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Market-Based Estimates of Value Gains from Takeovers: An Intervention Approach

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Abstract

Market-Based Estimates of Value Gains from Takeovers: An Intervention Approach

An unresolved issue in empirical research on corporate control is the extent to which takeovers improve target and bidder firm value. We provide estimates of value improvements that avoid the bidder-revelation bias present in previous studies. Our approach, the *intervention method*, is based on a model of the stock returns of an initial bidder when a competing bid occurs. We find four main results. First, investors perceive value improvements from cash tender offers on average to be large and positive (44.8% of target value). Second, in multiple bidder contests, average profits on bidders' initial shareholdings in the target are on average modest (1.28% of target value). Third, point estimates indicate that bidders on average pay too much for targets, but that most of the average successful takeover premium can be explained by value improvement. Finally, value improvements seem to be of similar magnitude for friendly and hostile transactions.

An unresolved issue in empirical research on corporate control is the extent to which takeovers improve target and bidder firm value. This problem is of significant scientific and policy importance. From a scientific viewpoint, zero or negative improvements imply severe agency problems or else severe cognitive biases on the part of bidding managers. From a policy point of view, if target shareholder profits are mainly a redistribution from bidder shareholders, then takeovers are unproductive and should be discouraged. However, if takeovers improve total value substantially, then they are primarily benign, and regulation of takeovers should be mild and target resistance activity should be discouraged. This study estimates average value improvements to be on the order of 40-50% of the value of the target. Comparing these with prices paid, the point estimates indicate that bidders are on average paying more for targets than they are worth to the bidders. However, most of the average successful bid premium can be explained by value improvement.

Two main approaches have been followed to estimating value improvements from takeovers. The first is to examine abnormal stock returns to bidders and targets associated with the announcement and conclusion of an offer. Bradley, Desai and Kim (1988) find that the value-weighted average of bidder and target abnormal returns for successful takeovers during the period 1963-1984 is positive and stable over this period. Numerous studies find significant and large positive average abnormal returns for target shareholders; Jensen and Ruback (1983) and Jarrell, Brickley, and Netter (1988) review this evidence. In contrast, there is substantial controversy about the profitability of takeovers for bidders. While some studies find small positive but statistically significant average abnormal returns, others find small negative and significant average abnormal returns, and still others document insignificant effects. In a review of this evidence, Roll (1986) emphasized that the bidder's abnormal return at the time of the bid gives a biased estimate of the market's valuation of the bidder's gain from takeover, because the form of the offer and the very fact of an offer may convey information about the bidder's stand-alone value. For example, the fact of a bid may convey the good news that a bidder expects to have high cash flows, or the bad news that the bidder has poor internal investment opportunities. Similarly, a high premium can convey good news about the bidder's stand-alone prospects. Also, theory suggests that the use of equity as a means of payment will convey bad news about the bidder, and the use of cash will convey good news, owing to adverse selection problems with

equity issuance.[1]

The second approach used to estimate value improvement from takeover has been to examine accounting or other performance measures following completed transactions. Healy, Palepu, and Ruback (1991), Jarrell (1991), Kaplan and Weisbach (1991), and Opler and Weston (1990), find improvement in bidders' accounting performance measures; however, Ravenscraft and Scherer (1987) do not find much improvement.[2] Bhagat, Shleifer, and Vishny (1990) find that target employee layoffs and bidder tax savings explain a moderate portion of hostile takeover premia.

Although such studies are quite informative, they do not quantify the total value effect of takeovers. Furthermore, while accounting studies provide valuable information about the *ex post* outcome, they do not describe the *market's* assessment of takeover transactions. Most importantly, it is likely that offers reveal information about future accounting improvements which would have occurred even without a takeover. These studies are therefore subject to the same revelation bias as previous stock market-based studies.

This paper examines stock price evidence, but attempts to avoid the revelation bias of previous studies. In doing so, it offers a method which may be useful in other contexts for disentangling revelation effects from value effects of discretionary corporate actions.

Our approach, which we call the *intervention method*, focuses on the returns to the initial bidder when a competitor arrives. The associated stock return is informative about value improvement[3] because the arrival of a second bidder has a large effect on the probability of the initial bidder's success. The abnormal return observed for the initial bidder at this event therefore implicitly reflects the size of the takeover improvement. Furthermore, this event does not occur at the discretion of the initial bidder; it is an *external intervention.* This is crucial, because it means that the arrival

[1] See Myers and Majluf (1984), Hansen (1987), Fishman (1989), Eckbo et. al., (1990), and Berkovitch and Narayanan (1990). Some empirical studies have found a negative effect of the use of equity on U.S. bidder returns (e.g., Franks et. al., [1988] and references therein); another study did not (Lang et. al. [1991]). The result of a negative effect of equity does not carry over to France, United Kingdom, or Canada (Eckbo et. al., [1990] and references therein).

[2] A possible explanation for conflicting results is the choice of benchmark. Jarrell (1991) finds that after adjusting for analysts' pre-offer forecasts of profitability, takeovers improve long-term performance.

[3] The term "value improvement" in this paper refers to joint bidder and target shareholder gains. It therefore does not exclude redistributions from other claimants that raise shareholder value. These redistributions could be from target or bidder debtholders, employees, customers, or suppliers.

of a competing bid will reveal little or nothing about the stand-alone value of the initial bidder. The goal of the intervention method is to calculate the value improvement implied by the observed abnormal return of the initial bidder when a competing bid intervenes.

There are two crucial inputs to this calculation.[4] The first input is the effect of the arrival of a competing bid on the probability that the first bidder succeeds in acquiring the target. The second input is the effect of the arrival of a competing bid on the expected price that the first bidder will pay should it win the contest. Each of these quantities can be estimated directly from *ex post* data. Holding constant these quantities, the abnormal return is algebraically decreasing with the size of the takeover improvement. Inverting this relationship, the size of the takeover improvement can be inferred from the observed abnormal return. A numerical illustration is provided in the next section.

Intuitively, since competition reduces the first bidder's probability of success, *ceteris paribus* its stock price will drop if its value improvement is large compared to the expected price that will be paid, and rise if the value improvement is less than the expected purchase price. However, its return will also depend on how the arrival of a competitor affects the ultimate price paid. Holding probability of success constant, competition should hurt the first bidder to the extent that he is forced to pay more when he wins. The intervention method disentangles these two effects.

The resulting estimates of value improvement lead to four main results. First, takeover improvements from cash tender offers are perceived by investors to be large and positive. We estimate takeover improvements to be positive in over 98% of our sample, and to be on average 44.8% of target value. There is error in these estimates to the extent that they rely on noisy estimates of the expected price to be paid for the target and of the probability of success. However, the conclusion that takeover improvements are on average positive is robust with respect to empirically plausible variations in these parameters.

Second, the average profits that bidders in multiple bidder contests can earn by improving the value of initial shareholdings are modest, being estimated as on average 1.28% of target value (median 0.00%). After excluding the majority of bidders whose initial holdings are zero, the mean (median) improvement is estimated as 3.36%

[4] A third input, the initial shareholding of the first bidder in the target, turns out to be relatively unimportant.

