Universidade do Minho
Escola de Economia e Gestão

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Impact of R&D intensity on M&A outcomes: Evidence from North America and Western Europe

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RESUMO

Impacto da intensidade de I&D nos resultados das F&A: Evidências da América do Norte e da Europa Ocidental

Em vez de desenvolverem novas tecnologias, algumas empresas optam por adquirir outras com elevados níveis de investigação e desenvolvimento (I&D) através de fusões e aquisições (F&A), com a expectativa de algum ganho. Por conseguinte, esta dissertação centra-se no impacto da intensidade de I&D da empresa-alvo sobre os retornos anormais dos acionistas. O prémio pago pela empresa adquirente é, também, objeto de estudo, uma vez que ajuda a explicar os resultados para os retornos anormais acumulados (CAR). A amostra estudada inclui 2620 negócios que envolvem empresas cotadas em bolsa, da América do Norte e da Europa Ocidental, entre 2007 e 2021.

Os resultados corroboram a ideia de que as empresas-alvo com atividade intensa em I&D recebem prémios mais elevados. Estes podem ser em demasia, uma vez que a intensidade de I&D tem um impacto negativo sobre os CAR totais. Neste caso, em média, a aquisição de I&D não é uma fonte de criação de valor. Contudo, as empresas-alvo com alta intensidade de I&D de indústrias de alta tecnologia têm um efeito positivo sobre os CAR das empresas adquirentes. Isto indica que o mercado reage mais positivamente à aquisição de empresas-alvo com atividade intensa em I&D de indústrias de alta tecnologia e que gera mais ganhos para os acionistas adquirentes. Assim, o efeito da intensidade de I&D sobre os CAR da empresa adquirente pode depender da indústria da empresa-alvo.

Além disso, as empresas-alvo com alta intensidade de I&D dos Estados Unidos (EUA) podem ter um impacto negativo sobre os CAR da empresa adquirente e totais. Isto é, esta combinação de fatores tem um efeito negativo. Por outras palavras, há evidências de que quando o foco é a intensidade de I&D, as empresas-alvo dos EUA podem ser prejudiciais para os retornos anormais dos acionistas.

Palavras-chave: Alta Tecnologia; Fusões e Aquisições; Investigação e Desenvolvimento; Prémio; Retornos Anormais Acumulados

ABSTRACT

Impact of R&D intensity on M&A outcomes: Evidence from North America and Western Europe

Instead of developing new technologies, some companies opt to acquire others with high levels of research and development (R&D) through mergers and acquisitions (M&A), expecting to gain from it. Therefore, this dissertation focuses on the impact of the target firm's R&D intensity on shareholders' abnormal returns. The premium paid by the acquiring firm is also a subject of study, as it helps explain the cumulative abnormal returns (CAR) results. The studied sample comprises 2620 deals involving publicly traded companies from North America and Western Europe from 2007 to 2021.

Results corroborate the idea that R&D-intensive target firms receive higher premiums. The latter can be in excess since R&D intensity has a negative impact on the combined CAR. In this case, on average, acquiring R&D is not a source of value creation. However, R&D-intensive and high-tech target firms have a positive effect on the acquirer CAR. This indicates that the market reacts more positively towards the acquisition of R&D-intensive target firms from high-tech industries and that it generates more gains for the acquirer shareholders. So, the effect of R&D intensity on the acquirer CAR may depend on the target firm's industry.

Additionally, R&D-intensive target firms from the United States (US) can negatively impact the acquirer and combined CAR. That is, this combination of factors has a negative effect. In other words, there is evidence that when the focus is on R&D intensity, US target firms can be detrimental to shareholders' abnormal returns.

Keywords: Cumulative Abnormal Returns; High-Tech; Mergers and Acquisitions; Premium; Research and Development

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INTRODUCTION

Mergers and acquisitions (M&A) are significant events in corporate finance for a firm and the economy (Fuller et al., 2002). Therefore, a vast literature about it has been developed by researchers for several decades. Acquisitions can take the form of mergers or consolidations, acquisitions of shares, and acquisitions of assets. A merger occurs when one firm absorbs the other, meaning the acquiring firm acquires all the assets and liabilities of the target firm, which is no longer a separate business entity. Consolidation is a similar process, but both firms cease to exist legally in this case, and a new one is created. Due to the similarities between the two processes, they are typically referred to as mergers (Hillier et al., 2013).

Since M&A are seen as an instrument of growth, continuing to influence corporate activities and different stakeholder groups significantly, it remains a topic of interest. Andrade et al. (2001) identify several motivations, such as a search for efficiency, market power, market discipline, overexpansion, and diversification. Because some companies have difficulties developing new technologies, they opt to acquire companies with high levels of R&D, mainly start-ups that aspire to innovate to obtain new skills and knowledge (Rossi et al., 2013; Sears & Hoetker, 2014). In other words, acquiring innovation can be seen as a substitute strategy for conducting R&D, as large firms find it unfavourable to engage in the "R&D race" (Phillips & Zhdanov, 2013, p. 3). This last motivation is the focus of this dissertation.

M&A are expected to boost a firm's performance. Consequently, it becomes relevant to analyse the impact of these transactions on shareholders, more specifically, whether they create value or not. That can be measured by analysing the shareholders' returns. Even though there is a consensus about M&A results for target companies, the literature offers mixed results regarding acquiring companies (Martynova & Renneboog, 2008). Moreover, as stated by Chan et al. (2001), it is essential to understand if the stock market values reflect the value of the respective companies' intangible R&D capital. However, the lack of accounting information about R&D and other intangible assets convolutes valuations.

Therefore, this dissertation focuses on the impact of the target firm's R&D intensity on acquirer shareholders' and combined abnormal returns, representing the value created by the deal. In other words, this research aims to verify if M&A involving target firms that invest more in R&D create wealth, especially for bidder shareholders, where the literature is not as consensual. The focus is on shareholders' returns during the deal announcement period. The premium paid by the acquiring firm is also a subject of study, as it can help explain the results of abnormal returns. Additionally, this study examines the impact of R&D intensity when the target firm is from a high-tech industry, where R&D intensity is generally of greater

importance. The aim is to understand whether the effect of R&D intensity on abnormal returns and the premium changes based on the target firm's industry.

The sample used to test the hypotheses includes 2620 M&A deals between 2007 and 2021, in which both the acquiring and target companies are public firms from North America and Western Europe. This study follows previous literature and conducts an event study (MacKinlay, 1997) to estimate the shareholders' abnormal returns around the M&A announcement. Next, univariate (T-Test and Wilcoxon-Mann-Whitney Test) and multivariate (OLS regressions) analyses take place.

Findings corroborate the idea that R&D-intensive target firms are associated with higher premiums due to their growth prospects (Madura et al., 2012). However, the target firm seems to be typically overvalued, negatively impacting the combined CAR. Therefore, R&D intensity does not create value for the acquirer and target shareholders combined. In other words, the market is apprehensive about whether the acquiring firm will, actually, benefit from the acquisition of R&D. This behaviour is in line with research from other authors, such as Higgins and Rodriguez (2006), King et al. (2008), Sears and Hoetker (2014), and Ochirova and Dranev (2021). Still, this result on the combined CAR is unexpected. Even though the acquisition might not be advantageous for the acquiring firm, it is anticipated that R&D creates value on average, even if most of it is accrued to the target shareholders (Martynova & Renneboog, 2008).

On the other hand, R&D-intensive target firms from high-tech industries positively impact acquirer shareholders' abnormal returns. This indicates that, in these industries, R&D is valued more highly. So, the market is more enthusiastic about the acquisition of R&D and expects that the acquiring firm will benefit from it. Therefore, the impact of R&D-intensive target firms on the acquirer CAR might depend on the target firm's industry. However, this result is not very statistically robust.

As an additional analysis, this study concludes that R&D-intensive target firms negatively correlate with the acquirer and combined CAR when they are from the US. Based on the literature, this negative effect could be explained by the competition in the US, where the focus is on high R&D intensity sectors, which leads to higher premiums. However, this study's results cannot fully support this theory due to the lack of statistically significant results.

The study contributes to the literature being developed about the impact of R&D on shareholder value creation. It provides insights into how the effect of R&D intensity may depend on the target firm's industry. In general, acquiring R&D can have a negative impact on combined CAR. However, the interaction

between R&D-intensive and high-tech targets has a positive effect on the acquirer CAR. So, it generates more gains for the acquirer shareholders.

It also contributes to research by focusing on US targets. Even though the US is more focused on high R&D intensity sectors, acquiring R&D-intensive target firms from the US might not be beneficial, as the interaction between US and R&D-intensive target firms has a negative effect on the acquirer and combined CAR.

The structure of the dissertation considers four chapters. Chapter 1 is dedicated to the literature review, including key points regarding R&D, its impact on shareholders' returns and the premium, and the definition of hypotheses. In sequence, Chapter 2 presents the methodology that supports the research, such as univariate and multivariate analyses, while Chapter 3 provides information about the data collected and a summary of its descriptive statistics. Chapter 4 regards the presentation and discussion of results.

At the end of the document, this dissertation's main final considerations and limitations are presented, along with possible ideas for future research, followed by the references used and appendices developed.

1. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

As mentioned, M&A can be seen as a method to acquire innovation. According to OECD and Eurostat (2005), innovation activities include R&D, which, according to the Frascati Manual 2015 (OECD, 2015), can be defined as "creative and systematic work undertaken to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge" (p. 28). Moreover, to be considered an R&D activity, it must be novel, creative, uncertain, systematic, transferable, and/or reproducible.

Phillips and Zhdanov (2013) show how large firms may decide to let small firms conduct R&D to innovate and then acquire these small innovative companies. This happens because smaller firms have incentives to invest in R&D with an active takeover market, while larger firms might find it detrimental. The study concludes that firms increase R&D in response to demand, competition, and industry M&A activity, but the effects are more potent for smaller firms. One possible explanation is the amount of R&D different firms would have to increase to stay competitive. Smaller firms have incentives such as selling out to larger firms or because it enables them to survive in the longer run. In comparison, larger firms must develop more R&D to stay competitive. Lin and Wang (2016) corroborate this theory, arguing that firms with higher R&D intensity are more likely to become takeover targets. Thus, since it is frequent to acquire firms due to their R&D intensity, it is essential to study the impact of these deals on the value created for shareholders.

To measure performance, Bruner (2002) studies investors' required returns, which can be defined as "the return investors could have earned on other investment opportunities of similar risk" (p. 48). In his critical literature review, he compares investment returns and required returns. Regarding returns to buyer firms, he finds that one-third of the studies show value destruction, one-third show value preservation, and one-third show value creation. On the other hand, returns to target firms are significantly and materially positive.

Therefore, Fuller et al. (2002) raise the question: "If bidder returns are not positive, then why do firms make acquisitions?" (p. 1767). They argue that even though bidder returns are, on average, small, there are significant variations in returns, and many bidders are trying to be one of the winning firms. Later in the decade, Martynova and Renneboog (2008) still find that, on average, bidder shareholders have abnormal returns that are statistically indistinguishable from zero. In contrast, target shareholders benefit from positive and higher returns.

Furthermore, Fuller et al. (2002) consider that bidder shareholders gain when their company acquires a private firm or a subsidiary of a public firm, whereas they lose when the target is a public firm. However, a recent study (Alexandridis et al., 2017) analyses US M&A "mega-deals" (p. 633) (in which the deal value is at least $500 million) announced between 1990 and 2015 to compare the period before the 2008 financial crisis with the post-2009. The results challenge the consensus, which assumes that public acquisitions, especially large ones, destroy value for acquiring shareholders more often than they create. For the post-2009 period, the study reports that the average acquirer was subject to an abnormal return of 1.05% around the deal announcement period, compared to the average loss of -1.08% between 1990 and 2009.

Regarding the impact of R&D intensity, Lin and Wang (2016) argue that because the takeover risk is higher, investors also demand higher stock returns, meaning a positive correlation between the target firm's R&D intensity and the shareholders' abnormal returns is expected. When it comes to technology-based industries, where R&D (such as patents) typically plays a more significant role, a paper from Kohers and Kohers (2000) shows that acquirers of high-tech companies experience, on average, significant positive CAR at the time of the merger announcement, regardless of the payment method. This reveals how the market is optimistic toward high-tech deals and expects that, on average, acquiring companies will benefit from future growth by buying high-tech target companies. Furthermore, these authors defend that high-tech acquisitions are value-enhancing in the short run.

Nevertheless, acquiring R&D does not guarantee innovation achievement or the respective positive outcomes. As stated in a paper by King et al. (2008), a firm will probably seek a target company with specific technological resources currently lacking. However, the interaction between the levels of R&D of the target and acquiring firms is significant and has a negative impact on firm performance. In other words, a surplus of the target's technology resources can be counterproductive. In line with this idea is the research developed by Ochirova and Dranev (2021), which finds that buying companies with high R&D expenditures negatively affect the M&A results. This indicates that companies that develop R&D activities internally may be unable to use the technology obtained through the M&A effectively or that the different technologies are incompatible.

Similarly, Masulis et al. (2007) argue that deals combining two high-tech firms lead to lower acquirer returns and that this effect is more substantial with rises in the relative deal size. This is explained by the difficulty for technology companies to integrate smoothly because of the importance of human capital and intellectual property, which are often lost due to the higher employee turnover caused by acquisitions.

These authors also state that acquirers are more likely to underestimate the costs and overestimate the synergies generated by the combination.

Apart from the idea of counterproductivity from the surplus of the target's technology resources, King et al. (2008) also mention that acquiring R&D can serve as a substitute for the internal development of the acquiring firm. Therefore, an R&D-intensive target firm will produce greater value for a bidder firm with an R&D intensity lower than the average. However, according to Cohen and Levinthal (1989), because they require the "absorptive" capacity (p. 569), acquiring firms still perform R&D. These authors suggest that R&D enhances the firm's ability to assimilate and use existing information besides generating new one. This learning, or "absorptive", capacity also includes the ability to exploit outside knowledge, which could provide the basis for future applied research and development. Still, a more recent study from Sears and Hoetker (2014) shows that the benefits of this "absorptive" capacity can be outweighed by the negative impact of increased redundancy as target overlap increases.

Besides, Higgins and Rodriguez (2006) conclude that bidders tend to pay too much for a target, meaning the value created for shareholders is little to none when intangible assets constitute most of the target's assets. This is due to the difficulty in valuing intangible assets. If the latter loses value with time and the target has been overestimated, the acquiring company can have negative results (Ochirova, 2019). So, because knowledge-based assets are more complex to value than tangible assets, a big concern of the acquirer is understanding the target's accurate value. Therefore, apart from the typical corporate due diligence, firms that intend to pursue "knowledge-intensive" acquisitions (Higgins & Rodriguez, 2006, p. 356) must have particular care in gathering pre-acquisition information to reduce asymmetric information between the parties. In other words, uncertainty surrounds the true value of the target's assets, which submits the acquirer to the risk of overpayment and submission to the winner's curse.

Moreover, Kohers and Kohers (2001) state that the market exhibits excessive enthusiasm toward high-tech acquisitions. Due to the high-growth and high-risk nature of high-tech industries, high expectations of targets' performance may not be met. Acquirers typically underperform industry-matched benchmarks in the long run. This indicates an overvaluation of the target firm's growth opportunities during the M&A announcement.

In summary, there are many expectations about R&D-intensive target firms, and acquirers typically overpay due to an overvaluation of the target firm's growth opportunities, negatively affecting abnormal returns at the time of the M&A announcement. Also, this dissertation considers only public acquisitions, frequently associated with negative acquirer CAR. Furthermore, studying the impact of R&D intensity on

deals involving high-tech target firms is important (Lusyana & Sherif, 2016). Apart from being more complex, high-tech industries are associated with higher levels of competition, which is thought to be the leading cause of the overvaluation of firms, as acquiring companies are afraid of being less competitive than their competitors (Rossi et al., 2013). In fact, when the degree of competition is higher, premiums tend to be higher, which negatively impacts the value creation for the acquirers (Rossi & Volpin, 2004; Alexandridis et al., 2010). Based on these arguments, the first hypotheses are the following:

H1: The target firm's R&D intensity is negatively correlated with the acquirer shareholders' abnormal returns.

H1.1: The effect of H1 is amplified when the target firm is from a high-tech industry.

