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THE OVERPAYMENT IN MULTIPLE BIDDING

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〈Abstract〉

This paper provides an empirical analysis of the winner's curse in the context of corporate takeovers. The study analyzes conditions which make overpayment likely. For a sample of corporate takeovers completed between 1982 and 1993, the analysis shows that the volatility of targets relative to that of acquirers (not the uncertainty of the target or acquirer alone) has a definitive impact on the magnitude of the winner's curse. Also, the incidence is more pronounced in multiple-bidder than in single-bidder contests. Specifically, white knights are more likely to overpay than other acquirers in multiple bidding situations. Furthermore, the study finds that the process of competitive bidding is a zero sum game since the greater returns to the shareholders of target firms in multiple-bid contests come at the expense of the acquiring companies. Overall, the evidence suggests that the bidders need to become more conservative, particularly as the relative uncertainty of the target's 'true' value and the number of bidders increase.

1. INTRODUCTION

Empirical studies show that the returns to bidder firms are either significantly negative or insignificant.[1] Several researchers suggest that the choice of stock financing can act as a negative signal for the bidder firm. Consequently, due to information asymmetry, negative bidder returns may not be indicative of a poor investment (Asquith, Bruner, and Mullins [3], Myers and Majluf [20], and Travlos [27]). An alternative explanation for the negative stock price performance of bidder firms is simply that bidders overpay for target firms. According to the overpayment hypothesis, shareholders of target firms gain at least in part because of bidder overpayment. This study examines the magnitude of

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1) Jarrell and Poulsen [11] and Jensen and Ruback [14], among others, discuss the effects of wealth on acquiring firms in takeover situations.

overpayment and analyzes the conditions under which overpayment is likely to occur.

Conflicts of interest between managers and shareholders provide much of the theoretical and empirical justification for expected overpayment. Morck, Shleifer, and Vishny [19] argue that some bidders systematically overpay for private benefits in order to further personal managerial objectives rather than to maximize shareholder wealth.[2] However, even if managers act in shareholders' best interest, bidder managers affected by hubris overpay for target firms (Roll [22]). This hubris rationale is based on bidders' ignorance of the winner's curse in bidding theory.[3] Optimistic managers are therefore prone to overestimating the target's value and thus to making negative net present value acquisitions.

In competitive bidding situations the successful bidder often overestimates the benefits of corporate consolidations and falls victim to the winner's curse.[4] This phenomenon can be observed by comparing returns to target and acquiring firms in single-bidder contests to those generated in multiple-bidder contests. Bradley, Desai, and Kim [6], Michel and Shaked [17], and Stulz, Walkling, and Song [26] report that target firms exhibit significantly higher abnormal returns when acquired in multiple-bid rather than in single-bid acquisitions. Also, Bradley, Desai, and Kim [6] note that "white knights" are responsible for the negative returns to acquiring firm shareholders in multiple-bidder contests.[5] This is because white knights are among those who are most likely to overpay for target firms.

The winner's curse is a result of both competitive bidding and uncertainty about the target's value.[6] Varaiya and Ferris [28] and Varaiya [29] find that the extent of overpayment is directly related to the degree of divergence in analyst estimates of the

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2) In a recent study, Seyhun [24] tested the conflict-of-interest hypothesis by examining stock tradings of top mangers in bidder firms. The evidence, however, does not appear to support Morck et. al.'s argument since bidder mangers, on average, do not knowingly overpay for target firms.

3) The hubris hypothesis may be considered a special case of the winner's curse hypothesis. Roll observes that bidders overpay due to hubris and the winner's curse.

4) For other situations of the winner's curse, see Bazerman and Samuelson [4].

5) "White knight " typically refers to a late bidder whom the target management invites to top an initial hostile offer.

6) Thus, acquirers in single-bidder contests are not immune to the winner's curse.

target's earnings. As the uncertainty associated with the future performance of the target company or with expected takeover gains increases, it is more likely that bidders will base their offers on different assessments. Overall, the evidence from the winner's curse suggests that as the uncertainty regarding potential takeover gains and the number of bidders increases, the bidder firm increases its discount from its estimate of the "true value" of the target (or bid less) in order to compensate for the tendency to overbid.

The purpose of this paper is to examine the winner's curse hypothesis with a new overpayment variable and different measures of the uncertainty associated with the firms involved in the bidding contests. The volatility of targets relative to that of acquirers (not the uncertainty of the target or acquirer alone) has an impact on the extent of winner's curse, and the incidence is more pronounced for multiple-bidder than for single-bidder contests. This paper suggests that managers affected by hubris and associated with firms having large cash flows often fail to recognize that overpayment is most likely to occur with volatile targets and in multiple-bidder situations. Acquirers with good pre-acquisition performance tend to overpay with accumulated free cash flows.

Section 2 presents the data and the methodology for identifying the winner's curse and measuring uncertainty. Section 3 shows the division of takeover gains among bidding participants and the extent of the winner's curse in competitive bidding situations. Targets' shareholders capture the largest share of the gains in multiple contests, and white knights contribute the most for windfalls to targets. Regression analysis illustrates the winner's curse hypothesis within the context of corporate takeovers. Section 4 presents the summary and concluding remarks.

