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How the innovation should be valued?

The relationship between the target's R&D intensity and the premium payment in European technology-based public M&As from 2000 to 2022.

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ABSTRACT:

The objective of the thesis is to investigate the relationship between the target's R&D intensity and the premium payment in European technology public M&As. The purpose is to deepen the understanding on the value relevance of the R&D investments in the M&A process, the information asymmetry dynamics regarding these R&D investments, and how these factors influence the M&A premium paid for the target firm.

The thesis utilizes the R&D intensity of the target firm as a proxy for innovativeness, further being analyzed from the perspective of R&D to market value, R&D to net sales, and R&D growth rate. To investigate insider trading effect around R&D intensive targets, the thesis analyzes the relationships four weeks, one week, and one day prior to the announcement. The data sample includes a total of 203 public European M&As of technology firms from 2000 to 2022. By the utilization of the OLS regression analysis, the thesis finds that all three R&D intensity proxies of the target firm have a positive relationship with the M&A premium. However, contrary to U.S.-based studies, the results for these R&D proxies are not statistically significant. Thus, between the three R&D proxies, R&D intensity based on net sales one day prior to the announcement emerges as the most relevant explanatory factor for analyzing the changes in the M&A premium. This is evidenced by its relatively high coefficient of 53.54 and a t-statistic of 1.56, which approaches the critical t-value of 1.65, corresponding to the 0.10 significance level.

On average, public European technology firms pay 39.87-44.22 percent premium excess to the share price of the target firm, which is higher compared to other more conservative sectors. Comparing M&A premium four week and one week prior to the announcement to one day prior to the announcement, M&A premium decreases -4.35 and -4.60 percent, respectively. As target's R&D intensity increases, increases the probability for insider trading effect and target's ability to achieve higher M&A premiums. In addition, the high expected M&A premium increases firm's incentives to harness innovativeness, further increasing the attractiveness among potential acquirers and execute EXIT through M&A transaction. The results are apt to enhance acquirer's rational decision-making, reduce managerial hubris around hard-to-value R&D assets, and decrease the total proportion of information asymmetry in the public stock market.

KEYWORDS: Mergers and acquisition, M&A, M&A premium, research and development, R&D, innovation, information asymmetry, insider trading

VAASAN YLIOPISTO**Laskentatoimen ja rahoituksen akateeminen yksikkö**

Tekijä:	Samu Happonen	
Tutkielman nimi:	Kuinka innovaatiota tulisi arvostaa? Kohdeyrityksen T&K-intensiteetin ja preemion maksun välinen suhde eurooppalaisissa teknologiapohjaisissa julkisissa yritysjärjestelyissä vuosina 2000–2022.	
Tutkinto:	Kauppätieteiden maisteri	
Oppiaine:	Rahoitus	
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Vuosi:	2024	Sivumäärä: 108

ABSTRAKTI:

Opinnäytetyön tavoitteena on tutkia kohdeyrityksen T&K-intensiteetin ja preemion maksun suhdetta Euroopan teknologisissa julkisissa yritysjärjestelyissä. Tarkoituksena on syventää ymmärrystä T&K-investointien arvorelevanssista yritysjärjestelyprosessissa, kyseisiin T&K-investointeihin liittyvästä tiedon epäsymmetriasta ja siitä, miten nämä tekijät vaikuttavat lopulta kohdeyrityksestä maksettavaan yritysjärjestelypreemioon.

Opinnäytetyössä hyödynnetään kohdeyrityksen T&K-intensiteettiä innovatiivisuuden mittarina, jota analysoidaan niin T&K markkina-arvoon, T&K bruttokatteeseen, että T&K kasvunopeuden näkökulmasta. Tutkiakseen sisäpiirikaupan vaikutusta T&K-intensiivisten kohdeyrityksien keskuudessa, opinnäytetyössä analysoidaan suhteita neljä viikkoa, yksi viikko ja yksi päivä ennen julkista yritysjärjestelyilmoitusta. Aineisto sisältää yhteensä 203 julkista eurooppalaista teknologiayritysten yritysjärjestelyä vuosina 2000–2022. OLS-regressioanalyysiä hyödyntäen opinnäytetyö löytää, että kaikilla kohdeyrityksen T&K-intensiteetin mittareilla on positiivinen suhde yritysjärjestelypreemiolla kanssa. Toisin kuin yhdysvaltalaisissa tutkimuksissa, T&K-intensiteetti mittarien tulokset eivät kuitenkaan ole tilastollisesti merkitseviä. Kuitenkin kaikkien kolmen T&K-intensiteetti mittarien kesken, T&K bruttokatteeseen yksi päivä ennen julkista yritysjärjestelyilmoitusta osoittautuu relevanteimmaksi selittäväksi tekijäksi yritysjärjestelypreemion analysoinnissa. Tämä perustuu sen suhteellisen korkeaan 53.54 kertoimeen ja 1.56 t-arvoon, joka lähestyy kriittistä 1.65 t-arvoa, mikä vastaa 0.10 tilastollista merkitsevyytensä.

Julkiset eurooppalaiset teknologiayritykset maksavat keskimäärin 39.87–44.22 prosentin preemiota yli kohdeyrityksen osakkeen hinnan, mikä on korkeampi verrattuna muihin konservatiivisempiin sektoreihin. M&A preemio laskee -4.35 ja -4.60 prosenttia, kun verrataan neljää viikkoa ja yhtä viikkoa yhteen päivään ennen julkista yritysjärjestelyilmoitusta. Kohdeyrityksen T&K-intensiteetin kasvaessa sisäpiirikaupan vaikutuksen todennäköisyys ja kohdeyrityksen kyky saavuttaa korkeampia preemioita yritysjärjestelypreemion valossa kasvaa. Lisäksi odotettu korkea yritysjärjestelypreemio lisää yrityksen kannustimia edistää innovatiivisuuttaan edelleen, mikä lisää entisestään houkuttelevuutta mahdollisten ostajayrityksien keskuudessa ja kohdeyrityksen johdon EXIT mahdollisuutta yritysjärjestelyn kautta. Tulokset ovat omiaan edistämään ostajayrityksen rationaalista päätöksentekoa, vähentämään johdon yli-itsevarmuutta T&K investointien ympärillä ja pienentämään tiedon epäsymmetrian kokonaisuutta julkisilla osakemarkkinoilla.

AVAINSANAT: Fuusiot ja yritysostot, yritysjärjestelyt, yritysjärjestelypreemio, tutkimus ja kehitys, T&K, innovaatio, tiedon epäsymmetria, sisäpiirikaupat

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1 Introduction

Mergers and acquisitions (M&A) are a vital part of any healthy economy and more importantly, a major way for companies to provide returns to their owners and investors. M&A transaction generally include one company – an acquiring company – that purchases the assets or shares of a target company. Due to the potential for high shareholder returns, M&As make a highly attractive way for entrepreneurs and owners to capitalize on the value created in a company (Sherman et al. 2016). The absolute objective for M&A is to create value for the organizations involved and their shareholders, and this value creation can be born in various ways. Still, M&As are large and complex financial transactions, and they often involve various challenges in achieving the desired economic benefits. Interestingly, Bruner (2005) states that M&A is a loser's game with only a 20 percent success rate.

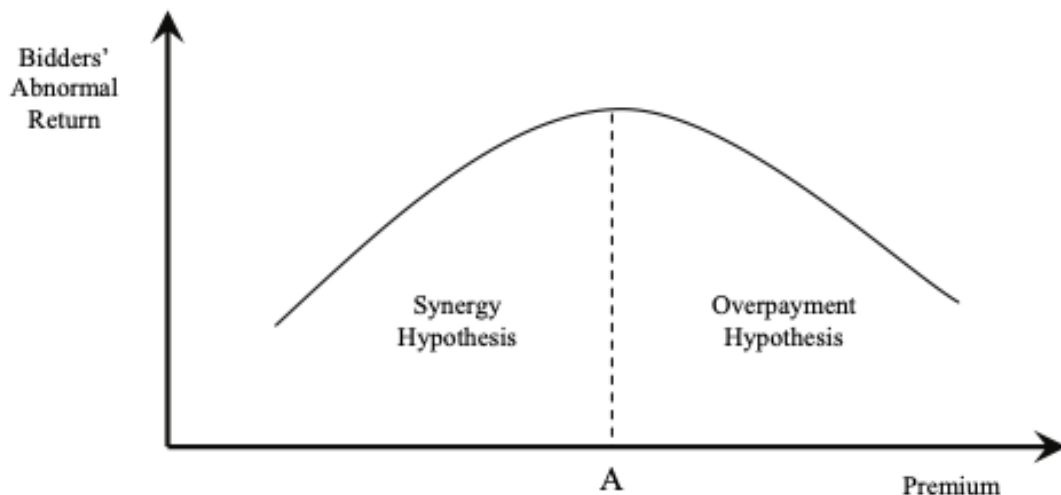
Due to the complexity of the M&A process, generally both transaction parties have team of full variety of M&A professionals, including managers, attorneys, accountants, and investment bankers. Both parties conduct due diligence and valuation analysis of prime candidates, and proceed to initial negotiations (Sherman et al., 2006). Generally, one of the most critical decisions of the M&A transaction is the final transaction price. Due to information asymmetry between transaction parties, there can be hard pinpoints in negotiating the fair valuation range for the target company. Difficulties arise not from relatively easily evaluated tangible assets e.g., plants, properties, and equipments, but rather from evaluation on more intangible assets such as intellectual property, research & development projects, or patents.

In general, companies are investing to research & development (R&D) to increase their potential to generate higher cash inflows in the future. In theory, these investments in R&D should increase the valuation of the company, if the initial investments yield higher returns than the company's cost of capital. Still in the context of M&As, investments in R&D involve uncertainty and information asymmetry, which can create widely varying opinions on the valuation of the target company. Thus Laamanen (2007) states that

acquirers are paying higher premiums on R&D-intensive firms, and Lin and Wang (2016) states that high R&D capacity relative to firm valuation makes R&D-intensive firms attractive M&A targets. R&D affects the company's operations and future cash flows in many different ways, which makes R&D an interesting variable from the point of view of M&A valuation.

The success of an M&A is not purely based on the obtained future profits, but rather completing the M&A process at a price that is not greater than the obtained profits. For the shareholders of the target company to be willing to sell their holdings to the acquiring company, the acquirer generally offers a premium in the M&A transaction. M&A premium, the bid price above the market value of the share price of the target company, can be seen as one of the most critical factors when considering the post-M&A obtained profits of the acquiring and target shareholders. Prior literature shows that the premium has a positive influence on the abnormal returns obtained by the shareholders of the target company. Thus, the relationship between the premium and acquirers' abnormal returns in M&A can be presented as a quadratic relationship (Diaz et al., 2009).

Figure 1 The relationship between the premium and acquirer's abnormal returns in M&A transaction (Diaz et al., 2009).



Diaz et al. (2009) suggest that the market can consider the higher premiums being an indication for greater future earnings, which supports the synergy hypotheses. The point A reflects the situation where the premium increases higher than the discounted future cash flows of the M&A transaction, and the M&A transaction results in net negative outcome for shareholders of the acquiring company (Diaz et al., 2009). When overpayment hypothesis becomes dominant against synergy hypothesis, there is a probability that the acquiring company has been estimated the value of the target company's assets inaccurately.

1.1 Background and motivation

If the target company is examined homogeneously, the R&D factor can be valued through traditional investment or option pricing models. The key is to assess whether R&D will generate more cash flows in the future, given the initial investments, work effort and time spent on it. In the case of publicly listed companies, the valuation of company's R&Ds depends on the consensus of the stock market. However, if the probability of a potential company takeover is added to the equation, the R&D factor can be valued differently. In the context of M&A, the target company's R&D can be valued higher if it is considered to have a high synergistic value for the business of the acquiring company.

More specifically, Bena and Li (2014) find that on average acquiring companies have large patent portfolios and low R&D expenses, while target firms have high R&D expenses and slow growth in patent output. In addition, any technological overlap between M&A parties has a positive effect on takeover probability, and this effect decreases when M&A parties overlap in same product markets. Interestingly, when the acquiring and target company have technological linkage pre-M&A, more patents are produced post-M&A. Authors conclude that synergies obtained from combining innovation capabilities are important drivers for engaging M&A.

In addition to rational factors, M&As are affected by irrational factors, the so-called behavioral finance. Behavioral finance theories affecting to M&As are examined in the

chapter 2.5.4, but this thesis more strongly supports the rational decision-making practices in M&A process. R&D is an information-sensitive asset, and its valuation is relatively more challenging than a valuation of a tangible asset. If the acquirer understands the relationship between the R&D and the M&A premium, can the acquirer argue the tender price more effectively. In contrast, if R&D is found to have a positive relationship with the M&A premium, it can increase the incentives of many, especially small companies, to invest in R&D and achieve higher innovativeness.

1.2 Literature review

In the realm of prior accounting and finance literature, the link between R&D expenditures and subsequent future financial benefits has long been a subject of inquiry and skepticism. The late 90s' prevailing believe for a relationship between R&D costs and future financial benefits is reflected by the lack of relevant and statistically significant studies. However, Lev and Sougiannis (1996), in their seminal work published in the *Journal of Accounting and Economics*, challenged this conventional view. Their research is the first research to systematically explore and identify a significant and economically meaningful association between R&D expenditures and subsequent earnings for a diverse set of R&D-intense firms. In addition to founding a relationship between R&D expenses and earnings, they introduce the concept of firm-specific R&D capital and its impact on stock prices and returns.

The study by Lev and Sougiannis (1996) marked a pivotal departure from the long-standing notion that failed to recognize the value-relevance of R&D capitalization. Their study not only address the issues of reliability and objectivity in R&D capitalization but also demonstrates the potential market inefficiency and additional market risk factor associated with R&D capital, thereby challenging the foundation of prior accounting standards. The pivotal findings of Lev and Sougiannis (1996) laid the groundwork for a more nuanced understanding of the economic implications of R&D expenditures in future's finance and accounting research.

In regards of this thesis, the research by Laamanen (2007) is used as a main reference study, and this thesis aims to continue to examine the relationship between the M&A premium and R&D investments of a target company. Several prior studies argue that paying high premium is value destroying for the shareholders of the acquiring company, and that paying high premiums is an indication of low-quality decision-making policies. The payment of the premium has been seen as an overpayment that exceeds the benefits created by the synergies from the M&A. On average, acquirers are paying 20 – 30 percent premium over the market price of the target, but more specially in U.S., the premium payment is presented to be 30 – 50 percent. The premium payment is higher for technology-based firms, and higher premiums are not shown to be due to managerial hubris or high competition for targets. Briefly, Hayward et al. (1997) suggest that managerial hubris leads to the manager's overconfidence, exaggerated self-confidence, in their skills to achieve calculated synergies and the willingness to pay a higher premium in M&As.

Laamanen (2007) suggests that technology firm's increasing cash outflow from the prior R&D assets increases the information asymmetry in the public stock market, further resulting higher variance between the potential M&A valuations and stock market participants. Generally, a potential acquirer that is ready to pay the highest M&A premium over the target shares wins the tender competition, in which case a higher variance of the M&A premiums is apt to increase target's bargaining power during the negotiation phase, further the increasing the probability of yielding higher M&A profits. Still, prior literature suggests that stock market heavily discounts R&D intensive firms until they yield tangible cash inflows, indicating a strong emphasize on traditional financial analysis for the targets. Still, the author suggests that acquirers engaging M&A with the technology firm with high R&D intensity indicate a more favorable view on target's risky R&D assets, further suggesting that M&A acquirers value the target's accumulated R&Ds higher than the public stock market.

Laamanen (2007) states that acquirers engaging in M&A with a technology-based target and paying higher premium does not result in negative abnormal returns. Abnormal returns are seen to be more strongly related to the homogenous valuation of the target company, being independent from the premium payment. One of the main findings is that the R&D investment-to-market ratios and R&D growth rate have a statistically significant positive relationship to paid premium by acquirers. Acquirer paying high premiums can be justified, when target firm's resources are difficult to value by the stock market, and acquirer can achieve private synergistic benefits due to the accumulated R&D investments of the target company.

Donelson and Resutek (2012) argue that the R&D premium primarily increases from elements of R&D firm's realized returns that are not directly linked to their R&D expenditures. More specifically, these excess returns are part of a broader value and growth anomaly. Although R&D investments are influence positively to future earnings, the R&D investment policies of firms do not influence the earning forecasts made by investors and analyst. The result suggest that the firm would have no incentives to aim to increase its share valuation based on increasing R&D investments. In contrast, a later study by Lin et al. (2016) presents that high R&D intensity firms achieve higher stock market returns. These dynamics are based on increased M&A attractiveness due to higher R&D intensity and growth multiples, further increasing the sensitivity and a positive fluctuation of the stock.

Interestingly, Aboody and Lev (2000) examine the relationship between information asymmetry, firm's R&D expenses and insider gains, using R&D intensity as a proxy for private information. The topic is relevant due to high uncertainty regarding the M&A transaction, as R&D expenses of firms creates challenges for public market valuing the transactions. Aboody and Lev (2000) construct a robust dataset from insider trading information, covering the period from 1985 to 1997 in the U.S. The methodological approach involves building portfolios based on R&D activities and insider transactions, examining regression analyses, and performing various robustness tests.

Aboody and Lev (2000) find that insider gains are significantly larger for R&D-intensive firms compared to non-R&D firms. Additionally, investors react more strongly to insider trading in R&D firms, further indicating information asymmetry and increased difficulty in valuing these firms publicly. Authors highlight the importance of R&D expenses as a critical factor in valuing and pricing a firm, emphasizing challenges associated with information disclosure and the potential for capitalizing on insider information in the presence of heightened information asymmetry. In the context of M&As, this information can contribute to fluctuations in M&A premiums as acquirers are challenged under uncertainties assessing the value of a target firm.

A study by Cheng et al. (2016) supports these findings by showing that in a M&A transaction, a target with higher information asymmetry is significantly and positively related to a higher bid premium compared to a more transparent target firm. Moreover, there is a positive relationship between the information asymmetry of the target and the acquirer's announcement abnormal returns. The investors of the acquiring company react positively to the announcement of opaquer target firm, furthermore, suggesting that the investors reward the acquiring company efficiently resolving a target firm's valuation under high information asymmetry. These relationships are persistent for all payment methods of the M&A transaction. Although the thesis mainly investigates R&D investments and the effect of asymmetric information on the premium paid for the target firm, the study by Cheng et al. (2016) reflects the relevance of asymmetric information in the M&A transaction and valuations itself.

In a study by Chan et al. (2001) authors do not only examine the valuation of the R&D investments in the U.S. stock market, but also its relationship to returns volatility. The topic is relevant to the thesis, as it investigates how the stock market success to evaluate R&D intensive firms and how uncertainty in R&D affects return volatility. This is crucial for understanding additional aspects influencing the pricing and valuation of M&A transaction, especially the valuation of the target firm.

Chan et al. (2001) utilizes daily stock market data from AMEX, NYSE, and Nasdaq, covering the period from 1975 to 1995 in the U.S. By ranking stock based on R&D expenses and facilitating them to portfolios, and examine the performance of these portfolios, authors aim to find patterns related to R&D-to-sales and R&D-to-market value dynamics. The multifactor regression model is used to investigate if excess returns from R&D-intensive stocks reflect risk differentials. Additionally, the research explores the association between R&D-intensive and return volatility cross-sectional regression analysis.

Chan et al. (2001) results indicate that while there is interestingly no strong evidence supporting an association between R&D spending and future stock performance, R&D intensity is significantly associated with share's return volatility. The finding has a direct implication for M&A transaction, suggesting that the lack of comprehensive accounting information on intangible assets like R&D can contribute to increased volatility for investors. Additionally, firms with high R&D intensity are shown to have beaten-down stocks. Hence, for potential acquirers in need of R&D capacity to generate growth, high R&D capacity relative to firm valuation makes R&D-intensive firms attractive takeover targets.

For the thesis, a more recent and geographically relevant study by Mataigne et al. (2017) investigates the impact of R&D investments by targets on the acquisition premium contingent upon the acquirer's financing choices. Examining the hand-collected data sample of 407 listed European transactions, authors find that, on average, target firms with R&D investments experience a 15.8 percent higher premium compared to targets with no R&D investments. The findings are in line with Laamanen (2007) and supports the evidence for potential synergies in a wide range of industries. Interestingly, the relationship is shown to be negative if the M&A transaction is financed with debt. These finding suggest the discretion of the acquiring company's management is stiffened in the decision-making process, mainly due to elevated interest cost and stronger monitoring by debt holders.

1.3 Purpose of the study

Through prior relevant research and European data sample from technology firm's M&A between 2000 to 2022, this thesis investigates is there a relationship between the R&D intensity of the target firm and the premium paid in the M&A transaction. The purpose of the study is to expand the understanding on value relevance of the R&D investments in the M&A process, the information asymmetry regarding these R&D investments, and does these factors influence the premium paid for the target company. The research topic is essential, given that the premium payment constitutes a significant element in a M&A transaction, and the premium paid has direct value implications for both M&A parties involved in the transaction.