Alexandridis et al. (2017) present relevant results regarding the combined CAR. They study synergy gains, estimated based on a market-value-weighted average portfolio of the acquirer and target CAR, and conclude that they show a distinctive improvement. They have increased by more than three times, relative to the previous 20 years, being the average synergy gain of 4.51% from 2010 to 2015. This agrees with research from Bruner (2002). Among twenty studies the author reviews regarding combined CAR, eleven of them present significant and positive combined returns. Thus, M&A benefit the investors in the combined acquiring and target firms. Furthermore, literature about the value created for acquirer and target shareholders is generally concordant. M&A are expected to create value, even though most of it is accrued to target shareholders (Martynova & Renneboog, 2008).

Therefore, even if the impact of R&D intensity on the acquirer CAR is negative (as predicted in H1 and H1.1), it is expected to be positive on the combined CAR. Since acquiring R&D-intensive target firms is common (Phillips & Zhdanov, 2013; Lin & Wang, 2016), the target CAR may be positive enough to offset the negative impact of the acquirer CAR on the combined CAR. To rephrase it, R&D-intensive deals can create synergies and value, on average, even if most of it is accrued to the target firm, especially when a previous alliance exists between firms (Porrini, 2004). So, the second set of hypotheses is the following:

H2: The target firm's R&D intensity is positively correlated with the combined abnormal returns.

H2.1: The effect of H2 is amplified when the target firm is from a high-tech industry.

As mentioned, the premium paid by the acquiring firm significantly impacts the acquirer CAR at the time of the M&A announcement. Lev and Sougiannis (1996) conclude that R&D is not fully reflected in stock prices. One of the possible reasons is the systematic mispricing of R&D-intensive firms' shares, meaning R&D information is underrated. However, according to Varaiya (1987), the premium is predicted to be

positively correlated with the magnitude of the acquiring firm's estimate of acquisition gains. Therefore, when there are great expectations and enthusiasm about an acquisition, just like it is stated in the research by Kohers and Kohers (2000), the acquiring firm may be willing to pay a higher premium. In fact, Laamanen (2007) concludes that market reactions are more positive, and the premium appears to be higher when targets are moderately valued in the beginning. Furthermore, the premium may be higher in industries with higher levels of R&D because they are more attractive due to their potential to innovate and grow (Madura et al., 2012).

When it comes to high-tech deals, valuation is riskier for the acquirer due to the high-growth nature of these industries. So, companies are not expected to generate cash flows in the foreseeable future. Nonetheless, the growth prospects offered are attractive, and acquirers will likely believe they are worth the cost. Kohers and Kohers (2000) show how high-tech targets receive better premiums than non-high-tech targets.

Therefore, consistent with arguments for H1 and H1.1, the last hypotheses are the following:

H3: The target firm's R&D intensity is positively correlated with the premium paid by the acquiring firm.

H3.1: The effect of H3 is amplified when the target firm is from a high-tech industry.

2. METHODOLOGY

The main objective of this study is to examine the impact of the target firm's R&D intensity on shareholder value creation during the M&A announcement period in public firms from North America and Western Europe. More specifically, the focus is on the impact of R&D intensity on shareholders' abnormal returns. In addition, the premium is also of interest.

2.1. EVENT STUDY

Assuming the market is efficient regarding public information, stock prices will rapidly incorporate the market expectations about a merger announcement. Therefore, financial market data, such as security prices, can be used, over a short period, to measure the event's economic impact on the value of a firm (MacKinlay, 1997; Andrade et al., 2001). Thus, this study follows the methodology of an event study.

Accordingly, the event date is defined as the announcement date since the goal is to capture the effect of the M&A announcement on the firm stock prices. Then, it is necessary to determine the estimation and event windows (MacKinlay, 1997), considering that the event window should be long enough to capture the significant effects of the event (McWilliams & Siegel, 1997). Therefore, the event windows assume a 3-day period (-1, +1), 5-day period (-2, +2), and 11-day period (-5, +5) around the announcement date supplied by Securities Data Company (SDC) to assess the M&A impact better. MacKinlay (1997) states that the event and estimation windows should not overlap. So, the estimation window is (-270, -30), aligned with Martynova and Renneboog (2011). As a requirement, firms must have data for each day of the event windows.

2.2. ABNORMAL RETURNS

An abnormal return can be defined as the "actual ex post return of the security over the event window minus the normal return of the firm over the event window" (MacKinlay, 1997, p. 15). So, the abnormal return for firm i and event date t is:

$$AR_{it} = R_{it} - E(R_{it}|X_t) \quad (1)$$

Where,

AR_{it} = Abnormal return for period t

R_{it} = Actual return for period t

$E(R_{it}|X_t)$ = Normal return for period t

X_t is the conditioning information for the normal return model.

The normal performance return model follows the market model, meaning there is a stable linear relation between the market return and the security return. Therefore, for any security i at period t (MacKinlay, 1997, p. 18):

$$R_{it} = \alpha_i + \beta_i * R_{mt} + \epsilon_{it} \quad (2)$$

Where,

R_{it}= Returns on security i at period t

R_{mt}= Returns on market portfolio at period t

ϵ_{it} is the zero mean disturbance term

α_i and β_i are the parameters of the market model.

The stock returns from each firm's country market index, provided by Refinitiv Datastream, are a proxy for the market.

The cumulative abnormal return is the sum of the daily abnormal returns over the event window, as follows (MacKinlay, 1997, p. 21):

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{it} \quad (3)$$

Finally, in a sample of N firms, the average cumulative abnormal return (ACAR) is the following (Betton et al., 2008, p. 362):

$$ACAR_i = (1/N) \sum_{t=t_1}^{t_2} CAR_{it} \quad (4)$$

Estimating the combined CAR is essential to verify whether M&A create shareholder value on average (Andrade et al., 2001). Following the methodology used by Wang and Xie (2009), the total returns are a value-weighted portfolio of the acquiring and target firms. The weights are based on the companies' market capitalisations on the day before the start of each event window. Furthermore, the target firm's weight is adjusted for the acquiring firm's toehold, meaning the target firm's equity value held by the acquiring firm before the acquisition is subtracted from the target firm's market capitalisation. So, the combined CAR is as follows:

$$CAR^{Combined} = \frac{CAR^{Target} * AdjMV^{Target} + CAR^{Acquirer} * MV^{Acquirer}}{AdjMV^{Target} + MV^{Acquirer}} \quad (5)$$

Where,

AdjMV = Adjusted market value, considering the acquiring firm's toehold

MV = Market value.

2.3. UNIVARIATE ANALYSIS

The univariate analysis aims to analyse the effect of a specific variable on the acquirer CAR, combined CAR, and the premium. For this purpose, a two-sample T-Test (parametric test) and Wilcoxon-Mann-Whitney Test (non-parametric test) are performed. The first test focuses on the difference in means between the two groups, while the latter focuses on the difference in medians. Therefore, the sample is divided into two groups, first according to the target firm's R&D intensity and then by high-tech target companies. The last analysis focuses on R&D-intensive target firms from high-tech industries.

2.4. MULTIVARIATE ANALYSIS

Ordinary Least Squares (OLS) regressions study the relationship between a dependent variable and one or more independent variables. All variables used in this section are described in section 2.5.

2.4.1. SHAREHOLDERS' ABNORMAL RETURNS

The first four hypotheses concern the acquirer's abnormal returns and in total. More specifically, H1 and H2 focus on the impact of the target firm's R&D intensity on CAR, tested as follows:

$$
\begin{aligned}
&CAR_{i,t} \\
&= \beta_0 + \beta_1 TargetR\&DIntensive + \beta_2 AMB_{t-1} + \beta_3 ASize_{t-1} + \beta_4 ALeverage_{t-1} \\
&+ \beta_5 CashOnly + \beta_6 StockOnly + \beta_7 Friendly + \beta_8 CrossBorder + \beta_9 SameIndustry \\
&+ \beta_{10} DealRelSize_{t-1} + \beta_{11} FixedEffects \\
&+ \epsilon
\end{aligned} \tag{6}
$$

H1.1 and H2.1 focus on the impact of R&D-intensive target firms from high-tech industries, tested using the following model:

$$
\begin{aligned}
&CAR_{i,t} \\
&= \beta_0 + \beta_1 TargetR\&DIntensive \times HighTech + \beta_2 HighTech \\
&+ \beta_3 TargetR\&DIntensive + \beta_4 AMB_{t-1} + \beta_5 ASize_{t-1} + \beta_6 ALeverage_{t-1} \\
&+ \beta_7 CashOnly + \beta_8 StockOnly + \beta_9 Friendly + \beta_{10} CrossBorder + \beta_{11} SameIndustry \\
&+ \beta_{12} DealRelSize_{t-1} + \beta_{13} FixedEffects \\
&+ \epsilon
\end{aligned} \tag{7}
$$

2.4.2. PREMIUM

The last hypotheses refer to the premium paid by the acquiring company. H3 focuses on the target's R&D intensity, being tested as follows:

$$\begin{aligned} Premium_{i,t} = {} & \beta_0 + \beta_1 TargetR\&DIntensive + \beta_2 AMB_{t-1} + \beta_3 ASize_{t-1} \\ & + \beta_4 ALeverage_{t-1} + \beta_5 TMB_{t-1} + \beta_6 TSize_{t-1} + \beta_7 TLeverage_{t-1} \\ & + \beta_8 CashOnly + \beta_9 StockOnly + \beta_{10} Friendly + \beta_{11} CrossBorder \\ & + \beta_{12} SameIndustry + \beta_{13} DealRelSize_{t-1} + \beta_{14} SharesAnnouncement \\ & + \beta_{15} CompetitiveBidding + \beta_{16} FixedEffects \\ & + \epsilon \end{aligned} \quad (8)$$

Finally, H3.1 concerns high-tech target firms in addition to R&D intensity. It is tested using the following models:

$$\begin{aligned} Premium_{i,t} = {} & \beta_0 + \beta_1 TargetR\&DIntensive \times HighTech + \beta_2 HighTech \\ & + \beta_3 TargetR\&DIntensive + \beta_4 AMB_{t-1} + \beta_5 ASize_{t-1} \\ & + \beta_6 ALeverage_{t-1} + \beta_7 TMB_{t-1} + \beta_8 TSize_{t-1} + \beta_9 TLeverage_{t-1} \\ & + \beta_{10} CashOnly + \beta_{11} StockOnly + \beta_{12} Friendly + \beta_{13} CrossBorder \\ & + \beta_{14} SameIndustry + \beta_{15} DealRelSize_{t-1} + \beta_{16} SharesAnnouncement \\ & + \beta_{17} CompetitiveBidding + \beta_{18} FixedEffects \\ & + \epsilon \end{aligned} \quad (9)$$

$$\begin{aligned} & Premium_{i,t} \\ & = \beta_0 + \beta_1 HighTech + \beta_2 AMB_{t-1} + \beta_3 ASize_{t-1} + \beta_4 ALeverage_{t-1} + \beta_5 TMB_{t-1} \\ & + \beta_6 TSize_{t-1} + \beta_7 TLeverage_{t-1} + \beta_8 CashOnly + \beta_9 StockOnly + \beta_{10} Friendly \\ & + \beta_{11} CrossBorder + \beta_{12} SameIndustry + \beta_{13} DealRelSize_{t-1} \\ & + \beta_{14} SharesAnnouncement + \beta_{15} CompetitiveBidding + \beta_{16} FixedEffects \\ & + \epsilon \end{aligned} \quad (10)$$

2.5. VARIABLES

2.5.1. DEPENDENT VARIABLES

The first dependent variable is the cumulative abnormal returns *(CAR)*, estimated for the acquirer shareholders and in total, and is explained in more detail in section 2.2. The second dependent variable, *Premium*, is the "Premium of offer price to target closing stock price 4 weeks prior to the original announcement date" (Thomson Reuters, 2017, p. 198) as a relative value. This study uses the four-week

pre-announcement stock prices to avoid possibly being affected by leaked information and rumours (Maung et al., 2019).

2.5.2. VARIABLES OF INTEREST

The first variable of interest is *TargetR&DIntensive,* a dummy variable that equals one if the target firm has an R&D intensity higher than the median, based on the year and country of the target firm, and zero otherwise. Measures of R&D performance can refer to either R&D input or R&D output. While R&D input represents the amount spent on R&D activities, R&D output is defined as the patent count or patent citations (Pandit et al., 2011). Nevertheless, R&D inputs are used more frequently to measure R&D performance because of the high uncertainty surrounding R&D activity. This study uses the ratio of the target firm's R&D expenditures to total assets (Leonard, 1971) to define R&D intensity primarily. Following the research by Laamanen (2007), the same analysis is performed using a different measure, R&D expenditures relative to sales (Chan et al., 2001), to check the robustness of the results. One of the problems with using this measure of R&D intensity is that growing firms may not yet generate many sales (Laamanen, 2007).

The second variable of interest is *HighTech,* a dummy variable that equals one if the target firm is from a high-tech industry and zero otherwise (Kohers & Kohers, 2000). Following the study by Kile and Phillips (2009), high-tech industries are defined according to the authors' recommendation regarding the combination of 3-digit Standard Industrial Classification (SIC) codes: 283 (Drugs), 357 (Computer and Office Equipment), 366 (Communication Equipment), 367 (Electronic Components and Accessories), 382 (Laboratory, Optic, Measure, Control Instruments), 384 (Surgical, Medical, Dental Instruments), 481 (Telephone Communications), 482 (Miscellaneous Communication Services), 489 (Communication Services, NEC), 737 (Computer Programming, Data Processing), and 873 (Research, Development, Testing Services).

TargetR&DIntensive x HighTech results from the interaction between the two previously described variables and tests the impact of high-tech target firms with an R&D intensity higher than the median.

2.5.3. CONTROL VARIABLES

Regressions also include control variables regarding the acquirer, target, and deal characteristics.

Acquirer characteristics

$AMB_{(t-1)}$ is the equity market-to-book value of the acquiring firm at the end of the year before the M&A announcement (Dionne et al., 2015). It is a proxy for the acquirer's growth opportunities (Kallapur &

Trombley, 2003; Ho et al., 2006). Based on research by Lang et al. (1989), a positive correlation is expected between the acquirer's growth opportunities and abnormal returns. However, concerning the premium, it is the opposite. Typically, acquirers with low market-to-book ratios, but large free cash flows, tend to use those cash flows to buy companies that serve their interests, even at a higher price. Moreover, they favour more aggressive acquisitions and pay a higher premium. This could signify agency problems (Gondhalekar et al., 2004).

ASize$_{(t-1)}$ is the acquiring firm's size, measured by the natural logarithm of the firm's total assets, at the end of the year before the M&A announcement (Malmendier & Tate, 2008). The value of total assets is adjusted using CPI – 2021. Moeller et al. (2004) define small firms as good acquirers and large firms as not. While the latter engage in M&A that result in significant dollar losses, small firms make acquisitions profitable for their shareholders. This is corroborated by Gorton et al. (2009), who state that the profitability of acquisitions tends to decrease with the acquirer's size. Moeller et al. (2004) also find evidence that supports the idea of hubris being present in the decision-making process of large firms. So, bigger firms tend to pay a higher premium in M&A when compared to smaller firms.

ALeverage$_{(t-1)}$ is the acquiring firm's leverage, measured by the ratio of total debt to total assets, at the end of the year before the M&A announcement (Laamanen, 2007). Krishnan and Yakimenko (2022) recently studied US M&A deal announcements and how the market reacts to them based on leverage. These authors find that higher equity ratios, or lower leverage levels, are significantly associated with negative CAR at the time of the announcement. On the other hand, companies with high leverage levels are closely monitored by creditors, who will try to prevent the acquirer from paying too high premiums. In other words, the company is more disciplined, and leverage is negatively correlated with premium (Gondhalekar et al., 2004).

Target characteristics

TMB$_{(t-1)}$ is the equity market-to-book value of the target company at the end of the year before the M&A announcement (Dionne et al., 2015). It is a proxy for the target's growth opportunities (Kallapur & Trombley, 2003; Ho et al., 2006). Betton et al. (2008) show that the offer premium will increase if the target's market-to-book ratio exceeds the industry median. Generally, when the target has higher growth potential (or new investment opportunities) than its competitors, it is associated with a higher premium (Dionne et al., 2015). Nonetheless, Laamanen (2007) studies technology-based firms and concludes that the target's market-to-book negatively correlates with the premium.

