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Master Thesis

Thesis Master of Science

How do payment methods and other deal characteristics affect abnormal returns?

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A comparison of “high-tech” versus “non-high-tech” industries in the European M&A market.

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Abstract

This master thesis investigates whether payment method affects the target company's cumulative abnormal return (CAR), if the premium paid is larger for cash-financed acquisitions, and if Research and Development (R&D) expense and intangible assets can explain CAR for high-tech target companies. We use a dataset of 463 European M&A transactions, between 2000 and 2018, and a sub-sample of 73 high-tech transactions within the same time period. To investigate our chosen research questions, we use a standard event study methodology with country-specific value-weighted indexes in addition to specified regression models for each question. Our results indicate that cash as a payment method is superior to stock when examining CAR for target shareholders. These findings are supported by other researchers based on data from the US M&A market. In contrast to previous research, we find no relationship between higher bid premiums and payment method. Further, we find that high-tech targets experience higher CAR, compared to companies in other industries. Using a sub-sample of high-tech targets, we find that targets with higher R&D expenses experience higher CAR. However, intangible assets as an explanatory variable is insignificant when regressed against CAR. We argue that this might be due to the difficulty in valuing intangible assets, and the leeway firms have when it comes to reporting their real value.

1.0 Introduction and motivation

Overview

The number of mergers and acquisitions (M&As) in Europe has increased significantly from 2000 to 2018 compared to 1982 to 2000 (Statista, 2019; IMMA, 2019). The high-tech industry has also grown both by number of transactions and value of transactions (IMMA, 2019), increasing this industry's importance in the M&A literature. Moreover, Berk and Demarzo (2017, p. 994) argue that due to the money at stake and the complexity of the deals, decisions concerning M&A are some of the most important decisions financial managers make. Even though M&As are one of the most researched areas in finance, the majority of previous literature is based on old data from the US market. Hence, research based on recent data could contribute with relevant findings to the existing literature on the European M&A market.

This thesis will investigate the target firm announcement-period abnormal returns following M&A transactions involving European targets. The firm initiating the takeover is referred to as the "bidding" firm or "acquirer," while the "target" firm is the object of interest. The total sample of 463 completed transactions between 2000 and 2018 consists of European targets characterized as "high-tech" and "non-high-tech" by SDC Platinum. Further, we use a high-tech sample of 175 transactions and a sub-sample of 73 high-tech target transactions with available data on R&D expenses and intangible assets to investigate high-tech target CAR. High-tech classifications include areas such as biotechnology, chemicals, communications, computers, defense, electronics, medicals, and pharmaceuticals, among others. We calculate abnormal returns as the difference between the actual return and the expected market return, based on country-specific value-weighted indexes. To test which factors might affect the abnormal returns around the announcement day, we include explanatory variables based on previous literature. Two high-tech specific explanatory variables, research and development (R&D) expenses and intangible assets, are included to explain possible differences between industries further.

Background

- *Cash versus stock*

When a bidder makes an offer to acquire a target firm, either cash, stocks, or a combination of these two can be offered as payment. Most scholars seem to agree that the wealth creation in M&As almost exclusively accrues to the shareholders of target firms (Datta, Piches & Narayanam, 1992). Other researchers argue that the target firm shareholders earn even more significant abnormal returns when receiving cash rather than stocks (Travlos, 1987). However, there are various findings in the literature concerning stock transactions. Studies such as Wansley, Lane, and Yang (1987), Franks, Harris, and Mayer (1988), and Servaes (1991) either report significantly negative or positive returns for both parties in stock-financed transactions. Interestingly, fewer studies examine the effect of payment method on the high-tech target shareholders' abnormal returns around the announcement day in the European market.

- *Bid premium*

Takeover premium is known to be the difference between the target's market price and the actual price paid to acquire it. Bid premium represents the increased cost of buying a target company, and this premium amount is affected by different factors according to the existing literature. Davidson and Cheng (1997) found that target shareholders received larger bid premiums from bidders in cash transactions compared to stocks. In contrast, Suk and Sung (1997) found no significant difference in premiums between cash and stock transactions. Other researchers also suggest that bid premiums tend to be higher in tender offers compared to mergers (Eckbo, 2009). Moreover, Flanagan and O'Shaughnessy (2003) argue that acquirers that are not in the same business sector as the target tend to pay higher premiums. This effect is found to have a more significant impact on tender offers when multiple bidders are competing for a target. Researchers argue that multiple bidders for a target can drive the offer bid price up, to the point where the price paid equals the total value of the target. Thus, all possible gains will go to the target (Markides & Oyon, 1998). The argument is empirically supported by Comment and Jarrell (1987), who further argue that single-bidder contests can create value for the acquirer while multiple-bidder contests do not. Given this, we include these relevant explanatory variables in our model.

- *High-tech target abnormal returns*

Since 1990, there has been a substantial increase in M&As of high-tech companies (IMMA, 2019). The increased importance of technology-oriented companies raises the question of whether their intangible R&D capital is reflected by their stock market values (Chan, 2001). Despite the importance, magnitude, and volume of high-tech acquisitions, we find limited research in the finance literature in this area. Existing literature finds that most of these acquisitions involve the takeover of relatively young, small start-up companies. Also, the acquisitions are often motivated by the acquirers' desire to obtain highly developed technical expertise and capabilities (Benou & Madura, 2005). Given the heterogeneity in the existing literature findings, we argue that this research area is of relevance. To examine abnormal returns around the announcement day, we include several explanatory variables (see section 2.2.1). However, since high-tech targets often are valued based on their intangible assets (Prentice & Fox, 2002), such acquisitions are associated with high information asymmetry (Benou & Madura, 2005). Thus, we include R&D expenses and intangible assets in our model to investigate the possible effect on abnormal returns. Accounting information about a target's R&D activity is, however, affected by the leeway companies have in identifying R&D as costs (European Commission, 2011). Further, R&D-intensive companies may appear to be priced at unjustifiably high multiples (Chan, 2001), so target companies could be "expensive" by such criteria. We use data on R&D expenditure and intangible assets from SDC Platinum and rely on the validity of these figures provided by the database.

- *Contribution*

The research questions we will investigate are of relevance because most of the past literature focus on the US market. Also, fewer studies have, to our best knowledge, examined high-tech transactions in Europe. Benou and Madura (2005) investigated high-tech acquisitions but focused mainly on the role of investment bank advisors. We find few articles focusing on how target firm shareholders' CAR is affected by the target's R&D expenditures and intangible assets. Thus, this thesis differs from previous literature as we aim to compare abnormal returns in the days around the announcement period for non-high-tech targets and high-tech targets.

1.1 Hypothesis

Given the findings, mostly from the US market, regarding the payment method, we expect to find that European target firm shareholders earn higher abnormal returns in cash transactions. However, it is uncertain whether the same holds for high-tech European targets. The same argument holds for the bid premium. Further, the magnitude of the high-tech industry allows us to examine if R&D expenses and intangible assets affect abnormal returns. We expect that these factors will have an impact on abnormal returns around the announcement day as we argue that these factors increase the difficulty of an accurate valuation of the target firm from a bidders' perspective.

Ultimately, the aim is to test if the following hypotheses hold:

H_1: *Abnormal returns are higher for cash-financed acquisitions, compared to stock-financed acquisitions. In addition, targets in the high-tech industry experiences higher abnormal returns compared to other industries.*

H_2: *The bid premiums are larger for cash-financed acquisition compared to stock-financed acquisitions.*

H_3: *Target firms with higher R&D expenses and more intangible assets earn higher abnormal returns.*

2.0 Literature review

In this section, we will start by reviewing the literature regarding the choice of payment method and target firms' abnormal return. Secondly, we will look at whether bid premiums, in general, are found to be higher for all cash acquisitions compared to stock-financed acquisitions in different industries. Lastly, we will investigate existing literature covering high-tech transactions and whether firm-spesific characteristics can explain target abnormal returns.

