Universidade do Minho
Escola de Economia e gestão

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Mergers and Acquisitions Outcomes: The role of R&D and Intangible Assets

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

I further declare that I have fully acknowledged the Code of Ethical Conduct of the University of Minho.

Mergers and Acquisitions Outcomes: The role of R&D and Intangible Assets

Resumo

As Fusões e Aquisições (F&A) têm sido usadas como um meio para as empresas investirem em R&D e Ativos Intangíveis. O objetivo principal deste estudo é analisar se as diferenças entre a empresa alvo e a empresa compradora em termos de R&D e Ativos Intangíveis podem afetar o resultado das F&A. Isto resulta na criação ou destruição de valor para os acionistas das empresas compradoras e alvo?

A amostra compreende 2,760 negócios dos Estados Unidos da América e da Zona Euro ao longo de 15 anos – desde 2005 a 2019. A reação do preço das ações ao anúncio de uma aquisição é medida pelas rendibilidades anormais acumuladas (CARs).

Em relação aos ativos intangíveis, não encontro evidência para a teoria de "adverse selection". A ideia de que a empresa alvo é comprada com desconto devido à possibilidade de assimetrias de informação não se confirma neste estudo. Relativamente aos gastos em R&D, a ideia de que a empresa compradora faz a aquisição de uma empresa que tem um investimento relativo superior em R&D para entrar num ambiente tecnológico, e por isso, ganhar com o negócio não é confirmada neste estudo. Encontro evidência de que as empresas combinadas incorrem em perdas quando a empresa alvo investe mais em R&D do que a empresa compradora. Encontro também evidência de que as empresas alvo com investimento superior em R&D do que as empresas compradoras ganham com o anúncio do negócio. Alguns autores defendem que a ideia – de que o comprador está a comprar uma empresa alvo com um investimento relativo superior em R&D para entrar num ambiente tecnológico, e por isso, ganhar com o negócio – é especialmente significativa num ambiente tecnológico onde as capacidades de R&D são cruciais para a expansão das empresas, no entanto não encontro resultados que confirmem essa ideia. No que diz respeito às diferenças entre os negócios realizados pelas empresas da zona euro e pelas empresas dos EUA, não encontro resultados que mostrem diferenças entre negócios realizados nessas zonas geográficas.

Palavras-chave: Ativos Intangíveis, Fusões e Aquisições, Investigação e Desenvolvimento, Rendibilidades Anormais Acumuladas.

Mergers and Acquisitions Outcomes: The role of R&D and Intangible Assets

Abstract

Mergers and Acquisitions (M&As) have been used by companies as a mean to invest in R&D and Intangible Assets. The main purpose of this study is to analyse if differences between the target firm and the acquiring firm in terms of R&D and Intangible Assets could affect the outcome of M&As. Does this result in the creation or destruction of value for the target and acquirer shareholders?

The sample comprises 2,760 deals from the United States of America and the Eurozone throughout 15 years – from 2005 to 2019. The stock price reaction to the announcement of an acquisition is measured by the cumulative abnormal returns (CARs).

Concerning the intangible assets, I do not find evidence for the theory of adverse selection. The idea that the target firm is bought at a discount due to the possibility of information asymmetries is not confirmed in this study. About the R&D expenditures, the idea that the acquirer is buying a firm with relatively higher R&D expenditures to enter a tech environment and, therefore, gain with the deal is not confirmed in this study. I find evidence that the combined firms incur losses when the target has relatively higher R&D expenditures than the bidder. I also find that targets firms with relatively higher R&D expenditures than the bidder gain with the announcement of the deal. Some authors defend that the idea - that the acquirer is buying a target with relatively higher R&D expenditures to enter into a tech environment and, due to that, gain with the M&A - is especially significant in a tech environment where R&D capabilities are crucial for further expansion of companies, however, I do not find support for that in this analysis. Regarding the differences between deals made by the Eurozone firms and the USA firms, I do not find results that show differences between the two geographical zones.

Keywords: Intangibles Assets, Mergers and Acquisitions, Research and Development, Cumulative Abnormal Returns.

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1. Introduction

The main objective of every organization must be the shareholder wealth maximization, to achieve that companies embrace different approaches. In addition, in the last few decades, the fearless competition in the capital markets leads companies to compete in pursuing value-creating strategies. One of the most meaningful deals of corporate finance is Mergers and Acquisitions (M&As). M&As are a business strategy that enables firms to enter new markets or to explore new business areas. The most common reason for firms to enter these deals is to work with other companies resulting in synergies (Kiymaz and Baker, 2008). Companies enter with the expectation that the combined value of the two companies will be greater than the sum of the individual parts separately. Many essays have been carried out to assess whether M&As have been value-enhancing or destroying for companies.

Companies are not only purchasing other firms due to their hard assets - tangible assets or resources with fundamental value. Companies are interested in acquiring information-based assets, methodologies, expertise, etc. These concepts are reflected in the firm's intangible assets and Research and Development (R&D).

Throughout the M&A process, the acquirer absorbs unobservable economic benefits from the target, usually as intangible assets. Although these unobservable assets can provide future benefits to acquirers, they have no physical substance. Which makes the possible synergies obtained with the deal more difficult to appraise, thereby creating inefficiencies.

Information about the resources can be unevenly distributed between the bidder and the target companies. If the seller cannot show the buyer a credible signal that enables the buyer to distinguish the quality of the firm, it creates a risk of adverse selection (Akerlof, 1970). The parties face adverse selection problems arising from information asymmetry (Shen and Reuer, 2005; Schildt and Laamanen, 2006; Capron and Shen, 2007). The level of asymmetric information between the target and the bidder depends on the bidder's ability to understand the value of the combined business. This type of company with intangible assets is more sensitive to these asymmetries.

The acquiring firm recognizing all these questions surrounding the information asymmetry argument - such as misrepresentation by the target - can discount the price offered accordingly (Balakrishnan and Koza, 1993) especially in deals facing less competition. In other words, the target can be bought at a discount.

In previous work on M&As, increasing R&D activities and improving technological performance seem hardly relevant as motives for M&As (Jong, 1976). However, more recent studies suggest that acquisitions are an important strategy for acquiring technology, especially in R&D-intensive industries (Grandstrand, et al., 1992; MacDonald, 1985).

The theory advocates that R&D intensity and acquisitions may be either directly or inversely related. Some suggest that firms must choose between acquisitions or R&D investments. Others that if M&A is motivated by synergy effects - e.g. economies of scale and scope -, M&As should be positively correlated with R&D investment.

Besides the correlation between R&D investment and M&A activity, it is relevant to study if companies will merge or acquire companies with the same or different levels of R&D intensity. That is the difference between target and acquirer in terms of R&D expenditures. The goal will be to analyse this differential in R&D between target and acquirer. Then, to examine if the gains to the bidder and target shareholders and the overall value created by the deal are higher or lower when the differential is higher. Can the asymmetries in terms of the investment in R&D between target and acquirer affect CARs? When the target company has a higher level of investment in R&D than the bidder, this means that the latter is buying a company with a potentially higher level of technology. Which can be explored by the acquirer to increase the investment in technological areas. When companies enter a deal with companies that have an R&D intensity above their sector average, they are expected to be future-oriented.

Some authors state that this effect should be especially significant in a high-tech environment where R&D capabilities are crucial for the further expansion of companies. Can the asymmetries in terms of the investment in R&D between target and acquirer affect CARs when at least one company is from a high-tech sector? In the last couple of decades, technological expertise, market know-how, and innovation are crucial corporate assets for facing increased competition.

The purpose of this study is to analyse the outcome of M&A activity when asymmetries between target and bidder in these differentials arise. How the asymmetries in R&D expenditures can affect CARs of M&A deals? How the asymmetries in Intangible asset records can affect CARs of M&A deals? Most of the literature studies and focuses on the factors that affect bidder CARs, more than the target or bidder-target combined CARs. Therefore, I propose to calculate the bidder, target, and bidder-target combined CARs - i.e. cumulative abnormal returns - from public companies in order to analyse the value of synergies.

I gather a sample of 2,760 completed mergers and acquisitions made by the Eurozone companies and the United States of America companies between 2005 and 2019. My results do not provide evidence for the adverse selection theory, the theory that the target is bought at a discount is not confirmed in this study. I do not find support for the main idea - that the acquirer is buying a target with relatively higher R&D expenditures to enter into a tech environment and, due to that, gain with the M&A - concerning R&D investment. The combined firms incur losses when the target has relatively higher R&D expenditures than the bidder. However, targets with relatively higher R&D expenditures than the bidder gain with the announcement of the deal. Some authors defend that the idea - that the acquirer is buying a target with relatively higher R&D expenditures to enter into a tech environment and, due to that, gain with the M&A - is especially significant in a tech environment where R&D capabilities are crucial for further expansion of companies, however, I do not find support for that in this analysis. With respect to the differences between deals made by the Eurozone firms and the USA firms, I do not find results that show differences between the two geographical zones.

This dissertation is structured as follows: Section 2 reviews the related literature. Section 3 presents the hypotheses. Section 4 describes the methodology used to achieve the results. Sections 5 and 6 explain and show the data sample. Section 7 presents and analyses the empirical results. Section 8 shows some robustness tests. Section 9 compares the differences between the Eurozone and the USA. The main conclusions of this dissertation are discussed in section 10. Finally, in section 11 are pointed some limitations of the dissertation.

2. Literature review

Mergers and acquisitions (M&As) are a well-known organizational strategy through which companies could increase their market power, enter new markets, or improve their capabilities. Empirical research studies the distribution of abnormal returns in M&As through the analysis of the short-term abnormal returns.

Extensive literature focuses on the motivations behind M&As, it is expected that the deal generates value, i.e., the combined firm's value is greater than the sum of each firm's separate value. The main reasons are synergies - economies of scale and scope -, market power, diversification, etc. Berkovitch and Narayanan, (1993) study some motives. The authors study the correlation between the target and total gains. This correlation should be positive if synergy is the primary motive for the deal. Since managers want to maximize shareholder wealth, they would enter into an M&A deal due to the economic gains that result from merging two firms. Therefore, if the main reason is synergy, the synergy value will be captured by the combined business.

These deals can offer companies a shortcut to their strategic objectives, although this complex process has its costs.

2.1. Distribution of the abnormal returns for the shareholders

Literature is mixed about the distribution of the abnormal returns for the shareholders in M&As. For many authors, the target firms' shareholders are the big winners, regarding the shareholders of the acquiring and the bidder-target combined firms the literature is not consensual about the resulting gains or losses.

2.1.1. Acquiring Companies

The existing literature struggles to find a clear cut about the abnormal returns of acquiring companies. Bruner (2002) summarizes the findings of 41 studies, one-third shows value destruction, one-third shows value conservation and one-third shows value creation. These studies find positive and negative results around zero percent. When acquiring firms are analysed, evidence suggests that these

shareholders earn, on average, a zero abnormal return at the acquisition's announcement (Fuller et al., 2002; Andrade et al., 2001).

Andrade et al. (2001) show results about the announcement period abnormal returns by decade, from 1973 to 1998, in the US. In a short window, they find that the abnormal returns for acquirers are slightly negative. Over a longer event window, the average abnormal returns of the acquiring firms are even more negative. In both cases, the results are not statistically significant. Under these results, they cannot state that the acquirers are clearly losers, but it is evident that they are not winners like the target firms.

Many studies suggest the idea that payment choices can influence the stock abnormal returns. Deals financed by stock, at least partially, have different valuation effects from deals that are financed without any stock payment. Andrade et al. (2001) find that the negative announcement period stock market reaction for bidding companies is limited to those that finance the deal with stock. The method of payment could affect the market price and consequently influence the stock gains. Some studies suggest that if the deal payment is made with stock the company will suffer a share price decline, conversely if the payment is made in cash. This effect is expected to occur also for the target stock price (Draper and Paudyal, 1999).

Fuller et al. (2002) study a large sample of M&A deals in the US between 1990 and 2000. The abnormal returns for the bidding firms change depending on the main characteristics of the firm and the method of payment involved in the deal. They find that larger targets and stock-financed deals lead to superior abnormal returns. This can be explained by management hubris since the larger the firm is, the more confident the managers can be to pursue deals. Related to that, companies are willing to overpay for the acquisition because they believe that they will be able to manage it more effectively than the managers of the target company (Roll, 1986).