The findings of the thesis have value relevance both for the acquirer and the target company in the M&A process. By the deeper understanding on how R&D assets, which are relatively challenging to value compared to more tangible assets, should be valued, an acquirer can evaluate the more accurate valuation of the target company. If the acquirer benefits from the R&D investments made by the target firm, the higher premium payment can be justified by the shareholders of the acquiring firm.

However, this thesis significantly benefits the target companies. If R&D investments have a value relevance in the M&A process, it is apt to increase the incentives to engage in R&D activities by technology companies, furthermore, increasing the potential to achieve higher future cash flows. If there is a significant and positive relationship between R&D investments and the premium paid in the M&A transaction, it provides an attractive EXIT strategy for smaller and agile technology firms in the form of M&A. As a whole, the thesis contributes to the ability of M&A parties and the stock market to understand more efficiently, how the innovativeness of the target firms should be valued, and what are the justifications for exceed premium on the current share price of the target firm.

1.4 Hypotheses

The main purpose of examining innovation in the light of R&D investments is discussed more deeply in chapter three. Nonetheless, it is imperative to adopt a multifaceted approach towards examining R&D from different aspects. By examining R&D through three different empirical hypotheses, the thesis can unveil the intricate interrelations within the market dynamics. To expand the understanding of value relevance of the R&D investments in the M&A process and to continue Laamanen (2007) seminal work, the thesis examines the following empirical hypotheses:

H1: “The target’s R&D-to-market value has a positive relationship with the premium paid in European technology-based public M&A”

H2: “The target’s R&D-to-net sales has a positive relationship with the premium paid in European technology-based public M&A”

H3: “The target’s R&D growth rate has a positive relationship with the premium paid in European technology-based public M&A”

The null hypothesis is rejected and vice-versa alternative hypothesis is accepted if the p-value is less than a statistical significance level of 0.05. If the studied p-value is less than 0.05, in practice this indicates that there is a statistically significant relationship between the studied variables, the observations are more than two standard deviations away from the median and the results can be generalized to a wider entity. If the p-value is over 0.05, accepting the null hypothesis means that there is no statistically significant relationship between the studied variables. Therefore, the thesis poses the following statistical hypotheses;

$$H_0: \beta_{R\&D\ proxy} \leq 0$$

$$H_1: \beta_{R\&D\ proxy} > 0$$

Laamanen (2007) argues that the information asymmetry in the market is expected to increase due to firm's higher R&D capital and R&D growth rate, further leading to undervaluation by the stock market. The undervaluation is rationalizable through reduced cash flows, but these firm-specific accumulated R&D investments can yield potential private benefits for M&A acquirer. Therefore, investigating R&D-to-market value can unveil interesting and significant empirical findings.

Laamanen (2007) finds that as the sales revenue of a target firm increases, the stock market reaction at the time of the M&A weakens. In addition, using R&D-to-net sales ratio can create problems in growing firms, which has not yet accomplished to turn these R&D investments to cash inflows. Still as a counterargument, Li and Wang (2016) find that takeover probability is not related to innovation efficiency, further suggesting that innovation efficiency premium should not be related to takeover probability. Some firms can try to capitalize the target firm's poorly managed R&D investments.

Finally, R&D growth rate is an interesting factor as it eliminates the absolute measures of the firm size but enables to investigate growing R&D intensity of the target. Aboody and Lev (2000) find that insider trading increases as the R&D intensity of the firm increases, and Laamanen (2007) finds significant relationship between the R&D growth rate and the M&A premium paid. Therefore, R&D changes can be argued to play important role in the context of M&A transaction, suggesting higher insider trading, accumulating firm-specific private benefits, and potential EXIT strategy for the target firm.

1.5 Contribution

The prior relevant literature finds the critical relationship between R&D expenditures and future financial benefits. Lev and Sougiannis (1996) establishes a significant relationship between the R&D expenses and future earnings for R&D-intensive firms, introducing the concept of firm-specific R&D capital and exposing market inefficiencies. The pivotal study for the thesis by Laamanen (2007) finds that uncertainty around cash flows from R&D investments created information asymmetry, further affecting the valuation

of the target firm in the M&A process. Author reveals that acquirers paying higher premiums experience no negative abnormal returns, and R&D investment-to-market ratios and R&D growth rates correlate positively to the M&A premium. Additionally, Lin and Wang (2016) highlight the likelihood of high R&D firms becoming takeover targets.

Interestingly, the study by Mataigne et al. (2017) produce a geographically relevant perspective, showing that target firms with R&D investments achieve higher premiums in the context of the European M&A transactions. Still, the data from 1997 to 2010 does not consider the significant importance of technology firms in the global markets, major financial crises and a period of zero interest rates, further increasing R&D investments with debt financing, and decreasing the discount rate of R&D and M&A investments. In addition, the data includes firms in varying sectors, further limiting the comparability of the results to the M&A premium of R&D intensive technology firms. Examining the relationship between R&D and M&A exclusively in the M&A of technology firms is important, as a significant proportion of R&D investments are conducted in the technology sector in order to achieve innovation edge in highly competitive markets.

This thesis aims to contribute updated findings for the relationship between R&D intensity and M&A premiums in public technology companies in Europe from 2000 to 2022. The majority of the prior relevant studies in the field focus on the dynamics of the U.S. market (Lev et al. 1995; Aboody et al. 2000; Chan et al. 2001; Laamanen, 2007; Cheng et al. 2016; Lin et al. 2016), and this thesis fills a gap in the European research field. Moreover, the thesis offers updates findings from 2000 to 2022, as the study by Laamanen (2007) contributes the period from 1989 to 1999. The thesis attributes to prior literature by generating multidisciplinary findings on the value relevance of R&D assets, information asymmetry and insider trading effect related to these R&D assets, and how these factors ultimately influence the M&A premium paid for the target firm.

2 Mergers and acquisitions

This chapter undertakes a thorough investigation of M&As, the main purpose being to establish a robust foundation for comprehending the intricacies of this vital corporate action. Firstly, the section 2.1 provides an understanding of the fundamental components of M&A process and waves. The section 2.2 investigates different types of M&A transactions since the nature of the M&A can have significant affects to the M&A process and the final transaction price. The section 2.3 examines varying financial options available to firms engaging in M&As, and how different financial methods affects to the M&A transaction. Then, the section 2.4 introduces different types of M&A acquirers, further deepening the understanding of varying organizational structures and objectives associated with these transactions. Especially in the context of technology-based M&A, it is important to distinguish how the strategic and financial acquirer aim to utilize the acquired assets of the target company.

After the investigation of the M&A itself, the thesis examines the most essential motives for engaging in M&A transaction based on the prior relevant literature. The section 2.5 emphasizes the potential growth and synergy opportunities for acquiring company and highlight the main sell-side motives of the target. Interestingly, the section 2.5.4 of the thesis examines the most relevant behavioral finance theories influencing the M&As. Although a M&A should be based on a rational decision that maximizes the value of the company's shareholders, prior literature has observed how different behavioral biases affect the decision-making process of company's managers. Additionally, the section 2.6 and 2.7 examines what is the premium payment and M&A valuation, further deepening the understanding how the premium payment can be justified by the shareholders of the company, based on the valuation in the M&A process.

The chapter concludes recognizing the significant impact of EU-level competition legislation and how it affects to the M&A deals. Examining the competition law of an individual EU member state is not relevant for the thesis, as it is more important to investigate the minimum requirements set by EU law, so that a M&A transaction within the EU

internal market can be proceeded successfully. The analysis of the chapter two creates the required foundation for the subsequent investigation of the interconnectedness between M&A and the R&D intensity of the target firm.

2.1 The basic concepts of M&A

The terms merger and acquisition are often used in general and academic discussions as synonyms. Although, mergers and acquisitions have their own technical nature, authors often do not distinguish the terms. In this study, terms are identified as they are presented in “Mergers and acquisitions from A to Z” by Sherman, A., and Hart, M. (2006) and in “Investment valuation” by Damodaran A. (2002).

2.1.1 The definition of M&A

A merger is a combination of two or more companies in which the assets and liabilities of the selling company(s) assets and liabilities are absorbed by the buying company (Sherman et al., 2006). As a result of the transaction, the target company is fully liquidated. In a merger, the board of directors of two companies agrees to combine. Directors seek stockholder approval for the combination, and in most cases, over 50 percent of the target and bidding company shareholders must agree to complete the merger. In a specific manner, a merger can also be called a consolidation, where both selling and buying companies are liquidated and converted into a new security of the new company. After the two companies' consolidation, both the acquiring and the target company stockholders receive stocks in the new company (Damodaran, 2002).

Mergers and buyouts have their structural differences. Firstly, buyouts do not cause a consolidation of two separate companies, unlike mergers. Instead, a group of investors acquires the target company, which may include changes in the management of the company, and usually, the target company becomes a private company. Two established buyouts are managerial buyouts (MBO) and leveraged buyouts (LBO). The MBO company is acquired by its own management. On the other hand, LBOs are financialized heavily by debt, and its commonly accepted by the small relative debt ratio of the target

company (Damodaran, 2002). Of the two, LBOs are studied more extensively in prior literature. This thesis will later examine how the debt structure of companies and the use of debt as a payment method affects the premium.

The acquisition is purchasing an asset such as a plant, a division, or even the entire company. An acquisition typically has a more explicit definition of transaction sides as a buyer and a target. In the acquisition process, the buyer purchases the assets or shares of the target company. The term acquisition is often called a takeover because after the transaction majority of the target company's shares, and voting rights are transferred to the control of the buying company. In addition, the commonly used term "reverse takeover" means an acquisition where the acquiring company is smaller than the target company (Immonen, 2018). Reverse-takeover ordinarily arises when a private company acquires a publicly traded company.

2.1.2 The M&A process

Depending on the incentive of a buyer company, buyers can be defined as financial buyers and strategic buyers (Arzac, 2005). In both cases, the end objective is to achieve exceeding value, yet the value creation method differs. Strategic buyers are companies that are seeking synergy effects by acquiring or merging with another company. Nowadays, M&As are increasingly strategically motivated as the strategic buyer can achieve synergies such as entering new markets, adding new product lines, or increasing distribution reach (Sherman et al., 2006). Moreover, strategic buyer value creation theories are discussed in detail in section 3.1.

Financial buyers are big individual investors or institutions, commonly private equity (PE) funds or venture capital funds, which support a target company with financing new projects or taking the business to a new level. During the transitory buyout period, management attempts to improve operations, and the financial buyer seeks to transfer the ownership of the company to a more permanent owner (Arzac, 2005).

There is a big difference in activity policy between financial institutions. Most institutional investors are passive, including many mutual and pension funds, which will sell the ownership if the development of the business is not at the desired level. Some hedge funds, private equity, and venture capital companies are more active owners seeking potential ways to develop company operations (Damodaran, 2011). Therefore, financial buyers are seeking the value of control, which is generated by changing the way the company is run. The investors consider that value can be created by running the target company more efficiently compared to the current way of managing the company (Damodaran, 2005).

Both acquiring and selling sides can approach the M&A transaction. Motivations to sell the company may have been long-lasting when management has done an exact plan and preparation on maximizing the future transaction's value. A company can also face a sudden, surprising change in competitive or financial factors, which motivates the owners to sell the company in fast phase. The most common personal level reasons are the death or illness of an owner, retirement, a partner "cashes out" due to dispute or divorce, or incompetence to lead the business further. In addition, reasons can be strategic level reasons such as relocation of the business, company or whole management being ready to move towards different opportunities, insufficient diversification of ownership, or the company being undercapitalized and needing funding to achieve the next strategic step (Sherman, A., and Hart, M. 2006).

The main objective of a selling process is preparation, regardless of the motivations that led to selling. The selling company needs to identify the financial and structural goals of the transaction, make a coherent selling plan, and understand the dynamics of the selling process with potential buyers. Same time as the seller prepares information considering past operating performance and valuable assets, it is important to turn the stones to reveal possible "transaction turnoffs," such as potential legal or financial obstacles. Finally, after drafting an offering memorandum, processing corporate housekeeping matters, and planning of transparent communication manner with

buyers, the seller is ready for the M&A process (Sherman, A., and Hart, M. 2006). Similarly, as in the acquisition process, higher quality preparation of the target indicates a higher probability of attracting better buyers and creates a possibility for higher value creation in the selling process.

2.1.3 The market waves of M&A

Managers are incentivized to make their companies grow, to which M&A activities are essential (Jensen, 1976). M&As are a vital part of any healthy economy and an important way for companies to pursue returns for shareholders. M&As have had various roles in corporate history, ranging from “greed is good,” referring to a hostile takeover strategy, to nowadays trend to use M&As for external growth and industry consolidation (Sherman, A., and Hart, M. 2006).

Prior literature recognizes that global M&A activity comes in waves and is influenced by the overall mood of the current economic cycle. The main reasons underlying the M&A waves are changes in the regulatory environment, industrial or technology shocks, capital market expansions, and incentives to expand business operations to new cross-border markets (Martynova et al., 2008). Even though the individual M&A waves differ from each other, common characteristics are found. Interestingly, all prior M&A waves ended as the stock market collapsed.

Rhodes-Kropf, Robinson, and Vishnwanathan (2005) find evidence that temporary company-specific and industry-specific fluctuations in the share price are significant drivers in acquisition activity. The overvaluation of acquiring companies triggers M&A activity, and merger activity spikes when expected growth opportunities are high (Martynova et al., 2008). To conclude the complexity of M&A activity analysis, Brealey and Myers (1991) suggest that takeover waves are one of the ten unexplained puzzles in financial economics.

2.2 Types of M&A transactions

Briefly, the prior literature recognizes three main types of M&A transactions as horizontal, vertical, and conglomerate M&A. It is important to understand how these M&A types differ from each other in order to further understand the motivations behind these M&As. For example, in the technology sector, a company can aim to improve its competitive advantage by acquiring its competitor, acquiring a supplier to enhance operations or acquire external expertise from a firm operating in different industry.

Importantly, in nowadays globalized economy, this section introduces the difference between the domestic and cross-border M&A transactions. An investigation into variations in market dynamics, cultural integration, and heightened risks intrinsic to cross-border M&As serves to further elucidate distinctions in valuations and motivations specific to the cross-border M&As.

2.2.1 Horizontal transaction

Rozen-Bakher (2017) states that horizontal M&As involve a combination of two firms that compete in the same market. The main motivations to engage in horizontal M&A is to enhance market power and cost efficiencies. Firstly, due to reduction of potential rivals in the same market, horizontal M&A increase the market power of combined entity, further allowing for strategic pricing decisions that contributes to heightened profits and market value. Secondly, even in the absence of cost savings, the performance of merging firms improves if a larger entity possesses lower marginal costs, primarily due to price increases.

Interestingly, horizontal M&As facilitate resource sharing and the transfer of employees and assets, further leading to reduction in total operating costs. Prior literature argues that related M&As carry lower risks compared to unrelated M&As, as management is familiar with the industry where the target firm is operating (Rozen-Bakher, 2017). However, it is relevant to highlight that if the merger company misuses its increased market power or the M&A itself is narrowing the competition within the industry, there is a

possibility of an obstacle to the creation of horizontal M&A. Especially, in technology industries where only a few firms manufacture a certain product, either the lack of relevant competitors or the monopolization of product manufacturing can create an obstacle for potential horizontal M&A.

2.2.2 Vertical transaction

Rozen-Bakher (2017) states that vertical M&As involve firms in a buyer-seller relationship, which are characterized by upstream and downstream transactions. Contrary to horizontal M&As, vertical counterparts have fewer target firm choices, often limited to a singular option fulfilling acquisition criteria. The main motivations for vertical transactions are enhanced market access, operational synergies, and improved efficiency through combined product or service flow. Interestingly, competitive parity within vertical M&As can strengthen bargaining positions, but asymmetry may diminish combined profits. In the context of technological M&As, firms with intricate and innovative processes, can strategically utilize vertical integration to enhance efficiency in R&D and competitive edge.

2.2.3 Conglomerate transaction

Where horizontal and vertical M&A allow acquisition of firms operating in the same market or in the same supply chain, conglomerate M&As combine firms which manufactures unrelated products. The main motivations for conglomerate M&As are market diversification and the potential to enter new geographic markets. Yet, prior literature recognizes challenges in conglomerate M&As due to complex integration process of two unrelated product or services, further hindering the realization of synergy benefits. Additionally, significant differences in markets, products, and geographic locations can create obstacles during the M&A integration process, further limiting the ability to reduce operating costs and generate future profits (Rozen-Bakher, 2017). The study by Hagedoorn and Duysters (200) supports the argument that conglomerate M&As experience less successful M&As compared to prior mentioned horizontal and vertical M&As. Authors find, that

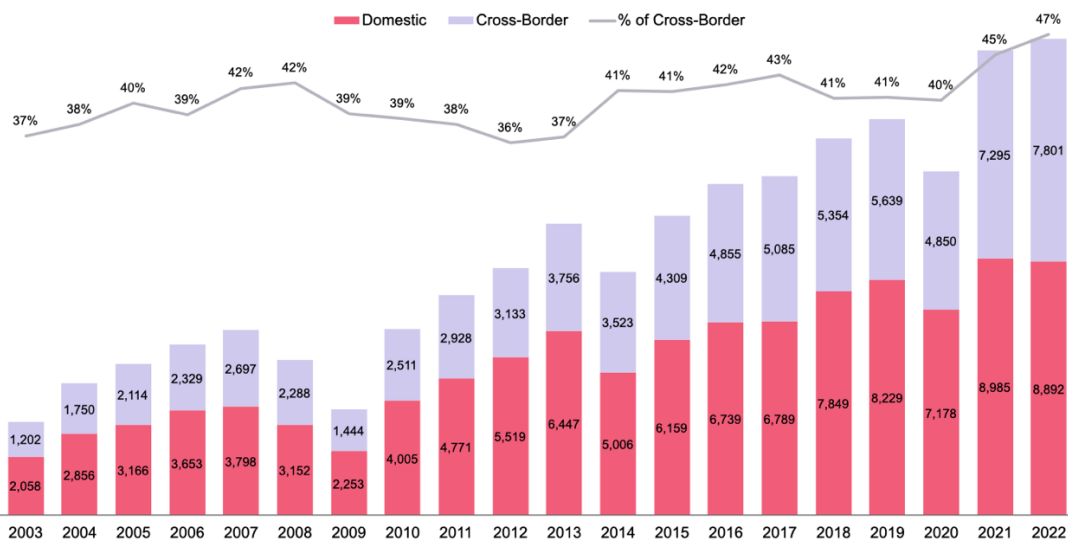
the strategic and organizational fit between firms involved in technological M&A have an important role in enhancing the technological performance of the combined firm.

2.2.4 Domestic and cross-border transaction

Marek (2018) introduces that cross-border M&A is an illustrative term for any transaction in assets between two companies located in two different countries. In the past few decades, globalization has accelerated the trend for companies to achieve external growth by cross-border M&As. Due to deregulation, trade liberalization, and privatization, European cross-border M&As have experienced rapid growth since the mid-1990s, significantly impacting the direction and magnitude of global foreign direct investment (FDI) flows.

More specifically, Drazdou (Aventic-Advisors.com, 2023) article investigating M&A activities in European Union, illustrates how companies are engaging in domestic and cross-border M&As. Although domestic M&As are dominating in European M&A activity, cross-border M&As achieved 47 percent of total deal volume in 2022. Overall, cross-border M&As transactions are averaging 40 percent of total M&A volume over the 20-year period. Highly relevant for the thesis, the following table 1 illustrates the development of European domestic and cross-border M&As from 2003 to 2022.

Table 1 M&A in Europe: Domestic vs. Cross-border from 2003 to 2022 (Aventic-Advisors.com, 2023).



Marek (2018) investigates the cross-border M&A activity in European Union countries, discovering the main motives behind these unique transactions. The main motivating factors include the synergy motive for economic benefits, the agency motive to further enhance shareholder value and achieve an access to new markets rapidly, and the diversification motive as a business-expansion strategy. Additional motives are shown to be restructuring possibilities, prevention of asset losses, and efficient resource allocation. In the context of technology-based transactions, cross-border M&As present a strategic avenue for firms encountering challenges in achieving independent technological development within their domestic markets. This is particularly relevant for high R&D-intensive firms, as cross-border M&As provide the opportunity to broaden their knowledge base, facilitating the acceleration of ongoing or new R&D initiatives, fostering innovation, and further enhancing competitive advantage.

2.3 Types of M&A financing

After a buying side has found the right target company to buy, evaluated the target company, and negotiated the transaction price, it is time to decide how the transaction is financed. Commonly, the transaction is financed by three different methods (Sherman,

A., and Hart, M. 2006; Damodaran, 2002). Cash is the simplest method to finance a transaction. This method is available for companies that have accumulated a high proportion of cash prior to the transaction or increased the proportion of debt to finance the transaction (LBOs). Furthermore, acquiring company can finance the transaction with its shares in a stock-swap deal. This method transfers the ownership of the target company and enables the shareholders of the target company to benefit from the growth of the acquiring company. Stock-swap negotiations focus strongly on the implemented exchange ratio of stocks. Lastly, the mixed transaction can be financed partly with cash and stock-swaps.