TSize(t-1) is the target firm's size, measured by the natural logarithm of the firm's total assets, at the end of the year before the M&A announcement (Malmendier & Tate, 2008). The value of total assets is adjusted using CPI – 2021. The absolute size of the target tends to decrease the premium, which may reveal how acquirers believe bigger targets are associated with higher integration costs (Alexandridis et al., 2013; Dionne et al. (2015).

TLeverage(t-1) is the target firm's leverage, measured by the ratio of total debt to total assets, at the end of the year before the M&A announcement (Laamanen, 2007). Dionne et al. (2015) conclude that it has a negative impact on the premium. The reasoning behind this theory is that a company with high debt levels will become less attractive, meaning the premium the acquirers will be willing to pay will be lower.

Deal characteristics

CashOnly is a dummy variable that equals one if the payment is all in cash, and zero otherwise. Similarly, *StockOnly* is a dummy variable that equals one if the payment is all in stock, and zero otherwise. Wang and Xie (2009) observe that acquirers' returns are higher in all-cash transactions. On the other hand, Travlos (1987) argues that bidder shareholders have significant losses if it is related to a pure stock exchange, as it delivers a negative message, such as the possible overvaluation of the bidder firm. Nonetheless, there are some differences in the outcome for shareholders, depending on the geography of the transaction. While US studies demonstrate that all equity-financed acquisitions are associated with significant negative abnormal returns for bidder shareholders, European studies reveal positive and sometimes significant returns to the bidders (Martynova & Renneboog, 2008). The premium is frequently higher when the deal is financed only with cash to compensate the target shareholders for the tax liability they incur. When stock is overpriced, and acquirers use it to finance the deal, the acquiring firm may overpay for the target firm (DePamphilis, 2018).

Friendly is a dummy variable that equals one if the offer attitude is friendly, and zero otherwise. According to Martynova and Renneboog (2008), friendly takeovers are typically associated with higher abnormal returns than mergers. The latter also has significantly larger returns than hostile bids. Using deals identified by the SDC platform as hostile offers, Schwert (2000) concludes that they are associated with higher average premiums. Also, hostile offers result in higher premiums than friendly offers (Dionne et al., 2015).

CrossBorder is a dummy variable that equals one if the acquirer and target companies are from different countries, and zero otherwise. Moeller and Schlingemann (2005) find that cross-border deals are

associated with lower returns during the announcement period than domestic acquisitions. This difference is named the cross-border effect, which is statistically and economically significant. Regarding the premium, Goergen and Renneboog (2004) study European takeovers and defend that acquirers pay a higher premium for cross-border targets since they can take advantage of capital market imperfections, generating more gains. Likewise, another study concerning cross-border deals (Maung et al., 2019), which includes countries from North America, concludes that acquirers are willing to pay higher premiums for targets based on countries where the investment environment is more favourable.

SameIndustry is a dummy variable that equals one if the acquirer and target companies are from the same industry, and zero otherwise. Typically, unrelated diversification is seen as inefficient and results in lower returns during the announcement period than related diversification (Morck et al., 1990; Akbulut & Matsusaka, 2010). Alexandridis et al. (2013) observe that targets in the same industry are paid premiums below average. However, using the 2-digit SIC to measure industry membership, Gondhalekar et al. (2004) state that acquirers are less willing to pay more for diversifying acquisitions.

DealRelSize$_{(t-1)}$ is the deal's relative size, estimated by dividing the deal value by the acquirer's total assets at the end of the year before the M&A announcement (Loureiro & Silva, 2022). One of Kohers and Kohers's (2000) conclusions is that, in high-tech takeovers, the size of the deal is positively correlated with the acquirer's excess returns, as acquirer shareholders think larger targets are more likely to contribute with synergies. On the contrary, evidence (Alexandridis et al., 2013) also supports a possible inverse relationship since the more considerable complexity of larger deals can prevent potential synergies from being realised. Ahuja and Katila (2001) recommend bidders to be aware of the acquisition's size, being preferable a smaller relative size. Linked to the integration costs theory mentioned, Gondhalekar et al. (2004) conclude that smaller firms are more easily integrated into the acquirers' operations and, therefore, the relative size of the target decreases the premium acquirers are willing to pay. Thus, a negative relationship is expected between the deal size and the premium paid.

SharesAnnouncement is the acquirer's percentage of stake in the target firm before the M&A, in relative value (Kohers & Kohers, 2000). Firms with a prior stake in the target company before the M&A deal typically have more access to relevant and privileged information about its stand-alone value, meaning they can value potential synergies more accurately (Dionne et al., 2015), which benefits the acquisition performance (Porrini, 2004). In fact, acquirers with previous toehold tend to pay lower offer premiums than others with no previous stake in the target company (Betton et al., 2008; Dionne et al., 2015).

CompetitiveBidding is a dummy variable that equals one if the number of bidders is more than one (including the acquirer) and zero otherwise (Rossi & Volpin, 2004). As mentioned, higher levels of competition lead to a higher premium (Rossi & Volpin, 2004; Alexandridis et al., 2010; Maung et al., 2019).

Fixed effects

Regressions include country, industry (based on the 2-digit SIC code), and year dummies, as specified in the results tables. The aim is to control for time-invariant characteristics of industries, countries, and time-variant effects by year.

2.5.4. CORRELATION MATRIX

Finally, a Pearson correlation matrix is presented between the variables described (Table 16, in Appendix A), in which the coefficients represent the strength of the linear relationship between the variables. The values are between -1 and 1, meaning a coefficient of 0 indicates no correlation between the variables. Moreover, the closer the coefficient is to -1 or 1, the stronger the relationship (Boslaugh & Watters, 2008). Most of the coefficients are closer to 0. Even though there are a few linear relationships with moderate and high levels of strength, it is not likely that they cause bias. The variables *TargetR&DIntensive (assets)* and *TargetR&DIntensive (sales)* have a strong relationship. This is expected since they both measure the target firm's R&D intensity.

3. DATA AND SAMPLE

The sample, collected from Refinitiv SDC Platinum, includes deals considered mergers or acquisitions from the beginning of 2007 to the end of 2021. Both the acquirer and target companies are publicly listed. The focus is on North America and Western Europe, where M&A activity is higher, according to Chari (2020). Thus, the countries considered are the United States, Canada, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom.

As prerequisites, transactions must be completed, and the deal value must be at least $1 million (Alexandridis et al., 2012). Only majority acquisitions in which the acquiring company acquires at least 20% of the target firm's shares are considered. This means that the acquirer owns no more than 50% of the target firm before the M&A, and afterwards, the percentage of ownership is greater than 50% (Wang & Xie, 2009). Some filters enable the comparison of results with other studies. After eliminating financial companies and stock buybacks, the final sample consists of 2620 deals.

Refinitiv SDC Platinum is also the source of information on the acquirer and target Primary SIC codes, the country of the acquirer and target firms, the date of the deal announcement, the payment method, the deal attitude, the deal value, the domesticity of the deal, the acquirer's stake in the target company before the announcement, the number of bidders, and the premium paid by acquiring firm. The daily returns for each company, country index, and the market value of equity are from Refinitiv Datastream. Accounting data on R&D, total assets, total debt, sales, and the book value of equity are from Refinitiv Worldscope. All data are in US dollars, and the variables are winsorized at 1% in each tail.

Table 1 presents the distribution of the sample and the deal value by year. The number of deals shows a decreasing pattern throughout the years, where 2007 and 2020 have the highest and lowest number of deals, respectively. As for the deal value, its average is relatively stable at the beginning. Then, in 2014, its value more than doubles. Afterwards, it remains higher than in the first part of the sample, even though it decreases more significantly in 2017 and 2021. Deal value reaches its highest value in 2019.

Table 1 – Sample distribution and deal value by year

This table presents the sample distribution and deal value by year. "No. Deals" refers to the number of M&A deals in that year, and "% Deals" refers to the respective percentage. The deal value's mean, median and standard deviation (SD) are presented. The deal value is in millions of US dollars.

Year	No. Deals	% Deals	Mean	Median	SD
2007	321	12.25	1150.535	236.916	2343.106
2008	212	8.09	1058.085	111.3435	3664.529
2009	217	8.28	1099.614	62.719	4454.219
2010	199	7.60	1069.592	224.08	2763.301
2011	164	6.26	1731.71	220.721	4789.774
2012	165	6.30	1117.687	242.194	3143.815
2013	146	5.57	1266.502	218.8695	2638.447
2014	177	6.76	2937.744	437.771	6461.669
2015	197	7.52	3328.315	360.907	7094.85
2016	167	6.37	3335.909	566.451	7172.766
2017	144	5.50	2319.147	501.3565	5167.747
2018	164	6.26	2946.127	667.5835	5851.979
2019	121	4.62	3963.05	585.864	8017.187
2020	106	4.05	3642.315	291.5755	8052.331
2021	120	4.58	2583.549	413.8675	5184.537
Total	2620	100	2070.209	277.0745	5256.425

Table 2 shows the sample distribution and deal value by country (Panel A is organised by the acquirer country, and Panel B is organised by the target country). M&A activity is more intense in countries from North America, particularly the United States, representing 48.24% of acquirer companies and 51.03% of target companies. Following, Canada is in second place for acquirers and targets. Regarding Western Europe, the United Kingdom is the most active country, followed by France. On the contrary, Denmark, Greece, and Spain are the countries with the lowest M&A activity, accounting for less than 1% among acquirers and targets. As for the deal value, in Panel A, the country with the highest mean value is Belgium, followed by Ireland, Switzerland, and Germany. Greece shows the lowest mean value. In Panel B, Ireland stands out, followed by the Netherlands and the United States. Denmark has the lowest average value.

Table 2 – Sample distribution and deal value by the acquirer and target country

This table presents the sample distribution and deal value by the acquirer and target country. "No. Deals" refers to the number of M&A deals in that year, and "% Deals" refers to the respective percentage. The deal value's mean, median and standard deviation (SD) are presented. The deal value is in millions of US dollars.

Panel A - Acquirer Country					
Country	No. Deals	% Deals	Mean	Median	SD
Belgium	12	0.46	7192.387	541.083	13453.79
Canada	761	29.05	553.2323	45.72	2223.385
Denmark	9	0.34	927.3942	101.894	1526.232
Finland	16	0.61	1777.138	283.9835	3739.888
France	99	3.78	2483.18	538.302	4543.85
Germany	45	1.72	3170.077	432.571	6326.583
Greece	9	0.34	181.8867	118.743	235.0434
Ireland-Rep	26	0.99	3831.707	372.2135	7409.613
Italy	22	0.84	1289.1	300.1025	1862.81
Netherlands	34	1.30	2085.776	395.608	3621.863
Norway	21	0.80	384.2513	156.74	936.8023
Spain	8	0.31	2639.944	1948.966	2982.381
Sweden	55	2.10	626.7379	93.686	1340.856
Switzerland	45	1.72	3486.415	1111.545	7173.424
United Kingdom	194	7.40	1911.129	172.889	5611.085
United States	1264	48.24	2926.831	619.8485	6211.464
Total	2620	100	2070.209	277.0745	5256.425
Panel B - Target Country					
Country	No. Deals	% Deals	Mean	Median	SD
Belgium	12	0.46	1523.175	237.3485	3077.357
Canada	817	31.18	437.9709	49.05	1506.336
Denmark	8	0.31	64.15537	53.039	55.58877
Finland	13	0.50	707.8968	639.183	637.9358
France	69	2.63	1331.484	88.871	3426.871
Germany	20	0.76	2474.779	309.3775	7189.364
Greece	7	0.27	125.256	118.743	98.36007
Ireland-Rep	7	0.27	8013.232	301.913	13111.08
Italy	18	0.69	1911.249	266.866	3659.494
Netherlands	23	0.88	4693.868	1197.687	8333.507
Norway	34	1.30	457.4808	194.4855	738.1042
Spain	8	0.31	1733.495	1445.831	1637.754
Sweden	43	1.64	451.2892	49.968	1212.921

Table 2 (continued)

Panel B - Target Country					
Country	No. Deals	% Deals	Mean	Median	SD
Switzerland	29	1.11	2965.4	301.294	8149.758
United Kingdom	175	6.68	2162.687	97.802	6130.588
United States	1337	51.03	3129.497	800.381	6292.515
Total	2620	100	2070.209	277.0745	5256.425

Table 3 presents the sample distribution by industry based on the 2-digit SIC code. The most represented industry is manufacturing, both for acquiring and target companies, followed by mining and services industries. The least represented are public administration and agriculture, forestry, and fishing.

Table 3 – Sample distribution by industry

This table presents the distribution of the sample used by industry based on the 2-digit SIC code. "No. Deals" refers to the number of deals, and "% Deals" refers to the respective percentage.

Industry	Acquirer		Target	
	No. Deals	% Deals	No. Deals	% Deals
Agriculture, Forestry & Fishing	5	0.19	7	0.27
Mining	759	28.97	771	29.43
Construction	33	1.26	36	1.37
Manufacturing	988	37.71	930	35.50
Transportation & Public Utilities	248	9.47	219	8.36
Wholesale Trade	42	1.60	44	1.68
Retail Trade	85	3.24	74	2.82
Services	460	17.56	538	20.53
Public Administration	0	0.00	1	0.04
Total	2620	100	2620	100

Table 4 shows the distribution of the sample by some deal characteristics. More than half of the deals involve R&D-intensive targets. In addition, about 37% of deals involve high-tech target firms. Even though there is a balance between all-cash and all-stock offers, the percentage of deals financed only with cash is slightly higher. Regarding deal attitude, most of the sample (98.47%) is composed of friendly M&A. Concerning domesticity, only a quarter of the deals involve companies from different countries. Most deals (70.42%) are between companies from the same industry, according to 2-digit SIC codes. Finally, 4.39% of deals involve competitive bidding.

Table 4 – Sample distribution by deal characteristics

Table 4 presents the distribution of the sample used by deal characteristics. "No. Deals" refers to the number of deals, and "% Deals" refers to the respective percentage. The variables on the left column represent deal characteristics and are defined in Table 15, in Appendix A.

Deal characteristics	No. Deals	% Deals
TargetR&DIntensive (assets)	1511	57.67
TargetR&DIntensive (sales)	1640	62.60
HighTech	976	37.25
CashOnly	988	37.71
StockOnly	852	32.52
Friendly	2580	98.47
CrossBorder	672	25.65
SameIndustry	1845	70.42
CompetitiveBidding	115	4.39

Table 5 reports descriptive statistics for the remaining variables used. On average, acquiring firms are bigger than target firms and have a higher market-to-book ratio. When it comes to leverage, both parties seem to have similar values. Regarding the deal's relative size, the deal value is, on average, 62.15% of the acquirers' total assets. It should also be noted that the average acquirer toehold at the M&A announcement is about 2%. The average premium is almost 47%.

Table 5 – Variables' summary statistics

Table 5 presents the descriptive statistics of some variables: Number of observations (N), mean, median, standard deviation (SD), minimum (Min), and maximum (Max). The variables are defined in Table 15, in Appendix A.

Variables	N	Mean	Median	SD	Min	Max
AMB	2320	2.9284	2.0343	4.5476	-14.0713	29.9566
ASize	2446	14.2959	14.6209	2.7000	7.3554	19.0475
ALeverage	2429	0.1829	0.1609	0.1647	0	0.7439
TMB	1493	2.1582	1.7683	4.2137	-21.9871	18.4627
TSize	1508	12.6027	12.5200	2.2028	7.3851	17.5933
TLeverage	1497	0.1717	0.1147	0.1994	0	1.0049
DealRelSize	2446	0.6215	0.1909	1.5354	0.0013	11.9113
SharesAnnouncement	2620	0.0175	0	0.0704	0	0.412
Premium	2309	0.4689	0.3517	0.5916	-0.6545	3.5349

Finally, Table 6 reports the acquirer and combined CAR summary statistics. Panel A shows a positive mean acquirer CAR of about 0.02%, 0.06%, and 0.11% for the 3-day, 5-day, and 11-day event windows, respectively, indicating that there is value creation for the acquirer (Alexandridis et al., 2017). However, these values are very close to zero, which could indicate that there are big variations regarding acquirers' returns and that these companies are trying to be among the successful ones (Bruner, 2002; Fuller et al., 2002). These results corroborate Martynova and Renneboog's (2008) research, which argues that, at the time of the M&A announcement, acquirer shareholders' abnormal returns are statistically indistinguishable from zero.