2.1.2. Target Companies

Extensive research shows that shareholders in target firms are clearly the winners in merger and acquisition deals. Bruner (2002) analyses the most important studies and observed that almost all of them show value creation for targets. Previous literature is consensual, target firm shareholders get significant and positive returns (Datta et al., 1992).

Andrade et al. (2001) also analyse the returns for the shareholders of the target firms, they find that the average announcement period abnormal return estimate for target companies is 16 percent. These results are very stable throughout the decades covered by the study. When it is analysed how the deals are financed, target firm shareholders have positive abnormal returns when stock-financed deals and even more positive when the deals are financed without stock. Even when they control for deal size, since larger deals have smaller premiums and a tendency to be financed through stocks, the difference remains. They show the following results, 11.3 percent for large stock deals and 17.8 percent for large non-stock deals.

2.1.3. Combined Results

The mixed literature about the latter issues raises the question about the net economic gain from bidder-target combined abnormal returns.

Andrade et al. (2001) examine 3,688 completed mergers. The average announcement period abnormal returns for the target and acquirer combined are similar across decades, which suggests that mergers do create shareholder value on average. They approach the impact that financing has on the overall value creation of mergers. Stock-financed deals have combined average abnormal returns of zero, on the opposite side deals without any stock have positive and significant combined abnormal returns. Thus, based on the announcement-period stock market response, they conclude that mergers create value for the shareholders of the combined companies.

Bruner (2002) shows the results of 20 studies where they form a portfolio of the bidding and target companies and examine either their weighted average returns (weighted by the relative sizes of the two firms) or by examining the absolute dollar value of returns. The studies report positive combined returns, with more than half being significantly positive.

These findings support the idea that M&As do pay the investors in the combined acquirer and target companies, although other authors claim the existence of negative combined abnormal returns. Roll (1986), by the central prediction of the hubris hypothesis, defends that the total combined takeover gain to shareholders is nonpositive.

In sum, the existing literature shows consistent results for the target companies. However, when acquiring companies and combined results are analysed the literature is mixed about the outcome of merger and acquisition deals.

2.2. Intangible assets

When two companies set a merger and acquisition deal there is a combination of accounting transactions that combines acquirer's and target's operation and structure. Throughout this process, the acquirer absorbs unobservable economic benefits from the target, usually as intangible assets. An intangible asset, in opposition to tangible assets, is not physical in nature. Intangible assets include patents, goodwill, trademarks, franchises, copyrights, employees' know-how, company reputation, etc (Itami, 1987).

Although intangible resources can provide future benefits to acquirers since they have no physical substance can be difficult to quantify or value. In other words, when accessing the other firm's value, it can be hard to measure that specific variable. So, the possible synergies obtained with the deal are more difficult to appraise when intangible assets are involved.

In addition, information about the resources can be unevenly distributed between the bidder and the target companies which creates inefficiencies. The valuation of future partners can be difficult to access when the deal process faces adverse selection problems arising from information asymmetry (Shen and Reuer, 2005; Schildt and Laamanen, 2006; Capron and Shen, 2007) between the parties.

The level of asymmetric information between the target and the bidder depends on the bidder's ability to understand the value of the combined business. Consequently, different levels of asymmetric information depend on the nature of the resources to be acquired. For instance, information about the value of physical assets can be easily disclosed which would not affect the valuation of a company. On the other hand, adverse selection tends to be more significant for deals of companies with substantial intangible assets. This is because financial reports may not contain information regarding the true value of intangible assets. Shen and Reuer (2005) suggest that besides other specifications the target firms' intangible assets affect the bidder's valuation challenges.

If the seller cannot reveal to the buyer a credible signal that allows the buyer to distinguish the level of quality of firms, it creates a risk of adverse selection (Akerlof, 1970). Buyers find it costly and

difficult to identify target quality, and sellers have the opportunity to misrepresent their value. Given the incentives for misrepresentations, the likelihood of adverse selection arises. This leads to inefficiencies which can result in a lower premium bid (Coff, 1999; Reuer and Ragozzino, 2007). Thus, targets receive discounted offer prices, and buyers bear the risk of adverse selection.

The acquiring firm recognizing all these questions surrounding the information asymmetry argument can discount the price offered accordingly (Balakrishnan and Koza, 1993) especially in deals facing less competition. In other words, the target can be bought at a discount.

The well-known Shleifer and Vishny (2003) model of corporate acquisitions based on investors' misevaluations of the merger partners predicts that some acquisition targets will be overvalued but not larger than the bidder's overvaluation. Managers will not pay exorbitant values for targets - to maximize the gains from acquisitions - since the price is constrained by the synergies, restricting, in turn, the values of goodwill.

However, Dong Hirshleifer, Richardson, and Teoh (2006) results show that acquisition targets are, on average, overvalued. Overvalued bidders tend to acquire overvalued targets, thereby increasing the likelihood of recognizing goodwill. Gu and Lev (2011) analysis also indicate that bidders' share overpricing is positively associated with the goodwill from acquisitions. They enhance goodwill through higher premiums paid for targets.

2.3. Research and Development

The literature suggests that if M&As are motivated by synergy effects (e.g. economies of scale and scope), then they should be positively correlated with R&D investment. The union of the two firm's knowledge base can provide opportunities such as synergies in future R&D investment. This means that firms can reduce redundant or duplicate R&D activity and even provide a wider research base to finance expenses (Cassiman et al., 2005; Hall, 1990).

In what concerns the future technological performance, firms operating in a high-tech, R&D intensive environment, must enhance the continuous search for new technological capabilities to improve performance through the integration means of M&As. Hagedoorn and Duysters (2002) suggest that successful M&As enable companies to develop new skills and improve their knowledge base in order to increase their technological performance. However, joining two companies with similar technological

capabilities and similar technological track-record only duplicates current capabilities which leads to little effect on the future technological performance of the firms.

Burgelman (1986) argues that in order to improve the technological level, to grow, and to develop, a firm must do it through acquisitions or innovations, suggesting that they are mutually exclusive. Therefore, acquisitions may be an attractive - although possibly a short-term-oriented - alternative to direct R&D investments. Also, after acquisitions managers become more risk-averse than they have been and thus less attracted by innovation. Although risks exist, the outcomes of acquisitions are more predictable than the outcomes of internal development.

Empirical evidence is mixed about the relation between R&D intensity and M&A activity. Blonigen and Taylor (2000) empirically examine high-technology industries, for instance, electronic and electrical equipment industries. R&D intensity is measured as the ratio of the firm's R&D expenditures to total assets. They find an inverse relation between R&D intensity and acquisition activity. Indicating that internal R&D and acquisitions are alternative strategies.

Lehto and Lehtoranta (2006) empirically test how R&D affects the likelihood of acquisitions in Finland. They find that a high level of R&D increases the likelihood of entering an M&A. Adversely to some other earlier findings, firms do not seem to specialize in their strategies, which means that R&D investment and M&A activity are not mutually exclusive. Their results can also indicate that it is important to invest in one's own R&D which enables the capacity to utilize the other firms' R&D and to have some bargaining power through the M&As process.

The acquiring firm must have the absorptive capacity, which plays a twofold role in improving innovative performance (Cohen and Levinthal, 1990). By increasing its internal knowledge base, the firm can generate innovations. In addition, the acquiring firm with a superior internal knowledge base has developed the capacity to identify valuable external technologies - i.e. value the target's R&D -, incorporate, and exploit them in combination with the existing technology and know-how - i.e. absorptive capacity.

When the target company has a higher level of investment in R&D than the bidder, this means that the latter is buying a company with a potentially higher level of technology. Which can be explored by the bidder to increase the investment in the technological field. When companies go through M&As with companies that have an R&D intensity above their sector average, they are expected to be future-oriented. Early evidence indicates that firms in mature industries with low R&D intensity engage in M&As with firms in R&D-intensive industries to expand into high-tech sectors (Chakrabarti and Burton, 1983).

2.3.1. High-tech deals

The latter is especially significant in a high-tech environment where R&D capabilities are a key issue for the further expansion of companies. In the last couple of decades, technological expertise, market know-how, and innovation are crucial corporate assets for facing increased competition. M&As have become an instrument for companies to acquire, absorb and exploit the knowledge assets of the acquired companies.

Thus, if managers pay attention to the strategic and organizational fit of companies, the external acquisition of technological skills through M&A deals can be a strategic advantage for firms in high-tech areas (Hagedoorn and Duysters, 2002).

There are several tech definitions and classifications, Loughran and Ritter (2004) use a classification for Internet and Technology Firms. They define some sectors such as computer hardware, communications equipment, electronics, navigation equipment, measuring and controlling devices, medical instruments, telephone equipment, communications services, and software as tech sectors.

Kohers e Kohers (2000) use the SDC approach to define high-tech areas. They analyse 1,634 acquisitions involving high-tech targets. Their findings regarding the method of payment for high-tech mergers indicate that offers using stock do not necessarily produce adverse reactions from bidder investors. That is the market reaction of stock financed and cash-financed mergers do not differ significantly. They also find a positive relation between bidder excess returns and the size of the transaction relative to the acquirer's size. Therefore, the shareholders of acquiring firms generally believe that larger high-tech targets are more likely to generate synergies in a transaction. They support the idea of the acquiring company being also from a high-tech industry to increase investor confidence about high-tech investments. Especially about the high-tech acquisition of firms that are also involved in the fields dealing with emerging technology. The result of the combination of two high-tech companies can lead investors to anticipate larger growth benefits.

Dutta and Kumar (2009) investigate Canadian acquirers and find that R&D intensity - i.e. R&D expenditures by sales - has a significant positive effect on the abnormal returns of acquiring companies. Thus, the investors of R&D-intensive firms consider the high level of investment in R&D as a potential factor for growth. Kohers and Kohers (2000) also advocate the same line of thinking.

3. Hypotheses

Considering the literature reviewed above, it is proposed the following hypotheses:

- H1: target CARs tend to be lower when targets have relatively higher intangible assets, ceteris paribus

- H2: acquirer CARs tend to be higher when targets have relatively higher intangible assets, ceteris paribus

- H3: bidder CARs and combined CARs tend to be higher when targets have relatively higher R&D expenditures, ceteris paribus

    - H3a: the effects in H3 tend to be higher when at least one company is from high tech industries

- H4: target CARs and combined CARs tend to be higher when targets have relatively higher R&D expenditures, ceteris paribus

    - H4a: the effects in H4 tend to be higher when at least one company is from high tech industries

4. Methodology

This study aims to measure the impact of target-bidder differential in R&D intensity and Intangible Assets intensity on M&A announcement returns for bidders, targets, and bidder-target combined from the United States and the Eurozone.

The goal of this dissertation is to determine if the outcomes of M&A deals are consistent with the literature. To determine if there is value creation or destruction resulting from the deal, I compute the abnormal returns of the companies involved around the announcement day.

4.1. Event study

The most common methodology to measure the impact of a specific event on the value of a firm is the event study from Mackinlay (1997). This methodology has been applied to several topics such as M&A, it is expected that the effect of the acquisition announcement will be reflected immediately in the stock prices. It is assumed that the market will immediately incorporate any new information about the firm such as synergies created by the acquisitions.

The period under analysis is from January, 1st 2005 to December, 31st 2019. First, it is necessary to define the event window that surrounds the deal announcement, where event day 0 is the acquisition announcement date. I use three different event windows – 3 days, 5 days, and 11 days. It is also required to define the estimation window to avoid the risk of contamination, I use an estimation window from -250 to -25 days prior to the announcement day.

The expected return is calculated using the market model, estimated over an estimation window from -250 to -25 days prior to the M&A announcement date. The market model that assumes a stable linear relation between the market return and the firm return,

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{it}$$

Where,

$R_{i,t}$ is the stock return of firm i in moment t;

α_i and β_i are the parameters of the market model;

$R_{m,t}$ is the daily market index return in moment t;

$\varepsilon_{i,t}$ is the error term with expected value equal to zero.