(2.68%) of target value, or in dollar terms $ 5.86 million (median $3.15 million). The finding of a modest initial holdings profit is robust with respect to plausible estimates of value improvements.

Third, cash tender offer bidders on average seem to pay too much for targets. This result is tentative, because our point estimates of value improvements are only moderately lower than the premia paid. Thus, most of the average successful premium paid can be explained by value improvement. In other words, grotesque overpayment does not seem to be the norm.[5]

Fourth, value improvements seem to be of similar magnitude for friendly and hostile transactions. This suggests that both discipline of bad managers and the realization of synergies (business complementarities) may be important economic roles for takeovers.

The next section develops an empirical measure of value improvements. Section II describes the data. Results are presented in Section III. Section IV discusses qualifications and extensions. The final section concludes.

I Empirical Measure of Value Improvements

A Numerical Illustration of the Intervention Method

The idea of the intervention method is best conveyed by a numerical example. Consider a bidder who does not own any shares of the target. Suppose that the stand-alone value of the target is $100, the stand-alone value of the bidder is $250, and the post-takeover NPV of target cash flows if managed by the bidder is $140. Suppose that at the time of the initial offer, the probability of the initial bidder succeeding is .6, but that if a competitor makes a bid, this probability is only .4. Suppose that at the time of the initial offer, the expected price that the first bidder will have to pay *if he succeeds* is $120, but that if a competitor arrives, this expected price paid by the first bidder rises to $130. Based on this information, the stock price of the bidder after

[5] This bears on the interpretation of studies of post-takeover performance. For example, Bhagat, Shleifer and Vishny (1991) point out that the gains from 1980's bustup takeovers may have been derived from selling off target assets at inflated prices. Kaplan and Weisbach (1991) estimate positive asset sale profits from acquisitions over several decades that were later divested. They also recognize that the possibility of systematic overpayment by later purchasers qualifies the conclusion that profitable acquisitions actually improved value. Our results suggest that since the extent of overpayment is limited, the prices at which assets were sold during our sample period were probably not severely inflated.

announcing his offer rises to

$$250 + .6(140 - 120) = 262.$$

If a competitor appears, the first bidder's stock price retreats to

$$250 + .4(140 - 130) = 254.$$

Thus, the first bidder's stock return on the arrival of a competing bidder is $(254 - 262)/262 \approx -3\%$.

The initial bidder's stock return reflects the facts that when a competing bid arrives, (1) the first bidder will have to pay more if he succeeds, and (2) the first bidder has a lower probability of succeeding. Clearly point (1) contributes negatively to the first bidder's return. Point (2) also contributes negatively to the stock return here, because a lower probability of success prevents the bidder from realizing profits. These profits are the difference between the improvement brought about by the first bidder and the expected price paid. Thus, *the first bidder's stock return on the arrival of a competing bid reflects the market's assessment of the value improvement that the first bidder can bring about.* Specifically, the larger the improvement, *ceteris paribus*, the more negative the return. And if the improvement is smaller than the expected price, then point (2) will contribute *positively* to the bidder's return.

These points are illustrated by making one change in the example. Suppose now that the takeover does not improve value, so the value of the target when acquired is the same as its stand-alone value of \$100. Replacing \$140 with \$100 in the above calculations shows that the bidder's stock return on the arrival of a competing bidder is 0%. The negative effect of the higher price that will be paid in the event of success is offset by the positive effect of an increased probability of failure.

The intervention method uses *ex post* data to estimate the various parameters of this numerical example: the unconditional probability of success of an initial bidder, the probability of success given the arrival of a competitor, the unconditional expected price paid by an initial bidder given that he succeeds, and the expected price he pays if he succeeds given that a competing bid occurs. Given these parameters, the value improvement from the takeover implies a specific stock return for the first bidder. It is therefore possible to infer backwards from the observed stock return the size of the value improvement.

B Hypotheses

The primary issues to be examined are (1) do takeovers on average increase the joint value of the bidder and target firms?; and (2) do successful bidders on average gain from acquisitions? According to Roll's (1986) Hubris Hypothesis, there is no value improvement from takeover; takeovers occur because of positive valuation errors by bidding managers. Agency problems can also lead bidding managers to pay more for targets than they are worth (e.g., "empire-building," and misuse of free cash flow). We therefore call the hypothesis of zero value improvement the *Strong Agency/Hubris Hypothesis.* A weaker version would admit possible gains from takeovers, but would assert that the price offered is so high that bidders, on average, make negative profits. We call this the *Weak Agency/Hubris Hypothesis.*

If the *Strong Agency/Hubris Hypothesis* obtains, the expected value of the target to the bidder is the pre-takeover market price of the target. If bidding costs are neglected, then the bidder makes negative profits equal in magnitude to the total premium paid for the purchased shares. If the *Weak Agency/Hubris Hypothesis* obtains, the bidder again makes negative profits. These profits include any value improvement in the initial shareholding of the bidder. Also, since tender offers are frequently for less than 100% of outstanding shares, estimated bidder profits will depend on the assumptions made about the price paid for remaining shares given that control is obtained.

For two reasons, the most natural assumption is that the same price is paid for holdouts as for the shares purchased in the tender offers.[6] First, fair-price antitakeover amendments require paying at least this much to minority shareholders. Second, even if the bidder is able to exploit control by expropriating minority shareholders, such opportunities for dilution should be fully reflected in the initial bid price, so that holdout shareholders on average receive the same price as tendering shareholders (see Grossman and Hart [1980]).

Let B be the price ultimately paid by a successful first bidder for the shares purchased in a tender offer. We will adopt the assumption that B is also the price paid for the remaining shares.

Let V_0 be the nontakeover value of the target, and let V be the post-takeover value of the target, fully reflecting any possible synergistic or other gains from takeover. Then the *Strong/Agency Hubris Hypothesis* obtains if and only if the average improvement

[6] Comment and Jarrell (1987) present evidence consistent with this assumption.

is zero, i.e.,

$$\frac{\bar{V}(\theta)}{V_0} = 1,$$

where θ is the market's information set.