2. RESEARCH DESIGN:

2.1. The Sample

The initial sample was drawn from the "Research Company" database on COMPUSTAT between 1980s and 1990s.[7] As of March 15, 1994, 5462 merger-related research

7) The COMPUSTAT database classifies companies as either "active" or "research." While an

companies were identified. To belong to the final sample, takeovers must meet the following criteria:

- Major Exchange: If a firm is not listed on the NYSE, AMEX, and OTC, it is excluded.
- CRSP (Center for Research in Security Prices) Availability: If a company is not listed on the database, it is excluded.
- Partial Acquisition: If less than 50% of controlling interests of a firm is involved, that firm is excluded.
- *Wall Street Journal Index* (WSJI): If no information about the acquisitionis available, the company is excluded.
- Data Availability: A firm is required to have data available on both the CRSP tapes and the COMPUSTAT database for aperiod of approximately five years ending one year prior to the announcement.[8]
- Divestitures and LBOs (Leveraged Buyouts) are excluded since they may exhibit different characteristics than mergers.
- Matched Pairs: The pairs for which the data are available are selected to estimate the magnitude of overpayment.[9]
- Operating Income Availability: Quarterly data on operating income before depreciation for a period of approximately five years, ending one year prior to the announcement must be available for the target and the bidding firms. Due to the limited nature of the data, this criterion is the ultimate determinant of the final sample size.[10]

"active" company is on the exchanges, a "research" company is a company that was delisted from the exchanges due to mergers, bankruptcy, and so forth. The database provides information for the last 20 years.

8) If security returns are not available for this entire 60-month period, a shorter interval of not less than 30 months is used.

9) In multiple-bid contests, there is only one pair in the 21-pair sample for which the successful acquirer is not the same as the first unsuccessful bidder.

10) OIBDPQ is the mnemonic used in the COMPUSTAT database for the Operating Income Before Depreciation. This item represents Net Sales less Cost of Goods Sold and Selling, General, and Administrative Expenses before deducting Depreciation, Depletion, and Amortization.

Using those criteria, 60 pairs of single-bid takeovers and 21 pairs of two-bid takeovers have been identified for the analysis.[11] To be classified as multiple-bid acquisitions, an identified bidder must make an offer in competition with another firm during the takeover battle. Exhibit 1 details the screening process used to obtain the final sample.

EXHIBIT 1

SAMPLE CONSTRUCTION AND SCREENING PROCESS

Research companies counted 3/15/94	8,575

The screening process to obtain the final sample is as follows:

Non-merger[1]			(3,113)
Merger-related Research Company			=5,462
Non-major Exchange			(950)
CRSP Availability			(400)
Partial Acquisition or No Information			(1500)
Available Deals			=2,612
Among 2,612 deals identified, final matched pairs of target and acquiring companies are obtained as follows:			
	2,612		
Data Availability	(1100)		
LBOs	(120)		
	=1,392		
Single-Bid Contests	1217	175	*Multiple-Bid Contests*
Matched Pairs	500	175	
Operating Income Availability	(440)	(154)	
Final Sample	**60 pairs**	**21 pairs**	

1. Reasons for non-merger deletion: bankruptcy, liquidation, etc. (coded 2, 3, 5, and 10 in COMPUSTAT)
2. For foreign-acquired targets, only 18 targets are involved in a multiple bidding situation. The remaining 17 targets are not included for a variety of reasons. For example, 7 of those targets have multiple acquirers, which are combination of U.S. and foreign acquirers.

2.2. Event Study Methodology

The event study methodology provides the framework for estimating the premiums paid to the target firms by the acquirers in single-bid and multiple-bid acquisitions. The capital

11) Four pairs of three-bid takeovers were available for the analysis. Because of the small sample of three-bidder firms and the potential unreliability of any resulting analysis, the three-bidder sample was excluded from this study.

asset pricing model (CAPM) is used in calculating the premiums paid to the target firm and the returns accruing to the acquiring firm around the announcement of the planned takeover. This study uses the day prior to the public announcement date of the first takeover bid in the *Wall Street Journal (WSJ)* as "the announcement date". It is the date when either party indicated publicly that a takeover was being considered (see Michel, Shaked, and Lee [18]).

The abnormal returns (ARs) for each company are calculated by subtracting the expected returns from the actual returns for each day under investigation. Then, daily abnormal returns for each company are summed over the same period to obtain cumulative abnormal returns (CARs). Average abnormal returns (s) for each day are calculated for the portfolios of both the target and the acquiring firms in single- and multiple-bid takeovers. The average portfolio abnormal return on a given day is then analyzed to determine whether the excess return is statistically significant.

The average cumulative abnormal returns (s) for each portfolio are obtained by summing the average abnormal returns during the period. The Kolmogorov-Smirnov test is performed to test the normality of the underlying CAR distributions (Manoukian [16]). Since the results produce normal distributions, a parametric, pairwise *t*-test is used to define the differences between the subsamples.

Abnormal returns are calculated for the 121-trading day interval surrounding the announcement date (from 40 days before to 80 days after). Since the latest bid is 68 days after the first bid, the 80-day period after the first bid date is used to evaluate the results associated with successive bids.[12] As was indicated by Michel and Shaked [17], the most significant difference between the CARs of single- and multiple-bid acquisitions is obtained during the 80-trading day period immediately following the announcement date. A large proportion of second bids are also concentrated within that time interval.