The model is estimated using daily stock returns and, as a proxy for the market, it uses the stock market index of each firm's country, provided by DataStream.

To calculate the abnormal returns, I define three different event windows - 3-day, 5-day, and 11-day window. By Mackinlay (1997), I compute the difference between the return of the firm over the event window and the expected return without the event (normal return).

The abnormal return (AR) for any company is given by:

$$AR_{i,\tau} = R_{i,\tau} - E(R_{i,t})$$

Where,

$AR_{i,t}$ is the abnormal return of firm i in moment t;

$R_{i,t}$ is the stock return of firm i in moment t;

$E(R_{i,t})$ is the expected return of firm i in moment t.

Then I calculate the combination of abnormal returns through time for all the companies. The cumulative abnormal returns (CARs) are calculated for the bidding companies, the target companies.

The cumulative abnormal returns (CARs) between any dates:

$$\overline{CAAR}_i(\tau_1, \tau_2) = \frac{1}{N}\sum_{i=1}^{N} CAR_i(\tau_1, \tau_2)$$

Where,

$\overline{CAAR}_i$ is the cumulative average abnormal returns;

CAR_i is the abnormal return of firm i;

τ is a period of time;

N is the number of events.

The cumulative average abnormal returns are calculated for all the target firms, acquirer firms, and, subsequently, for the combined companies. For the combined abnormal returns it is used the market value of each firm and adjusted for the toehold, then is created a portfolio with a weighted average for the firms (see, for instance, Andrade, Mitchell, and Stafford, 2001; Roll, 1986). This method follows as:

$$CAAR_i(weighted\ value) = \frac{(CAR_{i,acquiror} * MKTvalue_{acquiror}) + (CAR_{i,target} * MKTvalue_{target})}{MKTvalue_{acquiror} + MKTvalue_{target}}$$

Where,

$CAAR_i$ is the cumulative average abnormal return of the created firm;

CAR_i is the cumulative abnormal return of firm i;

4.2. Multivariate Analysis

4.2.1. Intangible Assets

In order to examine if the effect of Intangible Assets - i.e. the differential in R&D expenditures between bidder and target - leads to positive abnormal returns for the bidder, target, and bidder-target combined, it is proposed the following regressions. Having the Cumulative Abnormal Returns (CARs) as the dependent variable, the null hypothesis - the event has no impact on firm value - is tested.

For H1 and H2,

$$car_{(\tau_1\tau_2)} = \beta_0 + \beta_1 IntangibleAssetsIntensityDifferential_{t-1} + \beta_2 Cash + \beta_3 Stock + \beta_4 SameIndustry + \beta_5 Leverage_{t-1} + \beta_6 MTB_{t-1} + \beta_7 Logacqsize_{t-1} + \beta_8 Relativesize_{t-1} + \varepsilon$$

Besides the CARs, it is important to describe other variables that were included in the multivariate analysis. The variables of interest are defined under the previous hypotheses, they are the ones that I expect that can explain value creation or destruction in an M&A deal.

The first interest variable is the "Intangible Assets intensity differential t-1" and is calculated by dividing the Intangible Assets of each firm by the annual total assets of each firm and then the difference between target and acquirer, one year before the deal.

Other variables that are used in these models are the control variables, "Leverage t-1" is the ratio of total debt and total assets, one year before the deal. "Log acquirer size t-1" is the natural logarithm of the acquirer's total assets adjusted for the CPI - Consumer Price Index - 2019, one year before the deal. "MBT t-1" is the ratio of the market value and the common equity, one year before the deal. "Relative size t-1" is the ratio of the transaction value and the acquirer's total assets, one year before the deal.

The model also includes deal-specific variables, such as the dummy variable "Cash" is a dummy variable, which is equal to '1' if the method of payment is pure cash (100%) and '0' otherwise. The dummy variable "Stock", which is equal to '1' if the deal payment is made exclusively in stock and '0' otherwise. The dummy variable "Same Industry", which is equal to '1' if the acquirer and the target operate in the same industry. Same industry deals are defined by the 4 digits SIC - Standard Industrial

Classification -, deals with the acquirer and target with the same 4 digits SIC code is said to be a same industry deal.

This model also contains years dummies, industry dummies, and country dummies to take into account the fixed effects. This is necessary to control the effects on the dependent variable due to some specific factors that can cause bias.

The model will be applied to acquirer, target, and combined CARs, adjusting in relation to the hypotheses - see hypotheses section. It is proposed 2 hypotheses - H1 and H2 - as is presented in table 7.

4.2.2. Research and Development

I performed some regressions to examine if the effect of R&D - i.e. the differential in R&D expenditures between target and acquirer - leads to positive abnormal returns for the bidder, target, and combined bidder-target. The dependent variables are the Cumulative Abnormal Returns (CARs) and the null hypothesis - the event has no impact on firm value - is tested.

The other variable of interest is the "R&D intensity differential t-1" variable and is also calculated in the same logic, by dividing the R&D expenditure of each firm by the annual total assets of each firm[1] and then the difference between target and acquirer, one year before the deal. Commonly, R&D expenditures data are missing for many companies in the database. It must be noted that after the rest of the data has been linked to R&D expenditures data the number of observations decreases dramatically. For instance, the variable "R&D intensity differential" stands out because only has data for 816 observations. I follow the custom in the literature and assume that R&D expenditure is zero when it is missing. Due to that, I create another variable, "R&D intensity differential with zeros". In any case, I also present results using only those firms for which R&D expenditures are available.[2] The conclusions are not affected by the assumption of zero R&D when there are missing values.

Two models were created align with the previous hypotheses.

For H3 and H4,

[1] I follow Hall (1987) definition of R&D intensity.
[2] See the appendix section, tables 17 and 18.

$$car_{(\tau_1\tau_2)} = \beta_0 + \beta_1 R\&DIntensityDifferential_{t-1} + \beta_2 Cash + \beta_3 Stock + \beta_4 Leverage_{t-1} + \beta_5 MTB_{t-1} + \beta_6 Logacqsize_{t-1} + \beta_7 Relativesize_{t-1} + \varepsilon$$

All the other variables were described above.

For H3a and H4a,

$$car_{(\tau_1\tau_2)} = \beta_0 + \beta_1 R\&DIntensityDifferential_{t-1} + \beta_2 Cash + \beta_3 Stock + \beta_4 R\&DIntensityDifferential_{t-1} * TechSector + \beta_5 TechSector + \beta_6 Leverage_{t-1} + \beta_7 MTB_{t-1} + \beta_8 Logacqsize_{t-1} + \beta_9 Relativesize_{t-1} + \varepsilon$$

All the variables are defined above, except for the dummy "Tech Sector", which is equal to '1' if at least the acquirer or target operates in the tech sectors and '0' otherwise. When considering the tech industries, it was followed Loughran and Ritter's (2004) classification for Internet and Technology Firms. They define tech stocks as those in SIC codes 3571, 3572, 3575, 3577, 3578 (computer hardware), 3661, 3663, 3669 (communications equipment), 3674 (electronics), 3812 (navigation equipment), 3823, 3825, 3826, 3827, 3829 (measuring and controlling devices), 3841, 3845 (medical instruments), 4812, 4813 (telephone equipment), 4899 (communications services), and 7370, 7371, 7372, 7373, 7374, 7375, 7378, and 7379 (software).[3]

It also contains an interaction variable, "R&D intensity differential t-1*Tech Sector" which is the multiplication of the "R&D intensity differential t-1" and the dummy "Tech Sector".

These two models will be applied to the acquirer, the target, and the combined CARs, adjusting some variables concerning the hypotheses - see the hypotheses section - as is presented in tables 8, 9. These models also contain years dummies, industry dummies, and country dummies to take into account the fixed effects accordingly to the hypotheses.

[3] There are several tech classifications. In section 8, I perform a robustness test with a different tech classification.

5. Data

The main purpose of this study is to determine the short-term impact of value created through the deal for the acquiring company, the target company, and the combined company.

The data that is used in this study combines companies from the USA and the Eurozone. The sample period consists of deals taking place between 2005 and 2019. This time range is chosen to provide a wide and updated view of mergers and acquisitions.

Data for each deal is gathered from Security Data Company (SDC) Platinum, provided by Refinitiv. I gather data about the announcement date, the acquirers and targets' names, SIC codes, countries as well as other deal characteristics, such as the percentage of cash and stock, the value of the transaction ($mil).

Attending to the previous methodology, I use the following filters:

- Both target and acquirer are members of the USA or the Eurozone;
- The announcement of the mergers and acquisitions from 2005 and the end of 2019;
- Both have the same public status: public;
- Deals with a value below $1 million were excluded;
- Deal status is completed;
- Bidder must own more than 50% of the target after the deal;

The total return index is imported from Refinitiv DataStream in order to calculate the stock price, the market value of equity is also collected from DataStream. Additionally, to access the performance of the bidder and target companies, it has been extracted from Refinitiv World Scope database accounting data such as Research and Development, Total Debt, Total Assets, and Common Equity.

Within the group of 25 countries that compose the sample gathered from the SDC Platinum, six countries (Andorra, Latvia, Holy See, San Marino, Monaco, Saint-Pierre e Miquelon) are excluded since data for the total return index is not available, Lithuania and Slovakia have no merger and acquisition activity during this period and under these filters, and Malta, Estonia, and Slovenia where the number of deals is less than 5 are also excluded. Section 9 includes an analysis between deals from the Eurozone vs the USA.

The U.S. dollar (USD) total assets variable is adjusted to reflect 2019 prices using the Consumer Price Index (CPI) collected from the World Bank database to take into account the inflation effect.

Additionally, there are some companies with missing values for some variables which reflect variations in the actual sample size depending on the model being used. All the data are in U.S. dollars.

All the variables have been through a winsorizing process at the top and bottom 1% of the distribution to eliminate possible outliers.

6. Descriptive statistics

The sample used consists of 2,760 completed mergers and acquisitions made by the Eurozone companies and the United States of America companies between January, 1st 2005, and December, 31st 2019.

Table 1 reports the description of the sample about the number of deals and the mean transaction value of the deals - in millions of dollars - throughout the years. The intensity of deals, analysing the frequency that they occur, was high in 2005, 2006, and 2007 with 267, 282, and 282 deals, respectively. After that, the number of deals dropped a few during the years. Despite this tendency, in terms of the mean transaction value of the deals, the highest year was 2019 even if in that year are only made 137 deals.

Table 1- Distribution of M&A's transaction values by year

Table 1 shows the evolution of the M&As during the 15 years of the sample, reporting the total number of deals and the mean transaction value of the deals. The sample includes 2760 completed mergers and acquisitions. Transaction value is reported in millions of dollars.

Year	Freq.	Mean	St. Dev.
2005	267	1953.044	5498.527
2006	282	2274.552	7210.233
2007	282	1412.141	3009.688
2008	165	1689.547	6001.452
2009	142	2007.204	7882.497
2010	154	1201.630	3024.704
2011	118	2305.123	5519.235
2012	147	1068.198	1793.945
2013	147	1236.922	2464.117
2014	184	2766.460	8026.185

2015	185	3537.812	8271.326
2016	185	2975.722	8495.588
2017	178	2475.474	8755.520
2018	187	2721.467	6892.477
2019	137	4545.811	12674.173
Total	2760	2248.9761	6867.622

Table 2 shows the sample distribution related to the number of deals and the mean transaction value of the deals by the acquirer country. The most representative country by far is the USA with 2175 of 2760 deals. On the other side, Cyprus, Luxembourg, and Portugal are the less representative ones. Under the Eurozone countries, France stands out with 205 deals. In relation to the mean of the transaction value, the country that has the highest value is Ireland - a small country when compared to the others.

Table 2- Distribution of M&A's transaction values by acquirer country

Table 2 describes the evolution of the M&As by the acquirer country of the sample, reporting the total number of deals and the mean transaction value of the deals. The sample includes 2760 completed mergers and acquisitions from the Eurozone and The United States of America. Transaction value is reported in millions of dollars.