2.1 Payment methods, abnormal returns, and bid premiums

Previous research has found that European target firms gained average announcement returns of 24% in the period 1955-1985 (Franks & Harris, 1989), 19% in the period 1966-1991 (Danbolt, 2004), and 13% in the period 1990-2001

(Goergen & Renneboog, 2004). These findings indicate that M&A activity, in general, creates value for target shareholders. Initially, in an M&A decision, a company is faced with the choice of giving up corporate control of issuing stocks, or the financial distress costs of increased debt (Faccio & Masulis, 2005). Faccio and Masulis suggest that acquiring companies with an incentive to preserve its corporate governance structure are more likely to offer cash, often debt-financed, to the target company. Wansley et al. (1983) did a study on 203 firms listed in the Federal Trade Commission acquired between 1970 and 1978. Comparing the acquisitions by payment method they found significant differences in abnormal returns. The study suggests that target shareholders earn 33.54% abnormal return in cash transactions compared to 17.47% in stock-financed transactions.

Davidson and Cheng (1997) used a sample of 219 acquisitions, targets matched with bidders, to test whether the payment method influences abnormal returns. They also find that announcement-period abnormal returns for targets are larger in cash transactions. Moreover, Davidson and Cheng argue that target shareholders receive larger bid premiums in cash acquisitions. To explain the observed difference in abnormal returns, they argue that cash bids reduce the asymmetric information problem and that target shareholders have different tax liabilities in stocks compared to cash. Further, they argue that the size of abnormal returns will be related to the payment method only when the market is supplied with additional information by the chosen payment method. What we find particularly interesting is that the paper suggests no direct relation between the target firms' abnormal return and payment method when the sample is controlled for the bid premium. Intuitively, the findings suggest that the payment method alone is not explanatory for abnormal returns and that abnormal returns may only be indirectly related to the chosen payment method.

According to Datta et al. (1992), a meta-analysis done on 41 studies in the US, shareholder wealth creation for bidders and targets differ significantly (data from 1948 to 1992). With a sample of 409 observations, the same study argues that bidders, on average, gained 0.388% while target firms' shareholders experienced a value increase of over 20%. These results suggest that target shareholders benefit in acquisitions and that wealth creation is substantially larger for targets than bidders. Furthermore, they highlight that managers should be aware of factors that

are related to wealth creation before initiating an acquisition. Empirical findings suggest that the managers of target firms can increase the possibility of maximizing gains for their stockholders by avoiding stocks as a payment method (Myers and Majluf, 1984; Krasker, 1986).

M&A activity is of high interest for many researchers, and several aspects of such transactions are covered in previous research. Chang (1998), examined bidder returns at the announcement of private company takeovers. According to his study, shareholders of bidding firms do not experience abnormal returns in cash offers but experience positive abnormal returns in stock offers. These findings are also in line with the findings by Wruck (1989), who further suggests negative average abnormal returns following the announcement of a public offering of securities. Fuller et al. (2002) used a sample of 3,135 takeovers in the US from 1990 to 2000 to examine returns to acquiring firms. The findings show that bidders earn significantly negative returns when purchasing public targets, but the returns are significantly positive when the target is private or a subsidiary.

Furthermore, using a sample of 2,511 merger and tender offers, Officer (2003) finds significantly higher premiums in cash deals compared to stock-transactions. He argues that these findings could be connected to tax-related circumstances. Further, cash as a payment method signals a higher valuation of the target firm, which deters competition. Thus, cash transactions relate to higher premiums compared to other payment methods, according to Cai and Vijh (2007). Assuming that acquisition bid premiums are positively related to the target firm's announcement returns, Chen (2011) also argue that target shareholders earn higher returns in cash transactions compared to stock transactions.

2.2 Other Potential Determinants of Abnormal returns in M&A transactions

Abnormal returns in M&A transactions are affected by several important factors according to previous studies. A thorough review of the empirical and theoretical literature on M&As allows us to identify several variables which may explain differences in abnormal returns. In this part, we identify and discuss the variables that have been included in enough previous studies so that their impact (or lack of impact) can be assessed.

- *Number of Bidders*

When several bidders are aiming to acquire the same target company, the level of competitiveness increases, which may increase the premium paid (Datta. et al., 1992). The case of several bidders can create an arena for the so-called "winner's curse," which is the result of an overpaid price, due to incomplete information about the target company value. The aim is to test whether increasing competitiveness affects the stockholders of the target firm.

- *Takeover type*

Davidson and Cheng (1997), suggests that target firms in tender offers earn higher abnormal returns compared to mergers. Numerically, target company shareholders earn on average 29.1% in tender offers, while earning only 20.2% in mergers. The difference in these numbers is discussed by (Datta et al., 1992) who links the difference to the nature of the offers. A merger offer requires the target board's approval and subsequently goes to a shareholder vote. In many cases, a majority shareholder vote is sufficient for the agreement to materialize. In contrast, a tender offer is simply a bidding firm offering to acquire the target company's shares by directly offering cash or stocks to the shareholders.

The different potential outcome of these takeover types might be important, as the board of management and the shareholders of a company, can have different interest. Two main differences explain the increase in abnormal returns for the target shareholders in tender offers according to previous studies. Firstly, the announcement of a tender offer can alert other firms, which increases the competition, and possibly the abnormal returns (Comment & Jarrell, 1987). Secondly, the permit payment of a control premium in a merger, which goes directly to the firm's management post-acquisition, is removed in tender offers (Bradley, Desai, and Kim, 1988).

- *Asset relatedness*

In an M&A transaction, the relationship between bidding and target firms' assets might affect the abnormal return for both parties. Managers have a substantial investment in the employment of the firm, which creates incentives for diversification regarding potential risks (Sicherman and Pettway, 1987; Morck,

Shleifer, and Vishny, 1990). Hence, they may attempt to reduce this risk by investing in unrelated assets. However, it is far from certain that such decisions are optimal. From a bidders' perspective, acquiring a target in a related industry may allow managers to minimize the risks associated with acquiring a company in an industry where their knowledge might be limited.

Furthermore, conglomerate mergers can reduce the probability of bankruptcy as one firm's earnings can offset the other firm's losses, producing an increased expected return for lenders (Lewellen, 1971; Higgins & Schall, 1975). Previous research conducted by Seth (1990a; 1990b), provides evidence showing that both related and unrelated acquisitions gain but concludes that the source of value increase is different. Wansley et al. (1983), however, claims that pure conglomerate mergers are associated with slightly higher abnormal returns.

- *Transaction size*

In the period between 1998 and 2001, the US M&A market experienced an aggregate loss of $240 billion (Moeller, Schlingemann & Stulz, 2005). Previous research provides evidence which implies that this loss can be explained by a small percentage of the acquisitions, with extreme losses. Numerous papers examine the impact on shareholder wealth in various corporate events, and most studies focus on abnormal stock returns (Bessembinder et al., 2009). However, there is less research done on what effect the transaction size might have on abnormal returns for target shareholders in the European M&A market. According to Moeller et al. (2005), 2.1% of all acquisitions between the year 1998 and 2001, accounted for 43.4% of all money spent on acquisitions. These 87 (2.1%) acquisitions are classified as "large loss deals" and had a loss of $397 billion. Excluding these from the sample, results in an aggregate gain of $157 billion across the US M&A market. This evidence implicates a negative correlation between acquisition size and abnormal return since there is no evidence supporting substantial gains to compensate for the losses. However, the firms of these large loss deals had no noticeable characteristics when adjusted for market size and deal size. Also, previous findings by Moeller et al. (2005) finds large loss deals to be using stock more often than cash for the financial part of the transaction.