Let $\bar{B}(\theta)$ be the expected value of the final bid conditional on the first bidder succeeding and on θ. Let $\bar{V}(\theta)$ be the expected post-takeover value of the target conditional on the first bidder succeeding and on information set θ. Let $Pr(S|\theta)$ denote the probability of success of the first bidder in acquiring the target given θ. Also, let α refer to the fraction of the target's shares owned by the first bidder prior to the bid. The *Weak Agency/Hubris Hypothesis* obtains if and only if a successful bidder on average makes negative expected profits, that is,[7]

$$\alpha[\bar{V}(\theta) - V_0] + (1-\alpha)[\bar{V}(\theta) - \bar{B}(\theta)] < 0, \tag{1}$$

or

$$\frac{\bar{B}(\theta)}{V_0} > \frac{\frac{\bar{V}(\theta)}{V_0} - \alpha}{1-\alpha}. \tag{2}$$

In other words, if the price paid is too high relative to value, the bidder loses money.[8]

A secondary issue that is closely related to the Agency/Hubris Hypotheses is whether successful bidders profit on average on the shares purchased in the tender offer. Even if a bidder loses on these shares, he may still profit from the acquisition by increasing the value of the shares accumulated prior to the offer. This distinction has theoretical interest, because some models predict that in the absence of dilution of minority shareholders, bidders will not on average profit on shares purchased in the offer (Grossman and Hart [1980], Shleifer and Vishny [1986]). The prediction that the bidder profits on shares purchased in the tender offer is termed the *Underpayment Hypothesis*, as opposed to the opposite prediction of the *Overpayment Hypothesis*, and the neutral *Fair Payment Hypothesis*. These subsidiary hypotheses are also simply stated. The Fair Payment Hypothesis implies that the bid premium on average reflects fairly the value improvement, *i.e.*,

$$\frac{\bar{B}}{V_0} = \frac{\bar{V}}{V_0}. \tag{3}$$

[7] As in Grossman and Hart (1980), Shleifer and Vishny (1986), and Hirshleifer and Titman (1990), our calculations are based on a conditional tender offer. Similar calculations for unconditional offers would depend on estimates of the number of shares tendered in failed offers.

[8] We have assumed in (1) and (2) no profit from the sale of the first bidder's initial shareholding to a competing bidder. If initial holding profits are small, the effect on the RHS of (2) will also be small. In Section IV, such sales are explicitly taken into account.

The Overpayment and Underpayment Hypotheses respectively imply that the LHS is greater than/less than the RHS of (3).

C The Intervention Method of Estimating Value Changes

Let θ_0 be all public information known just prior to the first bid. Let θ_1 be all public information known just after the first bid. Let θ_2 refer to information known just prior to the arrival of a competing bid. Let θ_3 contain in addition the information conveyed by the competing bid. Let dates $t = 0, 1, 2, 3$ refer to dates at which $\theta = \theta_0, \theta_1, \theta_2$ and θ_3 respectively.

The first step is to calculate the bidder's abnormal return R_t between dates 1 and 3 in terms of the expected post-takeover value of the target $\bar{V}(\theta_t)$ at these dates.[9] Then (using empirical estimates of unconditional and conditional probabilities of success and expected premia, abnormal returns and other parameters) we will invert the relationship to infer $\bar{V}(\theta_t)$.

Consider the arrival of the competing bid at date 3. Let the market's assessment of the component of bidder's value not derived from the takeover be y. y may not equal the pre-offer value of the bidder as assessed by the market if the initial offer conveyed information about the bidder. We assume that the arrival of a competing bid is uninformative about the stand-alone value of the first bidder, so that y is the same at dates 1, 2 and 3 (before and after the arrival of the competing bid). Let $R_3 \equiv (P_3 - P_1)/P_1$ be the date 3 return associated with information θ_3, where P_1 is the bidder's stock price just after the initial bid, and P_3 is the price based on θ_3 after a competing bid arrives. So

$$P_3 = P_1(R_3 + 1). \tag{4}$$

Let $\bar{V}(\theta_1), \bar{V}(\theta_3), \bar{B}(\theta_1)$ and $\bar{B}(\theta_3)$ be abbreviated as $\bar{V}_1, \bar{V}_3, \bar{B}_1$ and $\bar{B}_3$ respectively. To relate $\bar{V}(\theta)$ to the observables P_3 and P_1, note that

$$\begin{aligned} P_1 &= y + \bar{\pi}_1 \\ P_3 &= y + \bar{\pi}_3, \end{aligned} \tag{5}$$

where $\bar{\pi}_t$ is the bidder's expected profit from takeover conditional on information θ_t.

[9] For expositional simplicity, the model examines raw returns. For standard reasons, in implementing the model empirically abnormal returns are used.

As in (1), this is

$$\begin{aligned}\bar{\pi}_1 &= Pr(S|\theta_1)\ \{\alpha[\bar{V}_1 - V_0] + (1-\alpha)[\bar{V}_1 - \bar{B}_1]\} \\ \bar{\pi}_3 &= Pr(S|\theta_3)\ \{\alpha[\bar{V}_3 - V_0] + (1-\alpha)[\bar{V}_3 - \bar{B}_3]\}. \end{aligned} \tag{6}$$

We assume that the arrival of the competing bid at date 3 does not provide any information about the value of the target to the first bidder.[10] Hence, $\bar{V}_3 = \bar{V}_1 = \bar{V}$. The robustness of the results with respect to this assumption is analyzed in Section IV.[11] The unobservable y can be eliminated from (5), and the result combined with (6), giving

$$\bar{V} = \frac{P_3 - P_1}{Pr(S|\theta_3) - Pr(S|\theta_1)} + \alpha V_0 + \frac{(1-\alpha)[Pr(S|\theta_3)\bar{B}_3 - Pr(S|\theta_1)\bar{B}_1]}{Pr(S|\theta_3) - Pr(S|\theta_1)}. \tag{7}$$

Dividing both sides of (6) by V_0, gives

$$\frac{\bar{V}}{V_0} = \frac{R_3(P_1/V_0)}{Pr(S|\theta_3) - Pr(S|\theta_1)} + \alpha + (1-\alpha)[\lambda(\bar{B}_1/V_0) + (1-\lambda)(\bar{B}_3/V_0)], \tag{8}$$

where

$$\lambda = \frac{Pr(S|\theta_1)}{Pr(S|\theta_1) - Pr(S|\theta_3)}.$$

In estimating (8), the terms $\bar{B}_1/V_0$ and $\bar{B}_3/V_0$ are estimated as means of ratios,

$$i.e.,\ \frac{1}{n_1}\sum_{i=1}^{n_1}(B^i/V_0^i) \text{ and } \frac{1}{n_3}\sum_{i=1}^{n_3}(B^i/V_0^i),$$

where an i superscript denotes the i'th takeover contest, n_1 the number of initial offers, and n_3 the number of contests in which a competing bid occurs. The quantities

[10]This would obtain under the Strong Agency/Hubris Hypotheses. As Roll (1986) points out, this is a natural null hypothesis against which to test for takeover improvements. More generally, the arrival of either an initial bid or competing bid could reveal information about target value. However, the evidence regarding the information conveyed by an initial bid is conflicting. Bradley, Desai and Kim (1983) find that average cumulative abnormal returns of targets are approximately zero among targets of failed offers that are not later acquired. This suggests that there is no permanent informational revaluation associated with the initial bid. Pound (1988) finds that analysts do not revise upward their forecasts of target stand-alone earnings when a takeover bid is announced. However, taking into account systematic biases in analyst forecast, Brous and Kini (forthcoming) find that in constrast to Pound, an adjustment measure of target earnings forecasts revisions is on average positive.

[11]This assumption is consistent with private information possessed by the second bidder. This could be information about a private component of its valuation of the target (e.g., a synergy unique to the second bidder). The second bidder can also possess information superior to that of investors about common value components (e.g., gains from remedying target management failure), so long as investors do not perceive the second bidder's information as adding to that of the first bidder.

