The Winner's Curse in Corporate Takeovers

Diplomarbeit

zur Erlangung des akademischen Grades
einer Magistra
der Sozial- und Wirtschaftswissenschaften

eingereicht bei Frau

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Innsbruck, Juli 2018

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Acknowledgment

First of all, I want to thank my adviser, Dr. Anita Gantner, who supported me during my writing process. She also pushed me and gave me guidance to stay on the right track.

In addition, I want to thank my family and friends, who had an open ear for occasional worries and helped me, whenever I needed them. Thank You!

Christina Berger

Chapter 2

Introduction

The objective of this thesis is to give an insight into the winner's curse in corporate takeovers. The initial motivation was to choose "the winner's curse" as the topic of this thesis. Due to extensive research on this topic, which was necessary to get a deep understanding about this subject prior to the actual process of writing the thesis, the thematic of the winner's curse in corporate takeovers popped up. The first encounter was, while reading the study of Thaler (1988). It was a rather short part, including only a few information about the winner's curse in corporate takeovers, but in a way, this was attractive enough to set the focus of the thesis to this particular field. Next to corporate takeovers, exists a huge amount of different markets, where economists already researched for information regarding the appearance of the winner's curse.

The thesis is divided into two main chapters, whereas the first one includes information about the winner's curse in general and the second on tries to find an answer to the question: *Can the winner's curse be taken into account for the overpaying in corporate takeovers?*

The first part of the thesis will consist of the explanation of the winner's curse theorem in general. It includes historical information about the phenomenon as well as some discovered reasons for the appearance of the winner's curse. Furthermore, this part includes

a summary of a well-known laboratory experiment. To change into the more empirical nature, two field studies from quite different market will act as a gradual transition from laboratory to field experiments. The first study is about the art market and it is dealing with the winner's curse in auctions for modern prints. The results are in favor of the winner's curse theory. The second study is engaged in the market for free-agent baseball players. No certain evidence could be found to provide proof for the existing of the winner's curse, but some kind of overpayment in the negotiation for new free-agent players is definitely present.

The main part of the paper is the second part. It is about the winner's curse in corporate takeovers. To answer the initial question stated above, two different studies with that particular subject in focus, are summarized in detail. The first paper of Varaiya (1988) gives strong evidence in favor of the winner's curse theory. The second paper of Boone and Mulherin (2008) on the other hand, could not find evidence for the existing of the winner's curse in corporate takeover at all. Afterwards, the studies are then compared with each other in order to find reasons for the dissimilarities in their results. While summarizing, but also before, during reading the papers, it became obvious, that not only the results of the papers and the data used, differ from each other. Also the nature of the variables used and the way the regression equations where defined, are very distinctive.

Chapter 3

The Winner's Curse

The winner's curse is a so-called 'anomaly' in the economic environment. Under economical behavior it is understood to make rational decisions and choices under full awareness of the own preferences. As humankind is not a so-called *homo oeconomicus*, decision making is not a completely rational process and therefore anomalies are likely to appear. The winner's curse' most common appearance is in competitive *common value auctions*, where the auctioned item has the same value for all participants. The true value is unknown and therefore the participants have to make their individual estimates about it. (Thaler, 1988) There are common value elements in most auctions; even the auction for an oil painting can have a common value element, if it is purchased for the solely purpose of an investment object. (Kagel and Levin, 2002)

3.1   Introduction of the Winner's Curse

The winner's curse describes the phenomenon of winning an auctioned item by overpaying for it. This is mostly due to the inability of making an estimation close to the objects true value. Due to different factors, these estimations are likely to overvalue the item.

The following exemplary experiment will visualize the winner's curse:

The experiment conductor takes a jar filled with pennies and asks a group of individuals to guess the value of the coins. The participant with the highest bid will win the money in the jar, but has to pay the guessed value. The results are most likely to have the following outcome: first, the moderate bid will significantly undervalue the true value of the jar and second, the winning bid will surpass the true value of the jar. Therefore, the winner clearly won the jar filled with pennies, but lost money doing so, because his/her estimated value exceeded the true value of the pennies in the jar. (Thaler, 1988)

Thaler (1988) states two different ways of how the winner's curse can appear: first, like explained in the example above, the winning party overbids for the true value and therefore loses money or second, the true value is less than estimated. To explain this a little further, the first case is dealing with an overenthusiastic bidder, who is stating a bid above the average, and most likely above his/her own value estimation. The bid is placed aggressively with the purpose to win the auction, without considering the losses or gains created. The second form has a bidder in mind who is more prone to the estimated value. Estimations about an uncertain commodity are dependent on information given as well as experiences made during other auctions or negotiations. The bidder trusts his/her estimation about the value and places a bid close to it. After the acquisition it gets clear, that the true value is less than expected. This may be due to faulty information or misinterpretations of the given information. Independent of what case is present, the winner will experience losses (Thaler, 1988)

The winner's curse can also be taken into account, if the bidding party pays less then the true value, say 92%, but the individual worth of the commodity is only 85% of the true value. Bazerman and Samuelson (1983) call this a *subjective winner's curse*. However, the winner's curse should not be taken into account if the auctioned good has intrinsic or personal value to the bidder. An example would be an oil painting. This value is purely subjective and the bidding party may be aware of the overvaluation, but still places a bid way above the true value of the item, without any regrets. (Bazerman and Samuelson,

1983)

3.2   History of the Winner's Curse

The winner's curse phenomenon first appears as such in 1971, in a study of three Atlantic Richfield engineers Capen, Clapp and Campbell. (C. Capen et al., 1971) They were the first who claimed unusual low returns for oil companies between the 1960's and 1970's on "outer continental shelf (OCS) oil-lease auctions."(Kagel and Levin, 2002, p.2)

C. Capen et al. (1971) stated, that due to the companies disregard to the respective "informational consequences of winning" (Kagel and Levin, 2002, p.2), the rates of return are low and the winning company pays too much. The firm therefore loses money due to an overpayment.

An example for oil-lease auctions are "the drilling rights of a particular parcel of land."(Thaler, 1988, p.192)

The common value element in these auctions, is the oil that can be extracted from the land and since the extent of it is unclear, estimations have to be made by the oil companies. These estimates come from each firms' individual experts. Under the assumption, that these estimates about the value of the tract are unbiased, the mean of all estimates equals the true value of the oil-land. As stated above, it is hardly achievable to obtain unbiased estimates, due to lack of rational behavior of individuals. The estimates will spread from too low to far too high. The companies with higher expert's estimations are therefore likely to place a higher bid than other firms and have, as a result, a higher chance to win the auction. (Thaler, 1988)

3.3   Reasons for the Winner's Curse

A possible explanation for the presence of the winner's curse is the inability of bidders to make a proper discount from their value estimations. If the winning party expects their bid to be the winning bid, their first reaction should be to reduce the estimation, and, in combination, also the offer appropriately, to avoid paying too much for the good. (Bazerman and Samuelson, 1983)

Bazerman and Samuelson (1983) further identified two factors that are to be taken into account for the magnitude and likelihood of the winner's curse.

Degree of Uncertainty   The degree of uncertainty naturally comes with the common value auction due to the unknown true value of the commodity. With the degree of uncertainty comes a greater variance in the bidders' placed bids and therefore the likeliness of the winner's curse increases. The average bidder hardly recognize the uncertainty and therefore has no chance to discount the bid properly. (Bazerman and Samuelson, 1983)

Level of Competition   Besides the uncertainty, the amount of competition is a further potential factor for the magnitude and likelihood of the winner's curse. With increasing number of participants, the range of the estimates, and therefore the range of the bids, widens. A more sizable group is more prone to extreme values and thus, for falling victim to the winner's curse. (Bazerman and Samuelson, 1983)

## 3.4   Laboratory Experiments to Test for the Winner's Curse

After the research of C. Capen et al. (1971) in the oil industry, other studies regarding the winner's curse have been made public. But the field data was not persuading enough to

definitely proof for an existence of the winner's curse. This may have been partially due to alternative explanation, like cartel theory, or due to problems regarding the reliability of the sample data. (Kagel and Levin, 2002)

These issues regarding the accuracy of studies about the winner's curse theory in field data, became the motivation to conduct laboratory experiments. One of the earliest experiments regarding the winner's curse, was published by Bazerman and Samuelson (1983). As mentioned above, the average of all estimations are close to the true value of an object. Thus, the estimations are normally distributed. Figure 3.1 is a graphical illustration of the winner's curse. It exhibits the defined behavior of estimations and bids in a competitive auction; the estimates E are normally distributed and the mean is equal to the true value $\bar{E}$. The bids B are also normally distributed but with a shift to the left, as mentioned above: the average placed bid is lower than the true value. The gap between E and B is the amount of discounting D. According to Bazerman and Samuelson (1983), the winner's curse occurs, if the bid of the winning party "draws the bid from the right tail of the bid distribution" (Bazerman and Samuelson, 1983, p.621) and therefore the bid surpasses the true value $\bar{E}$. Furthermore, the winner will overpay, if the "margin of overestimation exceeds the discount in making a bid". (Bazerman and Samuelson, 1983, p.621)

3.4.1 First Experimental Evidence

The laboratory experiment conducted by Bazerman and Samuelson (1983) is cited in many published studies. This may be because of its early beginning, or because it describes the phenomenon of the winner's curse properly; thus, the following example is a summary of the experiment conducted by Bazerman and Samuelson (1983):