2.3 High-tech target abnormal returns

Previous studies have found that shareholders of target firms receive most of the returns from M&A transactions, while bidding firms experience zero or negative announcement returns. These results could be because managers in bidding firms sometimes are motivated to acquire for other reasons than maximizing the firm value (Malatesta, 1983; Morck et al., 1990). Further, managers may be overly optimistic in the valuation of their targets, thereby failing to recognize that there are minimal gains in the takeover. Overly optimistic managers are what Roll (1993) defines as the hubris hypothesis of corporate takeovers.

Kohers and Kohers (2000) did a study on the value creation potential of high-tech M&A activity. They found that bidders earn significantly positive abnormal returns upon announcement regardless of whether the acquisition is cash or stock-financed. These findings are interesting because they challenge existing, quite established results regarding payment method and abnormal returns. The magnitude of high-tech industries makes this field interesting to investigate further.

Benou and Madura (2005) researched high-tech acquisitions and firm-specific characteristic. They try to measure the impact of R&D on the valuation effects of US high-tech targets. Their findings suggest that the valuation effects are more favorable when the target has fewer intangible assets. The same study suggests that the use of R&D expenditures mostly is based on the argument that bidders in the high-tech market aim to acquire an R&D capability. Importantly, since R&D predominantly is an intangible asset, the literature suggests that it is uncertain whether R&D based acquisitions deliver value. However, based on US firms' high-tech acquisitions in Canada and Europe made in the period 1975 to 1988, Markides and Oyon (1998) found R&D expenditures to have a significant impact on cumulative abnormal returns around the announcement day for the bidding firm. Since that period, the high-tech market has grown both in importance and aggregated value. Thus, it might be interesting to do more research on this field to add to existing literature and contribute with findings from the European market.

3.0 Theory

3.1 Efficient Market Hypothesis (EMH)

In an efficient capital market, the security prices would fully reflect all available information about all securities, which results in unbiased estimations of the value of the securities' underlying assets (Basu, 1977). The EMH explains how financial markets accomplish the allocation of ownership of economic resources efficiently. Under the assumption that the security prices reflect all available information, firms can make production-investment decisions, and investors can invest in securities that give them ownership of cash flows from economic activities (Fama, 1970). According to Fama, several researchers have presented empirical evidence in support of the EMH. There are also, however, findings suggesting that trading strategies such as the value investing strategy can generate a superior return. Value strategies call for buying stocks with low prices relative to measures of fundamental value such as earnings, book assets, or dividends amongst others (Lakonishok, 1994). The EMH is highly relevant in event studies as leakages of information and delay in the reach of information may be factors influencing the post and pre-event period estimates, respectively.

3.2 Winner's Curse and Hubris Hypothesis

The winner's curse is a situation when the winning bidder in an auction exceed the intrinsic value, or the real value, of the target firm due to overestimation (Capen et al., 1971). The economic intuition behind corporate takeovers is that the bidder expects the acquisition to generate positive cash flows in the future. Assuming that bidders can estimate the real value of the target firm on average, the winning bid, which will be higher than the average bid, will also be higher than the real value of the target. Thus, the winner's curse hypothesis suggests that the firm with the highest bid is also the firm that overestimates the target firm value the most (Varaiya & Ferris, 1987). Consequently, the price paid for the target may no longer be justified by the following returns in such cases.

In the absence of asymmetric information, the winner's curse should no longer be a problem (Cox & Isaac, 1984), as the rational bidders should have the same valuation of the target. If asymmetric information exists, however, Travlos (1987) argues that the payment method may provide valuable information to the market. Hence, the

winner's curse hypothesis becomes relevant in the decision process of M&A transactions.

Furthermore, Roll (1986) argues that overconfident executives tend to overpay for targets. Roll's hubris hypothesis suggests that systematic overpayment is due to managers being overconfident of their ability to manage the acquired assets. Overpaying for a target significantly reduces the equity value of the bidder (Travlos, 1987). We argue that overconfidence and the value of the transaction may be a factor that affects the target shareholders' abnormal return around the announcement day.

4.0 Data and descriptive statistics

Our dataset contains takeovers of listed European target companies carried out between 01.01.2000 and 31.12.2018. The Securities Data Corporation (SDC) Platinum database is the primary source of information used to construct the dataset. In addition, Thomson Reuters DataStream provided useful information regarding historical data on a variety of securities and indexes. To reduce issues with endogeneity and to increase the comparability of the deals, we construct a dataset including transactions between independent companies (i.e., the target is not a subsidiary, and the bidders are not management or employees). This will be explained more thoroughly in section 4.

4.1 Classification of data

Initially, our dataset consisted of 3031 transactions of European target companies, with the following restrictions:

(i) Completed transactions between 01.01.2000 to 31.12.2018.
(ii) The value of the transaction exceeds $1 million.
(iii) The target firm is listed on a country-specific index.
(iv) Total shares acquired by the acquiring firm exceeds 50%.

From these restrictions, we chose to extract the variables necessary for our regressions (see table 1).

TABLE 1 - VARIABLE DEFINITIONS

Variable definitions. This table presents the variables we use in our regression models to test each hypothesis. All variable definitions are retrieved from SDC Platinum (2012).

Variables	Definition
Log(ValueofTransaction)	Value of Transaction ($ mil): Total value of consideration paid by the acquiror, excluding fees and expenses. We compute the logarithm of this dollar value to make the value appear more normal.
BidPremium	Premium 1 Day Prior to Announcement Date: Premium of offer price to target closing stock price 1 day prior to the original announcement date, expressed as a percentage
NumberofBidders	Number of Bidders: The number of entities (including the acquiror) bidding for a target. Also, the number of challenging deals for one target. For deals with only one bidder (i.e., no challenger), Number of Bidders will be 1
TenderorMerger	Equals 1 if Tender and 0 if Merger
CashStock	Equals 1 if Cash transaction and 0 if Stock transaction
HighTech	Equals 1 if the target company is classified by SDC as "high-tech" and 0 otherwise
Industry	Equals 1 if both bidder and target are classified by SDC as the same industry and 0 otherwise
TargetMarketValue	Target Market Value in Dollars: Calculated by multiplying the total number of the target company's shares outstanding by the closing stock price 4 weeks prior to the announcement date of the transaction, stated in millions of Dollars.
Log(R&Dexpenses)	Target Research and Development Expenses Last 12 Months: Disclosed expenditures on research and development activities for the 12 months ending on the date of the most current financial information prior to the announcement of the transaction ($mil). We compute the logarithm of R&D expenses to make the value appear more normal.
Target Intangible Assets	Target Intangible Assets: Value of assets having no physical existence, yet having substantial value to the firm, including goodwill, patents, trademarks, copyrights, franchises, and costs in excess of net book value of businesses acquired, as of the date of the most recent financial information prior to the announcement of the transaction ($mil).

Note: Log(R&Dexpenses) and Target Intangible Assets are only used in the regression based on the high-tech target transactions. Target Intangible Assets appears in the regression models as the ratio Target Intangible Assets to Target Total Assets.