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12) The statistics on the distribution of the number of trading days between the initial (unsuccessful) offer and the subsequent (successful) offer are mean 21.4 days, median 14 days, standard deviation 19.6 days, and a minimum of 2 days.

2.3. The Winner's Curse

Bradley, Desai, and Kim [6] recommend that the significance of the total percentage of synergistic gains from successful acquisitions be estimated using matched pairs of target and acquiring firms.[13] In our analysis, the estimate of the synergistic gains in each takeover i is based on the CARs of a value-weighted portfolio of each successful bidder-target pair, each weighted by its market value of equity,

$$SCAR_i = (CAR_{Ti} * W_{Ti}) + (CAR_{Ai} * W_{Ai}), \quad (1)$$

where

$SCAR_i$ = total percentage synergistic gains on portfolio i, calculated over the same time period as CAR_{Ti} ;

CAR_{Ti} = cumulative abnormal returns to the target firm from 40 trading days prior to the first announcement date through 80 trading days thereafter;

W_{Ti} = weight of the target's market value of equity to the market value of equity of portfolio i as of (approximately) 40 trading days prior to the first announcement for the target;

CAR_{Ai} = cumulative abnormal return to the successful acquiring firm from 40 trading days prior to the first bid made by this firm through 80 trading days thereafter;[14]

W_{Ai} = weight of the bidder's market value of equity to the market value of equity of portfolio i as of the same time as W_{Ti}.

The total dollar synergistic gains on portfolio i, SDOLi can then be estimated using the following percentage measure:

$$SDOL_i = SCAR_i * MV_{Pi}, \quad (2)$$

where

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13) However, their study does not fully resolve the issue of the existence and magnitude of takeover gains. Roll [22] attempts an explanation with the hubris hypothesis, which states that the total combined takeover gain to the target and bidding firms is nonpositive.

14) The first bid made by the successful, ultimate acquirer is not the same as the first announcement date for the target firm in multiple-bid contests. See footnote 9.

MV_{Pi} = the market value of equity of portfolio i as of the same time as W_{Ti}.

When the bidder and target firms differ in terms of size, percentage returns are difficult to use for measuring takeover gains. Therefore, we utilize total dollar synergistic gains. In the case of a relatively small target, gains to acquiring firms are often disguised. In other words, the percentage returns may be negligible while the dollar gains are large (Bradley, Desai, and Kim [6], Malatesta [15], and Morck, Shleifer, and Vishny [19]). Asquith, Bruner, and Mullins [3] and Jarrell and Poulsen [11] also find that the abnormal returns of the acquiring firms are positively related to the size of the target relative to that of the acquiring firm.[15]

The distributions of the total percentage synergistic gains are determined to be normal, while those of the total dollar synergistic gains are not normal.[16] Therefore, nonparametric tests such as the Wilcoxon signed-rank test and the Mann-Whitney U test are used to define the statistical significance of the total dollar synergistic gains. The Wilcoxon signed-rank test is adapted to test if the median dollar gains for the subsample is statistically greater than zero. Since the sample distribution of dollar returns is skewed, the analysis focuses on median rather than on average values. The Wilcoxon signed-rank test considers the relative magnitude as well as the direction of differences; therefore, it is also useful for comparing two-paired subsamples of dollar gains The Mann-Whitney U test, (often referred to as the Wilcoxon rank sum test), is used to determine whether two independent (but not paired) subsamples have been drawn from the same population.

To evaluate the winner's curse hypothesis, we estimate the extent to which the successful acquirer is 'cursed' by overpaying for the target firm. The overpayment measure for each pair of the target and acquiring firm, WINCi, is defined as,

$$WINC_i = CAR_{Ti} - SCAR_i. \quad (3)$$

The variable $WINC_i$ considers the difference between the total premiums paid to the target firm and the total percentage synergistic gains, if any. In other words, it measures

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15) In this study, the mean and median relative sizes of the target to the acquiring firm are 35.6% and 18.2%, respectively. Although the relative size in the single-bid contests is larger than that in the multiple-bid contests, the difference is not statistically significant.

16) Kolmogorov-Smirnov Z is calculated to test the null hypothesis that the underlying distribution is normal. An overpayment variable, WINCi , is also determined to be normal.

the extent of the ultimate acquirer's overpayment for the expected takeover gains.[17]

As Bazerman and Samuelson [4] demonstrate, two conditions affect the likelihood and extent of the winner's curse: the degree of uncertainty associated with the target's value, and the existence of competing bidders. The volatility of both the operating income and stock price is utilized to analyze the uncertainty associated with the target's value. Acquirers tend to base their valuations of target firms primarily on the operating cash flows. Divergent assessments are thus a consequence of the resultant uncertainty.

The magnitude of operating income differs cross-sectionally as well as between the targets and the acquiring firms. Therefore, the coefficient of variation of the operating income is calculated using quarterly data for a period of five years, ending one year prior to the announcement. To separate the seasonal effects from the general variation of a series, the data is deseasonalized by dividing every data point by its corresponding seasonal index.[18] The standard deviations of the daily stock returns (including dividend) for a period of one year and the monthly stock returns for a period of five years (both for the period ending one year prior to the announcement) are used to assess volatility. Regression analysis then incorporates overpayment, volatility, and the degree of competition to establish the winner's curse hypothesis.

