

# *The Effect of Interest Rates on Acquisition Premiums*

Bachelor Thesis: International Bachelor Economics and Business-Economics

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## 0. Abstract

This investigation explores the relationship between interest rates and acquisition premiums. By examining a set of 410 transaction premiums ranging from 1999 to 2019, in the economies of EU and USA against the average economy wide long and short term interest rates and using an OLS regression this study attempts to determine a statistically significant correlation between its independent variable (acquisition premiums) and dependent variable (interest rates). Furthermore, this study tests, by independently examining this relationship in the EU and USA if there exists a difference in the magnitude of this relationship. The first conclusion drawn was that there exists a strong and significant negative correlation between interest rates and acquisition premiums, across the entire data set of 410 transactions. Secondly, whilst EU showed to have a strong and statistically significant relationship in terms of this regression the USA data set showed no significant coefficient thereby rendering the answer inconclusive.

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## 1. Introduction

### 1.1 Topic Introduction & Research Question

The question on how to price a company covers various overlapping fields and remains a continuously debated subject which can be addressed through a vast range of explanatory variables. The price of a company becomes a material question in the context of a Merger & Acquisition (M&A) transaction, where an acquirer, ranging from a single investor to a rival company has determined the benefits of the transactions to outweigh its costs. This, therefore, simplifies even a complex company acquisition, and its various components back into a simple economic model of supply and demand. Of the various potential explanatory variables, interest rates are distinct in that they hold a strong theoretical foundation in both finance and economics. All economic actors, including those within an M&A transaction take interest rates into consideration.

Corporate finance theory and the ‘Pecking order’ model (Myers & Majluf, 1984), states that the method of financing plays a central role in the acquisition process as well as the offer price. Sources of financing for any investment should be prioritized in the following order: first internal financing through retained earnings, second debt-based financing, and third the issuance of new equity. With acquisition returns being positively correlated to the amount of debt-financing used (Bharadwaj & Shivdasani, 2003), an acquirer’s ability to access more and cheaper debt (defined by a lower interest rate) should therefore in turn increase the likelihood of an acquisition as well as the willingness to pay a higher price.

Additionally, managerial decision making further impacts the likelihood as well as the price of an acquisition (Hayward & Hambrick, 1997). If a target company has a perceived qualitative and/or quantitative value to the acquirer, a reduction in the acquisition cost will increase the attractiveness of the acquisition prospect. A reduction in the cost of debt, would therefore represent one such instance of increasing a deal’s attractiveness, *ceteris paribus*. Furthermore, the reduced cost of debt, may lead management to pay more than what they otherwise would, as to fend off competitive bids, shorten the negotiation process, and secure the prospective acquisition. Finally, prospective acquirer who seeks to benefit from a state of lower interest rates may be willing to seek out acquisition opportunities when they otherwise may not have been able to.

Theory and research from the subjects of finance and behavioural finance both point towards a strong negative correlation between acquisition prices and interest rates. This notion is once more reinforced in classical Economic theory, where first on a macroeconomic scale, the

negative correlation between interest rates and prices has been assumed axiomatic, and second on a microeconomic scale the demand for a single company (implying a fixed supply and quantity), and the price paid for it (inherently linked to the interest rates of the debt financing structure), are positively correlated.

This paper seeks to discover whether a decrease in interest rates (cost of debt), results in an increase in the price paid in transactions, and whether this relationship varies across economies (USA vs. EU). Hence the main research question is as follows:

**“Does a decrease in market wide interest rates result in an average change in acquisition price?”**

## 1.2 Relative pricing: premiums as a proxy for price

As referred to earlier, the pricing of a single company, let alone the aggregate of companies in a set of acquisitions, presents several technical and theoretical problems, necessitating the usage of a strong proxy.

Given that companies vary greatly in size, unique value for the acquirer, industry, and business model among others, as well as the fact that a single company is never acquired in the same state twice, acquisition (or takeover) premiums serve this purpose well. Defined as:

$$\text{Acquisition Premium} = ((\text{Price Paid per share for the Target Company}) - (\text{Pre-acquisition value per share})) / (\text{Pre-acquisition value per share}).$$

As the acquisition premium presents a relative measure of pricing (stated as a percentage of pre-acquisition trading price), it allows for the average measure across time and across multiple companies. Furthermore, among public transactions acquisition premiums are publicly reported and therefor present for quantifiable measurements of changes in relative pricing.

Research in the field of M&A, and its determining variables, have utilized as a proxy for price, acquisition premiums, due to but not limited to the aforementioned rationale. Evident from this research is that premiums in a theoretical sense often act in similar manner to the economic notion of price, strengthening their validity as a proxy. For example, ‘acquisition premiums are positively related to bargaining strength of the acquiring firm’ (Varaiya, 1987), ‘takeover premiums are driven by unique perceived valuation’ (Nielsen & Melicher, 1973), and finally

‘the higher the quantity of bidders the higher the acquisition premium paid’ (Walkling & Edmister, 1985)

Finally, and most significantly, the usage of acquisition premiums as a variable to measure different pricing structures in acquisitions can be found in the The Quarterly Journal of Economics-published paper by Michael Gort (1969). Where the author measures among others various determinants of acquisitions and acquisition premiums. As a top-5 economic journal, this study lends credibility to the use and study of acquisition premiums, not only in a finance setting, but also in a traditional economic one.

### 1.3 Conceptual framework: Summarized Data and Methodology

#### 1.3.1 Definitions of Key Variables and Concepts

The target firm’s perspective will be taken, thus target firm specific data will be utilised. Firstly, the diverse range of acquisition types must be limited, therefore this investigation shall exclusively look at large cap (deal values exceeding \$1,000m), public acquisitions. USA and EU acquisitions will be defined as those where the acquiring company is headquartered in the USA or EU economic regions. These will be matched against the interest rates (the independent variable of interest), of those respective economies during the relevant time period. Furthermore, the timeframe must be measured over a significant number of years, as interest rates generally only change significantly in the long run. Acquisitions (especially large cap ones) also are a lengthy, several month-long endeavour. Any valuable insight about the relationship between these two factors must take these long-time horizons into account. The timeframe will be 31.12.1999 to 31.12.2019, providing a total of 40 semi-annual fiscal time windows.

#### 1.3.2 Acquisition Premium

Given the necessity for transparent pre-acquisition and acquisition share price data further justifies the exclusive focus on public acquisitions, through the availability of data and by extension the ease of calculation using the formula in section 1.2. In large cap acquisitions, information leakage (insider information) can occur, causing increased trading volumes several days prior to the acquisition announcement. Therefore it is not obvious what specific date and time period should be taken into consideration to best address this change of premium for the entire period of  $t < 0$  (where  $0$  denotes the announced acquisition date). It is for this reason that premiums are calculated often at 3 relevant dates/time-intervals. Conventionally, financial institutions and analysts look at the dates/time-intervals of: pre rumour premium, one month before  $t=0$  premium, and one day before  $t=0$  premium. Most cases see a decrease in the

premium associated with a price from one month before  $t=0$  to one day before  $t=0$ . This corresponds to the widely accepted notion of Weak Market Inefficiency (Fama, 1970), stating that insider information is not incorporated into the current share price.

### 1.3.3 Data & Data Sourcing Sourcing

‘MergerMarkets’ provides a complete list of over 306,000 deals dating back to 31.12.1997. Buyer geographies will be filtered for 1) USA, and 2) EU. Company Role Type will be set to “Buyer Publicly Owned” and “Target Publicly Owned”. Whilst not equally essential as the filter for public targets, the focus on Public Buyers excludes many transactions that are partial if not entirely undisclosed. The other key deal specific detail will consist of values upwards of \$1,000m. This will be done for the complete 40-time windows in question (2 windows per year, across 20 years). MergerMarkets calculates and provides the share price premiums for all three relevant variations mentioned in section 1.3.2. Interest rates will be sourced directly from the Organisation for Economic Cooperation and Development (OECD).