Acquirer Country	Freq.	Mean	St. Dev.
Austria	13	561.635	1043.696
Belgium	18	4356.047	12115.018
Cyprus	6	445.893	756.224
Finland	17	1636.228	3669.448
France	205	1720.053	5283.099
Germany	94	2582.512	6688.642
Greece	25	402.063	840.357
Ireland	13	5826.207	9711.864
Italy	82	2247.391	5803.614
Luxembourg	5	1615.638	1005.132
Netherlands	47	1690.078	4918.860
Portugal	9	173.056	142.929
Spain	51	1505.314	2278.953
United States	2175	2326.293	7169.015
Total	2760	2248.976	6867.622

Table 3 shows the sample distribution related to the number of deals and the mean transaction value of the deals by the target country. The most representative country by far is the USA with 2247 of 2760 deals. On the other side, Cyprus, and Ireland are the less representative ones. Under the Eurozone countries, France continues to stand out. With respect to the mean of the transaction value, the country that has the highest value is also Ireland.

Table 3- Distribution of M&A's transaction values by target country

Table 3 provides the evolution of the M&As by the target country of the sample, reporting the total number of deals and the mean transaction value of the deals. The sample includes 2760 completed mergers and acquisitions from the Eurozone and The United States of America. Transaction value is reported in millions of dollars.

Target Country	Freq.	Mean	St. Dev.
Austria	18	951.396	1324.964
Belgium	21	1674.424	3658.460
Cyprus	6	21.806	21.142
Finland	11	224.457	230.256
France	173	1085.546	4946.116
Germany	82	1451.681	4709.273
Greece	29	544.787	919.116
Ireland	7	10132.008	15128.085
Italy	71	2379.384	6006.048
Luxembourg	13	3473.822	9095.698
Netherlands	31	2786.042	4076.782
Portugal	11	212.389	204.993
Spain	40	1446.143	2676.929
United States	2247	2402.350	7219.346
Total	2760	2248.976	6867.622

Table 4 relates information about the summary statistics of the variables that are included in this dissertation. The dummy variables do not have values for the standard deviation, their mean corresponds to their frequency. All the numeric variables were winsorized at the top and bottom 1% of the distribution, except the dummy variables. This adjustment occurs to eliminate possible outliers from the sample.

The different number of observations through this list is due to the lack of data on the database. For instance, the variable “R&D intensity differential” stands out because only has 816 observations. Due to that, it is created another equal variable - “R&D intensity differential with zeros” - but with zeros when

missing values. Thus, it is realized regressions with one variable and others with the other variable. In the multivariate section is included the regression with the "R&D intensity differential with zeros" variable due to the number of observations, nevertheless in the appendix section is included the regressions with the "R&D intensity differential" variable.

Variables such as "MTB" and "Leverage" appear twice because are taken into consideration the acquirer companies and the target companies, and it is aligned with the proposed regression models. The variable "value of transaction" is expressed in millions of dollars. The "intangibles intensity differential" mean is negative, which indicates that acquirer companies have on average higher intangible asset records in relation to their total assets than the target companies. Contrary to this is the "R&D intensity differential" since it is positive.

Table 4- Summary statistics

Table 4 shows the summary statistics, which includes the variables of interest and the control variables as explained in the methodology section. For each variable, it is listed the number of observations in the sample (N), the mean, the median, the standard deviation, and the minimum and maximum values. The value of the transaction is in millions of dollars.

	N	Mean	Median	St. Dev.	Min.	Max.
Intangibles intensity differential	2035	-0.048	-0.014	0.212	-0.637	0.530
R&D intensity differential with zeros	2246	0.024	0	0.086	-0.129	0.527
R&D intensity differential	816	0.064	0.024	0.140	-0.207	0.759
Relative size	2641	0.372	0.084	0.791	0	5.623
MTB	2594	2.902	1.946	3.925	-5.392	28.862
MTB (target)	2284	2.210	1.679	4.150	-21.122	21.404
Log acquirer size	2641	15.391	15.390	2.197	9.144	20.854
Leverage	2639	0.232	0.190	0.191	0	0.830
Leverage (target)	2305	0.227	0.151	0.236	0	1.040
Dummy same industry	2760	0.677	1	-	0	1
Dummy tech sectors	2760	0.037	0	-	0	1
Dummy United States of America	2760	0.772	1	-	0	1
Dummy cash	2760	0.376	0	-	0	1
Dummy stock	2760	0.265	0	-	0	1

Value of transaction ($millions)	2760	2248.976	301.5	6867.621	1	86831.16

The appendix contains the matrix of correlation between the variables used in these models. The variables do not have a high level of correlation which indicates that bias is not likely to occur due to that. It also shows the regressions with the interest variable R&D intensity differential without the inclusion of zeros. These regressions are in tables 17 and 18. They test the hypotheses H3, H4, and H3a, H4a as the ones in tables 8 and 9.

7. Empirical Results

7.1. Abnormal Returns

Following the event study methodology - which is explained in the methodology section – I obtain the results about the distribution of the CARs - Cumulative Abnormal Returns - which reflects the creation or destruction of value. The main goal is to analyse the distribution of the losses or the gains surrounding the event day - day 0 - between the acquiring firm, the target firm, and the combined firms. This distribution is described in table 5. I present the CARs for the three event windows for the acquirer, the target, and the combined firms. Like the other variables, the CARs were winsorized at the top and bottom 1% of the distribution.

The results that I obtain for this sample are consistent with existing literature. Generally, acquiring companies are associated with neither creation nor destruction of value since their abnormal returns are very close to zero. For this sample, the values are slightly negative -0.43%, -0.37%, and -0.58% for the 3 days, 5 days, and 11 days event window, respectively. The CARs show statistical significance at the 1% level.

In relation to target companies, the literature states that they are the big winners in the deal, accordingly, 24.10%, 25.10%, and 26.60% for the 3 days, 5 days, and 11 days event window, respectively. All the CARs are statistically significant at the 1% level.

Regarding the combined CARs previous literature is mixed about the value creation or destruction. The present results show that there is value creation for the combined companies, 3.40%, 3.70%, and 3.90% for the 3 days, 5 days, and 11 days event window, respectively. The CARs are also statistically significant at the 1% level.

The results are also consistent since they are similar for all the event windows. The number of observations of the CARs of the combined companies is significantly less than the acquirer and target because they are the ones that have perfect correspondence between acquirer and target.

Table 5- Distribution of the Cumulative Abnormal Returns

Table 5 presents the summary statistics of the CARs - Cumulative Abnormal Returns - for the Acquirer, the Target, and Combined. The summary statistics include the number of observations (N), the mean, the median, the standard deviations, the minimum, and the maximum. In methodology section it explains how they are calculated, I use three different event windows- (-1, +1), (-2, +2) and (-5, +5), and the estimation window is (-250, -25). The significance levels are represented by ***, **, and * which represent 1%, 5%, and 10%, respectively.

CARs	N	Mean	Median	St. Dev.	Min.	Max.
Acquirer						
(-1, +1)	2539	-0.004***	-0.003	0.061	-0.207	0.221
(-2, +2)	2538	-0.004***	-0.003	0.067	-0.216	0.221
(-5, +5)	2539	-0.006***	-0.005	0.081	-0.278	0.246
Target						
(-1, +1)	2534	0.241***	0.172	0.299	-0.248	1.596
(-2, +2)	2534	0.251***	0.181	0.308	-0.286	1.650
(-5, +5)	2534	0.266***	0.192	0.343	-0.268	2.053
Combined						
(-1, +1)	1350	0.034***	0.016	0.089	-0.201	0.421
(-2, +2)	1349	0.037***	0.020	0.097	-0.190	0.453
(-5, +5)	1350	0.039***	0.021	0.112	-0.248	0.512

7.2. Univariate Analysis

I perform the univariate analysis to analyse the variations in the CARs by a specific variable. In order to analyse these variations, I perform T-tests for the differences of the means, and it is completed with Wilcoxon-Mann-Whitney for the differences in the medians.

The variables that I use are the intangibles intensity differential for panel 1 and panel 3 and the R&D intensity differential for panel 2 and panel 4, which are explained in the methodology section. Group 1 corresponds to the CARs that have the variable intangibles intensity differential higher than the median, group 2 the ones that have lower or equal to the median. This is true for panel 1 and panel 3. Group 1 corresponds to the CARs that have the variable R&D intensity differential higher than the median, group 2 to the ones that have lower or equal to the median. This is true for panel 2 and panel 4.

The results are reported in table 6. Panel 1 shows the average CARs of the firms regarding the differences of the means between two groups, group 1 - upper tail of the intangible's intensity differential median - and group 2 - lower tail of the intangible's intensity differential median. For this panel, the results do not seem relevant since the results are almost indistinguishable from 0% for the acquirer and combined, and around -1% for the target firms. In addition, the results are not statistically significant at 1%, 5%, or 10% level.

Panel 2 shows the average CARs of the firms regarding the differences of the means between two groups, group 1 - upper tail of the R&D intensity differential median - and group 2 - lower tail of the R&D intensity differential median. The results are also insignificant given that they are not statistically significant at 1%, 5%, or 10% level.

Panel 3 shows the average CARs of the firms regarding the differences of the medians between two groups, group 1 - upper tail of the intangible's intensity differential median - and group 2 - lower tail of the intangible's intensity differential median. In panel 3, I find some statistical significance, the difference in the median of the target CARs for the three event windows are all statistically significant at a 10% level for the two shorter windows and at a 5% level for the wider window. The differences are negative, -1.03%, -1.48%, and -1.57% for the 3 days, 5 days, and 11 days, respectively. Following the stylized fact that targets are the big winners in a deal, these results

show differences in the medians between the two groups. For the acquirer and combined firms, the results are indistinguishable from 0% and not statistically significant.

Panel 4 shows the average CARs of the firms regarding the differences of the medians between two groups, group 1 - upper tail of the R&D intensity differential median - and group 2 - lower tail of the R&D intensity differential median. In this panel, the differences in the median of the target CARs for the three event windows are all statistically significant at a 5% level for the two shorter windows and at a 1% level for the wider window. The differences are negative, -2.80%, -3.36%, and -4.18% for the 3 days, 5 days, and 11 days, respectively. Following the stylized fact that targets are the big winners in a deal, these results show differences in the medians between the two groups. Regarding the combined firms, the results show differences in the medians between the two groups - around 1% - and are statistically significant at different levels. For the acquirer, the results are indistinguishable from 0% and not statistically significant.

In addition, in what concerns the acquirer companies, the difference between groups is not likely to occur given that their average CARs is very close to zero.

Table 6- Univariate analysis by R&D intensity differential and by intangibles intensity differential

Table 6 presents the mean and the median of the CARs for the Acquirer, Target, and Combined firms by R&D intensity differential and by intangibles intensity differential for the three event windows - 3 days, 5 days, and 11 days. Panel 1 shows the average CARs of the firms regarding the differences of the means between two groups, group 1 - upper tail of the intangible's intensity differential median - and group 2 - lower tail of the intangible's intensity differential median. Panel 2 shows the average CARs of the firms regarding the differences of the means between two groups, group 1 - upper tail of the R&D intensity differential median - and group 2 - lower tail of the R&D intensity differential median. Panel 3 shows the average CARs of the firms regarding the differences of the medians between two groups, group 1 - upper tail of the intangible's intensity differential median - and group 2 - lower tail of the intangible's intensity differential median. Panel 4 shows the average CARs of the firms regarding the differences of the medians between two groups, group 1 - upper tail of the R&D intensity differential median - and group 2 - lower tail of the R&D intensity differential median. For each panel, I present the one side tests for the differences of the means and the medians because the CARs are not normally distributed. N is the number of observations. R&D intensity differential and intangibles intensity differential are defined in the methodology section. The significance levels are represented by ***, **, and * which represent 1%, 5%, and 10%, respectively.