3. EMPIRICAL RESULTS

3.1. The Division of Takeover Gains

The time series of cumulative abnormal returns (CARs) of the portfolios of 60 single- and 21 multiple-bidding contests provides the basis for determining the net effect of competition on the target and acquiring firms. Exhibit 2 presents the

17) Varaiya and Ferris [28] and Varaiya [29] use a different measure of overpayment, based on the dollar synergistic gains. This study also utilized the dollar-based variable; however, the results did not appear to be consistent with the previous studies. The average level of overpayment was negative and the data did not meet standard regression specifications. As the authors note, their results may be sample-dependent.

18) The seasonal index is obtained from the ratio-to-moving average procedure assuming a multiplicative time series model (Aczel [1] pp. 602-612).

average abnormal returns (s) and average cumulative abnormal returns (s) for the period +5 days surrounding the announcement date. The s and s are presented for both the acquired and acquiring firms and classified by the degree of competition among bidding firms. As indicated by the *t*-statistic, the abnormal returns for the subsamples are statistically significant surrounding the announcement date.

EXHIBIT 2

ABNORMAL RETURNs (ARs) AND CUMULATIVE ABNORMAL RETURNs (CARs)
portfolios of the target and acquring firms in single and multiple-bidder contests

Single–Bidding Subsample: Targets				Single Bidding Subsample: Acquiring Co.s			
Days	Avg. CARs	Avg. ARs	T–statistic	Days	Avg. CARs	Avg. ARs	T–statistic
-5	0.062	0.000	0.040	-5	0.027	0.005	1.561
-4	0.069	0.007	1.921 *	-4	0.027	-0.001	-0.202
-3	0.076	0.007	1.194	-3	0.028	0.002	0.652
-2	0.092	0.016	2.226 **	-2	0.032	0.003	0.807
-1	0.098	0.006	1.392	-1	0.028	-0.003	-1.104
0	0.248	0.149	6.464 **	0	0.028	-0.001	-0.143
1	0.302	0.054	2.893 **	1	0.033	0.005	1.533
2	0.301	-0.001	-0.318	2	0.034	0.001	0.281
3	0.302	0.001	0.433	3	0.038	0.004	1.456
4	0.303	0.001	0.409	4	0.040	0.003	1.130
5	0.304	0.001	0.440	5	0.039	-0.001	-0.470
Multiple–Bidding Subsample: Targets				**Multiple–Bidding Subsample: Acquiring Co.s**			
-5	0.071	0.013	2.046 *	-5	0.040	-0.004	-1.243
-4	0.094	0.023	1.804 *	-4	0.037	-0.004	-1.165
-3	0.092	-0.002	-0.260	-3	0.027	-0.010	-1.203
-2	0.107	0.015	2.436 **	-2	0.029	0.003	0.355
-1	0.140	0.033	3.234 **	-1	0.023	-0.007	-1.365
0	0.258	0.118	2.507 **	0	0.005	-0.017	-2.569 **
1	0.401	0.143	3.173 **	1	-0.025	-0.030	-2.274 **
2	0.404	0.003	0.664	2	-0.017	0.008	1.092
3	0.412	0.008	0.876	3	-0.023	-0.006	-1.069
4	0.420	0.009	1.673	4	-0.022	0.001	0.181
5	0.424	0.004	0.410	5	-0.019	0.003	0.619

Multiple Bidding Subsample: Acquiring Co.s (21 Co.s)

White Knights (13 Co.s)				*Pure Multiple Bidders (8 Co.s)*			
-5	0.031	-0.002	-0.684	-5	0.056	-0.006	-1.01
-4	0.026	-0.004	-0.922	-4	0.054	-0.002	-0.762
-3	0.029	0.002	0.757	-3	0.024	-0.03	-1.49
-2	0.023	-0.005	-1.31	-2	0.039	0.015	0.853
-1	0.019	-0.005	-1.677	-1	0.029	-0.01	-0.804
0	-0.005	-0.023	-2.473 **	0	0.022	-0.008	-0.897
1	-0.03	-0.025	-1.995 *	1	-0.018	-0.039	-1.319
2	-0.031	-0.002	-0.421	2	0.007	0.025	1.371
3	-0.035	-0.004	-0.71	3	-0.002	-0.009	-0.765
4	-0.037	-0.001	-0.209	4	0.002	0.003	0.994
5	-0.034	0.002	0.383	5	0.005	0.003	0.555

* significant at 0.10 level

** significant at 0.05 level

As Bradley, Desai, and Kim [6] and Michel and Shaked [17] find, on the announcement of the first bid, the average ARs and CARs of the single-bid targets (14.94% and 24.76%) are not statistically different from those of the multiple-bid targets (11.84% and 25.81%). However, as shown in Exhibit 3, the difference between the CARs of targets in multiple-bidder and single-bidder contests becomes significant as early as day +1 (t-statistic=1.750; p-value=0.083). By day +26 the gap between the two groups approaches 20%. This 20% improvement translates to a $100 million abnormal increase in equity value for a company with a stock market value of $500 million.[19] The plot of the target's CARs (Exhibit 4) confirms that the average cumulative abnormal returns for multiple-bidder takeovers are significantly higher than those associated with single-bidder takeovers.