This investigation will utilize an ordinary least square regression (OLS). For accuracy several key factors will have to be controlled for. These will account for both domestic and international acquisitions and include company size (sourced via MergerMarkets and measured through *EBITDA*), acquisition multiples (sourced via MergerMarkets and measured through *EBITDA Multiple*), relative profitability (sourced via MergerMarkets and measured through Earnings Per Share (EPS)), and semi-annual *GDP Growth* of the respective economies (sourced via the OECD). The general OLS formula applied will be as follows:

$$\text{Premium} = \alpha + \beta_1(\text{Interest Rate}) + \beta_2(\text{EBITDA}) + \beta_3(\text{EBITDA Multiple}) + \beta_4(\text{EPS}) + \beta_5(\text{GDP Growth}) + \varepsilon$$



## 2. Literature Review

### 2.1 Introduction to literature review and theoretical structure

M&A transactions and its interconnected variables have been the subject of a vast quantity of empirical studies, from the fields of financial and business-economics. Previous research generally uses similar publicly disclosed acquisition financials to this study, using data provided by a range of sources, often dependent on the specific country in question. As most papers have combined a multitude of factors measured across time the common econometric method of either a vector autoregression or panel data is implemented. Generally, many of the relationships uncovered in previous studies are of relevance for this investigation as they determine which variables are to be controlled for as to isolate for the desired relationship (namely interest rates against acquisition premiums).

The existing literature can broadly be divided into two categories, which this study seeks to combine: 1) research specific to the various factors (most notably being interest rates) towards acquisitions, and 2) research specific to the various factors driving acquisition premiums.

### 2.2 Impact of interest rates on acquisitions

The subject of M&A has been covered extensively, as it presents a case study for the topics of domestic investments as well as foreign direct investments (FDI), and how an economy and its policy makers impact the allocation of capital. The interchangeable use of the greater FDI and cross-border M&A (CBMA) can be justified through the work of Brakman, Garita, Garretsen & van Marrewijk (2008), who determined that 78% of FDI consists of cross-border M&A.

Uddin & Boateng (2011), extending upon Dunning's (2009) emphasis on the importance of macroeconomic variables in determining FDI analyse a set of CBMA's, and regress these against a set of various independent macroeconomic variables. Their resulting findings show that rising interest rates increases the rate at which capital leaves the UK in the form of outward-bound M&A. Along with their findings they extend upon the works of Tolentino (2010), who determined that a reduction in domestic interest rates increases the rate of outward-bound M&A due to the capital abundance generated through the reduced cost of financing.

Yagil (1996), has additionally discovered this inverse relation between interest rates and outward-bound M&A formation. Boatenga, Huab, Uddin, & Dud (2014) examine the macroeconomic factors driving CBMA, analysing for their sample UK M&A outflows (UK firms acquiring non-UK firms) during the period of 1987-2008. They conclude that CBMA show a positive and significant correlation against several macroeconomic variables including GDP, broad money supply, share prices and real effective exchange rate. In contrast, inflation rate and interest rates show a negative and significant correlation against CBMA.

On the other hand, it is of key importance to note studies who have shown how the negative relationship exists when assessing interest rates from the opposite perspective. Namely, the works by Yang, Groenewold, & Tcha (2000) and Jeon & Rhee (2008) concur that the lowering of interest rates has been crucial in attracting foreign investments into domestic markets.

Whilst this study seeks not to differentiate between outward-bound and inward-bound M&A activities to this extent, these previous findings show strong support, in accordance with economic and financial theory, for the negative significant relationship of interest rates and the willingness to acquire.

### 2.3 Determinants of acquisition premiums

Acquisition premiums have been the subject of investigation for a multitude of finance-focused papers, extending beyond macroeconomic variables and additionally focusing on firm specific factors.

Walkling & Edmister (1985), find several factors that will lead to a higher premium. These include declining leverage ratio, high valuation ratios, percentage of shares already controlled by the acquirer, a larger number of competing bids, and the ability to implement potential change. Significant to this study is the finding regarding declining leverage ratio, which presents an increase in the company's debt-capacity in-line with the Pecking order theory. Furthermore, and as previously stated, the finding that competing bids and the ability to implement potential change (implicitly linked to perceived value), would indicate that acquisitions premiums share many characteristics with the economic variable of price. Varaiya (1987) makes an extremely similar finding in that higher acquisition premiums are predicted to be positively related to "(1) the magnitude of the acquiring firm's estimate of acquisition gains, and (2) the acquired firm's relative bargaining strength."

Wickramanayke & Wood (2009) analyse the determinants of tender offers in Australia and Canada respectively, attempting to fill a previous gap in the literature by focusing exclusively on the mining industry. One relevant finding is that poor managerial performance leads to an increase in acquisition premiums, which can be assumed to be strongly correlated to the previously determined estimation of acquisition gains. Furthermore, the second key finding indicates a positive relationship between cash payments and acquisition premiums, supporting the proposition that the immediate realisation of capital gains tax liabilities by target shareholders forces the acquiring firm to offer a greater premium to induce the acceptance of the takeover offer.

Meier, Meinzer & Paientko (2019), find that the primary driver for increased acquisition premiums is the sought quantity of ownership, and thus control. Given that the level of control corresponds to the potential estimate of acquisition gains and the ability to enact valuable

change, this finding lends further credibility to the perceived-value argument. Additionally to their findings regarding perceived-value, their investigation shows several key insights, namely: 1) 'Takeover premiums are shown as a wave phenomenon', 2) Public listing of the buying entity results in higher takeover premiums, implying a strong attention-effect, 3) Payment modality (cash based acquisitions vs. stock based acquisitions), and by extension the uncovering of asymmetric information shows a strong effect on the eventual premium paid, 4) 'The size of the target company is negatively correlated with the level of takeover premium'. The fourth point specifically necessitates the usage of holding the size variable constant for this paper's findings. Finally, their study shows that economies defined as capital-oriented vs. bank-oriented paid significantly higher acquisition-premiums.

## 2.4 Hypothesis

Based on the previous literature, taking into consideration both the macroeconomic, as well as the firm specific variables, it becomes evident that acquisition premiums behave similar to the economic notion of price, and thereby are expected to have a negative relationship to interest rates. Furthermore, based on the literature that supports the notion of managerial hubris (namely Hayward & Hambrick, 1997), this paper hypothesises that, management decision making may be governed by less rational motives. That is to say, when there is money to be borrowed cheaply, they will seek an opportunity to spend it via an acquisition, and thus reap the perceived benefits. In this process they are willing to overspend, using debt that they may previously not have had access to, resulting in a higher premium paid for a company as paying the lowest possible price takes second priority to completing the acquisition.

Research regarding M&A activity on a whole indicates a consensus of a negative correlation towards interest rates. Therefore it is hypothesised that:

**H1: "A decrease of market wide interest rates results in an increase in the percentage of average acquisition premiums"**

Meier, Meinzer & Paientko (2019), in their assessment of capital-oriented vs. bank-oriented economies, refer to the works of Levine (2002) and Rossi & Volpin (2004). As they define the USA economy as more capital-oriented, and Germany/France as bank-oriented, and determine that the former pays higher premiums in general, it can be assumed that a similar relationship to hold in response to interest rates extended across the entire EU economy. This relationship is further reflected within the M&A professional scene where differences in culture often reflect differences in acquisition premiums. Namely that, European M&A markets are commonly considered to be more rigid and conservative (Sander Griffenjoen – MD Rothschild London).

Whilst it could be argued that a bank-oriented economy would respond stronger to a change in interest rates, Antoniou, Guney & Paudyal (2008), find that capital-oriented economies show higher leverage ratios, and thus have the tendency to take on more leverage. This relationship is assumed to also be reflected in their relative response to changing interest rates and therefore it is further hypothesised that:

**H2: “The negative correlation between interest rates and acquisition premiums is more pronounced in the USA than in the EU”**

## 2.5 Contribution & Relevancy

Whilst premiums, acquisitions, and interest rates have been studied extensively for their determining factors and their impact on the greater market and economy, this paper would fill a void in the existing literature and thus also contribute to future investigations. Specifically, the combination of regressing acquisition premiums against the macroeconomic variable of interest rates has been omitted from the current literature.

Furthermore, the conclusions drawn by such research would assist decision and policy makers in the private and public sector to better understand 1) The impact of their own decisions in the case of the Central Bank governance, and 2) The factors driving their decision making and return-projections in the case of investors and management.

Future investigations hold the opportunity to both broaden the research and specify it. By for example isolating various industries (as seen in the work of Wickramanayke & Wood, 2009), or by assessing the impact of M&A ‘premium waves’ (Meier, Meinzer & Paientko, 2019), research could gain a clearer understanding of the various magnitudes for the relationship between interest rates and premiums. Furthermore, research could be broadened using greater data sets, analysing for changes over longer periods of time and whether this relationship has changed in recent years and decades.