CARs	N	Mean high gap	N	Mean low gap	Difference	N
Panel 1- means Intangible intensity gap						
Acquirer						
(-1, +1)	1583	-0.0052	956	-0.0027	-0.0025	2539
(-2, +2)	1582	-0.0044	956	-0.0027	-0.0016	2538
(-5, +5)	1583	-0.0067	956	-0.0046	-0.0020	2539
Target						
(-1, +1)	1573	0.2339	961	0.2520	-0.0182	2534
(-2, +2)	1573	0.2443	961	0.2618	-0.0175	2534
(-5, +5)	1573	0.2590	961	0.2770	-0.0179	2534
Combined						
(-1, +1)	847	0.0328	503	0.0347	-0.0019	1350

(-2, +2)	846	0.0351	503	0.0409	-0.0058	1349
(-5, +5)	847	0.0362	503	0.0429	-0.0067	1350
Panel 2- means R&D intensity gap						
Acquirer						
(-1, +1)	2169	-0.0043	370	-0.0042	-0.0000	2539
(-2, +2)	2168	-0.0040	370	-0.0022	-0.0018	2538
(-5, +5)	2169	-0.0063	370	-0.0035	-0.0028	2539
Target						
(-1, +1)	2158	0.2411	376	0.2386	0.0026	2534
(-2, +2)	2158	0.2517	376	0.2465	0.0053	2534
(-5, +5)	2158	0.2648	376	0.2715	-0.0067	2534
Combined						
(-1, +1)	1130	0.0319	220	0.0417	-0.0098	1350
(-2, +2)	1129	0.0356	220	0.0460	-0.0104	1349
(-5, +5)	1130	0.0362	220	0.0516	-0.0154	1350
Panel 3- medians Intangible intensity gap						
Acquirer						
(-1, +1)	1583	-0.0031	956	-0.0025	-0.0006	2547
(-2, +2)	1582	-0.0039	956	-0.0027	-0.0012	2546
(-5, +5)	1583	-0.0053	956	-0.0036	-0.0017	2547
Target						

(-1, +1)	1573	0.1681	961	0.1784	-0.0103*	2544
(-2, +2)	1573	0.1753	961	0.1901	-0.0148*	2544
(-5, +5)	1573	0.1852	961	0.2009	-0.0157**	2544
Combined						
(-1, +1)	847	0.0168	503	0.0158	-0.0001	1356
(-2, +2)	846	0.0196	503	0.0198	-0.0002	1355
(-5, +5)	847	0.0192	503	0.0271	-0.0079	1356
Panel 4- medians R&D intensity gap						
Acquirer						
(-1, +1)	2169	-0.0032	370	-0.0015	-0.0305	2547
(-2, +2)	2168	-0.0040	370	0.0007	-0.0047	2546
(-5, +5)	2169	-0.0053	370	-0.0012	-0.0041	2547
Target						
(-1, +1)	2158	0.1673	376	0.1953	-0.0280**	2544
(-2, +2)	2158	0.1758	376	0.2094	-0.0336**	2544
(-5, +5)	2158	0.1829	376	0.2247	-0.0418**	2544
Combined						
(-1, +1)	1130	0.0150	220	0.0261	-0.0111**	1356
(-2, +2)	1129	0.0184	220	0.0255	-0.0071*	1355
(-5, +5)	1130	0.0190	220	0.0385	-0.0195**	1356

7.3. Multivariate Analysis

I perform the multivariate analysis to determine the explanatory power of the explanatory variables - Intangibles intensity differential and R&D intensity differential - on the firm's CARs. Being the CARs the dependent variable, tables 7, 8, and 9 present the CARs' regressions to test all the hypotheses - see hypotheses section. In each one of the tables, I test the hypotheses for the acquirer, target, and combined companies for all the three event windows - 3 days, 5 days, and 11 days. These regressions also include the control variables and the fixed effects explained in the methodology section.

Table 7 shows the regressions to test H1 and H2 - see hypotheses section. Analysing the interest variable - Intangibles intensity differential - I find that when the differential is positive - i.e. target record in relation to his total assets is higher than the acquirer record in relation to his total assets - the acquirer and combined CARs increase and the target CARs decrease. The acquirer CARs are very close to zero, in addition, the positive coefficients are smaller than 1% on average and not statistically significant. In what concerns the target, when the interest variable goes up by one the CARs decrease on average by -1.71%, -1.56%, and -2.44% for 3 days, 5 days, and 11 days event windows, respectively. In any case, the results are not statistically significant. For the combined, when the variable goes up by one the coefficients are 3.53%, 2.49%, and 1.47% for 3 days, 5 days, and 11 days event windows, respectively. The result is statistically significant at the 5% level for the shorter window.

Concerning the control variables, using cash as the method of payment of an M&A deal is associated, on average, with an increase in the CARs for the acquirer, target, and combined firms. This coefficient is statistically significant at the 1% level for the acquirer and the target firms in all the three event windows. Using stock exclusively as the method of payment decreases the target CARs around 6% and it is statistically significant at the 1% level. For the acquirer and combined firms, the results do not seem relevant neither statistically significant. Relative size has a negative impact on the target CARs, around -4% and it is statistically significant for all the three event windows at the 1% level. The other variables have coefficient values very close to zero.

Table 8 presents the regressions for H3 and H4 - see hypotheses section. Examining the variable of interest - R&D intensity differential - I find that when the differential goes up by one - i.e. target expenditures in relation to his total assets are higher than the acquirer expenditures in

relation to his total assets - the acquirer and combined CARs react negatively and the target CARs positively. For the acquirer firm, the coefficients are not statistically significant. There is no evidence to support H3 that the bidders gain when buying a target with relatively higher R&D expenditures. The hypothesis that the acquirer is buying a target with relatively higher R&D expenditures to enter the technological field - Chakrabarti, and Burton (1983) - do not seem to carry benefits for the acquirer CARs. For the combined firm, the coefficients for the R&D intensity differential are -8.85%, -10.26%, and -7.97% for the 3 days, 5 days, and 11 days event windows, respectively. These results are statistically significant at 5%, 1%, and 10% levels for the 3 days, 5 days, and 11 days event windows, respectively. There is evidence to support that the combined firms lose with the deal.

However, for the target companies' CARs the results are substantially different. When the variable of interest goes up by one the target CARs increase by, 39.01%, 47.53%, and 52.11% for the three event windows. These results are all statistically significant at the 1% level. There is evidence to support the H4 in relation to the target companies. So, target companies with relatively higher R&D expenditures can expect to gain with the M&A deal.

I do not find any different behaviour for the control variables in relation to the previous regression.

Table 9 displays the regressions for H3a and H4a - see hypotheses section. With respect to the interest variable, I do not find any substantial differences in the results when comparing to those reported in table 8. Under these hypotheses, it is expected to study the coefficients on the dummy variable “tech sector” and the coefficients on the interaction variable “R&D intensity differential with zeros* Dummy tech sectors” in order to analyse the moderating effect of tech sector deals. The coefficients on the dummy variable are statistically significant for the combined firms in the two shorter windows at the 5% level, the coefficients are around 3%. The coefficients of the interaction variable are not statistically significant. H3a and H4a cannot be confirmed. Dutta and Kumar (2009) findings that R&D intensity has a significant positive effect on the abnormal returns of acquiring companies are not confirmed under these results.

Table 7- Regression analysis for H1 and H2

Table 7 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated by the market model for (-250, -25) - see methodology section. The regression tests the hypotheses H1 and H2 - see hypotheses section. Each variable is explained and defined in the methodology section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Intangibles intensity differential	0.0046	0.0057	0.0013	-0.0171	-0.0156	-0.0244	0.0353**	0.0249	0.0147
	(0.61)	(0.71)	(0.13)	(-0.45)	(-0.40)	(-0.57)	(2.50)	(1.64)	(0.80)
Relative size	-0.0025	-0.0012	-0.0099**	-0.0374***	-0.0368***	-0.0482***	-0.0010	-0.0004	-0.0067
	(-0.77)	(-0.35)	(-2.16)	(-4.48)	(-4.22)	(-5.13)	(-0.22)	(-0.08)	(-0.98)
MTB	-0.0001	-0.0005	-0.0004				0.0001	-0.0005	-0.0007
	(-0.26)	(-1.06)	(-0.70)				(0.12)	(-0.54)	(-0.72)
Log acquirer size	-0.0002	-0.0001	0.0001	-0.0006	-0.0007	-0.0034	-0.0009	-0.0012	-0.0006
	(-0.23)	(-0.06)	(0.10)	(-0.17)	(-0.17)	(-0.77)	(-0.50)	(-0.59)	(-0.23)
Leverage	0.0039	0.0084	0.0035				-0.0071	-0.0100	-0.0084
	(0.34)	(0.66)	(0.22)				(-0.36)	(-0.46)	(-0.32)
Dummy cash	0.0174***	0.0197***	0.0142***	0.0534***	0.0560***	0.0555***	0.0093	0.0128	0.0093
	(4.65)	(4.76)	(2.75)	(3.27)	(3.34)	(3.03)	(1.24)	(1.59)	(0.99)
Dummy stock	0.0060	0.0072	0.0054	-0.0550***	-0.0636***	-0.0701***	-0.0000	0.0002	-0.0002
	(1.41)	(1.59)	(0.97)	(-4.06)	(-4.51)	(-4.40)	(-0.00)	(0.03)	(-0.02)
Same industry	0.0014	0.0024	0.0009	0.0064	0.0060	0.0073	0.0076	0.0069	0.0108
	(0.42)	(0.64)	(0.18)	(0.46)	(0.42)	(0.46)	(1.12)	(0.94)	(1.27)
MTB (target)				-0.0029	-0.0029	-0.0036			
				(-1.35)	(-1.31)	(-1.45)			
Leverage (target)				0.0320	0.0243	0.0253			
				(0.75)	(0.56)	(0.52)			
Constant	0.1333***	0.1208***	0.1126***	-0.0860	-0.0900	-0.0892	0.0753	0.1091**	0.2335***

	(4.21)	(3.58)	(3.09)	(-1.08)	(-1.13)	(-1.08)	(1.17)	(1.97)	(3.82)
Observations	1,895	1,895	1,895	1,899	1,899	1,899	1,038	1,038	1,038
R-squared	0.102	0.098	0.078	0.198	0.192	0.195	0.133	0.151	0.149
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8- Regression analysis for H3 and H4

Table 8 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated using the market model approach for (-250, -25) - see methodology section. The regression tests the hypotheses H3 and H4 - see hypotheses section. Each variable is explained and defined in the methodology section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
R&D intensity differential with zeros	-0.0202	-0.0284	-0.0052	0.3901***	0.4753***	0.5211***	-0.0885**	-0.1026***	-0.0797*
	(-1.20)	(-1.47)	(-0.21)	(3.02)	(3.51)	(3.38)	(-2.39)	(-2.65)	(-1.77)
Relative size	-0.0028	-0.0021	-0.0108**	-0.0284***	-0.0289***	-0.0392***	-0.0006	-0.0013	-0.0084
	(-0.90)	(-0.61)	(-2.42)	(-3.72)	(-3.61)	(-4.48)	(-0.15)	(-0.25)	(-1.28)
MTB	-0.0001	-0.0004	-0.0003				0.0000	-0.0005	-0.0007
	(-0.16)	(-0.94)	(-0.50)				(0.06)	(-0.64)	(-0.77)
Log acquirer size	-0.0001	-0.0002	-0.0003	0.0015	0.0008	-0.0016	-0.0016	-0.0021	-0.0022
	(-0.18)	(-0.20)	(-0.25)	(0.42)	(0.21)	(-0.38)	(-0.94)	(-1.17)	(-0.97)
Leverage	0.0045	0.0106	0.0135				-0.0037	-0.0055	-0.0023
	(0.43)	(0.92)	(0.90)				(-0.21)	(-0.28)	(-0.09)
Dummy cash	0.0171***	0.0184***	0.0134***	0.0507***	0.0523***	0.0538***	0.0106	0.0143*	0.0110
	(4.89)	(4.77)	(2.77)	(3.26)	(3.29)	(3.11)	(1.56)	(1.95)	(1.28)
Dummy stock	0.0056	0.0066	0.0029	-0.0498***	-0.0532***	-0.0583***	-0.0027	-0.0022	-0.0039
	(1.42)	(1.56)	(0.55)	(-3.71)	(-3.77)	(-3.64)	(-0.40)	(-0.29)	(-0.46)
MTB (target)				-0.0035	-0.0035	-0.0043*			
				(-1.60)	(-1.61)	(-1.69)			
Leverage (target)				0.0184	0.0091	0.0051			
				(0.46)	(0.22)	(0.11)			
Constant	0.1358***	0.1275***	0.1254***	-0.1111	-0.1033	-0.1051	0.0867	0.1240**	0.2649***
	(4.32)	(3.78)	(3.50)	(-1.44)	(-1.32)	(-1.31)	(1.33)	(2.22)	(4.34)