As shown in Panel B, the mean combined CAR is approximately 2.69%, 2.81%, and 2.99% for the 3-day, 5-day, and 11-day event windows, respectively. Since the mean is positive, there is value creation for the acquirer and target shareholders combined, and the M&A announcement is advantageous. This corroborates research by authors such as Bruner (2002) and Martynova and Renneboog (2008).

Table 6 – CAR's summary statistics

Table 6 considers the acquirer (Panel A) and combined (Panel B) CAR and presents the following summary statistics: Number of observations (N), mean, median, standard deviation (SD), minimum (Min), and maximum (Max). The methodology used to estimate CAR is described in Chapter 2.

Panel A: Acquirer CAR						
Event Window	N	Mean	Median	SD	Min	Max
(-1, +1)	2473	0.0002	-0.0023	0.0839	-0.2266	0.3429
(-2, +2)	2473	0.0006	-0.0020	0.0952	-0.2502	0.3758
(-5, +5)	2473	0.0011	-0.0030	0.1196	-0.3584	0.4824
Panel B: Combined CAR						
Event Window	N	Mean	Median	SD	Min	Max
(-1, +1)	2372	0.0269	0.0150	0.0805	-0.1832	0.3299
(-2, +2)	2372	0.0281	0.0178	0.0898	-0.1814	0.3470
(-5, +5)	2372	0.0299	0.0208	0.1108	-0.2680	0.4459

4. PRESENTATION AND DISCUSSION OF RESULTS

4.1. UNIVARIATE ANALYSIS

R&D-intensive targets

The first analysis covers the impact of the target firm's R&D intensity (Table 7). The sample is divided into two groups based on the variable *TargetR&DIntensive,* which equals one if the target firm's R&D intensity is higher than the median and zero otherwise.

Regarding the acquirer CAR, neither the difference in means nor medians is statistically significant. Therefore, the mean and median acquirer CAR are similar between the two groups.

With respect to the combined CAR, in the 3-day event window, the difference in means is 0.85 percentage points (pp) and statistically significant at 5%. So, R&D-intensive target firms are associated with lower mean combined CAR. The difference in medians is also positive and statistically significant at 1% (0.68pp), in the 3-day event window, and at 5% (0.63pp), in the 5-day event window, leading to a similar conclusion. This shows that the target firm's R&D intensity is not guaranteed to be beneficial, in line with the results of King et al. (2008), Sears and Hoetker (2014), and Ochirova and Dranev (2021). The difference in means and medians between the groups is not statistically significant in the remaining cases.

Concerning the premium, the difference in means and medians is negative and statistically significant at 1%. The mean (median) premium paid to R&D-intensive target firms is 11.39pp (6.70pp) higher than to firms with R&D intensity lower or equal to the median. Hence, the target firm's R&D intensity can lead to higher premiums, consistent with Madura et al. (2012).

There are no significant differences in qualitative interpretations when the R&D intensity measure differs (Table 17, in Appendix B).

Based on these results, there is no indication to confirm or deny H1, as the results for the acquirer CAR are not statistically significant. However, they seem to be against H2, which predicts a positive correlation with the combined CAR. Finally, H3 expects a positive correlation between the target firm's R&D intensity and premium, and the results favour this hypothesis.

High-tech targets

The second analysis considers the impact of high-tech transactions (Table 8). The sample is divided into two groups based on the variable *HighTech*, which equals one if the target firm is from a high-tech industry and zero otherwise.

Focusing on the acquirer CAR, the difference in means is positive (0.69pp) and statistically significant at 10% in the 5-day event window. Furthermore, the mean for the group where the target firm is from a high-tech industry is negative (-0.37%), while the mean for the other group is positive (0.32%). This means that high-tech targets seem to have a negative impact on the acquirer CAR, countering research by Kohers and Kohers (2000). In the other event windows, the difference between the two groups is not statistically significant. Also, the difference in medians does not present any statistically significant results.

Analysing the results for the combined CAR, even though both groups have positive means, the difference is still positive and statistically significant at 5% in the 5-day (0.92pp) and 11-day (1.03pp) event windows. Similarly, the difference in medians is positive and statistically significant at 10% in the 5-day (0.69pp) and 11-day (0.87pp) event windows. So, high-tech target firms are associated with lower CAR, which is not expected based on Kohers and Kohers' (2000) conclusions. In the 3-day event window, the mean and median combined CAR are similar between the two groups.

On the other hand, when it comes to premium, the results are consistent with these authors' research. The difference in means (medians) is -12.69pp (-9.27pp) and statistically significant at 1%. This indicates that high-tech target firms receive higher premiums.

Combination of R&D-intensive and high-tech targets

The third analysis concerns the impact of combining higher levels of R&D with high-tech industries (Table 9). The sample is divided into two groups based on the variable *TargetR&DIntensive x HighTech*, which results from the interaction of the two previously described variables.

Regarding the acquirer CAR, the difference in means is not statistically significant. So, the mean acquirer CAR are similar between the two groups. However, the difference in medians is -0.47pp and significant at 10% in the 3-day event window. This indicates that the interaction between higher levels of R&D and high-tech target firms is associated with a higher median acquirer CAR. This result is in line with papers by Kohers and Kohers (2000), Phillips and Zhdanov (2013), and Lin and Wang (2016). In the remaining event windows, the difference in medians between the two groups is not statistically significant.

Concerning the combined CAR, the difference in means in the 5-day event window is positive and statistically significant at 10%. So, the mean combined CAR is 0.70pp lower when the target firm has an R&D intensity higher than the median and is from a high-tech industry. On the other hand, the difference in medians is never statistically significant. The other event windows do not present statistically significant results, meaning the mean and median combined CAR are similar between the two groups.

The difference in means and medians for the premium is negative and significant at 1%. Therefore, this combination of factors is associated with a 13.25pp (9.32pp) higher mean (median) premium, consistent with research by Kohers and Kohers (2000) and Madura et al. (2012).

When the R&D intensity measure differs (Table 18, in Appendix B), the difference in medians for the acquirer CAR is never statistically significant. Also, the difference in medians for the combined CAR is positive and significant at 10% in the 5-day event window. Other than that, there are no significant differences in qualitative interpretations.

H1.1 predicts an amplified negative effect of the target's R&D intensity on the acquirer CAR when it is from a high-tech industry. Since the results indicate a higher acquirer CAR, this might be evidence against the hypothesis. The results could also counter what is assumed in H2.1 concerning the combined CAR. H3.1 expects an amplified positive correlation between R&D-intensive and high-tech targets and the premium. The fact that the difference between groups in Table 9 is higher than in Table 7 is in favour of this hypothesis.

Table 7 – Univariate analysis: R&D-intensive targets

This table presents the results of the T-Test and Wilcoxon-Mann-Whitney Test for acquirer CAR, combined CAR, and premium. The focus is on the target firm's R&D intensity, measured by the ratio of R&D expenditures to total assets. The group division is based on the variable *TargetR&DIntensive*, which equals one if the target firm's R&D intensity is higher than the median and zero otherwise. N is the number of observations. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Panel A - Difference in means								
T-Test		Low-R&D (0)		High-R&D (1)		Difference (0) - (1)	t	p-value
		N	Mean	N	Mean			
Acquirer CAR	(-1, +1)	1047	0.0011	1426	-0.0004	0.0015	0.4382	0.6613
	(-2, +2)	1047	0.0001	1426	0.0010	-0.0008	-0.2161	0.8290
	(-5, +5)	1047	-0.0018	1426	0.0032	-0.0050	-1.0218	0.3070
Combined CAR	(-1, +1)	1024	0.0318	1348	0.0233	0.0085**	2.5494	0.0109
	(-2, +2)	1024	0.0308	1348	0.0260	0.0049	1.3083	0.1909
	(-5, +5)	1024	0.0314	1348	0.0288	0.0026	0.5759	0.5648
Premium		1011	0.4049	1298	0.5188	-0.1139***	-4.6084	0.0000
Panel B - Difference in medians								
Wilcoxon-Mann-Whitney Test		Low-R&D (0)		High-R&D (1)		Difference (0) - (1)	z	p-value
		N	Median	N	Median			
Acquirer CAR	(-1, +1)	1047	-0.0017	1426	-0.0029	0.0012	0.6140	0.5392
	(-2, +2)	1047	-0.0017	1426	-0.0022	0.0005	0.0040	0.9965
	(-5, +5)	1047	-0.0056	1426	-0.0006	-0.0050	-0.7880	0.4308
Combined CAR	(-1, +1)	1024	0.0189	1348	0.0120	0.0068***	3.0140	0.0026
	(-2, +2)	1024	0.0220	1348	0.0158	0.0063**	1.9650	0.0494
	(-5, +5)	1024	0.0227	1348	0.0187	0.0041	1.0660	0.2866
Premium		1011	0.3158	1298	0.3828	-0.0670***	-4.6020	0.0000

Table 8 – Univariate analysis: High-tech targets

This table presents the results of the T-Test and Wilcoxon-Mann-Whitney Test for acquirer CAR, combined CAR, and premium. The focus is on target firms from high-tech industries. The group division is based on the variable *HighTech*, which equals one if the target firm is from a high-tech industry and zero otherwise. N is the number of observations. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Panel A - Difference in means								
T-Test		Low-Tech (0)		High-Tech (1)		Difference (0) - (1)	t	p-value
		N	Mean	N	Mean			
Acquirer CAR	(-1, +1)	1538	0.0006	935	-0.0005	0.0011	0.3142	0.7534
	(-2, +2)	1538	0.0032	935	-0.0037	0.0069*	1.7525	0.0798
	(-5, +5)	1538	0.0038	935	-0.0034	0.0072	1.4555	0.1457
Combined CAR	(-1, +1)	1479	0.0284	893	0.0244	0.0040	1.1770	0.2393
	(-2, +2)	1480	0.0315	892	0.0223	0.0092**	2.4276	0.0153
	(-5, +5)	1479	0.0338	893	0.0235	0.0103**	2.1863	0.0289
Premium		1436	0.4210	873	0.5479	-0.1269***	-5.0255	0.0000
Panel B - Difference in medians								
Wilcoxon-Mann-Whitney Test		Low-Tech (0)		High-Tech (1)		Difference (0) - (1)	z	p-value
		N	Median	N	Median			
Acquirer CAR	(-1, +1)	1538	-0.0047	935	0.0000	-0.0047	-1.4720	0.1411
	(-2, +2)	1538	-0.0024	935	-0.0017	-0.0007	0.4990	0.6179
	(-5, +5)	1538	-0.0031	935	-0.0027	-0.0004	0.3050	0.7601
Combined CAR	(-1, +1)	1479	0.0163	893	0.0134	0.0029	0.4740	0.6356
	(-2, +2)	1480	0.0217	892	0.0147	0.0069*	1.8520	0.0640
	(-5, +5)	1479	0.0242	893	0.0155	0.0087*	1.7670	0.0773
Premium		1436	0.3144	873	0.4070	-0.0927***	-7.311	0.0000

Table 9 – Univariate analysis: Combination of R&D-intensive and high-tech targets

This table presents the results of the T-Test and Wilcoxon-Mann-Whitney Test for acquirer CAR, combined CAR, and premium. The focus is on high-tech and R&D-intensive target firms, in which R&D intensity is measured by the ratio of R&D expenditures to total assets. The group division is based on the variable *TargetR&DIntensive x HighTech*, which results from the interaction of the following variables: *TargetR&DIntensive*, which equals one if the target firm's R&D intensity is higher than the median and zero otherwise; and *HighTech*, which equals one if the target firm is from a high-tech industry and zero otherwise. N is the number of observations. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Panel A - Difference in means								
T-Test		Other (0)		High-Tech x High-R&D (1)		Difference (0) - (1)	t	p-value
		N	Mean	N	Mean			
Acquirer CAR	(-1, +1)	1776	-0.0003	697	0.0014	-0.0016	-0.4327	0.6653
	(-2, +2)	1776	0.0015	697	-0.0017	0.0033	0.7660	0.4438
	(-5, +5)	1776	0.0017	697	-0.0005	0.0021	0.3973	0.6912
Combined CAR	(-1, +1)	1711	0.0279	661	0.0245	0.0034	0.9252	0.3550
	(-2, +2)	1712	0.0300	660	0.0230	0.0070*	1.6913	0.0909
	(-5, +5)	1709	0.0316	663	0.0257	0.0059	1.1654	0.2440
Premium		1662	0.4318	647	0.5643	-0.1325***	-4.8557	0.0000
Panel B - Difference in medians								
Wilcoxon-Mann-Whitney Test		Other (0)		High-Tech x High-R&D (1)		Difference (0) - (1)	z	p-value
		N	Median	N	Median			
Acquirer CAR	(-1, +1)	1776	-0.0044	697	0.0003	-0.0047*	-1.8530	0.0639
	(-2, +2)	1776	-0.0025	697	-0.0012	-0.0012	-0.2390	0.8107
	(-5, +5)	1776	-0.0038	697	-0.0009	-0.0029	-0.2940	0.7689

Table 9 (continued)

Panel B - Difference in medians								
Wilcoxon-Mann-Whitney Test		Other (0)		High-Tech x High-R&D (1)		Difference (0) - (1)	z	p-value
		N	Median	N	Median			
Combined CAR	(-1, +1)	1711	0.0160	661	0.0128	0.0032	0.7400	0.4592
	(-2, +2)	1712	0.0208	660	0.0132	0.0076	1.5880	0.1123
	(-5, +5)	1709	0.0235	663	0.0148	0.0087	1.2940	0.1957
Premium		1662	0.3250	647	0.4181	-0.0932***	-6.7150	0.0000

4.2. MULTIVARIATE ANALYSIS

4.2.1. THE IMPACT ON THE ACQUIRER AND COMBINED CAR

Table 10 focuses on the acquirer CAR and presents the regressions for H1 and H1.1. The first hypothesis expects a negative correlation between the target firm's R&D intensity and the acquirer CAR. H1.1 predicts that this negative effect is amplified when the target firm is from a high-tech industry.

In models 1, 2, and 3, used to test H1, the variable of interest *(Target R&D-Intensive)* is not statistically significant in none of the event windows. Thus, it is not possible to make any interpretation about the impact of R&D-intensive target firms on the acquirer CAR.

Looking at the models regarding H1.1, the interaction variable *(Target R&D-Intensive x High-Tech)* has a positive coefficient, statistically significant at 10% in the 3-day event window. Therefore, the combination of R&D-intensive and high-tech targets has a positive marginal effect. Target companies with an R&D intensity higher than the median from high-tech industries earn 1.52pp higher acquirer CAR (-1, +1). However, this result is no longer statistically significant in the 5-day and 11-day event windows.

In qualitative terms, there are no significant differences in interpretations when the measure of R&D intensity is different (Table 19, in Appendix C).

High-tech targets are negatively correlated with the acquirer CAR, and the variable *High-Tech* has a statistically significant coefficient at 1% in models 4 and 5. This contradicts the research by Kohers and Kohers (2000), who show that the market is enthusiastic regarding high-tech deals and that acquirers will benefit from future growth, leading to higher acquirer CAR at the time of the M&A announcement.

Regarding control variables, the acquirer's size negatively correlates with the acquirer CAR, and the coefficient is statistically significant at 1% in all event windows. This confirms the research by Moeller et al. (2004) and Gorton et al. (2009), who conclude that bigger firms tend to have lower abnormal returns concerning M&A announcements. On the other hand, the acquirer's leverage has a positive impact in the 3-day event window, as expected based on Krishnan and Yakimenko's (2022) research. Moreover, all-cash offers are associated with a positive and statistically significant coefficient at 1% in all event windows. Therefore, it can be argued that deals fully financed with cash benefit the acquiring company, agreeing with Wang and Xie (2009). Finally, the deal's relative size negatively impacts the acquirer CAR, supporting research by Ahuja and Katila (2001) and Alexandridis et al. (2013).