## 3. Data & Methodology

### 3.1 Data Sourcing

Transactions will be sourced through the widely used and reputable MergerMarkets database. The database is managed by Acuris and is frequently utilized by financial intuitions due to its

ability to search and specify large sets of acquisition data from its catalogue of over 306,000 deals. The system provides an extensive selection of numeric and non-numeric data points on acquisitions which can be specifically selected and filtered for. Figure 1 summarizes the variables relevant to this study and the filters applied to extract the necessary data.

*Figure 1: Summary of search criteria applied on MergerMarkets*

Variable	Filter applies
<i>Buyer Geography:</i>	USA & EU Respectively
<i>Value:</i>	Greater than or equal to USD (m) 1,000
<i>Deals with Undisclosed Value:</i>	Included
<i>Announcement date:</i>	Between 31/12/1999 - 31/12/2019

The OECD is a public Co-operation between 37 governments, that has provided reliable data and analysis since 1948. Similar to MergerMarkets this platform allows for the specific selection and filtering of its datasets. From its wide range of macroeconomic statistics, the ones of relevancy consist of “Short-term interest rates”, “Long-term interest rates”, and “Nominal GDP forecast”. As this data applies to the various time-frames, the output range was selected of “Q1 2000 – Q42019”, this corresponds to the timeframe of 31.12.1999 to 31.12.2019. To filter for the countries in question the “EU-19” and the “United States” were selected.

### 3.2 Data

The sample used for this investigation will cover a total of 410 transactions over the 20-year period of 31.12.1999 to 31.12.2019. This set is comprised of 190 USA transactions and 220 EU transactions. These constitute all public transactions with a deal value equal to or exceeding \$1,000m. In particular this cut-off is chosen as it selects for mature companies, investors with a similar level of investing capital, and avoids acquisitions that represent asset/subsidiary sales. Furthermore, this set of transactions provide the highest level of transparency and therefore data availability. These acquisitions are reported in nominal terms as MergerMarkets does not adjust the historical data to inflation. All data entries are denominated in \$ millions, as to avoid discrepancies caused by exchange rate differences between € and \$. This therefore determines the use of nominal values for the other relevant variables including Nominal GDP growth and firm specific control variables. Corresponding firm and deal specific variables, namely EBITDA, EBITDA-Multiple, EPS, and Deal Value are provided in the same data set via MergerMarkets and accurately matched to each transaction. It should be noted that a total of 114 transactions had one or more missing data entries for control variables, to which the average

of the remaining 296 was used for specifically EBITDA, EBITDA-Multiple and EPS as to have the least impact upon the regression result.

Interest rate data was provided by the OECD on a quarterly bases, covering a total of 80 data points for “Long-term interest rates” and “Short-term interest rates”, respectively to the USA and EU economies, for a total of 320. The average of two quarters was taken to find an interest rate applicable to the aforementioned 40 semi-annual time periods. Finally, Nominal-GDP growth also sourced through the OECD consisted of 80 quarterly data points for the USA and EU economies repetitively. Here similarly to the method applied to interest rates the average of two quarters was calculated to match GDP data against the time periods in question.

## 3.2 Definition and Justification of Variables

### 3.2.1 Dependent Variable

#### *Acquisition Premium*

Acquisition Premiums broadly within the theoretical framework of this study will serve as a proxy for company price. As previously stated, they have both been the subject of various reputable papers, as well as serving as relative metric to measure pricing across companies/transactions and across time, and therefor can be regressed against the independent variable of interest rates. Defined as:

$$\text{Acquisition Premium} = ((\text{Price Paid per share for the Target Company}) - (\text{Pre-acquisition value per share})) / (\text{Pre-acquisition value per share}).$$

The Weak Market Efficiency Hypothesis (Fama, 1970), states that all current and disclosed information is incorporated into the price, as an acquisition announcement would thus impact the share price and premium, various intervals are made necessary. MergerMarkets calculates 3 key different Premiums. These consist of the *Pre-Rumour Premium*, *One Month Before Premium*, and *One Day Before Premium*, note that these will be the variable’s notation onwards. *Pre-Rumour* rates are of highest relevance as they reflect the share price before it incorporates the information related to the impending acquisition, and in most cases the premium decreases as acquisition date approaches. This study will investigate each of these individual premiums against both the long- and short-term interest rates, as to increase the scope of this research and provide a comprehensive result.

### 3.2.2 Independent and Control Variables

#### *Interest Rates – Independent Variable*

Interest rates across an economy can be measured in a multitude of ways, each consisting of a different maturity and yield. OECD provides two highly relevant rates in the form of “Long-Term interest rates” and “Short-Term interest rates”. “Long-term interest rates” are defined as the value of government bonds maturing in 10 years. “Short-term interest rates” are calculated by taking the average of daily rates, representing the rate at which short term borrowing takes place between financial institutions or at which short-term government papers are issued/traded. These variables will be referred to *Long term rate* and *Short term rate* respectively from here onwards. as According to the Expectation Hypothesis by Corte, Sarno & Thorton, (2008), long term interest rates represent investors’ expectations of future short term rates, implying a strong relationship between the two and necessitating the measurement of both for increased scope and accuracy. The ultimate policy makers for long term rates are the central banks of the respective economies under investigation, namely the Federal Reserve for the USA, and the European Central Bank for the EU.

#### *GDP Growth* – Control Variable

As economic growth and interest rates are frequently negatively correlated (Atanasov, 2021), and to eliminate the possibility for Acquisition Premiums to be the product of economic growth correlated against the measured interest rate, *GDP-Growth* must be controlled for. Additionally, as this study assumes that managerial hubris is a cause for H1, it is important to control for economic growth as a psychological variable, whereby the mass-psychological impact of an economic boom may strengthen managements willingness towards acquisitions and higher premiums. Nominal *GDP-Growth* is found by expressing the values of all goods and services produced in the current reporting period for the EU and USA respectively. Inflation related variables including inflation rate and money supply among others have been omitted from this study as a nominal perspective exclusively will be considered.

#### *EBITDA* – Control Variable

EBITDA is defined as “Earnings Before Interest Taxes Depreciation & Amortization”, an accounting line item comparable to the notion of ‘operating profit’, and a proxy for size. In the context of M&A, the EBITDA is the most frequently utilized determinant for size as it is used to calculate the Enterprise Value (see *EBITDA Multiple* – Control Variable). Due to the assumption that greater company size allows for risk reduction (Hargreaves Lansdown), a larger company can command a higher price and by extension a higher premium. Furthermore, it additionally serves as a proxy for absolute profitability and cash-generation, and therefor investors frequently base their acquisition decision on this line item.

#### *EBITDA Multiple* – Control Variable

The EBITDA multiple is defined as  $EBITDA\ Multiple = Enterprise\ Value / EBITDA$ , and refers to the ratio between company price and ‘operating profit’ (EBITDA). Whilst absolute EBITDA serves as the most relevant proxy for size within an M&A setting, the EBITDA Multiple provides a strong overarching proxy to account for the differences in business-strategy, industry, and further discrepancies between businesses that result in a difference in price and valuation (Baker & Rubadck, 1999 and Serra & Favero, 2018). Notable is the deliberate omission of the variables of absolute EBIT (“Earnings Before Interest & Taxes”) and EBIT Multiple. This is because by definition they have an extremely high correlation to the chosen *EBITDA* and *EBITDA Multiple* variables and would therefore be a cause for potential multicollinearity. In addition to an EBITDA multiple, other relevant ratios used in M&A may include Sales, Gross Profit, Operation Square Meters, and Active Users among others. However, there exist two reasons this study has chosen exclusively on EBITDA Multiple: 1) They are the most commonly used multiple in an M&A setting (Suozzo, Cooper, Sutherland, & Deng, 2001), and therefore would capture the largest share of the regressed data, and 2) the strong correlation of other multiples against EBITDA (as with EBIT and EBIT multiples), may cause multicollinearity and hinder this study from generating a parsimonious model.

#### *EPS* – Control Variables

To ensure further accuracy and eliminate the effect of omitted variables, an additional firm-specific metric will be controlled for that potentially impact the overall premium for the acquisition. This will consist of *Earnings Per Share (EPS)* (Defined as  $EPS = Total\ Earnings / Outstanding\ Shares$ ) as this often can result in a significant impact on an investor’s perspective, and visa-versa (Jitmaneroj, 2017).