Observations	2,091	2,091	2,091	2,087	2,087	2,087	1,148	1,148	1,148
R-squared	0.098	0.095	0.076	0.196	0.192	0.192	0.118	0.139	0.133
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9- Regression analysis for H3a and H4a

Table 9 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated using the market model approach for (-250, -25) - see methodology section. The regression tests the hypotheses H3a and H4a - see hypotheses section. Each variable is explained and defined in the methodology section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
R&D intensity differential with zeros	-0.0238	-0.0296	0.0068	0.5429***	0.6198***	0.6522***	-0.0856**	-0.0835**	-0.0545
	(-1.51)	(-1.59)	(0.29)	(4.00)	(4.44)	(4.15)	(-2.44)	(-2.28)	(-1.27)
Relative size	-0.0026	-0.0018	-0.0095**	-0.0248***	-0.0253***	-0.0354***	0.0018	0.0017	-0.0062
	(-0.88)	(-0.55)	(-2.23)	(-3.43)	(-3.41)	(-4.33)	(0.48)	(0.37)	(-1.02)
MTB	-0.0000	-0.0004	-0.0003				0.0001	-0.0004	-0.0006
	(-0.09)	(-0.89)	(-0.55)				(0.11)	(-0.47)	(-0.60)
Log acquirer size	-0.0006	-0.0006	-0.0009	0.0006	-0.0001	-0.0026	-0.0021	-0.0023	-0.0030
	(-0.88)	(-0.76)	(-0.81)	(0.20)	(-0.03)	(-0.68)	(-1.35)	(-1.33)	(-1.43)
Leverage	0.0082	0.0097	0.0090				0.0007	-0.0029	0.0002
	(0.95)	(1.06)	(0.78)				(0.05)	(-0.19)	(0.01)
R&D intensity differential with zeros*Dummy tech sector	0.0496	0.0415	-0.1506*	-0.4365	-0.4998	-0.2723	0.0233	-0.0157	-0.2030
	(1.08)	(0.80)	(-1.73)	(-1.38)	(-1.56)	(-0.68)	(0.29)	(-0.18)	(-1.33)
Dummy cash	0.0188***	0.0198***	0.0162***	0.0669***	0.0694***	0.0678***	0.0144**	0.0178***	0.0188**
	(5.87)	(5.58)	(3.70)	(4.62)	(4.65)	(4.21)	(2.37)	(2.72)	(2.49)
Dummy stock	0.0031	0.0045	0.0000	-0.0576***	-0.0611***	-0.0664***	-0.0044	-0.0044	-0.0058
	(0.81)	(1.09)	(0.01)	(-4.33)	(-4.39)	(-4.21)	(-0.69)	(-0.63)	(-0.69)

Dummy tech sector	-0.0098	-0.0129	0.0012	-0.0184	-0.0166	0.0200	-0.0288**	-0.0342**	-0.0100
	(-1.30)	(-1.53)	(0.10)	(-0.47)	(-0.42)	(0.45)	(-2.02)	(-2.22)	(-0.47)
MTB (target)				-0.0031	-0.0030	-0.0037			
				(-1.47)	(-1.39)	(-1.48)			
Leverage (target)				-0.0099	-0.0127	-0.0079			
				(-0.31)	(-0.38)	(-0.22)			
Constant	0.0457**	0.0330	0.0123	-0.0120	-0.0070	-0.0086	0.1335**	0.1244***	0.0962**
	(2.01)	(1.28)	(0.44)	(-0.17)	(-0.09)	(-0.11)	(2.39)	(2.89)	(2.20)
Observations	2,091	2,091	2,091	2,087	2,087	2,087	1,148	1,148	1,148
R-squared	0.059	0.055	0.039	0.161	0.160	0.161	0.072	0.082	0.079
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	No	No	No	No	No	No	No	No	No

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

8. Robustness Tests

8.1. Tech deals

In this section, I present robustness tests for the main results of this study. First, I use a different approach to tech classification from the one that I have used previously in this dissertation. Following Kohers and Kohers (2000), I use the SDC definition of high-tech sectors. SDC defines the target or the acquirer tech industry (codes), by Thomson Reuters code of the high-tech industry in which the target or the acquirer is involved as its primary line of business (if applicable).

Table 10 presents the regressions with this different tech classification. There are different results in relation to the one presented in the multivariate section. The coefficients of the "dummy tech sector" for the target firm are statistically significant and positive around 30% for all the event windows. In the regression presented in the multivariate analysis section, the results were not statistically significant. In contrast with that regression, in this one, the coefficients of combined firms are not statistically significant.

The coefficients for the interaction variable are statistically significant by 10% and 1% for the 3 days and 5 days event windows, respectively. When this variable goes up by one the CARs of the combined firm increase on average by 18.32% and 30.81% for the 3 days and 5 days event windows, respectively.

These results can indicate that the combined firm gain when the deal is in a high-tech environment.

8.2. Consecutive deals

Second, I delete from the analysis deals in which the acquirer announced two or more acquisitions within five days. This requirement avoids overlapping effects on the returns of the acquiring firms across different deals.

Tables 11 and 12 show the results. Comparing these regressions with the ones in tables 7 and 8, there are no significant differences in the results for the hypotheses H1 and H2, neither for H3 and H4.

Table 10- Regression analysis for H3a and H4a

Table 10 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated using the market model approach for (-250, -25) - see methodology section. The regression tests the hypotheses H3a and H4a - see hypotheses section - but with a different tech classification in relation to the one performed previously. Each variable is explained and defined in the methodology section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
R&D intensity differential with zeros	-0.0070	-0.0582	0.1441	1.0220	0.9460	0.8215	-0.2596***	-0.3812***	-0.2538*
	(-0.08)	(-0.45)	(0.98)	(0.92)	(0.80)	(0.73)	(-2.85)	(-3.93)	(-1.87)
Relative size	-0.0024	-0.0016	-0.0094**	-0.0284***	-0.0288***	-0.0388***	0.0024	0.0023	-0.0054
	(-0.80)	(-0.48)	(-2.19)	(-3.85)	(-3.81)	(-4.69)	(0.61)	(0.51)	(-0.89)
MTB	-0.0000	-0.0004	-0.0002				0.0001	-0.0003	-0.0005
	(-0.01)	(-0.82)	(-0.47)				(0.20)	(-0.38)	(-0.48)
Log acquirer size	-0.0007	-0.0007	-0.0010	0.0010	0.0001	-0.0019	-0.0023	-0.0026	-0.0035*
	(-1.04)	(-0.95)	(-0.96)	(0.30)	(0.04)	(-0.48)	(-1.52)	(-1.53)	(-1.71)
Leverage	0.0083	0.0102	0.0093				0.0010	-0.0021	0.0009
	(0.97)	(1.11)	(0.80)				(0.07)	(-0.13)	(0.05)
R&D intensity differential with zeros*Dummy tech sector	-0.0109	0.0348	-0.1456	-0.5660	-0.4112	-0.2361	0.1832*	0.3081***	0.2018
	(-0.12)	(0.27)	(-0.98)	(-0.50)	(-0.34)	(-0.21)	(1.89)	(2.98)	(1.42)
Dummy cash	0.0191***	0.0199***	0.0161***	0.0549***	0.0581***	0.0589***	0.0150**	0.0185***	0.0200**
	(5.75)	(5.47)	(3.53)	(3.72)	(3.82)	(3.58)	(2.43)	(2.78)	(2.57)
Dummy stock	0.0028	0.0042	-0.0001	-0.0552***	-0.0589***	-0.0638***	-0.0048	-0.0049	-0.0065
	(0.74)	(1.01)	(-0.02)	(-4.19)	(-4.27)	(-4.09)	(-0.74)	(-0.69)	(-0.76)
Dummy tech sector	-0.0030	-0.0033	-0.0015	0.0371***	0.0345**	0.0361**	-0.0060	-0.0075	-0.0094
	(-0.89)	(-0.90)	(-0.34)	(2.80)	(2.53)	(2.40)	(-1.04)	(-1.15)	(-1.26)
MTB (target)				-0.0037*	-0.0035	-0.0042			

				(-1.71)	(-1.62)	(-1.64)			
Leverage (target)				-0.0016	-0.0046	-0.0022			
				(-0.05)	(-0.14)	(-0.06)			
Constant	0.0469**	0.0352	0.0149	-0.0300	-0.0209	-0.0281	0.1341**	0.1261***	0.1073**
	(2.05)	(1.35)	(0.54)	(-0.41)	(-0.28)	(-0.35)	(2.38)	(2.88)	(2.48)
Observations	2,091	2,091	2,091	2,087	2,087	2,087	1,148	1,148	1,148
R-squared	0.059	0.054	0.038	0.163	0.160	0.163	0.071	0.081	0.079
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	No	No	No	No	No	No	No	No	No

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11- Regression analysis for H1 and H2

Table 11 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated by the market model for (-250, -25) - see methodology section. The regression tests the hypotheses H1 and H2 - see hypotheses section - but I delete from the analysis deals in which the acquirer announced two or more acquisitions within five days. Each variable is explained and defined in the methodology section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Intangibles intensity differential	0.0065	0.0084	0.0033	-0.0253	-0.0240	-0.0320	0.0314**	0.0208	0.0097
	(0.86)	(1.04)	(0.32)	(-0.68)	(-0.63)	(-0.75)	(2.35)	(1.44)	(0.55)
Relative size	-0.0038	-0.0026	-0.0111**	-0.0387***	-0.0383***	-0.0507***	-0.0001	0.0005	-0.0059
	(-1.16)	(-0.69)	(-2.32)	(-4.46)	(-4.23)	(-5.24)	(-0.02)	(0.09)	(-0.85)
MTB	-0.0002	-0.0005	-0.0004				-0.0000	-0.0006	-0.0009
	(-0.39)	(-1.15)	(-0.72)				(-0.01)	(-0.67)	(-0.86)
Log acquirer size	-0.0002	-0.0001	0.0000	0.0000	0.0001	-0.0027	-0.0007	-0.0009	-0.0002
	(-0.25)	(-0.08)	(0.02)	(0.00)	(0.02)	(-0.60)	(-0.39)	(-0.45)	(-0.08)
Leverage	0.0050	0.0086	0.0014				-0.0032	-0.0058	-0.0040
	(0.43)	(0.68)	(0.09)				(-0.16)	(-0.27)	(-0.16)
Dummy cash	0.0177***	0.0203***	0.0154***	0.0505***	0.0530***	0.0521***	0.0085	0.0119	0.0081
	(4.67)	(4.85)	(2.94)	(3.04)	(3.10)	(2.79)	(1.14)	(1.48)	(0.87)
Dummy stock	0.0062	0.0077*	0.0051	-0.0531***	-0.0614***	-0.0675***	0.0000	0.0007	0.0006
	(1.44)	(1.68)	(0.90)	(-3.87)	(-4.29)	(-4.18)	(0.01)	(0.09)	(0.07)
Same industry	0.0011	0.0021	0.0010	0.0064	0.0069	0.0083	0.0068	0.0062	0.0106
	(0.31)	(0.55)	(0.21)	(0.46)	(0.48)	(0.52)	(1.01)	(0.86)	(1.25)
MTB (target)				-0.0033	-0.0032	-0.0040			
				(-1.54)	(-1.49)	(-1.61)			
Leverage (target)				0.0289	0.0215	0.0215			
				(0.68)	(0.50)	(0.44)			

Constant	0.1331***	0.1234***	0.1223***	-0.0796	-0.0865	-0.0878	0.0717	0.1043*	0.2258***
	(4.07)	(3.56)	(3.37)	(-0.98)	(-1.06)	(-1.04)	(1.12)	(1.88)	(3.66)
Observations	1,851	1,851	1,851	1,855	1,855	1,855	1,031	1,031	1,031
R-squared	0.103	0.100	0.082	0.203	0.196	0.198	0.137	0.154	0.154
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12- Regression analysis for H3 and H4