The payment method is a two-sided decision that is purely motivated by the incentives of transaction parties. If the financial markets value companies incorrectly, managers can use this asymmetry of the market to their advantage. At least, in theory, investors should be able to choose between different securities, and prices should at any point of time “fully reflect” the available information, known as “the efficient market hypothesis” (Fama, 1970). The efficient market hypothesis divides market stages into three forms. Firstly, the strong form is where the individual investors or group have monopolistic access to any information affecting the stock price. The second semi-strong form reflects all public information about the markets. Lastly, the weak form of the market only consists of historical data from stock and returns. In conclusion, when the level of information in the markets is low, a higher level of misvalued M&As is created.

This statement can be supported by the prior study by Shleifer and Vishny (2003), which created a model to demonstrate that relatively overvalued acquirers frequently make acquisitions compared to target companies. In addition, stock acquisitions are explicitly used in transactions where the acquiring company believes its stock price to decline and aspires to make these future negative returns less negative. On the other hand, the frequency of cash payments increases when the valuations in the market are low. More precisely, a study by Rhodes-Kropf, Robinson, and Vishnwanathan (2005) shows that in intense merger markets, stock-financed transactions are common and can be motivated by the overvaluation of the stock. On average, cash acquirers are less overvalued than

stock acquirers. Certainly, shareholders of the target company should be aware of the possibility of overvaluation if the acquiring company suggests pursuing the transaction with its stocks (Damodaran, 2002).

2.4 Types of M&A acquirers

Two distinct buyer approaches to M&A process can be defined as strategic acquirer and financial acquirer (Bragg, 2008). In both instances, the absolute objective of the buying company is to create exceeding value, still the value creation method differs. This thesis places a particular emphasis on strategic M&As due to the crucial influence of the target's R&D investments on the assessment of valuation and the subsequent success of the merger.

2.4.1 Financial acquirer

A financial acquirer engages in a M&A process with the primary objective of holding the acquired company temporarily, anticipating value appreciation over time, and subsequently selling it for profit (Bragg, 2008). Typical financial acquirers are big institutional investors, private equity (PE) funds, or venture capital funds, which support a management of the target firm with new projects and aims to lead the firm towards more profitable growth. Due to this transitory period, management attempts to improve operations, and initial financial buyer seeks to transfer the ownership to more permanent owner (Arzac, 2005).

If the financial acquirer possesses pertinent technical know-how, the substantial premiums offered by financial acquirers can be rationally justified. This justification is based on the acquirer's capacity to contribute to the continued advancement of the target company's R&D investments. Considering Bragg's (2008) perspective, it can be suggested that the influence of technical knowledge within financial acquirers is comparatively limited when juxtaposed with strategic acquirers. This is attributable to the inherent constraints faced by financial acquirers as synergies can be realized only by strategic acquirers, not by financial acquirers.

2.4.2 Strategic acquirer

Strategic buyers are companies that are seeking synergy effects by acquiring or merging with another company. Nowadays, M&As are increasingly strategically motivated as the strategic buyer can achieve synergies such as entering new markets, adding new product lines, or increasing distribution reach (Sherman et al., 2006). Bragg (2008) suggests that a strategic buyer is willing to pay higher premium for the target company, exceeding the average amount a financial buyer offers. This higher valuation is justified due to strategic acquirer's incentive to retain and develop the most valuable components of the target entity while discarding the less essential components.

The strategic acquirer's capability to execute this strategy is based on its extensive understanding of the relevant industry, as well as a profound understanding of the target company's products, intellectual property, R&D investments, and operational processes. In the light of this thesis, strategic acquirers are in a more interesting position than financial acquirers, as strategic acquirers are expected to achieve higher synergistic benefits from target's R&D investments than financial acquirers. Interestingly, Mneijja et al. (2010) find that on average European financial buyers pay from 16 percent to 24 percent lower premiums compared to strategic buyers.

2.4.3 Friendly and hostile takeover

The acquisition can be identified as a friendly or hostile takeover. In a friendly takeover, the target company's managers are incentivized to accept the acquisition. Involved parties perform due diligence, negotiate transaction price and other deal-specific terms. In a hostile takeover, the management of the target company is not willing to be acquired, and management is usually forced to take action to prevent the acquisition (Damodaran, 2011). Companies are increasingly using "value consultants" to assist them in restructuring, increasing value, and avoiding being taken hostilely over (Damodaran, 2002). In contrast to a friendly takeover, the bidder side does not negotiate with the management of the target company but instead makes a tender offer directly to the shareholders.

Although, the nature of a takeover can change rapidly in mid-acquisition from friendly to hostile and vice versa (Miller et al., 2017).

2.5 M&A valuation

The determination of the transaction price holds critical significance within the context of M&A deal, as it delineates whether the transaction generates exceeding value or leads to value destruction for the acquiring company's shareholders. In typical M&A transaction, the acquirer customarily offers a premium above the current market value of a publicly traded target company's shares, incentivizing shareholders of the target company to tender their shares. As articulated by Arzac (2005), this premium denotes an excess payment beyond the value enhancement already reflected in the target's pre-acquisition share price.

This section is vital for the thesis, as it creates foundation on how the valuation of a target company and the final M&A deal price itself is determined. As this thesis delves into the relationship between the target R&D intensity and the premium payment, it is therefore necessary to understand why the premium is paid above the target company's pre-acquisition share price and what are its drivers. In addition, this section examines different valuation techniques to introduce varying methods of evaluating the fair price of the target assets.

2.5.1 Valuation of a target firm

In the acquisition process, the valuation of the target company does not fundamentally differ from the valuation of companies in general. To begin with, status quo valuation should be calculated or so-called "stand-alone" valuation, where only the target company is valued with existing investing, financial, and dividend policies. This status quo valuation builds the base value of the transaction price, in which future control, operating, and financial premiums are added. To calculate the status quo value for the target company, there are three commonly used methods; the discounted cash flow method, the method of multiples, and the asset valuation method (Damodaran, 2002).

The discounted cash flow (DCF) method estimates the company's intrinsic value based on its fundamentals. The DCF model is built by discounting the future cash flows of the company, and its strength underlies counting in the company-specific information. The weakness of the DCF model is that the model cannot effectively value non-profitable companies or private companies with short historical data (Damodaran, 2002). Despite DCF method is highly common among practitioners, it can introduce challenges in valuing newly established R&D-intensive targets, as these investments have not yet progressed to generate growing future cash flow for the company. Furthermore, even if the R&D investments are taken into account in the expected future cash flows, it is challenge to define the actual increasing effect of the R&D investments on these future cash flows.

The method of multiples compares the relations of common variables of the company, such as price/earnings, price/book, and price/sales ratio, to its competitors. The method's strength is to disclose which company is potentially under or overvalued compared to its competitors in different market situations. Even if the model can identify a relatively undervalued company, the weakness of the model is its inability to recognize the valuation of the market in general (Damodaran, 2002). The efficacy of the method of multiples lies in its ability to interpret whether a target's R&D investments are valued more favorably than those of its counterparts within a set of comparison companies. When the financial metrics of two companies are aligning closely, the method of multiples can be used to reveal the market perception regarding a specific target's potential to leverage its R&D investments more efficiently than its competitors in the future.

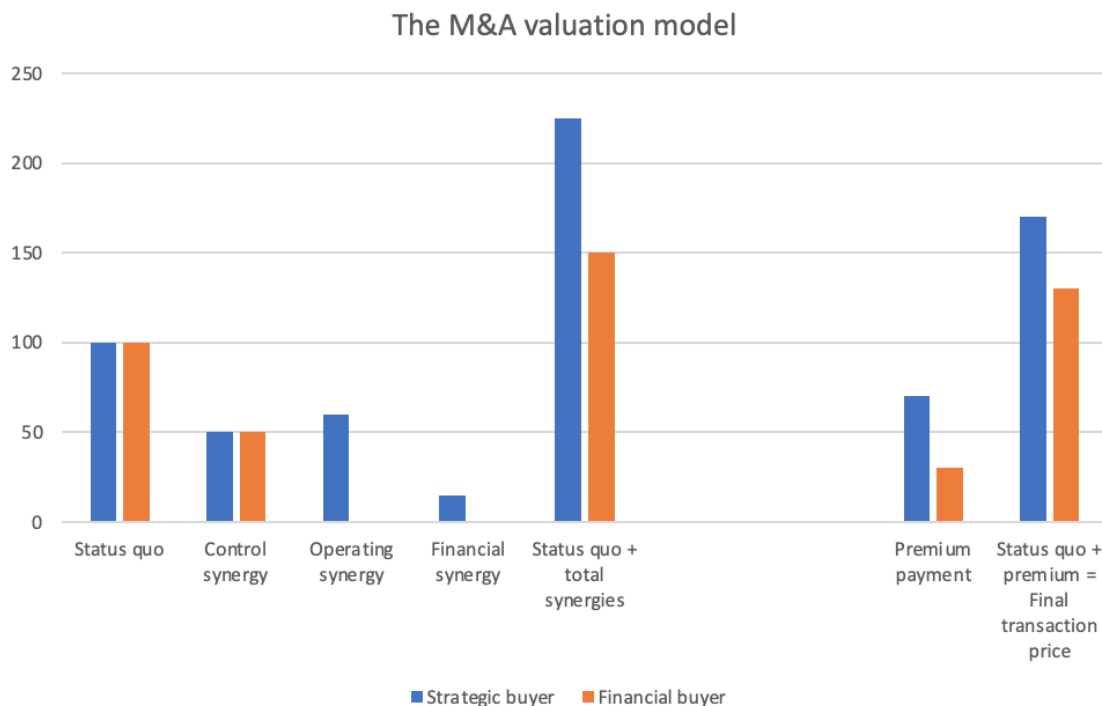
Finally, the asset valuation method accepts that the value of the asset can be greater than the present value of the expected cash flows on the occurrence or nonoccurrence of an event. The asset valuation method is generally used to evaluate options but can also be used to evaluate "optionlike" assets. For example, the method will help evaluate smaller innovative companies with intangible assets whose value is not yet realized in the balance sheet (Damodaran, 2002). In other words, when the probability of generating future cash flows from the target's R&D investments depends highly on other

developments in the market, if investors expect such developments to occur, it is apt to indirectly increase the valuation of these R&D investments.

2.5.2 Valuation of synergy

Calculating the status quo value of a target company is a relatively straightforward process, yet complexity increases when future deal synergies are estimated. Calculating synergies holds certain risks, as synergies can occur in a different size or period than expected. All these changing factors must be considered in valuation and discount the estimated future earnings. Prior literature does not have a consensus on whether the valuation of synergies is too complex a process to operate. However, possible guidelines are found if visible synergies can be transferred into financial numbers. Arzac (2005) suggests calculating sensitivity, scenario analyses, and estimating the probabilities for different scenarios. Valuating synergies more comprehensively, sensitivity analysis should always be calculated as estimates of the worst, neutral and best-case scenarios.

Table 2. The M&A valuation model developed by the author, influence by Damodaran (2002) and Arzac (2005). The table presents positive NPV investment.



The table 1 states that transaction price should always be between “status quo” and “status quo + total synergies” (Arzac, 2005). The difference between the “status quo + total synergies” of the strategic and financial buyer is that only the control premium matters for financial buyers. Big investors, private equity, and venture capital companies are willing to pay large premiums over the market price to control the companies because they assume they can manage the company more efficiently compared to current management. Rationally, control synergy is greater for an inefficiently managed company, and a hypothetically “perfectly” managed company should have zero control synergy.

Interestingly, Dutordoir (2010) studies the period of 1995-2008 and finds that 54 percent of M&A premium payments exceed the estimated synergies. These M&A transactions achieve so-called negative net present value (NPV). If the investment generates higher returns than its costs, it receives a positive NPV. Thus, M&As significantly impact a company and its shareholders, and management should only accept the M&As that generate higher returns than shareholders could earn themselves (Brealey, 2011). An example of positive NPV investment is demonstrated in the table 2.

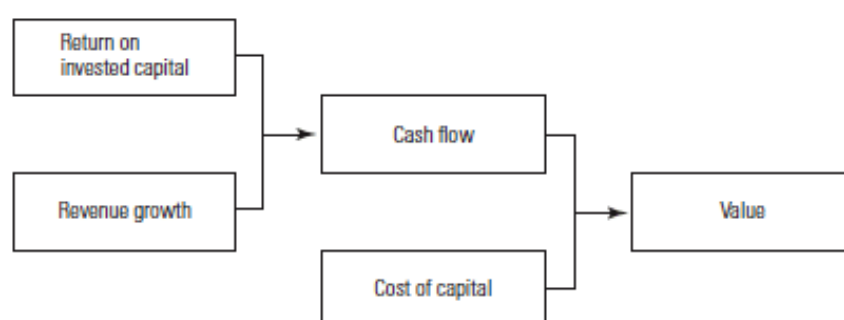
It is imperative to highlight from Dutordoir (2010) that it does not take a stand on what is the quantum of premium paid in the M&A per se. What holds greater centrality is the acquirer’s deliberate or inadvertent willingness to opt for a decision wherein it commits to pay a premium for the target exceeding the expected synergies. In other words, the relatively high premium payment does not exclusively signal a decline in the value of the acquiring company’s shareholder, expected that the synergy benefits from the target company is greater than the premium.

2.5.3 M&A value creation

Companies create value for their owners by investing cash now to generate more cash in the future. The amount of value created is the difference between investments made and future cash inflows, which are adjusted by the discount rate and riskiness of future

cash flows. The company's return on invested capital (ROIC), revenue growth, and ability to sustain both over time determine future cash flows of the company and ultimately drive value creation for the owners. Although, earnings and cashflows are regularly correlated, too heavy concentration on earnings often leads companies astray (Koller et al., 2011). These doctrines in question are not only limited to companies' internal investments, but to all engaged investments, including M&As.

Figure 2. Growth and ROIC drive value (Koller et al., 2011)



Growth, ROIC, and cash flows are tightly linked. For any level of growth, value always increases with improvements in ROIC. However, the matter is different with growth. When ROIC is high, faster growth increases value, but when ROIC is low, faster growth decreases the value. The ultimate creation or destruction of value is determined by whether the return on capital is greater or less than the company's cost of capital (Koller et al., 2011). Understanding the impact of a company's ROIC, revenue growth, cash flows, and cost of capital on the company's value strongly influence value creation calculations such as net present value (NPV) and discounted cash flow (DCF) model. For example, when management is aware of the company's ability to create value as a result of the M&A deal, it can use varying valuation techniques to define the threshold value for premium payment and avoid the destruction of shareholder value.

According to a highly recognizable phrase referring to the time value of money, a dollar today is worth more than a dollar tomorrow. Practitioners' most used investment criteria to optimize the time value of money are net present value (NPV), internal rate of return

(IRR), and the payback rule (Dai et al., 2022). NPV calculates the present value of the cash flows generated by the investment and divides them by the cost of the investment, i.e., the applied discount rate. Therefore, the investment with the highest positive NPV should be accepted. One of the core advantages of the NPV method is its ability to include most of the risks and costs inside the calculations. However, NPV can face difficulties due to future uncertainties and recognizing the required time for obtaining the estimated cash inflows.

IRR is the discount rate that produces zero NPV for the investment. The most relatively profitable investment should be accepted, and the rate of return should be higher than the company's opportunity cost of capital. If the IRR is lower than the discount rate, the investment generates a negative NPV and should not be accepted. As NPVs do, IRR does not consider the size of the investment, and generally, IRR prefers short-term investments over long-term investments. Lastly, the payback rule measures how long investors need to wait until the investment covers its initial costs. The company sets a cutoff date for the investment to cover its expenses. Applying the payback rule further, the discount payback period discounts future cash flows to present value and compares whether the NPV is positive before the cutoff date (Dai et al., 2022). According to a Finnish-based study by Wang (2021), in 1984, 57.7 percent of companies considered IRR as the primary indicator, while only 2.5 percent utilized NPV. By 2004, IRR was still the leading indicator, but 52.1 percent of analyzed publicly listed companies reported NPV to be either their primary or secondary decision rule for investment.

Kang et al. (2018) investigates how firm's methods for evaluating M&As are influenced by two socio-political determinants identified in the behavioral theory of the firm. Authors analyses the roles of uncertainty and controversy in influencing valuation techniques such as net present value (NPV), internal rate of return (IRR), valuation multiples, leveraged buy-out (LBO) valuations, and relative valuations like EBITDA multiples. The results indicate that the higher uncertainty around the target firm enhance focused financial analysis, while controversy drives decision-makers to prioritize the role of

negotiation and coalition-building to achieve their M&A objectives. Authors identifies four distinct M&A valuation approaches, which can be utilized under varying uncertainty and controversy levels. Moreover, desktop valuation emphasizes traditional financial analysis, capability design incorporates scenario planning and goal-setting, issue list flags potential conflicting objectives, and finally storytelling aims to create persuasive narratives for the transaction. Especially when they have high R&D intensity, the ability of financial advisors to yield higher premiums is emphasized through scenario planning and attractive story telling. A financial economist can be prone to under-emphasize the benefits of incorporating behavioral explanations in activities such as M&A assessment, and scholars with higher organizational focus underestimate the role of financial analysis.

Valuation models can be used as guidance and provide a benchmark for acquisition pricing. However, from time to time only part of the premium can be calculated and justified using valuation models. It is necessary to recognize that intangible and, in some cases, emotional factors will significantly influence the final price (Thomas, 2016).

2.6 Competition law in Europe

Before delving into the investigation of R&D as a proxy for target innovativeness, this thesis scrutinizes the pertinent legislative environment that impacts M&A transactions within the Europe. The primary emphasis in the examination of relevant legislation does not include precise rule or article-based legal interpretation, rather it aims to enhance comprehension of the mechanism that both prohibit and facilitate the initiation of M&A transactions within the Europe. Investigating the relevant legislation is important, as it limits the emergence of M&As that could be successfully rationalized on financial grounds. As R&D-intensive firms often operate in sectors with significant innovation and technology, they can experience heightened regulatory reviews to ensure that proposed M&A do not unduly limit competition or stifle innovation.

In the EU, the main legal instrument for the merger control of concentrations between undertakings is the Council Regulation (EC) No 139/2004. It establishes the European

Commission as the authority responsible for reviewing and approving or prohibiting M&As that have a significant impact on competition within the EU. In addition, the EU's antitrust rules including the Articles 101 and 102 of the Treaty on the Functioning of the European Union (TFEU) apply to M&As.

TFEU Article 101 prohibits agreements, decisions, and practices that may harm competition in the EU internal market, including price-fixing and market sharing-practices. Yet, exceptions exist for agreements that contribute to economic progress, benefit consumers, and do not impose unnecessary restrictions on competition. In practical terms, while a M&A between two R&D-intensive technology firms might typically raise concerns about restricting competition, it could be permissible under TFEU Article 101 if the M&A ensures consumers receive a fair share of the resulting benefits.

In contrast, TFEU Article 102 prohibits the abuse of a dominant market position within the EU internal market or a substantial part of it if it may impact trade between member states. More specifically, the abuse of a dominant market position includes actions as imposing unfair prices, limiting production or markets to harm customers, applying unequal conditions to similar transactions, and requiring unrelated supplementary obligations for contract acceptance. While a M&A deal may be initially permitted under TFEU Article 101, it could later be prohibited under TFEU Article 102 if the merger entity engages in abusive practices that harm competition and consumers through its dominant market position.

3 Innovation through R&D

As this thesis aims to contribute updated findings for the relationship between R&D intensity and M&A premiums in public technology companies in Europe from 2000 to 2022, it is important to investigate the strategies employed by firms to enhance their innovativeness through R&D. Section 3.1 examines what is innovation and why is it important. Section 3.1.1 investigates innovation from the perspective of innovation input and output. Section 3.1.2 Briefly deepens the understanding of historical and current innovation waves. Relevant for the scope of this thesis, section 3.1.3 examines the development and factors affecting the innovation in the Europe. Finally, section 3.2 rationalizes the utilization of R&D as a proxy for company's innovativeness.

3.1 Innovation

In the dynamic landscape of business, innovation stands as a pivotal force, enhancing competitive advantage and increasing sustainable growth. Yet, prior literature lacks singular, universally accepted definition for innovation. Furthermore, this reflects the multifaceted nature of innovation, suggesting not only technological possibilities but also novel approaches to processes, products, services, and business models. As this thesis delves into the essence of innovation, it becomes increasingly evident that comprehending and leveraging innovation are paramount for businesses navigating in continually evolving competitive markets.