R_3, P_1/V_0, and α can be calculated directly for a given first bidder. $\bar{V}/V_0$ ("VRATIO") is the market's estimate of the value to the bidder of a takeover target relative to its nontakeover value. While *VRATIO* measures improvements normalized relative to target stand-alone, it should be emphasized that the intervention method makes no assumption whatsoever as to whether improvements are specific to the bidder, the target, or are joint synergies.

The Strong Agency/Hubris Hypothesis implies that this ratio is one. Substituting $\bar{V}/V_0$ from (8) into (2) gives the condition for the Weak Agency/Hubris Hypothesis to obtain. The Overpayment, Underpayment and Fair Payment Hypotheses are tested simply by comparing the average bid premium with the average estimated improvement as in (3).

II Data

The initial data set consists of 559 tender offers that were announced during the period October 1958 through December 1984. "It contains almost every tender offer made in the 1958-1984 period where at least one firm (the target or a bidder) was listed on the NYSE or AMEX...at some time between July 1962 and December 1984."[12] This study investigates the wealth effects on both bidders and targets for the same tender offer. Hence 232 of the 559 tender offers were deleted from the sample since either the bidder or the target was not listed on the NYSE or AMEX. Additional data-availability and data-consistency requirements reduced the sample size to 290.[13]

To compile a history of the events that occur subsequent to a tender offer that might affect the probability of success of the bid, we used the *Wall Street Journal Index* to obtain information on the following:

1. Litigation by the target firm or its shareholders.

2. Litigation by the bidding firm or its shareholders.

3. Second and third bidders.

[12]The quotation is from the write-up for the dataset compiled by Michael Bradley, Robert Comment, Anand Desai, Peter Dodd, and Richard Ruback. We thank these authors for providing us with their data.

[13]12 tender offers were announced prior to July 1962. The Daily CRSP tape does not contain returns prior to this date. Our verification of tender offer announcements and name changes led to some minor changes in the database.

4. Objection raised by a regulatory agency (e.g., FTC, Department of Justice).

5. Financing-related issue.

6. Final resolution. The final resolution was classified as "favorable," "unfavorable," and "unknown."[14]

Table I records the frequency of the above mentioned events. Of the initial sample of 290 tender offers, in 150 cases no event is recorded prior to the final resolution. Litigation by the target and entry of a second bidder are the two most frequent events observed. The final resolution is in favor of the first bidder in 188 cases or 65% of the sample. The median number of business days from the announcement of the first bid through a successful final resolution is 27, through unsuccessful final resolution is 28, through announcement of litigation by target is eight, and through entry of the second bidder is 16.

One objective of this study is to measure the effect of takeovers on the wealth of bidder shareholders, while avoiding the revelation bias inherent in bidder's returns on the announcement of the offer or of its completion. As discussed earlier, we address the revelation bias in bidder stock returns, emphasized by Roll (1986), by considering interventions that change the probability that the first bidder will be successful, but are not at the discretion of the first bidder. Litigation by the target, entry of a second bidder, and objection by a regulatory agency are examples of such exogenous events. In principle, one could use any such event (or several events) in empirical tests. Our main analysis focuses on the entry of a second bidder. We begin with an examination of the effects of various interventions in order to document that the entry of a competing bidder is an important event for the initial bidder.

Table II contains bidder abnormal returns around the announcement of litigation by the target and the announcement of entry of a second bidder. The abnormal returns are computed using the market model as the benchmark; see Dodd and Warner (1983).[15] The market model is estimated using returns from day -170 through day -21 where day 0 is the announcement of the first bid in the *WSJ*. The equally weighted CRSP index

[14]If the first bidder was successful in acquiring the target, resolution was classified as "favorable." If there was information that the first bidder had been unsuccessful, resolution was classified as "unfavorable." Six cases for which there was no information on the final resolution were classified as "unknown."

[15]The market model is biased to the extent that bids occur after the bidder has experienced abnormally good times (see Franks, Harris, and Titman [1991]). However, for the short return cumulation window used here, the choice of benchmark is unlikely to affect results materially.

is used as the market index. Though both events have a negative impact on bidder stock price, announcement of entry of a second bidder has a more negative impact, both stastically and economically.

The change in the probability that the first bidder will be successful given the entry of a second bidder can be estimated using a logit model. Table III provides estimates of such a model. The dependent variable equals one if the first bidder is successful and zero otherwise. TLITA = 1 if the target files a lawsuit against the first bidder and zero otherwise. BID2EN = 1 if a second bidder enters the bidding contest and zero otherwise. MREACT = 1 if target management verbally opposes the first bid, and zero otherwise. α is the fraction of the target's shares held by the first bidder at the date of the initial offer. PREM is the premium offered by the first bidder using the target's price one month prior to the bid as the baseline.[16] The results indicate that target management opposition, entry of a second bidder and the premium offered are determinants of bidder success (opposition and competition having negative effects), whereas target litigation (*ceteris paribus*) is not.[17] Target opposition is a matter of degree, whereas the arrival of a competing offer is a discrete event. Thus, the latter seems a more appropriate focus for investigation.

III Estimates of Value Improvements

A Value Gains to the Initial Bidder

A.1 Basic Estimates

As discussed in Section I, $\bar{V}_1/V_0$ (henceforth, "*VRATIO*") provides the market's estimate of the value to a bidder of a takeover target, i.e., the joint value improvement brought about by the takeovers. If the bidder is unable to improve the value of the target, then the Strong Agency/Hubris Hypothesis obtains, and this ratio is one. If the bidder is able to improve value, then this ratio is greater than one. *VRATIO* is estimated based on equation (8).

If the market is efficient, and if no news about a competing bid arrives until the

[16] Walkling (1985) has found some of these variables to be significant determinants of tender offer success.

[17] The fraction of target held by the first bidder is not statistically significant, in contrast with Walkling's results. However, if the sample is restricted to offers in which there is a second bidder, the fraction of target held by the first bidder is marginally significant.

day that the bid occurs, then the abnormal return expected from date 1 (immediately after the initial bid) through date 2 (just before the competing bid) will on average be zero. Thus, even though equation (8) gives $\bar{V}_1/V_0$ in terms of R_3, the return from date 1 through date 3, valid results can also be derived with a return from date 2 through date 3, or by choosing some starting date between date 1 and date 2.

There is a tradeoff in using different periods. If news about a competing bid sometimes arrives between date 1 and 2, calculating the return based on the earlier starting point has the advantage of including the effects of such anticipation of the event. However, calculating the abnormal return over a longer period has the disadvantage of introducing noise arising from the normal fluctuations in stock price over time (as well as increasing the effects of any benchmark estimation errors).

We therefore calculate the return to be substituted for R_3 in (8) based on two different periods. First is a two-day period consisting of the day of the publication of the news of the second bid in the *WSJ* and the day before.[18] Second is the period from one day after the publication of the news of the first bid in the *WSJ* to the day of the publication of the news of the second bid. Summary statistics of the cumulative abnormal returns are in the Table II, Panel B, CAR1 and CAR3; bidder returns in both periods are significantly negative. (For comparision, we also include CAR2 as defined in footnote 2 of the table.) Two different scenarios are consistent with this negative market reaction. First, the acquisition may be value-increasing for the first bidder, and arrival of the second bidder decreases the probability that the first bidder will prevail. Second, the acquisition may be value-decreasing for the first bidder, but the arrival of the second bidder elicits a higher successful premium from the first bidder. Equation (8) allows us to discriminate between these scenarios.