Table 12 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated using the market model approach for (-250, -25) - see methodology section. The regression tests the hypotheses H3 and H4 - see hypotheses section – but I delete from the analysis deals in which the acquirer announced two or more acquisitions within five days. Each variable is explained and defined in the methodology section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
R&D intensity differential with zeros	-0.0260	-0.0347*	-0.0070	0.3712***	0.4613***	0.5115***	-0.1091***	-0.1256***	-0.1007**
	(-1.57)	(-1.85)	(-0.28)	(2.85)	(3.38)	(3.28)	(-3.11)	(-3.45)	(-2.30)
Relative size	-0.0042	-0.0035	-0.0119***	-0.0299***	-0.0306***	-0.0418***	-0.0002	-0.0009	-0.0081
	(-1.32)	(-0.97)	(-2.58)	(-3.73)	(-3.65)	(-4.60)	(-0.05)	(-0.17)	(-1.23)
MTB	-0.0001	-0.0004	-0.0003				-0.0001	-0.0007	-0.0009
	(-0.27)	(-1.00)	(-0.49)				(-0.08)	(-0.78)	(-0.92)
Log acquirer size	-0.0002	-0.0002	-0.0004	0.0021	0.0014	-0.0010	-0.0015	-0.0019	-0.0019
	(-0.20)	(-0.22)	(-0.33)	(0.58)	(0.38)	(-0.23)	(-0.85)	(-1.06)	(-0.85)
Leverage	0.0054	0.0107	0.0116				0.0001	-0.0014	0.0019
	(0.51)	(0.92)	(0.77)				(0.01)	(-0.07)	(0.08)
Dummy cash	0.0173***	0.0190***	0.0144***	0.0480***	0.0494***	0.0504***	0.0102	0.0137*	0.0103
	(4.91)	(4.85)	(2.92)	(3.03)	(3.04)	(2.86)	(1.51)	(1.88)	(1.19)
Dummy stock	0.0058	0.0071*	0.0025	-0.0483***	-0.0515***	-0.0563***	-0.0024	-0.0015	-0.0031
	(1.45)	(1.66)	(0.48)	(-3.55)	(-3.60)	(-3.48)	(-0.36)	(-0.20)	(-0.35)
MTB (target)				-0.0038*	-0.0038*	-0.0046*			
				(-1.75)	(-1.74)	(-1.81)			
Leverage (target)				0.0141	0.0050	-0.0001			
				(0.35)	(0.12)	(-0.00)			
Constant	0.1359***	0.1303***	0.1352***	-0.1041	-0.0984	-0.1026	0.0849	0.1214**	0.2602***
	(4.18)	(3.74)	(3.77)	(-1.31)	(-1.22)	(-1.25)	(1.30)	(2.15)	(4.18)

Observations	2,047	2,047	2,047	2,043	2,043	2,043	1,141	1,141	1,141
R-squared	0.099	0.097	0.079	0.199	0.194	0.194	0.125	0.146	0.139
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

9. Analysis: Deals from the Eurozone vs the USA

In order to analyse if there are asymmetries between the Eurozone and the US, I perform the following multivariate analysis. In table 13, all the variables are defined in the methodology section, except for the dummy "US", which is equal to '1' if the acquirer and the target operate in the United States of America and '0' otherwise. And, the interaction variable, "Intangible intensity differential t-1*Dummy US" is the product of the multiplication between the variable "Intangible intensity differential t-1" and the dummy "US". In table 14, all the variables are defined in the methodology section, except for the dummy "US", which is equal to '1' if the acquirer and target operate in the United States of America and '0' otherwise. And, the interaction variable, "R&D intensity differential t-1*Dummy US" is the product of the multiplication between the variable "R&D intensity differential t-1" and the dummy "US".

Although a substantial part of the sample is from the United States of America, the results are not statistically significant. Neither the dummy variable nor the interaction variable present statistically significant results, so I cannot state that exist differences between the two geographical areas.

Table 13- Regression analysis for The Eurozone vs The USA

Table 13 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated using the market model approach for (-250, -25) - see methodology section. The regression analyses the differences between the Eurozone and the US. Each variable is explained and defined in the methodology section and in the US vs Eurozone section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Intangibles intensity differential	-0.0138	-0.0208	-0.0254	0.0738	0.0859	0.0737	0.0517	0.0032	-0.0073
	(-1.02)	(-1.43)	(-1.46)	(0.78)	(0.90)	(0.72)	(1.19)	(0.06)	(-0.12)
Relative size	-0.0025	-0.0013	-0.0100**	-0.0370***	-0.0364***	-0.0478***	-0.0009	-0.0004	-0.0066
	(-0.77)	(-0.37)	(-2.17)	(-4.48)	(-4.21)	(-5.13)	(-0.20)	(-0.08)	(-0.97)
MTB	-0.0001	-0.0005	-0.0004				0.0001	-0.0005	-0.0007
	(-0.29)	(-1.03)	(-0.72)				(0.13)	(-0.54)	(-0.74)
Log acquirer size	-0.0002	-0.0001	0.0002	-0.0007	-0.0007	-0.0035	-0.0011	-0.0013	-0.0007
	(-0.19)	(-0.07)	(0.14)	(-0.18)	(-0.19)	(-0.79)	(-0.59)	(-0.66)	(-0.30)
Leverage	0.0041	0.0079	0.0037				-0.0062	-0.0094	-0.0082
	(0.36)	(0.63)	(0.24)				(-0.32)	(-0.44)	(-0.32)
Intangible intensity differential* Dummy US	0.0224	0.0327*	0.0327	-0.1171	-0.1307	-0.1268	-0.0210	0.0243	0.0241
	(1.43)	(1.94)	(1.60)	(-1.14)	(-1.27)	(-1.14)	(-0.46)	(0.45)	(0.37)
Dummy cash	0.0173***	0.0194***	0.0140***	0.0532***	0.0554***	0.0549***	0.0090	0.0122	0.0082
	(4.61)	(4.72)	(2.73)	(3.25)	(3.30)	(2.99)	(1.20)	(1.51)	(0.88)
Dummy stock	0.0061	0.0074	0.0055	-0.0552***	-0.0638***	-0.0703***	-0.0001	0.0002	-0.0002
	(1.45)	(1.63)	(0.99)	(-4.08)	(-4.53)	(-4.42)	(-0.01)	(0.02)	(-0.03)
Dummy US	-0.0087	0.0001	-0.0117	0.0009	-0.0054	-0.0046	-0.0353	-0.0358	-0.0371
	(-0.82)	(0.01)	(-0.76)	(0.03)	(-0.15)	(-0.12)	(-0.97)	(-0.87)	(-0.74)
MTB (target)				-0.0029	-0.0028	-0.0036			

				(-1.32)	(-1.28)	(-1.43)			
Leverage (target)				0.0342	0.0262	0.0274			
				(0.80)	(0.61)	(0.56)			
Constant	0.1319***	0.1193***	0.1099***	-0.0730	-0.0740	-0.0736	0.0809	0.1104**	0.2363***
	(4.16)	(3.53)	(3.02)	(-0.87)	(-0.88)	(-0.85)	(1.26)	(1.98)	(3.82)
Observations	1,895	1,895	1,895	1,899	1,899	1,899	1,038	1,038	1,038
R-squared	0.104	0.099	0.080	0.199	0.194	0.196	0.134	0.152	0.149
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 14- Regression analysis for The Eurozone vs The USA

Table 14 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated using the market model approach for (-250, -25) - see methodology section. The regression analyses the differences between the Eurozone and the US. Each variable is explained and defined in the methodology section and in the US vs Eurozone section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
R&D intensity differential	-0.0268	-0.0434	-0.0538	0.7869**	1.1165***	1.0981**	0.0291	0.0202	-0.0022
	(-0.85)	(-1.10)	(-0.85)	(2.29)	(2.96)	(2.45)	(0.20)	(0.13)	(-0.01)
Relative size	-0.0027	-0.0021	-0.0108**	-0.0283***	-0.0287***	-0.0390***	-0.0008	-0.0014	-0.0086
	(-0.88)	(-0.61)	(-2.41)	(-3.71)	(-3.59)	(-4.47)	(-0.18)	(-0.28)	(-1.32)
MTB	-0.0001	-0.0004	-0.0003				0.0001	-0.0005	-0.0007
	(-0.21)	(-0.93)	(-0.53)				(0.07)	(-0.63)	(-0.76)
Log acquirer size	-0.0001	-0.0002	-0.0003	0.0021	0.0014	-0.0011	-0.0016	-0.0022	-0.0023
	(-0.15)	(-0.21)	(-0.26)	(0.60)	(0.40)	(-0.26)	(-0.95)	(-1.18)	(-1.00)
Leverage	0.0050	0.0106	0.0140				-0.0022	-0.0039	-0.0008
	(0.47)	(0.92)	(0.94)				(-0.12)	(-0.20)	(-0.03)
R&D intensity differential with zeros* Dummy US	0.0082	0.0172	0.0564	-0.4701	-0.7544*	-0.6783	-0.1289	-0.1346	-0.0847
	(0.23)	(0.39)	(0.83)	(-1.27)	(-1.89)	(-1.45)	(-0.87)	(-0.83)	(-0.42)
Dummy cash	0.0171***	0.0184***	0.0134***	0.0521***	0.0528***	0.0540***	0.0108	0.0144**	0.0112
	(4.88)	(4.77)	(2.76)	(3.35)	(3.32)	(3.13)	(1.57)	(1.96)	(1.30)
Dummy stock	0.0056	0.0065	0.0027	-0.0487***	-0.0518***	-0.0570***	-0.0021	-0.0015	-0.0035
	(1.42)	(1.55)	(0.52)	(-3.63)	(-3.69)	(-3.58)	(-0.31)	(-0.20)	(-0.40)
Dummy US	-0.0087	-0.0000	-0.0113	0.0304	0.0112	0.0062	-0.0335	-0.0344	-0.0347
	(-0.84)	(-0.00)	(-0.75)	(0.91)	(0.33)	(0.17)	(-0.95)	(-0.92)	(-0.75)
MTB (target)				-0.0034	-0.0036	-0.0043*			

				(-1.59)	(-1.63)	(-1.72)			
Leverage (target)				0.0188	0.0073	0.0032			
				(0.47)	(0.18)	(0.07)			
Constant	0.1360***	0.1285***	0.1283***	-0.1249	-0.1165	-0.1160	0.0781	0.1151**	0.2597***
	(4.32)	(3.79)	(3.54)	(-1.59)	(-1.47)	(-1.45)	(1.17)	(2.06)	(4.31)
Observations	2,091	2,091	2,091	2,087	2,087	2,087	1,148	1,148	1,148
R-squared	0.098	0.095	0.077	0.198	0.198	0.197	0.122	0.142	0.135
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

10. Conclusion

The main objective of this dissertation is to examine the impact of the intangible asset records and R&D expenditures in companies involved in M&As. I analyse if there was value creation or destruction for the Acquirer, Target, and Combined firms when asymmetries in these variables arise. This study focuses on companies located in the United States of America and the Eurozone, from 2005 to 2019.

The hypotheses are developed taking into consideration the existing literature. In relation to the intangible asset records, some authors state the existence of adverse selection due to information asymmetries between the target and the acquirer arising from substantial intangible asset records. In sum, the acquirer will discount the price offer, according to the possibility of information asymmetries. Thus, target firms can be bought at a discount.

In what concerns the R&D expenditures, when the target company has a higher level of investment in R&D than the bidder, this means that the latter is buying a company with a potentially higher level of technology. Which can be explored by the bidder to increase the investment in the technological field, and thereafter ensure gains. Finally, some state that the latter effect tends to be higher when at least one company is from high tech industries, to analyse firms under a high-tech environment.

In order to measure the impact of the intangible asset records and R&D expenditures in M&As, I calculate the differential between the target and the acquirer. Following the event study methodology, I calculate the CARs for the acquirer and target firms, and then for the combined ones.