The 21 multiple bidders are divided into two subgroups: the 13 white knights (WKs) and the remaining 8 "pure" multiple bidders. This permits examination of the intertemporal behavior of the CARs of the multiple-bidder takeovers. The results of pairwise comparison between the subgroups are presented in Panel B of Exhibit 3. The difference between the CARs of the portfolios of targets in single-bidder and white knights is still statistically significant immediately following the announcement date (t-statistic=2.030; p-value=0.046 on day +1). However, the difference between the portfolios of the single bidder and the pure multiple bidder is not statistically significant. On day +1, the CARs for the portfolio of white knights are 44.11%, whereas those for the portfolio of pure multiple bidders and single bidders are 33.54% and 30.15%, respectively (Panel A of Exhibit 3). No significant differences are found between the subgroups of multiple-bidder takeovers. Thus, the significant difference between the CARs of targets in single-bidder and multiple-bidder contests is due primarily to white knights. In other words, shareholders of targets that are sought by white knights earn greater returns than those sought by single bidders. The additional returns accruing to the targets of white knights are reflected in the prime performance of its CAR series (Exhibit 4).

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19) The average and median market values of the targets of this sample are $570.528M and $193.084M, respectively.

EXHIBIT 3

CUMULATIVE ABNORMAL RETURNS AND SIGNIFICANCE TESTS

Panel A: Average Cumulative Abnormal Returns

Subsample	Target Co.s			Acquiring Co.s		
	Day 0	Day +1	Day +4	Day 0	Day +1	Day +4
Single Bidder	0.2476	0.3015	0.3028	0.0277	0.0332	0.0402
Multiple Bidder	0.2581	0.4008	0.4203	0.0054	-0.0251	-0.0220
Pure Multiple Bidder	0.3069	0.3354	0.3660	0.0216	-0.0177	0.0017
White Knight Bidder	0.2281	0.4411	0.4537	-0.0046	-0.0296	-0.0366

Panel B: Pairwise Comparison of CARs Between Subsamples
Single vs. Multiple, Pure Multiple, and White Knight

Target Co.s

Single vs.	Multiple			Pure Multiple		White Knight	
Days	Day0	Day+1	Day+4	Day+1	Day+4	Day+1	Day+4
t-statistic	0.190	1.750	1.990	0.400	0.710	2.030	2.130
p-value	0.847	*0.083	**0.050	0.690	0.480	**0.046	**0.037

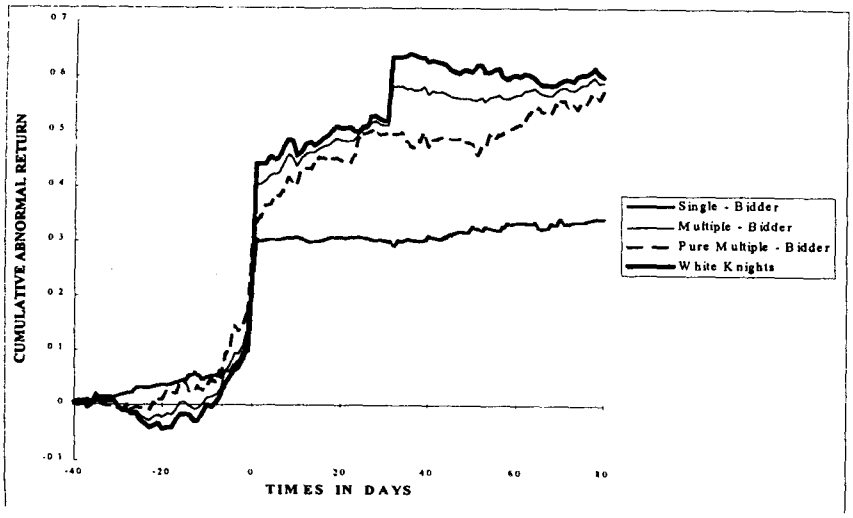
Acquiring Co.s

Single vs.	Multiple			Pure Multiple		White Knight	
Days	Day0	Day+1	Day+4	Day+1	Day+4	Day+1	Day+4
t-statistic	0.840	2.020	2.180	1.120	0.860	1.970	2.400
p-value	0.404	**0.047	**0.032	0.265	0.391	*0.053	**0.019

*; ** statistically significant

EXHIBIT 4

CARs to the Portfolios of the Target Firms



The CARs for the portfolios of acquiring firms (Exhibit 2) are plotted in Exhibit 5. The results are consistent with those of the targets. Also, on the first bid date the average ARs and CARs of the single-bid acquirers (-0.06% and 2.77%) are not statistically different from those of the multiple-bid acquirers (-1.74% and 0.54%). As indicated by Panel B of Exhibit 3, the significant difference in the CARs of acquiring firm in single-bidder and multiple-bidder takeovers starts on day +1 (t-statistic=2.020; p-value=0.047), but the difference can be attributed primarily to white knights (t-statistic=1.970; p-value=0.053). The t-statistic in Exhibit 2 demonstrates that the negative ARs are statistically significant for white knights but not for pure multiple bidders on days 0 and +1.[20] The plots of the acquiring firm CARs (Exhibit 5) illustrate that toward the end of the period, pure multiple bidders act similarly to single bidders, while white knights experience the greatest losses.[21] Thus, acquiring shareholders have the most to lose by being white knights. In sum, the data in Exhibits 2 through 5 support the conclusion that multiple bidders in general and white knights in particular are the most likely to overpay for takeover targets.