An article authored by McKinsey and Company (2022) posits that innovation is a systematic practice involving the development and marketing of breakthrough products and services for adoption by customers. The survey within the article reveals that despite over 80 percent of executives ranking innovativeness among their firm's top three priorities, less than 10 percent express satisfaction with their actual innovative performance. While high proportion of companies seek to be innovative, McKinsey and Company investigated assessing the innovation proficiency of 183 companies, comparing it against a proprietary database of economic profit, where economic profit is calculated as the

total profit minus the cost of capital. The results emphasize the significance of innovativeness, indicating that successful innovation yield economic profits 2.4 times higher than those achieved by other companies.

3.1.1 Innovation input and output

Innovation is a fundamental factor for the growth and development of an individual company, further accelerating the economic growth of the specific area. However, the thesis leads to the question that if the innovativeness of companies is highly valued, how should innovation be invested or how should it be quantified. Kijek et al. (2010) suggest that in order to increase the innovation performance, the firm must be efficient in transforming the innovation inputs into innovation outputs. Consequently, authors recognize the importance of innovation efficiency as a part of firm's innovation policy and conduct canonical correlation analysis to investigate the innovation input and output relationship in the group of 22 EU member states.

In the light of Rose et al. (2009), Kijek et al. (2010) present that innovation metrics are evolving through four generations. Firstly, the most dominant generation metric for innovation is a linear concept of innovation focusing on inputs as R&D investments. R&D expenditures are crucial for creating a formal process to further create value-adding knowledge within the firm, but the use of R&D as an input does not exhaustively identify all forms of innovation. Key disadvantages are that R&D does not reflect the actual output efficiency and R&D strategies can vary based on the firm's strategy or sector. Therefore, accounting firm's science and technology (S&T) activities and highly skilled human resources is highly recognized method to proxy innovation more effectively. The rationale for identifying human capital as a company's input is based on the fact that companies can use human capital to develop new communication and information technologies and methods in ways, which are not reflected in accounting R&D expenses per se.

For the outputs, the third-generation metrics gives emphasis to a more comprehensive away of innovation indicators and indexes derived from surveys and the amalgamation

of publicly accessible data sources. Additionally, fourth generation metric is based on a knowledge-based networked economy, what has its own ad hoc nature and are the subject of measurement. While these relatively discretionary used output data sources support to deepen the knowledge of the company's level of innovation, the most frequently implemented output evaluation method in prior literature is patent counts. The strength of investigating patents is the information access to public data sources, what guarantees a relatively robust continuity for research. On the other hand, there are major differences between patents in terms of their actual business value, and a significant proportion of innovation do not result in patent protection. Authors conclude that the most pertinent gauge of the commercial success of innovation lies in the proportion of overall revenue attributable to novel and substantially enhanced products (Kijek et al., 2010).

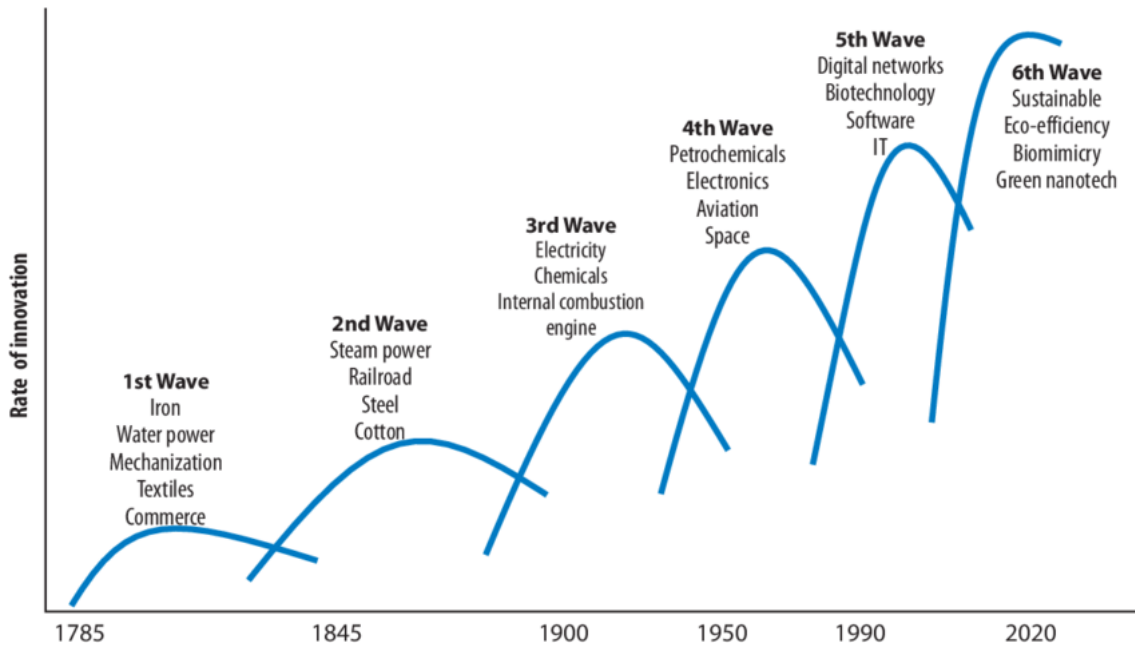
3.1.2 Innovation waves

Investigating innovation waves in the light of technology-based M&As is crucial due to their pivotal role in shaping organizational trajectories amidst evolving competitive landscapes. Across centuries, firms have navigated diverse development paths influenced by shifts in competitive environments and their responses. A brief examination of these economic transformations facilitates an understanding of the intricate interplay between innovation and the economy, particularly in delineating the reliability of research results across distinct phases of innovation waves. In practice, the discernible presence of an innovation wave within the economic landscape increases a rationale wherein firms exhibit willingness to offer higher premiums to align themselves with the forefront of innovation, further developing their competitive edge in the market. On the other hand, it is justified to argue that if there were no clear macroeconomic innovation wave in the market, firm's R&D investments would increasingly focus on company-specific objects, rather than directions of general macroeconomic innovation.

The figure by Hargroves and Smith (2005) provides a significant illustration of historical innovation waves, offering insights into the evolutionary trajectory of varying innovation trends in the market landscape. The development of innovation has continued ever since

the first industrial revolution in the 19th century, and it can interpret that innovation waves are emerging more and more dynamically. Of particular relevance to this thesis is the fifth wave, characterized by pivotal breakthroughs in technological investments, signifying a paradigmatic shift in organizational strategies and competitive dynamics.

Figure 3. Drivers for long-term innovation (Hargroves et al., 2005).



Currently, the focus of contemporary discourse gravitates toward the sixth wave of innovation. The sixth wave is characterized by pronounced emphasis on sustainability development and fostering enduring growth. As firms increasingly prioritize environmental and social factors in their decision-making, technology-intensive M&As plays a significant role in driving sustainability-driven innovation. These transactions enable firms to access competitive technologies and expertise, further facilitating the development and implementation of sustainable solutions. The pursuit of sustainable growth objectives can serve as a catalyst for strategic collaborations and partnerships within the technology sector, fostering synergies and enhancing competitive edge in the dynamic marketplace.

3.1.3 Innovation in Europe

Within the context of this thesis, it is crucial to briefly investigate the evolutionary trajectory of innovation within the European Economic Area (EEA), discerning pivotal trends inherent to its development. The European innovation scoreboard (2023) authored by European commission suggest that bold policies and increased investments towards R&D are necessary to contribute to the success of Europe's digital and green transformation. The scoreboard suggests that Europe favorable environment for innovation investments, and the innovation performance in Europe is increased 8,5 percent between 2016 to 2023. The main external factors impacting on innovation performance in Europe includes Russian invasion, the resulting energy crises, and the high inflation period. In addition, the analysis of Covid-19 shows that the pandemic has a negative impact on innovation expenditures, innovative sales, and venture capital expenditures since 2020.

The European innovation scoreboard (2023) shows that South Korea is the most innovative country in the world. Additionally, Australia, Canada, and the U.S. have an innovation performance lead over the EU. Compared to 2016, performance for the EU has improved most in SME innovators due to strong performance in product and business process development. Additionally, the linkages and collaboration efforts between innovating firms has strong increase, further suggesting solid M&A market. Also, there is a solid increase trend in government support for business R&D. The performance for the EU declined most in human resources due to strong decline in doctoral graduates and intellectual assets due to a decline in both patent applications and design applications. These findings support the use of R&D as a proxy for innovation, instead of innovation outputs such as patents and design applications. Interestingly, 2021 data shows that even R&D expenditures in the business sector increased 6.3 percent in EU, the GDP has increased stronger with 7,7 percent, suggesting a decline in R&D intensity for the EU. The scoreboard indicate that large enterprises account for almost 80 percent of EU business R&D expenditures.

3.2 R&D as a proxy for innovation

To continue Laamanen (2007) seminal work, this thesis uses firm's R&D expenditures to capture the relationship between the target firm's innovative actions and the M&A premium paid. Although R&D expenditures do not cover all forms of innovation in the company, the prior literature suggest R&D as the main indicator of innovation input. In addition, under IRFS, GAAP and other relevant accounting principles, firms are obligated to account the necessary yearly R&D expenditures as incurred, which ensures the continuity of future research of the same quality.

Based on the European innovation scorecard (2023), European industries characterized by medium-high and high technological intensities exhibit increased levels of R&D expenditure, alongside a heightened propensity for patent applications and a greater prevalence of innovative firms. The presence of increased levels of R&D further bolsters the robustness of the study findings, underlining the significance of R&D expenditure as a pivotal determinant in investigating the dynamics within the context of technological M&As.

4 Theoretical framework

Following an exploration of the M&A process and business innovativeness, it is pertinent to delve into the theoretical framework that prior literature has examined concerning M&A and R&D. Firstly, this chapter investigates the leading neoclassical theory of M&A and emerging behavioral theories that also offers insight into the rationale behind the substantial premiums associated with M&A transactions. Additionally, the chapter briefly investigates relevant macroeconomic theories, which are particularly relevant to cross-border M&A activities and R&D endeavors. Furthermore, this chapter addresses the motivations underlying the acquisition of R&D assets both prior to and following M&A transactions, further deepening the understanding the relationships between M&A activities and R&D investments.

4.1 Neoclassical theory

The neoclassical theory presents M&A as a synergy-driven investment in which the value of the combined company is higher than the value of independent companies. Similarly, the value creation theory is one of the earliest theories to explain why companies seek M&A transactions. At its core, two separate companies can achieve more than they could themselves, referring to synergy creation with the “ $1 + 1 > 2$ ” formula (Zhang, 2019). The neoclassical theory is strongly based on the synergy hypothesis by Bradley, Desai, and Kim (1988), which explains the emergence of M&As with operational synergies, economies of scale, and benefits in the form of economic scope.

Combining two separate companies makes it possible to achieve advantages that are not possible to attain as individual companies. With the greater turbulence of the economic environment, neoclassical theory suggests that companies have more incentive to pursue M&A, which enables the company to adapt more quickly compared to internal organic growth (Ahern et al., 2007). In line with neoclassical theory, Damodaran (2005) states that synergy is the additional value generated by combining two companies, creating opportunities that would not be available to these companies operating

independently. Synergies can be categorized mainly into two separate groups operating and financial synergies. Damodaran suggests synergies are the most widely used and misused rationalizer in M&As.

Operating synergies allow a company to increase its operating income from existing assets and increase growth. Operating synergies are created with economies of scale, higher pricing power, a combination of different functional strengths, and higher growth in a new or existing market. Generally, economies of scale and higher pricing power occur after horizontal M&A due to a reduced competition environment and the higher market share of the combined company. Using combined competition advantages, shared distribution network, and prior brand name recognition, the new company can pursue new market opportunities, which it could not achieve before the M&A (Damodaran, 2005).

Financial synergies produce higher cash flows and a lower cost of capital. Financial synergies can occur in the form of increased debt capacity, tax benefits, diversification, and higher efficiency of capital spending. If a company with high-return projects (with limited cash) and excess cash (with limited project opportunities) company pursues M&A, the combined company can expect to yield higher-value projects. Value creation occurs when excess cash can be invested in new high-returning projects, and the future cash flows of the combined company can become more stable and predictable, which creates higher debt capacity. In addition, the profitable company can create tax benefits if it acquires a money-losing company, as the acquiring company can use the net operating losses of the latter to reduce its tax burden. Finally, there can be potential diversification benefits for some private or closely held companies.

In the sample of 264 large mergers, a “value line” forecasts average M&A synergy gains to be 10.03 percent for the combined equity of the merging company. The estimates show that only 1.64 percent in additional value is from financial synergies, and the rest, 8.38 percent, is from operating synergies. This distribution is explained by those

operating synergies that arise in higher-focused mergers, while tax savings contribute a significant fraction of the gains in diversifying mergers. The main driver for operational synergies is cutbacks in investment expenditures rather than increasing the company's operating profits (Devos, 2010). Also, Damodaran (2005) suggests that cost-saving mergers are more likely to deliver estimated synergies than mergers were estimated synergies weights toward growth synergies.

Prior literature also recognizes strategic and managerial synergies. Strategic synergies are the additional real options a target company brings to a new combined company. The company's value includes both cash flows and strategic capital, such as intellectual and human capital, that includes plans and the "know-how" of turning these plans profitable. These new real options can be seen as "the new possibilities to create synergies" in the future and can take a long period to emerge (Collan et al., 2009). Moreover, managerial synergies can be generated by acquiring a target company with inefficient management performance. The objective of the acquiring company is to discipline the inefficient management of the target company and renovate non-value-maximizing operational strategies (Martin et al., 1991).

To summarize, as neoclassical theory presents M&A as a synergy-driven phenomenon, there can be various ways to create excess value by combining two companies. Synergies occur mainly as operating and financial synergies, and operational synergies are shown to generate the highest proportion of the excess value. Nonetheless, the more critical issue relates to evaluating this potential synergy and determining how much to pay for the synergy (Damodaran, 2005).

4.2 Sell-side motives

Both acquiring and selling sides can approach the M&A transaction. Motivations to sell the company may have been long-lasting when management has done an exact plan and preparation on maximizing the future transaction's value. A company can also face a sudden, surprising change in competitive or financial factors, which motivates the

owners to sell the company in fast phase. The most common personal level reasons are the death or illness of an owner, retirement, a partner "cashes out" due to dispute or divorce, or incompetence to lead the business further. In addition, reasons can be strategic level reasons such as relocation of the business, company or whole management being ready to move towards different opportunities, insufficient diversification of ownership, or the company being undercapitalized and needing funding to achieve the next strategic step (Sherman, A., and Hart, M. 2006).

The main objective of a selling process is preparation, regardless of the motivations that led to selling. The selling company needs to identify the financial and structural goals of the transaction, make a coherent selling plan, and understand the dynamics of the selling process with potential buyers. Same time as the seller prepares information considering past operating performance and valuable assets, it is important to turn the stones to reveal possible "transaction turnoffs," such as potential legal or financial obstacles. Finally, after drafting an offering memorandum, processing corporate housekeeping matters, and planning of transparent communication manner with buyers, the seller is ready for the M&A process (Sherman, A., and Hart, M. 2006). Similarly, as in the acquisition process, higher quality preparation of the target indicates a higher probability of attracting better buyers and creates a possibility for higher value creation in the selling process.

4.3 Behavioral theories

Financial theories present that the goal of the company is to maximize its shareholder value. Nonetheless, managers can have individual drivers and motivation to pursue M&A transactions, even if the transaction would not benefit the shareholders. Asaoka (2019) finds that the human errors and biases of the managers often result in failure and impairment loss, leading to a risk of overvaluation of the target company. By understanding the role of emotion and psychology, more effective decision-making can be secured in M&A transactions, leading to higher value creation for the acquiring company's shareholders.

4.3.1 Winner's curse and managerial hubris

Ahern and Weston (2007) present the winners' curse theory, as many bidders around a highly uncertain target company, causing a wide range of bids. As a result, the highest bid rationally wins, which frequently causes the winner to overpay in relation to the fair value of the target company. The winning bidder is "cursed" in the sense of the overpayment.

Roll (1986) presents the empirical evidence supported by psychologists that individuals do not always produce rational choices in an uncertain environment, and the overconfidence and arrogance of the managers are remarkable motivators for engaging the deal through. The winner's curse theory is linked closely with the managerial hubris theory because many acquisitions are motivated by the managers' mistakes and pursued without future synergy gains (Berkovitch et al., 1993). In addition, Roll (1986) suggests that some managers have only a few or fewer possibilities to engage in M&A in their whole career, which can motivate them to convince themselves that the valuation is correct, and the market does not fully reflect the total economic value of the combined company. Winner's curse and managerial hubris theories have a long history in the literature on M&A auctions and are undeniably one of the biggest motivators to pursue the M&A transaction.

4.3.2 Agency theory

The agency theory, also known as the principal-agent problem, is an interest conflict between the principal (shareholder) and agents (managers) (Ross et al., 2010). As a result of the conflict, two types of agency costs are born, indirect and direct agency costs. Indirect agency cost reflects, for example, a situation where shareholders want managers to pursue profitable M&A, but managers do not use the opportunity. Direct agency cost can take two forms, the first being corporate expenditure, which benefits managers at the cost of the shareholders. Second, agency costs are expenses from monitoring management actions. Jensen and Meckling (1976) investigate that in some situations, it will pay the agent to expend resources which will guarantee that harmful actions

towards the principal do not happen, or at least it is compensated. The authors conclude that agency costs are impossible to be at zero when the principal and agent want to ensure optimal decisions for the principal.

Jensen (1986) studies how agency costs affect on M&As. The company's payout policy will reduce resources under the control of the management and incur the monitoring of capital markets when the company obtains new capital. Managers have the incentive to invest capital in the projects and make their company grow beyond the optimal size because this growth increases the management's compensation and bonuses as the sales and generation of the new cash flows grows. The problem of cash flows occurs when there is a dichotomy between shareholders and managers. In some situations, shareholders would want excess cash flows as payouts. However, managers can choose to invest in a new project with a lower return than the cost of capital or in other inefficiencies.

The agency theory is supported by the empire-building theory, which suggests the motivation of managers to pursue inefficient M&As to grow their power (Kanniainen, 2000). Findings state that under the separation of ownership and control, managers pursue investments with a high probability of inefficiency. Furthermore, the empire-building motive of managers is shown to be related to the degree of uncertainty, the structure of the managerial compensation, and the degree of risk aversion and preference for prudence.

4.3.3 Market mis-valuation theory

Depending on the payment method in an acquisition, management can benefit from the short-term mis-valuation of the markets. The mis-valuation results from asymmetric information between managers and other investors, which will lead overvalued companies to use their stock as a payment method rather than fairly valued cash (Shleifer et al., 2003). The authors suggest a strong incentive for companies to achieve their equity as overvalued so that they could use stock more profitably for acquisitions. In addition, overvalued equity can help companies to survive and grow. Meanwhile, undervalued

companies are in danger of becoming takeover targets themselves. The authors' model assumes that financial markets are inefficient, occurring that some companies are valued incorrectly. Simultaneously managers act entirely rationally, understand the misvaluation of the market and their shares, and use this to their advantage in M&A. Rhodes-Kropf, Robinson, and Vishnwanathan (2005) suggest that M&A activity changes in different market fluctuations and a proportion of the acquisitions would never have occurred if the management had not taken advantage of the short-term mis-valuation of its share price.

In line with the market mis-valuation theory, Akbulut (2005) support the view that acquirers with an overvalued stock have a strong incentive to engage in M&A to benefit from short-term stock market valuations. Authors find that if the M&A is a financed by the stock, there is a higher probability of potential insider trading effect by the managers. In addition, the firms with the overvalued stock are more likely to engage diversification M&As, as they trust their whole sector can be overvalued. Still, undervalued targets are more likely to require higher M&A premium bids and resist unfavorable tender offers. Finally, the overvaluation of the target leads to lower returns for the acquirer on the announcement day, as the public stock market penalizes the acquirer for paying an excessively high premium over the shares of the target firm. All these findings point to the acquiring firm's incentives to capitalize on short-term stock overvaluation, engage in more M&A deals, and potentially further capitalize personal gains through increasing insider trading.

4.4 Macro-economic theories

All the prior motives and theories for M&As are also relevant for cross-border M&As, but this section presents explicit theories for foreign market investments (FDI). The commonly held theories about why companies engage FDIs are the theory of comparative advantage, the imperfect market theory, and the product cycle theory (Madura, 2006). The theories in question are not mutually exclusive, and they even intersect when academics evaluate the development of cross-border M&As.

cross-border M&As are increasing over time, and part of this growth is due to the realization that specialization by countries can increase production efficiency. Every country has its advantages, and since these advantages cannot be transported efficiently, countries tend to specialize in producing goods that can be produced with relative efficiency. These comparative advantages motivate firms to engage in cross-border M&As, where companies can reach the specialization that cannot be achieved in the domestic country (Madura, 2006). The imperfect market theory states that available resources vary between firms, and factors of production, such as labor, and raw materials, are not transferable without a cost (Madura, 2006). If the market were perfect, labor and other resources could be transported wherever there were in demand. As a result of imperfect markets, firms have the incentive to engage in international opportunities to fill their needs.