So, H1 can neither be confirmed nor denied due to the lack of statistically significant results. Also, the results contradict what is hypothesised in H1.1, as the interaction variable has a positive coefficient. Even

though results lose strength in the longer event windows, this could be a sign that the impact of R&D intensity on the acquirer CAR depends on the target firm's industry. Furthermore, the fact that the target firm is from a high-tech industry could have a positive effect on the impact of R&D intensity on the acquirer CAR.

Table 11 focuses on the combined CAR and presents the regressions for H2 and H2.1. The former hypothesis expects a positive correlation between the target firm's R&D intensity and the combined CAR. H2.1 predicts that this positive effect is amplified when the target firm is from a high-tech industry.

Contrary to results regarding H1, the variable of interest *(Target R&D-Intensive)* now has statistically significant results at 1% for H2 in the 3-day event window. The variable's coefficient indicates an average decrease in combined CAR (-1, +1) of 1.09pp for target firms with an R&D intensity higher than the median. This aligns with the perspective that considers the negative impact of R&D on CAR, described in Chapter 1. One of the main arguments presented is that the interaction between the acquirer and target firms' R&D can cause an inefficient exploration and use of R&D being acquired, negatively affecting M&A results (King et al., 2008; Sears & Hoetker, 2014; Ochirova & Dranev, 2021). Additionally, the uncertainty around R&D submits the acquirer to the winner's curse (Higgins & Rodriguez, 2006).

On the other hand, this negative result is not predicted based on Phillips and Zhdanov (2013), who show that it is common for bigger firms to let smaller firms conduct R&D and acquire them. Aligned, Lin and Wang (2016) agree that R&D-intensive firms are more likely to become takeover targets and argue that stock returns demanded by investors would be higher. In other words, this result is unexpected since R&D intensity is considered a source of value creation on average, even if most of it is accrued to target shareholders (Martynova & Renneboog, 2008).

When looking at regressions regarding H2.1, the interaction variable, which represents the impact of R&D-intensive target firms from high-tech industries, is not associated with a statistically significant coefficient.

In qualitative terms, there are no significant differences when the measure of R&D intensity differs (Table 20, in Appendix C).

Moreover, similar to the results for H1.1, high-tech target firms are negatively correlated with CAR, which does not align with Kohers and Kohers' (2000) research. The variable *High-Tech* is statistically significant at 1% (model 5) and 5% (models 4 and 6).

Concerning control variables, the acquirer's size continues to have a negative coefficient, while the level of leverage is positively correlated with the combined CAR. Concerning the method of payment, all-cash

offers continue to have a positive effect on CAR. On the other hand, all-stock offers are associated with a negative coefficient. The impact of deals fully financed with stock on abnormal returns may depend on the transaction geography, where US studies show a negative influence and European studies a positive one (Martynova & Renneboog, 2008). The fact that, in the sample used, the United States represents 48.24% of acquirers and 51.03% of targets (see Table 2, in Chapter 3) may help to explain this result.

In summary, the results deny what H2 predicts, as R&D-intensive target firms have a negative impact on the combined CAR. Thus, on average, R&D intensity is not a source of synergies and value creation. H2.1 is neither confirmed nor denied due to the lack of statistically significant data. So, the impact of R&D-intensive targets on the combined CAR does not seem to depend on the target firm's industry.

Table 10 – Regressions regarding H1 and H1.1

This table presents the regression results for H1 (models 1, 2, and 3) and H1.1 (models 4, 5, and 6). The acquirer *CAR* (cumulative abnormal returns) are estimated using three event windows: a 3-day period (-1, +1), a 5-day period (-2, +2), and an 11-day period (-5, +5). The estimation window is (-270, -30). *Target R&D-Intensive* is a dummy variable that equals one if the target firm's R&D intensity is higher than the median and zero otherwise. R&D intensity is measured by the ratio of R&D expenditures to total assets. *High-Tech* is a dummy variable that equals one if the target firm is from a high-tech industry and zero otherwise. The interaction variable, *Target R&D-Intensive x High-Tech*, results from the interaction of the two previously described variables. The control variables are defined in Table 15, in Appendix A. The coefficients are in line with each variable, with respective t-statistics underneath in parentheses. Regressions include fixed effects based on year, acquirer country, and acquirer industry. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Dependent Variable	Acquirer CAR					
Hypothesis	H1			H1.1		
Event Window	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Model	(1)	(2)	(3)	(4)	(5)	(6)
Target R&D-Intensive x High-Tech	-	-	-	0.0152*	0.0066	0.0011
	-	-	-	(1.95)	(0.77)	(0.10)
High-Tech	-	-	-	-0.0179***	-0.0210***	-0.0129
	-	-	-	(-2.66)	(-2.91)	(-1.38)
Target R&D-Intensive	-0.0024	0.0003	0.0036	-0.0058	0.0006	0.0049
	(-0.63)	(0.07)	(0.65)	(-1.20)	(0.10)	(0.69)
Acquirer Market-to-Book	0.0005	0.0003	0.0005	0.0006	0.0004	0.0005
	(1.14)	(0.58)	(0.72)	(1.24)	(0.74)	(0.82)
Acquirer Size	-0.0037***	-0.0042***	-0.0041***	-0.0038***	-0.0042***	-0.0041***
	(-3.55)	(-3.52)	(-2.77)	(-3.63)	(-3.52)	(-2.74)
Acquirer Leverage	0.0286**	0.0174	0.0055	0.0282*	0.0152	0.0036
	(1.97)	(0.99)	(0.24)	(1.94)	(0.86)	(0.16)

Table 10 (continued)

Dependent Variable	Acquirer CAR					
Hypothesis	H1			H1.1		
Event Window	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Model	(1)	(2)	(3)	(4)	(5)	(6)
Cash Only	0.0185***	0.0216***	0.0190***	0.0193***	0.0233***	0.0202***
	(4.53)	(4.77)	(3.48)	(4.70)	(5.12)	(3.66)
Stock Only	0.0026	0.0043	0.0070	0.0027	0.0046	0.0073
	(0.48)	(0.70)	(0.91)	(0.49)	(0.74)	(0.94)
Friendly	-0.0067	-0.0126	-0.0139	-0.0056	-0.0108	-0.0127
	(-0.64)	(-1.22)	(-1.27)	(-0.54)	(-1.04)	(-1.15)
Cross-Border	0.0023	0.0037	0.0027	0.0024	0.0037	0.0027
	(0.57)	(0.76)	(0.44)	(0.60)	(0.77)	(0.44)
Same Industry	0.0001	-0.0017	-0.0023	0.0006	-0.0006	-0.0015
	(0.02)	(-0.38)	(-0.41)	(0.15)	(-0.13)	(-0.27)
Deal Relative Size	-0.0041**	-0.0056**	-0.0066**	-0.0041**	-0.0056**	-0.0066**
	(-1.99)	(-2.38)	(-1.97)	(-2.00)	(-2.40)	(-1.97)
Constant	0.1173***	0.1321***	0.1776***	0.1181***	0.1293**	0.1749***
	(3.07)	(2.68)	(3.76)	(3.04)	(2.58)	(3.68)
FE: Year, Acquirer Country, Acquirer Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,272	2,272	2,272	2,272	2,272	2,272
R-squared	0.077	0.072	0.053	0.080	0.076	0.055

Table 11 – Regressions regarding H2 and H2.1

This table presents the regression results for H2 (models 1, 2, and 3) and H2.1 (models 4, 5, and 6). The combined *CAR* (cumulative abnormal returns) are estimated using three event windows: a 3-day period (-1, +1), a 5-day period (-2, +2), and an 11-day period (-5, +5). The estimation window is (-270, -30). *Target R&D-Intensive* is a dummy variable that equals one if the target firm's R&D intensity is higher than the median and zero otherwise. R&D intensity is measured by the ratio of R&D expenditures to total assets. *High-Tech* is a dummy variable that equals one if the target firm is from a high-tech industry and zero otherwise. The interaction variable, *Target R&D-Intensive x High-Tech*, results from the interaction of the two previously described variables. The control variables are defined in Table 15, in Appendix A. The coefficients are in line with each variable, with respective t-statistics underneath in parentheses. Regressions include fixed effects based on year, acquirer country, and acquirer industry. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Dependent Variable	Combined CAR					
Hypothesis	H2			H2.1		
Event Window	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Model	(1)	(2)	(3)	(4)	(5)	(6)
Target R&D-Intensive x High-Tech	-	-	-	0.0121	0.0071	0.0081
	-	-	-	(1.63)	(0.86)	(0.77)
High-Tech	-	-	-	-0.0159**	-0.0201***	-0.0187**
	-	-	-	(-2.44)	(-2.81)	(-2.13)
Target R&D-Intensive	-0.0109***	-0.0059	-0.0045	-0.0134***	-0.0060	-0.0051
	(-2.98)	(-1.41)	(-0.85)	(-2.81)	(-1.11)	(-0.75)
Acquirer Market-to-Book	-0.0003	-0.0004	-0.0001	-0.0003	-0.0003	-0.0000
	(-0.76)	(-0.75)	(-0.17)	(-0.65)	(-0.59)	(-0.07)
Acquirer Size	-0.0042***	-0.0052***	-0.0058***	-0.0042***	-0.0053***	-0.0058***
	(-4.11)	(-4.63)	(-4.07)	(-4.18)	(-4.64)	(-4.08)
Acquirer Leverage	0.0400***	0.0383**	0.0213	0.0395***	0.0363**	0.0197
	(2.69)	(2.25)	(0.99)	(2.65)	(2.13)	(0.91)

Table 11 (continued)

Dependent Variable	Combined CAR					
Hypothesis	H2			H2.1		
Event Window	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Model	(1)	(2)	(3)	(4)	(5)	(6)
Cash Only	0.0068*	0.0091**	0.0057	0.0077*	0.0107**	0.0072
	(1.65)	(2.04)	(1.08)	(1.88)	(2.41)	(1.34)
Stock Only	-0.0105*	-0.0099*	-0.0125*	-0.0104*	-0.0095	-0.0122
	(-1.91)	(-1.65)	(-1.67)	(-1.88)	(-1.59)	(-1.63)
Friendly	-0.0106	-0.0151	-0.0167	-0.0099	-0.0137	-0.0154
	(-0.87)	(-1.19)	(-1.34)	(-0.80)	(-1.07)	(-1.23)
Cross-Border	0.0019	0.0045	0.0075	0.0019	0.0046	0.0076
	(0.46)	(0.95)	(1.27)	(0.47)	(0.97)	(1.28)
Same Industry	0.0053	0.0037	0.0029	0.0057	0.0046	0.0037
	(1.31)	(0.85)	(0.56)	(1.43)	(1.08)	(0.72)
Deal Relative Size	0.0010	-0.0008	-0.0019	0.0009	-0.0009	-0.0019
	(0.46)	(-0.36)	(-0.59)	(0.45)	(-0.38)	(-0.60)
Constant	0.1981***	0.2079***	0.2729***	0.1982***	0.2052***	0.2709***
	(6.00)	(5.91)	(7.11)	(6.12)	(5.81)	(7.10)
FE: Year, Acquirer Country, Acquirer Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,184	2,184	2,184	2,184	2,184	2,184
R-squared	0.081	0.071	0.052	0.084	0.074	0.054

4.2.2. THE IMPACT ON THE PREMIUM

Table 12 focuses on the premium paid by the acquiring firm and presents the regressions for H3 and H3.1. The former expects a positive correlation between the target firm's R&D intensity and the premium. H3.1 predicts that this positive effect is amplified when the target firm is from a high-tech industry.

In this case, results depend on the way R&D intensity is measured. When it is based on total assets, the variable *Target R&D-Intensive* is not statistically significant (model 1). In contrast, it is positive and significant at 5% when R&D intensity is based on sales (model 1A). Therefore, the target firm's R&D intensity can positively impact the premium the acquiring firm pays. In this study, the premium is, on average, 9.32pp higher in deals involving R&D-intensive target firms. This is in line with research by Madura et al. (2012).

Also with a positive coefficient is the variable *High-Tech* (model 3). This corroborates the research by Kohers and Kohers (2000). These authors show that high-tech target firms receive higher premiums since acquirers are willing to pay for the growth prospects offered.

The interaction variable *(Target R&D-Intensive x High-Tech)* is not associated with statistically significant results. Therefore, there is no evidence that the relationship between R&D-intensive target firms and the premium paid by the acquiring firm varies based on the target firm's industry.

Regarding control variables, the acquirer's size is positively correlated with the premium, expected according to Moeller et al. (2004). This may indicate that hubris is a part of bigger firms' decision-making process. Concerning the impact of target characteristics, the target's size is negatively correlated with the premium, which could signify that bigger targets are associated with higher integration costs, as Alexandridis et al. (2013) and Dionne et al. (2015) defend. Nonetheless, contrary to the conclusions of Dionne et al. (2015), the target firm's leverage is associated with a positive coefficient. Regarding the payment method, all-stock offers are negatively correlated with the premium. When it comes to the deal's relative size, it is positively correlated with the premium, against research by Gondhalekar et al. (2004). Finally, competitive bidding (where the number of bidders is higher than one, including the acquirer) positively impacts the premium, as expected (Rossi & Volpin, 2004; Alexandridis et al., 2010; Rossi et al., 2013).

To sum up, the results confirm H3. So, R&D-intensive target firms have a positive impact on the premium. H3.1 is neither confirmed nor denied due to the lack of statistically significant data. Therefore, the fact that the target firm is from a high-tech industry does not seem to influence the impact of the target firm's

R&D intensity on the premium. However, by themselves, high-tech target firms are positively correlated with the premium.

These results regarding the premium help to explain the results for the acquirer and the combined CAR. In general, the target firm's R&D intensity is positively correlated with the premium paid by the acquiring firm. One possible cause could be the big expectations of the higher levels of R&D and how that would be beneficial (Laamanem, 2007; Madura et al., 2012). However, if the enthusiasm displayed is in excess, the acquirers can overpay for the target firms, causing adverse market reactions. This could explain the negative impact of the target firm's R&D intensity on the combined CAR, meaning it is not a source of value creation. Thus, it can be speculated that the target CAR is insufficient to offset the acquirer CAR's negative impact on the combined CAR. Also, the results for the acquirer CAR are not statistically significant, which could mean there is no unanimous opinion regarding whether acquiring R&D will be advantageous or worth the premium paid. This can derive from the difficulty and complexity of valuing R&D (Higgins & Rodriguez, 2006). Furthermore, these results show how the market is sceptic about the true value of the R&D acquired and if it will be favourable for the acquiring firm. In reality, it is not certain that acquiring firms will use/explore efficiently the knowledge and technology acquired and that they will benefit from it.

When studying the impact of R&D-intensive target firms from high-tech industries, its impact on the combined CAR and the premium is not statistically significant. On the other hand, the impact on the acquirer CAR is positive. This means that in high-tech industries, where R&D plays a more significant role, the market reacts more positively to the acquisition of R&D-intensive target firms. In other words, the combination of R&D-intensive and high-tech target firms has a positive effect. It is possible that, in this case, the market and the acquiring firm are more in agreement regarding the benefits of R&D.

In summary, findings seem to demonstrate that, in general, R&D can lead to a higher premium and have a negative impact on the combined shareholders' abnormal returns at the time of the M&A announcement. Nonetheless, when the target firm is from a high-tech industry, its R&D intensity is seen as more beneficial and generates more gains for the acquirer shareholders. Thus, the impact of R&D-intensive target firms on acquirer CAR might depend on the target firm's industry.

