimate their abilities to create shareholder value. Due to hubris the managers may take excessive risks when acquiring a company without proper evaluation.

Overconfidence increases the likelihood to overpay from the target firm (Malmendier & Tate, 2008). There is empirical evidence about hubris in both US and Europe, where approximately one third of M&As is motivated by hubris. Rau & Vermaelen (1998) state that hubris is more common among so called glamour firms with low book-to-market ratios. Motives for M&A can also be speculative. Yet, evaluating speculative behaviour is challenging because managers barely want to admit to having pursued acquisitions opportunistically (Ali-Yrkkö, 2001).

2.5.2 Discreditation

Jensen (1986) moves the focus of motivation from personal traits to company's balance sheet. He presents that unprofitable mergers are due to excess liquidity and free cash flow. According to Martynova & Renneboog (2008) executives have tendency to invest the money to M&As even when there are no well-performing target companies on the merger market. Counterintuitively, the more excess money the company has, the more short-sighted decisions the managers make. This can be a result from house money-effect and mental accounting, where managers take greater risk when reinvesting profits and other "extra" money. Instead of investing the money into something long-term the money is spent in strategic decisions that need little consideration. This is opposite to the firms with low liquidity (Weitzel & McCarthy, 2011). The management can also feel pressure from other stakeholders to execute mergers rather than keeping the money reserved for future investments.

The similarity with previous theory arises not from manager's personal incentives but from irrationality. However, this does not exclude the simultaneous opportunistic

behaviour of management. Managers consider and evaluate the M&As more when they are concerned financially themselves (Harford, 1999).

2.5.3 Entrenchment

The theory of managerial entrenchment suggests that the management enters investments that minimize the risk of being replaced (Shleifer & Vishny, 1989). Entrenchment has confluence with corporate control theory, and it can act as a counterforce for that. Whereas corporate control theory suggests that incompetent managers are replaced, entrenchment is a phenomenon that makes the managers fight for their position. The managers aim to increase not the shareholder value but their own individual value to the company. They execute investments with high opportunity costs so that the replacement of current manager would be expensive. Therefore, the investments do not tend to be long-term since long time intervals before profit making increase the risk and R&D expenditures cannot be capitalized easily.

Risk-aversion further reduce investment rate on long-term projects. This has negative impact on shareholder value since the asset allocation is not optimum. Counterintuitively, the better position, the fewer risks are taken. Like other people, managers also avoid uncertain wins and want to ensure their position (Kahnemann, 2011). Besides job security managers may aim to gain fame, wealth and status as well. Managers pursue especially conglomerate mergers in order to make the earnings rate more stable by decreasing earnings volatility (Amihud & Lev, 1981). High volatility in earnings makes the stakeholders incredulous and impairs the position of manager. Chakraborty, Rzakhanov & Sheikh (2014) present that managers whose position is secured perform poorly on innovation which eventually lead to lower firm value. However, high-tech companies seem to be robust against managerial incentives and the impact of value decreasing phenomena dissipates in highly innovative firms (Chakraborty et al, 2014).

2.5.4 Empire building

Like entrenchment, empire building too arises from personal incentives and cause agency problems. Managers aim to grow the business as fast as possible with minimum profit requirements. This is problematic since growth alone does not indicate the long-term success. Growth without profitability serves the management but not the shareholders. As the desired rate of return is not fulfilled, the value for shareholder decreases (Weitzel & McCarthy, 2011).

Growth through M&As is often motivated by managerial power and the goal is to maximize growth rather than profits (Rhoades, 1983). This do not favour any long-time commitments, since long-term advantages resulting from R&D require risk-taking. From this perspective it seems that internal growth through R&D is more sustainable than inorganic growth via M&As when the motives for growth are affected by managerial incentives.

2.6 Principal-agent dilemma

The principal-agent dilemma is an example of moral hazard and it usually arises from managerial incentives in value-destroying theories. The typical situation is excessive risk-taking in pursuing fast growth on the expense of shareholder value. The principal-agent problem may arise between the acquiring firm (principal) and the target (agent), too. The acquirer is seeking to maximize the benefits from the merger with minimum price. The target firm, in turn, seeks maximized premium with minimum effort. Managers with hubris overestimates their capacity to harvest synergies and value from the selling firm ending up paying unjustified premia (Hodgkinson & Partington, 2008).

Asymmetric information between acquirer and target most likely has explanatory power over high failure rate in M&As. Information asymmetry can be related to hidden firm characteristics, actions, information or intentions. Several studies conclude that the

information asymmetry affects the uncertainty and wealth generated by both acquirer and target (e.g., Officer, Poulsen & Stegemoller, 2009; Chemmanur, Paeglis & Simonyan, 2009).

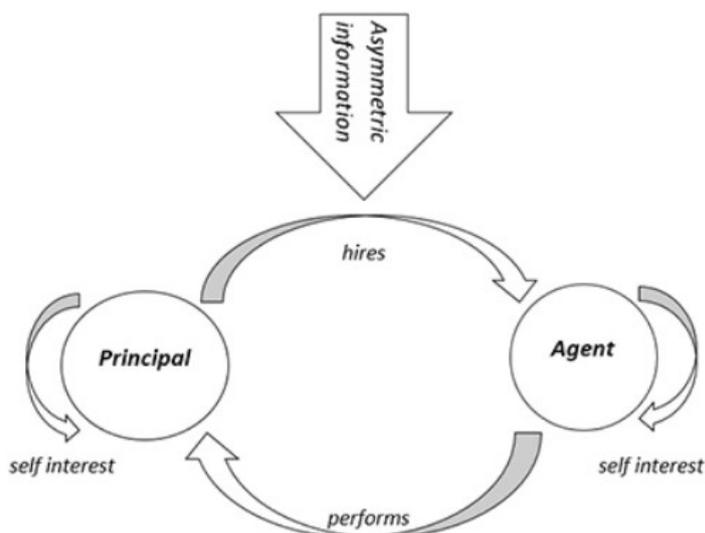


Figure 2. Principal-agent dilemma

In order to pay justified premium the acquirer must evaluate and price the target correctly. Likewise, the increase in wealth for the shareholders of the target firm depend on the acquirer's ability to extract value from target and create synergies (Luypaert & Van Caneghem, 2017). A "lemons problem" proposed by Akerlof (1970) refers to hidden characteristics and occur when the target firm possesses undisclosed information about its own value and accepts only offers that exceed its actual value. Luypaert & Van Caneghem (2017) suggest that to protect themselves from adverse selection the acquirer can offer the payment in stocks, when the value for the target is also dependent on the market reaction between the M&A announcement and M&A completion. On the other hand, if the acquirer believes there will be incremental gains after the deal completion, the acquirer tries to keep any additional gains to themselves. In that case the acquirer can offer fixed cash offers as payment.

3 Research & Development

Companies invest money on research and development activities in order to obtain new information, to develop better technology and to contribute to innovation. This helps companies to solve problems, gain advantage in competitive markets and to gain increased profits in the future. R&D is one of the companies' key activities. The role and the importance of R&D depends on company's activities, industry, and macroeconomic factors. R&D is the starting point when a company wants to launch a new project or service. It takes a lot of money and time and it creates the base to later success. Von Zedtwitz & Gassmann (2002) observe that research is centralized in only five areas in the world, whereas development takes place more globally. This thesis investigates next the essence of R&D and why companies should spend money on that. Then the factors that may have an impact on willingness to invest in R&D are analysed briefly. Those factors are touched on with PEST analysis. Willingness to invest in R&D depends on managerial views and missions but is affected by many other factors, too.