Panel A of Exhibit 6 presents the magnitude of overpayment: the difference between the target's CARs and the total percentage synergistic gains (as defined in Section 2.3), for the 121 day period (days -40 through days +80). As expected, the overpayment is a striking 52.07% for the portfolio of white knights, compared to 21.32% for the portfolio of single-bidder contests. Furthermore, the difference in overpayment between the single-bidder and the other multiple-bidder subsamples is statistically significant. Thus, consistent with the winner's curse hypothesis, the extent of the winner's curse or the magnitude of overpayment increases with the number of the bidders in the contests. In

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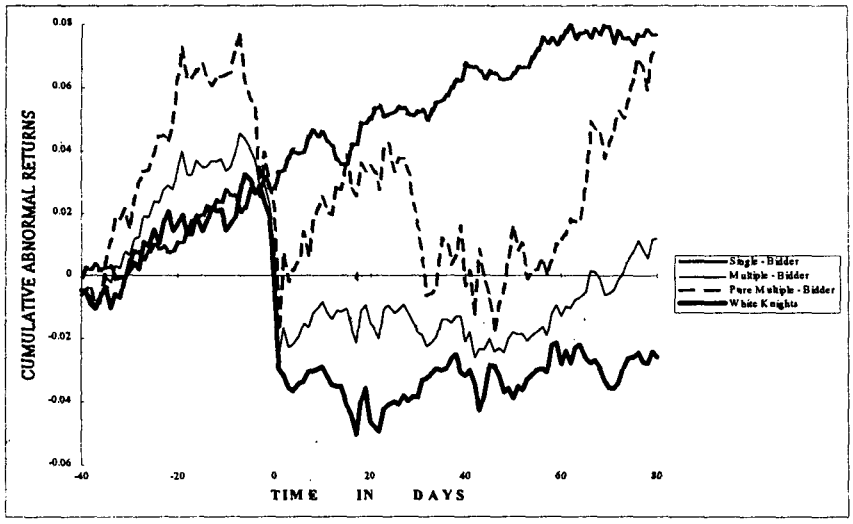
20) In multiple contests, the annoucement date for the acquiring firm is the date of the first bid made by the final, ultimate acquirer and is not necessarily the same as the first bid date for the target. Thus, the statistically significant ARs for the acquiring firms in multiple contests are not surprising, compared to insignificant ARs for those in single contests.

21) Bradley, Desai, and Kim [6] note that the market reacts similarly to the first bid of successful first-bidder acquirers and to the first bid of successful single bidders. Moreover, the results of our study state that the behavior of the CARs of the pure multiple acquirers is similar to that of the CARs of the single bidders, regardless of whether the acquirer is a first bidder or a late bidder, .

EXHIBIT 5
CARs to the Portfolios of the Acquiring Firms



78.33% of the single-bid acquisitions and in all multiple-bid acquisitions, the winning bidder is estimated to overpay.

The difference in overpayment between the single-bid and multiple-bid contests (48.24% - 21.32% = 26.92%) warrants a closer look at how the intensity of the competition affects the division of the takeover gains between the target and acquiring firms. The results of the Wilcoxon signed-rank test (Panel B of Exhibit 6) show that the median dollar gains or mean percentage gains for all the subsamples are statistically greater than zero (except for acquirers in multiple-bid contests). The significant synergistic gains (either dollar or percentage) for the acquiring firms in single-bid contests and the insignificant synergistic gains for those in multiple-bid contests are consistent with the general findings (Jensen and Ruback [14]). The insignificant synergistic gains for multiple bidders are due primarily to the fact that target shareholders capture most of the gains, whether measured as rates of return or as dollar gains (95.04% and 98.6% of the total gains, respectively). However, the division of the synergistic gains between the target and acquiring firms is not statistically different in single-bid contests or in the combined sample of multiple-bid and single-bid takeovers.

Bradley, Desai, and Kim [6] hypothesize that either (1) competition among bidders generates valuable information on expected synergistic gains or (2) potential large

synergistic gains induce multiple biddings. However, our results do not support their arguments. The Mann-Whitney U test and *t*-test together show that dollar or percentage synergistic gains from multiple-bid takeovers are not statistically different from those of single-bid takeovers (*p*-value=0.747 and 0.421, respectively). Furthermore, the point estimate of the percentage gains for single-bid contests is even larger than those for multiple-bid contests, while the reverse is true regarding dollar gains.[22] Acquiring companies experience their most significant losses in multiple-bid rather than in single-bid situations. Therefore, the overall conclusion remains that the winning bidders in multiple contests pay too much.