### 3.3 Empirical Method and Model

To test for the two hypotheses, this study applies an empirical model centred around an Ordinary Least Squared (OLS) regression. Broadly defined this empirical model comprises of measuring for a linear relationship and correlation between the various dependent, independent, and control variables.

Whilst other premium and M&A studies have included various methods ranging from panel data models to non-linear models, given the data structure and research question, OLS serves the most appropriate function. For the large set of regressions ran, an OLS model can most efficiently, and effectively measure in a linear fashion the relationship of acquisition premiums and interest rates.

To test the first hypothesis: whether the independent variable of interest rates significantly impacts the dependent variable of acquisition premiums, a total of 6 regressions will be run,



based on the 2 sets of interest rate variables (*Long term rate & Short term rate*), measured against 3 sets of premium variables (*Pre Rumour, One Month, and One day*).

To test the second hypothesis: whether the relationship between interest rates and acquisitions premiums is more pronounced in the USA than the EU, the data set of acquisitions will be separated into EU and USA and a similar regression will be ran, resulting in 12 total regressions. All control variables will be applied in each regression. This framework will result in a comprehensive examination of the research question and offer additional insight that can be contrasted against both Economic and Financial theory. Figure 2 shows an overview of the general structure applied to all regressions, each unique combination of dependent and independent variables will be tested for in order to give a comprehensive answer to the research question and hypothesis, in detail seen in Appendix 1.

*Figure 2: Overview of regression structure applied*

$y$	$\alpha$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$
<i>Pre Rumour Premium,</i>	<i>Constant</i>	<i>Short term rate<sub>USA &amp; EU</sub></i>	<i>EBITDA</i>	<i>EBITDA Multiple</i>	<i>EPS</i>	<i>GDP Growth</i>
<i>One Month Premium</i>		<i>Long term rate<sub>USA &amp; EU</sub></i>				
<i>One Day Premium</i>		<i>Short term rate<sub>EU</sub></i>				
		<i>Long term rate<sub>EU</sub></i>				
		<i>Short term rate<sub>US</sub></i>				
		<i>Long term rate<sub>US</sub></i>				

### 3.4 Outline of Statistical Test(s) & Statistical Metrics used

The methodological framework above will utilize several key statistical test and test values to ensure that this investigation accurately answers its two hypotheses. The outcome structure of the test results will provide each of the beta's in section 3.3 with a numeric value, which will carry an implication upon the investigated relationship.

The two core variables of acquisition premium data and interest rate data are reported by their respective sources in percentages. For simplicity and consistency all values will be processed in their decimal form. Therefor eg. an interest rate of 2.5% will be calculated as the value 0.025, and an acquisition premium of 33% will be calculated as the value 0.33. The implication then for a negative correlation of eg. -1.5, is that a 1% increase in interest rates results in a 1.5%

reduction acquisition premium. The identical approach shall be applied for the GDP Growth rate, which is also reported as a percentage. For the values of EBITDA, EBITDA multiples and EPS their reported absolute decimal values will remain unchanged. Furthermore, the statistical output will benchmark statistical significance at 5%, requiring that the P-value is below 0.05.

Prior to the applied framework in 3.3, a test for multicollinearity was performed to ensure that there exists no correlation between the intended variables and that the assumptions of OLS are accurately met. Performing this test on the complete set of selected (potential) variables grants the output seen in Figure 3.

Figure 3: Correlation Matrix (of the entire potential dataset)

	<i>Pre Rumour</i>	<i>One Month Premium</i>	<i>One Day Premium</i>	<i>Long term rate</i>	<i>Short term rate</i>	<i>EBITDA</i>	<i>EBITDA Multiple</i>	<i>EPS</i>	<i>Net Debt</i>	<i>Deal Value</i>	<i>GDP Growth</i>
<i>Pre Rumour</i>	1.0000										
<i>One Month Premium</i>	0.6767	1.0000									
<i>One Day Premium</i>	0.5649	0.5701	1.0000								
<i>Long term rate</i>	-0.1466	-0.2060	0.0884	1.0000							
<i>Short term rate</i>	-0.1140	-0.1562	-0.0520	0.7889	1.0000						
<i>EBITDA</i>	-0.1244	-0.0689	-0.0570	0.0171	-0.0543	1.0000					
<i>EBITDA Multiple</i>	0.3152	0.3282	0.0601	-0.0209	-0.0260	-0.1009	1.0000				
<i>EPS</i>	-0.0524	0.0245	0.0488	0.1027	0.0648	0.0499	-0.0448	1.0000			
<i>Net Debt</i>	-0.1247	-0.0466	-0.0092	-0.0536	-0.1144	0.7568	-0.0742	0.0286	1.0000		
<i>Deal Value</i>	-0.0102	0.0376	0.0407	-0.1121	-0.0946	0.3419	0.0048	-0.0125	0.4897	1.0000	
<i>GDP Growth</i>	-0.0288	0.0589	-0.1494	0.0608	0.1866	-0.0534	0.0264	0.0276	-0.0593	-0.0597	1.0000

The strong correlation of 0.7889 between the *Long term rate* and *Short term rate* support the Expectation Hypothesis, and further justifies the separation in regression between the two values. Similarly, all 3 types of acquisition premiums share a very high correlation, which is to be expected and further justifies the separation in regression between the three values. Having

performed this test against a set of additional potential firm-specific control variables, consisting of *Net Debt* and *Deal Value*, has resulted in multicollinearity against one and other. Therefor this study has excluded them from the final framework.

### 3.5 Selection criteria & Descriptive Statistics

This examination does not utilize time-series statistical data or tests, and instead opts to allocate each average period interest rate against the set of acquisitions based on the individual announcement dates. This results in an imbalance in the data, whereby several values of interest rates are allocated to more acquisitions than others. This is to be expected as it is common for number of acquisitions to vary across the year. This may indicate a relationship between the number of acquisitions and the prevailing interest rates, as seen in studies by Tolentino (2010) and Yagil (1996). As this study focuses on specifically the acquisition premiums this relationship will be omitted from its scope. A summary of the data points can be seen in Appendix 2, indicating the relevant frequency of each specific interest rate that appears in the data set. Whilst not perfectly uniform, the data can be referred to as ‘semi-balanced’ and in general lacks discrepancies that would disqualify this study’s findings.

The initial data set included upwards of 440 observations which were individually processed for necessary omissions. Firstly, all deals that did not report acquisition premiums were necessarily removed. Furthermore, several strong outliers in the data were investigated on a case-by-case basis. This study implicitly touches upon the notion of seller-power, whereby a higher degree of seller power commands a higher acquisition premium (Reuer, Tong, & Wu, 2012). To address this and select for a set of observations with approximately comparable seller power: large negative values in *Pre Rumour Premium* and *One Month Premium* were removed as they represented instances where a sale was necessitated from the perspective of the existing shareholder, and therefor do not accurately compare to the instances in the data set. The final selection then resulted in the 410 observations which this study applied its methodological framework upon. Finally, the data set categorized USA and EU on the criteria of headquarters. This resulted in several countries where the dominant region of business was categorized in a region different to its headquarters. Within the selection of USA acquirers 10 out of 190 defined their dominant region as non-USA, and within the selection of EU acquirers 26 out of 220 defined their dominant region as non-EU. Appendix 3 gives a descriptive statistical overview of all data used in this study.