We thoroughly examined all selected variables for incomplete data and removed insufficient findings, which reduced the sample to 1912 transactions. In addition, countries with less than ten transactions were cut from the sample. The argument is that low number of transactions may impose an adverse impact on the regression

models. As a result, the sample size was reduced to 1702. Further, we disregard data with mixed payment, mainly because we wish to mitigate any mixed impact these transactions might have. After that, the dataset from SDC platinum counted 654 transactions.

The data necessary for calculating abnormal returns were obtained from Thomson Reuters DataStream. The database includes stock prices for all transactions we gathered from SDC platinum and selected country-specific value-weighted indexes for each transaction. Since our dataset consists of transactions from 15 different countries, we decided to use country-specific indexes to best capture the correct market fluctuations for all transactions. Both the stock prices and the indexes had a period of -125 to +5 days, with day 0 being the announcement date. All indexes were chosen based on the target company's country. After controlling for incomplete or incorrect data, our final sample consisted of 463 transactions.

Of the final 463 transactions obtained, high-tech target companies accounted for 175. As our interest lies upon target shareholder returns, we did not require the acquiring company to be within the high-tech industry. To address the possible impact of R&D expenses and intangible assets on abnormal return in the high-tech industry, we extracted two additional variables from SDC platinum, R&D expenses for the last fiscal year, and intangible assets. Data on R&D expenses were somewhat incomplete, which reduced our high-tech transactions from 175 to 73. These transactions were used as a sub-sample to investigate whether R&D expense and intangible assets can explain CAR for high-tech targets.

Table 2 – Descriptive statistics

Descriptive statistics. This table presents the mean values of our selected test and control variables. Differences marked with *,**,*** are statistically significant at the 10%, 5%, and 1% level, respectively, using a two-sample t-test.

	N	CAAR (-3,+3)	Avg. Bid Premium	Avg. Transaction value (in $mil)	Avg. Nr of bidders	Avg. Tender offer	Avg. Same Industry
All transaction	463	14,69 %	27,30%	$1441,86	1,06	36,06%	58,31 %
High-tech targets	175	21,01 %***	38,13%	$1019,06	1,06	41,63%	49,71 %
Non high-tech targets	285	10,74 %	20,25 %	$1688,31	1,06	32,98%	63,44 %
Cash financed transaction	271	19,13 %***	31,68 %*	$1023,73	1,10	45,58%	51,66 %
Stock financed transactions	192	8,41 %	21,13 %	$2026,78	1,01	22,91%	67,70 %

Note: Cumulative Average Abnormal Return (CAAR)

In table 2, we present the descriptive statistics of interest for our dataset. The differences in cumulative average abnormal return (-3, +3) (CAAR) between both high-tech versus non-high-tech and cash versus stock-financed acquisitions are significant at the 1% level. Further, the differences in bid premiums for cash versus stock-financed acquisitions is found significant at the 5% level. The findings will be explained more thoroughly in section 6. Another important observation from this table is the overall low average number of bidders. We include the number of bidders as a control variable in our regression models, however there is uncertainty as to whether our dataset contains enough transactions with several bidders to provide significant results.

5.0 Methodology

In this section, we will outline the methodology used to answer our research questions. Initially, we explain how abnormal returns for each transaction is acquired. Thereafter, we address each research question separately and provide a full description of the statistical procedures used.

5.1 Measuring abnormal returns

To test our hypotheses regarding abnormal returns, we first need to obtain the abnormal returns for our selected transactions. We use a standard event study methodology (Brown & Warner, 1985) to obtain abnormal returns for target firms, and a single index model that predicts normal returns for firm *i*:

$$NR_{it} = \alpha_i + \beta_i R_{mt} + \in_{it}$$

where:

α_i	= the intercept of the linear relationship between the return of stock *i* and the return of the country-specific market index.
β_i	= the slope of the linear relationship between the return of stock *i* and the return of the country-specific value-weighted market index.
NR_{it}	= the expected rate of return of firm *i* at time *t*.
R_{mt}	= the market rate of return at time *t.*
$\in_{it}$	= the error term for firm *i* at time *t.*

The α and β coefficients are OLS parameter estimates for the slope and intercept of firm *i*. To estimate the market rate of return, we use an estimation window of 120 days, ranging from -125 to -5, where day 0 is the acquisition announcement day. The abnormal return is further determined as the difference between the expected market return at time *t*, and the actual return of firm *i* at time *t*, which is obtained from their country-specific value-weighted index.

We calculate the abnormal returns for firm *i* at time *t* (AR_{it}) as follows:

$$AR_{it} = R_{it} - NR_{it}$$

With:

$$R_{it} = \ The\ actual\ return\ for\ firm\ i\ at\ time\ t.$$

After abnormal returns for all target firms are estimated, we cumulate them, to obtain cumulative abnormal returns with an event window of +/- 3 days.

$$CAR_{+3/-3} = \sum_{i=1}^{T} AR_{i,+3/-3}$$

5.1.1 Are abnormal returns higher for cash-financed acquisitions, and do high-tech targets experience higher abnormal returns?

To test the effect of payment method on abnormal returns, and if high-tech targets experience higher abnormal returns, we will regress each target firms' CAR, against two dummy variables representing payment method and high-tech targets respectively. By regressing CAR against these dummy variables, we can evaluate the relationship between the variables and abnormal returns. Importantly, to avoid biased results, we control for variables with a significant effect on abnormal returns according to previous studies. These variables include the number of bidders, acquisition type, value of the transaction, and asset relatedness (denoted as CV*i*).

The final regression model takes the form:

$$CAR_i = \ \alpha + \ \beta_1 D_1 + \beta_2 \mathrm{D2} + \ \sum_{i=1}^{n} \beta_i CV_i \qquad (1)$$

Where:

CAR_i	= Cumulative abnormal return for the *i*th company.
α_i	= The regression parameter for the *i*th variable.
D_1	= A dummy variable taking the value 1 if the acquisition is cash financed, zero otherwise.
D_2	= A dummy variable taking the value 1 if the target company is within the high-tech industry (defined by SDC Platinum), zero otherwise.
CV*i*	= Control variables.

5.1.2 Is the bid premium higher for all cash-financed acquisitions, compared to stock-financed acquisitions?

To investigate this question, we cumulate the bid premiums for all cash and stock-financed acquisitions separately and test if the difference is statistically significant by using a two-sample t-test. Furthermore, to test the explanatory power of the independent variables, we will regress the bid premium against our test variable and selected control variables:

$$BidPremium_i = \alpha_i + \beta_1 D1 + \sum_{i=1}^{N} CVi \qquad (2)$$

Where:

BidPremium	= The premium paid to the *i*th company.
D_1	= A dummy variable taking the value 1 if the acquisition is cash financed, and zero otherwise.
CV*i*	= Control variables.

5.1.3 Are abnormal returns higher for the high-tech industry, and can R&D expenses and Intangible Assets explain potential differences?

To test this hypothesis, we calculate the CAR for both the high-tech target companies, and non-high-tech targets, and test if the difference is statistically significant by conducting a two-sample t-test. Further, we regress CAR for high-tech targets, against several test variables defined below. The control variables included in this model are the number of bidders, if the acquisition is a tender offer or a merger, the logarithm of the transaction value, and the premium paid to target shareholders.

$$CAR_{i+3/-3}^{HT} = \alpha_i + \beta_1 D_1 + \beta_2 Log(R\&Dexpenses)_i + \beta_3 \frac{IntangibleAssets_i}{TotalAssets_i} + \sum_{i=1}^{n} \beta_i CV_i \qquad (3)$$

Where:

$CAR_{i+3/-3}^{HT}$	= Cumulative abnormal return for the *i*th company.

