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Abstract

The takeover literature suggests that bidders systematically mark up offer prices with pre-bid target stock price runups. Such "markup pricing" is surprising because it suggests either a lack of market deal anticipation—despite the media frenzy often surrounding takeover bids—or that bidders tend to "pay twice" for the target shares (costly feedback loop). To resolve this puzzle, we first characterize the theoretical relationship between target runups and offer price markups under rational deal anticipation. The theory provides testable implications for the existence of a costly feedback loop, and for how target stand-alone value changes may be inferred from runups in equilibrium. We then provide large-sample empirical tests which strongly support deal anticipation in runups while rejecting the existence of a costly feedback loop in the data. Contrary to the prevailing view, pre-offer target runups do not appear to increase bidder takeover costs.

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1 Introduction

Suppose you are negotiating to acquire a target firm and notice a recent runup in the target's stock price. Do you mark up your already planned offer price? The runup may represent an exogenous change in the target's value as a stand-alone company (without a control change), which would warrant a markup. However, if the runup reflects market anticipation of the pending deal, the markup amounts to "paying twice" for the target shares. Your problem is to decipher the impact of the two different sources of the target runup.

We provide large-sample, theory-based evidence on how merger negotiations may be resolving this conundrum in practice. Throughout, we focus on the properties of the offer price "markup"—the difference between the offer premium and the runup—as a measure of the *unanticipated* component of the offer premium. We show how market rationality constrains the pricing relationship between the anticipated (runup) and the surprise (markup) component of the deal value, which we test using a large sample of initial takeover bids for public targets. Since the prospect of "paying twice" might deter some otherwise profitable bids, our evidence is of interest not only to potential acquirers, but also to the debate over the efficiency of the takeover mechanism itself.

Conventional intuition holds that, when the runup reflects deal anticipation, the premium should not change with the runup, and so a dollar increase in the runup should be offset by a dollar decrease in the markup. Schwert (1996) rejects this substitution hypothesis on a sample of takeover bids and suggests that runups lead to costly offer price markups. However, while merger negotiations undoubtedly cause some high-valuation bidders to mark up the offer with the runup in a last-minute effort to close the deal, we find it difficult to believe that the *typical* bidder agrees to "pay twice". Our analysis helps to resolve this issue.

We begin by showing that the theoretical pricing relationship between runups and markups under deal anticipation is more complex than the conventional intuition suggests. In general, the projection of markups on runups is highly nonlinear (does not have a constant slope) and therefore cannot be tested using a linear regression framework, including that in Schwert (1996). The nonlinearity arises whenever takeover rumors provide new information not only about the probability of a pending bid (which is implicit in the conventional intuition) but also about the total deal value.

The notion that takeover rumors may inform market participants about potential deal value seems entirely reasonable. As explained below, however, this assumption implies that higher runups may be driven by greater synergies and not just a higher takeover probability, which in turn allows runups and markups to move in the *same* direction for some deals, and not necessarily in opposite direction as the conventional intuition suggests. Depending on the sample frequency of such bids, the estimated slope in the usual linear cross-sectional regressions of markups on runups may be negative, zero or positive, all with rational deal anticipation in the runup.

Moreover, nested within the same theoretical pricing framework, we show that an equilibrium where the market anticipates the offer price to be increased by the runup—a costly feedback loop—implies a strictly *positive* relationship between markups and runups. This result, which accounts for the endogeneity of the runup, further contradicts the conventional intuition that markups will be independent of runups when bidders "pay twice" for the runup. Importantly, this hypothesis is testable: a negative *linear* regression slope between markups and runups rejects the existence of a costly feedback loop where bidders pay twice. In our sample of 6,150 initial takeover bids for U.S. public targets, the linear regression slope is robustly negative. Moreover, the predicted nonlinear form of the markup projection under deal anticipation receives strong empirical support.

Our theoretical analysis produces additional important insights. Within our setting, there exists a unique equilibrium in which the market's pricing over the runup period fully reveals to the bidder and target the magnitude of the target's stand-alone value change. In this equilibrium, bidders do not "pay twice" for the runup—there exists no costly feedback loop. As indicated above, this conclusion is supported by our empirical evidence. Moreover, we use this equilibrium condition to construct a best linear unbiased estimator (BLUE) for the portion of the runup driven by deal anticipation (which is unobservable to the econometrician).

The BLUE estimator speaks directly to the question posed in the introductory paragraph above. Of particular interest is our finding that this estimator confirms the presence of a positive deal anticipation component in nearly all of the bids preceded by a *negative* total target runup (about 30% of our 6,150 sample deals). The model correctly interprets negative runups as driven by a reduction in target stand-alone value, and our BLUE estimator confirms that this fall is attenuated by market anticipation of positive takeover gains.

Moreover, our model, in which takeover synergies are correctly priced and bidders act rationally, predicts a positive link between target runups and the market price of *bidder* shares conditional on a bid being made. This insight provides a new cross-sectional test of the existence of positive bidder synergies in takeovers. As has been widely documented (Betton, Eckbo, and Thorburn, 2008a), and which is true also in our sample, bidder announcement returns are indistinguishable from zero on average. However, bidder average announcement returns are clouded by measurement error. To the extent that this measurement error is uncorrelated with the target runup, cross-sectional regressions of bidder gains on target runups should produce a positive coefficient if bidder gains are positive. Our empirical evidence strongly supports this prediction.