Table 12 – Regressions regarding H3 and H3.1 (plus robustness test)

This table presents the regression results for H3 (models 1 and 1A) and H3.1 (models 2, 2A, and 3). The dependent variable is the relative value of the premium of offer price to the target closing stock price 4 weeks before the original announcement date. *Target R&D-Intensive* is a dummy variable that equals one if the target firm's R&D intensity is higher than the median and zero otherwise. *High-Tech* is a dummy variable that equals one if the target firm is from a high-tech industry and zero otherwise. The interaction variable, *Target R&D-Intensive x High-Tech*, results from the interaction of the two previously described variables. In models 1 and 2, R&D intensity is measured by the ratio of R&D expenditures to total assets. In models 1A and 2A, R&D intensity is measured by the ratio of R&D expenditures to sales. The control variables are defined in Table 15, in Appendix A. The coefficients are in line with each variable, with respective t-statistics underneath in parentheses. Regressions include fixed effects based on year, acquirer country, and acquirer industry. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Dependent Variable	Premium				
Hypothesis	H3		H3.1		
Model	(1)	(1A)	(2)	(2A)	(3)
Target R&D-Intensive x High-Tech	-	-	-0.0080	0.0232	-
	-	-	(-0.11)	(0.31)	-
High-Tech	-	-	0.0889	0.0597	0.0959**
	-	-	(1.60)	(1.19)	(2.32)
Target R&D-Intensive	0.0555	0.0932**	0.0342	0.0649	-
	(1.31)	(2.38)	(0.57)	(1.27)	-
Acquirer Market-to-Book	-0.0030	-0.0031	-0.0032	-0.0033	-0.0031
	(-0.68)	(-0.69)	(-0.71)	(-0.74)	(-0.68)
Acquirer Size	0.0439***	0.0415***	0.0430***	0.0410***	0.0435***
	(3.03)	(2.90)	(2.98)	(2.87)	(3.02)
Acquirer Leverage	0.1586	0.1659	0.1655	0.1707	0.1653
	(0.96)	(1.01)	(1.00)	(1.03)	(1.00)
Target Market-to-Book	-0.0065	-0.0065	-0.0065	-0.0065	-0.0065
	(-1.49)	(-1.50)	(-1.49)	(-1.50)	(-1.47)
Target Size	-0.0654***	-0.0620***	-0.0629***	-0.0604***	-0.0634***
	(-4.53)	(-4.42)	(-4.34)	(-4.26)	(-4.42)
Target Leverage	0.2220	0.2395*	0.2203	0.2381*	0.2113
	(1.63)	(1.74)	(1.63)	(1.73)	(1.57)
Cash Only	0.0396	0.0386	0.0328	0.0310	0.0342
	(1.07)	(1.05)	(0.88)	(0.82)	(0.92)
Stock Only	-0.0779*	-0.0801*	-0.0803*	-0.0825*	-0.0805*
	(-1.78)	(-1.82)	(-1.83)	(-1.89)	(-1.84)

Table 12 (continued)

Dependent Variable	Premium				
Hypothesis	H3		H3.1		
Model	(1)	(1A)	(2)	(2A)	(3)
Friendly	0.1310	0.1360	0.1208	0.1272	0.1159
	(1.43)	(1.47)	(1.32)	(1.37)	(1.25)
Cross-Border	-0.0116	-0.0086	-0.0102	-0.0085	-0.0094
	(-0.28)	(-0.21)	(-0.25)	(-0.21)	(-0.23)
Same Industry	-0.0053	-0.0069	-0.0113	-0.0122	-0.0110
	(-0.17)	(-0.22)	(-0.37)	(-0.39)	(-0.36)
Deal Relative Size	0.0336*	0.0320*	0.0327*	0.0315*	0.0327*
	(1.94)	(1.82)	(1.84)	(1.76)	(1.84)
Shares at Announcement	-0.2336	-0.2365	-0.2534	-0.2484	-0.2615
	(-1.09)	(-1.10)	(-1.20)	(-1.18)	(-1.24)
Competitive Bidding	0.2549***	0.2601***	0.2555***	0.2596***	0.2549***
	(3.20)	(3.27)	(3.19)	(3.24)	(3.18)
Constant	0.3650	0.3442	0.3524	0.3440	0.3584
	(1.29)	(1.20)	(1.25)	(1.22)	(1.29)
FE: Year, Acquirer Country, Acquirer Industry	Yes	Yes	Yes	Yes	Yes
Observations	1,229	1,229	1,229	1,229	1,229
R-squared	0.154	0.157	0.157	0.159	0.156

4.3. ADDITIONAL ANALYSIS: THE CASE OF US TARGETS

There are differences between the United States (US) and the European Union (EU) countries, some of which are part of the sample, and the gap has widened. One key difference is that the US is more focused on high R&D intensity sectors, while most of the EU R&D investment is in sectors with low or medium R&D intensity (Moncada-Paternò-Castello & Grassano, 2020). Therefore, testing the impact of R&D intensity and high-tech transactions when the target is from the US becomes relevant. To do so, the dummy variable *US Only* is created, which equals one if the target company is from the US and zero otherwise. The other variables used are described in Table 15, in Appendix A. So, the main variables of interest in the following analyses are *High-Tech x US Only* and *Target R&D-Intensive x US Only.*

Table 13 presents the regressions of the impact of US target firms on the acquirer CAR. Regarding high-tech deals, the interaction variable *High-Tech x US Only* does not present statistically significant results. So, the combination of US high-tech targets does not present a significant effect. On the other hand, when focusing on R&D intensity, the interaction variable *Target R&D-Intensive x US Only* has a negative coefficient, statistically significant at 10%, in the 5-day (model 4A) and 11-day (model 6) event windows. Taking model 6 as an example, R&D-intensive target firms from the US lead to an average decrease of 1.85pp on the acquirer CAR (-5, +5).

Table 14 presents the regressions of the impact of US target companies on the combined CAR. The qualitative interpretations are similar. The variable *High-Tech x US Only* continues not to present statistically significant results. In contrast, the variable *Target R&D-Intensive x US Only* has a negative impact on the combined CAR (models 4, 4A, and 6A).

Regarding the premium, none of the variables of primary interest has statistically significant results (Table 21, in Appendix D), meaning it is not possible to make any interpretation.

In summary, the fact that the target firm is from the US does not seem to affect the impact of high-tech target firms on acquirer CAR, combined CAR, and premium. However, it is a different scenario when it comes to R&D intensity. In this case, the effect of R&D intensity may depend on whether the target firm is from the US.

Findings show evidence that supports a negative impact of R&D-intensive targets from the US on the acquirer CAR, meaning this combination of factors has a negative effect. Therefore, the fact that the target firm is from the US can negatively impact the relationship between R&D-intensive target firms and the acquirer CAR. Research by authors such as Rossi and Volpin (2004) and Alexandridis et al. (2010)

concludes that the premium paid is higher in the US compared to other countries, which limits the value created for the acquirer shareholders. These authors also mention that M&A activity is more intense, and the level of competition is higher. Since the results for the premium are not statistically significant (Table 21, in Appendix D), this study cannot fully corroborate this theory. Despite this, some descriptive statistics agree with this research. The US is, in fact, the country in which M&A activity is more intense (Table 2, in Chapter 3). When ranking countries from highest to lowest average premium paid based on the target country (Table 22, in Appendix D), the US is in fourth place (46.68%) out of the sixteen countries, although the premium is slightly lower than the average of the total sample (46.89%). However, the US does not stand out that much when it comes to the percentage of deals involving competitive bidding (4.11%), which is also below the total sample's average (4.39%). When ranking countries from highest to lowest percentage of deals that involve competitive bidding based on the target country (Table 22, in Appendix D), the US is in ninth place.

Regarding the value created by the deal, measured by the combined CAR, R&D-intensive targets from the US continue to be associated with a negative coefficient. This analysis adds that US target firms can have a negative effect on the impact of R&D-intensive target firms on the combined CAR. Because the US is more focused on R&D, the acquirer's expectations of the benefits of the R&D being acquired may be too high, causing a more negative market reaction. As for the acquirer CAR, the premium may help explain why the combination of US high-tech target firms has a negative effect.

Table 13 – Regressions regarding the impact of US targets on the acquirer CAR

This table presents the regression regarding the impact of US targets on the acquirer CAR, when the target firms are from high-tech industries (models 1, 3, and 5) and when R&D-intensive target firms are involved. In models 2, 4, and 6, R&D intensity is measured by the ratio of R&D expenditures to total assets. In models 2A, 4A, and 6A, R&D intensity is measured by the ratio of R&D expenditures to sales. *CAR* (cumulative abnormal returns) are estimated using three event windows: a 3-day period (-1, +1), a 5-day period (-2, +2), and an 11-day period (-5, +5). The estimation window is (-270, -30). *High-Tech* is a dummy variable that equals one if the target firm is from a high-tech industry and zero otherwise. *Target R&D-Intensive* is a dummy variable that equals one if the target firm's R&D intensity is higher than the median and zero otherwise. *US Only* is a dummy variable that equals one if the target firm is from the US and zero otherwise. *High-Tech x US Only* results from the interaction of the variables *High-Tech* and *US Only. Target R&D-Intensive x US Only* results from the interaction of the variables *Target R&D-Intensive* and *US Only.* The control variables are defined in Table 15, in Appendix A. The coefficients are in line with each variable, with respective t-statistics underneath in parentheses. Regressions include fixed effects based on year, acquirer country, and acquirer industry. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Dependent variable	Acquirer CAR								
Event Window	(-1, +1)			(-2, +2)			(-5, +5)		
Model	(1)	(2)	(2A)	(3)	(4)	(4A)	(5)	(6)	(6A)
High-Tech x US Only	-0.0009	-	-	0.0055	-	-	0.0009	-	-
	(-0.12)	-	-	(0.64)	-	-	(0.08)	-	-
High-Tech	-0.0077	-	-	-0.0194**	-	-	-0.0112	-	-
	(-1.15)	-	-	(-2.56)	-	-	(-1.14)	-	-
Target R&D-Intensive x US Only	-	-0.0023	-0.0073	-	-0.0131	-0.0156*	-	-0.0185*	-0.0175
	-	(-0.31)	(-0.96)	-	(-1.57)	(-1.86)	-	(-1.72)	(-1.64)
Target R&D-Intensive	-	-0.0011	0.0030	-	0.0070	0.0111*	-	0.0131	0.0147*
	-	(-0.21)	(0.53)	-	(1.12)	(1.75)	-	(1.58)	(1.83)
US Only	-0.0019	-0.0011	0.0017	-0.0092	-0.0002	0.0014	-0.0106	-0.0006	-0.0008
	(-0.34)	(-0.18)	(0.28)	(-1.41)	(-0.03)	(0.20)	(-1.35)	(-0.07)	(-0.09)

Table 13 (continued)

Dependent variable	Acquirer CAR								
Event Window	(-1, +1)			(-2, +2)			(-5, +5)		
Model	(1)	(2)	(2A)	(3)	(4)	(4A)	(5)	(6)	(6A)
Acquirer Market-to-Book	0.0006	0.0005	0.0005	0.0004	0.0003	0.0003	0.0006	0.0005	0.0005
	(1.22)	(1.15)	(1.14)	(0.78)	(0.62)	(0.59)	(0.87)	(0.77)	(0.75)
Acquirer Size	-0.0036***	-0.0036***	-0.0036***	-0.0041***	-0.0039***	-0.0039***	-0.0039**	-0.0037**	-0.0038**
	(-3.32)	(-3.42)	(-3.35)	(-3.31)	(-3.23)	(-3.20)	(-2.58)	(-2.47)	(-2.50)
Acquirer Leverage	0.0273*	0.0287**	0.0287**	0.0155	0.0180	0.0179	0.0045	0.0064	0.0062
	(1.88)	(1.98)	(1.97)	(0.88)	(1.02)	(1.02)	(0.20)	(0.28)	(0.27)
Cash Only	0.0193***	0.0186***	0.0184***	0.0236***	0.0219***	0.0215***	0.0210***	0.0194***	0.0191***
	(4.70)	(4.56)	(4.49)	(5.20)	(4.85)	(4.74)	(3.82)	(3.58)	(3.50)
Stock Only	0.0028	0.0027	0.0026	0.0047	0.0045	0.0042	0.0075	0.0073	0.0070
	(0.51)	(0.48)	(0.47)	(0.76)	(0.72)	(0.69)	(0.96)	(0.94)	(0.90)
Friendly	-0.0054	-0.0063	-0.0061	-0.0104	-0.0115	-0.0113	-0.0119	-0.0122	-0.0122
	(-0.53)	(-0.61)	(-0.60)	(-1.00)	(-1.12)	(-1.10)	(-1.08)	(-1.11)	(-1.11)
Cross-Border	0.0020	0.0020	0.0018	0.0034	0.0024	0.0025	0.0018	0.0009	0.0012
	(0.48)	(0.48)	(0.45)	(0.70)	(0.50)	(0.52)	(0.29)	(0.15)	(0.19)
Same Industry	0.0007	0.0003	0.0002	0.0000	-0.0010	-0.0011	-0.0005	-0.0013	-0.0013
	(0.17)	(0.07)	(0.05)	(0.01)	(-0.21)	(-0.24)	(-0.08)	(-0.22)	(-0.23)
Deal Relative Size	-0.0041**	-0.0041**	-0.0040**	-0.0055**	-0.0055**	-0.0055**	-0.0065*	-0.0066*	-0.0065*
	(-1.98)	(-1.97)	(-1.97)	(-2.35)	(-2.36)	(-2.34)	(-1.94)	(-1.95)	(-1.93)
Constant	0.1136***	0.1163***	0.1146***	0.1297***	0.1282***	0.1267***	0.1755***	0.1719***	0.1716***
	(2.95)	(3.03)	(3.00)	(2.61)	(2.62)	(2.58)	(3.68)	(3.65)	(3.65)

Table 13 (continued)

Dependent variable	Acquirer CAR								
Event Window	(-1, +1)			(-2, +2)			(-5, +5)		
Model	(1)	(2)	(2A)	(3)	(4)	(4A)	(5)	(6)	(6A)
FE: Year, Acquirer Nation, Acquirer Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,272	2,272	2,272	2,272	2,272	2,272	2,272	2,272	2,272
R-squared	0.078	0.077	0.078	0.076	0.074	0.074	0.055	0.056	0.056

Table 14 – Regressions regarding the impact of US targets on the combined CAR

This table presents the regression regarding the impact of US targets on the combined CAR, when the target firms are from high-tech industries (models 1, 3, and 5) and when R&D-intensive target firms are involved. In models 2, 4, and 6, R&D intensity is measured by the ratio of R&D expenditures to total assets. In models 2A, 4A, and 6A, R&D intensity is measured by the ratio of R&D expenditures to sales. *CAR* (cumulative abnormal returns) are estimated using three event windows: a 3-day period (-1, +1), a 5-day period (-2, +2), and an 11-day period (-5, +5). The estimation window is (-270, -30). *High-Tech* is a dummy variable that equals one if the target firm is from a high-tech industry and zero otherwise. *Target R&D-Intensive* is a dummy variable that equals one if the target firm's R&D intensity is higher than the median and zero otherwise. *US Only* is a dummy variable that equals one if the target firm is from the US and zero otherwise. *High-Tech x US Only* results from the interaction of the variables *High-Tech* and *US Only. Target R&D-Intensive x US Only* results from the interaction of the variables *Target R&D-Intensive* and *US Only.* The control variables are defined in Table 15, in Appendix A. The coefficients are in line with each variable, with respective t-statistics underneath in parentheses. Regressions include fixed effects based on year, acquirer country, and acquirer industry. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Dependent variable	Combined CAR								
Event Window	(-1, +1)			(-2, +2)			(-5, +5)		
Model	(1)	(2)	(2A)	(3)	(4)	(4A)	(5)	(6)	(6A)
High-Tech x US Only	0.0011	-	-	0.0032	-	-	-0.0004	-	-
	(0.15)	-	-	(0.39)	-	-	(-0.04)	-	-
High-Tech	-0.0113	-	-	-0.0185**	-	-	-0.0140	-	-
	(-1.63)	-	-	(-2.46)	-	-	(-1.53)	-	-
Target R&D-Intensive x US Only	-	-0.0035	-0.0118	-	-0.0148*	-0.0198**	-	-0.0081	-0.0171*
	-	(-0.49)	(-1.64)	-	(-1.85)	(-2.49)	-	(-0.80)	(-1.71)
Target R&D-Intensive	-	-0.0094*	-0.0017	-	0.0011	0.0061	-	-0.0009	0.0068
	-	(-1.80)	(-0.33)	-	(0.18)	(1.01)	-	(-0.12)	(0.90)
US Only	0.0027	0.0057	0.0101*	-0.0013	0.0083	0.0112*	0.0052	0.0095	0.0145*
	(0.48)	(1.00)	(1.73)	(-0.21)	(1.30)	(1.75)	(0.66)	(1.17)	(1.81)

Table 14 (continued)