P_1/V_0 in equation (8) is the relative size of the bidder versus the target. The mean (median) figure is 2.63 (1.85).

$Pr(S|\theta_1)$ is the probability of success of the first bidder in the full sample. In the full sample of 290 cases the first bidder is successful in 188 instances. Hence, $Pr(S|\theta_1)$ is estimated as .6483. $Pr(S|\theta_3)$ is the probability of success of the first bidder given the arrival of a competing bidder. In our sample, there are 71 cases in which a competing bidder arrives; the first bidder is successful in 21 instances. Hence $Pr(S|\theta_3)$ is estimated as $21/71 = .2958$.

[18]Results are similar using a 5-day window.

α is the fraction of the target's equity owned by the first bidder. For the 55 tender offers used to construct Table IV-A, the mean (median) α is .038 (.000). This is different from the mean fractional ownership in Table V since these 55 observations only include offers that were followed by competing bids.

$\bar{B}_1/V_0$ is the average price (relative to the target's pre-offer price) at which the first bidder wins in the full sample. The mean (median) for this is 1.5741 (1.4679). $\bar{B}_3/V_0$ is the average price at which the first bidder wins given the arrival of a competing bidder. The mean (median) for this is 1.7381 (1.4720). The above figures are calculated using only all-cash offers.

In Table IV-A market-based estimates of the expected value to bidders of takeover targets (relative to target stand-alone value) are labeled "*VRATIO*," and calculated as in equation (8). The average *VRATIO* is 1.448, indicating that the target is 44.8% more valuable to the bidder than the target's pre-offer value. Also, all but one estimate of *VRATIO* is greater than one.[19] This evidence is inconsistent with the Strong Agency/Hubris Hypothesis.[20] Since the distributional properties of *VRATIO* are not known, we rely on non-parametric statistics rather than t-statistics to determine significance. Since 54 of 55 *VRATIO*s are greater than one, the conclusion that *VRATIO* is significantly greater than one seems highly robust.

Since *VRATIO* is on average smaller than either $\bar{B}_1/V_0$ or $\bar{B}_3/V_0$, based on point estimates bidders seem to be overpaying for target shares in both single and multiple bidders contests, consistent with the Overpayment Hypothesis. However, we cannot reliably reject the null, or Fair Payment Hypothesis. In the multiple bidder sample, the estimates indicate that 24 of the 45 successful initial bidders overpaid. However, since value improvements are large, it appears that most of the average successful premium can be explained by value improvement.[21]

[19]Since the means and medians differ substantially for the average bid premia summarized in the preceding paragraph, we also calculated *VRATIO* based on median values of these variables. This makes virtually no difference, leading to a mean (median) *VRATIO* of 1.475 (1.456), with only 1 out of 55 being less than 1.

[20]These results pertain only to all-cash tender offers.

[21]This conclusion should be qualified by a possible sample selection bias. The intervention method examines initial bidder returns when a competing bidder enters, but if the initial bidder offers too much on his first bid, this will tend to discourage competitors from arriving. Thus, a bidder who offers a very generous initial offer may not end up in the return sample. On the other hand, an effect acting in the opposite direction is the fact that other things equal, the arrival of a competitor raises the amount that a first bidder with given valuation will have to pay. Thus, we doubt that there is more overpayment in single-bidder contests than in multiple bidder contests. This view is consistent

It is also of interest to compare value improvements in different categories of transactions, such as bids occurring in the pre- and post-Williams Amendment eras, and "friendly" versus "hostile" bids. The Williams Act of 1968 and associated legislation requiring disclosure and delaying completion of tender offers makes it easier for competitors to investigate after an initial bid (see Jarrell and Bradley [1980]). One would expect this to narrow the set of bidders willing to make an initial offer to those with higher valuations. In our sample, among 36 observations in the post-Williams Amemdment era, the mean value improvement was 40.8%, (median 43.3%), which is close to the pre-Williams Amendment estimates. Of course, the Williams Act was just one of many important differences between the early and later periods.

Friendly and hostile transactions are associated with two different economic roles that have been proposed for takeovers—removal of inefficient target management, and realizing business synergies. The mean (median) *VRATIO* is 1.4373 (1.4165) among transactions opposed by target management, a figure very close to that of the overall sample. Thus, takeovers seem to improve value in both friendly and hostile transactions. This evidence indicates that both managerial replacement and business synergies are important roles for takeovers.

A.2 Sensitivity Analysis

In this subsection we analyze the robustness of estimated *VRATIO*'s with respect to parameter estimates for $\bar{R}_3$, $Pr(S|\theta_1), Pr(S|\theta_3), \bar{B}_1/V_0$, and $\bar{B}_3/V_0$. To determine the robustness of our conclusions with respect to these parameters, we conduct two further experiments. First is a sensitivity analysis of *VRATIO* with respect to the probability of success unconditionally, $Pr(S|\theta_1)$, and conditional on a competing bid, $Pr(S|\theta_3)$; with respect to the expected price paid unconditionally, $\bar{B}_1/V_0$, and conditional on a competing bid, $\bar{B}_3/V_0$; and with respect to the mean first bidder stock return on annnouncement of a competing bid, $\bar{R}_3$, in Table IV-B, Panels A, B, C, D, and E respectively. Second, we compare our results to those implied by a more recent the sample studied by Bhagat, Shleifer, and Vishny (1990) (BSV).

Table IV-B indicates that the conclusion of generally positive *VRATIO*'s is not unduly sensitive to the parameter estimates. Panels D and C are of interest, because the sample mean of $\bar{B}_3/V_0$, 1.7381, differs substantially from the median, 1.4720. The

evidence on competitors' stock returns (see Bradley, Desai and Kim (1988).

sensitivity to $\bar{R}_3$ provides an indication of whether the conclusions we derive are likely to be sample specific. A limitation of the intervention method is that it provides value estimates only in those contests for which the intervention (competing bid) actually occurs. It is possible that contests that did not enter the intervention sample are different, so that the returns to the first bidder in such contests if a competing bidder had arrived would be systematically different from the first bidder returns in the actual sample. While it is impossible to address this issue conclusively, it is interesting to observe the extreme robustness of the conclusion of positive value improvements with respect to the estimated stock returns. The *VRATIO*'s in Panel E are calculated substituting in the the same value as given in the left hand column for $\bar{R}_3$ for all first bidders. The mean and median *VRATIO*'s remain positive even for an abnormal return as high as +5%, and a majority are greater than one even for an abnormal return as high as +7%.[22] These sensitivity analyses (and footnote 19) supports the conclusion that value improvements are on average positive and substantial.

BSV analyze an exhaustive sample of hostile takeover contests in the U.S. during 1984 through 1986 where the purchase price was $50 million or more. Their sample consists of 61 contests: 50 targets were acquired and 11 remained independent. The first bidder was successful in 29 of the 61 contests. Competing bids were observed in 30 of the 61 contests. The first bidder prevailed in the face of a competing offer in nine instances.