Figure 3.1: Illustration of the Winner's Curse
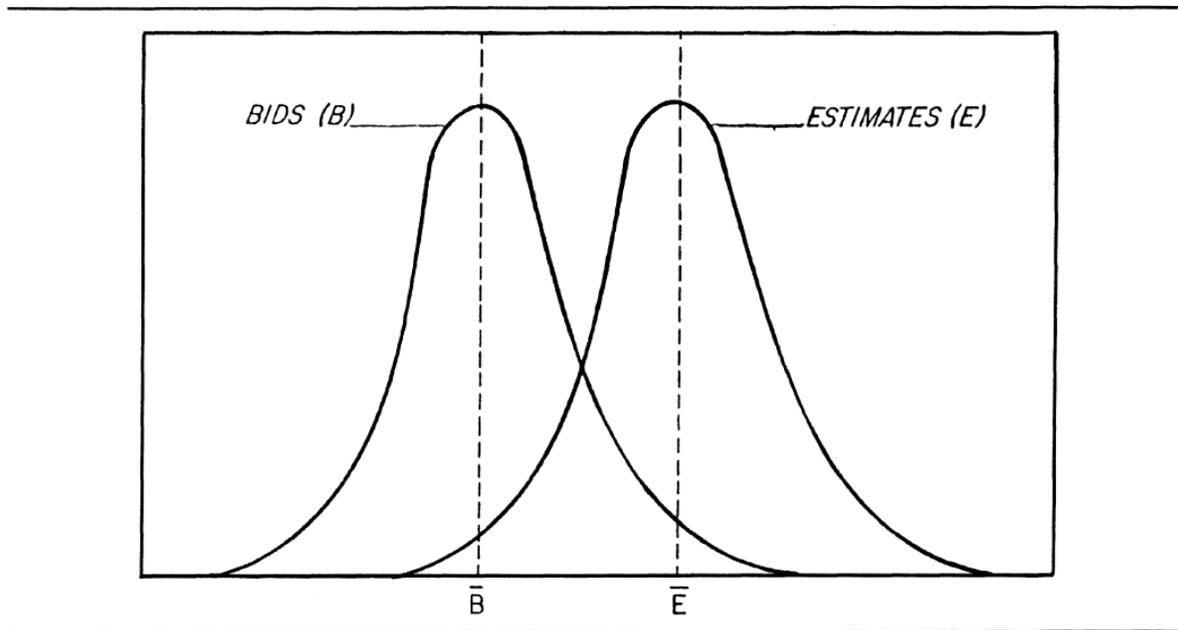
Figure 1: Graphic Illustration of the Winner's Curse
Variables: E = estimates; B = bid; D = (amount of disounting) =E – B.
Assumptions: (1) True Value $\approx \bar{E}$; (2) True Value will be equal for all bidders.

(Bazerman and Samuelson, 1983, p.620)

Method

Subjects The subjects were MBA microeconomics students at Boston University, in total N = 419. Therefore, the experiment includes well-informed subjects rather than completely strangers to the topic.

Procedure The experiment includes four sealed-bid auctions with four auctioned goods (jar filled with 800 pennies, 160 nickels, 200 large and 400 small paper clips), each worth $8. As in the example of Thaler (1988) from above, the winner (the highest bidding subject) will pay the placed bid and, in return, wins the jar he/she bet for. For Bazerman and Samuelson (1983) not the sole placed bid is for importance, but rather the estimates the subjects have made about each of the four jars. Thus, they gave an extra $2 as prize for the estimate, including its 90% confidence bounds, which came closest to the true value

of the commodities. This experiment was repeated four rounds, and the subjects did not receive any feedback within the four rounds.

Experimental Design As earlier described, Bazerman and Samuelson (1983) were interested in two factors: the uncertainty about the commodity and the effect of the number of competition. The mean of the 90% confidence interval worked as a measure of uncertainty in the auctioned good. The size of competition was manually influenced by handing each participant an information sheet containing the number of competitors in the auction.

Analysis The approach was, to define upfront all possible auction group combinations out of the 48 auctions and determine the highest bid in each combination. To measure the degree and sincerity of the winner's curse, Bazerman and Samuelson (1983) calculated the average value of the winning bid (AWB). The AWB is calculated as in equation 3.1:

$$AWB = \sum_{I=1}^{N} P_i B_i \tag{3.1}$$

P_i describes "the propability that the ith highest bidder in the class will appear in and be the highest bidder in an auction group drawn at random."(Bazerman and Samuelson, 1983, p.627) B_i labels the value of highest placed bid.

Results

The outcomes of the 48 auctions confirmed the theoretical approach of stating, that the mean bid is close to the true value of the commodity. While the average estimate was $5.13, the mean AWB equals to $10.01; therefore the average loss adds up to $2.01. The standard deviation is $5.48; 12 auctions had calculated $AWBs$ less than $7, 10 of the $AWBs$ were between $7.00 and $8.00, 3 had been between $8.00 and $9.00 and a total of 23 auctions

had *AWB*s above $9.00.

The findings of Bazerman and Samuelson (1983) largely supports the findings of C. Capen et al. (1971); the frequent occurrence of the winner's curse in an auction context confirms, what has been found in the field data. Furthermore, with the use of regression models, Bazerman and Samuelson (1983) where able to give prove for the significance of the two factors, uncertainty in the true value and number of competitors, in the winner's curse discussion. This is due to the failure of the subjects to discount the estimates respectively to increasing uncertainty and/or competition.(Bazerman and Samuelson, 1983)

Conclusion

While at first, the winner's curse' appearance in field data was not taken into account for the overpayment that occurred, after experimental studies on this phenomenon, criticism spread among economists. It included the critic that results of experimental studies "do not accord with economic theory" (Thaler, 1988, p.196). The argument to strengthen this criticism is, that this may be due to using students as test person for the theoretical experiments rather than experts. But studies using experts as subjects proved this objection to be wrong; the outcome did not differ from the outcome a test group of students achieved. The reason, why in existing situations the winner's curse may not play that bid of a role, Thaler (1988) defined: "Dyer, Kagel and Levin believe the result occurs because the managers have learned situation specific rules of thumb rather than the relevant theory". (Thaler, 1988, p.196)

However, the learned rules cannot be applied in either an laboratory experiment nor in a different environmental structure. Therefore, the rule of thumb does not rule out the possible appearance of a winner's curse.

3.5 Field Studies

Not only was the winner's curse an interesting phenomenon in laboratory design, but especially in the area of economical field studies. After experiments proveded evidence for the existence of a winner's curse, numerous researchers in various market contexts published studies, which insist on having found evidence for the winner's curse is the respective area. The following subsections will give a short overview about different markets which, might or might not become victims of the winner's curse. The first part describes the studies of Kräussl and Mirgorodskaya (2016), who focused on the overpayment in fine art market for modern prints. The second part comes 'directly' from the *field*. Blecherman and Camerer (1996) focused on free agent baseball player and the overpayment, and therefore, the likelihood of the presence of the winner's curse in 1990s negotiations.

3.5.1 The Winner's Curse in the Art Market

In the common opinion, art markets are not seen as a classical example to test for the existence of the winner's curse; art works usually have a high private value to the bidder and, as described above, if private value plays a role in an auction, the winner's curse is lapsed. Therefore, to find evidence in the art market, Kräussl and Mirgorodskaya (2016) used data from auctions of modern prints. Prints are commonly replicated 50, 100 or more times and are therefore more suitable for the testing of possible overpayment. The true value of the auctioned print is not clearly to be defined. Thus, estimates made by auctioneers are used as the best guess. Due to maintaining their auction houses good reputations, these estimates are less likely to be falsified. To test for the overreaction and thus, the winner's curse, Kräussl and Mirgorodskaya (2016) compared the auctioneers estimates with the selling price for the art prints.

Data

The sample consists of 4.728 prints sold in 80.281 repeat-sales pairs of 178 artists from the Gordon's Prints Price Annual database. The 178 artist have the largest total number of sale records in the database; including artists such as *Andy Warhol, Pablo Picasso* and *Rembrandt.* Kräussl and Mirgorodskaya (2016) identified ten Top Artists as artists with the highest number of sale records, as well as two major artistic styles: Impressionist and Modern, 54% of the total sample, as well as, Post-war and Contemporary, 21% of the total sample. The sample includes other styles as well, but due to insufficient number of measurements there will be no distinction. The data includes furthermore, high and low price estimates from the years 1998 to 2011.

Methodology

Due to the characteristics of the data which consists of repeat-sales prints, Kräussl and Mirgorodskaya (2016) applied a repeat-sales regression, short *RSR*. The *RSR* measures "the continuously compound return of print i" (Kräussl and Mirgorodskaya, 2016, p.7) which is the dependent variable in the regression analysis. The *RSR* includes print-specific variables in order to test for the winner's curse; these are *Overbid* and *Underbid*, where *Overbid* defines the circumstance of a purchase price that exceeds the high price estimate of the purchased print. On the other hand, *Underbid* describes the opposite situation, meaning the purchasing price understates the low pricing estimate. Kräussl and Mirgorodskaya (2016) additionally included two control variables, the spread in pricing estimates and the average pricing estimate. Also included are an auction house dummy, which is used to test for a possible violation of the law of one price, an U.S. business cycle dummy, to test if the purchase is classified as a recession or an expansion, as well as a variable for the diversification in the average estimates of the true value between the purchasing and the sales date of a print, to test if the pricing estimates of the auctioneers are an accurate estimation of the true value of the print. (Kräussl and Mirgorodskaya, 2016)

Results

Kräussl and Mirgorodskaya (2016) used a three-stage GLS regression and reported coefficient estimates for repeat-sales indices, short RS, for the whole data set: the Impressionist and Modern, the Post-war and Contemporary art styles, as well as for the ten Top Artists. As described above, the dependent variable is the return on print i, the coefficients display "a log-price index of the prints market," (Kräussl and Mirgorodskaya, 2016, p.10) and the discrepancy between the coefficients shows the geometric return of the index at time t. The regression results show high statistically significant coefficients at the 1% level. The statistical insignificance in some coefficients is due to unsatisfactory amount of RS pairs. The strong negative statistically significant coefficient for the variable *Overbid*, is an indicator for the existence of the winner's curse. The print was therefore overvalued, which leads to a negative excess return at the respective sale. Kräussl and Mirgorodskaya (2016) find confirmation in this outcome due to 5.182 overvalued prints which were sold for a lower price in the following auction and 4.269 undervalued prints, that were sold for a higher price. The coefficient for the variable *Underbid* also give a statistically significant negative result, which is illustrating, that by attaining the print by 10% less than the low pricing estimate, the bidder experiences a positive excess return.

Additionally, the findings also contain prove for the violation of one price: prints sold in big auction houses as Christie's or Sotheby's create positive excess returns compared to other auction houses.