## 4. Results and Discussion

### 4.1 Introduction & Summary

Figures 4 through 10 summarize the outcome of the methodological framework, and broadly-speaking indicates an inverse relationship between acquisition premiums and interest rates. As to be expected the different specific variables and their combinations result in differences in  $\beta_i$  and level of statistical significance, however general conclusions towards answering the research question can be made. From the selected data set it becomes evident that when analysing the USA plus EU economies there exists a strong negative relationship when regressing *Long term rate* and *Short term rate* against *Pre Rumour Premium* and *One Month Premium*, whilst often this relationship was not statistically significant when regressed against *One Day Premium*. When analysing differences between the economies the EU economy reflects the combined data set of USA plus EU in that this inverse relationship was significant and often more pronounced. However, this investigation failed to find a significant relationship of any sort in the selected set of USA transactions when analysed independently. To differentiate between the highest level of statistical significance and a regular level of statistical significance, the following notations have been used: \* denotes  $0.000 < P < 0.5$ , whilst \*\* denotes  $P = 0.000$

### 4.2 Results for H1

Figure 4: Regression output for USA & EU transactions – Short term rates

	$\alpha$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$
Regression						
A1	0.264301	-1.825683	-0.000011	0.003871	-8.25e-06	-0.296876
Significance	Yes**	Yes*	Yes*	Yes**	No	No
Std. Error	0.030830	0.822267	5.37e-06	0.000602	0.000015	0.652730
A2	0.155140	-2.643451	-4.58e-06	0.003736	0.000014	0.977361
Significance	Yes**	Yes**	No	Yes**	No	No
Std. Error	0.027794	0.741300	4.84e-06	0.000543	0.000013	0.588461
A3	0.143587	-0.321531	-4.54e-06	0.000478	0.000012	-1.291559
Significance	Yes**	No	No	No	No	Yes*
Std. Error	0.020205	0.538877	3.52e-06	0.000395	9.57e-06	0.427770

Figure 4 shows the relationship between the three different premiums (A1: *Pre Rumour Premium*, A2: *One Month Premium*, and A3: *One Day Premium*) against the *Short term rate* in the USA plus EU economies. *Short term rate* has a strong and significant relationship of -1.825683 and -2.643451 against *Pre-Rumour Premium* and *One Month Premium* respectively.

Against *One Day Premium* no significant relationship was found. Furthermore, *EBITDA Multiple* shows a significant but small correlation against the *Pre Rumour Premium* and *One Month Premium*, however not against *One Day Premium*. *GDP Growth* impacts the dependent variable of and *One Day Premium* but not *One Month Premium* and *Pre Rumour Premium*. *EBITDA* and *EPS* show no such relationship to any of the dependent variables.

In short and in general: *Pre Rumour Premium* and *One Month Premium* are significantly and negatively correlated against the prevailing *Short term rate*. Other independent variables show minimal and inconsistent correlation against the dependent variables.

Figure 5: Regression output for USA & EU transactions – Long term rates

	$\alpha$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$
Regression						
B1	0.343466	-3.417000	-0.000011	0.003887	-6.07e-06	-0.453313
Significance	Yes**	Yes*	Yes*	Yes**	No	No
Std. Error	0.045649	1.186810	5.34e-06	0.000510	0.000015	0.640164
B2	0.2659958	-4.820557	-3.40e-06	0.003761	0.000017	0.746786
Significance	Yes**	Yes**	No	Yes**	No	No
Std. Error	0.040942	1.064432	4.79e-06	0.000538	0.000013	0.574153
B3	0.179155	-1.330446	-4.35e-06	0.000474	0.000013	-1.295778
Significance	Yes**	No	No	No	No	Yes*
Std. Error	0.029944	0.778505	3.50e-06	0.000393	9.57e-06	0.419925

Figure 5 shows the relationship between the three different premiums (A1: *Pre Rumour Premium*, A2: *One Month Premium*, and A3: *One Day Premium*) against the *Long term rate* in the USA plus EU economies. *Long term rate* has a strong and significant relationship of -3.417000 and -4.820557 against *Pre Rumour Premium* and *One Month Premium* respectively, more pronounced than the *Short term rate*. Against *One Day Premium* no significant relationship was found. Furthermore, *EBITDA Multiple* shows a significant but small correlation against the *Pre Rumour Premium* and *One Month Premium*, however not against *One Day Premium*. *GDP Growth* impacts the dependent variable of *One Day Premium* but not *Pre Rumour Premium* and *One Month Premium*. *EBITDA* and *EPS* show no such relationship to any of the dependent variables.

In short and in general: *Pre Rumour Premium* and *One Month Premium* are significantly and negatively correlated against the prevailing *Long term rate*. Other independent variables show minimal and inconsistent correlation against the dependent variables.

#### 4.2.1 Commentary on H1

From this sample it becomes evident that indeed for the dependent variables of *Pre Rumour* and *One Month Premium*, both long run and short run interest rates are negatively and significantly correlated. The additional independent variables have less consistent and less pronounced correlations. In accordance with the Expectation Hypothesis, the Long term interest rates effect is more pronounced than the Short term rate. Broadly speaking this provides sufficient evidence for H1, thereby being unable to be rejected.

#### 4.3 Results for H2

Figure 6: Regression output for EU transactions – Short term rates

	$\alpha$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$
Regression						
C1	0.291913	-2.637628	-9.98e-06	0.000609	-0.000018	0.311815
Significance	Yes**	Yes*	No	No	No	No
Std. Error	0.039545	1.147869	5.58e-06	0.001012	0.000017	0.883419
C2	0.2023911	-4.611287	-6.96e-06	0.0003843	0.0000138	2.089598
Significance	Yes**	Yes**	No	No	No	Yes*
Std. Error	0.034143	0.991074	4.82e-06	0.000873	0.000015	0.762747
C3	0.166610	-1.437678	-4.07e-06	0.000511	9.96e-06	-1.555461
Significance	Yes**	No	No	No	No	Yes*
Std. Error	0.030288	0.879168	4.27e-06	0.000775	0.000013	0.676622

Figure 6 shows the relationship between the three different premiums (A1: *Pre Rumour Premium*, A2: *One Month Premium*, and A3: *One Day Premium*) against the *Short term rate* in the EU economy. *Short term rate* has a strong and significant relationship of -2.637628 and -4.611287 against *Pre-Rumour Premium* and *One Month Premium* respectively. Against *One Day Premium* no significant relationship was found. *GDP Growth* impacts the dependent variables of *One Month Premium* and *One Day Premium* but not *Pre Rumour Premium*. *EBITDA*, *EBITDA Multiple* and *EPS* show no such relationship to any of the dependent variables.

In short and in general: *Pre Rumour Premium* and *One Month Premium* are significantly and negatively correlated against the prevailing *Short term rate*. Other independent variables show minimal and inconsistent correlation against the dependent variables.

Figure 7: Regression output for EU transactions – Long term rates

	$\alpha$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$
Regression						
D1	0.384221	-3.940270	-8.91e-06	0.000519	-0.0000142	-0.095966
Significance	Yes**	Yes*	No	No	No	No
Std. Error	0.056615	1.398412	5.55e-06	0.001006	0.000017	0.856844
D2	0.338718	-6.062549	-5.25e-06	0.000240	0.000018	1.368861
Significance	Yes**	Yes**	No	Yes	No	No
Std. Error	0.048801	1.205401	4.78e-06	0.000867	0.000015	0.738581
D3	0.227858	-2.505280	-3.43e-06	0.0004567	0.000013	-1.774341
Significance	Yes**	Yes*	No	No	No	Yes*
Std. Error	0.043345	1.070638	4.25e-06	0.0007610	0.000013	0.656008

Figure 7 shows the relationship between the three different premiums (A1: *Pre Rumour Premium*, A2: *One Month Premium*, and A3: *One Day Premium*) against the *Long term rate* in the EU economy. *Long term rate* has a strong and significant relationship of -3.940270, -6.062549, and -2.505280 against *Pre-Rumour Premium*, *One Month Premium*, and *One Day Premium* respectively. In general, the relationship here is more pronounced than for *Short term rate*. Furthermore, *EBITDA Multiple* shows a significant but small correlation against the *One Month Premium*, however not against *Pre Rumour Premium* and *One Day Premium*. *GDP Growth* impacts the dependent variables of *One Day Premium* but not *Pre Rumour Premium* and *One Month Premium*. *EBITDA* and *EPS* show no such relationship to any of the dependent variables.

In short and in general: *Pre Rumour Premium*, *One Month Premium*, and *One Day Premium* are significantly and negatively correlated against the prevailing *Long term rate*. Other independent variables show minimal and inconsistent correlation against the dependent variables.

Figure 8: Regression output for USA transactions – Short term rates

	$\alpha$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$
Regression						
E1	0.2916384	-0.971644	-0.0000267	0.0054983	0.0000201	-1.280598
Significance	Yes**	No	No	Yes**	No	No
Std. Error	0.0500095	1.143243	0.000016	0.0007344	0.0000266	0.9565491
E2	0.131429	-0.518305	-7.18e-06	0.005573	0.000022	-0.211545
Significance	Yes*	No	No	Yes**	No	No
Std. Error	0.04619	1.055928	0.0000148	0.0006783	0.0000246	0.8834927
E3	0.112613	0.791052	-7.40e-06	0.000525	0.000021	-0.929720
Significance	Yes**	No	No	No	No	No
Std. Error	0.026883	0.614549	8.62e-06	0.000395	0.000014	0.514192

Figure 8 shows the relationship between the three different premiums (A1: *Pre Rumour Premium*, A2: *One Month Premium*, and A3: *One Day Premium*) against the *Short term rate* in the USA economy. No significant relationship was found for the independent variable of Short term rate against any of the three independent premium variables. Furthermore, *EBITDA Multiple* shows a significant but small correlation against the *One Month Premium* and *Pre Rumour Premium*, however not against *One Day Premium*. *EBITDA*, *EPS* and *GPD growth* show no such relationship to any of the dependent variables.