Studies show that R&D expenditures are the most important variable in innovation (Dosi, 1988; Freeman & Soete, 1997), although they do not directly measure the amount and quality of innovations. Shefer & Frenkel (2005) also state that if the company has had a successful innovation in the past, it is more likely to increase its' R&D budget in the future. R&D is ultimately the source for the increase in the total revenue and productivity. The results of R&D are not immediate but rather cumulative. Within successful R&D companies gain advantages in the markets by sparing raw materials, reducing cost which lead to lower prices or by increasing efficiency or coming up with better products or services.

3.1 R&D expenditures by country and industry

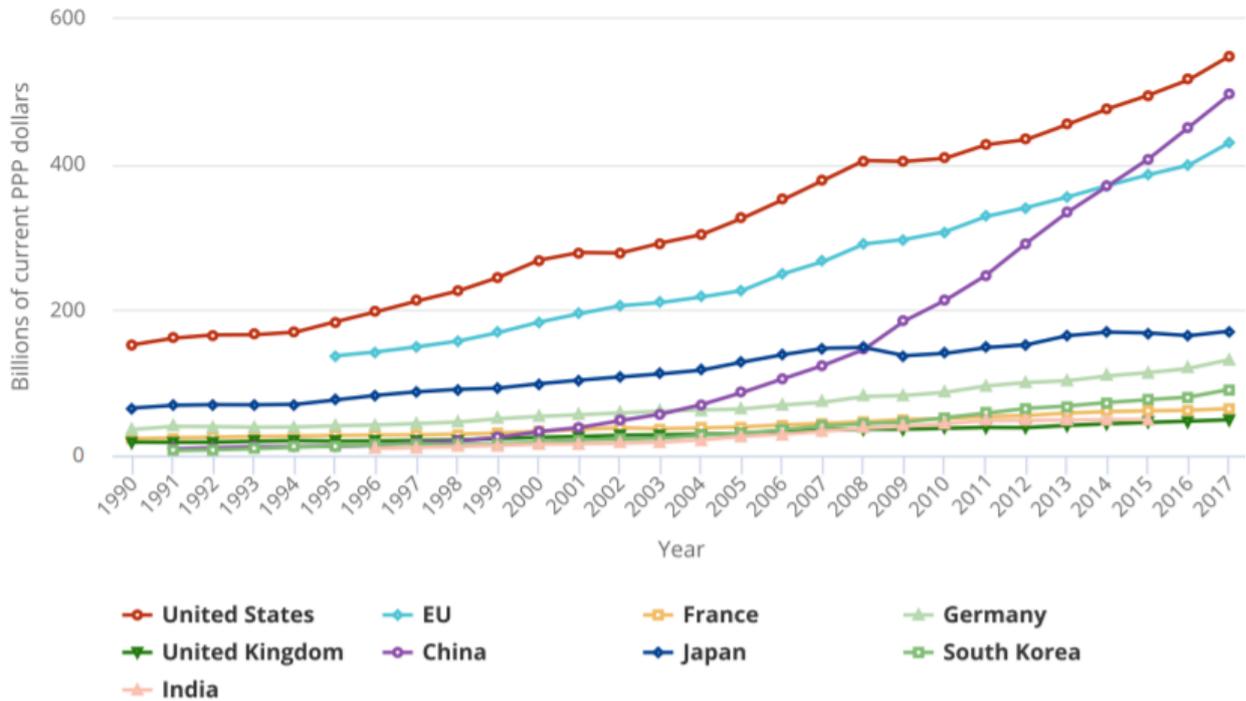
The amount of R&D investments differs between industries and countries. For now, the biggest R&D expenditures are concentrated on a few industries. Top three industries

measured in R&D expenditures in 2018 are pharmacy & healthcare, computing & electronics and software & internet (Jaruzelski, Chwalik & Goehle, 2018). Technology has improved rapidly in recent decades and that development is expected to be continued in accelerated phase. Fast and anticipatory development is crucial because current technology becomes obsolete fast and it needs to be constantly developed. In technological frontier there is a lot of competition, start-ups and giant multinational corporations competing together. The leap to the technology front line is relatively easy to take whereas moving the frontier ever beyond is tougher. Companies operating in pharmacy & healthcare are competing with patents to maintain profit margins and to cover R&D expenditures. The demand is also increasing due to shift in age distribution as people are aging in western countries. Healthcare has also the preventive aspect; it is most often easier to prevent diseases than cure them.

Studies show that besides the industry R&D expenditures have connection to the size of the firm, location, type of ownership and organizational structure. R&D concentrates on urban areas. R&D expenditures and firms size has a positive correlation; large companies spend more on R&D than small ones (Fisher & Temin, 1973). High-tech companies are often export-oriented and as shown earlier, industries related to high technology use significant share of global R&D expenses (Shefer & Frenkel, 2005).

The biggest investors on R&D in absolute are the US, China, Japan and Germany. Top ten companies investing the most in R&D in August 2019 are all originated from either US or China when measured by market capitalization (Ventura, 2019). Countries spending the most gross domestic expenditure on R&D as a percentage of GDP in 2016 are the US, China, Australia, France, Germany, Sweden and Finland. Interesting fact is that whereas the share of western countries in R&D spending has dropped, East Asia has increased its share since the financial crisis (UNESCO Institute for Statistics, 2019). Especially China has increased its R&D spending in accelerating phase. Figure 3 below shows that the increase in gross domestic R&D expenditures has been growing steadily in US and EU, whereas the R&D budget increase in China has been exponential from 2000 onwards.

Gross domestic expenditures on R&D, by the United States, the EU, and selected other countries: 1990–2017



EU = European Union; PPP = purchasing power parity.

Figure 3. Gross domestic R&D expenditures 1990-2017

3.2 Buyers and sellers

Bena & Li (2013) present that in general companies with lot of patents in their portfolios and low current R&D expenditures are acquirers, whereas companies who invest a lot in research and development, have fewer intangible assets and slower growth rate are target firms. Acquirers also have higher innovation output. In other words, larger firms and fast-growing firms with better operating performance are more likely to be acquirers whereas smaller or lower-growing firms end more likely to be target firms. Start-ups make an exception being fast-growing and in-demand targets. For some deals, acquirers are motivated by the target firm's R&D that is not fully commercialized and sellers are motivated by the premium they receive in the acquisition (Szücs, 2014). Technological

overlap benefits for both the acquirer and the target when the motivation for the merger or acquisition arise from synergy benefits. Therefore, firms that have high innovation rate are likely to engage mergers and acquisitions. Technological acquisitions that are driven by synergy are reported to improve their later innovation outcomes.

Companies to be absorbed through friendly takeovers are usually relatively young and fast growing. Haller & Johnson (2019) report that innovation in technology companies is in transition from internal R&D to start-ups which are more often financed by venture capital. Small companies that want to sell out may decide to invest more in R&D (Phillips & Zhdanov, 2012). Those firms tend to have high Tobin's q ratio meaning the market value of company that is divided by company's assets' replacement costs. When the acquisition is hostile, the target firm is usually older but relatively smaller firm, whose growth has slowed down significantly. (Morck et al, 1988.)