3.5.2 The Winner's Curse in the Market for Baseball Players

To give an insight into a different field, this section is a study of negotiations for free agent baseball players in 1990 by Blecherman and Camerer (1996). Free agent players are defined as having at least six years in service and whose contract is expired. Therefore, they are not bounded to any agent and are free to choose with whom to make a contract with. To measure the extent (or occurrence) of the winner's curse, the authors Blecherman and

Camerer (1996) used the players' salaries as well as their overall performance on the field. As suggested in economic theory, the salary should mirror the worker's productivity and performance, namely the marginal product of labor (MP_L). This is under the assumption that baseball clubs are risk-neutral.

To attain a new player, baseball clubs have to attend an auction and place bids on the wanted player. These auctions have a major common-value character and thus are suitable to test for the winner's curse (overpayment is likely to occur). In their study, Blecherman and Camerer (1996) test for two hypotheses; first, they compare the free agent players' marginal product of labor with their salaries to indicate, if an overpayment is visible. The second prediction comprises the baseball clubs' sensitivity regarding the uncertainty of value of free agent players.

Data

The data used for measuring the players' performances comes from "Total Baseball, edited by Thron and Palmer (1991)"(Blecherman and Camerer, 1996, p.23). Blecherman and Camerer (1996) used the "Runs Created" (RC) measure of Bill James to account for the players' performance. The RC gives an estimation about the numbers of runs a player devotes to his team.

The data including details about the salary, comes from multiple editions of USA Today, The National and others. It includes base salaries of players with major league contracts signed between the end of the season 1989 and before start of season 1990. The city population information are found in the Statistical Abstract of the United Stated (1991) and the Canada Year Book 1990.

Methodology

Blecherman and Camerer (1996) defined two regressions to test for the winner's curse in

the market for free agent baseball players. The first regression model sets *Revenue* as the explanatory variable to test for the overpayment in the acquisition of a new player. The explanatory variables are: the weighted wins, as their "best linear predictive balance between this and last years' victory totals" (Blecherman and Camerer, 1996, p.12); the population of the city, to get a feeling about the environment of the baseball team; the interaction of weighted wins and population, because "each team has a different marginal value of victory, but player marginal product of labor across teams remains perfectly correlated" (Blecherman and Camerer, 1996, p.12); and the last variable, a place holder X for unimportant but statistically significant demographic variables. Non free agents baseball players were used as a control group, to see if there is a difference between their payment and the payment of the free agent players.

To test for uncertainty, the dependent variable in the second regression is the base salary (salary without any incentives). Explanatory variables are: the RCs of the years 1989, 1988 and 1987, to test for the performance in historic data; the historical variance of the performances; a dummy variable with the value 1 if the player is a free agent player and 0 otherwise; and a variable accounting for the seniority of a player. The variable, that accounts for the winner's curse is the "adjustment for performance variance predicted by the winner's curse theory" (Blecherman and Camerer, 1996, p.17)

Results

The outcome of the first regressions shows foremost the negative significant impact of the coefficient for the interaction of weighted wins and population. This indicates a greater importance of accumulative victories for teams in smaller cities compared to teams in a bigger cities. The result is strengthened due to the fact, that in 1990, 18 out of the 32 free agent signed a contract with a team sized smaller than the median. As this model showed some faults, Blecherman and Camerer (1996) remodeled the initial revenue regression. Now the weighted wins are divided, instead of multiplied, by the population. The model

is more realistic and suggests that out of the 32 free agent players, 25 were overpaid. The average created value by a player was \$604.678 and the average payment was \$934.115. Therefore, the average loss per player was \$ 329.437. The comparison group, the non free agent players, generate an average value of \$704.317 and get paid roughly their marginal revenue product, that is to say \$712.023.

As for the second regression, regarding the winner's curse, the coefficient of the adjustment for performance variance predicted by the winner's curse theory variable, is negative and statistically significant, meaning that teams do decrease their bids for free agents when the variance in the players performance is increasing. This outcome is not in line with the winner's curse prediction.

The results show that free agents are overpayed, but do adjust for the uncertainty accordingly. A possible explanation for the overpayment and therefore the winner's curse, may lie in the number of competitors in the auction of a free agent baseball player. (Blecherman and Camerer, 1996)

While the art market and the market for baseball players include relatively small scaled auctioned items, the main part of this paper focuses on an auctioned item of a by far bigger size: the auction, or respectively, the negotiation of a company. Before that, the next section goes more into detail about the character of a corporate takeover and why, although the buying company experience losses, a takeover takes place.

3.6   Corporate Takeovers

As firms always had the need of expanding and increasing their market share, one strategy includes the merger with, or acquisition of, another company. The acquiring firm overpays the target company due to various factors, like the number of competitors, overenthusiastic managers and ill-calculated firm values. To point out the overpayment that might occur within a corporate takeover, the following example about an acquisition conducted by

Microsoft will act as a short demonstration:

When Microsoft decided to join the social media business, it surely did not foresee to become a victim of the winner's curse. After the acquisition of Skype, Microsoft decided to buy Yammer, which is a social network designed for businesses. During the negotiation process, Yammer itself decided to put some effort into increasing its own value by acquiring oneDrum. Yammer's CEO pointed out that the acquisition of oneDrum will add additional value to Microsoft. Due to this value creation, the difficulty in making estimated about Yammer's firm value was even more present.
This all added up, so that Microsoft in the end, paid twice as much for Yammer than their market value was at this point of time. With an estimated market value of $600 million, Microsoft acquired the company for $1.2 billion in cash. (STAFF, 2018)

The overpayment that occurred in this negotiation, can be seen as Microsoft's overvaluation of the true value of Yammer. Due to the acquisition made by Yammer's CEO and his self-marketing, when pointing out the additional value this takeover will add to Microsoft, the estimated value might have been shifted upwards and therefore, led to the final offer of $1.2 billion.

Despite the fact that, on average, bidding firms experience hardly any gains in their returns, various economists were interested in finding out more about corporate takeovers and their effects. The study of Black (1989) engages with the overpayment in corporate takeovers and the created gains for the target firm's shareholders. The findings include the so-called *Overpayment Hypothesis*: a possible explanation for why bidders still desire a takeover despite the fact that they might lose. The explanation the study gives is, that investors already include the expected loss in the stock price of the bidder. The firm does not experience a net social loss, but rather a wealth transfer to the target firm's shareholders. Therefore, as long as investors expect a certain degree of overpayment by the bidding firm, at least the stock price will remain constant, assuming that there is no significant differentiation from the expectation. (Black, 1989)

Further positive characteristics of takeovers is the value creation. Therefore, it is also beneficial to the shareholders of the bidding firms. Mergers often appear within an investment strategy (as the example of Microsoft) instead of an isolated event. Thus, forms usually encompass more than one merger. Additionally, if the buying firm shares synergies with the selling company, the negative effect of the overpayment can be reduced. (Asquith et al., 1983)

Furthermore, firms cannot only increase in size, but also the takeover can be seen as increasing the diversification of a company and therefore increases the market share in more than one fields.

The question remains, why firms are mostly overpaying in their attempt of acquiring another firm. The next chapter should give a more detailed answer to this question.

Chapter 4

The Winner's Curse in Corporate Takeovers

Why does the winner's curse find attention in the discussion of corporate takeovers? As suggested by evidence in the capital market, there may be common value items in the assessment of the target firm's true value. (Varaiya, 1988)

Publicly traded firms have in general a marketable nature and this implies again a common value element. As objection to the theory of having a common value element in a corporate takeover, synergies between firms have to be mentioned. But even these synergies can be for more than one firm and earlier researchers provide the evidence that synergies are more valuable for the selling than for bidding companies. (Boone and Mulherin, 2008)

As mentioned in the previous chapter, bidding firms often overpay for the target company, while the target's shareholders get large abnormal returns. This leads to the question, if this happens due to the winner's curse. The definition of the winner's curse in corporate takeovers is the difference of the bid premium the bidding firm paid and the maximum bid premium that can be offered, dependent on the market's estimation of the expected gain from the acquisition. The magnitude between is called the winner's curse. (Varaiya, 1988)

This chapter will go into further details of the winner's curse in corporate takeovers. First,

two studies, which deals with this subject in particular, will be described in more detail. The second part consists of a comparison of the studies, the data used, the methodology and other specifics.

The first paper is from the year 1988 by Nikhil P. Varaiya. (Varaiya, 1988) The paper " The 'Winner's Curse' Hypothesis and Corporate Takeovers" provides proof for the existence of a winner's curse in the corporate takeover section.

The second paper was published 20 years later, in 2008, by Audra L. Boone and J. Harold Mulherin. (Boone and Mulherin, 2008) Their paper, "Do auctions induce a winner's curse? New evidence from the corporate takeover market" does not relate the winner's curse with the negative effects for acquiring companies in a corporate takeover.

The added value of these two studies is, on the one hand, the differences in their findings. It is interesting to see, that although the initial approach is in line with experiments about the winner's curse conducted in laboratory environment, the authors find differences in their results. Furthermore, variances in the way the authors chose and defined relevant variables (dependent and explanatory) have an impact on the results of the testing for the winner's curse.

4.1   Study I: The Winner's Curse Hypothesis and Corporate Takeovers

In the opinion of Varaiya (1988), the magnitude between the bid premium paid and the maximum bid premium that can be offered. Thus, the winner's curse is expected to rise on three occasions: with the "(1) increase in the divergence of opinion amongst acquires with respect to the size of takeover gains, (2) increase in the degree of competition for control of the target firm and (3) increase in the pre-acquisition profitability of the winning bidder." (Varaiya, 1988, p.209)

The author focuses on the extent of abnormal returns for the bidding firm, that can be explained by the winner's curse hypothesis.

4.1.1   Sample Selection

Varaiya (1988) used the merger and acquisition database of Kidder Peabody & CO. The time frame includes data from more than 800 acquisitions that started between 1974 and 1983. The value of the considered buyers' offers surpassed \$15 million.