In short and in general: No significant relationship could be found to determine the correlation between acquisition premiums and Short term rates in the USA

Figure 9: Regression output for USA transactions – Long term rates

	$\alpha$	$\beta_1$	$\beta_2$	$\beta_3$	$\beta_4$	$\beta_5$
Regression						
F1	0.344201	-2.286003	-0.000027	0.005522	0.000019	-1.253327
Significance	Yes**	No	No	Yes**	No	No
Std. Error	0.078623	2.137485	0.000016	0.000732	0.000027	0.955444
F2	0.177907	-1.842486	6.36e-06	0.005578	0.000021	-0.160410
Significance	Yes*	No	No	Yes**	No	No
Std. Error	0.072576	1.973110	0.000015	0.000675	0.000025	0.881969
F3	0.089965	1.180035	-7.65e-06	0.000498	0.000022	-0.912026
Significance	Yes*	No	No	No	No	Yes
Std. Error	0.042381	1.152200	8.64e-06	0.000394	0.000014	0.515027



Figure 9 shows the relationship between the three different premiums (A1: *Pre Rumour Premium*, A2: *One Month Premium*, and A3: *One Day Premium*) against the Long term rate in the USA economy. No significant relationship was found for the independent variable of Short term rate against *Pre Rumour Premium* and *One Month Premium*. Against *One Day Premium* a significant, yet relatively small relationship was determined. Furthermore, *EBITDA Multiple* shows a significant but small correlation against the *One Month Premium* and *Pre Rumour Premium*, however not against *One Day Premium*. *GDP Growth* shows a significant relationship against *One Day Premium*. *EBITDA* and *EPS* show no such relationship to any of the dependent variables.

In short and in general: No significant relationship could be found to determine the correlation between acquisition premiums and Long term rates in the USA, when excluding the correlation against *One Day Premium*.

#### 4.2.1 Commentary on H2

From this sample it is not possible to confirm nor deny H2. Based on the sample selection there is no significant relationship found within the USA data set to determine a relationship between acquisition premiums and interest rates. Therefore it cannot be contrasted against the determined relationship in EU rates, other than stating that a lacking relationship implies a rejection of H2 by default.

#### 4.3 Summary Matrix & Conclusion on Hypothesis

Figure 10: Summary Matrix of Key Dependent and Independent Variables

	USA & EU			EU			USA		
	<i>Pre Rumour Premium</i>	<i>One Month Premium</i>	<i>One Day Premium</i>	<i>Pre Rumour Premium</i>	<i>One Month Premium</i>	<i>One Day Premium</i>	<i>Pre Rumour Premium</i>	<i>One Month Premium</i>	<i>One Day Premium</i>
Short term Rate	-1.826	-2.645	-0.322	-2.638	-4.611	-1.438	-0.972	-0.518	0.791
Significance	Yes*	Yes**	No	Yes*	Yes**	No	No	No	No
Std. Error	0.823	0.741	0.539	1.148	0.991	0.879	1.143	1.0556	0.615
Long term Rate	-3.417	-4.821	-1.330	-3.940	-6.063	-2.505	-2.286	-1.842	1.180
Significance	Yes*	Yes**	No	Yes*	Yes**	Yes*	No	No	No
Std. Error	1.186	1.064	0.779	1.400	1.205	1.071	2.137	1.973	1.152

Given the findings across all 18 regressions initial conclusions can be drawn on H1, and only partial conclusions can be drawn regarding H2.

H1 states that there exists an inverse relationship between market wide interest rates and the percentage of average acquisition premiums. This hypothesis cannot be rejected as at a significance level of 5% this relationship was found to hold across 4 out of 6 regressions pertaining to the USA plus EU data set. Notably too is the strength of this relationship, as seen for example with *Long term rate* measured against *One Month Premium* corresponds to a Beta of -4.821. The implication therefor is that a 1% increase in Long term interest rates results in a 4.821% decrease in acquisition premiums for the time period one month prior to an acquisition. The exception to this general take-away is that of *One Day Premium*, where no statistically significant relationship could be determined. This however is to be expected, as explained previously the announcement of an acquisition would in the vast majority of cases result in upward pressure on the share price as investors trade in the pursuit of an arbitrage opportunity. H2 states that the inverse relationship predicted in H1 is more pronounced in the USA economy than the EU economy. This however can neither be proven nor disproven, as there was no statistical significance found between the variables when tested within the USA sample. One implication may be that there exists no such relationship in the USA and thereby rejects H2 through default. Furthermore, this carries over into the conclusions drawn in H1, that whilst the combined set sees a significant negative relationship, it is driven almost exclusively by the coefficients from the EU data set, implying that this may be an EU exclusive phenomenon.

This investigation has indirectly made several additional findings, including the lacking significant relationship between premiums and the independent variables of EBITDA and EPS. Indicating that 1) absolute size has no predictive power over premiums, and 2) relative profitability has no predictive power over premiums. Furthermore, EBITDA Multiples often had a significant albeit very small relationship to premiums, which can be disregarded due to their insignificance. Finally, GDP growth was a highly inconsistent variable as it, based on the specific regression, could be both significant and insignificant, as well as positive or negative. Given that consistency is a necessary element of the OLS process, this variable can be further disregarded.

Concluding this investigation finds that within the selected sample and variable sets, specifically for EU acquisitions, the predominant explanatory variable for a change in acquisition premiums were indeed the market wide interest rates.

## 5. Conclusion

### 5.1 Summary of Study

There are a multitude of variables that enter the decision to buy a company, and by extension the price at which the company ought to be purchased. The economic notion of price becomes more difficult to assess when applied to a complex and multi-faceted company transaction. A quantitative analysis performed on acquisition premiums however, whilst containing its limitations comes closest to providing a strong proxy measurable across time and across a large set of transactions. In regressing acquisition premiums against interest rates, this study has provided a unique insight into a previously unexplored combination of variables within the economics and financial literature. Furthermore, the data set containing 410 acquisitions far exceeds the scope covered by various other M&A-based investigations (Varaiya, 1987 and Wichramanayke & Wood, 2009), whilst limiting the data set to transactions exceeding \$1,000m avoids transactions that differ in maturity and other identifiers, and therefore lack comparability. By selecting transactions over the 20-year period of 31.12.1999 to 31.12.2019 from the USA and EU economies, analysing them firstly as a combined set and next independently has further offered unique insight into the differences in investor sentiment similar to the works of (Meier, Meinzer & Paientko, 2019). Through the logical application of various control variables as well as the selection of different independent and dependent variables several other insights have been covered including those addressing profitability (EBITDA), relative valuation (EBITDA Multiple), relative profitability (EPS), and Economic Growth.

In line with several foundational concepts of both a macroeconomic framework and a financial theory perspective, this study indeed points towards a significant and strong negative correlation between interest rates and acquisition premiums. In line with the expectation hypothesis, it is indeed seen that Long term interest rates have a stronger influence over investor expectation and thus show a stronger negative correlation. Furthermore, it is clear that, corresponding to the notions of the weak market Efficiency hypothesis, premiums do not only decrease as the time horizon towards the announced acquisition date closes, but additionally the predictive power of explanatory variables becomes insignificant. Investors desire to seek arbitrage opportunities can explain this phenomenon. Furthermore, the variables included in this study but only investigated indirectly imply that from the selection of variables chosen, interest rates exceeding, even the firm-specific variables, possess the strongest correlation against premiums.

## 5.2 Implications of Findings on Practice and Theory

The guiding question of this investigation began as a psychological one. Would management 'overpay' for an acquisition if they had access to cheaper capital? Extending this guiding notion upon a classical economics framework resulted in the closer consideration of the term 'overpaying'. There exist several other angles at which a question like this could have been addressed, beyond comparing premiums. For example, analysing how the sizes of categorized industries and sectors change alongside changes in interest rates would have been insightful, however would come up short in addressing the topic of managerial hubris, whilst being necessitating an unrealistic set of control variables.