Product cycle theory presents that firms become established in the domestic country due to some perceived specialization compared to their competitors (Madura, 2006). Firms are familiar with the domestic competition environment and have information about the market, but over time foreign demand will motivate firms to export their products. The only way the firm retains its competitive advantage in a foreign country can be by producing an entirely new product for foreign markets, which is more cost-effective for transportation compared to prior products (Madura, 2006). Therefore, as the firm matures, it can recognize additional opportunities which could not be achievable in the domestic market. Due to M&As, firms can achieve higher quality product development and eventually meet foreign demand.

4.5 Acquiring innovation through M&A

M&As are used by both transaction parties to enhance their corporate specific incentives, ultimately aiming to increase the shareholder value of the company. In specifically in the technology sector, many firms seek to develop their competitive advantage through M&A to diverse product offering, enhance product quality, increase cost-efficiencies,

and other synergies. Apart from company's internal motives, a strong incentive for the company can be to acquire an innovative and market share-growing competitor out from the market, even paying relatively high premium over target's shares. Interestingly, paying high premium in M&A transaction can potentially yield greater profitability for the acquirer in the long-term against the potential decline in the valuation of its own stock due to competitors increasing market share.

The economic relevance of technology firm's pre- and post M&A motives can be illustrated by Google's M&A strategy. An article by Walton (2023) presents causalities why and how Google as a global technology leader supports its growth and innovation strategy by unique approach in identifying and integrating over 230 targets to enhance their core businesses and expand its technological capabilities. The primary driver for Google's business growth is information access and high-quality data management services, further enhancing customer experience. Growing M&A targets which poses innovations to reach to new markets or increase the customer experience in the data management, are more likely to get acquired by the Google. For example, in 2005, the M&A with other technology giant Android enabled Google to engage in mobile operating system market, increasing the user base into the Google ecosystem.

Google pays high premium for groundbreaking technologies and intellectual properties. A M&A of DeepMind enabled Google to increase customer experience through AI-systems and M&A of Motorola Mobility provided Google a large-scale patent portfolio to defend against core competitors in mobile technology. Other relevant drivers for Google's M&A strategies are targets with robust growth potential, sustainable business models and targets, who can offer strategic partnerships to further increase post M&A synergies (Walton, 2023). In line with Collan et al. (2009) findings on management synergies, Google places high importance of acquiring skilled professionals in new areas of expertise, further bolstering prior and new R&D capabilities.

It can be argued that Google should not necessarily try to stay on the crest of the technology wave in every dimension. By making technology M&As, Google can focus more strongly on developing its core business sectors and maintaining competitiveness. Next, based on prior relevant literature, this thesis investigates what are the main pre- and post-M&A causalities driving not only the M&A activity, but further increasing premium payments towards target's R&D assets.

4.5.1 Pre-M&A causalities for R&D and M&A

A study by Raad (2012) investigates a relationship between various target-specific determinants with M&A premium in the sample of 190 takeovers from 1995-2005. On average, high leveraged targets receive 13.34 percent higher premiums compared to low leveraged targets. After controlling high leverage levels, target opposing M&A receive significantly higher M&As compared to high leverage targets, who do not oppose the takeover. In addition, controlling the prior management ownership over the target, the relationship between leverage and premiums are more significant when managerial ownership is high and less significant when its low pre-M&A.

These findings provide interesting conclusions for targets who aim to plan their EXIT plan and maximize the M&A premium payment. Targets can increase the potential premium by financing and developing their current R&D projects by higher debt ratio and increasing potential acquirer's share of the firm. If the acquirer considers the future profit potential of the target's R&D investments to be attractive and the target opposes the M&A, even in the good faith or not, R&D-intensive and highly leveraged M&A targets can experience significant premiums.

Phillips and Zhdanov (2013) find that active M&A market and tighter industry competition encourages particularly smaller sized firms to increase their R&D investments in likelihood to increase attractiveness towards potential acquirers. Larger firms can find it disadvantageous to engage in R&D competition between smaller, more agile firms, further increasing the likelihood to acquire R&D assets through M&As. This effect not only

decrease the in-house risks to engage in R&D investments but gives a potential EXIT strategy for target to sell its shares with higher premiums.

Yiu et al. (2020) study how firm's financial returns of R&D investments can be enhanced through operations management based on sample of 468 U.S. manufacturing firms from 2007 to 2014. Results show that financial returns of R&D investments are significantly enhanced by adopting Six sigma and efficiency improvements in operations. Further findings show that improvement of quality and efficiency improvements yield higher returns under complex operations compared to improvements in labor intensity and geographical intensity. Although results of the study do not examine M&As per se, they provide basis for further conclusions.

Acquirer's M&A willingness and high premium payment is directly linked to the future potential financial returns following the M&A transaction. Since the acquirer can expect prior R&D investments to yield high results based on high-quality efficiency-increasing improvements, the workforce or geographical factors of the target do not so strongly determine future financial returns. In other words, the target's management and employees do not limit the acquirer's opportunities to yield high financial returns, which significantly affects the screening and valuation processes of the acquirer's pre-M&A targets.

Based on prior literature it can be concluded that there are significant causalities affecting both transaction party's pre-M&A. Acquirer's willingness to engage in M&A increase by lack of attractive in-house R&D capabilities, both in form of product development and necessary know-how. On the other hand, acquirer may have incentives to secure its market position by acquiring potential competitors or there may not simply be more attractive IRR investment possibilities in the market. For target firms, the highest incentives for engaging in M&A seem to be high premiums in the form of successful EXIT strategy. Maximizing shareholder returns drives the target to improve its operations and R&D projects, potentially adjusting debt levels and attracting acquirers to enhance their

ownership stakes pre-M&A. The significant relationship between M&A premiums and the financial decision of the target emphasizes the importance of strategic decision on whether the firm wants to compete in the innovative market itself or prepare the company for sale to a potential buyer.

4.5.2 Post-M&A causalities for R&D and M&A

Prior literature shows many significant post-M&A causalities between R&D and M&A. In terms of target firms, the most significant motives are based in pre-M&A period, since the target aims to maximize the premium paid in the M&A transaction and give up the ownership over its operations. As a result, the investigation of post-M&A causalities emphasizes the post-M&A integration process and yield potential of the acquired R&D investments.

Cassiman et al. (2003) investigate 31 individual in-depth technology M&As, finding that M&A parties operating in same fields reduce their R&D efforts and rationalize their R&D processes due to decreased competition, in contrary to M&A parties in operating in complementary fields. Former rivals engaging in M&A are less likely to expand into new R&D fields or leverage their technological competences to new market opportunities. In contrary, non-rival M&As significantly increase R&D output and efficiencies. Although these findings do not address M&A premiums per se, the findings highlight the relationship of R&D to the development of post-M&A operations of technology firms, further influencing the acceptability of high premiums.

A study by Cloudt (2006) investigates effects of non-technological and technological M&As on the post-M&A innovative performance of an acquirer. As non-technological M&A experience negative performance effects due to disruptiveness to initial activities and organizational routines, further requiring resources to repair these disruptions and enhance post-M&A integration. In technology M&As, if target's knowledge base is relatively large compared to acquirer's, it reduces the innovative performance of the acquiring firm. Thus, the absolute size of the target's knowledge base has only a positive effect

on innovation, turning around after the first few years post-M&A. The relatedness of M&A parties' knowledge base has a curvilinear effect on the acquiring firm's innovativeness.

These results suggest that acquirers should target technology firms neither too close or far of their current knowledge base. Interpreting these findings into M&A premiums, it can be argued that whether innovative knowledge is very related or unrelated, the post-M&A integration phase contains decreased risks to prevent future acquirer's innovativeness. The more efficiently a acquiring company can maintain or increase its innovativeness post-M&A, it has higher probabilities of generating new business opportunities and future cash inflows, further justifying the high pre-M&A premium.

Through organizational, managerial, and financial examination, Desyllas and Hughes (2010) seek to find whether 2624 U.S. technology acquirers become more innovative and generate financial benefits post three years from M&A. Due to these transactions, acquirers show positive R&D-intensity changes, but interestingly, insignificant R&D productivity changes. Controlling deal-specific and acquisition endogeneity factors reveals, that in related M&As a wide knowledge base increases R&D productivity, further increasing capabilities screen and integrate future M&A targets. In unrelated M&As these relationships shifts increasingly negative due to scattered know-how concentration, further creating conflict in core business operations and strategies. High leverage increases R&D productivity due to higher management monitoring, thus decreasing R&D-intensity, consistent with increased financial constraints and short-termism. These findings contribute significantly to private equity investors, who seek to yield high profits in three to eight year holding period, using high leverage, high firm monitoring, and wider business know-how. In addition, these results increase confident in implementation of strategic M&As in related industry in light of higher R&D productivity, further justifying higher premiums.

Interestingly, Szücs (2014) investigates the impact of M&A activity on the growth and intensity of R&D spending of 265 acquiring and 133 target firms from 1990 to 2009. In line with Desyllas and Hughes (2010), Szücs (2014) suggest that targets' high R&D-to-sales ratio support the conjecture, that smaller targets have not been able to capitalize their R&D investments, and large and profitable acquirers seems to pick these targets with an attractive technological portfolio. Four years after M&A, target's R&D spending decreases 37 percent, but overall R&D growth remains positive, suggesting that acquirers are inclined to continue their current R&D projects over target's. On average, acquirer's sales increases 75 percent post-M&A and continue to grow strongly, targets become profitable, increasing their sales 30 percent due to absence of significant R&D growth. These results suggest that instead engaging in target's R&D projects, acquirers start marketing the innovative success of the target, yield increasing sales and continue pursuing their initial R&D projects. If unprofitable target has attractive R&D investments, these future positive results can motive the target engage in M&A. However, this may include the risk of weakening the continuity of target's R&D projects.

As a conclusion, based on prior literature one of the main post-M&A causality between R&D and M&As seems to be that acquirers tend to develop their prior R&D investments over target's R&D investments to increase future sales and justify high M&A premiums. Therefore, technology M&As emphasize more strongly developing existing operations and R&D projects compared to expanding to new technology markets. High future returns seem to be based on efficient M&A integration process and the development of prior R&D projects.

5 Data

The chapter presents the data collection and development process to achieve the final sample used in the research methodology. The final data sample is illustrated by the descriptive statistics, and varying figures representing the total M&A activity and individual transactions values. Next, the chapter examines the variables and relevant formulas utilized generating the final results.

5.1 Collecting the data

The thesis analyses the data from Thomson Reuters Eikon database, which include relevant individual company and M&A transaction information. The sample includes information on public European technology-based M&A transactions engaged from January 1, 2000, to 31 December 2022. During the selected period, there are 2 783 completed technology-based M&A transactions. Since the United Kingdom was the most significant part of the European economic area before Brexit, United Kingdom's M&As have been included in the sample. The choice is supported by the United Kingdom's role as a strong European economic concentration. The purpose of the selected data sample is providing continuity to seminal work of Laamanen (2007) and to fill the academic gap on the significance of R&D in the M&A European technology companies.

5.2 Improving the data

The thesis enhances the quality and reliability of the data sample by excluding incomplete data points. After excluding missing relevant M&A transactions and firm-specific data points, the data sample decreases from 2 783 to 203 observations. A significant decrease in the number of observations is characteristic for M&A-based studies. In the data sample of Laamanen (2007), the initial number of observations is 105 701, but after exclusion based on ownership, publicity, and transaction premium disclosure factors the final number of observations reduces to 2 692. The following table presents the improvement process for the final data sample:

Table 3. The improvement of the data.

Initial data	2783
Excluding missing data points:	
Rank Value inc. Net Debt of Target	-1035
Target Market Value 4 Weeks Prior to Announcement	-230
Net Sales 1 Year Prior	-195
Premium Paid - 1 Day Prior to Announcement	-201
Premium Paid - 1 Week Prior to Announcement	-6
Premium Paid - 4 Weeks Prior to Announcement	0
Research & Development Expense 1 Year Prior	-762
Research & Development Expense 2 Years Prior	-46
Research & Development Expense 3 Years Prior	-47
Research & Development Expense 4 Years Prior	-58
The final data sample	203

The final data sample of the thesis includes 203 public technology-based M&A transactions from 2000 to 2022 in Europe. The thesis achieves a ratio of initial data to final data of 0.07 percent, while in Laamanen (2007) study the ratio is only 0.02 percent. The holistic final data covers all relevant data points for further methodology, which enables a uniform analysis of the relationships between examined variables.

The thesis acknowledges the possibility of excluding potential outliers from the data sample whose values increase above the significance of more than two standard deviations. However, the thesis does not use this statistical method on the basis that different M&A premium calculation period would exclude different M&A transactions from each other. Therefore, the choice supports the consistency of the data sample when comparing and interpreting the final results. In addition, the inclusion of potential individual outliers in the data sample enables the investigation of the effects of potential insider trading, asymmetric information, and market anticipation regarding the R&D-intensive firms' M&As.

5.3 The final data sample

The purpose of this section is to delve deeper into the final data sample of the thesis. The section presents relevant target firm-specific and M&A transaction descriptive statistics and figures to support further interpretation of the final data sample. In the following table the target firm-specific variables are presented in the form of descriptive statistics:

Table 4. Descriptive statistics for the target firm-specific data.

Variables	<i>Target Market Value 4 Weeks Prior to Announcement</i>	<i>Net Sales 1 Year Prior</i>	<i>Research & Development Expense 1 Year Prior</i>	<i>Research & Development Expense 2 Years Prior</i>	<i>Research & Development Expense 3 Years Prior</i>	<i>Research & Development Expense 4 Years Prior</i>
Mean	3475,22	2262,65	104,57	101,60	100,95	99,91
Standard Error	896,34	535,90	26,72	26,15	25,53	24,92
Median	155,15	117,50	9,63	9,19	8,58	7,85
Standard Deviation	12770,88	7635,36	380,66	372,53	363,68	355,08
Kurtosis	42,13	28,31	30,60	30,70	28,14	27,50
Skewness	6,07	5,08	5,42	5,41	5,21	5,11
Minimum	0,22	3,12	-4,52	-3,82	0,17	0,00
Maximum	109150,21	59604,00	2867,00	2828,00	2438,00	2444,00
Observations	203,00	203,00	203,00	203,00	203,00	203,00

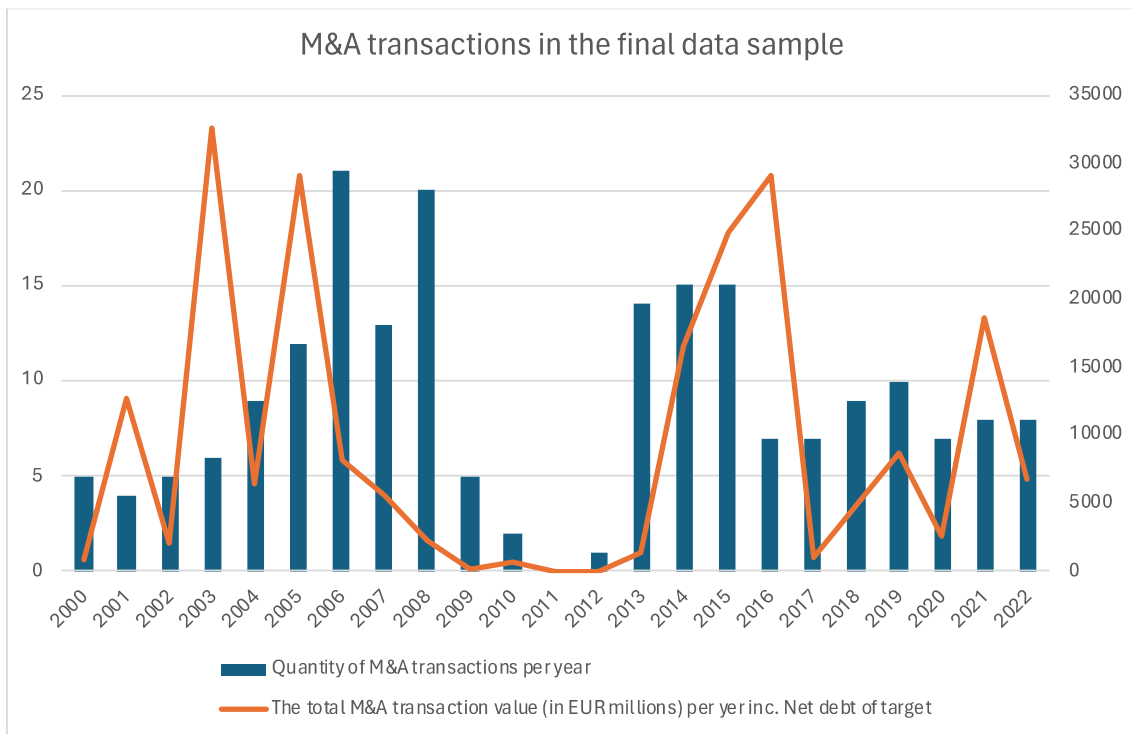
Next, the M&A transaction variables are presented in the form of descriptive statistics:

Table 5. Descriptive statistic for the M&A transaction data.

Variables	<i>Rank Value inc. Net Debt of Target</i>	<i>Premium Paid - 1 Day Prior to Announcement</i>	<i>Premium Paid - 1 Week Prior to Announcement</i>	<i>Premium Paid - 4 Weeks Prior to Announcement</i>
Mean	1061,77	39,87	44,47	44,22
Standard Error	251,70	5,85	6,20	6,12
Median	119,07	21,77	26,61	27,74
Standard Deviation	3586,13	83,35	88,38	87,18
Kurtosis	37,39	39,81	36,62	40,74
Skewness	5,84	5,87	5,60	5,90
Minimum	0,33	-28,24	-29,89	-39,42
Maximum	27864,94	647,74	705,22	697,57
Observations	203,00	203,00	203,00	203,00

Next, it is crucial to investigate how many M&A transactions per se the final data sample includes in the same year, and how their combined transaction values vary. This assessment supports to interpret the significance of the final results and illustrates the emphasis of the results on certain decades. The following figure four presents the M&A transactions in the final data sample:

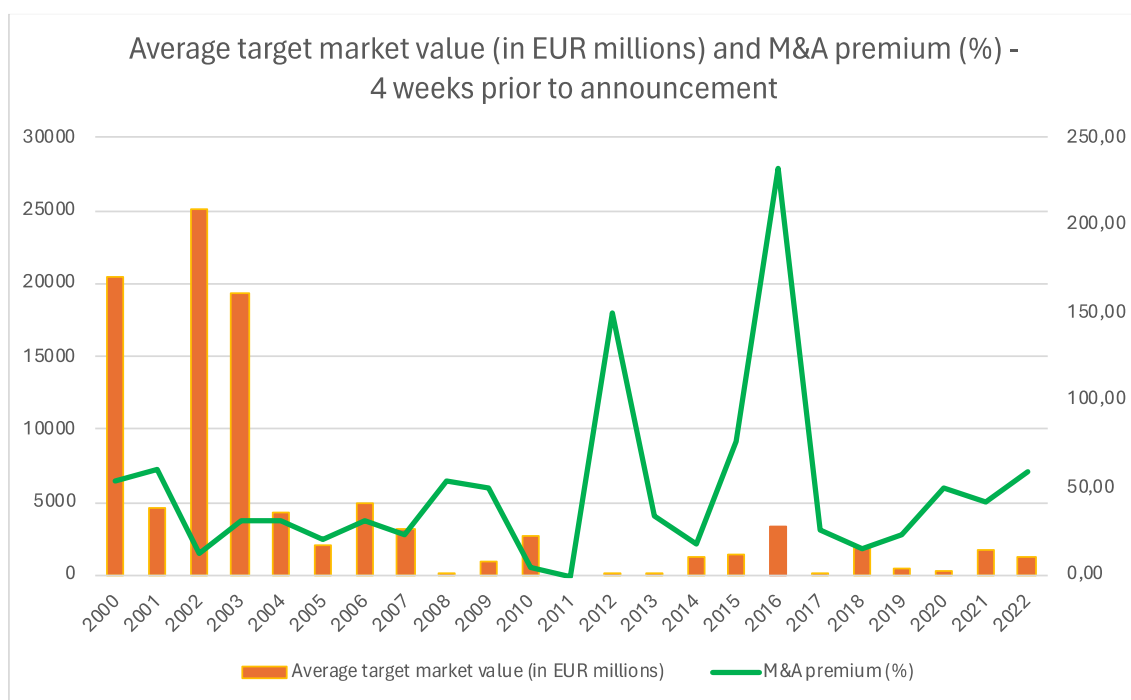
Figure 4. M&A transactions in the final data sample.



The figure 4 shows that there is a trend for increasing quantity in technology M&As from 2000 to 2008. The trend can be explained by a recovery from the dot-com bubble and increasing globalization. However, from 2008 to 2022, there is a slight decrease in M&A activity due to global financial crisis, economic recession, and increased regulatory environment. Also, prior literature recognizes that in 2015, there was a strong increase in high market value M&A activity in both Europe and the U.S. Interestingly, with the annual quantity of M&As being approximately 10, the thesis results comprehensively represent the entire data period.