3.3 Exogenous factors affecting on R&D

The macroeconomic environment sets the framework for companies' operations and they must be able to cope with the changes that occur around them. Over 30 years many scholars have attempted to find and explain the critical factors that define the success of projects generated from R&D. These factors can be found at the firm-level as well as from macroeconomic environment. Because alongside M&A there are a set of other factors affecting R&D, in the next subsections there are presented some environmental factors that contribute to decisions about R&D investments. This review is rooted in PEST analysis.

3.3.1 Political and Legislative factors

Several economic studies show that regulation decreases productivity growth (Gray & Shadbeglan, 1993). According to Aggarwal (2000), interference by government had

dampening effects on technology imports and therefore on R&D as well in certain regimes of India. In the studies conducted in the US the findings suggest that when government discharges regulation on energy sector, the R&D expenditures decreases (Dooley, 1998). This kind of behaviour can result negative externalities to the environment. Therefore, sometimes legislation act as indirect incentive for R&D, for example by imposing pollution or emission taxes. In numerous studies published it is presented that under incentive-based environmental policies incentives towards R&D are stronger than under control and command (Jaffe & palmer, 1997). R&D expenditures are increased when the societies face mutual challenges. Fernández, López & Blanco (2018) find that the net effect of innovation has positive impact on CO₂ –emissions since there is an inverse relationship between innovation and CO₂-emissions. The significance in the role of the politics is uncharted, but it is likely that politics can either help to speed up the innovation or suppress that by trying to influence on public opinion.

3.3.2 Economic factors

Cyclical patterns can be observed when examining the amount of firm-financed R&D expenditures. Overall innovation may decrease over time if the amount reduced in R&D during downturns is bigger than the excess amount invested in booms. (Rafferty, 2003; Fatas, 2000). It can be easy to cut the budget of R&D since R&D exertions are not crucial in everyday operations (Barret, Musso & Pahdi 2009). It could be reasoned that the trade-off between M&A and R&D is emphasized when the economy is slumping, since it is easier to search growth from acquisitions than take more risks by increasing expenditures for the accounting period.

Figure 3 below shows the parallel movements in GDP and R&D expenditures growth. When the GDP growth decreases, the growth in R&D spending decreases more fiercely.

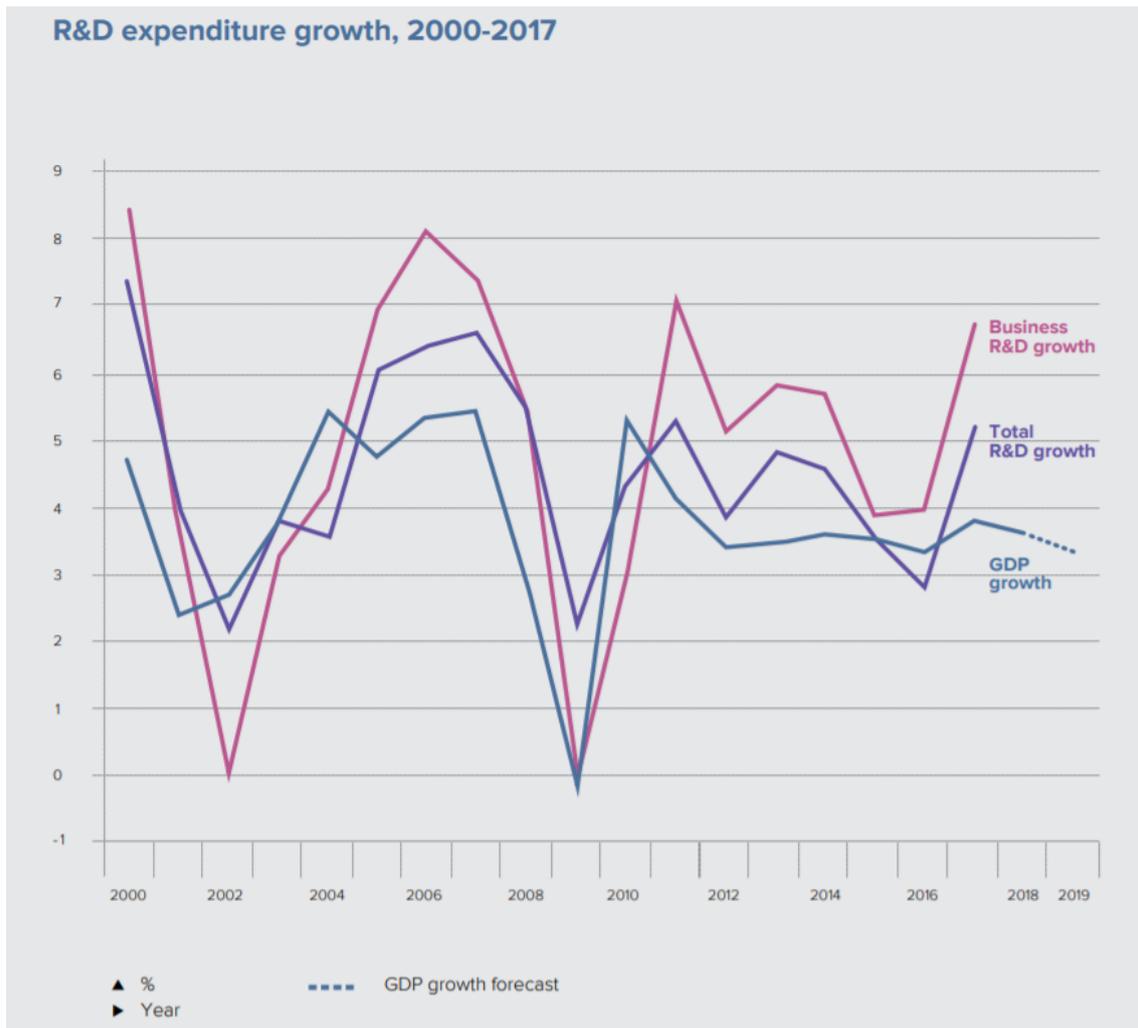


Figure 4. Global GDP and R&D growth

During dotcom -crash in 2002 and financial crisis in 2009 the growth of R&D spending reached zero or even negative values.

3.3.3 Sociocultural factors

At least for now R&D cannot be outsourced to machinery, and R&D is conducted by humans. Therefore, sociocultural factors and human capital play a critical role in research and development. Wang & Huang (2007) present that the better general English skill level the country has, the more it will invest on research and development activities. This is not unequivocal since speaking a certain language is not a condition for R&D, but high

national skill level in English implicates that the country has prerequisites for international cooperation that promote innovation spread. Lee, Wong & Chong (2005) add that education is major factor in R&D since complex tasks require strong educational base. This human capital can, in turn, be shared and accumulated via mergers and acquisition and increase the post-merger value (Lee, Mauer & Zu, 2018).

3.4 R&D effectiveness

Increasing the effectiveness of R&D is the most important objective in R&D management. Effectiveness must be proved for several reasons; to justify the R&D expenditures, to estimate the growth via R&D exertion and to further improve efficiency (Schwartz, Miller & Plummer, 2011). Measuring R&D effectiveness is tricky since R&D projects are usually complex and time-consuming. Several aspects, such as competition and customer support must be considered as well. Expenditures alone is not relevant measurement. For example, consulting company Booz & Company states that R&D expenditures do not correlate with company's market value, and the crucial factors are innovation-oriented culture and strategic alignment (Knott, 2012). However, those are hard to measure since they cannot be converted into numerical data.