Dependent variable	Combined CAR								
Event Window	(-1, +1)			(-2, +2)			(-5, +5)		
Model	(1)	(2)	(2A)	(3)	(4)	(4A)	(5)	(6)	(6A)
Acquirer Market-to-Book	-0.0003	-0.0003	-0.0004	-0.0003	-0.0004	-0.0004	-0.0001	-0.0001	-0.0001
	(-0.72)	(-0.76)	(-0.81)	(-0.62)	(-0.74)	(-0.79)	(-0.09)	(-0.17)	(-0.20)
Acquirer Size	-0.0040***	-0.0043***	-0.0041***	-0.0051***	-0.0052***	-0.0051***	-0.0058***	-0.0059***	-0.0058***
	(-3.87)	(-4.16)	(-3.97)	(-4.46)	(-4.52)	(-4.42)	(-4.01)	(-4.08)	(-4.00)
Acquirer Leverage	0.0381**	0.0398***	0.0395***	0.0358**	0.0385**	0.0381**	0.0188	0.0211	0.0209
	(2.56)	(2.68)	(2.66)	(2.10)	(2.26)	(2.24)	(0.87)	(0.98)	(0.97)
Cash Only	0.0065	0.0067	0.0062	0.0102**	0.0092**	0.0087*	0.0066	0.0056	0.0051
	(1.58)	(1.63)	(1.50)	(2.29)	(2.08)	(1.96)	(1.24)	(1.06)	(0.96)
Stock Only	-0.0105*	-0.0106*	-0.0105*	-0.0096	-0.0098	-0.0099*	-0.0123	-0.0126*	-0.0127*
	(-1.91)	(-1.92)	(-1.92)	(-1.60)	(-1.64)	(-1.67)	(-1.64)	(-1.68)	(-1.70)
Friendly	-0.0094	-0.0110	-0.0107	-0.0134	-0.0151	-0.0150	-0.0158	-0.0172	-0.0171
	(-0.79)	(-0.91)	(-0.89)	(-1.06)	(-1.20)	(-1.20)	(-1.26)	(-1.39)	(-1.38)
Cross-Border	0.0024	0.0021	0.0018	0.0049	0.0039	0.0038	0.0080	0.0076	0.0074
	(0.58)	(0.50)	(0.42)	(1.02)	(0.82)	(0.80)	(1.34)	(1.27)	(1.24)
Same Industry	0.0050	0.0051	0.0048	0.0044	0.0040	0.0037	0.0032	0.0027	0.0026
	(1.25)	(1.26)	(1.18)	(1.04)	(0.92)	(0.86)	(0.63)	(0.52)	(0.49)
Deal Relative Size	0.0009	0.0009	0.0009	-0.0009	-0.0009	-0.0008	-0.0020	-0.0020	-0.0019
	(0.44)	(0.43)	(0.45)	(-0.37)	(-0.38)	(-0.35)	(-0.62)	(-0.62)	(-0.60)
Constant	0.1913***	0.1988***	0.1963***	0.2027***	0.2062***	0.2052***	0.2690***	0.2734***	0.2714***
	(5.95)	(6.01)	(5.97)	(5.74)	(5.83)	(5.84)	(6.99)	(7.07)	(7.07)

Table 14 (continued)

Dependent variable	Combined CAR								
Event Window	(-1, +1)			(-2, +2)			(-5, +5)		
Model	(1)	(2)	(2A)	(3)	(4)	(4A)	(5)	(6)	(6A)
FE: Year, Acquirer Nation, Acquirer Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,184	2,184	2,184	2,184	2,184	2,184	2,184	2,184	2,184
R-squared	0.080	0.082	0.081	0.074	0.072	0.073	0.054	0.053	0.053

FINAL CONSIDERATIONS, LIMITATIONS, AND FUTURE RESEARCH

The main goal of this study is to examine the impact of the target firm's R&D intensity on M&A outcomes, specifically, on shareholders' abnormal returns at the time of the M&A announcement. The premium paid by the acquiring firm is also a subject of study. The sample comprises 2620 M&A deals involving publicly traded companies from North American and Western European countries from 2007-2021.

The first hypothesis, H1, predicts a negative correlation between the target firm's R&D intensity and the acquirer CAR. Neither univariate nor multivariate analysis is associated with statistically significant results. Therefore, H1 is neither proven nor refuted. Nevertheless, results indicate a positive correlation between the acquirer CAR and R&D intensity when the target firm belongs to a high-tech industry, refuting H1.1. The difference in medians is also evidence against this hypothesis. Concluding, the impact of R&D-intensive target firms on acquirer CAR might depend on the target firm's industry.

Regarding the combined CAR, univariate and multivariate analysis results refute H2, which predicts a positive impact of R&D, as some tests show how R&D-intensive targets are negatively correlated with the combined CAR. Regarding H2.1, univariate analysis shows that CAR are lower in the group where R&D-intensive and high-tech target firms are involved. This could be evidence against this hypothesis, which predicts an amplified positive correlation. However, this result does not constitute evidence enough to refute H2.1. Since the results from the multivariate analysis are not statistically significant, H2.1 is neither proven nor refuted. Therefore, there is no evidence that high-tech target firms influence the relationship between the target firm's R&D intensity and the combined CAR.

Concerning the premium, results from the univariate and multivariate analyses confirm H3, which predicts a positive correlation between R&D intensity and the premium. This is consistent with previous literature. H3.1 predicts an amplified positive effect when the target firm is from a high-tech industry. The results from the univariate analysis indicate that this hypothesis might be correct. However, the results from the multivariate analysis can neither confirm nor deny H3.1. In other words, even though high-tech targets are positively correlated with the premium, this effect does not seem to influence the impact of the target's firm R&D intensity on the premium.

To sum up, R&D-intensive target firms receive higher premiums than the others, which could explain the negative impact of R&D intensity on the combined CAR. Acquirers may show excessive enthusiasm, thinking they will highly benefit from the growth prospects, and end up overpaying, also possibly due to the higher uncertainty around R&D. Nevertheless, when the target firm is from a high-tech industry, R&D

intensity positively impacts the acquirer CAR, which means the market and the acquiring firms are more in tune about the potential benefits of acquiring R&D-intensive firms. In other words, the combination of R&D-intensive and high-tech target firms has a positive effect on acquirer shareholders' abnormal returns.

When focusing on US targets, there is no evidence that the fact that the target firm is from the US affects the impact of high-tech target firms on acquirer CAR, combined CAR, and premium. On the other hand, results show that R&D-intensive target firms from the US negatively impact the acquirer and combined CAR. That is, this combination of factors has a negative effect. Even though this study does not fully corroborate this theory, previous literature states that a possible explanation is the higher premium in this country due to more intense M&A activity and higher levels of competition. In this study, the US is, in fact, the country with the highest number of deals in the sample and is the fourth country with the highest premium. Still, it does not seem to be the country with the highest level of competitive bidding. Also, the results for the premium in the regressions are not statistically significant.

Some of these results are not very robust. For instance, results for the impact of the interaction between R&D intensity and high-tech target firms on the acquirer CAR are only statistically significant at 10% in one event window. The impact of R&D-intensive targets on the combined CAR is also only statistically significant in the shorter event window, although it is significant at 1% (using the primary measure of R&D intensity) and 5% (using the secondary measure). Furthermore, the premium results in the main multivariate analysis are only statistically significant when using the secondary measure of R&D intensity. Finally, the results from the additional analysis are only statistically significant in some models.

One limitation of this study is that it only considers publicly traded target companies, apart from having to be majority acquisitions, in which the deal value is at least $1 million. The aim is to enable comparison with other research and easier access to accounting information besides estimating combined CAR. Nonetheless, it prevents studying the impact of the target firm's R&D intensity on CAR if the target is a private and smaller company. The fact that the target firm is public also causes a negative impact on CAR, and this effect should not be forgotten. Still, there is a lack of information available regarding R&D expenditures, which is a possible cause of some statistically insignificant results.

For future research, apart from having a larger sample size, including private target companies could lead to more statistically significant results. Additionally, the OLS regressions should consider other measures of market competitiveness, such as the percentage of listed companies within a country targeted in completed deals in a specific year (Alexandridis et al., 2010), besides competitive bids. The aim is to explain better the possible negative moderating effect of US target firms.

Regarding the measures of R&D intensity, this study uses R&D inputs, such as expenses, which could be why some results are statistically insignificant. So, in a further and more complex study, R&D output, such as patent count and citations, would be of interest to measure R&D performance. It would also be interesting to know if the market and the companies are aware of and follow the results of academic research to understand whether this contributes to their decision-making process, for instance, through inquiries. The last suggestion is to test a different definition of high-tech industries and examine if there are any significant differences in results.

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APPENDICES

APPENDIX A – METHODOLOGY

Table 15 – Variables' names, definitions, and sources

This table shows each variable's name, definition, and source of information.

Variable	Name	Definition	Source
CAR	Cumulative abnormal returns	Absolute value of cumulative abnormal returns over a 3-day (-1, +1), 5-day (-2, +2) and 11-day (-5, +5) event windows. The estimation window is (-270, -30).	Datastream
Premium	Premium	Relative value of premium of offer price to target closing stock price 4 weeks before the original announcement date.	SDC
TargetR&DIntensive	Target R&D-Intensive	Dummy variable that equals one if the target firm has an R&D intensity higher than the median, and zero otherwise.	Worldscope
HighTech	High-Tech	Dummy variable that equals one if the target firm is from a high-tech industry, and zero otherwise.	(Kile & Phillips, 2009)
AMB	Acquirer Market-to-Book	Equity market-to-book value of the acquiring firm at the end of the year before the M&A announcement.	Datastream and Wordscope
ASize	Acquirer Size	Natural logarithm of the acquiring firm's total assets, adjusted using CPI - 2021, at the end of the year before the M&A announcement.	Worldscope
ALeverage	Acquirer Leverage	Ratio of the acquiring firm's total debt to total assets at the end of the year before the M&A announcement.	Worldscope
TMB	Target Market-to-Book	Equity market-to-book value of the target firm at the end of the year before the M&A announcement.	Datastream and Wordscope

Table 15 (continued)

Variable	Name	Definition	Source
TSize	Target Size	Natural logarithm of the target firm's total assets, adjusted using CPI - 2021, at the end of the year before the M&A announcement.	Worldscope
TLeverage	Target Leverage	Ratio of the target firm's total debt to total assets at the end of the year before the M&A announcement.	Worldscope
CashOnly	Cash Only	Dummy variable that equals one if the payment is all in cash, and zero otherwise.	SDC
StockOnly	Stock Only	Dummy variable that equals one if payment is all in stock, and zero otherwise.	SDC
Friendly	Friendly	Dummy variable that equals one if the offer attitude is friendly, and zero otherwise.	SDC
CrossBorder	Cross Border	Dummy variable that equals one if the acquirer and target companies are from different countries, and zero otherwise.	SDC
SameIndustry	Same Industry	Dummy variable that equals one if the acquirer and target companies are from the same industry, and zero otherwise.	SDC
DealRelSize	Deal Relative Size	Ratio of the deal value to the acquirer's total assets at the end of the year before the M&A announcement.	SDC and Worldscope
SharesAnnouncement	Shares at Announcement	Relative value of the acquirer's percentage of stake in the target firm before the M&A.	SDC
CompetitiveBidding	Competitive Bidding	Dummy variable that equals one if the number of bidders is more than one (including the acquirer), and zero otherwise.	SDC

Table 16 – Correlation matrix

This table shows the results of the Pearson Correlation Matrix for the variables used in univariate and multivariate analysis.

Panel A										
	TargetR&D Intensive (assets)	*TargetR&D Intensive (sales)*	*HighTech*	*AMB*	*Aleverage*	*ASize*	*TMB*	*TLeverage*	*TSize*	*CashOnly*
TargetR&DIntensive (assets)	1.0000									
TargetR&DIntensive (sales)	0.8704	1.0000								
HighTech	0.2654	0.2008	1.0000							
AMB	0.0840	0.0545	0.1455	1.0000						
ALeverage	-0.0688	-0.1299	-0.0083	0.0517	1.0000					
ASize	-0.0626	-0.1211	0.1534	0.0423	0.3778	1.0000				
TMB	0.0918	0.0556	0.0581	0.0520	0.0654	0.1278	1.0000			
TLeverage	-0.1774	-0.2477	-0.1138	-0.0052	0.2984	0.1766	-0.1550	1.0000		
TSize	-0.1428	-0.3000	-0.1494	0.0434	0.3156	0.6470	0.0661	0.2734	1.0000	
CashOnly	0.1007	0.0465	0.3094	0.0383	0.0242	0.3470	0.0205	-0.0973	-0.0457	1.0000
StockOnly	-0.0088	0.0719	-0.2619	-0.0410	-0.1375	-0.4518	-0.0140	-0.0155	-0.1464	-0.5401
Friendly	0.0130	0.0067	0.0380	0.0110	-0.0014	-0.0104	0.0165	-0.0249	-0.0121	-0.0316
CrossBorder	-0.0169	-0.0373	0.0699	-0.0319	-0.0052	0.1338	0.0400	-0.0045	0.0225	0.1976
SameIndustry	0.0710	0.1039	-0.0247	-0.0002	-0.0450	-0.0889	-0.0096	0.0191	0.0081	-0.1376
DealRelSize	0.0144	0.0259	-0.0548	0.0958	-0.1146	-0.4113	-0.0673	-0.0182	-0.0505	-0.1929
SharesAnnouncement	-0.0850	-0.0718	-0.0945	0.0022	0.0515	0.0254	0.0129	0.0240	0.0188	-0.0002
CompetitiveBidding	-0.0352	-0.0384	-0.0071	0.0178	0.0143	0.0539	0.0287	0.0031	0.0597	0.0563

Table 16 (continued)

Panel B							
	StockOnly	*Friendly*	*CrossBorder*	*SameIndustry*	*DealRelSize*	*SharesAnnouncement*	*CompetitiveBidding*
StockOnly	1.0000						
Friendly	0.0399	1.0000					
CrossBorder	-0.1428	0.0019	1.0000				
SameIndustry	0.1464	0.0148	-0.0464	1.0000			
DealRelSize	0.2047	0.0144	-0.0707	0.0433	1.0000		
SharesAnnouncement	0.0203	-0.0769	0.0258	-0.0643	-0.0657	1.0000	
CompetitiveBidding	-0.0732	-0.0645	0.0491	0.0409	0.0050	-0.0048	1.0000

APPENDIX B – UNIVARIATE ANALYSIS

Table 17 – Univariate analysis: R&D-intensive targets (robustness test)

This table presents the results of the T-Test and Wilcoxon-Mann-Whitney Test for acquirer CAR, combined CAR, and premium. The focus is on the target firm's R&D intensity, measured by the ratio of R&D expenditures to sales. The group division is based on the variable *TargetR&DIntensive*, which equals one if the target firm's R&D intensity is higher than the median and zero otherwise. N is the number of observations. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Panel A - Difference in means								
T-Test		Low-R&D (0)		High-R&D (1)		Difference (0) - (1)	t	p-value
		N	Mean	N	Mean			
Acquirer CAR	(-1, +1)	866	0.0017	1607	-0.0006	0.0023	0.6429	0.5204
	(-2, +2)	866	-0.0001	1607	0.0010	-0.0011	-0.2640	0.7918
	(-5, +5)	866	-0.0041	1607	0.0038	-0.0079	-1.5709	0.1163
Combined CAR	(-1, +1)	848	0.0310	1524	0.0247	0.0063*	1.8285	0.0676
	(-2, +2)	850	0.0302	1522	0.0269	0.0033	0.8592	0.3903
	(-5, +5)	847	0.0278	1525	0.0311	-0.0032	-0.6813	0.4957
Premium		843	0.3760	1466	0.5224	-0.1464***	-5.7660	0.0000
Panel B - Difference in medians								
Wilcoxon-Mann-Whitney Test		Low-R&D (0)		High-R&D (1)		Difference (0) - (1)	z	p-value
		N	Median	N	Median			
Acquirer CAR	(-1, +1)	866	-0.0002	1607	-0.0031	0.0029	0.9770	0.3288
	(-2, +2)	866	-0.0012	1607	-0.0023	0.0010	0.2390	0.8112
	(-5, +5)	866	-0.0049	1607	-0.0017	-0.0031	-0.7950	0.4267
Combined CAR	(-1, +1)	848	0.0193	1524	0.0127	0.0066***	2.7190	0.0066
	(-2, +2)	850	0.0220	1522	0.0162	0.0059*	1.8690	0.0617
	(-5, +5)	847	0.0220	1525	0.0196	0.0025	0.3500	0.7265