α_i	= The regression parameter for the *i*th variable.
D_1	= A dummy variable taking the value 1 if the acquisition is cash financed, and zero otherwise.
Log(R&Dexpenses)$_i$	= Target firm *i*'s logarithmic R&D expenses the past 12 months prior to the announcement day, ending on the actual announcement day.
$\frac{IntangibleAssets_i}{TotalAssets_i}$	= The relative size of intangible asset to total assets of target firm *i*.
CV*i*	= Control variables.

5.2 Important diagnostics for valid results

Before and after data is used in regression models, specific tests and assumptions need to be checked for valid results and estimates (Brooks, 2015). In this section, we outline the most critical diagnostics we control for in our analysis.

- *Homoscedasticity*

One assumption for making ordinary least square (OLS) regressions valid is homoscedasticity. The variance of the error terms should be consistent for all observations, meaning they are independently and identically distributed. If this assumption is violated, the error terms will be heteroscedastic, and the regression results unreliable. To test for heteroscedasticity in Stata, we run a White test, with the hypothesis:

H_0: Homoscedasticity
H_A: Unrestricted heteroscedasticity

- *Multicollinearity*

When fitting a regression model, multicollinearity is a problem that arises when the independent variables are highly correlated. To test for this, we create a correlation matrix, including all independent variables. Correlation values exceeding 0.8 will be removed from the regression model since they provide inefficient coefficient estimates. Increasing multicollinearity makes the coefficient estimates of the regression "unstable" with highly inflated standard deviations (Brooks, 2015). To further test for multicollinearity in Stata, we run a "variance inflation factor" (VIF)

test. Variables with a higher VIF than 10, gives evidence that they are a linear combination of other independent variables, and will be removed (O'Brien, 2007).

The correlation matrices and VIF test diagnostics for the variables used in the regression models are presented in the appendix section (Appendix 1-6).

5.2.1 Endogeneity

- *Omitted variable bias*

If one or more explanatory variables are excluded in the estimated regression model, omitted variable bias will occur (Stock & Watson, 2015, p.229). Consequently, if the omitted variable has explanatory power of the regressions' dependent variable, and is correlated to another independent variable, then a single OLS estimator is inconsistent. The error terms would also be correlated to the estimator, violating the first OLS assumption. For our regression models, omitted variable bias would be problematic if an omitted independent variable is correlated to another independent variable. If this is the case, the included variable will be correlated to the error term, causing endogeneity. The problem of endogeneity, will, to our best extent, be mitigated by adding several control variables that have been shown statistically significant against CAR in previous research.

- *Measurement errors*

Measurement errors occur when the data under assessment has been revised, changed, or altered without taking the right precautions to deal with it (Brooks, 2015, p. 3 and p. 236). For our dataset, the estimated alpha and beta coefficient, together with the calculation of abnormal returns is crucial, regarding measurement errors. To mitigate potential measurement errors, every alpha and beta coefficient is obtained through an ordinary least square estimation, using country-specific value-weighted indexes and stock prices obtained from Thomson Reuters DataStream. Furthermore, we examine both the indexes and firms stock prices thoroughly before using them for estimations. Every transaction has been checked for incomplete data and been removed from the dataset if found insufficient. Lastly, given that all variables are obtained from either SDC Platinum or DataStream, we believe measurement errors have been reduced to a minimum.

6.0 Results and discussions

In this section, we will discuss the results we obtained from our regression models and analyze our findings. We follow our research questions in order, meaning the first analysis will investigate whether the payment method affects abnormal returns for the whole sample, and if high-tech industries experience higher abnormal returns. Secondly, we discuss if the premium paid to target shareholders are significantly larger for cash-financed acquisitions, compared to stock-financed acquisitions. Lastly, we analyze the findings regarding abnormal returns in high-tech industries and discuss economic intuition around our selected test variables.

6.1 The effect of payment method on abnormal returns

Our first research question is initially addressed by running a two-sample t-test to check if there is a statistically significant difference between cash and stock payments on CAR. As we can see from table 3, there is a difference between cash and stock payment of 10.72% which is significant at the 1% level, and we can reject the null hypothesis of zero difference in mean.

TABLE 3 - Two-sample t-test: CAR (-3, +3), by CashStock

This table present the results from a two-sample t-test on CAR(-3,+3), by the group CashStock. CAR(-3,+3) is target firm's cumulative abnormal return on a three day event window around acquisition announcement date. "CashStock" is a dummy variable taking the value 1 for cash-financed acquisitions, zero otherwise.

Group	***N***	***Mean***	***t-value***
Cash	271	0.191	
Stock	192	0.084	
Combined	463	0.147	-4.975***
Difference		0.107***	

*Note: *, **, and *** indicate that the variable is significant at the 10%, 5%, and 1% level respectively.*

This is not a surprising result and is in line with previous research such as Davidson and Cheng (1997) and Wansley et al. (1983). Interestingly, our findings differentiate regarding the extent of abnormal returns. Davidson and Cheng report a difference in CAAR of 2.62% between stock and cash payments, while Wansley et al. report a difference of 16.07%. Importantly, their event window was -40/+5

and -1/+1, respectively, while our event window is -3/+3. Based on the EMH, stock prices should adjust quickly following an M&A announcement, incorporating any expected value change (Andrade, Mitchell, & Stafford, 2001). Therefore, using different lengths in event windows may yield different results.

To further investigate our research question, we conducted a multiple regression model as specified in section 4.1, with the following output:

TABLE 4 - Regression with all variables

This table presents the estimation results of the multiple OLS regression model. It tests whether the value of the transaction, the bid premium, number of bidders, whether the transaction is a tender or a merger, and cash versus stock as payment can explain the cumulative abnormal returns (-3, +3). We include the logarithm of the value of transaction to make the distribution of the transformed variable appear more normal. The bid premium is calculated as the offer price above the target closing stock price the day prior to the original announcement date, expressed as a percentage. NumberofBidders is the numerical value of bidding firms. "TenderorMerger" takes the value 1 for a tender offer, and zero for a merger. "CashStock" takes the value 1 for cash acquisitions, and zero for stock."HighTech" takes the value 1 if the target company is specified as a high-tech target according per SDC platinum. "Industry" takes the value 1 if both the target and acquirer company have the same industry code.

Regression **CAR (-3, +3)**	**Coefficients**	**t-value**
Log(ValueofTransaction)	0.018	1.39
BidPremium	0.001	1.99**
NumberofBidders	-0.035	-1.32
TenderorMerger	0.022	0.96
CashStock	0.077	3.22***
HighTech	0.065	3.14***
Industry	-0.009	-0.45
cons	0.029	0.63
N = 463	R^2 = 0.2256	
F =17.28	Prob > F = 0.0000	

*Note: *, **, and *** indicate that the variable is significant at the 10%, 5%, and 1% level respectively.*

From table 4, our results indicate three statistically significant variables, and our findings are, to some extent, in line with previous research. We expected the variable "BidPremium" to be significant, which it is at the 1% level. However,

previous research provides evidence suggesting that the value of transaction is significant on target abnormal returns, in contrast to our results.

Interestingly, the variables “NumberofBidders”, “TenderorMerger” and “Industry” are according to our dataset, not significant, even at the 20% level. This is surprising given that several studies provides evidence to the contrary (Sicherman and Pettway, 1987; Datta et al., 1992; Davidson and Cheng, 1997). However, these results are based on old data and tested on geographically different targets which may be an explanation to the different results.