The biggest unaddressed subject within this investigation is that each individual acquisition is unique in its valuation depending on the individual perceived benefits, therefore a claim of 'overpaying' may be trivial altogether. However, this investigation is more interested in a relative 'overpaying', and here is where premiums serve as the strongest indicator when applied across time and across a set of transactions.

Across macroeconomics, finance and investing, self-fulfilling prophecies and models have a measurable and tangible impact, predicated in most cases on estimates and assumptions. Acquisitions, as the product of valuation techniques are no different: Leverage Buyout Models (LBO), Comparable Transaction & Company Analysis, and Discounted Cash Flow Projections, all represent methods of determining a price for a company largely dependent on the market-wide sentiment. Investors when applying these techniques regard a lower cash-demand caused by a higher debt capacity as a substantive change in valuation and treat lower interest rates as a signal to pay a higher price and premium. This investigation, answers not the question of 'overpaying' in a strict sense, but instead in a relative sense, relative in this case to the perception of the other economic actors and investors.

Whilst premiums may present limitations as a proxy for price, they undoubtedly when applied across a large enough scope, indicate differences in managerial and investor decision making. Whilst an extremely wide set of factors enter the decision of an acquisition, the degree of significant correlation found in this study points towards the fact that interest rates do indeed make up a component of this decision.

For decision makers of all kinds this investigation allows for stricter self-reflection. Investors and management who over way the impact of a lower rate in their assumptions about return on investment, can analyse more carefully if indeed this variable is relevant to such a degree in their decision making. Furthermore, decision makers determining the market wide interest rates can more accurately implement new rates as their understanding of their specific impact rises. Knowing how to make more efficient decisions about investing capital or understanding how (in-line with economic theory), the lowering of interest rates results in an increase in capital towards equity markets, can help economic actors avoid unwanted consequences.

### 5.3 Limitations

All investigations have their unique set of limitations, especially when analysing the estimate-heavy fields of macroeconomics and finance. Several improvements towards this study can be applied in future iterations or extensions. Firstly, whilst the chosen method of specific allocating interest rates against specific acquisition dates serves the purposes of simplicity, more comprehensive time-series and panel data techniques could add to the study's scope and validity. As touched upon in section 3.5, the unequal distribution of certain interest rates influences the regression outcome, increasing the margin of error assumed towards either hypothesis. Future iterations of this research could incorporate a more extensive econometric model to better address this relationship as it is measured over time. Certain omitted data points within the selection of firm-specific variables were addressed using averages. This also by definition increases the margin of error, as certain observations for the control variables could have potentially changed the outcome of the various regressions. Whilst rarely publicly available the optimal point of improvement would have been to determine manually the values for these variables and remove the possibility of relevant data points impacting the regression. As seen with the inability to derive an explicit answer towards H2 in section 4.2.1, the general insignificance found in the USA data set requires further review. It can be assumed that the significant relationship found within the USA plus EU data set is largely driven by the significant relationship in the EU data set only. When analysing the research question most critically, the claim can be made that only the relationship of acquisition premiums and interest rates in the EU was found. Another flaw in the selected data is the discrepancy between registered headquarters and self-determined primary geography/region. Registered headquarters have been the guiding variable to determine if a country is USA or EU defined, whilst in the practical realm of business this is often not what guides key decisions such as expansion or acquisitions. An improved data set would give weighted consideration to both factors as well as analysing 1) where capital was raised / debt was issued and 2) a more detailed understanding of both buyer/target regions and headquarters.

Finally, and central to the theoretical assumptions, there exists sufficient continued room for discussion when it applies to the question on whether premiums are reflective of price and serve as a strong enough proxy for them when utilized in research such as this. Whilst this paper made no attempt at being unequivocal in this sense, it contributed to the overall discussion and provided a starting point for future research.

### 5.3 Future Research

Guided by a recently unexplored question, this investigation has provided a basis upon which further research can expand. Beyond the improvements suggested in section 5.2, there exist several avenues which can contribute to the existing body of literature and provide insight for decision makers.

Firstly, the set of observations can be extended, and categorized more clearly by relevant groups such as industry, company age, and position in the value chain. EBITDA multiples have been used as a proxy for these categories, however a manual allocation of each transaction would further limit any error margin. Similarly, the notion of seller power additionally plays a central role in this investigation, and a detailed investigation assigning a metric to the degree of seller power can be utilized as a variable in future research. A set of additional appropriate macroeconomic and firm specific variables can be implemented to uncover any further mechanisms which effect the interest rate and acquisition premium relationship.

This investigation explored the economic regions of the USA and EU, leaving for future research 1) the specific isolation of individual countries and 2) the extension of the research question onto unexplored economies. In section 5.2 the notion of a self-fulfilling prophecy was touched upon, notably in the setting of an LBO model which drastically changes its expected return based on interest rates. Finally, isolating this impact, thus exclusively testing for the psychological (managerial hubris) element assumed in this research will give further insight into the rationality of investment decisions.

## 6. Appendix

### *Appendix 0: Additional Definitions in order of appearance*

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Merger & Acquisition	The consolidation of a company and/or its assets into a new ownership structure through a financial transaction
Deal value	$Deal\ Value = Enterprise\ Value * Share\ of\ the\ acquired\ Enterprise\ Value$
Insider information	Information not yet publicly disclosed and often providing beneficial insight into a company allowing for an investment-advantage
Foreign direct investment	An investment and/or financial transaction resulting in ownership of a company and/or its asset by an entity located in another country
Leverage ratio	$Leverage\ Ratio = Total\ Debt / EBITDA$
Valuation ratio	$Valuation\ Ratio = Enterprise\ Value / Relevant\ company\ metric$
Managerial hubris	The (unrealistic) belief of managers in an acquiring firm to better manage the target firm than they currently are being managed
Enterprise Value	$Enterprise\ Value = Equity\ Value + Net\ Debt + Preferred\ Stock + Minority\ Interest$
Return on investment	$ROI = Net\ Profit / Total\ investment\ cost$
Value chain position	The position held and set of tasks performed by a company within a specific industry, ranging from raw material sourcing to customer supply
Seller-power	The ability of a target firm to command a higher price in the negotiating process of an M&A transaction
Leverage Buyout Model	A model to evaluate a Leveraged Buyout Transaction, whereby when acquiring a company, new debt is raised/issued and subsequently put on the targets balance sheet

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*Appendix 1: Overview of complete set of regressions applied in Methodological Framework*

Hypothesis	Regression #	Applied OLS Regression
H1	A1	$Pre\ Rumor\ Premium_i = \alpha + \beta_1(Short\ term\ rate_{USA_i \& EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i \& EU_i})$
H1	A2	$One\ Month\ Premium_i = \alpha + \beta_1(Short\ term\ rate_{USA_i \& EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i \& EU_i})$
H1	A3	$One\ Day\ Premium_i = \alpha + \beta_1(Short\ term\ rate_{USA_i \& EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i \& EU_i})$
H1	B1	$Pre\ Rumor\ Premium_i = \alpha + \beta_1(Long\ term\ rate_{USA_i \& EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i \& EU_i})$
H1	B2	$One\ Month\ Premium_i = \alpha + \beta_1(Long\ term\ rate_{USA_i \& EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i \& EU_i})$
H1	B3	$One\ Day\ Premium_i = \alpha + \beta_1(Long\ term\ rate_{USA_i \& EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i \& EU_i})$
H2	C1	$Pre\ Rumor\ Premium_i = \alpha + \beta_1(Short\ term\ rate_{EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{EU_i})$
H2	C2	$One\ Month\ Premium_i = \alpha + \beta_1(Short\ term\ rate_{EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{EU_i})$
H2	C3	$One\ Day\ Premium_i = \alpha + \beta_1(Short\ term\ rate_{EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{EU_i})$
H2	D1	$Pre\ Rumor\ Premium_i = \alpha + \beta_1(Long\ term\ rate_{EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{EU_i})$
H2	D2	$One\ Month\ Premium_i = \alpha + \beta_1(Long\ term\ rate_{EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{EU_i})$
H2	D3	$One\ Day\ Premium_i = \alpha + \beta_1(Long\ term\ rate_{EU_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{EU_i})$
H2	E1	$Pre\ Rumor\ Premium_i = \alpha + \beta_1(Short\ term\ rate_{USA_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i})$
H2	E2	$One\ Month\ Premium_i = \alpha + \beta_1(Short\ term\ rate_{USA_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i})$
H2	E3	$One\ Day\ Premium_i = \alpha + \beta_1(Short\ term\ rate_{USA_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i})$