After defining four requirements, the remaining data includes 91 takeovers, consisting of 51 mergers and 40 tender offers. These requirements are: (1) a successful takeover, (2) the winning buyer financing the takeover with cash, stock or a combination of both, (3) it was not a leveraged buyout, and (4) sufficient necessary information was available. (Varaiya, 1988)

4.1.2   Conditions for the Existence of the Winner's Curse

The appearance of a winner's curse likely depends on the already mentioned factors: first, the degree of divergence in the opinion regarding to the value of the takeover gains and second, the degree of competition between the potential buyers. Varaiya (1988) states, that

with the increasing divergence of opinion in takeover values, the variance in the estimates of buyers, as well as the variance for the bid distribution for sellers, rise. To antagonize this, buyers have to discount the bid to the same degree as the divergence of opinion will rise. On the other hand, this applies also for the degree of competition: with increasing number of bidders, the more likely it is, that the estimates of the true value increase.

To test if this is true, Varaiya (1988) defined two hypothesis where, in both cases, the null-hypothesis is the favored one regarding to explaining the winner's curse:

H_{01}: The winning bidder will pay more than his/her estimated target value.

H_{02}: An increase in divergence of opinion as well as in the degree of competition will lead to an increasing likeliness and magnitude of overpayment, or in other words, the winner's curse.

Pre-Acquisition Buyer Profitability And The Winner's Curse

As a takeover is highly cost-intensive, prior to the announcement of a takeover, bidding firms are likely to experiences significant positive abnormal returns. These abnormal returns may be decisive for an already planned takeover. When firms experience such abnormal returns, they are facing two options. either distribute the extra cash flows to investors or use it for an investment strategy, as participation in a takeover process. The preferred choice hereby will be most likely the second one. Additionally, in a bidding process, earlier positive abnormal returns motivate bidders to bid more aggressively than they usually would and therefore exaggerate their estimated value. This lead to the third hypothesis Varaiya (1988) defined as:

H_{03}: The magnitude of pre-acquisition abnormal performance has a positive influence on the magnitude and likelihood of the winner's curse.

Magnitude Of The Winner's Curse

Instead of using a dependent variable already existing in his data set, Varaiya (1988) defined the dependent variable *Overpayment* as the difference in the observed premium and the estimated maximum of the premium that can be offered:

$$OVERPAYMENT = Observed\ Premium - Maximum\ Offerable\ Premium \qquad (4.1)$$

The dependent variable $OVERPAYMENT$ stands for the magnitude of the winner's curse. It shows, to which extent the observed premium **understates** or **overstates** the market's estimations of gains created due to a takeover. Understating means: $OVERPAYMENT < 0$, and overstating means: $OVERPAYMENT > 0$. The winner's curse hypothesis predicts, that the winning firm will, on average, place a bid that overstates the market's estimated takeover gains.

The observed premium is the sum of excess returns of the target firm for event day t relative to the announcement date $t=0$ and the maximum offerable premium is the "capital market's unbiased estimate of the expected takeover gain" (Varaiya, 1988, p.212).

Divergence Of Opinion

The first explanatory variable is the divergence of opinion, which is a proxy for the uncertainty in the true value of the target company. To measure the divergence of opinion, Varaiya (1988) uses the I/B/E/S database of Lynch, Jones, Ryan, which is a brokerage firm from New York. This database includes the summary statistics of earnings per share (EPS) estimates with their means an variances for over 2000 firms.

Varaiya (1988) used the coefficient of variance of these estimated EPS (CV) to measure the divergence of opinion. The coefficient of the variance seemed as a better measure, because all of the predictions are cross-sectional and selling companies with a higher variance do not automatically experience a higher divergence of opinion, but instead show a higher

expected value of the EPS forecast. Variance can appear due to a combination of differences in gathered information about the target company, dissimilarities in the capacity of the management and diversities in the economic environment. With what is known about a the winner's curse, the hypothesis predicts, that the winning firm will, on average, place a bid that overstates the market's estimated EPS. (Varaiya, 1988)

Degree Of Competition

The second explanatory variable is the degree of competition. To measure this properly, the number of competitors were divided into two different forms: the first form is called **potential competition** and the second form is the so-called **actual competition**. While for the latter form of competition at least two bidders are known to the public, the first form includes only one publicly known bidder. But the winning firm's offered premium also depends on potential competition from other, publicly unknown, bidders. To measure this, Varaiya (1988) defined the dummy variable *COMP*. If *COMP* equals zero, then the form of competition is a **potential competition**. Due to the difficulties in finding operational measures for potential competitors, this defined dummy variable will be taken into account as a measurement of the presence of competitors. Therefore, if *COMP* equals to one, then the takeover deals with an **actual competition**. (Varaiya, 1988)

Measurement of Pre-acquisition Performance and Buyer Cash Flows of the Winning Buyer

For the third explanatory variable, two approaches are used as substitutes.

1) Performance ($PERF$) The pre-acquisition performance is measured by using the "average monthly market-adjusted return over the twelve-month period" (Varaiya, 1988, p.213) 24 to 13 months prior to the announcement month. It is is measured as the sum

of the difference between the rates of return for the bidders at month t and the weighted market index at month t. (Varaiya, 1988)

2) Buyer Cash Flows (CF) The pre-acquisition buyer cash flows are measured as "the extend to which a firm's capital expenditures are (on average) financed by internally generated funds." (Varaiya, 1988, p.213)

These cash flows are measured over a time period three to one year prior to the announcement date. $CF < 1$ means, that the capital expenditures are financed from external sources. On the contrary, if $CF > 1$ means, the firm is generating excess cash flow. These abnormal excessive cash flows will then be used to fund a takeover. The expectations are, that CF should be considerably larger than one for the winning firm, compared to average firms in the market. (Varaiya, 1988)

Empirical Methodology

To test for the winner's curse, Varaiya (1988) used a linear regression model. As the dependent variable $OVERPAYMENT$ suggests to have a positive outcome, the null-hypothesis H_{01}, that will be tested for, is defined as:

H_{01}: *E(OVERPAYMENT)>0*

The variable $OVERPAYMENT$ furthermore, is expected to be positive related to the divergence in opinion, the competition and the pre-acquisition performance. With that in mind, the null-hypothesis H_{02} as well as H_{03} are estimated to implicate positive outcomes as well. (Varaiya, 1988)

The estimated linear regression equation therefore is:

$$OVERPAYMENT = \alpha_0 + \alpha_1 CV + \alpha_2 COMP + \alpha_3 PERF + \epsilon \qquad (4.2)$$

or respectively,

$$OVERPAYMENT = \alpha_0 + \alpha_1 CV + \alpha_2 COMP + \alpha_3 CF + \epsilon \qquad (4.3)$$

4.1.3 Descriptive Statistics

To get a first impression of the data used for the regression model, Varaiya (1988) demonstrated a descriptive analysis of the data. The defined dependent variable $OVERPAY$-$MENT$ has a positive outcome in its mean value. As defined above, the positive outcome in the variable $OVERPAYMENT$ is an indicator, that the observed premium **overstates** the maximum offerable premium in a takeover. The descriptive analysis also show, that this overstating is true in 67% of the takeovers. To align this outcome with the winner's curse hypothesis, H_{01}: $E(OVERPAYMENT)>0$, in most cases, the premium paid by the winning bidder overstates the maximum premium expected by the market and thus, provides evidence for the existing of the winner's curse.

As explained above, the maximum offerable premium is the estimation of the overall gain created through a takeover. It is the sum of created gains for the target as well as the selling company and therefore gives an overview about the distribution of the the gains created by an acquisition. The outcome of the descriptive statistic displays that the results for the overall created gain is positive but statistical insignificant different from zero. Therefore, concluding these results, the average gain per dollar for the selling firm's shareholders can be associated with the average loss per dollar for the bidding firm's shareholders. (Varaiya, 1988)

The outcome for the first explanatory variable, the coefficient of the variance of estimated EPS (CV), has a positive outcome as well, meaning that the mean CV is positive at 12,7%. This indicates that a variance in the estimates of the earnings per shares is visible in the data set. (Varaiya, 1988)

Outcomes for the explanatory variables $PERF$ and CF are both positive, which indicates,

that, on average, buying companies tend to experience positive, abnormal performances and cash flows prior to the acquisition. Varaiya (1988) states furthermore, that the positive mean value of *CF* is significantly higher compared to the average value of cash flows in the US corporate sector. The positive mean value observation of these two variables suggests positive growth of the companies in the observed periods prior to the takeover. (Varaiya, 1988)

There is no descriptive part for the variable for measuring the competition, therefore, at this point, there cannot be made any interpretations about its nature in this data set.

4.1.4 Regression Results

The results of the regression equation 4.2 and 4.3 are displayed in Figure 4.1. Results are from a sub sample of 55 takeovers, taken from the sample of 91 acquisitions, where data is available for divergence of opinion, *CV*, as well as for *OVERPAYMENT*, the magnitude of the winner's curse. The first regression analysis contains the variable *PERF*, while the second one includes the variable fo cash flow, *CF*. Regression (3) includes neither of the two variables.

The coefficient for *CV* is statistical significantly positive at the 5% level for all three equations. The variable for competition, *COMP* on the other hand, has a negative value and is statistical insignificant from zero in all equations. The positive and significant result in the coefficient of the variance implies the winning bidders to fail to "(completely) adjust for uncertainty about the magnitude of takeover gains [which then] results in winning bids that substantially overstate the value of takeover gains." (Varaiya, 1988, p.216)

One possible explanation of the insignificance of the variable *COMP* may be, that the variable is vaguely defined, especially when *COMP = 0* (potential competition) which means there is only one publicly known bidder. Due to the possibility of placing a preemptive bid at a considerable premium in order to reduce the chance of potential competitors to "start a (costly) bidding contest" (Varaiya, 1988, p.216), takeovers may be falsely classified as

Figure 4.1: Results from Estimating the Regression Equation

Table 3.   Results from Estimating the Regression Equation
$$OVERPAYMENT = a_0 + a_1\,CV + a_2\,COMP + a_3\,PERF + \varepsilon \text{ for Sample of Winning Buyers}$$

	Intercept	CV	COMP	PERF	CF	R^2	F	N
	−0.44	0.04	−0.20	34.4		0.20	5.4	54
(1)	0.0	0.28	0.05	0.39				
	(−1.08)	(2.2)[b]	(−0.41)	(3.2)[a]				
	−0.27	0.04	0.29		0.10	0.03	1.6	54
(2)	0.0	0.30	−0.07		0.04			
	(−0.45)	(2.1)[b]	(−0.54)		(0.33)			
	−0.14	0.04	−0.28			0.05	2.4	55
(3)	0.0	0.30	−0.07					
	(−0.33)	(2.2)[b]	(−0.52)					

Notes: (1) In each equation the first row of numbers are the unstandardized coefficient estimates, the second row contains the standardized coefficient estimates (i.e. standardized beta estimates) and the numbers in parentheses are *t*-values.
(2) For definitions of *OVERPAYMENT* see Table 2.
(3) *COMP*=0, if the winning Buyer is the only publicly known Buyer seeking control of Seller and 1.0 otherwise.
(4) *CV* equals the coefficient of variation of analysts' EPS forecasts for a given Seller.

$$(5) \qquad PERF = \frac{1}{12} \sum_{t=I-24}^{t=I-13} (R_{it} - R_{mt})$$

is the average monthly market-adjusted return over the period [*I*-24, *I*-13]; *I* is the announcement month.

$$(6) \quad CF = \frac{1}{3} \sum_{t=I-3}^{t=I-1} CF_t, \; CF_t = (\text{Net income}_t + \text{Depreciation}_t - \text{All divi-}$$

dends$_t$)/Capital expenditures$_t$; *I* is the announcement year.
[a,b] Significant at 1% and 5% levels, respectively, for one-tail *t*-tests.