According to Werner & Souder (1997) methods developed to measure R&D effectiveness lack systematic classification. Techniques are often divided between micro- and macro-level. The former measures the impact in firm level and the latter view the effects in the whole society. The metrics used also vary case by case and can be quantitative, qualitative or combination of these two. The problem is to find matching metrics for every layer of R&D process. McGrath & Romeri (1994) present the R&D effectiveness index, which measure product development performance by comparing product's profits to its expenses during product development stage. After application they find strong positive relation of the index and other factors that measure R&D performance. Also, strategic tools, like Balanced Scorecard are used to evaluate R&D performance (Bremser & Barsky,

2004). Its advantage is that it measures both financial and non-financial aspects. It also brings managerial commitment and leadership skills into evaluation.

Knott (2012) presents research quotient (RQ), a new metric for measuring R&D productivity. It helps to evaluate the R&D performance compared to competitors and to perceive the relation between R&D strategy and profitability. It uses the same formula than in measuring capital and labour productivity but expands this equation by adding third input. To successfully calculate RQ one needs enough data of components. 100 denoting the average, most companies measured have RQ between 86 and 115. (Knott, 2012).

RQ is stated to be universal, reliable and uniform. It gathers the data straight from numerical financial information, so there are no restrictions concerning firm size or industry. Preliminary findings suggest that RQ rises within the breadth of company's activities and varies for different innovation types. RQ is also negatively correlated with outsourced R&D which favours that R&D made in-house outperforms cooperative R&D. (Knott, 2012.) Even though RQ is relatively new, several studies have adopted the concept (see Cooper et al. 2018; Santi 2019).

4 Data and Methodology

This chapter presents the data and methodology for the empirical research. Then, the methods and model specifications used to test the hypotheses are introduced. The use of each model is motivated by previous literature and research.

4.1 Data

The data is retrieved and combined from Worldscope and Datastream platforms from Thomson Reuters Eikon database. The sample consists of M&As with technology target and US technology acquirer during the time period of 2010-2018. The sample includes a wide range of technology-intensive industries, categorized by the following 2-digit SIC codes: 28, 35, 36, 37, 38, 48, 73 & 87¹. This categorization is originally adapted from OECD and first used by Hall & Vopel (1996). Firms whose primary business sector is solely in software are excluded from the sample, since for those companies, intellectual property is secured usually with copyrights, not with patents.

The dataset contains completed control M&As where the ownership of the target firm is less than 50% before the transaction and 50% or more after it. In most cases the bidding firm acquires 100% of the voting shares of the target firm. Data selection is limited to public acquirers since the information from financial statements is more readily obtained for public companies, and they are also more closely followed by analysts and investors. The target companies come from US and other developed countries. Almost every acquisition in the sample was reported to be a friendly one, suggesting that the motives arise from synergies.

The study consists of a sample with 401 acquirers yielding 3,609 firm-year observations. An important criterion for sample selection was the financial statement availability. Table

¹ See appendix A.

1 describes the distribution of acquirers and acquisitions over the examination period. The total number of M&As is 2,810, but in the final sample only one acquisition per firm per year is included. That leaves 1,474 M&As. If the acquirer makes several acquisitions within a year, those acquisitions are recorded in the $DEALS_{it}$ variable. This criterion has been previously applied by Kallunki, Pyykkö & Laamanen (2009) and Danzon, Epstein and Nicholson (2004). Targets and acquirers of all sizes are included in the sample, but due to the lack of disclosed information the size of the target company in relation to the size of the acquirer cannot be controlled for.

Table 1 shows that the M&As are slightly decreasing towards the end of the examination period, except for the year of 2010 when the number of M&As was less than half of the acquisitions in next year. This is due to the global financial crisis which cut the global M&A volumes. In the sample only acquirers with information at least one year before and one year after the M&As are included. Further, companies that were acquired during the examination period as well as dead companies were excluded from the sample. Table 2 presents descriptive statistics for the variables used in the regressions.

Table 2 reports the mean, median, standard deviation and minimum and maximum values for the variables, which are as follows: RD_{it} is the acquirer i 's R&D expenditures in year t ; BV_{it} is the acquirer i 's book value of equity in year t ; P_{it} is the market value of acquirer i 's equity in year t ; E_{it} is the net income of acquirer i before extraordinary items and discontinued operations in year t ; TA_{it} is the acquirer i 's total assets in year t (in million dollars); $DEALS_{it}$ is the number of other acquisitions the acquirer i has made in the year of the $M\&A_{it}$ and CHS_{it} is the acquirer i 's closely held shares that are held by insiders in proportion to common shares outstanding. First three variables are trimmed at 2 % since the dataset displayed values so extreme that they could not be considered plausible. Further, some of the firms displayed temporarily negative book value of equity during the examination period resulting negative minimum values. Yet, most of the companies are overvalued during the examination period since their market capitalization exceeds

their book value of equity.

<i>Year</i>	<i>Number of Acquirers per year</i>	<i>Number of M&As</i>
2010	105	186
2011	179	376
2012	176	359
2013	157	300
2014	166	324
2015	172	335
2016	177	345
2017	176	298
2018	166	287
<i>Total</i>	1,474	2,810

Table 1. Acquirers and M&As 2010-2018

<i>Variable</i>	<i>Mean</i>	<i>Median</i>	<i>Standard deviation</i>	<i>Minimum</i>	<i>Maximum</i>
RD_{it}/BV_{it}	0.142	0.085	0.209	-1.104	1.586
P_{it}/BV_{it}	3.836	2.879	4.498	-28.250	34.286
E_{it}/BV_{it}	0.077	0.110	0.382	-2.737	2.728
TA_{it}	11,976	1,593	43,261	0.002	751,216
$DEALS_{it}$	0.370	0.000	1.110	0.000	15.000
CHS_{it}	7.929	2.370	12.227	0.016	99.411

Table 2. Descriptive statistics

From table 2 it can be observed that among the acquirers there are some “tech giants” with massive total assets. Those firms usually have multiple acquisitions per year. Similarly, at least half of the firm have only one acquisitions per year, as can be seen from the descriptive statistics for the variable $DEALS_{it}$.

4.2 Research design

The methodology and model specification closely follow the study from Kallunki, Pyykkö & Laamanen (2009). They compare the market valuation of acquirer’s R&D spending and the linkage between R&D spending and future profitability in the year of the M&As between technology and non-technology acquirers. Similar model specifications are used in this study, although with reduced number of control variables. To test, whether the M&As with technology target increases the valuation of acquirer’s current R&D spending, the following OLS regression is used:

$$\begin{aligned} \frac{P_{it}}{BV_{it}} = & \beta_0 + \beta_1 \frac{RD_{it}}{BV_{it}} + \beta_2 \frac{E_{it}}{BV_{it}} + \beta_3 M\&A_{it} + \beta_4 \frac{RD_{it}}{BV_{it}} * M\&A_{it} + \\ & \beta_5 E_{it} * M\&A_{it} + \beta_6 X_{it} + \beta_7 \frac{RD_{it}}{BV_{it}} * M\&A_{it} * X_{it} + \\ & \sum_{y=2010}^{2018} \lambda_y YEAR_y + \varepsilon_{it} \end{aligned} \quad (1)$$

Where additional variables $M\&A_{it}$ and $YEAR_y$ are indicator variables. $M\&A_{it}$ is given value of 1 if an acquirer i has bought a company in year t and 0 otherwise. For $YEAR_y$ value 1 is given in year y and 0 in other years. In all model specifications cross-sections and periods are fixed. Results from this equation are reported in table 3. The robustness of the results from this equation is tested with Generalized Method of Moments technique. The results from using this method are reported in table 6.