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<i>H2</i>	<i>F1</i>	$Pre\ Rumor\ Premium_i = \alpha + \beta_1(Long\ term\ rate_{USA_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i})$
<i>H2</i>	<i>F2</i>	$One\ Month\ Premium_i = \alpha + \beta_1(Long\ term\ rate_{USA_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i})$
<i>H2</i>	<i>F3</i>	$One\ Day\ Premium_i = \alpha + \beta_1(Long\ term\ rate_{USA_i}) + \beta_2(EBITDA_i) + \beta_3(EBITDA\ Multiple_i) + \beta_4(EPS_i) + \beta_5(GDP\ Growth_{USA_i})$

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Where:

- *Pre Rumour Premium* = Acquisition Premium compared to the share price prior to the announcement of the acquisition taking place
- *One Month Premium* = Acquisition Premium compared to the share price one month prior to the acquisition taking place
- *One Day Premium* = Acquisition Premium compared to the share price one month prior to the acquisition taking place
- *Long term rate* = The semi-annual interest rate of government bonds maturing in 10 years for the respective economies of EU and USA
- *Short term rate* = The semi-annual interest rate average of daily rates for the respective economies of EU and USA
- *EBITDA* = Proxy representing size as a product of operating profitability
- *EBITDA Multiple* = Proxy to account for operational differences in businesses calculated through: (Enterprise Value / EBITDA)
- *EPS* = Proxy for relative profitability calculated through: (Net Income of the Company / Average Outstanding Shares of the Company)
- *GDP Growth* = Growth in GDP for the respective economies of EU and USA
- *EPS* = Proxy for relative profitability calculated through: (Net Income of the Company / Average Outstanding Shares of the Company)
- *GDP Growth* = Growth in GDP for the respective economies of EU and USA

*Appendix 2: Frequency of data points allocated to specific interest rates*

<i>Year</i>	<b>EU</b>			<b>USA</b>		
	<i>Long term Rate</i>	<i>Short term Rate</i>	<i>Count</i>	<i>Long term Rate</i>	<i>Short- term Rate</i>	<i>Count</i>
H2 2019	0.00217	-0.00400	9x	0.01795	0.01953	3x
H1 2019	0.00952	-0.00313	3x	0.02493	0.02462	7x
H2 2018	0.01343	-0.00317	1x	0.02980	0.02370	4x
H1 2018	0.01187	-0.00327	8x	0.02840	0.02007	8x
H2 2017	0.01057	-0.00329	6x	0.02307	0.01307	10x
H1 2017	0.01284	-0.00329	7x	0.02353	0.00998	8x
H2 2016	0.00876	-0.00305	4x	0.01847	0.00733	7x
H1 2016	0.00983	-0.00222	4x	0.01837	0.00555	5x
H1 2015	0.01213	0.00020	6x	0.02067	0.00152	2x
H2 2014	0.01792	0.00123	4x	0.02388	0.00130	8x
H1 2014	0.02771	0.00297	8x	0.02693	0.00118	11x
H2 2013	0.03209	0.00232	3x	0.02728	0.00125	6x
H1 2013	0.02815	0.00209	8x	0.01973	0.00208	7x
H2 2012	0.02554	0.00277	6x	0.01675	0.00250	3x
H1 2012	0.03541	0.00870	8x	0.01930	0.00315	1x
H2 2011	0.04236	0.01529	7x	0.02237	0.00355	3x
H1 2011	0.04386	0.01252	6x	0.03335	0.00252	9x
H2 2010	0.03611	0.00948	8x	0.02825	0.00308	9x
H1 2010	0.03953	0.00674	6x	0.03603	0.00315	7x
H2 2009	0.04165	0.01661	4x	0.03488	0.00262	3x
H1 2009	0.04165	0.01661	4x	0.03025	0.00850	4x
H2 2008	0.04386	0.04598	5x	0.03558	0.02937	7x
H1 2008	0.04326	0.04670	5x	0.03775	0.02993	7x
H2 2007	0.04410	0.04613	10x	0.04495	0.05223	9x
H1 2007	0.04254	0.03943	11x	0.04763	0.05313	8x
H2 2006	0.03915	0.03408	14x	0.04763	0.05358	6x
H1 2006	0.03804	0.02751	9x	0.04820	0.04948	5x
H2 2005	0.03341	0.02237	9x	0.04352	0.04017	4x
H1 2005	0.03541	0.02132	9x	0.04228	0.03007	1x
H2 2004	0.04026	0.02140	5x	0.04228	0.03007	4x
H1 2004	0.04255	0.02073	1x	n.a.	n.a.	0x
H2 2003	0.04267	0.02144	5x	0.04238	0.01977	1x
H1 2003	0.04055	0.02523	1x	0.04310	0.01150	3x
H2 2002	0.04651	0.03233	3x	n.a.	n.a.	0x
H1 2002	n.a.	n.a.	0x	n.a.	n.a.	0x
H2 2001	0.04965	0.03856	1x	n.a.	n.a.	0x
H1 2001	0.05090	0.04668	4x	0.05160	0.04677	1x
H2 2000	0.05521	0.03903	1x	0.05160	0.04677	1x
H1 2000	n.a.	n.a.	0x	n.a.	n.a.	0x

*Appendix 3.1: Overview and Descriptive Statistics of selected data – USA & EU*

Variables	Observations	Mean	Standard Deviations	Min	Max
Pre Rumour Premium	410	0.2794049	0.3032643	-0.9802	2.4375
One Month Premium	410	0.207791	0.2763348	-0.9801	2.3951
One Day Premium	410	0.0985588	0.1895465	-0.9841	2.0244
Long term rate	410	0.0308244	0.0119533	0.0021738	0.0573
Short term rate	410	0.0165196	0.0175685	-0.0039985	0.06608
EBITDA	410	1,069.138	2,657.466	-1,703.601	3,6248.8
EBITDA Multiple	410	17.69004	23.64271	1.7361	370.8908
EPS	410	101.7967	972.3914	-14,524.44	6,013.917
GDP Growth	410	0.0344656	0.0220861	-0.05579	0.082925

*Appendix 3.2: Overview and Descriptive Statistics of selected data – EU*

Variables	Observations	Mean	Standard Deviations	Min	Max
<i>Pre Rumour Premium</i>	220	0.2557186	0.2823693	-0.3704	1.9852
<i>One Month Premium</i>	220	0.1935686	0.252531	-0.6174	1.9456
<i>One Day Premium</i>	220	0.1003636	0.2165529	-0.221	2.0244
<i>Long term rate</i>	220	0.0307997	0.01359	0.0021738	.0552123
<i>Short term rate</i>	220	0.0157214	0.0169331	-0.0039985	.0467023
<i>EBITDA</i>	220	1,304.432	3,405.438	-973.9179	3,6248.8
<i>EBITDA Multiple</i>	220	17.15278	18.76991	2.0525	232.251
<i>EPS</i>	220	102.4236	1,115.897	-14,524.44	6,013.917
<i>GDP Growth</i>	220	0.0309887	0.0218906	-0.05579	0.05862

*Appendix 3.3: Overview and Descriptive Statistics of selected data – USA*

Variables	Observations	Mean	Standard Deviations	Min	Max
<i>Pre Rumour Premium</i>	190	0.3068311	0.3243851	-0.9802	2.4375
<i>One Month Premium</i>	190	0.2242589	0.3014037	-0.9801	2.3951
<i>One Day Premium</i>	190	0.0964689	0.152976	-0.9841	0.8539
<i>Long term rate</i>	190	0.030853	0.0097566	0.0021738	0.0573
<i>Short term rate</i>	190	0.0174437	0.0182781	-0.0039985	0.06608
<i>EBITDA</i>	190	796.6931	1,306.032	-1,703.601	8,944
<i>EBITDA Multiple</i>	190	18.31212	28.29635	1.7361	370.8908
<i>EPS</i>	190	101.0709	776.7221	-8,630	2,578
<i>GDP Growth</i>	190	0.0384915	0.0216789	-0.03341	0.082925

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