(Varaiya, 1988, p.215)

potential competition.

As predicted, both regression coefficient for variables *PERF* and *CF* are positive. However, only the coefficient for *PERF* is statistical significant an the 1% level. This means that an increasing of one standard deviation in *PERF*, induces an increasing of the standard deviation for *OVERPAYMENT* by 0.39. The pre-acquisition performance has a positive relation to the degree of overpayment and therefore, the magnitude of the winner's curse. The results are in line with H_{03}. However, Varaiya (1988) states, that it should be viewed

with caution in ascribing any causal explanations to the empirical relationship between the magnitude of overpayment and the pre-acquisition performance of the winning bidder. This may be due to the sensitivity of the the measure of *OVERPAYMENT*. As the maximum offerable premium is taken as a post-acquisition market returns' estimation, it can be positive related to the post-acquisition buyer's excess returns. To test for this, Varaiya (1988) used the pre- and post-acquisition sample distribution for performance. The findings show, that the mean on average is statistical significantly higher for pre-acquisition performances than for post-acquisition performances. The positive relation observed between the *OVERPAYMENT* and *PERF* therefore can be seen as a strong support of H_{03}. (Varaiya, 1988)

4.1.5 Conclusion

The findings from above, can be seen as a support for the appearance of the winner's curse in corporate takeovers. The results for the sample used show, that the bid premium, on average, considerably **overstates** the market's estimation of the respective takeover gain: in 67% of the takeovers, the winning buyer is estimated to overpay. The results also give evidence for the three hypothesis: H_{01} has already been proved for. For H_{02}, an increase in divergence of opinion as well as in the degree of competition will lead to an increasing likeliness and magnitude of overpayment, is only partly true: divergence of opinion has a significantly positive effect on the overpayment and therefore, is in line with the winner's curse theory. But the same cannot be said about the competition, due to the negative and statistical insignificant result. H_{03} is also likely to be true as the pre-acquisition performance of the winning buyer is significantly positive related to the overpayment in a takeover. (Varaiya, 1988)

4.2 Study II: Do Auctions induce a Winner's Curse? New Evidence from the Corporate Takeover Market

In their paper, Boone and Mulherin (2008) stated, that the winner's curse can happen due to the level of competition and the degree of uncertainty in the value of the target company. Their prediction includes, that bidder's returns are inversely related to these variables. This paper includes direct tests to test for the presence of the winner's curse consisting of an OLS regression model, a two stage regression as well as a simultaneous equation model. The novelty compared to earlier studies is, next to the use of multiple empirical models, the use of a new data set to define a more accurate view in the takeover competition. (Boone and Mulherin, 2008)

4.2.1 Introduction

As the competition is a vaguely measurable variable, Boone and Mulherin (2008) used, as a novelty compared to previous studies, data from Securities and Exchange Commission (SAC) documents that should provide more accurate information about the competition in an acquisition. With this data set, the private process prior to the public takeover bid can be displayed and the connection between winning bidders' returns and the level of competition in an acquisition is easier to study. Comparing this approach with previous studies, there solely the public bidding process was taken into consideration.

Next to the new data set used, Boone and Mulherin (2008) measured for endogeneity, produced by the ordinary least squares (OLS) regression method, between the bidders' returns and the competition. With a two-stage regression model, possible endogeneity should be avoided. To test for the winner's curse, bidders' returns after the acquisition are predicted to be statistical significantly negative related to the target firm's value un-

certainty and takeover competition. Additionally to the competition and uncertainty of a takeover, other characteristics influential to the outcome of a takeover, are taken into account.(Boone and Mulherin, 2008)

4.2.2 Data description

The data was in large parts taken from Boone and Mulherin (2008) earlier paper, published in 2000, *Comparing acquisitions and divestitures*, and includes 308 large-scale takeovers announced between 1989 and 1999. The data comes from the Value Line Investment Survey 1990. The number of takeovers in this study is extended by 27 observations compared to the 281 samples used in the previous paper from 2000. This sample includes 251 mergers and 57 tender offers. Within the 308 observations, 290 takeovers where successfully conducted while 18 failed to be completed. To test for the bidding competition Boone and Mulherin (2008) used data from Securities and Exchange Commission (SAC) documents that should provide more accurate information about the competition in an acquisition. With this data set, the private process prior to the public takeover bid can be displayed and the connection between winning bidders' returns and the level of competition in an acquisition, is easier to study. These documents include information about each observation's level and depth of competition. The four levels are: the number of firms contacting or were contacted by the seller's investment banks, signing confidentiality agreements, placed private written offers and the number of publicly known bidders. (Boone and Mulherin, 2008)

4.2.3 Developing tests of the winner's curse

As mentioned above, this study contains the private process prior to the public bidding of an acquisition. The private sales process covers auctions with multiple bidders as well as negotiation with a single bidder. By including this information about the privates sales process, the variable *competition* is likely to be measured more closely to its true value. (Boone and Mulherin, 2008)

Measuring takeover competition

In order to display the magnitude of the private sales process, Boone and Mulherin (2008) used Household International's acquisition of Beneficial Corporation in 1998 as example:

In this takeover process 29 firms contacted or were contacted by the Beneficial Corporation's investment banks, Goldman Sachs and Merrill Lynch, after the strategic decision of the Beneficial board of selling the company. 23 companies signed confidential agreements. After preliminary indications of interest in March 1998 were offered by multiple companies, Beneficial Corporation went into discussion with the five highest bidding parties. With the very promptly deadline of April 6 the same year to submit the final proposal, only one company, Household International, fulfilled the request accordingly. Household International therefore was the only publicly known bidder in the takeover process reported in the Securities Data Corporation. (Boone and Mulherin, 2008)

The descriptive statistic used by Boone and Mulherin (2008) provides evidence, that the declining of observations in each level of competition as seen in the example above, is the same for the data-set they used to test for the winner's curse. The next step of describing the nature of the data respective to the competition is, to divide the data-set into auctions and negotiations. In auctions, multiple bidder bid for one selling company, while in negotiations there usually is one bidding and one selling company.
Comparing the divided data with the whole sample, displays the similar overall decline of competitors per category in auctions. The number of competitors in negotiations is on each level roughly the same, so to say one, due to the nature of a negotiation. The two categories that deviate from the definition of a negotiation are *Contact* and *Public bidders*, where the number is slightly larger than one, because, on some occasions, informal discussions did not succeed or the selling company was contacted by an unsolicited bidder or an unsolicited bidder placed a public bid. (Boone and Mulherin, 2008)

Figure 4.2 lists the desriptive statistic of the sales process of all 308 observations.

Figure 4.2: Summary of the sales process

	Mean	Maximum	Median	Minimum
Panel A. Full sample (N = 308)				
Contact	7.10	150	2	1
Confidential	3.25	50	1	1
Private bidders	1.24	6	1	1
Public bidders	1.12	2	1	1
Panel B. By sales method				
Auction (N = 145)				
Contact	13.81	150	3	2
Confidential	5.77	50	2	1
Private bidders	1.51	6	1	1
Public bidders	1.23	2	1	1
Negotiation (N = 163)				
Contact	1.13	3	1	1
Confidential	1.00	1	1	1
Private bidders	1.00	1	1	1
Public bidders	1.02	2	1	1

(Boone and Mulherin, 2008, p.4)

Tests of the winner's curse

As it is likely that a common value element is present in a corporate takeover, the likelihood of the presence of the winner's curse is to be taken into account. Boone and Mulherin (2008) described three direct tests in order to test for the winner's curse. To find confirmation for the winner's curse, a regression analysis with the bidder's returns as the dependent variable is used.

The first prediction states that the overvaluation of the object is a function of the number of parties participating in a certain auction. If this estimation is valid, the winner's curse is present, when the returns for the winning firms are statistical significant and negatively related to the number of participating bidders. (Boone and Mulherin, 2008)

The second prediction covers the relation between the winning bidders return and the degree of uncertainty in the selling company's true value. The explanatory variable is a of

proxy for defining the uncertainty in the target's value. If the winner's curse predictions are true, the relation between uncertainty and the buyer returns are inversely related and statistical significant. (Boone and Mulherin, 2008)

The third predictions serves to supplement the above described tests. To give proof for the winner's curse, the post-acquisition operating performances of the winning firm have to be a function of the magnitude of competition. Evidence for the winner's curse is provided, if the level of competition is significantly negative related to the post-acquisition performance of a takeover. (Boone and Mulherin, 2008)

4.2.4 Descriptive Statistic

As the analysis of Boone and Mulherin (2008) includes a lot of different variables, it is worth to describe the nature of the variables a bit more in detail, prior to the regression analysis. As mentioned above, the full data-set is divided into auctions and negotiations. The full sample are split nearly half-half into auctions and negotiations, meaning, that there are sufficient observations for both sales procedure clusters.