The X_{it} represent the three control variables used in the regression. Total assets of the acquirer are included since the size of the buyer may have a significant role in M&A performance and future shareholder value creation. There are several reasons for this. First, large public companies are more closely followed by analysts and media (Booth et al, 2006). Moreover, large companies usually have larger resources to extract value and fully utilize R&D obtained in acquisition (Ahuja & Katila, 2001). However, the size of the acquirer can also have negative impact on post-merger performance. It is reported that there is an inverse relationship between the size of the acquirer and the abnormal returns after M&A. This finding has been explained by unjustified premium paid to target firms. Managerial hubris predisposes to pay extra price since managers exaggerate their abilities to create synergies (Moeller et al, 2004).

Second, one variable to control for acquirer's ownership structure is obtained. This variable, closely held shares scaled by buyer's common shares outstanding, represents the proportion of shares held by insiders. There is mixed evidence about the effect of ownership and managements on firm performance and corporate investment. If the management is little engaged personally and do not hold equity in company, an agent problem may arise since decisions related to M&As may be affected by managerial hubris or other personal incentives. From descriptive statistics the share of closely related shares is generally low in this sample. This can also be a good sign, since the management becomes risk-averse if their own wealth is tied to one company. This leads managers to abandon risky but viable projects with positive net present value (Smith & Stulz, 1985). In the long run excessive risk aversion may lead to decision-making that is not optimal for the shareholders.

The last control variable used in this thesis is $DEALS_{it}$. It measures the number of other M&As the acquirer i has conducted in year t . The M&A activity can bear positive or negative effects to the stock market reaction (Fuller et al, 2002). On the other hand, if the acquirer has made successful acquisitions before the year of current M&A, it indicates that the acquirer has the ability to utilize outsourced R&D and harness synergies from

the M&As. As chapter 2 presents, large firms are usually buyers and in a state where they are familiar with challenges in executing M&As (Hitt et al, 2001). In other words, they are agile and have attainments for consequent acquisition. In the sample used in this study it can be seen that at least half of the companies did buy only one target per year, but there are also firms that have acquired over 10 companies within one year. Higgins & Rodriguez (2006) report that companies have negative abnormal returns if they have prior engagement in M&A within three years before current M&A. It is suggested that investors tend to interpret multiple technology acquisitions as a sign of inferior internal R&D activities.

Kallunki, Pyykkö & Laamanen (2009) used several other control variables, such as acquirer executives' in-the-money options, cash-bonus compensation, size and dummy variable to distinguish the mergers from acquisitions. Due to lack of available data these are not used in this study. However, Kallunki et al. find that only closely held shares and options of the executives are statistically significant in explaining stock market valuation of the acquiring firm's R&D spending in technology-oriented M&As.

For the second hypothesis the average three-years and five-years-ahead net income is regressed on earnings and R&D expenditures. The following regressions are used:

$$\begin{aligned} \frac{1}{3} \sum_{k=1}^3 \frac{E_{i,t+k}}{BV_{i,t+k}} &= \beta_0 + \beta_1 \frac{E_{it}}{BV_{it}} + \beta_2 \frac{RD_{it}}{BV_{it}} + \beta_3 M\&A_{it} + \\ &\beta_4 \frac{RD_{it}}{BV_{it}} * M\&A_{it} + \beta_5 \frac{E_{it}}{BV_{it}} * M\&A_{it} + \sum_{k=1}^3 \eta_{i,k} \frac{RD_{i,t+k}}{BV_{i,t+k}} + \\ &\sum_{k=1}^3 \gamma_{i,k} \frac{RD_{i,t+k}}{BV_{i,t+k}} * M\&A_{it} * \varepsilon_{it} \end{aligned} \quad (2)$$

$$\begin{aligned} \frac{1}{5} \sum_{k=1}^5 \frac{E_{i,t+k}}{BV_{i,t+k}} &= \beta_0 + \beta_1 \frac{E_{it}}{BV_{it}} + \beta_2 \frac{RD_{it}}{BV_{it}} + \beta_3 M\&A_{it} + \\ &\beta_4 \frac{RD_{it}}{BV_{it}} * M\&A_{it} + \beta_5 \frac{E_{it}}{BV_{it}} * M\&A_{it} + \sum_{k=1}^5 \eta_{i,k} \frac{RD_{i,t+k}}{BV_{i,t+k}} + \\ &\sum_{k=1}^5 \gamma_{i,k} \frac{RD_{i,t+k}}{BV_{i,t+k}} * M\&A_{it} * \varepsilon_{it} \end{aligned} \quad (3)$$

Where E_{it} is the acquirer i 's net income before extraordinary items in year t ; BV_{it} is the acquirer i 's book value of equity in year t , RD_{it} is acquirer i 's R&D spending in year t , $M\&A_{it}$ is a dummy variable getting value of 1 if an acquirer i makes M&A in year t and otherwise equal to zero. Further, R&D spending in the following years are included in the model since they are likely to also have an impact on firm's profitability. Current earnings are included since they have been detected to predict earnings in the future, too (Kalunki, Pyykkö & Laamanen, 2009). All the variables are interacted with the $M\&A_{it}$ variable to see whether it is the M&A that strengthens the linkage between future profitability and R&D spending in year t . Results from the equations (2) and (3) are presented in the table 4.

5 Results

In this chapter the results from the regression are presented. First sub-chapter discloses the first hypothesis and second sub-chapter the second hypothesis. After reporting the results there are also additional test of acquirer's post-merger R&D spending and robustness test made with GMM estimation technique to strengthen the conclusions from testing hypothesis 1. P-values are reported in the brackets and asterisks *, ** and *** indicate significance at 1%, 5% and 10%, respectively. Not all the results are unambiguous and there is certainly room for further exploration and discussion.

5.1 M&A and R&D valuation

Results from testing the hypothesis 1 with first regression are represented below in table 3. The results show that the estimated coefficient for the interaction variable $RD_{it}/BV_{it} * M\&A_{it}$ is positive at 5 % level in column 3 and at 1 % level in column 4, where all the control variables are included. The result indicates that when technology firm buys another technology firm, the stock market valuation of the acquirer's R&D spending is enhanced. Stock markets anticipate that the M&A between two technology firm improves the R&D operations of an acquiring firm and that the buyer is able to utilize the acquired R&D in its business. Positive stock market response also indicates that the market expects the acquirer to be able to convert the combined R&D exertions into future profitability. The estimated parameters RD_{it}/BV_{it} and $RD_{it}/BV_{it} * M\&A_{it}$ can be compared to examine the magnitude of the stock market response (Kallunki, Pyykkö & Laamanen, 2009). In column 4 the RD_{it}/BV_{it} gets value of 12.653 and the interaction variable $RD_{it}/BV_{it} * M\&A_{it}$ gets value of 2.483. It can be calculated that there is a 20% increase (2.483/12.653) in the stock market response towards acquirer's R&D spending in the year of the M&A. Hence, the first hypothesis,

H1: The current market valuation of the technology acquirer's R&D spending increases when acquiring a technology target,

is confirmed.