“CashStock” is found significant at the 1% level and has a positive coefficient of 0.077. This implies that target company shareholders' experience on average 7.7% higher CAR (-3, +3) in cash-financed transactions. This number is notably lower than the original difference of 10.72%, found by the two-sample t-test. This is because a multiple regression model captures the explanatory power of each included independent variable, while the two-sample t-test only reports the combined difference.

The second test variable, “HighTech," is a far less researched variable on CAR across European target transactions. From the regression based on our dataset, the variable is found significant at the 1% level. The positive coefficient of 0.055 implies that high-tech target shareholders, on average, experience 5.5% higher CAR compared to shareholders of non-high-tech companies. This raises the question if the same variables used in our total sample can explain the difference in CAR (-3, +3) for high-tech targets. In section 6.3, a high-tech target regression model aims to investigate this question and give insight into potential explanatory variables.

6.2 Differences in premium paid

Similar to our first research question, we run a two-sample t-test on bid premium, to check for a statistically significant difference between cash and stock. Table 5 reports a difference of 10.98% with a negative t-value of 1.666.

TABLE 5 - Two-sample t-test: BidPremium, by CashStock

This table presents the results from a two-sample t-test on BidPremium, by the group CashStock. The bid premium is calculated as the offer price above the target closing stock price the day prior to the original announcement date, expressed as a percentage. "CashStock" is a dummy variable taking the value 1 for cash financed acquisitions, and zero for stock.

Group	***N***	***Mean***	***t-value***
Cash	271	0.317	
Stock	192	0.207	
Combined	463	0.271	-1.666*
Difference		0.110*	

*Note: *, **, and *** indicate that the variable is significant at the 10%, 5%, and 1% level respectively.*

The result implies that we can reject the null hypothesis of zero difference in mean and conclude that the mean is statistically significantly different from zero. Previous studies conducted in the US conclude similarly but provide different arguments to support their findings. Officer (2003) argues that bid premiums are higher due to tax-related circumstances, while Cai and Vijh (2007) ties higher bid premiums in cash acquisition to the deterred competition. Importantly, our next model focus on deal characteristics rather than exogenous factors. Running a multiple regression model with bid premium as the dependent variable, yielded the following output:

TABLE 6 - Bid premium regression

This table presents the estimation results of the multiple OLS regression model. It tests whether target firm market value, number of bidders, whether the transaction is a tender or a merger, industry relatedness, and cash versus stock as payment can explain the premium paid to target firms' shareholders. The bid premium is calculated as the offer price above the target closing stock price the day prior to the original announcement date, expressed as a percentage. We include the logarithm of the target firms market value to make the distribution of the transformed variable appear more normal. NumberofBidders is the numerical value of bidding firms. "TenderorMerger" takes the value 1 for a tender offer, and zero for a merger. "CashStock" takes the value 1 for cash acquisitions, and zero for stock. "Industry" takes the value 1 if both the target and acquirer company have the same industry code.

Regression BidPremium	Coefficients	t-value
Log(TargetMarketValue)	-0.114	-1.99**
TenderorMerger	0.149	2.03**
CashStock	0.051	0.55
Industry	-0.001	-0.03
NumberofBidders	0.092	1.67*
cons	0.356	1.66*
N =463	R^2 = 0.053	
F = 47.84	Prob > F = 0.0000	

*Note: *, **, and *** indicate that the variable is significant at the 10%, 5%, and 1% level respectively.*

The table above presents three significant variables, most of them expected, but with some deviation from our initial expectations. We expected the dummy variable CashStock to explain bid premiums to some degree but found it insignificant. This emphasizes that the two-sample t-test only captures the combined difference and excludes the explanatory power of relevant independent variables. Moreover, these findings are contradictory to earlier research, conducted on the US M&A market. Davidson and Cheng (1997) argue that the payment method is unrelated to abnormal returns once the bid premium is controlled for. In contrast, we find the payment method to be a significant explanatory variable regressed against CAR (-3, +3), but not against bid premium.

"TenderorMerger" has the highest coefficient, and indicate that target shareholders, on average, obtain 14.9% higher premiums in tender offers, compared to mergers. Asset relatedness, represented by the variable "Industry", is a control variable that researchers have found significant when regressed against bid premium (Morck et al., 1990). However, we find no evidence supporting these results. "Log(TargetMarketValue)," indicates that target firms gain less in excess of their market value per share as target market value increases. Intuitively, since larger target firms would require significantly higher payments in total, and since bid premium is the percentage in excess of market value per share, bidding companies would be less willing to pay larger premiums due to the risk at stake.

6.3 Abnormal returns in high-tech industries.

Results from the descriptive statistics on the total sample of 175 high-tech targets suggest that there is a significant difference in CAR between industries. From a high-tech target perspective, we find average CAR (-3, + 3) to be 21.01% and statistically significant at the 1% level. High-tech target firms also receive an average bid premium of 38.13%, which is statistically significant at the 1% level. This result is in line with Kohers and Kohers (2000) who found results supporting that high-tech targets were paid significantly higher premiums than non-high-tech target companies. Given that Kohers and Kohers' study is restricted over the timed period 1987 to 1996, thus not capturing the critical rise of the tech industry, we would expect that our findings would differ somewhat from their findings. However, they report a one-day bid premium of 37.89%. One explanation for the high average bid premiums in transactions involving high-tech targets could be due to the difficulty of valuing intangible assets. Acquirers may be overly optimistic in their valuation of the high-tech target and could end up paying based on perception rather than the actual value.

TABLE 7 - Regression High-Tech Targets

Cumulative abnormal returns (-3, +3). This table presents the estimation results of the multiple OLS regression model. It tests whether the value of the transaction, the bid premium, number of bidders, whether the transaction is a tender or a merger, and cash versus stock as payment can explain the CAR (-3, +3) for high-tech targets. We include the logarithm of the value of transaction to make the distribution of the transformed variable appear more normal. The bid premium is calculated as the offer price above the target closing stock price the day prior to the original announcement date, expressed as a percentage. NumberofBidders is a variable indicating the number of competing bids (i.e., if there is one bidder, this variable takes the number 1). TenderorMerger and CashStock are dummy variables taking the value 1, if it is a tender offer and if the payment method is cash, respectively.

Regression CAR (-3, +3)	**Coefficient**	**t-value**
Log(ValueofTransaction)	0.006	0.38
BidPremium	0.091	2.04**
NumberofBidders	-0.071	-1.62
TenderorMerger	0.048	1.40
CashStock	0.135	3.95***
Cons	0.126	2.52**
N = 175	R^2 = 0.2151	
F = 7.41	Prob > F = 0.0000	

*Note: *, **, and *** indicate that the variable is significant at the 10%, 5%, and 1% level respectively.*

To test for similarities between the full sample and the high-tech target sample, we regress the same variables on high-tech CAR as we did on the full sample. However, we removed the dummy variables "HighTech" and "Industry", as we now only investigate high-tech targets. The results suggest that the independent variables "NumberofBidders", "TenderorMerger", and "Log(ValueofTransaction)" seems to be insignificant. We find that the number of bidders is significant only at the 15% level. This finding is contradictory to economic intuition and can be due to sample inadequacies. The sample consisting of only high-tech target contains few transactions with more than one bidder involved which could explain our findings on this note.

The two variables, "BidPremium" and "CashStock", are significant at 5% and 1% level respectively. Both coefficients are positive, implying that targets receiving higher bid premiums experience higher CAR(-3, +3) and that cash as payment method yields, on average, 13.5% higher CAR(-3, +3). These findings are in line with previous research such as Jung et al. (1996), Kohers and Kohers (2000), and Faccio and Masulis (2005). However, we find no evidence supporting the argument that the market favors stock financed high-growth investments as suggested by Jung et al. (1996).