EXHIBIT 6

OVERPAYMENT and the DIVISION of SYNERGISTIC GAINS

Panel A: **OVERPAYMENT**

Target's CAR - Total Percentage Synergistic Gains

Subsample	Single	Multiple	PM	WK
Mean	0.2132	0.4824	0.4201	0.5207
Median	0.2020	0.5010	0.3900	0.5510
t-statistic	Single	4.9000	2.4800	4.5900
p-value	vs.**	*0.0000	*0.0160	*0.0000

PM Pure Multiple
WK White Knight
* Statistically significant
** Single vs. Multiple, PM, and WK

Panel B: **DIVISION OF SYNERGISTIC GAINS**

Total Dollar Synergistic Gains

	Single Bidding			Multiple Bidding			Total Sample[2]		
	Target	Acquirer	Synergy[1]	Target	Acquirer	Synergy	Target	Acquirer	Synergy
$Mean	127.518	298.789	426.308	556.613	7.884	563.497	238.506	223.370	461.875
%Portion	29.910	70.090	100.000	98.600	1.400	100.000	51.640	48.360	100.000
$Median	49.170	54.800	148.434	154.670	-14.050	105.480	59.310	27.740	123.220
Null Hypothesis: median equal to zero									
Wilcoxon Z	5.514	4.019	4.962	4.015	0.400	2.555	6.900	3.293	5.539
p-value	0.000	0.000	0.000	0.000	0.689	0.011	0.000	0.001	0.000
Null Hypothesis: target equal to acquirer									
Wilcoxon Z (p-value)	1.23 (0.21)			2.485 (0.013)			0.407 (0.684)		
Null Hypothesis: single contests equal to multiple contests									
Mann-Whitney U (p-value)	Target 376 (.006)			Acquirer 417 (0.022)			Synergy 500 (0.747)		

Total Percentage Synergistic Gains

	Single Bidding			Multiple Bidding			Total Sample		
	Target	Acquirer	Synergy	Target	Acquirer	Synergy	Target	Acquirer	Synergy
%Mean	7.12	5.42	12.54	10.10	0.53	10.63	7.89	4.15	12.04
%Portion	56.77	43.23	100.00	95.04	4.96	100.00	65.52	34.48	100.00
%Median	3.46	6.73	8.69	7.22	-0.19	8.69	4.02	5.54	8.69
Null Hypothesis: mean equal to zero									
t-statistic	4.630	3.790	5.360	4.780	0.250	3.550	6.240	3.450	6.360
p-value	0.000	0.000	0.000	0.000	0.803	0.002	0.000	0.001	0.000
Null Hypothesis: target equal to acquirer									
t-statistic (p-value)	0.93 (0.356)			3.27 (0.004)			2.35 (0.021)		
Null Hypothesis: single contests equal to multiple contests									
t-statistic (p-value)	Target 1.03 (0.304)			Acquirer 1.81 (0.075)			Synergy 0.81 (0.421)		

1 Synergistic gains are defined in the text (Section 2.3).
2 Total sample of multiple-bid and single-bid takeovers.
This is statistically NOT significant.

22) Stulz, Walkling, and Song [26] find the same insignificant difference as does this study, although their point estimate of the percentage gains for multiple-bid contests is larger than those for single-bid contests.

3.2. Regression Analysis Determinants of The Winner's Curse

Although the time series analysis of the CARs helps identify the degree of competition, it cannot evaluate the simultaneous effects of the degree of competition and the volatility of the firm on the overpayment. The following linear regression model is used to examine the cross-sectional differences in the overpayment situations.

$$\begin{aligned} WINC_i = {} & b_0 + b_1 T_{vol} + b_2 A_{vol} + b_3 (T_{vol}/A_{vol}) + b_4 M + b_5 W \\ & + b_6 IntTM + b_7 IntAM + b_8 IntRM \\ & + b_9 IntTW + b_{10} IntAW + b_{11} IntRW + e_i, \end{aligned} \tag{4}$$

where

$WINC_i$ is the overpayment measure for each pair of target and acquiring firms;

b_0, b_1,..., b_{11} are regression coefficients;

T_{vol} and A_{vol} are volatilities of the target and the acquiring firm, respectively;

T_{vol}/A_{vol} is the volatility of the target relative to that of the acquiring firm;

M [W] is the dummy variable, which equals 1 if the takeover is made in a multiple-bid contest [if the takeover involves a white knight] , and zero otherwise;

IntTM [W], are the interaction variables between the dummy

IntAM [W], variable M [W] and

IntRM [W] 1) the volatility of the target - IntTM [W],

2) the volatility of the acquirer - IntAM [W], and

3) the relative volatility - IntRM [W];

e_i are independent $N(0, s^2)$.

The cross-sectional regression analysis is performed separately using each of three definitions of volatility: the coefficient of variation of the operating income and standard deviations of 1-year and 5-year stock returns. Each time one measure of volatility enters into a stepwise regression to identify the best subset of independent variables.

Various formal and informal tests of the assumptions underlying the linear regression model are conducted to ensure its robustness. For normality, two tests are performed: (1) a normal probability plot of observed standardized residual against the expected residual value, and (2) the Kolmogorov-Smirnov test of the standardized residual. The results

indicate little departure from normality. Residuals are plotted against the fitted value to test the heterosdasticity and linearity. There is nothing systematic that invalidates the model used. Additionally, multicollinearity is not problematic since none of variance inflation factor (VIF) values is greater than 10.[23]

The results of the analysis show that the relative volatility of the 1-year stock return (T_{vol}/A_{vol}) and its interaction with the multiple contests (IntRM) are the most significant factors determining the magnitude of the winner's curse. The estimated equation and accompanying statistics from the 60 single-bid and 21 multiple-bid contests are:

$$\begin{array}{ccccc} \text{WINC} = 0.124084 & + & 0.1898\text{IntRM} & + & .0726T_{vol}/A_{vol} \\ (2.409;\ 0.0183) & & (5.045;\ 0.000) & & (2.092;\ 0.0397) \end{array}$$