<i>Variable</i>	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>
Intercept	1.375 (0.000)*	1.729 (0.000)*	1.918 (0.000)*	2.058 (0.000)*
RD _{it} /BV _{it}	13.714 (0.000)*	13.717 (0.000)*	12.554 (0.000)*	12.653 (0.000)*
E _{it} /BV _{it}	3.055 (0.000)*	3.053 (0.000)*	2.292 (0.000)*	2.280 (0.000)*
M&A _{it}		0.012 (0.092)***	-0.520 (0.001)*	-0.476 (0.000)*
E _{it} /BV _{it} * M&A _{it}			2.483 (0.002)*	2.559 (0.000)*
RD _{it} /BV _{it} * M&A _{it}			2.210 (0.043)**	2.483 (0.000)*
TA _{it}				0.000 (0.612)
RD _{it} /BV _{it} * M&A _{it} * TA _{it}				0.000 (0.084)***
DEALS _{it}				-0.095 (0.209)
RD _{it} /BV _{it} *M&A _{it} * DEALS _{it}				-0.011 (0.980)
CHS _{it}				-0.018 (0.005)*
RD _{it} /BV _{it} * M&A _{it} * CHS _{it}				-0.013 (0.632)
Yearly controls	Included	Included	Included	Included
Industry controls	Included	Included	Included	Included
N	3,489	3,489	3,489	3,489
R ²	0.718	0.718	0.723	0.725
Adj. R ²	0.680	0.680	0.686	0.687

Asterisks *, ** and *** indicate significance at 1%, 5% and 10%, respectively.

Table 3. Stock market valuation of acquirer's R&D spending in technology M&As

However, the response towards acquirer's earnings in year of M&A is perhaps even more interesting. The estimated parameter for variable E_{it}/BV_{it} and for the interaction variable $E_{it}/BV_{it} * MA_{it}$ are also both positive and significant. There is an increase of 112% (2.559/2.280) in stock price response to the acquirer's earnings in the year of M&A. The economic impact of stock market response towards earnings is much stronger than the response towards R&D spending. This suggests that the current earnings create expectations for generating future earnings, too, and that these expectations are strongly strengthened after the merger. Investors place value on both earnings and R&D during the year of M&A, but they are unquestionably more interested in earnings. These findings suggest that investors expect the future performance being generated more through increased market power than via synergies in R&D exertions.

Only one control variable and one interaction term are significant. Interaction term with total assets is significant on 10% level but has no economic impact. Second is closely held shares with 1% significance level, but with interaction term $M\&A_{it}$ the significance vanishes.

5.2 M&A, R&D spending and profitability

The results from testing hypothesis 2 are found in table 4. When looking for average 3-years-ahead earnings the variable RD_{it}/BV_{it} is significant at 1% meaning that the current R&D exertions explain the future profitability. The consequent R&D spending most likely explains future earnings, too. Almost every estimated parameter for consequent R&D spending are positive and most of them are statistically significant.

More surprisingly, the current earnings do not explain the next three- or five-years profitability, even when market expects them to do. The positive stock market response towards acquirer's earnings in the year of the M&A may suggest that the investors expect that the greater the earnings, the better financial prerequisites the acquirer has to cope with the costs related to post-merger integration.

<i>Variable</i>	<i>3-years-ahead-model</i>	<i>5-years-ahead-model</i>
Intercept	0.152 (0.000)*	0.122 (0.000)*
E_{it}/BV_{it}	0.028 (0.745)	-0.018 (0.603)
RD_{it}/BV_{it}	0.318 (0.001)*	0.042 (0.423)
RD_{it+1}/BV_{it+1}	0.150 (0.050)***	0.224 (0.034)**
RD_{it+2}/BV_{it+2}	-0.021 (0.775)	0.151 (0.100)
RD_{it+3}/BV_{it+3}		0.177 (0.004)*
RD_{it+4}/BV_{it+4}		0.153 (0.079)***
$M\&A_{it}$	-0.049 (0.008)*	-0.011 (0.030)**
$E/BV_{it} * M\&A_{it}$	-0.035 (0.712)	-0.028 (0.470)
$RD_{it}/BV_{it} * M\&A_{it}$	-0.147 (0.481)	0.092 (0.151)
$RD_{it+1}/BV_{it+1} * M\&A_{it}$	-0.097 (0.749)	-0.070 (0.396)
$RD_{it+2}/BV_{it+2} * M\&A_{it}$	0.620 (0.001)*	0.027 (0.868)
$RD_{it+3}/BV_{it+3} * M\&A_{it}$		0.031 (0.767)
$RD_{it+4}/BV_{it+4} * M\&A_{it}$		-0.041 (0.446)
N	2,667	1,875
R2	0.680	0.891
Adj. R2	0.622	0.860

Asterisks *, ** and *** indicate significance at 1%, 5% and 10%, respectively.

Table 4. Impact of R&D spending on the future profitability

The interaction variable $RD_{it}/BV_{it} * M\&A_{it}$ is positive but not significant in 5-years-ahead model, meaning that the second hypothesis,

H2: Acquiring a technology target strengthens the linkage between technology acquirer's R&D spending and its future profitability,

is not confirmed. When technology firm acquires a technology target, the R&D spending of the acquirer is not translated into future profitability more strongly than in other years. The stock market anticipation towards increased future profitability through R&D spending in the year of M&A are reflected in enhanced valuation of the R&D spending in the same year, but the expectations are not always fulfilled. It remains inconclusive whether the acquiring firm can extract enough value from target firm's R&D assets to generate additional future earnings.

To summarize the results from testing the two hypotheses, it can be concluded that there is a positive relationship between R&D spending, stock market valuation and future profitability. M&A has a positive impact on valuation of acquirer's R&D spending and even greater impact on valuation of acquirer's earnings in the year of M&A. However, these responses are overshooting since the R&D spending in the year of M&A do not translate into future profitability more strongly than in other years. Likewise, the net income in the year of M&A is not reflected in the future profitability. This disparity between expectations and actual outcome may be an indicator of post-merger integration problems.

5.3 Post-merger R&D expenditures

Majority of prior studies suggests that the R&D spending of the acquirer decrease after the M&As. This is tested as additional analysis and the results are reported in table 5. The model to test the acquirer's post-merger R&D expenditures is the following regression:

$$\frac{RD_{it}}{BV_{it}} = \beta_0 + \beta_1 M\&A_{it} + \sum_{y=2010}^{2018} \lambda_{iy} YEAR_y + \varepsilon_{it} \quad (4)$$

Where RD_{it} is the acquirer i 's R&D expenditures in year t , BV_{it} is the acquirer i 's book value of equity in year t , $M\&A_{it}$ is an indicator variable with value of 1 if acquirer i acquires a company in year t and otherwise zero, and $YEAR_y$ is another indicator variable getting value of 1 in year y and zero otherwise. The results from this regression are reported in table 5.

<i>Dependent variable</i>	<i>Intercept</i>	<i>M&A</i>	<i>N</i>	<i>R2</i> <i>(Adj. R2)</i>
RD_{it}/BV_{it}	0.154 (0.000)*	-0.029 (0.000)*	3,392	0.005 0.003

Asterisks *, ** and *** indicate significance at 1%, 5% and 10%, respectively.

Table 5. Acquirer's post-merger R&D spending

As the table shows, there is a reduction in acquirer i 's R&D expenditures in the year of M&As and it is significant at 1 % level. This finding is in line with prior literature that suggest that the R&D expenditures are decreased in the acquiring firm when it buys a technology target (Hitt et al, 1991).