The above figures indicate that in the BSV sample $Pr(S|\theta_1)$, the probability of success of the first bidder in the full sample, is 29/61 or .4754. Also, $Pr(S|\theta_3)$, the probability of success of the first bidder in the presence of a competing bidder, is 9/30 or .3000. Table IV-C compares these parameter estimates with those used in this study. This table also provides the estimates of $\bar{B}_1/V_0$, and $\bar{B}_3/V_0$ implied by the BSV sample.

The BSV sample period of 1984-1986 is quite different from that of this study 1963-1984. It is therefore interesting how similar are the estimated parameters from the two sample periods. Also, when the BSV sample parameter estimates are included in the sensitivity analysis in Table IV-B, in every case the inference about *VRATIO* (the ratio of the post-takeover value of the target to the pre-takeover target value) is

[22]Intuitively, the reason that the estimates remain positive even when intervention returns are high is that the mean bid premia are very substantial. Thus, even if the value improvement is positive, if it is smaller than the expected price to be paid, the arrival of a competing bid and the associated reduction in the probability of the first bidder succeeding can be good news.

unchanged, namely, we are unable to reject the hypothesis that the mean *VRATIO* is greater than one. For example using the BSV estimate of $\bar{B}_3/V_0$ of 1.4719 in Table IV-B, Panel D, the implied mean *VRATIO* is 1.66.

In conclusion, the sensitivity analysis in Table IV-B, especially when viewed in conjunction with parameter estimates obtained from the BSV sample, suggests with a high degree of confidence that *VRATIO*, the ratio of the post-takeover value of the target to the bidder to the pre-takeover target value, is greater than one.

B The Bidder's Initial Shareholding in the Target

Bidders often own a significant fraction of the target's equity prior to making the bid. Bradley, Desai, and Kim (1988) report mean ownership of 9.8% (median 0%) of the target by the bidder in 236 successful tender offers during 1963-84. A significant rise in the market price of target shares around announcement of a tender offer is well-documented in the literature. Shleifer and Vishny (1986), among others, have suggested that increase in the underlying value of the bidder's initial foothold provides a potential motive for acquisition, despite the free-rider problem of Grossman and Hart (1980). This section provides an empirical analysis of the change in bidders' wealths at the time of the announcement of the bid that can be explained by the increase in the underlying value of their initial footholds.

The expected increase in the value of the bidder's initial shareholding in the target may be estimated using the target's stock return. However, this return largely reflects investors' expectations about the likelihood of offer success and the price the bidder will pay, not the change in the underlying value of target post-takeover cash flows. *VRATIO* is used to estimate the potential increase in the underlying value of the bidder's foothold in the event of takeover by the first bidder. The post-takeover value of the foothold is the pre-takeover value multiplied by the *VRATIO*. As a robustness check, we also compare these to initial holding profits based on multiplication of initial foothold value by target cumulative abnormal stock returns.

Table V provides details on fractional ownership of target firms by bidders during 1963-84. When the sample is restricted to tender offers in which both the target and bidder were listed on NYSE and AMEX, the mean bidder ownership is 10.2%, the median is 0%, and 138 of the 230 bidders (60%) do not own any shares in the target at the time they make the bid. 92 firms owned at least one share of the target at the

time of the bid: their mean ownership is 25.6% and the median is 19.5%. It appears that conditional on a bidder owning a positive fraction of the target at the time of the bid, his initial holding is substantial.[23]

Table IV-A shows that the mean (median) change in the event of takeover in the underlying value of the initial shareholding held by the initial bidder in the event of successful takeover (calculated based on the VRATIO) is $2.13 million ($0.0 million).[24] This compares with McLaughlin's (1990) estimate of average investment banker advisory fees paid by bidders of $2.7 million in a 1978-85 sample of 195 tender offer bidders during 1978-85.[25] Thus, increase in the value of the initial holdings of those initial bidders who became involved in multiple bidder contests seems to provide an insufficient motive for takeover. In percentage terms, the change in value of initial holdings in the event of takeovers is on average 1.28% of target value (median 0.00%). After excluding contests with zero initial holdings, the mean (median) improvement is estimated as 3.36% (2.68%) of target value. These results suggest that many tender offer bidders are not primarily motivated by the possibility of increase in value of their initial holding.[26,27]

This conclusion is unaffected if profit on initial shareholdings is calculated using target stock returns instead of *VRATIO*. Table VI summarizes bidder stock price movements from five days before through five days after the announcement of a tender offer bid.[28] The mean (median) bidder abnormal return is 1.2% (.6%). The mean

[23]The offer of an initial bidder that owns shares in the target may fail. The subsequent arrival of a second bidder would increase the value of the first bidder's initial holding. In our sample the frequency of such a sequence of events is not high (12 cases).

[24]When the sample is restricted to cases where the bidder owns at least one share of the target, the mean (median) change in the underlying value of the initial shareholding is $5.86 million ($3.15 million).

[25]This figure does not include financing, underwriting, legal, and accounting expenses, as well as the opportunity cost of managers' time. This average includes unsuccessful offers, so it is an underestimate of the fees that must be paid in order for the first bidder to realize value improvements. On the other hand, the period covered by McLaughlin's study involved larger transactions than the earlier part of our sample.

[26]Other possible motives for takeover include profits from dilution (Grossman and Hart [1980]), a manager's desire to expand his domain of power, or a desire by bidding managers to entrench themselves (Shleifer and Vishny [1990]).

[27]Note that while the calculation focuses on first bidders who become embroiled in multiple bidder contests, since the calculation is based on underlying value improvements and initial shareholdings, these bidders would earn small initial holding profits in single-bidder contests as well.

[28]Our calculations of initial holding profits based on target stock returns ignore price runup occuring from day −30 to day −6. The length of the pre-offer window of stock returns to be used is somewhat

(median) of change in the market value of the initial shareholding held by the bidder calculated based directly on the target's stock return is \$1.05 million (\$0.0 million).[29]

IV Qualifications and Extensions

Although the intervention method of estimating takeover improvements avoids the bidder-revelation bias present in previous studies, the intervention method is subject to its own potential biases. The first, as mentioned in Section III, is that the arrival of a competing bid may convey information about the value of the target to the initial bidder. As footnotes 10 and 11 indicate, this may not occur to any significant extent. However, if the competing bid conveys information about the target's stand-alone value or value to the first bidder, then the derived estimates are biased. It should be kept in mind that target-revelation bias is also present in previous attempts to estimate takeover gains. The intervention method *mitigates* this problem by focusing on competing bids, since it is likely that much of the private information possessed by bidders about targets will already be conveyed by the initial offer.

If in reality $\bar{V}_3 > \bar{V}_1$, *i.e.*, the arrival of a competing bid causes an upward revision in the assessed valuation of the first bidder, then *ceteris paribus* the first bidder's abnormal return R_3 should be higher. By constraining $\bar{V}_3 = \bar{V}_1$, our estimates would tend to attribute any such higher abnormal return to the reduced probability of the initial bidder succeeding. To this extent, the estimated value improvements are biased downwards, providing conservative estimates. Thus, the conclusion that takeovers are on average associated with positive value improvements is strengthened by this consideration.[30]

To quantify this, suppose that the arrival of a competing bid reveals a larger post-

arbitrary, since initial holdings are being purchased at different dates by different bidders.