6.3.1 Can R&D expenses and Intangible Assets explain the higher CAR in high-tech target transactions?

In the previous section, the full sample of acquisitions for which data were available was first separated into acquisitions consisting of deals where the target was classified as high-tech by SDC Platinum (*N= 175*). In this section, the sample is further reduced due to the lack of available information regarding R&D expenses and intangible assets. High-tech targets with no missing values on the two new variables are included in the sample, which now contains 73 observations.

Given that our results indicate a significant difference in CAR(-3, +3) between the high-tech and non-high-tech industry, and the lack of existing research on this field in the financial literature, we find it useful to investigate it further. To value a high-tech target accurately is difficult for the acquirer due to their intangible assets and future growth opportunities. Moreover, most high-tech acquisitions are associated

with a high degree of information asymmetry (Benou & Madura, 2005). Information asymmetry can create skepticism regarding the prospects of the target and the real value of the deal.

Based on this argument we include the target firms' R&D expenses and the most recent financial information on intangible assets. The rationale is that high-tech targets with higher R&D expenses and more intangible assets will be more difficult to value accurately and could, therefore, be associated with lower bidder announcement period abnormal returns (Benou & Madura, 2005). Thus, we identify these factors as possible explanatory variables for high-tech target firm announcement period CAR.

TABLE 8 - Regression CAR (-3, +3) for High-Tech industry (Sub-sample)

This table presents the estimation results of the multiple OLS regression model on the sub-sample for high-tech targets. It tests whether the value of the transaction, the bid premium, number of bidders, whether the transaction is a tender or a merger, cash versus stock as payment, R&D expenses, and Intangible Assets can explain the CAR(-3,+3) for high-tech targets. Log(ValueofTransaction), NumberofBidders, TenderorMerger, BidPremium, and CashStock are the same variables as in the previous regressions. Log(R&Dexpenses) is a variable including the targets' disclosed logarithmic expenditures (dollar value) on R&D activities for the 12 months ending on the date of the most current financial information prior to the announcement of the transaction. We include the logarithm of R&D expenditure to make the distribution of the transformed variable appear more normal. The ratio Intangible Assets to Total Assets is included to capture the relative size of Intangible Assets to Total Assets for high-tech targets.

Regression CAR (-3, +3)	**Coefficients**	**t-value**
Log(ValueofTransaction)	-0.049	-1.56
NumberofBidders	-0.118	-2.20*
TenderorMerger	0.084	1.73*
CashStock	0.014	0.31
BidPremium	0.003	4.34***
Log(R&Dexpenses)	0.075	2.15**
IntangibleAssets/TotalAssets	0.106	0.74
Cons	0.212	2.14**
N = 73	R^2 = 0.457	
F = 8.31	Prob > F = 0.0000	

*Note: *, **, and *** indicate that the variable is significant at the 10%, 5%, and 1% level respectively.*

We find "Log(R&D expenses)" to be statistically significantly different from zero at the 1% level. The results indicate that high-tech targets with higher R&D expenses twelve months prior to the announcement day earn higher CAR (-3, +3), on average. Prior research suggests that bidders that acquire targets with a higher

degree of R&D expenditures earn significantly lower CAR in the announcement period (Hsu et al., 2009). To our best knowledge, we find no evidence regarding high-tech target shareholder CAR in this context, but our findings are in line with our initial expectations.

The variable "IntangibleAssets/TotalAssets" represents the relative relationship between the targets' intangible assets to total assets. We find this variable to be insignificant when regressed against CAR(-3, +3). It is uncertain to what extent the book value of Intangible Assets has an informative value for explaining the target share price and stock market returns. Costs related to intangible assets is also difficult to distinguish from maintenance costs related to operations. Furthermore, the leeway firms have in reporting such figures makes it difficult to decide what should be classified as an expense and what should not. Consequently, data on intangible assets from SDC Platinum may not represent the true value, which could be an explanation as to why this variable is found insignificant.

Results based on this sub-sample suggest that the payment method chosen to finance the transaction is insignificant. Interestingly, this contradicts the findings in the preceding sections covering the full sample of high-tech targets. However, in this sub-sample, only three acquirers are classified as non-high-tech, and 18 transactions are stock-financed. Thus, we argue that this result could be attributed to the sample reduction of stock financed transactions. Further, we find that high-tech target shareholders experience higher CAR (-3, +3), on average, in tender offers compared to mergers. The number of bidders is insignificant even at the 15% level, which is surprising as the number of bidders in previous literature is found to positively affect target shareholders' CAR (Datta et al., 1992). Controlling for the bid premium received by the high-tech target, we find the variable to be statistically significantly different from zero at the 1% level. Higher bid premiums received by high-tech targets positively affect high-tech target CAR (-3, +3), which is unsurprising according to existing literature.

7.0 Conclusion

In this Master Thesis, we have investigated the effect of payment method on target company shareholders' cumulative abnormal return. Further, we investigate the effect of intangible assets and R&D expenses on high-tech transactions. With the chosen restrictions, our dataset eventually consists of 463 European target transactions in the period 2000 to 2018. Using an event study methodology and specified regression models, we find results that both support and contradicts findings from previous research.

We find that the payment method does affect target CAR(-3, +3) based on the whole sample. Our results indicate a 7.7% higher CAR for target firms when they receive cash as payment. This is not contradictory to previous research and is something we expected to find. However, we find no evidence supporting that the payment method affects the bid premium which is contradictory to previous findings. Further, based on the descriptive statistics of our sample, we found that high-tech target transactions yielded 10.25% higher CAR compared to non-high-tech transactions. Given this, we included high-tech transactions as a test variable and found the results statistically significant.

Related previous research suggests that Intangible Assets and R&D can affect the valuation of firms and abnormal returns in M&As of high-tech targets (Chan et al., 2001; Gu & Wang, 2005). Thus, we included these as high-tech industry-specific explanatory variables to test a sub-sample of high-tech targets. Our findings suggest that targets with higher R&D expenses experience higher CAR around the announcement day. However, we find no evidence supporting that targets with higher Intangible Assets to Total Assets ratio experience higher abnormal returns around the announcement day. This is possibly due to intangible assets being more difficult to value in an M&A transaction (Benou & Madura, 2005).

8.0 Limitations and further research

There are some limitations to our dataset. Firstly, the number of bidders throughout the entire dataset is arguably deficient and may have an impact when we use it as a control variable. This could be an explanation as to why our results indicate that the number of bidders is insignificant when regressed against CAR. Secondly, data on target firms' R&D expenses obtained from SDC Platinum lacked some observations. Consequently, we ended up with a sub-sample of 73 transactions, which is quite low. This reduced sample size might have resulted in increased standard errors, subsequently making it more difficult to obtain significant test results.

Further, we use R&D expenses and Intangible Assets as explanatory variables, which introduces uncertainty to a degree. Even though R&D is expensed each year (European Commission, 2011), the uncertainty connected to including the ratio Intangible Assets to Total Assets as a variable in our model should not be neglected. According to IFRS, the cost of development is capitalized when the asset meets the requirements that the intangible investment is likely to be brought to the market or sold. Whether this assumption holds for all the high-tech targets in our sample is uncertain. However, we rely on the validity of both R&D expenses and Intangible Assets provided by SDC Platinum.