5.4 Robustness test

Table 6 reports the results from using alternative model, generalized method of moments. This model is useful since it is able to assess potential heteroskedasticity and autocorrelation in the data. It is also applicable in the situations where the full shape of the sample distribution is unknown and where maximum likelihood estimation cannot be applied. The results are similar to the model specification 1.

<i>Variable</i>	<i>GMM method</i>
Intercept	2.058 (0.000)*
RD _{it} /BV _{it}	12.653 (0.000)*
E _{it} /BV _{it}	2.280 (0.000)
M&A _{it}	-0.476 (0.008)*
E _{it} /BV _{it} * M&A _{it}	2.559 (0.000)*
RD _{it} /BV _{it} * M&A _{it}	2.438 (0.039)**
DEALS _{it}	-0.095 (0.244)
RD _{it} /BV _{it} * M&A _{it} * DEALS _{it}	-0.011 (0.985)
CHS _{it}	-0.018 (0.082)***
RD _{it} /BV _{it} * M&A _{it} * CHS _{it}	-0.013 (0.854)
TA _{it}	0.000 (0.351)
RD _{it} /BV _{it} * M&A _{it} * TA _{it}	0.000 (0.056)*
Control variables	Included
N	4,489
R2	0.725
Adj R2	0.687

Table 6. Results from using Generalized Method of Moments

6 Discussion

Mergers and acquisitions and their impact on research and development has been a popular topic but not much investigated in terms of long-term effects on competitive advantages and shareholder value. In this chapter the aim is to present previous evidence about how do mergers and acquisitions affect on R&D activities considering both the input and the output. Moreover, the aim is also to find out how does the possible trade-off affect long-term growth. The key is to optimize the allocation and maximize the return of investment (ROI) to increase shareholder value.

As discussed in previous chapters, the incentives and outcomes of mergers and acquisitions vary resulting changes in shareholder value and innovation rate. The time horizon is also an important aspect since in short term R&D cause expenses that lower the price to earnings ratio and net profits for the accounting period. The outcome can be seen only after a long period of time and the success is not guaranteed. This chapter presents evidence about the relationship between M&As and R&D and their impact on company's prosperity. The findings are based on research and literature. The results of this study are also discussed and reflected in theoretical framework.

6.1 Post-merger R&D spending

The preliminary findings suggest that M&A decrease R&D intensity – R&D expenditures divided by turnover – more often than increase it. Empirical studies conducted in the US show that M&A have negative effect on R&D inputs. However, the volatility is high and robust interpretations cannot be made based on these findings alone (Cassiman et al., 2005). Partial explanation is scarcity of resources and trade-off between M&A and R&D; the limited amount of money must be spent between them. This allocation is widely directed by the incentives of the executives. As presented in chapter two, managers pursuing personal interests, like entrenchment or empire building, tend to make strategic decisions that do not threat their current position. The explanators for reduced R&D

spending can also be found from value-increasing theory. In the light of the market power theory the merged companies reduce the competition and gain more pricing power in the market as united. M&A can end the “R&D race” between the competitors and decrease post-merger R&D spending. However, as drivers for mergers are usually a mixture from the theories presented, ending the R&D race combined with managerial incentives may blindsight the executives to settle to the current market position and not to invest in the future competitiveness.

The outcomes of M&A likely have an impact on R&D spending, too. Studies show that usually shareholders in the target firms get premium and have positive cumulative abnormal returns after and prior to the announcement date. This is despite the variables such as time period, industry, merger type and measurement of cumulative abnormal returns (Campa & Hernando, 2004). This can be due to managerial hubris where the acquirer pays unfounded premium for the target firm. Shareholder value change in the acquiring firm is more ambiguous, but generally the gains are significantly smaller than gains for the target firm’s shareholders, or they turn out to be negative. Bruner (2002) presents that returns also tend to slightly decrease over time, too. Poor outcomes may hamper the R&D process by lowering the incentives for managers to take new risks. In previous literature there are mixed results about combined outcomes for target and buyer firms. Aktas, de Bodt & Declerck (2001) support findings presented in previous chapters and have found that around 50 % of mergers have destroyed value in the second half of 19th century.

Hitt, Hoskisson & Ireland (1990) present that between firm’s acquisition and relative R&D intensity there is a negative relationship. Cassiman et al. (2005) amplifies that merged companies decrease their R&D level significantly when the merged companies have substitutive technologies. These findings suggest that post-merger R&D intensity decreases as new acquisitions are made, especially when the merging firms do not have any strategic fit. Bertrand (2009) presents opposite findings; in France foreign acquisitions increased the R&D budget as mergers were motivated by overseas R&D

development and technology sourcing. This makes foreign acquirers willing to finance R&D of target firms. Similarly, Kallunki, Pyykkö & Laamanen (2009) that non-technology acquirers increase their R&D spending after acquiring a technology target.

It is also important to investigate whether the R&D efficiency – number of patents divided by turnover – changes after M&As. The reduction in R&D expenditures is not always bad for the business. R&D spending may decrease because of elimination of overlapping R&D activities (Cassiman et al, 2005). The post-merger effectiveness of R&D quality is harder to measure since there are no commonly used exact meters that would cover all the layers of R&D process. The literature exposes mixed results about how mergers and acquisitions affect R&D quality. When the results from testing models 1 and 4 are combined, it is found that the investors expect the acquirer to intensify its R&D activities through technology M&A.

Hitt et al. (1990) present several studies with findings that growth through acquisition may hamper the innovation and decrease the R&D outputs. This is when the acquirers make a trade-off between long-term innovation and rapid growth. Baysinger and Hoskisson (1989) replenish that the negative effect on patents is especially due to firm diversification. In diversifying acquisition, the technology of target firm can be ulterior or obscure to the acquirer and therefore left to be unutilized. Due to high premium the target firms receive in the deal the pressure to innovate slackens causing the target firm to reduce their exertions in R&D. (Hitt et al., 1990.) As the company grows it can also become more inflexible in its practises and procedures causing the creative atmosphere to flatten.

Those who manage to increase the post-merger value tend to have a “strategic fit” (Hopkins, 1987). It could be reasoned that negative outcomes do not encourage to invest in R&D, especially when the original motive for the merger is short-sighted and arises from managers’ personal incentives. In literature dealing with corporate control it is suggested that internal efficiencies, capital market imperfections and agency problems can be

straightened through M&A (Jensen & Ruback, 1983). Mergers also cause international spread of development. Overlapping and redundant R&D units are cancelled, and firms get access to new technology and markets (Von Zedtwitz & Gassmann, 2002). Cassiman et al. (2005) observe that merging companies with similar technologies perform stronger in post-merger R&D. They become more active and increase their R&D efficiency as well. The acquirer can help the target firm to commercialize their innovation more easily. It seems that mergers can have positive effect on R&D when they are motivated by synergies and technology integration, the process is actively managed, the key personnel are retained and managers have strong base of knowledge – the ability to evaluate incentives, partners and long-term consequences.

6.2 Long-term effects

As discussed earlier, R&D has ultimately the biggest influence in shareholder value and competitiveness, although it is not the only source for growth. Even small sustainable growth rate has significant influence on company's profitability in a long run, as Boer (2004), demonstrates. As R&D expenditures tend to decrease the shareholder value due to lowered price-to-earnings ratio, it must be evaluated, to what extent are the current value acceptable to be sacrificed in order to increase shareholder wealth in the future.