Starting with the bidder returns, as this is used as the dependent variable in the regression model of Boone and Mulherin (2008). The returns the bidders expereinces are negative for auctions and negotiations, but the *p-value* suggests, that there is no statistical significant difference between the returns. As auctions are used as a proxy for competition, this result is inconsistent with the winner's curse theory, which indicates an inverse, significant relation between the bidder's return and the level of competition. (Boone and Mulherin, 2008)

The main explanatory variables are the proxy for the level of competition and the proxy for the degree of uncertainty. While the level of competition has been already discussed in the previous section, the proxy to measure the degree of uncertainty was mentioned only shortly above. The second main explanatory variable therefore, are the *Intangible assets*, which are defined as: "one minus the ratio of plant, property, and equipment to

assets and proxies for the uncertainty in the value of the target." (Boone and Mulherin, 2008, p.6) The descriptive analysis show, that for the full sample, as well as for auctions and negotiations separately, the percentage of intangible assets is above 60%. (Boone and Mulherin, 2008)

Next to the two main variables, Boone and Mulherin (2008) included several control variable which they said to have an impact on the outcome of a takeover. These control variables also include information about the size of the companies: the sample used for the analysis consists of large-scale takeovers. Therefore, the average size of the selling company is with 45% relative to the bidding firm's size of a significant importance. Firm sizes for bidding as well as target companies, are significantly smaller in auctions than in negotiations. (Boone and Mulherin, 2008)

Included are also deal characteristics like the percentage of firms using stock as payment, and the percentage of unsolicited offers made to the target company. Other target characteristics are: the anti-takeover state, a dummy variable that equals to 1 if the target firm is located in a state with strong takeover regulations; industry count, amount of firms active in identical industries as the selling firm but value succeeding the target's value prior to the announcement of the takeover; and if the target's CEO retains in the firm. The authors also lay a focus on the impact of investment banks on the outcome of a takeover, therefore information about the nature of the investment banks chosen in a takeover are displayed in the descriptive analysis. Boone and Mulherin (2008) hold a particular interest in the relation of prestigious investment banks and the winner's curse. They divided the target companies into two clusters: taking use of a top-tier or low-tier investment bank; and the bidder into three clusters: no investment bank used, top-tier or low tier investment bank used. (Boone and Mulherin, 2008)

4.2.5 OLS analysis of bidder returns

As stated above, the dependent variable in the regression are the bidder returns and the two main explanatory variables are proxies for the level of competition and the degree of uncertainty. The first variable is a proxy to measure the level of takeover competition. It is the dummy variable *Auction*, which takes a value of zero if the sales process is a negotiation, and one if it was an auction. As mentioned above, the winner's curse is predicted to be significantly negative linked to the number of competitors, therefore, the coefficient of *Auction* is expected to be statistical significantly negative. The second variable is the above mentioned proxy for the degree of uncertainty, the *Intangible assets*. The winner's curse is predicted to increase with growing uncertainty in the target's value, therefore, the coefficient for *Intangible assets* is expected to be statistical significantly negative. (Boone and Mulherin, 2008)

The other control variables as defined in the previous section, have a significant importance on bidders' returns in previous studies. (Boone and Mulherin, 2008)

The regression results are listed in Figure 4.3.

The first thing to look at, are the results of the coefficients of two main explanatory variables. The first finding, the outcome for *Auction*, supports the evidence found in the descriptive analysis for bidder returns. The coefficient of variable *Auction* is negative but not statistical significantly different from zero, therefore this outcome is not in line with the winner's curse theory.

The next step is to look at the finding in the coefficient for *Intangible assets*. The results are the opposite of the winner's curse prediction, so to say positive and significantly different from zero.

The results displayed for the control variables are in line with the outcomes in earlier researches. (Boone and Mulherin, 2008)

The positive and significant outcome in the coefficient for *Intangible assets* is not directly

Figure 4.3: OLS regression analysis of bidder returns, (-1, +1) window

Variable	$(-1, +1)$ Window
Intercept	0.213
	(0.000)
Auction	−0.010
	(0.281)
Intangible assets	0.033
	(0.024)
Relative size	0.011
	(0.007)
Bidder size	−0.009
	(0.002)
Stock	−0.038
	(0.000)
Unsolicited	−0.024
	(0.044)
Bidder hires no IB	0.036
	(0.002)
Bidder hires top bank	0.028
	(0.003)
Target hires top bank	−0.016
	(0.060)
Model p-value	0.000
Adjusted R^2	0.145

(Boone and Mulherin, 2008, p.9)

explained in the study, but it may be due to the ability of managers to discount their bid appropriately with increasing uncertainty. Either that or their estimates about the uncertainty where wrongly calculated and the intangible assets of firms have a greater value than they have expected. Either way, Boone and Mulherin (2008) could find similarities for their outcome in other studies.

A possible explanation in the insignificance of variable *Auction* is, that in this variable the level of competition is not defined sufficiently. In the beginning of the study, Boone and Mulherin (2008) defined four stages of a takeover process: bidders contacted or be contacted by an investment bank, bidders signing a confidential agreement, bidders placing a written offer and publicly announced bidders. The results of the new OLS extended by the four proxies for takeover competition are presented in Figure 4.4.

In this new approach, which is quite different from the analysis of Varaiya (1988), the outcomes are as following: regarding the control variables, the outcomes for all four regres-

Figure 4.4: OLS regression analysis of bidder returns including proxies for takeover competition

Variable	(1)	(2)	(3)	(4)
Intercept	0.209	0.214	0.209	0.201
	(0.000)	(0.000)	(0.000)	(0.000)
Contacted	−0.003	–	–	–
	(0.410)			
Confidential	–	−0.006	–	–
		(0.193)		
Private bidders	–	–	−0.020	–
			(0.109)	
Public bidders	–	–	–	−0.017
				(0.391)
Intangible assets	0.033	0.032	0.033	0.032
	(0.028)	(0.027)	(0.026)	(0.032)
Relative size	0.011	0.011	0.011	0.012
	(0.006)	(0.005)	(0.004)	(0.003)
Bidder size	−0.009	−0.009	−0.008	−0.008
	(0.003)	(0.002)	(0.003)	(0.004)
Stock	−0.037	−0.038	−0.038	−0.037
	(0.000)	(0.000)	(0.000)	(0.000)
Unsolicited	−0.024	−0.024	−0.026	−0.024
	(0.042)	(0.043)	(0.024)	(0.047)
Bidder hires no IB	0.037	0.038	0.037	0.037
	(0.002)	(0.001)	(0.002)	(0.002)
Bidder hires top bank	0.029	0.029	0.029	0.029
	(0.002)	(0.002)	(0.002)	(0.002)
Target hires top bank	−0.017	−0.017	−0.017	−0.018
	(0.048)	(0.052)	(0.042)	(0.038)
Model p-value	0.000	0.000	0.000	0.000
Adjusted R^2	0.144	0.147	0.149	0.144

(Boone and Mulherin, 2008, p.10)

sions are comparable to those shown in Figure 4.3, all four coefficients of the proxies for the level of takeover competition are negative and insignificantly different from zero using a two-tailed test. But if a one-tailed test is used, than at least for regression (2) and (3) the outcome is significant a the 10% level and therefore give some confirmation for existence of the winner's curse. Boone and Mulherin (2008) acknowledged that on account of them reporting p-values for all results, "the reported two-tailed test can be readily converted to one-tailed tests by dividing by two." (Boone and Mulherin, 2008, p.8)

4.2.6 Modeling the level of competition in a takeover

To cross out the possibility for endogeneity, which may be the answer to the statistical significantly negative outcome for the coefficients in regression (2) and (3) in Figure 4.4, the used sales procedure is not seen as a randomly made choice, but is dependent on multiple

variables important to take into account in a takeover.

The probit model used by Boone and Mulherin (2008) depends on the auction theory, using *Auction* as the dependent variable, which can take values one (auction) and zero (negotiation). The main explanatory variable used in this regression are again the intangible assets, in order to define the amount of uncertainty. This variable is expected to be positive related with the number of competition. Other control variables that are in line with the auction theory (Boone and Mulherin, 2008)

Results for the variables are in line with the outcomes estimated by the auction theory. The positive, statistical significant coefficient for intangible assets states, that the greater the amount of uncertainty in the true value of the target company, the more likely an auction will be conducted. Due to the demonstrated relation between the used sales procedure, and therefore the level of competition, and other deal characteristics as the intangible assets, Boone and Mulherin (2008) used a two-step regression analysis and a simultaneous equation system to test further for the presence of a winner's curse.

4.2.7 Regression analysis that incorporates selection

The previous section gives a reasoning why further testing is necessary. In order to get results that eliminate the presence of endogeneity, a two-step regression analysis or an simultaneous regression can be used. In the two-stage regression, a regressed variable for the sales procedure was used as an explanatory variable to regress for the bidder returns. The first regression therefore, serves to rule out eventual correlation between the bidder returns and the choice of sales procedure (auction or negotiation), which acts as a proxy for takeover competition.

The simultaneous equation analysis is used under the assumption, that the choice of the sales procedure is not exogenous, but has a strategical use to the bidder in order to maximize the results. In this model, both variables, sales procedure and bidder returns, are regressed on a set of variables and the results are so-called *fitted values*. These fitted val-

ues are afterwards used as explanatory variables for the respective other one. (Boone and Mulherin, 2008)

Independent of which model was used, the results remain similar to the outcome of the OLS regression. Furthermore, the significant coefficients found for *Confidential* and *Private bidders* lost their significance. Therefore, endogeneity is not the reason for the insignificance of the proxy for takeover competition and the positive, significant coefficient for the proxy of uncertainty in the regression for bidder returns.

The last regression Boone and Mulherin (2008) conducted, tests for the hubris hypothesis defined by Roll (1986) namely that the hubris together with the winner's curse "induce some takeovers that are mistakes and would not provide synergies." (Boone and Mulherin, 2008, p.16). The approach was, to take the sum of the pre-operative performance of target and buying company and compare it to the post-operative performance of the merged company. Boone and Mulherin (2008) wanted to test if the operating performance after an acquisition depends on the type of sales procedure used for the acquisition. They stated that the winner's curse theory predicts that the operating performance post-takeover are lower in auctions compared to negotiations.