Table 17 (continued)

Panel B - Difference in medians							
Wilcoxon-Mann-Whitney Test	Low-R&D (0)		High-R&D (1)		Difference (0) - (1)	z	p-value
	N	Median	N	Median			
Premium	843	0.3067	1466	0.3821	-0.0754***	-5.4080	0.0000

Table 18 – Univariate analysis: Combination of R&D-intensive and high-tech targets (robustness test)

This table presents the results of the T-Test and Wilcoxon-Mann-Whitney Test for acquirer CAR, combined CAR, and premium. The focus is on high-tech and R&D-intensive target firms, in which R&D intensity is measured by the ratio of R&D expenditures to sales. The group division is based on the variable *TargetR&DIntensive x HighTech*, which results from the interaction of the following variables: *TargetR&DIntensive*, which equals one if the target firm's R&D intensity is higher than the median and zero otherwise; and *HighTech*, which equals one if the target firm is from a high-tech industry and zero otherwise. N is the number of observations. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Panel A - Difference in means								
T-Test		Other (0)		High-Tech x High-R&D (1)		Difference (0) - (1)	t	p-value
		N	Mean	N	Mean			
Acquirer CAR	(-1, +1)	1739	0.0000	734	0.0007	-0.0007	-0.1834	0.8545
	(-2, +2)	1739	0.0019	734	-0.0025	0.0045	1.0632	0.2878
	(-5, +5)	1739	0.0017	734	-0.0004	0.0021	0.4004	0.6889
Combined CAR	(-1, +1)	1677	0.0280	695	0.0244	0.0036	0.9837	0.3253
	(-2, +2)	1678	0.0303	694	0.0227	0.0076*	1.8831	0.0598
	(-5, +5)	1675	0.0316	697	0.0260	0.0056	1.1132	0.2658
Premium		1627	0.4281	682	0.5665	-0.1384***	-5.1575	0.0000

Table 18 (continued)

Panel B - Difference in medians								
Wilcoxon-Mann-Whitney Test		Other (0)		High-Tech x High-R&D (1)		Difference (0) - (1)	z	p-value
		N	Median	N	Median			
Acquirer CAR	(-1, +1)	1739	-0.0044	734	0.0000	-0.0044	-1.6290	0.1033
	(-2, +2)	1739	-0.0023	734	-0.0016	-0.0007	0.0860	0.9316
	(-5, +5)	1739	-0.0038	734	-0.0013	-0.0025	-0.3600	0.7188
Combined CAR	(-1, +1)	1677	0.0162	695	0.0126	0.0035	0.8110	0.4174
	(-2, +2)	1678	0.0209	694	0.0133	0.0076*	1.8450	0.0651
	(-5, +5)	1675	0.0235	697	0.0149	0.0086	1.1960	0.2316
Premium		1627	0.3239	682	0.4141	-0.0902***	-6.9840	0.0000

APPENDIX C – MULTIVARIATE ANALYSIS

Table 19 – Regressions regarding H1 and H1.1 (robustness test)

This table presents the regression results for H1 (models 1A, 2A, and 3A) and H1.1 (models 4A, 5A, and 6A). The acquirer *CAR* (cumulative abnormal returns) are estimated using three event windows: a 3-day period (-1, +1), a 5-day period (-2, +2), and an 11-day period (-5, +5). The estimation window is (-270, -30). *Target R&D-Intensive* is a dummy variable that equals one if the target firm's R&D intensity is higher than the median and zero otherwise. R&D intensity is measured by the ratio of R&D expenditures to sales. *High-Tech* is a dummy variable that equals one if the target firm is from a high-tech industry and zero otherwise. The interaction variable, *Target R&D-Intensive x High-Tech*, results from the interaction of the two previously described variables. The control variables are defined in Table 15, in Appendix A. The coefficients are in line with each variable, with respective t-statistics underneath in parentheses. Regressions include fixed effects based on year, acquirer country, and acquirer industry. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Dependent Variable	Acquirer CAR					
Hypothesis	H1			H1.1		
Event Window	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Model	(1A)	(2A)	(3A)	(4A)	(5A)	(6A)
Target R&D-Intensive x High-Tech	-	-	-	0.0141*	0.0037	-0.0070
	-	-	-	(1.77)	(0.42)	(-0.62)
High-Tech	-	-	-	-0.0175***	-0.0197***	-0.0080
	-	-	-	(-2.60)	(-2.72)	(-0.84)
Target R&D-Intensive	-0.0010	0.0026	0.0050	-0.0043	0.0038	0.0091
	(-0.25)	(0.60)	(0.94)	(-0.87)	(0.68)	(1.32)
Acquirer Market-to-Book	0.0005	0.0003	0.0005	0.0006	0.0004	0.0005
	(1.13)	(0.57)	(0.72)	(1.26)	(0.74)	(0.81)
Acquirer Size	-0.0037***	-0.0042***	-0.0041***	-0.0038***	-0.0042***	-0.0040***
	(-3.50)	(-3.49)	(-2.77)	(-3.59)	(-3.47)	(-2.70)

Table 19 (continued)

Dependent Variable	Acquirer CAR					
Hypothesis	H1			H1.1		
Event Window	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Model	(1A)	(2A)	(3A)	(4A)	(5A)	(6A)
Acquirer Leverage	0.0285**	0.0174	0.0055	0.0283*	0.0150	0.0030
	(1.96)	(0.99)	(0.24)	(1.95)	(0.85)	(0.13)
Cash Only	0.0184***	0.0213***	0.0188***	0.0192***	0.0230***	0.0200***
	(4.47)	(4.69)	(3.44)	(4.65)	(5.05)	(3.63)
Stock Only	0.0026	0.0042	0.0070	0.0028	0.0045	0.0072
	(0.47)	(0.68)	(0.89)	(0.50)	(0.73)	(0.92)
Friendly	-0.0066	-0.0125	-0.0138	-0.0056	-0.0107	-0.0126
	(-0.64)	(-1.21)	(-1.26)	(-0.55)	(-1.03)	(-1.14)
Cross-Border	0.0023	0.0037	0.0027	0.0025	0.0038	0.0027
	(0.57)	(0.77)	(0.46)	(0.61)	(0.78)	(0.44)
Same Industry	-0.0001	-0.0018	-0.0023	0.0006	-0.0006	-0.0014
	(-0.01)	(-0.40)	(-0.41)	(0.14)	(-0.13)	(-0.25)
Deal Relative Size	-0.0041**	-0.0056**	-0.0066**	-0.0041**	-0.0056**	-0.0066**
	(-1.98)	(-2.38)	(-1.97)	(-2.01)	(-2.39)	(-1.96)
Constant	0.1164***	0.1311***	0.1773***	0.1174***	0.1278**	0.1729***
	(3.04)	(2.66)	(3.75)	(3.02)	(2.55)	(3.66)
FE: Year, Acquirer Country, Acquirer Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,272	2,272	2,272	2,272	2,272	2,272
R-squared	0.077	0.072	0.054	0.079	0.076	0.055

Table 20 – Regressions regarding H2 and H2.1 (robustness test)

This table presents the regression results for H2 (models 1A, 2A, and 3A) and H2.1 (models 4A, 5A, and 6A). The combined *CAR* (cumulative abnormal returns) are estimated using three event windows: a 3-day period (-1, +1), a 5-day period (-2, +2), and an 11-day period (-5, +5). The estimation window is (-270, -30). *Target R&D-Intensive* is a dummy variable that equals one if the target firm's R&D intensity is higher than the median and zero otherwise. R&D intensity is measured by the ratio of R&D expenditures to sales. *High-Tech* is a dummy variable that equals one if the target firm is from a high-tech industry and zero otherwise. The interaction variable, *Target R&D-Intensive x High-Tech*, results from the interaction of the two previously described variables. The control variables are defined in Table 15, in Appendix A. The coefficients are in line with each variable, with respective t-statistics underneath in parentheses. Regressions include fixed effects based on year, acquirer country, and acquirer industry. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Dependent Variable	Combined CAR					
Hypothesis	H2			H2.1		
Event Window	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Model	(1A)	(2A)	(3A)	(4A)	(5A)	(6A)
Target R&D-Intensive x High-Tech	-	-	-	0.0083	0.0041	-0.0036
	-	-	-	(1.08)	(0.49)	(-0.34)
High-Tech	-	-	-	-0.0144**	-0.0186***	-0.0119
	-	-	-	(-2.16)	(-2.58)	(-1.34)
Target R&D-Intensive	-0.0077**	-0.0042	-0.0019	-0.0092*	-0.0034	0.0012
	(-2.09)	(-1.02)	(-0.38)	(-1.91)	(-0.63)	(0.19)
Acquirer Market-to-Book	-0.0004	-0.0004	-0.0001	-0.0003	-0.0003	-0.0001
	(-0.79)	(-0.76)	(-0.19)	(-0.67)	(-0.60)	(-0.10)
Acquirer Size	-0.0040***	-0.0052***	-0.0057***	-0.0041***	-0.0052***	-0.0056***
	(-3.96)	(-4.56)	(-4.02)	(-4.01)	(-4.55)	(-3.98)
Acquirer Leverage	0.0398***	0.0382**	0.0213	0.0391***	0.0361**	0.0188
	(2.68)	(2.24)	(0.99)	(2.63)	(2.12)	(0.87)

Table 20 (continued)

Dependent Variable	Combined CAR					
Hypothesis	H2			H2.1		
Event Window	(-1, +1)	(-2, +2)	(-5, +5)	(-1, +1)	(-2, +2)	(-5, +5)
Model	(1A)	(2A)	(3A)	(4A)	(5A)	(6A)
Cash Only	0.0064	0.0089**	0.0054	0.0073*	0.0105**	0.0068
	(1.54)	(1.99)	(1.02)	(1.77)	(2.35)	(1.27)
Stock Only	-0.0104*	-0.0098*	-0.0125*	-0.0102*	-0.0094	-0.0122
	(-1.90)	(-1.65)	(-1.67)	(-1.86)	(-1.58)	(-1.63)
Friendly	-0.0104	-0.0150	-0.0165	-0.0095	-0.0135	-0.0152
	(-0.86)	(-1.19)	(-1.33)	(-0.79)	(-1.06)	(-1.21)
Cross-Border	0.0018	0.0045	0.0075	0.0019	0.0046	0.0076
	(0.44)	(0.94)	(1.27)	(0.47)	(0.98)	(1.29)
Same Industry	0.0048	0.0034	0.0026	0.0054	0.0045	0.0036
	(1.19)	(0.79)	(0.51)	(1.35)	(1.05)	(0.71)
Deal Relative Size	0.0010	-0.0008	-0.0019	0.0010	-0.0009	-0.0019
	(0.47)	(-0.36)	(-0.59)	(0.46)	(-0.38)	(-0.60)
Constant	0.1962***	0.2069***	0.2714***	0.1958***	0.2038***	0.2671***
	(5.99)	(5.89)	(7.11)	(6.06)	(5.77)	(6.97)
FE: Year, Acquirer Country, Acquirer Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,184	2,184	2,184	2,184	2,184	2,184
R-squared	0.079	0.070	0.052	0.081	0.074	0.053

APPENDIX D – ADDITIONAL ANALYSIS

Table 21 – Regressions regarding the impact of US targets on the premium

This table presents the regression regarding the impact of US targets on the premium when the target firms are from high-tech industries (model 1) and when R&D-intensive target firms are involved. In model 2, R&D intensity is measured by the ratio of R&D expenditures to total assets. In model 2A, R&D intensity is measured by the ratio of R&D expenditures to sales. The dependent variable is the relative value of the premium of offer price to the target closing stock price 4 weeks before the original announcement date. *High-Tech* is a dummy variable that equals one if the target firm is from a high-tech industry and zero otherwise. *Target R&D-Intensive* is a dummy variable that equals one if the target firm's R&D intensity is higher than the median and zero otherwise. *US Only* is a dummy variable that equals one if the target firm is from the US and zero otherwise. *High-Tech x US Only* results from the interaction of the variables *High-Tech* and *US Only. Target R&D-Intensive x US Only* results from the interaction of the variables *Target R&D-Intensive* and *US Only.* The control variables are defined in Table 15, in Appendix A. The coefficients are in line with each variable, with respective t-statistics underneath in parentheses. Regressions include fixed effects based on year, acquirer country, and acquirer industry. The level of statistical significance is represented by ***, **, and * at 1%, 5%, and 10%, respectively.

Dependent variable	Premium		
Model	(1)	(2)	(2A)
High-Tech x US Only	-0.0131	-	-
	(-0.17)	-	-
High-Tech	0.1052	-	-
	(1.42)	-	-
Target R&D-Intensive x US Only	-	0.0178	-0.0071
	-	(0.22)	(-0.09)
Target R&D-Intensive	-	0.0448	0.0975
	-	(0.61)	(1.53)
US Only	-0.0030	-0.0167	-0.0054
	(-0.06)	(-0.34)	(-0.11)
Acquirer Market-to-Book	-0.0030	-0.0031	-0.0031
	(-0.68)	(-0.68)	(-0.69)
Acquirer Size	0.0436***	0.0439***	0.0416***
	(3.05)	(3.05)	(2.93)
Acquirer Leverage	0.1658	0.1597	0.1665
	(1.01)	(0.97)	(1.01)
Target Market-to-Book	-0.0065	-0.0065	-0.0065
	(-1.48)	(-1.48)	(-1.51)
Target Size	-0.0632***	-0.0650***	-0.0618***
	(-4.32)	(-4.49)	(-4.36)

Table 21 (continued)

Dependent variable	Premium		
Model	(1)	(2)	(2A)
Target Leverage	0.2117	0.2233	0.2403*
	(1.56)	(1.64)	(1.74)
Cash Only	0.0352	0.0404	0.0393
	(0.94)	(1.08)	(1.06)
Stock Only	-0.0800*	-0.0778*	-0.0799*
	(-1.82)	(-1.77)	(-1.82)
Friendly	0.1173	0.1314	0.1381
	(1.26)	(1.41)	(1.47)
Cross-Border	-0.0111	-0.0108	-0.0099
	(-0.27)	(-0.26)	(-0.23)
Same Industry	-0.0104	-0.0050	-0.0062
	(-0.34)	(-0.16)	(-0.20)
Deal Relative Size	0.0328*	0.0336*	0.0321*
	(1.84)	(1.93)	(1.82)
Shares at Announcement	-0.2672	-0.2391	-0.2393
	(-1.26)	(-1.10)	(-1.11)
Competitive Bidding	0.2541***	0.2536***	0.2597***
	(3.16)	(3.15)	(3.24)
Constant	0.3501	0.3638	0.3384
	(1.23)	(1.27)	(1.17)
FE: Year, Acquirer Nation, Acquirer Industry	Yes	Yes	Yes
Observations	1,229	1,229	1,229
R-squared	0.156	0.154	0.157

Table 22 – Descriptive statistics: Premium and competitive bids (additional analysis)

This table presents descriptive statistics, by target country, regarding the average premium paid by the acquiring firm, defined as the relative value of the premium of offer price to the target closing stock price 4 weeks before the original announcement date. It also reports the average number of deals that involve competitive bidding, meaning the number of bidders is higher than 1 (including the acquirer). "N" is the number of observations.

Target Country	Premium		Competitive Bids	
	N	Mean	N	Mean
Belgium	10	0.3465	12	0.0833
Canada	713	0.5156	817	0.0392
Denmark	5	0.2609	8	0.0000
Finland	12	0.4071	13	0.0769

Table 22 (continued)

Target Country	Premium		Competitive Bids	
	N	Mean	N	Mean
France	58	0.4883	69	0.0290
Germany	12	0.4507	20	0.0500
Greece	6	0.4454	7	0.0000
Ireland-Rep	6	0.3702	7	0.0000
Italy	16	0.1816	18	0.0556
Netherlands	21	0.5940	23	0.1739
Norway	30	0.2099	34	0.0588
Spain	8	0.2408	8	0.0000
Sweden	37	0.4256	43	0.0000
Switzerland	16	0.3830	29	0.0690
United Kingdom	147	0.3786	175	0.0800
United States	1212	0.4668	1337	0.0411
Total	2309	0.4689	2620	0.0439