The shareholder value can fluctuate within the R&D stages and progression. First, the investors' reactions to R&D announcements vary. High-tech companies, small businesses and frequent innovators get better responses than firms with less adequate technology or firms operating in industry where constant innovation is less common. The results from testing the first hypothesis strengthen this finding. Unexpected R&D projects are viewed risky. R&D investments do not have any value per se, but the investors rather evaluate the probabilities of success case by case. Stock price movements are derived from unforeseen information; expected positive cash flows increase the stock price and vice versa. Kelm, Narayanan & Pinches (1995) present two stages, innovation and commercialization, for R&D projects. During innovation investors evaluate the company's

capabilities to survive technology-related risks that are essential in R&D. They also consider factors presented in PEST analysis and mirror the strategic fit to the environment. In the commercialization the focus shifts to the company's positioning, since in that stage the technological challenges have been overcome and the aim is to thrive in the markets and acquire customers. It is relatively easy to catch up but harder to move the technology frontier forward. The aim is to retain the cashflows generated by the R&D exertions and not let the competitors benefit from the spillover. Big corporations can compete with prices so the innovation in smaller firms should be unique or targeted to small niches. Considering these facts, it could be interpreted that even though R&D announcements are received more readily from smaller firms, the innovation stage is also more crucial to them, because the innovation cannot be fully utilized and thus shareholder value is not maximized if the innovation is easy to reproduce. In technology M&A the acquirer's and target firms combined R&D assets are viewed unique.

R&D progress should be constantly evaluated, and unprofitable projects should be ceased immediately. Because of the sunken cost fallacy this is not easily done, even there is many valuable lessons to be learnt from failures, too. (Kelm et al., 1995.) To maximize the shareholder value in the long run the key is to allocate the resources between M&A and R&D activities effectively and maintain a balanced portfolio. Although the previous evidence suggests that post-merger R&D spending tend to decrease, the quality in R&D may increase resulting higher shareholder wealth. The motives, mode and type of entry and the execution of M&As largely define the post-merger outcome and set up the framework for future innovation and prosperity. Unfortunately, synergies are not easy to find and the challenges in the M&A implementation phase may hamper the technological cooperation.

6.3 Post-merger integration

Technology-oriented M&As target to broaden their scope to an increasing degree (Haller & Johnson, 2019). These so-called scope deals account the vast majority of technology

M&A in 2019. It is common that technology firm seeks access to new sectors, markets, and product lines. Big technology giants, like Amazon, Apple, Facebook, Google and Microsoft have expanded in many areas of business and everyday life, and smaller firms are shifting towards this mode of operation in a smaller scale as well. When technology firms shift the focus away from horizontal mergers the importance of post-merger integration and careful due diligence are pronounced. Further, synergies are harder to find, even though the stock market still reacts positive when two tech firms announce about merger. In scope deals, which bear more resemblance to conglomerate or concentric mergers, revenue synergies are more uncertain since the different products, services and pricing models are harder to fit together (Haller & Johnson, 2019). Also managing the human capital and integrating the different corporate cultures is challenging. Retaining the talent and key personnel is also crucial. One notorious example from Finland is the merger with Nokia and Alcatel-Lucent in 2016. It seemed to be like a strategic fit, but the post-integration problems tainted the company's reputation badly.

As there is evidence that companies with strategic fit have the best prerequisites to succeed and increase long-term profitability, there is a need for further research in the interface between those companies' due diligence and corporate cultures in order to ensure smooth post-merger integration and utilization of the potential synergies.

7 Summary

The purpose of this thesis is to present the two strategic components that are involved in companies' decisions and investigate the relationship between them. Mergers & acquisitions serve as a way to rapid growth. M&As have increased their popularity during recent decades, especially in downturns when gaining organic growth is challenging. Research and development, in turn, are only a small part among company operations, but their meaning in innovation and long-term competitiveness is crucial since ultimately premises to evolve and develop arise from the exertions in R&D activities. The aim is also to emphasize the possible trade-off between the M&A and R&D and investigate how this might affect on shareholder value in the long run.

First, it is discovered that the incentives for M&As are either synergy-, agency- or hubris-based or a combination of them. R&D can play a big role in synergy-based motives since studies show that mergers likely benefit more companies with complementary technologies. Target firms are usually investing a lot in R&D but have relatively slow growth rate whereas acquirers have a large patent portfolio and better operational performance, but in technology-driven industries it is common that the target firm too is a fast-growing company. M&As, in turn, are not considered to be usual motive for R&D investments. Rather, the R&D investing decisions are affected by several macrolevel and circumstantial factors. Industry, firm size and PEST factors steer the amount of R&D expenditures.

Second, it is suggested that the post-merger outcome may have an impact on future innovation. There are many studies that favour the view that mergers cause R&D input reduction, i.e. the amount spent on R&D. When investigating whether M&A also reduce the R&D outcome, i.e. number of patents, the results are more mixed. Nearly half the mergers fail causing shareholder value reduction. Reflecting the value-destroying theories the unpleasant outcome may be due to short-sighted decision making and managerial motives that are not targeted to shareholder value maximization. Managerial hubris cause acquirer to pay high, unjustified premia for target firms ending up reducing shareholder value in the acquiring firm. This combined to the entrenchment the willingness

to take new risks by investing in R&D reduces even more. Previous evidence suggests that diversifying, hostile acquisition generates little value or even destroy that. This discreditation happen when the executives dump the excess liquidity to buy firms that are not the best strategic fit. The managers' empire building strengthens this, because selecting target firms with minimum profit requirements benefit the managers but not the shareholders.

Mergers and acquisition can help both the target and acquirer companies to reduce overlapping functions, create synergies and eliminate capital market imperfections and agency problems. The acquirer can help the target firm in commercialization process and to fully utilize their resources. At the same time the acquirer get access to new technology. This supports the findings that synergy-thriven mergers where companies have complementary technologies create the best base for future innovation and shareholder value increase.

This thesis tests how the stock market responses to acquirer's R&D spending in the year of M&A in technology-driven industries and whether the acquirer is able to translate its current R&D spending into future profitability. A sample of technology mergers during 2010-2018 with US public technology acquiror and technology target is constructed and tested with OLS regressions. It is found that in the year of M&A there is an increase in stock market response towards the valuation of acquirer's current R&D spending indicating that investors expect the spending can be converted into future profitability. However, there is even greater increase towards acquirer's earnings indicating that investors place more value on them and may expect that the bigger the current profitability, the better prerequisites the acquirer has in coping with costs related to post-merger integration. The expectations do not always meet the reality since it is observed that the linkage between R&D spending in the year of the M&A and future profitability is not any stronger than in other years.

These findings can illustrate the shift from so called scale deals to scope deals, that are more and more common in technology industries. Scope deals are more complex and motivated by access to new markets or product lines. Also the increased proportion of start-ups among the target companies increases the uncertainty in M&A outcomes. The changing nature of technology-oriented M&As emphasize the importance of due diligence and post-merger integration.

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Appendix A. SIC Codes: Standard Industrial Classification

- 28 Manufacturing: Chemicals and allied products
- 35 Manufacturing: Industrial and commercial machinery and computer equipment
- 36 Manufacturing: Electronic and other electrical equipment and components (excl. computer equipment)
- 37 Manufacturing: Transportation equipment
- 38 Manufacturing: Measuring, Analyzing, and Controlling instruments; Photographic, medical and optical goods; Watches and clocks
- 48 Transportation & public utilities: Communications
- 73 Services: Business services
- 87 Services: Engineering, Accounting, Research, Management, and related services