The lack of M&A transactions between 2008 and 2013 can be explained by the economic recovery from the 2008 crisis and missing thesis data points. In terms of the thesis results, however, it is favorable that the absence of data points is present at the midpoints of the period. In practice, the thesis results can be considered to be relatively reliable, especially during the non-crisis period. However, the values of annual individual M&As and the premium paid have varied from year to year, which is illustrated in the following figure five:

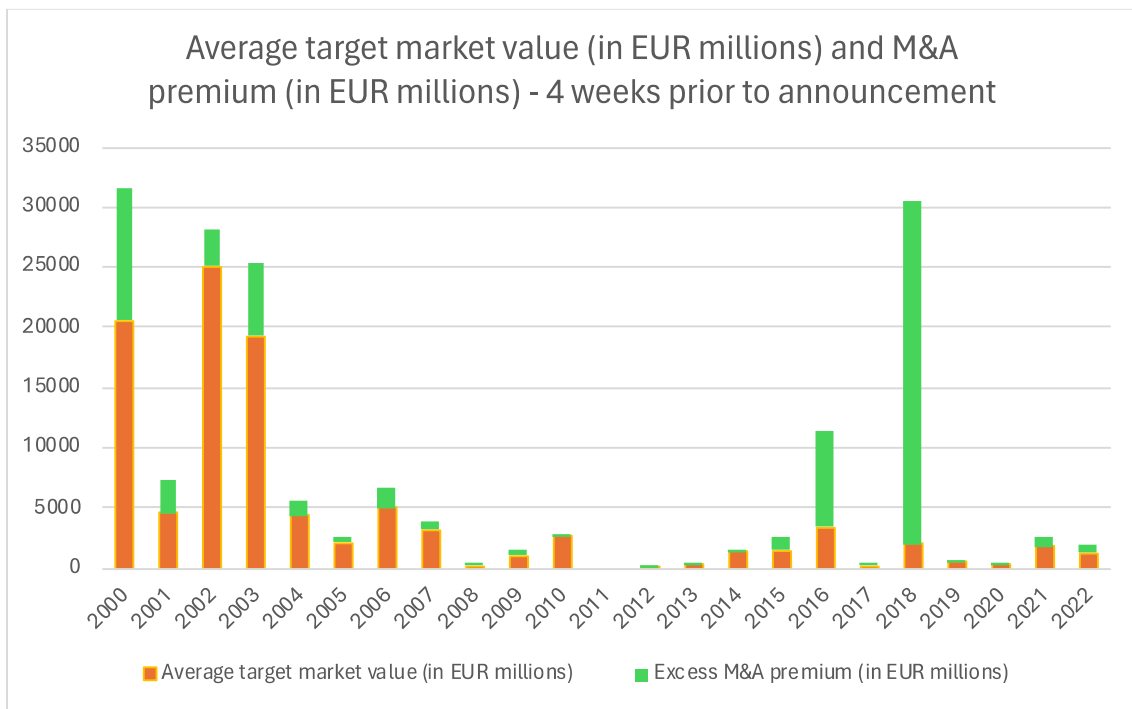
Figure 5. Annual average target market value and M&A premium four weeks prior to announcement.



In the figure 5, net debt of the target is excluded from the average target market value. The market values of individual M&As can be explained by the same factors as changes in overall M&A activity. The table 5 shows that in the final data sample there are a few M&As in the early years of the data period, where the average market value of the target firm is relatively high. The weighted average of M&A premium four weeks prior to announcement is 44,21 percent.

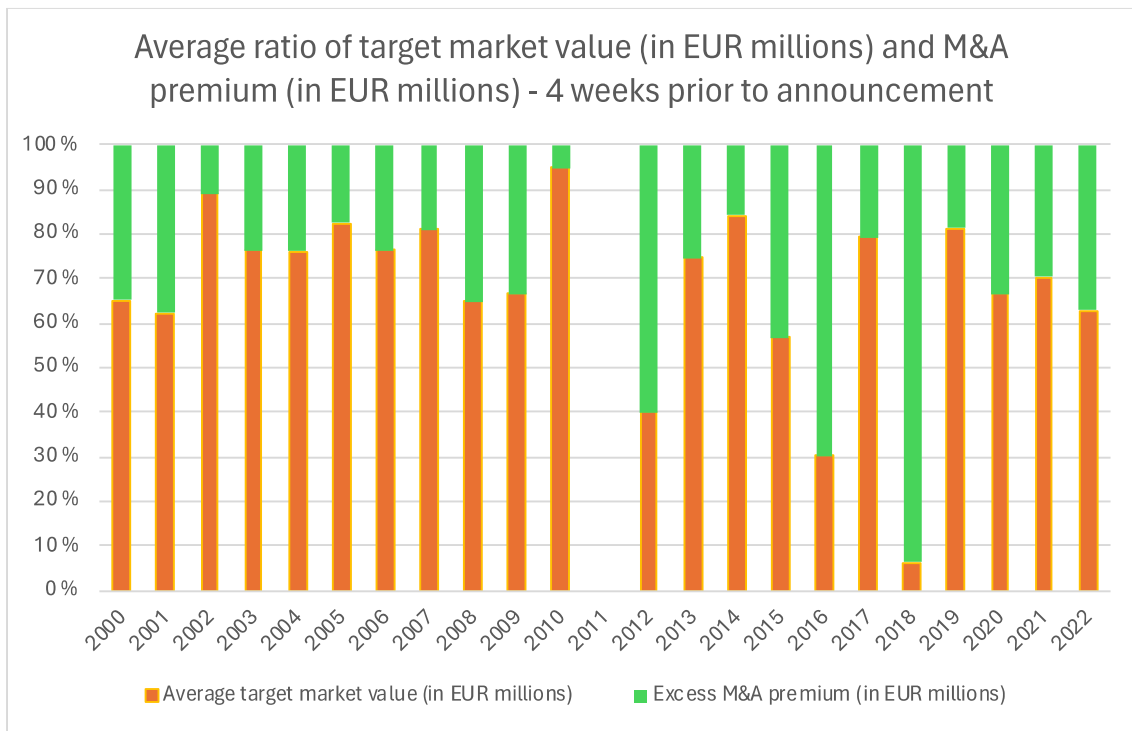
Interestingly, Laamanen (2007) suggests that European premiums average from 20 to 30 percent, and in U.S. from 30 to 50 percent, but overall, the highest premiums have been paid for in technology-intensive sectors. In line with the Laamanen (2007), in the final data sample the average M&A premium paid is approximately 40 percent over the target market value, illustrating the relatively high attractiveness towards technology firms. In the following figure six, the premium paid is also presented in EUR million, which illustrates the ratio of the premium to the market value of the target company:

Figure 6. Annual average target market value and excess M&A premium four weeks prior to announcement.



Interestingly, the data shows M&A transactions with relatively high premiums in 2018. However, this does not distort the thesis results in a negative way, as the number of M&A transactions in the year is nine, which is practically the same as the average transaction quantity per year across the final data. In other words, a potential single data point as an outlier does not burden the figure six. In the following figure seven shows the same results but as stacked bar figure:

Figure 7. Annual average ratio of target market value and excess M&A premium four weeks prior to announcement.



5.4 Variables

The following section defines the dependent, independent and control variables used in the thesis. The utilized variables are in line with Laamanen (2007) study, and this thesis aims to continue his seminal work in the European market. Additionally, the sections present and illustrates the chosen variables in the form of descriptive statistics.

5.4.1 Dependent variables

As presented by Arzac (2005), the premium payment denotes a payment exceeding the value enhancement already reflected in the target's pre-acquisition share price. The role of the premium as a single variable is significant in the light of the purpose of the thesis, which increases the need to study the premium in a multidisciplinary manner. The thesis selects three different premium calculation times relating the announcement of the M&A transaction. Three different dependent variables are the premium 1 day prior to announcement, 1 week before to announcement and 4 weeks prior to announcement.

Laamanen (2007) suggest that as the stock market anticipate the M&A and the likelihood of deal completion increases, the announcement-day premium is generally smaller compared to premium farther from the M&A announcement. One crucial factor affecting changes in the premium is that, using longer period can reduce the market anticipation effect, but it is apt to introduce general market noise in the share valuation. Aboody and Lev (2000) find that insider gains in R&D-intensive firms are substantially larger compared to non-R&D-intensive firms, R&D being a major factor to information asymmetry in the market. The thesis examines insider trading, information asymmetry and market noise factors in the interpretation of the final results.

5.4.2 Independent variables

Next to M&A premiums, the thesis includes values for individual companies. All public firms listed on the stock exchange in the European Union are not obliged to comply with International financial reporting standards (IFRS) in their financial statements. However, since 2005, The EU has required all listed companies in the EU, which are mostly aimed at the stock market, to comply with IFRS standards in their consolidated financial statements. The IFRS 38 standards specifically deals with R&D costs and gives instructions on how to account them in the financial statements. Briefly, IFRS 38 requires after certain criteria are met, a company can capitalize certain development costs on the balance sheet, which lead recording them as an asset. On the other hand, R&D cost are not capitalized, but are immediately accounted as expenses.

The use of pre-acquisition market value of a target company variable varies depending on the study. This thesis utilizes the target market value 4 weeks prior to announcement. The rationale for the choice is that the four weeks is relatively close to the actual M&A transaction, while removing a significant proportion of the potential influence of market anticipation and insider gains. In other words, the target's market value reflects more strongly the stock market's valuation of the target's value as an independent asset. However, this thesis acknowledges the statistical inability to exclude market anticipation and

the influence of insider gains in absolute terms from the large data sample. The thesis uses the following formula to analyze the hypothesis one and illustrate target's R&D intensity based on its pre-M&A market value:

$$\frac{\sum_{t=-4}^{-1} \text{Target R\&D expenses}_t}{\text{Target market value 4 weeks prior to announcement}} \quad (1)$$

Target net sales one year prior is used to illustrate the operational profitability of the target to produce a positive result in relation to ongoing R&D projects. Prior literature also uses sales instead of net sales, but net sales is more widely available from Thomson Reuters Eikon database and use of net sales captures the target's operational profitability more effectively. Chan et al. (2001) suggests that technology-based R&D-intensive companies are thought to generate relatively high stock market returns, but findings show that on average R&D intensive firm's raw returns do not differ from firms without significant R&D. These high R&D-to-sales ratio firms tend to be glamorous stocks with low book-to-market equity, sales-to-price, earnings-to-price, and dividends. Using target's net sales one year prior supports to investigate how much of the target's sales margin is invested in the development of R&D projects. The strength of the relative value is to reflect the target's R&D strategy, but on the other hand, the relative value does not reveal the absolute economic value of the R&D investments.

Laamanen (2007) does not utilize regression model based on net sales, but the regression in question has been used in the later Cheng et al. (2016) study. The final comparison of the regression results is therefore considered mainly in the light of other relevant literature than Laamanen (2007). The thesis uses the following formula to analyze the hypothesis two illustrate target's target R&D intensity based on its pre-M&A net sales:

$$\frac{\text{Target R\&D expenses}_{t-1}}{\text{Target net sales 1 year prior}}, t = 0 \quad (2)$$

The thesis uses two different R&D expenses calculated in the financial statements. R&D expense 1 year prior is used to illustrate firm's current R&D strategies and R&D expense 4 year prior to capture long-term matters. R&D expenses 1 year prior is used to reflect the firm's current R&D position, and R&D expenses 4 years prior illustrate the development of the firm's R&D strategy. The strength of the selection is capturing the development of firm's R&D projects, but the weakness is the sample exclusion of individual fast-growing public companies that lack relevant prior four-year R&D data. The thesis uses the following formula to analyze the hypothesis three and illustrate target's pre- M&A R&D growth:

$$\left(\frac{\text{Target R\&D}_{t-1}}{\text{Target R\&D}_{t-4}}\right)^{\left(\frac{1}{3}\right)} - 1, t = 0 \quad (3)$$

The following table presents independent variables in the form of descriptive statistics:

Table 6. R&D intensity based on market value, net sales and R&D growth.

<i>Variables</i>	<i>R&D intensity based on market value</i>	<i>R&D intensity based on net sales</i>	<i>R&D growth (CARG)</i>
Mean	3,05	0,13	0,08
Standard Error	2,45	0,01	0,02
Median	0,23	0,09	0,06
Standard Deviation	34,94	0,18	0,34
Kurtosis	202,52	25,05	11,12
Skewness	14,22	4,24	0,84
Minimum	0,00	-0,08	-1,82
Maximum	498,10	1,46	2,00
Observations	203,00	203,00	203,00

5.4.3 Control variables

To enhance the interpretation of the relationship between R&D and M&A premium, this thesis examines control variables in accordance with prior relevant literature. In line with

Laamanen (2007), the thesis controls the target firm's net sales, the target firm's return on equity, the management's resistance to takeover, the existence of competing bids, the method of payment, tender offers, mergers of equals, the acquirers' financial advisors, and transaction's macro industry relatedness, and mid industry relatedness. Target's market-to-book value and target debt ratio are excluded, since the quantity of the data points is significantly low or totally absent from Thomson Reuters Eikon database. Additionally, the thesis controls the target's use of financial advisor, and cross-border deal flag. The following table summarizes the control variables and their further definitions:

Table 7. The summarization of control variables.

Control variable	Definition
Target net sales 1 year prior	Target net sales 1 year prior to announcement in millions in the currency of the target's nation.
Target firm's return on equity (ROI)	Target's ratio of net income to common equity for the recent fiscal year prior to the announcement
Tender offers	Dummy variable that is 1 if a tender offer is launched for the target's equity holders, otherwise 0
The existence of competing bids	Dummy variable that is 1 if a third party launched an offer for the target while the original bid was pending, otherwise 0
Deal attitude	Dummy variable that is 1 if the target's management is friendly, otherwise 0
The method of payment	Dummy variable that is 1 if M&A is disclosed dollar value deal, otherwise 0
Cross-border deal flag	Dummy variable that is 1 if the target is not located in the same country as the acquirer, otherwise 0
Macro industry relatedness	Dummy variable that is 1 if the target and the acquirer have the same macro industry, otherwise 0
Mid industry relatedness	Dummy variable that is 1 if the target and the acquirer have the same mid industry, otherwise 0
Merger of equals	Dummy variable that is 1 if the target and the acquirer in a stock swap M&A have approx. Same market cap and roughly 50/50 ownership due to M&A, otherwise 0
Acquirer's financial advisors	Dummy variable that is 1 if the acquirer used a financial advisor in the M&A, otherwise 0
Target's financial advisors	Dummy variable that is 1 if the target used a financial advisor in the M&A, otherwise 0

The selected control variables support the interpretation of the final results with both target- and transaction-based factors. Next, control variables are presented in the form of descriptive statistics:

Table 8. Descriptive statistics for control variables.

Variables	Net Sales 1 Year Prior	Return on Equity 1 Fiscal Year Prior	Tender Offer Flag	The existence of competing bids Flag	Deal Attitude	The method of payment	Cross Border Deal Flag	Macro industry relatedness	Mid industry relatedness	Merger of Equals Flag	Target Financial Advisors Name	Acquiror Financial Advisors Name
Mean	2262,65	-5,01	0,52	0,04	0,88	0,74	0,67	0,36	0,18	0,01	0,72	0,79
Standard Error	535,90	3,39	0,04	0,01	0,02	0,03	0,03	0,03	0,03	0,01	0,03	0,03
Median	117,50	2,12	1,00	0,00	1,00	1,00	1,00	0,00	0,00	0,00	1,00	1,00
Standard Deviation	7635,36	48,27	0,50	0,21	0,33	0,44	0,47	0,48	0,38	0,10	0,45	0,41
Kurtosis	28,31	36,49	-2,02	18,07	3,37	-0,81	-1,48	-1,67	0,91	98,96	-0,99	0,02
Skewness	5,08	-5,10	-0,07	4,46	-2,31	-1,10	-0,73	0,59	1,70	10,00	-1,01	-1,42
Minimum	3,12	-435,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Maximum	59604,00	65,57	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Observations	203,00	203,00	203,00	203,00	203,00	203,00	203,00	203,00	203,00	203,00	203,00	203,00

Interestingly, the table 8 presents that on average target firms exhibit a negative return on equity in the fiscal year preceding the M&A announcement. This observation suggests potential inefficiencies in the ability of these firms to generate higher returns on their current R&D projects. Prior to the completion of the M&A, approximately half of the transactions includes a tender offer, although there are only a limited number of competing bids. The predominant nature of M&As are characterized by a friendly attitude, and often disclosed as dollar-value deals. Interestingly, although all M&As are European, the majority of the transactions have a transnational scope. Furthermore, a minority of the deals demonstrate macro and mid-industry relatedness. Lastly, the table shows that both M&A parties typically utilize financial advisors to facilitate the completion of the transaction.

6 Methodology

This chapter present the methodology utilized to implement the empirical part of the thesis. Firstly, the chapter discussed the utilized method and the rationality of its use. Additionally, the chapter present regression models which are used to analyze M&A premiums in different time windows.

6.1 Ordinary Least Squares method (OLS)

The thesis utilizes the ordinary least squares (OLS) method to examine the relationship between target firm's R&D as a proxy for innovation and M&A premium. The analysis examines M&A premium 1 day, 1 week, and 4 weeks prior to announcement as a dependent variable, and R&D intensity based on target market value, net sales, and R&D growth rate as the primary independent variables. The approach is in line with the main reference study by Laamanen (2007), what supports the comparison of the thesis results independently, as well as the comparison in relation of Laamanen (2007) U.S.-based study. By utilizing OLS method, the thesis aims to provide insight into the influence of innovation on the financial outcomes of M&A transactions, further contributing to the existing finance literature. Based on Laamanen (2007), the thesis poses the following regressions for M&A premium one day, one week, and four weeks prior to announcement:

$$\begin{aligned}
 \text{M\&A premium 1 day prior to announcement} = & \alpha_i + \beta_1 * \text{R\&D proxy}_i + \beta_2 * \\
 \text{net sales} + & \beta_3 * \text{ROI} + \beta_4 * D_{\text{Tender offers}_i} + \beta_5 * D_{\text{Competing bids}_i} + \beta_6 * \\
 D_{\text{Deal attitude}_i} + & \beta_7 * D_{\text{The method of payment}_i} + \beta_8 * D_{\text{Cross border}_i} + \beta_9 * \\
 D_{\text{Macro industry}_i} + & \beta_{10} * D_{\text{Mid industry}_i} + \beta_{11} * D_{\text{Merger of equals}_i} + \beta_{12} * \\
 D_{\text{Acquirer's financial advisor}_i} + & \beta_{13} * D_{\text{Target's financial advisor}_i} + \varepsilon_i \quad (4)
 \end{aligned}$$

$$\begin{aligned}
 \text{M\&A premium 1 week prior to announcement} = & \alpha_i + \beta_1 * \text{R\&D proxy}_i + \beta_2 * \\
 \text{net sales} + & \beta_3 * \text{ROI} + \beta_4 * D_{\text{Tender offers}_i} + \beta_5 * D_{\text{Competing bids}_i} + \beta_6 * \\
 D_{\text{Deal attitude}_i} + & \beta_7 * D_{\text{The method of payment}_i} + \beta_8 * D_{\text{Cross border}_i} + \beta_9 *
 \end{aligned}$$

$$D_{Macro\ industry_i} + \beta_{10} * D_{Mid\ industry_i} + \beta_{11} * D_{Merger\ of\ equals_i} + \beta_{12} * D_{Acquirer's\ financial\ advisor_i} + \beta_{13} * D_{Target's\ financial\ advisor_i} + \varepsilon_i \quad (5)$$

$$M\&A\ premium\ 4\ weeks\ prior\ to\ announcement = \alpha_i + \beta_1 * R\&D\ proxy_i + \beta_2 * net\ sales + \beta_3 * ROI + \beta_4 * D_{Tender\ offers_i} + \beta_5 * D_{Competing\ bids_i} + \beta_6 * D_{Deal\ attitude_i} + \beta_7 * D_{The\ method\ of\ payment_i} + \beta_8 * D_{Cross\ border_i} + \beta_9 * D_{Macro\ industry_i} + \beta_{10} * D_{Mid\ industry_i} + \beta_{11} * D_{Merger\ of\ equals_i} + \beta_{12} * D_{Acquirer's\ financial\ advisor_i} + \beta_{13} * D_{Target's\ financial\ advisor_i} + \varepsilon_i \quad (6)$$

Each of the three regressions formally uses the same variables, but the actual content differs. The variations in the results are due to whether the regression uses the M&A premium one day, one week, or four weeks prior to the announcement, and whether R&D intensity, the main independent variable, is measured based on the target's market value, net sales, or R&D growth rate. In other words, each of the three R&D intensity formulas is applied in different regression models, creating a comprehensive analysis of the dynamics between M&A premium and R&D intensity.