[29] When the sample is restricted to cases where the bidder owns at least one share of the target, these figures become \$2.72 million (\$1.25 million).

[30] A special case of this problem can occur under a modification of Roll's hubris hypothesis. Suppose that some bidders are afflicted with hubris, while others are fully rational. Hubristic bidders do not create value improvements. If so, then the arrival of a competing bid might indicate to shareholders that the first bid was due to an actual value improvement rather than hubris. The outcome of this would be that the market's assessment of the first bidder's valuation would be greater at date 3 than at date 1. In addition, a decreased likelihood that the first bidder is afflicted with hubris may amount to good news about the bidder value independent of the outcome of the particular contest. Again, this reinforces the conservatism of our estimates.

takeover value of the target, $\bar{V}_3 = K\bar{V}_1$, $K \geq 1$. We abbreviate $\bar{V}_1$ as $\bar{V}$ in the following. Substituting into equations (4), (5), and (6), and solving give

$$\frac{\bar{V}}{V_0} = \frac{R_3 \frac{P_1}{V_0}}{KPr(S|\theta_3) - Pr(S|\theta_1)} + \alpha \left(\frac{Pr(S|\theta_3) - Pr(S|\theta_1)}{KPr(S|\theta_3) - Pr(S|\theta_1)} \right) + \frac{(1-\alpha)[Pr(S|\theta_3)\frac{\bar{B}_3}{V_0} - Pr(S|\theta_1)\frac{\bar{B}_1}{V_0}]}{KPr(S|\theta_3) - Pr(S|\theta_1)}. \tag{9}$$

Differentiating $\bar{V}/V_0$ with respect to K gives

$$s_K \equiv \frac{1}{\bar{V}/V_0} \frac{d(\bar{V}/V_0)}{dK} = -\frac{Pr(S|\theta_3)}{KPr(S|\theta_3) - Pr(S|\theta_1)}. \tag{10}$$

Using the estimates of the parameters, at $K = 1, s_K = 0.839$, confirming that if $K > 1$, then $\bar{V}/V_0$ increases. Based on the previous discussion, we believe that K is likely to be close to one. The implied ratios for different values of K are provided in the first two columns of Table 7. Large values of K lead to implausibly high values for $\bar{V}/V_0$.

A second qualification to the estimates is that the basic method assumes that success or failure of the initial offer is independent of the size of the first bidder's value improvement. It is probably more plausible to assume that success is positively correlated with the value improvement, because a high valuation first bidder will probably be willing to offer more. However, the potential bias is a subtle one, because estimates are based on the *change* in probability of success when a competing bid occurs.[31] Similarly, it can plausibly be argued that if improvements are common across bidders, a high value improvement increases the probability of a competing bid arrives. Again, the potential bias implied by this effect is subtle, because the *ex ante* probability of a competing bid is overestimated for some contests and overestimated for others.[32] We

[31] A high valuation first bidder may have a higher probability of success both unconditionally and conditional on a competing bid. But it is not obvious whether such a bidder should have a higher or lower *change* in probability of success when a competing bid occurs. Suppose that there is such a correlation. The most plausible presumption is probably that the arrival of a competitor has a smaller impact on probability of success when the valuation is high. Then for a high valuation first bidder, the drop in probability of success is overestimated, which implies that *VRATIO* is an underestimate. (Because the negative abnormal return is attributed excessively to the drop in probability of success rather than to a large value improvement.) Conversely, for low (but positive) valuation firms, the drop in probability of success is underestimated, so that *VRATIO* is an overestimate. Under these conditions this potential bias changes the relative magnitude of *VRATIO* for different firms, but it does not imply a bias in overall sample averages.

[32] If the true improvement is high, the arrival of a competing bid would be less of a surprise than our calculations indicate. For such contests, the improvement is underestimated. On the other hand, if the true improvement is low, the arrival of a competing bid would be more of a surprise than our calculations indicate. For such contests, the improvement is overestimated. The effect on overall sample averages is unclear.

believe that it is unlikely that these effects would have much effect on the conclusions of this paper. Third, the analysis has assumed that success or failure of the offer has no effect on any future acquisitions that the bidder may make. Consider an alternative and rather extreme assumption, that if the first bidder fails to acquire the target, he will soon thereafter successfully acquire another equally good (or bad) target at a price equal to what he would have paid if he had been successful in acquiring the original target. In such a case, probability of success would be irrelevant for the bidder's value, which would invalidate the intervention method. As a possible example, a bidder afflicted with hubris may, after a failed bid, turn to another target that is equally bad or even worse.

Clearly, the case described above is too extreme, because a bidder whose offer fails is not certain to make an additional acquisition as a consequence of failure.[33] One way of modeling this possible dependence is to allow for some probability that failure of the offer will cause the bidder to try to acquire another comparable target.[34] Since the basic method used in Section III in effect assumes a zero probability that failure of the acquisition will cause another acquisition to occur, the estimates provided are biased if this probability is actually positive. The direction of bias depends on whether takeover improvements are positive, zero, or negative. Suppose that value improvements in takeovers are positive. Then when the arrival of a competing bid reduces the probability of success, the bidder actually has a good chance of succeeding in another acquisition, so the actual bidder return will be greater than that implied by the model. This higher return implies that *VRATIO* will underestimate the actual improvement. Similarly, if value improvements are negative, *VRATIO* will overestimate the improvement. So long as the assumption is maintained that failure may lead to another comparable acquisition, then the basic method biases *VRATIO* toward zero, but leaves its sign unchanged.[35] A sensitivity analysis is provided by reestimating

[33]There is no difficulty if the bidder intends to make other acquisitions regardless of the outcome of the first contest. The calculation of the stock price reaction associated with the arrival of a competing bid needs modification only if future acquisitions depend on the success or failure in the current contest.

[34]There are several possible reasons why this probability is less than one. First, alternative targets may seem less attractive to bidding management. For example, under Roll's hubris hypothesis, a bidder's first offer will be to the target he overvalues the most. Second, a manager may change his mind about the desirability of acquisition. Third, he may retire or be replaced before he locates another target. Fourth, if acquisition is undesirable, the initial offer may motivate large shareholders or the board to oppose further attempts. Fifth, the quality of a later acquisition may be imperfectly correlated with that of the initial attempt.

[35]More generally, the sign could be incorrect, but this requires a rather special scenario. For example,

VRATIO's in a model in which, given failure, there is a probability that the bidder will make another acquisition attempt of equal quality to the first.