Adjusted R2 (ADJRSQ) =28.146% F= 16.67 (significance = 0.000)

where *t*-values and significance level are presented in parentheses under each coefficient. The other measures of volatilities-the coefficient of variation of the operating income as well as the standard deviation of the 5-year stock returns-do not produce ADJRSQs that are as powerful as the ADJRSQ for the volatility of the 1-year stock returns. Given that the adjusted multiple coefficient of determination (R^2) measures the percentage of variation of overpayment as explained by the combination of the independent variables, the measure yielding the most significant ADJRSQ is closely observed.[24]

The above results suggest that the volatility of the target relative to that of the acquirer (not uncertainty *per se*) has a definitive impact on the extent of the winner's curse. Also, the incidence is more pronounced in multiple-bidder than in single-bidder contests. Specifically, the coefficient of the relative volatility (T_{vol}/A_{vol}) on the overpayment is 0.0726 in single-bid and 0.2624 (0.0726 + 0.1898) in multiple-bid takeovers. If the

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23) Variance Inflation Factor (VIF) is a formal method of detecting the presence of multicollinearity. It measures how much the variances of the estimated regression coefficients are inflated as compared to when the independent variables are not linearly related. A maximum VIF value among all independent variables in excess of 10 is often taken as an indication that multicollinearity may be unduly influencing the least squares estimates (see Neter, Wasserman, and Kutner [21]).

24) When a stepwise regression is run with all of the measures together, the same two variables are chosen as the subset of the variables that best explains the overpayment.

relative volatility increases by 0.1 (i.e., if the volatility of the target increases by 10% of that of the acquiring firm), the overpayment increases by 0.726% (0.0726 x 0.1 = 0.00726) in single-bid and 2.624% (0.2624 x 0.1 = 0.02624) in multiple-bid acquisitions. On average, the impact of the relative volatility on the magnitude of the winner's curse is 0.1218.[25] When estimating the magnitude of takeover gains, the bidders, particularly in multiple-bid contests, should pay special attention to the relative uncertainty as measured by the relative volatility of the 1-year stock returns. When bidders disregard this, they risk substantial overpayment.

The importance of the relative volatility may be due to the fact that acquirers with exceptionally good pre-acquisition performance (perhaps they have relatively low volatility of stock returns) tend to overpay with accumulated free cash flows.[26] Jensen [12, 13] argues that managers of firms with substantial cash flows may even pursue low-benefit or value-decreasing takeovers. Managers affected by hubris and equipped with large cash flows often fail to recognize that overpayment is exacerbated with a more volatile target, and especially in multiple-bidder contests.[27] Varaiya [29] finds that the prominent pre-acquisition performance of the winning bidder is positively related to the extent of the winner's curse. It is possible that even when performance is not exceptional, bidders estimate large takeover gains, and hence offer large premiums. This is particularly likely if they assess the expected takeover gains based on relatively stable performance of acquirers' stock returns. Instead, these valuations should consider the more volatile performance of targets.

4. SUMMARY AND CONCLUSIONS

This paper provides an empirical analysis of the winner's curse in the context of

25) The average impact, 0.1218, is obtained as 0.0726 x (60/81; proportion of single-bids in the sample) + 0.2624 x (21/81; proportion of multiple-bids in the sample).

26) Free cash flow is defined as cash flow in excess of the amount required to finance positive net present value projects.

27) The hubris hypothesis may be viewed as a special case of the winner's curse hypothesis (footnote 3).

corporate takeovers. As a rationale for corporate overpayment, the study supports the winner's curse hypothesis and analyzes the conditions under which overpayment is most likely. The extent of the winner's curse, or overpayment, is defined as the difference between the total premiums paid to the target firm and the total percentage of synergistic gains.

The analysis indicates that among winning bidders in multiple contests, white knights overpay and suffer more than other bidders. The shareholders of targets in multiple-bidder contests capture most of the synergistic gains, whether measured as rates of return or as dollar gains. The study also finds that the process of competitive bidding is a zero sum game since total synergistic gains generated in multiple-bid takeovers are not larger than those in single-bid takeovers. That is, the greater returns accruing to the shareholders of target firms in multiple-bid contests come at the expense of the gains to those of acquiring companies. As a result, shareholders of target firms gain at least in part because of bidder overpayment.

The results of the cross-sectional regression analysis indicate that the volatility of targets relative to that of acquirers has a definitive impact on the magnitude of the winner's curse, and the impact differs by the degree of competition. It is plausible that because of their own firms' good pre-acquisition performance and/or low volatility, optimistic managers with excess cash flows are willing to offer large premium, especially in multiple-bid contests, .

In conclusion, bidders need to become more conservative as the relative uncertainty of the targets and the number of bidders increase. If shareholders are reasonably well informed, or rational, they will discount the company's stock price to reflect the expected "over-investment". The overpriced takeover bid will then have a negative effect on the bidder's stock price. Therefore, in order to maximize shareholder wealth, corporate managers should account for this "shareholders' perspective" when bidding for a target.

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