7 Results

This chapter presents the final results based on the thesis methodology. The relationships between the M&A premium and the R&D intensity of the target company are presented in section 7.1 based on market value, in section 7.2 based on net sales, and in section 7.3 based on R&D growth rate of the target firm. Each section includes M&A premium window for one day, one week, and four weeks prior the announcement day. This distribution of tables aims to illustrate how different coefficients influence the M&A premium, considering chronological time and different natures of target's R&D intensity. Furthermore, varying tables are apt to strengthen the versatile interpretation of the final results.

Within each section, M&A premiums are examined in the order of one day, one week, and four weeks prior to the announcement. First, each section states whether the regression analysis achieves a statistically significant p-value, and whether the null hypothesis is rejected or not. The statistical significance of the variables is illustrated by t-statistics and p-values per se are not shown in the regression analysis tables, but the thesis still presents the found p-values for rejecting or accepting the null hypothesis.

Moreover, the interpretation of the results emphasize regression R-square, and the values of the main coefficients, and t-statistics. For two-tailed tests, the critical t-values for the significant level of 0.10, 0.05, and 0.01 are 1.65, 1.97, and 2.60, respectively. In other words, if the t-statistics of the variable is higher than aforementioned t-values, the thesis finds statistically significant findings. After the interpretation of the tables, thesis compares the regression results with relevant prior literature, mainly with the main reference study by Laamanen (2007). In the following discussion chapter eight, the results are interpreted as part of the wider relevant prior literature.

7.1 M&A premium and R&D to market value

For the hypothesis 1, the thesis finds that the target's R&D to market value has a positive relationship with the M&A premium, but as the p-values of the aforementioned R&D proxy one day, one week, and four weeks prior to the announcement are 0.60, 0.51, and 0.44, respectively, the relationship is not statistically significant based on predetermined 0.05 level. Therefore, the null hypothesis is not rejected. In practice, this indicates that the regression analysis fails to provide statistically significant conclusions from the investigated relationship. Thus, it is important to highlight that not rejecting the null hypothesis does not mean that the effect in question does not exist *de facto*, and the future research have a potential to find statistically significant findings for the effect by utilizing other data or methodology.

R-square is a statistical measure in a regression model that determines the proportion of variance in the dependent variable that can be explained by the independent variable. On average, the R-square of market value-based regression models is 0.12, which is low in absolute terms, but completely in line with Laamanen's (2007) 0.12 R-square. Still, based on the coefficients, on average, R&D intensity based on market value has the weakest statistical significance of all the regression tables determinizing the M&A premium. Interestingly, in the context of R&D intensity on market value, the merger of equal shows to have almost a half higher coefficient compared to other regression models.

Table 9. M&A premium and R&D intensity based on market value.

OLS regression for M&A premium and R&D intensity based on market value

The table presents the influence of the R&D intensity based on the market value on the M&A premium one day, one week, and four weeks prior to the announcement day, further examining the hypothesis 2. More detailed information on the dependent and independent variables are presented in formulas 1,2, and 3 and in table 7, respectively. M&A premiums one day, one week and four weeks prior to the announcement are 39.87, 44.47, and 44,22 percent, respectively. The coefficients for each time window are presented in the same line, and the t-statistics of the individual coefficients are presented below inside the brackets. ***, **, and * indicate statistical significance at the 1, 5, and 10 percentage level, respectively. The number of observations and r-square of the regression models are presented below the coefficients.

Variable	1 day	1 week	4 weeks
R&D intensity based on market value	0,12 (0,52)	0,16 (0,67)	0,19 (0,77)
Net sales 1 year prior	0,00* (1,83)	0,00* (1,73)	0,00 (1,64)
Return on equity 1 fiscal year	-0,04 (-0,34)	-0,05 (-0,40)	-0,04 (-0,31)
Tender offers	9,08 (0,74)	10,48 (0,80)	13,70 (1,06)
The existence of competing bids	-6,19 (0,22)	-8,99 (-0,30)	2,49 (0,09)
Deal attitude	21.39 (1,07)	19,77 (0,94)	9,48 (0,46)
The method of payment	13.91 (0,80)	20,26 (1,10)	19,55 (1,08)
Cross-border deal	24,11* (1,94)	22,87* (1,74)	19,45 (1,50)
Macro industry relatedness	0,36 (0,02)	-3,050 (-0,18)	-2,51 (0,15)
Mid industry relatedness	52,3*** (2,67)	54,1** (2,59)	60,53*** (2,95)
Merger of equals	-95,60 (-1,16)	-108,86 (-1,24)	-108,49 (-1,26)
Acquirer's financial advisors	-8,27 (-0,50)	-11,11 (-0,63)	-17,14 (-0,99)
Target's financial advisors	12,47 (0,78)	16,70 (0,98)	17,18 (1,03)
C	-24,60 (-1,18)	-22,99 (-1,04)	-10,30 (-0,47)
Observations	203	203	203
R-square	0,12	0,12	0,12

Table 9 shows that R&D intensity based on the market value and M&A premium one day prior to the announcement has a positive but not significant relationship with a coefficient of 0.12 and a t-statistics of 0.52. There is a positive, but statistically weak upslope trend between the R&D intensity based on the market value and M&A premium as the examination is conducted further from the date of the deal announcement, with a coefficient of 0.16 and a t-statistics of 0.77. The most statistically significant independent variables are net sales one year prior with an almost non-existent 0.001 coefficient and 0.52 t-statistics. In addition, cross-border M&As have relatively high 21.40 coefficient with significant 1,94 t-statistics. Still, the most statistically significant independent variable influencing the M&A premium one day prior to the announcement is mid industry relatedness with 52.40 coefficient and 2,95 t-statistics. Interestingly, table 9 shows that as the examination window in relation to the announcement day increases, the role of acquirer's financial advisor is relatively stronger.

When comparing the results, it is noted that the M&A premium and the target's R&D to market value has a positive relationship and is in line with Laamanen (2007). However, contrary to the thesis, Laamanen (2007) finds the relationship to be economically and statistically higher with a coefficient of 3.59 and 2.26 t-statistics. The higher relationship can be argued to be based on the U.S market efficiency, high investor expectations, and stronger focus on growth in the public stock exchanges. Still, Laamanen (2007) finds that when performing the robustness test and changing the accumulated R&D expenses of four years to expenses of three, two and one years, the positive relationship also remains in the U.S. market, but the statistical significance also weakens. This observation is apt to support the argument that the company's long-term additional investment and trust in the development of its own R&D project creates positive signaling towards the market participants, further increasing attractiveness in the M&A market.

Additionally, both increasing and decreasing relationships of independent variables to the M&A premium are in line with Laamanen (2007). Both studies find that the merger of equal independent variable prove to be the most economically significant factor in

relation to the M&A premium. Still, in Europe, the significance of merger of equal shows to be approximately three times higher compared to U.S. technology M&As with only -31.02 coefficient with a t-statistic of 1.89. This relatively stronger ratio can be argued to be based on firm's incentives for consolidating fragmented markets to achieve economies of scale, and European business culture can emphasize collaboration and partnerships relatively higher than U.S.-based businesses. In contrast, in U.S.-based M&A, the target's resistance shows to have a statistically greater significance for the M&A premium compared to European M&As, with a coefficient of 30.53 and a 3.10 t-statistics, further indicating more aggressive negotiation dynamics.

7.2 M&A premium and R&D to net sales

For the hypothesis 2, the thesis finds that the target's R&D to net sales has a positive relationship with the M&A premium, but the p-values of the aforementioned R&D proxy one day, one week, and four weeks prior to the announcement are 0.12, 0.15, and 0.26, respectively. As the relationship is not statistically significant based on predetermined 0.05 level, the null hypothesis is not rejected. In practice, the finding indicates that the on the basis of the regression analysis, no statistically convincing conclusions can be made regarding the relationship.

Still, on average, the R&D to net sales regressions have the highest r-square among all thesis regressions and are in line with Laamanen (2007) study. Although the regression analysis does not achieve a statistically significant result for the R&D proxy, the table 10 shows that R&D intensity based on target net sales has the most statistically significant, but still insignificant, and positive relationship to the M&A premium among all studied R&D proxies. Interestingly, the t-statistics of the R&D intensity based on the net sales increases as the number of days towards the announcement day decreases, coefficient being 53.54 with a 1.56 t-statistics at the one day prior to the announcement. Additionally, mid industry relatedness, cross-border flag, and merger of equals show to have the highest coefficients.

It is still important to observe that due to t-statistics of 1.56, R&D intensity based on the net sales one day prior to the announcement achieves almost a 0.10 statistical significance level at t-statistics of 1.65, in which case statistically convincing conclusions could be drawn from the result. If the future research finds statistically significant findings using different data or methodology, can it provide statistically sufficient evidence that the target firm's strategic decision to invest a significant amount of the available capital to R&D increases the opportunity to yield higher M&A returns in form of premium.

Table 10. M&A premium and R&D intensity based on net sales

OLS regression for M&A premium and R&D intensity based on net sales

The table presents the influence of the R&D intensity based on the net sales on the M&A premium one day, one week, and four weeks prior to the announcement day, further examining the hypothesis 1. More detailed information on the dependent and independent variables are presented in formulas 1,2, and 3 and in table 7, respectively. M&A premiums one day, one week and four weeks prior to the announcement are 39.87, 44.47, and 44,22 percent, respectively. The coefficients for each time window are presented in the same line, and the t-statistics of the individual coefficients are presented below inside the brackets. ***, **, and * indicate statistical significance at the 1, 5, and 10 percentage level, respectively. The number of observations and r-square of the regression models are presented below the coefficients.

Variable	1 day	1 week	4 weeks
R&D intensity based on net sales	53,54 (1,56)	53,21 (1,46)	41,15 (1,14)
Net sales 1 year prior	0,00** (2,04)	0,00* (1,92)	0,00* (1,78)
Return on equity 1 fiscal year	0,02 (0,12)	0,00 (0,03)	0,00 (0,01)
Tender offers	8,44 (0,69)	9,60 (0,74)	12,67 (0,99)
The existence of competing bids	-5,97 (-0,21)	-8,81 (-0,30)	2,57 (0,09)
Deal attitude	20,43 (1,04)	18,86 (0,90)	20,95 (0,43)
The method of payment	15,61 (0,90)	21,98 (1,19)	20,00 (1,15)
Cross-border deal	24,07* (1,93)	23,11* (1,77)	-4,67 (1,55)
Macro industry relatedness	-2,53 (-0,16)	-5,89 (-0,35)	61,72 (-0,28)
Mid industry relatedness	53,86*** (2,75)	55,59*** (2,67)	58,03*** (3,01)
Merger of equals	-60,21 (-1,02)	-62,83 (-1,01)	-58,03 (-0,94)
Acquirer's financial advisors	-6,28 (-0,38)	17,53 (0,52)	-15,61 (-0,90)
Target's financial advisors	11,19 (0,70)	15,45 (0,91)	16,26 (0,97)
C	-31,76 (-1,50)	30,25 (-1,34)	-16,09 (-0,73)
Observations	203	203	203
R-square	0,13	0,13	0,13

Table 10 shows that R&D intensity based on the net sales and M&A one day prior to the announcement has a positive but not significant relationship with a coefficient of 53.54 and t-statistics of 1.56. It is important to observe that due to t-statistics of 1.56, R&D intensity based on the net sales one day prior to the announcement achieves almost a 0.10 statistical significance level at t-statistics of 1.65, in which case statistically convincing conclusions could be drawn from the result. If the future research finds statistically significant findings using different data or methodology, can it provide statistically sufficient evidence that the target firm's strategic decision to invest a significant amount of the available capital to R&D increases the opportunity to yield higher M&A returns in form of premium.

Interestingly, net sales one year prior to the announcement proves to be a statistically significant determinant, but in line with tables 9 and 11, its actual economic significance to the premium is practically non-existent. These dynamics illustrates effectively, how acquirers do not value target net sales as an independent variable, but trust in its ability to harness the higher yield from the target's assets and created deal synergies. In contrast, acquirers emphasize higher the target's strategic decision to invest a significant part of the capital into the running R&D projects, further suggesting the attractive yield potential of the R&D assets. Still, the most significant independent variable is the mid industry relatedness with a coefficient of 53.86 and a t-statistics of 3.01. Additionally, table 10 strengthens the finding that the use of financial advisors has a positive effect on the M&A premium for both parties, and this significance increases the further away from the investigation is from the announcement day. Also, the results strengthen the prior table 9 finding about the high role of merger of equals in R&D-based M&A transactions.

As Laamanen (2007) did not study R&D intensity based on revenue or net sales, the comparison is conducted with relevant prior literature. Chan et al. (2001) argues that the stock market predicts technology-based R&D-intensive firms to generate higher stock market returns compared to firms without significant R&D levels. The studied period from 1975 to 1995 shows a strong trend of how the percentage of companies' R&D

investments in relation to the sales has grown almost threefold. As R&D intense firms generally do pay zero or minimal dividends, the role of R&D capital as an intangible asset can be arguably increased. In a more recent study, Mataigne et al. (2017) find that R&D to sales of European listed target firms from 1997 to 2010 is on average 12 percent. In this thesis, the percentage has increased to 13 percent.

Cheng et al. (2016) examines target information asymmetry and acquisition price, where R&D is obtained as the ratio between R&D to sales at the end of the year prior to the M&A announcement. The results show that R&D on bid premium has a coefficient of 0.01 at the 10 percent significance level, further suggesting that acquirers are willing to pay higher premiums for R&D intensive targets and obtaining higher announcement returns. Thus, Laamanen (2007) finds that the larger the target in terms of sales revenue, the more negative the stock market reaction at the time of the announcement.

The thesis finds that the relationship between R&D intensity based on net sales and M&A premium is in line with prior relevant literature. However, even though the thesis finds a positive relationship between the R&D intensity based on net sales and the M&A premium with a significantly higher coefficient value of 53.54, contrary to the thesis, Cheng et al. (2016) and Mataigne et al. (2017) finds the same positive relationship to be statistically significant, but with much lower coefficient value of 0.01 and 2.60, respectively. Thus, Cheng et al (2016) examines R&D intensity based on sales at the end of the year prior to the announcement and Mataigne (2017) utilizes sales instead of net sales.

7.3 M&A premium and R&D growth rate

For the hypothesis 3, the thesis finds that the target's R&D growth rate has a positive relationship with the M&A premium, but the p-values of the aforementioned R&D proxy one day, one week, and four weeks prior to the announcement are 0.98, 0.62, and 0.74, respectively. As the relationship is not statistically significant based on predetermined 0.05 level, the null hypothesis is not rejected. In practice, the finding indicates that the

on the basis of the regression analysis, no statistically convincing conclusions can be made regarding the relationship.

On average, the r-square of the R&D growth rate regressions are in line with market value regressions and Laamanen (2007) study. On average, based on the t-statistics, R&D intensity based on the R&D growth rate has the weakest statistical significance of all the regression tables determining the M&A premium. Similarly to other thesis regressions, mid industry relatedness, cross-border, and merger of equals have the highest coefficients. In practice, when comparing the results with the table 10, it can be interpreted that it is not economically profitable for the target company to increase the R&D growth rate in order to optimize the M&A premium, but rather the absolute size of the R&D investments in relation to net sales. This finding is relevant for companies whose R&D projects grow rapidly but are a significantly small part of the target's operations.

Table 11. M&A premium and R&D intensity based on R&D growth rate.OLS regression for M&A premium and R&D intensity based on R&D growth rate

The table presents the influence of the R&D intensity based on the R&D growth rate on the M&A premium one day, one week, and four weeks prior to the announcement day, further examining the hypothesis 3. More detailed information on the dependent and independent variables are presented in formulas 1,2, and 3 and in table 7, respectively. M&A premiums one day, one week and four weeks prior to the announcement are 39.87, 44.47, and 44,22 percent, respectively. The coefficients for each time window are presented in the same line, and the t-statistics of the individual coefficients are presented below inside the brackets. ***, **, and * indicate statistical significance at the 1, 5, and 10 percentage level, respectively. The number of observations and r-square of the regression models are presented below the coefficients.

Variable	1 day	1 week	4 weeks
R&D intensity based on R&D growth rate	3,93 (0,23)	9,28 (0,50)	6,01 (1,14)
Net sales 1 year prior	0,00* (1,84)	0,00* (1,77)	0,00* (1,78)
Return on equity 1 fiscal year	-0,40 (-0,36)	0,00 (-0,44)	-0,04 (0,01)
Tender offers	8,62 (0,70)	10,10 (0,77)	12,99 (0,99)
The existence of competing bids	-6,10 (-0,22)	-8,66 (-0,29)	2,63 (0,09)
Deal attitude	21,55 (1,09)	20,04 (0,95)	9,73 (0,43)
The method of payment	14,48 (0,83)	21,48 (1,15)	20,43 (1,15)
Cross-border deal	24,7** (2,00)	23,52 (1,79)	20,36 (1,55)
Macro industry relatedness	0,43 (0,03)	-2,95 (-0,17)	-2,40 (-0,28)
Mid industry relatedness	52,55*** (2,67)	54,41*** (2,60)	60,78*** (3,01)
Merger of equals	-64,57 (-1,09)	-65,71 (-1,04)	-60,58 (-0,94)
Acquirer's financial advisors	-7,95 (-0,48)	-10,36 (-0,59)	-16,66 (-0,90)
Target's financial advisors	12,02 (0,74)	15,52 (0,90)	16,48 (0,97)
C	-25,61 (-1,22)	-25,02 (-1,12)	-11,86 (-0,73)
Observations	203	203	203
R-square	0,12	0,12	0,12

Table 11 shows that R&D growth and M&A premium one day prior to the announcement day has a positive but not a statistically significant relationship. Interestingly, the values of the coefficients create a U-shape curve, being statistically weakest at the one day prior to the announcement. When comparing the R&D growth rate regressions one day and four weeks prior to the announcement, the R&D growth rate coefficient increases relatively high from the 3.93 to the 6.01, and the t-statistics changes from relatively weak 0.23 to 1.14. Thus, still being statistically insignificant.

In line with table 9 and 10, the most significant independent variables are cross-border flag, mid industry relatedness, and merger of equals. Mid industry relatedness has a strong statistical and economical influence on M&A premium with a coefficient of 60.78 and a significant t-statistics of 3.01 four weeks prior to the announcement. Also, closer the announcement day of the deal, the cross-border flag has a statistically significant and strengthening influence on M&A premium.

Table 11 shows effectively how both side's use of financial advisor benefits the premium with a coefficient of more than 16.00 and with a t-statistics averaging 0.90, but the statistical and economic gap increases as the observation is executed closer to the announcement day. In practice, the table 11 analysis suggests that the target firm benefit from the use of financial advisor more significantly in terms of M&A premium, compared to the use of financial advisors of the acquiring company. This relationship can be due to the fact that the target firm's value is significantly increased by presenting the yield potential of R&D-related assets, while the acquirer's premium decision is more significantly influenced by behavioral finance factors.

A comparison with Laamanen (2007) shows that the R&D growth rate has a corresponding positive relationship with the M&A premium, but the U.S.-based data achieves a statistically significant result. Interestingly, the U.S.-based data achieves only a coefficient value of 0.51, further suggesting low economic value of the results. Additionally, in contrast to thesis results, the U.S.-based data achieves a statistically significant relationship

between merger of equals, but the European coefficient is more than the double at its highest with a coefficient of -65.71. On the other hand, U.S. data achieves a strong statistical significance between M&A premium and target resistance with a coefficient of 33.14, when the highest coefficient for European M&As is 21.55 with a t-statistics of 1.09. In line with Laamanen (2007), the thesis finds statistically significant positive relationship between the merger of equals and the M&A premium, the coefficient being the highest at 60.78 four weeks prior to the announcement.

8 Discussion

This chapter conducts a broader interpretation of the thesis results in light of the prior research and theoretical background. Firstly, section 8.1 examines the basis of prior relevant literature for the thesis results. Next, sections 8.1.1, 8.1.2, and 8.1.3 discuss the thesis results relating to M&A premium and R&D intensity, information asymmetry in R&D intensive firms, and practical implications for M&A parties, respectively. Finally, section 8.2 highlights the thesis limitations and section 8.3 characterizes the potential directions of possible future research.

8.1 Discussion on M&A premium and R&D intensity

Through prior relevant literature and European data sample from public European technology firms' M&As between 2000 to 2022, this thesis investigates the relationship between the M&A premium and the R&D intensity of the target company. The thesis continues and fills the academic gap from Laamanen (2007) seminal study, what examines same dynamics in the U.S. market from 1989 to the end of 1999. Most of the research on M&A premium and R&D assets in the prior literature examines the dynamics of the U.S. market (Lev et al. 1995; Aboody et al. 2000; Chan et al. 2001; Laamanen, 2007; Cheng et al. 2016; Lin et al. 2016). Additionally, Mataigne (2017) investigates geographically relevant European M&A market, including all European public M&As from 1997 to 2010. In the light of Laamanen (2007) and Mataigne (2017), the thesis contributes to new findings in terms of geography, the technology sector, and the new time period considering the zero interest rate economy. The thesis aims to deepen the understanding regarding the value relevance of R&D investments, the information asymmetry regarding these investments, and the relationship between the R&D intensity and the M&A premium.