Suppose that the first bidder can find another identical target with probability γ after failure to acquire the first target. We now return to the assumption $\bar{V}_1 = \bar{V}_3$. Then equations (6) and (8) become

$$\begin{aligned}\bar{\pi}_1 &= Pr(S|\theta_1)[\alpha(\bar{V} - V_0) + (1-\alpha)(\bar{V} - \bar{B}_1)] + \\ &\quad \gamma Pr(S|\theta_1)[1 - Pr(S|\theta_1)][\alpha(\bar{V} - V_0) + (1-\alpha)(\bar{V} - \bar{B}_1)] \qquad (11)\end{aligned}$$

$$\begin{aligned}\bar{\pi}_3 &= Pr(S|\theta_3)[\alpha(\bar{V} - V_0) + (1-\alpha)(\bar{V} - \bar{B}_3)] + \\ &\quad \gamma Pr(S|\theta_1)[1 - Pr(S|\theta_3)][\alpha(\bar{V} - V_0) + (1-\alpha)(\bar{V} - \bar{B}_1)], \qquad (12)\end{aligned}$$

$$\frac{\bar{V}}{V_0} = \frac{R_3 P_1/V_0}{Pr(S|\theta_3) - \delta} + \alpha + \frac{(1-\alpha)\left[Pr(S|\theta_3)\frac{\bar{B}_3}{V_0} - \delta\frac{\bar{B}_1}{V_0}\right]}{Pr(S|\theta_3) - \delta}, \qquad (13)$$

where $\delta \equiv Pr(S|\theta_1)\{1 + \gamma[Pr(S|\theta_3) - Pr(S|\theta_1)]\}$. Differentiating with respect to γ and evaluating at $\gamma = 0$ gives

$$s_\gamma(0) = \frac{1}{\bar{V}/V_0}\frac{d(\bar{V}/V_0)}{d\gamma} = \frac{Pr(S|\theta_1)[(\bar{V}/V_0) - \alpha - (1-\alpha)(\bar{B}_1/V_0)]}{\bar{V}/V_0} \qquad (14)$$

Using previous parameter estimates, at $\gamma = 0, s_\gamma = -0.0467$. Therefore, when $\gamma > 0$, *VRATIO* decreases, but the effect is weak. As shown in columns 3 and 4 of Table 7, the estimated value improvement is still positive and substantial for plausible values of γ. It should be noted that the effect of γ on *VRATIO* would be stronger if, after a second failure, the bidder again has a probability of turning to a third target and so on.

Finally, as mentioned in footnote 8, an unsuccessful initial bidder can sometimes profit by selling his holdings to a successful competing bidder (see also footnote 23). We now examine the effect of such initial holdings profits on *VRATIO*. Let $Pr(S^2|\theta)$ denote the probability of arrival and success of the second bidder, and let β denote the expected winning bid of the second bidder. Then

$$\bar{\pi}_1 = Pr(S|\theta_1)[\alpha(\bar{V} - V_0) + (1-\alpha)(\bar{V} - \bar{B}_1)] + \alpha Pr(S^2|\theta_1)(\beta - V_0) \qquad (15)$$

if the improvement is always zero in the initial contest, but after an initial failure the bidder always makes a negative NPV acquisition, then the stock return will be lower than the calculation in Section III. The negative stock return, in combination with the reduction in probability of success associated with the arrival of a competing bid, would tend to be attributed to a positive value improvement.

$$\bar{\pi}_3 = Pr(S|\theta_3)[\alpha(\bar{V} - V_0) + (1-\alpha)(\bar{V} - \bar{B}_3)] + \alpha Pr(S^2|\theta_3)(\beta - V_0) \tag{16}$$

$$\frac{\bar{V}}{V_0} = \frac{R_3 P_1/V_0}{Pr(S|\theta_3) - Pr(S|\theta_1)} + \alpha + \frac{(1-\alpha)(Pr(S|\theta_3)\bar{B}_3/V_0 - Pr(S|\theta_1)\bar{B}_1/V_0)}{Pr(S|\theta_3) - Pr(S|\theta_1)} - \frac{\alpha(\beta/V_0 - 1)[Pr(S^2|\theta_3) - Pr(S^2|\theta_1)]}{Pr(S|\theta_3) - Pr(S|\theta_1)}. \tag{17}$$

For purposes of numerical estimation, as an approximation we replace β with our estimates of the expected price paid by a successful first bidder conditional on the arrival of a competing bidder, $\bar{B}_3$. The unconditional probability of a second bidder winning is the probability that a second bidder arrives multiplied by the probability given arrival that the second bidder wins, $Pr(S^2|\theta_1) = Pr(\text{Competing Bid Occurs})Pr(S^2|\theta_3)$. $Pr(\text{Competing Bid Occurs})$ is estimated as 71/290. Thus, only one of the other two probabilities is a free variable. *VRATIO* for different possible values of $Pr(S^2|\theta_3)$ are given in columns 5-7 of Table 7. A benchmark value for this variable is .5, the case in which, given the arrival of a competing bidder, the first and second bidder have equal probabilities of winning. Column 6 gives the estimated improvement ratio when the bidder's initial shareholding in the target is taken as its mean value of 0.038. Column 7 provides alternative numbers assuming larger initial shareholdings of 0.15. We do not extend column 5 beyond probability 0.7, since in 20 out of 71 contests with competing bids the first bidder won, implying a probability of the second bidder winning of no more than 50/71. The table shows that the estimated value improvement is insensitive with respect to the possibility of a competing bidder buying the initial bidder's foothold.

In summary, several sensitivity analyses with respect to possible modelling variants confirm that the estimates provided using the basic model are highly robust. For plausible parameter values, all estimates of value improvements are positive and substantial.

V Summary and Conclusions

This paper estimates whether and by how much takeovers improve target and bidder firm value. We offer an approach to estimating value improvements that avoids the bidder-revelation bias stressed in Roll (1986). This approach, the *intervention method*, is based on a model of the stock returns of an initial bidder when a competing bid occurs. We find that investors perceive value improvements from cash tender

offers to be large and positive—about 45% of the target's pre-takeover equity value. Second, average profits on bidders' initial shareholdings in the target in multiple bidder contests are modest relative to costs of bidding. Third, the point estimates indicate that bidders on average overpay for targets for cash tender offers. However, most of the premium in successful tender offers can be explained by value improvement. Finally, value improvements seem to be similar for friendly and hostile transactions.

From a policy standpoint, this evidence tends to support the view that takeovers are usually desirable, so that regulation of takeovers should be limited. There is a major caveat, however. Since "value improvement" here is defined as a shareholder gain, the positive improvements we estimate are consistent not only with efficiency increases, but also with redistributions from from bondholders or other stakeholders.

The intervention method can be used to relate value improvements to other variables suggested by intuition or theories of takeover. For example, an interesting issue that could be addressed using the intervention method is whether the arrival of white knights blocks superior hostile acquisitions. As another example, the method may be useful in for understanding how cross-sectional variables relate to value improvements. The free cash flow theory of Jensen (1988) implies greater overpayment by bidders with high free cash flow; empirically, bidder cash flow is related to bidder stock returns (Lang, Stulz, and Walkling [1991]). Other variables have been suggested as indicating managerial motives on the part of the bidder, and hence lower value improvement, such as high target q, and lesser similarity of the target firm to the bidder (see Morck, Shleifer and Vishny [1990]). Since cross-sectional variables may be related to the information that a bid conveys about a bidder, the intervention method can be used to separate cross-sectional value versus revelation effects.