But the outcome is comparable to the findings of previous studies: no statistically significant difference in the operating performances of negotiations and auctions could be found in the data. Therefore, this hypothesis has to be rejected as well. (Boone and Mulherin, 2008)

4.2.8 Conclusion

One of the most challenging facts about measuring for the presence of the winner's curse in corporate takeovers, is the difficulty of accurately measuring the level of competition. The approach of Boone and Mulherin (2008) was, to divide the number of possible competitors into four clusters. However, there could not be provided proof in favor of the winner's curse. The second mentioned factor that induces a winner's curse, is the amount of uncertainty

in the value of the target company. The idea of the authors was, to use the intangible assets as a measurement for the uncertainty. The regression results for the coefficients are statistical significantly from zero but, in contrast to what is predicted by the winner's curse theory, they are positive.

The results of the tests conducted suggests, that the winner's curse is not the reason for overbidding in a takeover process and therefore, "the decisions of bidders in corporate takeovers are consistent with rational behavior." (Boone and Mulherin, 2008, p.18)

4.3 Comparison of Study I & II

The two described papers give an insight into the complexity of the of the subject. Although both papers engaged with the task of finding evidence and proof for the existence of the winner' s curse in corporate takeovers, the results differ widely from each other. While the paper of Varaiya (1988) provided proof for the existence of a winner's curse in corporate takeovers, the paper by Boone and Mulherin (2008) did not find evidence for the winner's curse. To go into further detail why the outcomes differ from each other, this section compares the differences in the authors' approach and initial statements, the used data, the used analysis and the results.

4.3.1 Approach

There is some overlapping in the approach of both studies. Varaiya (1988) as well as Boone and Mulherin (2008) built their study in line with theoretical studies of the winner's curse theory. So to say, the winner's curse depends on two factors defined by Bazerman and Samuelson (1983): the degree of uncertainty and the amount of competition. The underlying structure is therefore the same for both paper. What varies, are the authors' different approaches how they defined the degree of uncertainty and the level of takeover competition.

Degree of Uncertainty

Varaiya (1988) defined uncertainty as the divergence of opinion of the true value of the target company. In order to measure the divergence of opinion, he used a database including a summary statistics of estimated earnings per share (*EPS*) forecasts. To get an appropriate measurement, Varaiya (1988) took the coefficient of the variance of the predicted *EPS*. The winner's curse predicts, that the winning bid is higher than the *EPS* estimated by the market. On the contrary, Boone and Mulherin (2008) used the intangible assets

of firm as a proxy to measure the uncertainty in a takeover. The intangible assets are all immaterial properties of a company, and therefore hardly measurable for an outsider. The greater the amount of intangible assets, the greater the uncertainty about a firm's true value. Therefore, while Varaiya (1988) used existing estimations about the firms' values, Boone and Mulherin (2008) focused on the immeasurable factors of a company.

Degree of Competition

To measure the takeover competition the bidders are facing, Varaiya (1988) defined two types of competition, namely potential and actual competition. Actual competition occurs, when more than one bidder is publicly known. Potential competition describes the situation of only one publicly known bidder, but there might be potential competition from publicly unknown bidders. Twenty years later, Boone and Mulherin (2008) tried to make a more accurate measure of the takeover competition by including the private bidding process prior to the publicly announced process as well. Instead of saying, there is competition or there might be competition, their research enables them to get a more or less exact number of participants competing in an acquisition. The authors defined four stages of the competition in takeover process: Firms contacted or were contacted by the selling company, firms signing confidential agreements, firms placed written bids and fourth, firms which placed a public offer. For the regression analysis, Boone and Mulherin (2008) used Auction as a proxy for high competition and Negotiation as a variable for a one-to-one takeover. Compared to the study of Boone and Mulherin (2008), the measure for the degree of competition is quite simplified displayed in the research of Varaiya (1988). Nevertheless, in both studies the coefficient for competition has an insignificant outcome.

Hypothesis

In both papers, the authors defined three null-hypothesis in order to test for the winner's curse. The first hypothesis of Varaiya (1988) is a more general view, that the winning

bidder will overpay his/her estimated target value. The second null-hypothesis says, that the likelihood of the winner's curse rises with increasing competition and divergence of opinion (uncertainty). His third hypothesis is a more individual view, that the chance of a winner's curse is positive influenced by the magnitude of pre-acquisition abnormal performance.

Boone and Mulherin (2008) defined in their first hypothesis, that the winner's curse can be taken into account, when the bidder's returns are inversely related to the number of bidders (competitors). Their second null-hypothesis says more or less the same but for uncertainty in a takeover: the winner's curse can be taken into account if bidder's returns are inversely related to the amount of intangible assets of the target company. The third hypothesis is in regard to the operating performance of the companies. It states, due to hubris (Roll, 1986) and the winner's curse, post-acquisition operating performances tend to be lower after conducting an auction rather than a negotiation.

4.3.2 Data

As between the papers lies a time difference of 20 years, the data also is from different time period. But the thing their data-sets have in common is, that they used only data from large-scaled corporate takeovers. Varaiya (1988) used data from the period of 1974 to 1983. It comes from the merger and acquisition database of Kidder Peabody & Co. The used sample included 91 takeovers, including 51 mergers and 40 tender offers. Varaiya (1988) defined for requirements the used samples have to fulfill: the takeover must be successful, financed with cash, stock or a combination of both, not a leveraged buyout and have sufficient information accessible. The data to measure for the divergence of opinion, comes from a database including earning per share estimates and forecasts of over 2000 firms including their summary statistics (I/B/E/S database of Lynch, Jones, Ryan).

The data used by Boone and Mulherin (2008) includes more than three-times the number of acquisitions in Varaiya (1988), that is 308 in total. The data-set includes 251 mergers and 57 tender offers in the period of 1989 to 1999. The information about the depth of

competition comes from documents of the Securities and Exchange Commission. (Boone and Mulherin, 2008).

4.3.3 Analysis

Both studies use an Ordinary Least Square regression model (OLS) to test for the winner's curse, but Boone and Mulherin (2008) further included a two-stage regression as well as a simultaneous equation model to test further for endogeneity in their OLS model.

Dependent Variable

In the study of Varaiya (1988), the dependent variable is called *Overpayment* and is defined as the magnitude of the winner's curse. *Overpayment* is the difference between the observed premium, defined as the sum of excess returns of the target firms on event day t relative to the announcement day, and the maximum offerable premium, the outcome of the total gains of an acquisition divided by the selling firms total market value an *t-20*. If the variable *Overpayment* takes on a value smaller than 0, the observed premium **understates** the estimated takeover gains. On the contrary, if *Overpayment* takes a value greater that 0, the observed premium **overstates** the market's estimates gains. The latter case is observable if the winner's curse is present.

In the paper of Boone and Mulherin (2008), the dependent variable is *Bidder's Return*, therefore they chose to directly regress on the outcome of the takeover and did not, as Varaiya (1988), define a variable to test for the winner's curse. As mentioned above, Boone and Mulherin (2008) additionally conducted a two-stage and simultaneous equation regression, where the second dependent variable is called *Sales Procedure*. The greater the value for this variable, the more likely an auction is used as sale procedure in an acquisition.

Explanatory Variable

Varaiya (1988) used in his regression analysis as explanatory variables the variance of the coefficient of the estimated earnings per share, a dummy variable for competition which has a value of either 1 (actual competition) or 0 (potential competition), and the pre-acquisition performance as well as the pre-acquisition buyer cash flow of the bidding firm. Pre-acquisition performance and cash flows function as substitutes for the respective other one. Varaiya (1988) used performance in one regression and cash flow in the other one. The number of explanatory variables is another factor where the two studies differ from each other, while Varaiya (1988) included a limited amount of three explanatory variables, Boone and Mulherin (2008) chose to include up to nine explanatory variables.

The study of Boone and Mulherin (2008) includes the two main explanatory variables auction (or the more detailed alternative, that includes the four stages of the bidding process: contacted, confidential, private bidders and public bidders) and intangible assets. Additionally, the regression includes variables such as the relative target size compared to the bidder, the bidder size, a dummy variable equals to 1 if at least some stock is used and otherwise equals to 0, a dummy to display unsolicited offers (1 if such an offer has been made, otherwise 0). The last three variables are in regard to the usage of an investment bank in the takeover process, bidder highers no bank, bidder hires top bank and the last, target highers top bank.

The characteristics of the variables used in the two studies are from a different nature. Boone and Mulherin (2008) used variables which consists to a great amount of dummies with a value of either 1 or 0. The other variables could mostly be extracted directly from the used data set.

Intangible assets, together with relative target size, are the only two variable with an underlying calculation. In comparison, Varaiya (1988) only used one dummy variable for the definition of competition. The variable to test for uncertainty is taken as the coefficient of the variance of the estimated *EPS* and the pre-acquisition performance, as well as the cash flow is also calculated from the monthly, to the market adapted bidder returns.

4.3.4   Findings

Before the comparison of the results of the regression analysis, it is worth to briefly discuss the results of the descriptive statistic of the used data in both papers.

Descriptive Statistic

The descriptive statistic of the data is important in both studies in order to get a first impression of the data they are dealing with. Starting with Varaiya (1988), two findings were worth mentioning: positive results in the mean for his defined variable *PERF* and, more importantly, the positive statistical significant outcome for the variable *OVERPAYMENT*. The first one suggests, that in the data set, the average bidding company experienced larger pre-acquisition abnormal performance. The positiveness of the second variable is in line with the overall expectations about the winner's curse, so to say, that *OVERPAYMENT* is expected to be greater than zero and therefore, the likeliness of the winner's curse is there.

For the description of the data used in Boone and Mulherin (2008), it is worth to mention briefly, that in the used data-set, the number of auctions and negotiations is nearly equally split, therefore, whenever the authors talk about the differences in the outcome of auctions and negotiations, this is not due to insufficient amount of observations in one or the other sales procedure. Another variable worth to mention is *Intangible Asset*. The mean of the percentage of intangible assets is over 60% for the full sample as well as for auctions and negotiations, which indicates a great amount of uncertainty in the true value of the target company. An additional result neccessary to mention here, is the mean value for *Bidder returns*; the mean for the full sample as well as for the two types of sales processes are negative and therefore in line with the prediction that in a company takeover the bidding firm is likely to experience negative return. But the p-value suggests, that the differences in the outcome for auctions and negotiations is not statistical significantly different from zero, which is not in line with the prediction, that the winner's curse increases with more

competition.