Acquirer's inability to find synergistic factors has rationalized the high premium payments due to the management's low-quality decision making (Slusky et al. 1991). A seminal study by Hayward et al. (1997) emphasizes the view that high premiums are mainly

the result of managerial hubris. In practice, managerial hubris means that the acquirer's management has excess confidence about its abilities to manage and further yield higher results from the target's assets than the current management of the target company.

However, a later study by Diaz et al. (2009) shows that the relationship between the M&A premium and the acquirer's abnormal returns is determined by both synergy and overpayment hypothesis. In practice, the overpayment hypothesis becomes dominant over the synergy hypothesis, when the acquirer fails to effectively evaluate the synergistic value of the target company's assets. In other words, the payment of high premiums does not indicate low-quality decision making per se, if the acquirer can evaluate target company's assets effectively and create future synergies from the acquired assets. Additionally, in the very competitive sectors, acquiring a potential competitor out from the market can increase the acquirer's future cash flows even independently without significant operational synergies.

M&A, like any financial transaction, is basically based on the calculation of the expected return requirement, where M&A parties are utilizing IRR, NPV, and the payback rule (Dai et al., 2022). Generally, a firm is more attractive M&A target, the more assets it owns that enable a higher yield potential. Such firms can be technology-based firms, whose high R&D intensity enables the firms itself and potential M&A acquirer to create increasing shareholder value. Lev and Sougiannis (1996), and Aboody and Lev (2000) recognize the value-relevance of the target's R&D investments, and that they include relatively higher uncertainty than more easily valuable tangible assets. The high uncertainty regarding these R&D assets increases the opportunity for insider trading, but on the other hand, the M&A process itself offers the market the opportunity to seek public announcements considering R&D investments, further reducing the risk of the stock. However, Chan et al. (2000) suggests that there is no significant connection between firm's R&D and returns, and high R&D intensive firms have, on average, beaten-down stocks.

8.1.1 Discussion on M&A premium and R&D intensity results

The main finding regarding the M&A premium per se, is that public European firms paid, on average, 39.87-44.22 percent premium over the target's market price between 2000 and 2022. Laamanen (2007) states that the average premium is around 30 percent, but the average U.S. market premium varies between 30 and 50 percent. Also, historically, a higher premium has been paid for technology firms due to their higher growth potential. Mataigne (2007) finds that the premium for all European M&As between 1997 and 2010 is 41 percent, and the average R&D to sales is 12 percent. The thesis finding is in line with the prior literature, and it can further be argued that a premium increase of a few percent can be the result of the growing relevance R&D in the target firms. The thesis finds target's R&D to net sales and the M&A premium has a positive relationship with a coefficient of 53.54 and a t-statistics of 1.56, but the relationship is statistically insignificant. The aforementioned relationship would be statistically significant at the 0.10 level with a coefficient of 1.65. If future research finds the same connection to be significant using different data or methodology, it supports the view that R&D has a growing importance increasing the M&A premium towards R&D intense targets. The level of innovation in the global market increases the competition among technology firms, further accelerating the M&A activity towards highly innovative M&A targets.

The thesis finds a positive relationship between M&A premium and R&D intensity of the target firm among all R&D proxies, the r-square being in line with Laamanen (2007). Unexpectedly, all three R&D proxies achieve statistically insignificant results. Still, it can be argued that the most explanatory innovation proxy for high M&A premiums is R&D intensity based on net sales one day prior to the announcement. If the future research achieves significant results from the relationship, would these results strengthen the argument that target's strategic decision to invest a significant proportion of its available free cash flow to R&D project signals external actors that the target firm trust the yield potential of its R&D projects. This increases the attractiveness of the target firm's assets in the M&A market, further increasing the M&A premium.

This analogy is supported by Lin and Wang (2016), according to which there is a positive relationship between takeover probability and large R&D increases, further explaining the high premium associated with R&D intensive firms. However, R&D efficiency has no relation to the M&A premium. These dynamics illustrates the assumption that the acquirer trust its own abilities to harness the yield potential of R&D projects more effectively than the target company's management.

Conversely, the thesis finds a statistically and economically weak relationship between M&A premium and R&D intensity based on the market value. When the target acknowledges that the R&D intensity based on the market value is not a significant explanatory factor in relation to M&A premium, the target can leave that dynamic largely unassessed in a strategic decision-making. Relatively little statistical significance, but higher economic significance is the target's R&D intensity based on the R&D growth rate. Additionally, it can be argued that as the R&D intensity based on the R&D growth rate does not illustrate the yield potential of R&D projects per se or reflect the absolute size of the target's R&D, the lower statistical significance compared to R&D based on net sales is justified. In practice, a target can have non-existent or economically insignificant R&D investments, for example short-term product market tests, in which case its R&D growth increases rapidly in percentage terms. To conclude, based on tables 9, 10, and 11, it is justified to state that although the relationship between the R&D intensity based on net sales and the M&A premium does not achieve statistical significance to reject null hypothesis, when comparing the R&D proxies with each other, R&D to net sales is the most relevant innovation proxy to consider in the M&A process.

8.1.2 Discussion on information asymmetry in R&D intensive firms

The thesis finds that on average, in European public technology-based M&As, an acquirer pays a 44.22 percent premium over the market price of the target, four weeks prior to the announcement. Utilizing the four weeks prior to the announcement reduce the market anticipation effect towards the M&A, and it also introduce a general market noise. Interestingly, the thesis finds the M&A premium to marginally increase to 44.47

percent on average, when the analysis is focused one week prior to the announcement. However, when the analysis is focused one day prior to the announcement, the M&A premium is on average 39.87 percent.

In practice, this dynamic means that the M&A premium decreases four weeks and one week prior to the announcement by -4.35 and -4.60 percent, respectively. This is a significant percentage point considering that, for example, the average annualized return of the MSCI Europe index and the STOXX Europe 600 index for the last 20 years has been 6.40 percent and 6.70 percent, respectively. Furthermore, the utilization of insider information generally involves the use of complex financial products, which are conducive to realizing significant gains from even minor stock market fluctuations, often as minimal as few percentage points.

The thesis results considering the potential insider trading effect are supported by Aboody and Lev (2000), according to which insider gains for R&D intensive firms from 1985 and 1997 are substantially larger than for non-R& intensive firms. R&D intensive firms contain a higher information asymmetry between the management of the firm and the public market, which the acquirer can also access within the M&A process. In M&A process, the public market is informed about acquired assets, including R&D projects, and the expected synergy benefits in general. Before the public announcement by deal participants, insider information holders can leverage this information asymmetry for their own private financial benefits.

From another perspective, Coff and Lee (2003) analyze 134,000 insider trading events and find that insider purchases generate larger positive stock price reactions for R&D intensive firms. Based on the findings, it can be argued that management's exploitation of asymmetric information does not hurt the company's existing shareholders, as long as the share purchases are conducted in accordance with the applicable legislation. In light of the thesis results, it can be argued that M&A parties and relevant stakeholders should be particularly attentive when pursuing share transactions close to the M&A

process, as the presence of a large information asymmetry regarding R&D assets exposes significant share purchases to the supervision of financial regulatory authorities, further creating grounds for significant private sanctions.

The thesis results support Cheng et al. (2016) finding that target firms that contains more substantial information asymmetry achieve higher bid premiums in M&A. The shareholders of the acquirer react more positively to such a M&A transaction, the more difficult the target company is to value. This relationship illustrates the phenomenon that the public stock market recognizes and accepts the acquirer's high premium bid towards opaque target more strongly, further enabling the acquiring company to pay a higher premium over the price of the target shares. Additionally, public M&As contribute to overall elimination of information asymmetry in the stock market.

To conclude, the results of the thesis find the presence of potential insider trading and the positive effect of R&D assets on high premiums in M&A of public European technology firms. Although the thesis does not find a statistically significant relationship between the R&D assets and the M&A premium, the thesis results serve as the basis for future investigation.

8.1.3 Discussion on implications for M&A parties

The interpretation of thesis results in the light of practical implications is important, as scientific findings can thus enhance rational decision-making policies in firms. The thesis results provide practical implications for both the acquirer and the target, with a stronger emphasis on the implications of the target firm. This is rationally justified, as the R&D investments acquired in M&A are based on the strategic decision-making of the target firm.

The main practical implication of the thesis is that the target firm's high R&D to net sales increases the firm's M&A attractiveness among potential acquirers, further increasing the target management's probability to implement a strategic EXIT plan. If the firm has

an incentive to implement a strategic EXIT or another change of ownership through M&A, it is economically advantageous for target, considering optimizing the future M&A premium, to invest a significant part of net sales in R&D investments at least one year prior the start of the M&A process. This implication is supported by Lin and Wang (2016), according to which the takeover probability of high R&D intensity firms increases, further increasing the M&A premium. Because the higher takeover risk is based on a large R&D increase, and not on the efficiency of the innovation per se, the target firm does not need to harness all the capital used for R&D prior the M&A.

Furthermore, this supports the view that acquirers aim to acquire hard-to-value intangible assets whose current valuation is relatively low, but with a more efficient management the future yield potential of the initial investment is high. Thus, supported by Hayward et al. (1997), acquiring R&D intensive target's hard-to-value intangible assets, the acquiring firm's management should focus strongly on rational decision-making policies to avoid managerial hubris.

After conducting a rational investment analysis on high R&D intensity firm, the acquirer can satisfy its NPV, IRR, payback rule, or any other chosen investment analysis method post-M&A, even though it initially paid a relatively high premium in the M&A. This finding further supports Diaz et al. (2009) view that a high premium per se does not prove the overpayment hypothesis to be present if the yield according to the synergy hypothesis leads to higher returns than the initial M&A premium.

Although the thesis does not find a statistically significant relationship between the M&A premium and R&D intensity, the thesis achieves the same relations with Laamanen (2007) regarding other factors affecting the M&A process. To optimize the premium payment, the target firm should engage in the M&A process with a strategic acquirer operating in the same mid industry. In the highly competitive technology sector, the role of innovation plays a significant part in increasing the market share, further increasing the firm's incentives to acquire a potential smaller competitor's assets and enhance its own

innovativeness. This finding is in line with Phillips and Zhdanov (2012), according to which small firms have a strong incentive to optimize their innovativeness and R&D projects, if they plan to engage in M&A with the larger firm. Larger firms, for example Google, can find it disadvantageous to engage in a R&D race with more agile smaller firms, as they can acquire innovative through M&A.

Furthermore, Phillips and Zhdanov (2012) find that R&D responsiveness of firms increases with demand, competition, and industry M&A activity. M&A activity in unrelated sector does not have a significant relationship to R&D, but inside industry M&A activity has both statistical and economically significant results for the development of R&D. In practice, to optimize the future M&A premium, the target firm should invest a large proportion of its capital compared to net sales to R&D projects and develop them in such a way that the firm's assets can be effectively transferred to a potential larger firm in the M&A process. This dynamic is apt to reduce the initial investment risk involved in R&D projects if the firm is aware of the higher probability of a potential high premium in future M&A EXIT.

The thesis finds that the growth of the target firm's M&A premium has a statistically and economically significant relationship to M&A's cross-border nature. This relationship emphasizes the target's ability to harness its current total assets so that it can be effectively acquired in the cross-border M&A market. In addition, the thesis finds a statistically insignificant, but economically significant finding that the role of the use of financial advisors by the target firms is more significant to the M&A premium than for acquiring firms. Both cross-border M&A and higher intangible nature of the transaction emphasize the importance of leveraging financial advisors' expertise in increasing the future M&A premium. cross-border M&As' significantly greater implementation risks compared to domestic M&As, and the valuation of intangible R&D assets and their future marketing to potential M&A acquirers all require competent financial expertise. As 88 percent of the analyzed M&As in the data are cross-border, the thesis highlight the ability of financial advisors to create increasing value for target firm in the form of M&A premium.

Although the thesis does not methodologically examine the role of legal advisors, the same dynamics can be argued to be present in the field of EU competition law and intellectual property rights expertise.

The thesis finds practical implications for the acquiring firm, which it can utilize in the M&A decision-making. Based on Diaz et al. (2009), the main objective of the acquiring firm in the M&A process is to achieve a higher rate of return on the initial investment capital post-M&A compared to the paid premium rate pre-M&A. The thesis identifies relatively large negative coefficients between mergers of equals and M&A premiums, though these results are statistically insignificant. In contrast, mid industry relatedness exhibits a statistically and economically significant positive impact on M&A premiums across all Tables 9, 10, and 11. This suggests that when M&As occur within the same mid-industry, often targeting the acquirer's competitors, significant fluctuations in the M&A premium can arise based on whether the parties perceive themselves as equal partners, both de jure and de facto, post-M&A. The more acquirer agrees with the target on a common equal position post-M&A, the higher is the probability for the acquirer to be saved from the risk of losing the transaction during the strict negotiation phase and later from the target's significant premium request.

All in all, prior relevant literature (Lev et al. 1996; Aboody et al. 2000; Chan et al. 2001; Laamanen 2007; Cheng et al. 2016; Lin et al. 2016; Mataigne et al. 2017) suggest that the importance of R&D in the M&A transaction is statistically increasing. When acquirer acknowledges more effectively the risks and synergy potentials included in R&D assets during the target valuation, it can enhance the rational decision-making policies in the M&A process. On average, acquirers pay a higher premium R&D intensity target than for non-R&D intensity targets, but this does not indicate a weak decision-making policy of the acquirer's management (Laamanen, 2007). The main attributes for profitable M&A are that the acquirer recognize the synergy value from the individual target, conducts a rational decision-making process avoiding managerial hubris, and yields a higher return percentage post-M&A than the premium it paid pre-M&A.

8.2 Limitations

The main limitation to the generalizability of the thesis results is the examination of only technology-based M&As. The disadvantage of the sector limitation is that the interpretation of the results cannot be fully extended to the M&A processes of all business sectors. On the other hand, prior literature identifies higher valuation challenges for technology firms relative to more conservative sectors, as technology firms often include higher proportion of hard-to-value, option like intangible assets. This leads to acquirer's higher carefulness in the M&A process (Laamanen, 2007), and requires higher financial expertise in the target valuation.

Another limitation is the geographical focus on the European M&As. The results of the thesis are not completely generalizable to other geographical areas but can give an indication of the direction of the investigated M&A and R&D dynamics. Especially, regarding to the M&A premium, prior literature generally emphasize U.S.-based market studies. On average, U.S. market have experienced 8.17 percent higher M&A premium from 2010 to 2018 (Statista.com, 2022), mainly due to tighter competition and higher valuation multiples. Therefore, the thesis aims to contribute to the research gap regarding the European M&A market. In addition, the thesis requires M&A parties to be publicly traded firms to obtain relevant datapoints and enhance the reliability of the regression analysis. The thesis results can vary for private, more agile technology firms.

The thesis decision to use R&D as a proxy for innovation also limits the generalization of the research results. The disadvantage of the decision is that R&D does not recognize all the forms of innovation, for example patents and trademarks. On the other hand, utilizing R&D as a proxy for innovation captures the significant role of R&D inputs among technology firms and emphasizes the comparability with prior M&A literature.

8.3 Future research

The aim of the thesis is to fill the academic gap regarding how the target firm's R&D intensity affects the premium paid in European public M&As from 2000 to 2022. The importance of both M&A as a major financial transaction and R&D as a method of increasing innovativeness during the sixth wave of innovation is on the rise, which offers interesting and economically relevant study topics for future research. Understanding the importance of R&D in M&A more deeply increases the firm's incentives to develop its innovativeness, enhances rational decision-making by the M&A parties, further increasing Europe's level of innovation and competitiveness in the global business market.

One future research direction investigating the innovativeness of the target firm and M&A premium, is to investigate the importance of increasing patents, design rights, and trademarks in relation to the M&A premium. In Europe, this can be effectively investigated, as the European Patent Office (EPO) offers the EPO database, which enables the search and examination of patents in Europe. European Union Intellectual Property Office (EUIPO) provides a database with information on EU trademarks and design registration. These public databases enhance the continuity of future research.

Another interesting and economically relevant topic is how the increased interest rate environment influences the M&A premium and R&D dynamics. The increased interest rate environment influences the financing of current and future R&D investments, to use of leverage in the M&A financing, and to the overall future yield requirement for the post-M&A financial returns due to the higher discount rate. On the other hand, reduced new R&D investments can be argued to increase the attractiveness of firm's current R&D investments among potential M&A acquirers.

In addition, one practical way to study the same phenomenon, but potentially achieve statistically significant results, is to analyze the R&D intensity and M&A dynamics using a different data base or a different methodology, for example the quantile regression (QR) method. It can be argued that regression analysis has a higher probability of finding

statistically significant results, if the number of observations in the final data sample is higher.

9 Conclusion

The thesis investigates the relationship between the target's R&D intensity and the premium payment in European technology public M&As. The purpose of the thesis is to deepen the understanding on the value relevance of the R&D investments in the M&A process, the information asymmetry dynamics regarding these R&D investments, and how these factors influence the premium paid for the target firm. A deeper understanding of the importance of the target firm's R&D intensity to the M&A premium enhance the acquirer's rational decision-making, increase the target's incentives to invest in innovation, and reduce the insider trading effect of the stock market regarding R&D intensity firms.

The thesis uses the R&D intensity of the target firm as a proxy for innovation, further being studied from the perspective of R&D to market value, R&D to net sales and R&D growth rate to achieve diverse understanding of the phenomenon. The data sample includes a total of 203 public European M&A transactions of technology companies from 2000 to 2022. Utilizing OLS regression analysis, the thesis finds that all R&D intensity proxies for the public European technology target firm has a positive, but statistically insignificant relationship with the M&A premium. Although the directions of the R&D relations are parallel, the results are contrary to U.S.-based R&D and M&A studies, which generally find statistically significant results. As an analogous conclusion, the results do not achieve the expected statistical significance as Laamanen (2007), which serves as the main predetermined comparison study for the thesis.

Thesis finds that, on average, public European technology firms pay 39.87-44.22 percent premium over the market price of the target firm, which is higher than in other more conservative business sectors. Although the thesis does not find a statistically significant R&D proxy to explain the M&A premium, among all three studied R&D proxies, the most relevant dynamic for both the buyer and the target can be considered the R&D based on net sales one day prior to the announcement, what almost achieves statistical significance level of 0.10. If the future research achieves statistically significant results on the

phenomenon, it can further suggest that the target's strategic decision to invest a high proportion of its available free cash flow to R&D projects signals trust and the yield potential regarding these R&D projects, further increasing the attractiveness among potential M&A acquirers. Without a statistically significant relationship between the R&D and M&A premium, the results indicate that the M&A premium for public European technology targets with high R&D intensity is more affected by other determinants, such as mid industry relatedness and cross-border nature of the transaction.

Examining the M&A premium four and one week prior to the announcement to one day prior to the announcement, the thesis finds that the M&A premium decreases by -4.35 and -4.60 percent, respectively. The dynamics are mainly due to higher information asymmetry relating to hard-to-value R&D assets, further leading to a growing insider trading effect in the M&A process. Additionally, as the information asymmetry associated with the target's R&D assets increases, there is a higher probability for the public stock market to justify acquirer's valuation of the target firm and the higher premium payment over the target's current share price. The thesis attributes to existing literature by increasing market participants awareness of potential insider trading effect relating to M&As of R&D intensive technology firms.

The primary practical implication of the thesis is that when the management of the firm acknowledges that it can potentially yield higher M&A premium from increased R&D investments in relation to net sales, it further reduces the financial risks towards enhancing innovativeness and increases incentives to execute EXIT through M&A transaction. To optimize the size of the premium, the target firm should engage in cross-border M&A with a relatively large strategic acquirer that operates in the same mid industry. In addition, the use of financial advisors benefits the target more than the acquirer in terms of the M&A premium, which can be due to the ability to harness the value of R&D assets in the M&A process and market them effectively to potential acquirers. In contrast, when the acquirer acknowledges more effectively the risks and synergy potentials included in

R&D assets during the target valuation process, it can enhance the rational decision-making policies, and reduce the influence of managerial hubris around R&D assets.

The thesis states that the relatively high M&A premium for R&D intensive targets do not immediately indicate poor quality decision-making policies of the acquirer, if the acquirer is able to achieve a relatively attractive yield percentage for the initial investment post-M&A. The higher yield of the M&A investment can be mainly based on synergies created by the target firm's innovative assets or on reduced competition in the highly competitive technology sector. However, in case of hard-to-value high R&D intensity targets, financially successful M&A requires that the acquirer receives as clear observation as possible of the current and potential future value of current R&D projects, further reducing the information asymmetry and managerial hubris effect around the target's assets. The statement is supported by the prior literature such that a high M&A premium per se does not prove overpayment hypothesis to be present, if the yield according to the synergy hypothesis leads to higher future return percentage than the initial M&A premium percentage.

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