During our research, we found several potentials for future investigation. We investigate the M&As of publicly traded "high-tech" and "non-high-tech" targets. High-tech acquisitions are a less researched area in the finance literature. We referred to various papers suggesting that the valuation of high-tech targets may be affected by the uncertainty of R&D expenses and Intangible Assets. We argue that the role of investment bankers could mitigate the potential misvaluations of target firms with a high degree of intangibles. Acquisitions advised by experienced banks could, in turn, affect the wealth creation in high-tech transactions. Thus, we suggest that more research on this field would provide a better understanding of the magnitude of high-tech transactions for decision-makers in the future.

9.0 Appendixes

1. Correlation Matrix (Full sample)

Table 9 - Correlation Matrix (Full sample)

This table reports the correlation of the variables used in regression x. Each entry reports the corresponding correlation between the two variables. Correlation measures to what extent the variables move in tandem, where 1 indicates perfect positive correlation between the variables and -1 indicates perfect negative correlation.

	Log(ValueofTransaction)	NumberofBidders	BidPremium	TenderorMerger	Cashstock	HighTech	Industry
Log(ValueofTransaction)	1						
NumberofBidders	0.1	1					
BidPremium	-0.039	0.046	1				
TenderorMerger	-0.069	0.105	0.151	1			
CashStock	-0.063	0.174	0.084	0.2305	1		
HighTech	-0.233	0.009	0.147	0.094	0.211	1	
Industry	0.1071	0.008	-0.044	-0.103	0.162	-0.146	1

2. VIF (Full sample)

TABLE 10 - VIF (Full sample, N = 463)

Variance Inflation Factor (VIF). VIF is the ratio of variance in a multiple regression model divided by the variance of a regression model with one term. It is a quantitative measure of how severe multicollinearity is in an OLS regression. VIF values > 10 implies that the model suffers from multicollinearity.

Variables	VIF	1/VIF
CashStock	1.14	0.874
HighTech	1.13	0.883
TenderorMerger	1.09	0.918
Log(ValueofTransaction)	1.08	0.926
NumberofBidders	1.05	0.951
Industry	1.05	0.951
BidPremium	1.04	0.957
Mean VIF	1.08	

3. Correlation Matrix (Full sample, Bid premium)

Table 11 - Correlation Matrix (BidPremium)

This table reports the correlation of the variables used in regression x. Each entry reports the corresponding correlation between the two variables. Correlation measures to what extent the variables move in tandem, where 1 indicates perfect positive correlation between the variables and -1 indicates perfect negative correlation.

Bidprem regresjon	NumberofBidders	TenderorMerger	CashStock	Industry	;(TargetMarketValue)
NumberofBidders	1				
TenderorMerger	0.105	1			
CashStock	0.174	0.23	1		
Industry	-0.008	-0.103	-0.161	1	
Log(TargetMarketValue)	0.069	-0.135	-0.077	0.121	1

4. VIF (Full sample, Bid premium)

TABLE 12 - VIF (Bid Premium Full Sample, N = 463)

Variance Inflation Factor (VIF). VIF is the ratio of variance in a multiple regression model divided by the variance of a regression model with one term. It is a quantitative measure of how severe multicollinearity is in an OLS regression. VIF values > 10 implies that the model suffers from multicollinearity.

Variables	VIF	1/VIF
CashStock	1.11	0.903
TenderorMerger	1.08	0.923
NumberofBidders	1.05	0.956
Industry	1.04	0.959
Log(TargetMarketValue)	1.04	0.961
Mean VIF	1.06	

5. Correlation Matrix (High-tech targets Sub-sample)

Table 13 - Correlation Matrix (Target High-Tech Sub-Sample)

This table reports the correlation of the variables used in regression x. Each entry reports the corresponding correlation between the two variables. Correlation measures to what extent the variables move in tandem, where 1 indicates perfect positive correlation between the variables and -1 indicates perfect negative correlation.

	Log(ValueofTransaction)	NumberofBidders	BidPremium	TenderorMerger	CashStock	Intangible assets/total assets	Log(R&Dexpenses)
Log(ValueofTransaction)	1						
NumberofBidders	0.173	1					
BidPremium	0.139	0.054	1				
TenderorMerer	0.159	0.127	0.141	1			
CashStock	-0.008	0.068	0.216	0.093	1		
IntangibleAssets/TotalAssets	-0.089	0.002	-0.077	-0.192	-0.049	1	
Log(R&Dexpenses)	0.646	0.249	0.205	0.071	-0.041	-0.253	1

6. VIF (High-tech targets Sub-sample)

TABLE 14 - VIF (High-tech targets Sub-sample, N = 73)

Variance Inflation Factor (VIF). VIF is the ratio of variance in a multiple regression model divided by the variance of a regression model with one term. It is a quantitative measure of how severe multicollinearity is in an OLS regression. VIF values > 10 implies that the model suffers from multicollinearity.

Variables	VIF	1/VIF
Log(R&D expenses)	2.01	0.498
Log(ValueofTransaction)	1.79	0.558
IntangibleAssets/TotalAssets	1.14	0.879
BidPremium	1.12	0.894
TenderorMerger	1.11	0.902
NumberofBidders	1.1	0.911
CashStock	1.07	0.932
Mean VIF	1.33	

7. Value-Weighted country-specific Indexes

TABLE 15 - INDEX DEFINITIONS

All index data is retrieved from Thomson Reuters DataStream. The indexes are value-weighted, country-specific, and used to calculate expected returns.

Index	Definition
FTSE ALL SHARE	A capitalization-weighted index, comprising around 600 of more than 2,000 companies traded on the London Stock Exchange.
FRANCE CAC 40	A benchmark French stock market index. The index represents a capitalization-weighted measure of the 40 most significant stocks among the 100 largest market caps on the Euronext Paris.
WARSAW GENERAL INDEX	Based on the value of portfolio with shares in 20 major and most liquid companies in the WSE Main List.
IBEX 35	The benchmark stock market index of Spain's principal stock exchange. It is a market capitalization weighted index comprising the 35 most liquid Spanish stocks traded in the Madrid Stock Exchange General Index.
FTSE MIB INDEX	The benchmark stock market index for the Italian national stock exchange. Superseded the MIB-30 in September 2004. The index consists of the 40 most-traded stock classes on the exchange.
AEX ALL SHARE	Derived from Amsterdam Exchange index, is a stock market index composed of Dutch companies that trade on Euronext Amsterdam, formerly known as the Amsterdam Stock Exchange.
SWISS MARKET (SMI)	Switzerland's blue-chip stock market index, which makes it the most important in the country. It is made up of 20 of the largest and most liquid Swiss Performance Index (SPI) large- and mid-cap stocks.
OMX HELSINKI (OMXH)	The Helsinki Stock Exchange.

OMX COPENHAGEN (OMXC)	The Copenhagen Stock Exchange.
OMX STOCKHOLM (OMXS)	The Stockholm Stock Exchange.
DAX 30 PERFORMANCE	Consists of the 30 major German companies trading on the Frankfurt Stock Exchange.
ATHEX COMPOSITE	Athens Stock Exchange is the main Greek stock index. The Athex Composite tracks the performance of the 60 largest Greek companies.
BEL 20	The BEL 20 is the benchmark stock market index of Euronext Brussels. In general, the index consists of a minimum of 10 and a maximum of 20 companies traded at the Brussels Stock Exchange.
OSLO EXCHANGE ALL SHARE	The Oslo Stock Exchange.
MOEX RUSSIA INDEX	The main ruble-denominated benchmark of the Russian stock market.

Note: All variable definitions are retrieved from Thomson Reuters.

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