However, the outcome of the descriptive statistic in both studies provides evidence for the trueness of the initial predictions about the dependent variable; Varaiya (1988) suggested that the variable $OVERPAYMENT$ is greater than zero and Boone and Mulherin (2008) stated that the returns for bidders are negative.

Regression Results

As discussed above, Varaiya (1988) used only a very limited amount of variables. He conducted three regression analysis following these models:

$$Overpayment = \alpha_0 + \alpha_1 CV + \alpha_2 COMP + \alpha_3 PERF + \epsilon \tag{4.4}$$

and respectively,

$$Overpayment = \alpha_0 + \alpha_1 CV + \alpha_2 COMP + \alpha_3 CF + \epsilon \tag{4.5}$$

All three regressions include the two main independent variables CV and $COMP$. In one of the regressions he included the pre-acquisition performance and in the other one he used the pre-acquisition cash flow as substitute, as previously mentioned. To get more information about the quality of the regression equation, it is worth to have a closer look at the coefficient of determination R^2, which explains what proportion of the variance of the explanatory variable can be explained by the explanatory variable of the regression.(Stocker, 2011)

In the three outcomes regressed by Varaiya (1988), the regression including pre-acquisition performance displays the biggest R^2, which is also in line with the significance of the independent variables. While CV is always positive and statistical significant at the 5% level and the variable $COMP$ is always negative and statistical insignificant throughout all three equations, $PERF$ included in the first regression, has a positive and statistical significant

coefficient at the 1% level. (The outcome of the regression are include in Figure 4.1)

The results in Varaiya (1988) are to a great extent in line with his initial winner's curse prediction, so to speak the overpayment is significantly positive related to the uncertainty in a takeover. Pre-takeover abnormal performance is, additionally, significantly important in the result of a takeover process. The only thing not in line with the winner's curse estimation, is the outcome for the level of competition. If this is due to an insufficient way of measuring competition or because it actually has no significant effect on overpayment, is difficult to answer.

In the regression analysis of Boone and Mulherin (2008), they started as Varaiya (1988) with an OLS regression model with the *Bidder's Return* as the dependent variable. The OLS has the following form:

$$Bidder'sReturn = \alpha + \beta_1 Auction + \beta_2 IntangibleAssets + \sum \beta_k X_{i,k} + \epsilon_i \qquad (4.6)$$

whereas $X_{i,k}$ is an indicator for the additional control variables. The outcome of the OLS is differing from the winner's curse predictions made by the authors at the beginning of their analysis. Although the variable *Auction* experiences a negative coefficient, it is not statistical significantly different from zero. The variable *Intangible Asset* on the other hand, is statistical significant but positive, therefore oppositional to the winner's curse estimations.

The coefficient of determination R^2 for the regression of Boone and Mulherin (2008) is slightly smaller than the R^2 in the OLS of Varaiya (1988), but it cannot directly compared because the R^2 in Boone and Mulherin (2008) is an adjusted R^2 (used in multiple regression models in order to minimize the increasing effect of including additional variables in the equation (Stocker, 2011)). There is no further information about the R^2 used in Varaiya (1988). If he also displayed the adjusted R^2 in his paper, the model of Varaiya (1988) contains slightly more of the proportion of variance of the dependent variable can be explained by the independent variable or the regression.

Boone and Mulherin (2008) tried a different version of the OLS regression to get significant results for the competition. While Varaiya (1988), for the measuring of competition included the variable *COMP*, Boone and Mulherin (2008) defined the level of competition further by including this new information about competition in the OLS regression. The four regression results (to be seen in Figure 4.4) have the similar outcome as the basic equation model, using *Auction* as a dummy for competition. As already mentioned, two of the competition dummies had a significant outcome it the OLS, but this vanished when using the second-stage model.

4.3.5   Summary

Both study results show, that the number competition is not significant to the outcome of a corporate takeover. As Varaiya (1988) states that this might be to the insufficient accurate way of defining and measuring takeover competition, Boone and Mulherin (2008) proofs in their study, that even with a more defined and precise way of measuring the level of competition in an acquisition, the outcome in the winner's curse prediction stays the same: the level of competition is negative but statistical insignificantly different from zero. Both paper therefore, had to reject their null-hypothesis.

On the other hand, the papers differ in the results of the degree of uncertainty in an acquisition. While Varaiya (1988) finds positive and statistical significant results for the coefficient of uncertainty that support his winner's curse hypothesis, the results of Boone and Mulherin (2008) are also and statistical significant. But this led them to reject their winner's curse hypothesis. This may be due to the different approach how the authors defined a variable for measuring uncertainty and/or in the data they both used, as they both had a different approach there as well.

As stated in the introduction, these differences made it interesting to compare these two papers with each other. The study of Boone and Mulherin (2008) seems to be a more accurate measure of testing for the winner's curse. Instead of having calculations lying

behind each variable used, they were more keen to use variables directly out of the data set. The only variable which was not like that in the data-set is the proxy for uncertainty, the *intangible assets*. But even this calculation is by far more comprehensible than the variable Varaiya (1988) used as a proxy for the degree of uncertainty, the coefficient of the variance of the estimated earnings per share. It could be argued, that the preferred outcome can have an impact on the underlying calculation of a variable. Not only can the outcome interfere with a rational calculation of a variable, but also biases in the different data used, can have an impact on the final results.

Another point that is in favor of the results stated by Boone and Mulherin (2008), is their recognition of possible endogeneity in their initial OLS regression. Therefore, they tried to find evidence and proof, that the results are not biased in terms of correlations between the independent variable and the error term of the regression.

As mentioned above, the regression model of Varaiya (1988) includes less variables compared to the model used by Boone and Mulherin (2008). And while a long model definitely not always means, that its results are more accurate, the shorter form of Varaiya (1988) can be victim to so-called *ommited variables*, which are variables that weren't considered in the model. This means, that variables that are important in the true regression model, but are not considered in this model, act through an included variable and therefore give this variable a significance that may not be true. (Stocker, 2011)

The significant results found in the proxy variable for uncertainty, can therefore be a result of these ommitted variables.

Chapter 5

Conclusion

While many economists were studying the impact of the winner's curse in different business areas, and even more studied its impact in laboratory experiments, the number of published researches in the area of corporate takeover was quite limited. Boone and Mulherin (2008) mentioned, that many economists where satisfied due to the "persuasive hubris hypothesis posed by Roll (1986) in which overconfident managers fall prey to the winner's curse and overbid when acquiring other corporations." (Boone and Mulherin, 2008, p.2)

The two papers described in detail above, illuminate not only the differences in the outcome, but how two economic analyses can vary between each other. One of the main differences is definitely the time when the studies were developed. There is a time difference of 20 years between the papers and the data used. It is most likely, that between the two studies, values and impacts of certain variables changed. For example, Boone and Mulherin (2008) included the impact on investment banks in their analysis and studies their influence on the outcome for a corporate takeover. This information was not not at all taken into consideration by Varaiya (1988). If this is whether the acquisitions were conducted without target or bidding company chose to hire an investment bank or because, during that time, investment banking was governmental regulated (Fohlin, 2014) and therefor it didn't seem to have an impact on the outcome of an acquisition, remains an open question.

5.1 Summary of Study I & II

After working through the two papers, the initial question *Can the winner's curse be taken into account for the overpaying in corporate takeovers?* remains difficult to find an answer to. As stated above, the winner's curse is defined to depend on two factors: the level of competition and the degree of uncertainty. While in laboratory experiments, both factors can be fabricated, in field studies the approach differs widely. In both papers, the authors succeeded in defining variables for both relevant factors. The process of finding satisfying results, is similar in both studies. First, an overview about the nature of the data set was done by using descriptive statistics, and second, with the help of pre-defined null-hypotheses, regression equations were defined. The difference hereby was, that while Varaiya (1988) stopped after conducting his OLS regression, Boone and Mulherin (2008) went a little bit further and tried other models as well.

In the results, there is one outcome that both studies have in common: the insignificance in the proxy used to test for the impact of the level of competition. Neither Varaiya (1988), who used a dummy variable to distinguish between actual or potential competition, nor Boone and Mulherin (2008), who defined also the private process behind the public process, were able to find evidence that the unsatisfying results in corporate takeovers has anything to do with the level of competition.

The results for the second important factor for the winner's curse, differ widely from each other, although for both variables the coefficients are significantly different from zero. For Varaiya (1988) the outcome is in line with his stated null-hypothesis which stated, that an increasing in the degree of uncertainty leads to an increasing overpayment in the acquisition. The results found by Boone and Mulherin (2008) on the other hand, were not in line with their winner's curse prediction, that bidder returns will decrease with growing amount of uncertainty. Their results suggests quite the opposite: bidder returns increase with more uncertainty present in the takeover process.

Personal Note Why exactly these inconsistencies appeared, is difficult to say and rather than pointing the finger to one particular issue in one or the other paper, is unlikely to lead to the right answer. Rather than focusing on a certain difference in the researches, the studies as a whole should be considered. Despite the undelying winner's curse theory, the both studies have nothing in common. They differ in each major point and therefore, are quite difficult to compare. Some attempts to compare the papers are made in the previous chapter but they are rather subjective. A third study about this subject may shed some more light on this topic, but it may also confuse with a completely different outcome as either one of the studies explained above.

When I started with reading the papers, the first one I found, was the study of Varaiya (1988) which convinced me of the presence of the winner's curse in corporate takeover. The results of the paper of Boone and Mulherin (2008) rather surprised me afterwards, due to the highly different results. As the first paper has already convinced me, it was difficult at first, to adapt my thinking in order to fully understand the second paper. After I read through the papers more and more often to figure out which parts are essential for this thesis, I understood their approach better and better. And with a more or less unbiased view on the papers, I started my analysis of the studies.

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