Concerning the intangible intensity differential variable, I do not find statistically significant results. This dissertation does not support the presented literature about adverse selection. Thus, I cannot state that the target firm is bought at a discount.

Regarding the R&D intensity differential variable, the main idea - that the acquirer is buying a target with relatively higher R&D expenditures to enter into a tech environment and, due to that, gain with the M&A - does not find support in this analysis. The combined firms incur losses when the target has relatively higher R&D expenditures than the bidder. However, targets with relatively

higher R&D expenditures than the bidder gain with the announcement of the deal. Some authors defend that the idea - that the acquirer is buying a target with relatively higher R&D expenditures to enter into a tech environment and, due to that, gain with the M&A - is especially significant in a tech environment where R&D capabilities are crucial for further expansion of companies, however, I do not find support for that in this analysis.

Lastly, concerning the asymmetries between deals made by the Eurozone firms and the USA firms, I do not find results that support that asymmetries although the sample is mostly composed of firms from the USA.

11. Limitations

Like other studies, this one has some limitations. The sample is composed of two geographical zones - the USA and the Eurozone - but the USA represents almost all the companies due to the fact that the United Kingdom is not included. Generally, the United Kingdom has a lot of representation in M&A activity.

Analysing the R&D intensity differential variable, when the R&D expenditures variable is gathered there is a substantial lack of data. Which results in a sample with a considerable small size to be meaningful. Although the regressions with this variable being included in the appendix, I use the R&D expenditures variables with zeros when missing data. The regressions using different variables result essentially in the same results.

Obviously, to attest to some of the results presented previously in this dissertation, it would be necessary to perform more studies and bigger sample size.

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13. Appendix

Table 15- Description of the variables

Table 15 presents the description of the variables used in this dissertation.

Variable	Description
$car_{(\tau_1 \tau_2)}$	The dependent variable, cumulative abnormal return for a given event window, that is computed for each deal.
$IntangibleAssetsIntensityDifferential_{t-1}$	The difference between the target and the acquirer of the quotient of the Intangible Assets of each firm by the annual total assets of each firm, one year before the deal.
$R\&DIntensityDifferential_{t-1}$	The difference between the target and acquirer of the quotient of the R&D expenditure of each firm by the annual total assets of each firm, one year before the deal.
$Relativesize_{t-1}$	The ratio of the transaction value and the acquirer's total assets, one year before the deal.
MTB_{t-1}	The ratio of the market value and the common equity for the acquiring firm, one year before the deal.
$MTB_{t-1}(target)$	The ratio of the market value and the common equity for the target firm, one year before the deal.
$Logacqsize_{t-1}$	The natural logarithm of the acquirer's total assets adjusted for the CPI – Consumer Price Index – 2019, one year before the deal.

$\boldsymbol{Leverage_{t-1}}$	The ratio of total debt and total assets of the acquiring firm, one year before the deal.
$\boldsymbol{Leverage_{t-1}(target)}$	The ratio of total debt and total assets of the target firm, one year before the deal.
$\boldsymbol{Cash}$	Dummy variable, which is equal to '1' if the method of payment is pure cash (100%) and '0' otherwise.
$\boldsymbol{Stock}$	Dummy variable, which is equal to '1' if the deal payment is made exclusively in stock and '0' otherwise.
$\boldsymbol{SameIndustry}$	Dummy variable, which is equal to '1' if acquirer and target operate in the same industry
$\boldsymbol{TechSector}$	Dummy variable, which is equal to '1' if at least the acquirer or target operate in the tech sectors and '0' otherwise
$\boldsymbol{R\&DIntensityDifferential_{t-1} * TechSector}$	Interaction variable, which is the multiplication of the "R&D intensity differential t-1" and the dummy "TechSector".

Table 16- Matrix of correlations

Table 16 shows the Pearson correlation coefficients of the variables that compose the regression models. The correlation coefficient range between -1 and 1, the closer the value to -1 or 1 means that the relation between any two variables is stronger. A value of 0 implies there is no relation between the variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Intangibles intensity differential	1.000												
(2) R&D intensity differential with zeros	-0.280	1.000											
(3) R&D intensity differential	-0.266	0.985	1.000										
(4) Relative size	0.168	-0.196	-0.195	1.000									
(5) MTB	0.127	-0.052	-0.057	0.099	1.000								
(6) MTB (target)	-0.102	0.079	0.061	-0.014	0.081	1.000							
(7) Log acquirer size	-0.122	0.048	0.052	-0.398	-0.065	0.132	1.000						
(8) Leverage	-0.192	0.017	0.015	-0.080	0.098	0.078	0.213	1.000					
(9) Leverage (target)	0.094	0.032	0.060	-0.000	-0.030	-0.113	0.106	0.214	1.000				
(10) Dummy cash	-0.083	0.062	0.051	-0.365	0.005	0.026	0.324	-0.125	-0.163	1.000			
(11) Dummy stock	0.054	-0.042	-0.038	0.230	0.051	-0.040	-0.334	0.058	-0.001	-0.492	1.000		
(12) Dummy same industry	-0.106	0.133	0.133	0.107	-0.047	0.026	-0.085	-0.036	-0.010	-0.057	0.030	1.000	
(13) Dummy tech sector	0.165	0.019	0.010	-0.126	0.029	0.027	0.215	-0.074	-0.028	0.154	-0.080	-0.266	1.000

Table 17- Regression analysis for H3 and H4

Table 17 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated using the market model approach for (-250, -25) - see methodology section. The regression tests the hypotheses H3 and H4 - see hypotheses section – but the missing values in the "R&D intensity differential" variable are not replaced by zeros. Each variable is explained and defined in the methodology section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
R&D intensity differential	-0.0135	-0.0184	0.0062	0.2383*	0.3046**	0.2947**	-0.0753**	-0.0720*	-0.0537
	(-0.74)	(-0.89)	(0.25)	(1.86)	(2.36)	(2.13)	(-2.11)	(-1.83)	(-1.29)
Relative size	-0.0021	0.0001	-0.0061	-0.0415***	-0.0358***	-0.0504***	0.0013	0.0030	-0.0033
	(-0.39)	(0.01)	(-0.83)	(-3.40)	(-2.65)	(-3.44)	(0.18)	(0.33)	(-0.31)
MTB	-0.0001	-0.0007	-0.0006				0.0007	-0.0001	0.0004
	(-0.21)	(-1.11)	(-0.71)				(0.59)	(-0.10)	(0.24)
Log acquirer size	0.0001	0.0005	-0.0009	0.0087	0.0093	0.0072	-0.0082***	-0.0077**	-0.0107***
	(0.08)	(0.34)	(-0.45)	(1.23)	(1.25)	(0.88)	(-2.72)	(-2.29)	(-2.67)
Leverage	-0.0056	0.0074	0.0144				-0.0305	-0.0269	-0.0205
	(-0.29)	(0.33)	(0.54)				(-0.91)	(-0.67)	(-0.41)
Dummy cash	0.0212***	0.0230***	0.0168*	0.0513*	0.0477	0.0441	0.0288**	0.0277**	0.0196
	(3.29)	(3.11)	(1.86)	(1.66)	(1.54)	(1.30)	(2.37)	(2.07)	(1.26)
Dummy Stock	0.0043	0.0130	0.0153	-0.0269	-0.0386	-0.0597	0.0013	0.0070	0.0027
	(0.40)	(1.16)	(1.14)	(-0.82)	(-1.15)	(-1.62)	(0.09)	(0.42)	(0.13)
MTB (target)				0.0005	0.0004	-0.0007			
				(0.23)	(0.17)	(-0.26)			
Leverage (target)				-0.0397	-0.0503	-0.0754			
				(-0.47)	(-0.59)	(-0.78)			
Constant	0.0433	-0.0060	0.0008	-0.3899***	-0.4019***	-0.3302**	0.1339**	0.1319*	0.1194
	(1.39)	(-0.20)	(0.02)	(-3.03)	(-3.07)	(-2.34)	(2.02)	(1.82)	(1.47)
Observations	756	756	756	749	749	749	415	415	415

R-squared	0.155	0.161	0.132	0.204	0.201	0.207	0.180	0.174	0.168
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 18- Regression analysis for H3a and H4a

Table 18 shows the regression results for the Acquirer, Target, and Combined CARs in the three event windows - (-1, +1), (-2, +2), and (-5, +5). The estimation window is estimated using the market model approach for (-250, -25) - see methodology section. The regression tests the hypothesis H3a and H4a - see hypotheses section – but the missing values in the "R&D intensity differential" variable are not replaced by zeros. Each variable is explained and defined in the methodology section. The coefficients appear next to each variable, the grey lines represent the standard errors. N represents the number of observations that change due to the lack of data of some variables in the database. The significance levels are represented by ***, **, and *, which illustrate 1%, 5%, and 10%, respectively. The absence of these symbols means that the coefficients are not statistically significant. The fixed effects are included if "Yes" and are not included if "No".

	Acquirer			Target			Combined		
VARIABLES	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
R&D intensity differential	-0.0097	-0.0134	0.0240	0.3176**	0.3849***	0.3484**	-0.0716**	-0.0582	-0.0375
	(-0.57)	(-0.67)	(1.04)	(2.43)	(2.92)	(2.43)	(-2.09)	(-1.52)	(-0.93)
Relative size	-0.0016	0.0006	-0.0042	-0.0360***	-0.0322**	-0.0499***	0.0004	0.0025	-0.0043
	(-0.30)	(0.10)	(-0.58)	(-3.04)	(-2.53)	(-3.49)	(0.06)	(0.29)	(-0.41)
MTB	-0.0001	-0.0007	-0.0006				0.0001	-0.0007	-0.0005
	(-0.13)	(-1.05)	(-0.75)				(0.13)	(-0.62)	(-0.32)
Log acquirer size	-0.0002	-0.0002	-0.0010	0.0137**	0.0142**	0.0101	-0.0070***	-0.0064**	-0.0085**
	(-0.17)	(-0.11)	(-0.53)	(2.08)	(2.09)	(1.33)	(-2.69)	(-2.21)	(-2.39)
Leverage	0.0045	0.0162	0.0205				-0.0136	-0.0097	-0.0065
	(0.25)	(0.80)	(0.83)				(-0.48)	(-0.28)	(-0.15)
R&D intensity differential*Dummy tech sector	0.0136	0.0227	-0.1781*	-0.1831	-0.2225	0.0504	-0.0193	-0.0624	-0.2372*
	(0.26)	(0.41)	(-1.84)	(-0.54)	(-0.66)	(0.12)	(-0.26)	(-0.78)	(-1.71)
Dummy cash	0.0236***	0.0251***	0.0185**	0.0566*	0.0521*	0.0402	0.0231**	0.0225*	0.0143
	(3.76)	(3.47)	(2.09)	(1.85)	(1.72)	(1.21)	(2.17)	(1.89)	(1.03)
Dummy stock	0.0067	0.0144	0.0126	-0.0404	-0.0512	-0.0536	-0.0009	0.0052	0.0038
	(0.65)	(1.34)	(0.97)	(-1.25)	(-1.57)	(-1.36)	(-0.07)	(0.33)	(0.19)
Dummy tech sector	-0.0055	-0.0092	0.0079	-0.0748*	-0.0661	-0.0289	-0.0116	-0.0142	0.0123
	(-0.62)	(-0.95)	(0.60)	(-1.67)	(-1.46)	(-0.57)	(-0.74)	(-0.87)	(0.59)
MTB (target)				0.0010	0.0007	-0.0002			

				(0.48)	(0.37)	(-0.09)			
Leverage (target)				-0.0447	-0.0589	-0.0594			
				(-0.64)	(-0.82)	(-0.75)			
Constant	0.0326	0.0201	-0.0180	-0.2380**	-0.2190*	-0.1618	0.0618	0.0616	0.0402
	(1.39)	(0.61)	(-0.35)	(-2.06)	(-1.82)	(-1.26)	(1.22)	(1.14)	(0.63)
Observations	756	756	756	749	749	749	415	415	415
R-squared	0.090	0.086	0.059	0.143	0.147	0.143	0.111	0.107	0.092
Fixed Effects									
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	No	No	No	No	No	No	No	No	No

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1