Finally, we use the model framework to motivate two additional empirical investigations. The first confirms that offer prices are marked up with an observable proxy for a target stand-alone value change such as the market return over the runup period (exogenous to the takeover synergy gains). Moreover, we examine effects of significant trades in the target shares during the runup period. In the presence of a costly feedback loop, and to the extent that such trades fuel runups, they should cause offer price markups. While we find that block trades *do* fuel runups (whether by the initial bidder or by some other investor), there is no evidence that the additional runup is associated with higher offer premiums. This evidence also fails to support the notion that bidder toehold purchases in the runup period increase takeover costs (Schwert, 1996; Goldman and Qian, 2005; Betton, Eckbo, and Thorburn, 2009).

Our paper adds to the growing empirical literature examining possible feedback loops from market prices to corrective actions taken by bidders in takeovers. For example, Luo (2005) and Kau, Linck, and Rubin (2008) report that negative bidder stock returns following initial bid announcements increase the chance of subsequent bid withdrawal. It is as if bidders learn from the information in the negative market reaction and in some cases decide to abandon further merger plans. We do not pursue this issue here as our empirical tests are not impacted by a decision to abandon after the initial offer has been made. However, our findings suggest that the chance of abandonment will be lower for targets with relatively large pre-bid runups, since these target likely represent deals with greater total synergies to be shared with the bidder.

Also, there is an interesting indirect link between our evidence and the findings of recent studies such as Bradley, Brav, Goldstein, and Jiang (2010) and Edmans, Goldstein, and Jiang (2011) who link takeover activity to broad stock market movements *ex ante*. It appears that positive marketwide price shocks (exogenous to takeovers) are associated with a reduction in takeover likelihood. At first, this may seem to contradict our finding that bidder gains in observed bids are *increasing* in target runups. However, while target runups may deter bids driven by attempts to acquire undervalued target assets, bids driven by bidder-specific synergy gains remain undeterred—and end up in our sample.

Our evidence of deal anticipation in the runup is also consistent with the extant evidence that target runups in observed bids tend to revert back to zero following bid rejection (Bradley, Desai, and Kim, 1983; Betton, Eckbo, and Thorburn, 2009). If bids were primarily motivated by targets being undervalued by the stock market, and runups tend to correct the undervaluation, the runup would represent a permanent change in the target value, irrespective of a subsequent control change. On the other hand, runups that discount expected synergy gains requiring a control change, which is implicit in our takeover model, will revert back when it becomes clear to the market that the offer will fail.

The rest of the paper is organized as follows. Section 2 lays out the dynamics of runups and markups as a function of the information arrival process surrounding takeover events, and derives the key testable predictions of rational deal anticipation. Section 3 summarizes the empirical strategy and presents the results of our empirical tests. Section 4 examines effects of exogenous shocks to the target value in the runup period, while Section 5 concludes the paper. The Appendix contains theoretical proofs and examples.

2 A theory of rational deal anticipation

Figure 1 illustrates the information arrival process assumed in our analysis, and it indicates the economic significance of the average target price revisions for our sample (sample description follows in Section 3 below). The market receives a rumor (signal) of a pending takeover bid, which results in a target stock price runup, denoted V_R. In the figure, where V_R is measured as the abnormal target stock return over the conventional two months prior to the first public offer announcement, the target runup averages a significant 8% (the raw target runup is 10%).

The offer price markup is the surprise in the offer announcement—the unanticipated portion of the offer. We denote the markup as $V_P - V_R$, where V_P is the expected final offer premium conditional on the initial bid announcement. V_P is a conditional expectation as the initial offer announcement rarely resolves all remaining uncertainty about the bid outcome (the initial bid may be followed by a competing offer or otherwise rejected by target shareholders). In Figure 1, the markup is represented by the target abnormal stock return over the three-day offer announcement period (from day -1 through day +1), which averages 21% (our empirical analysis uses other measures of the markup as well).

Below, we first derive the equilibrium pricing relationship between the runup V_R and the markup $V_P - V_R$ implied by market efficiency. This provides the basis for modeling a situation where the negotiating parties agree to mark up the offer price with V_R (the costly feedback hypothesis), and where the target experiences an exogenous change in its stand-alone value during the runup period. Finally, we derive testable implications of deal anticipation for the relationship between V_R and *bidder* takeover gains.[1]

2.1 Properties of the markup projection

Suppose the market receives a signal (rumor) s which partially reveals the potential for total synergy gains S of a takeover. S is known to the bidder and the target, while the market knows only the distribution over S given the signal s. The bid process involves a known (negotiated) sharing rule $\theta \in [0, 1]$ for how the synergy gains will be split between target and bidder, and a known sharing rule $\gamma \in [0, 1]$ for the bidding cost C. The cost C includes things like advisory fees, litigation risk and the opportunity cost of expected synergy gains from a better business combination than the target under consideration.

Given a takeover, the bidder receives the net benefit $\theta S - \gamma C$ and the target receives $B = (1 - \theta)S - (1 - \gamma)C$. Since realization of S requires a target control change (a takeover), we assume $B = 0$ if no takeover occurs. This abstracts from scenarios such as those discussed in Edmans, Goldstein, and Jiang (2011), where bidders may be motivated by the prospect of purchasing undervalued targets, or in Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004) where the bidder gets away with paying for the target with overpriced bidder shares. Alternatively, our assumption is consistent with an equilibrium in which the bidder's choice of payment method fully

[1] For additional analytical perspectives on information arrival processes and pricing around takeovers, see e.g. Malatesta and Thompson (1985), Lanen and Thompson (1988), and Eckbo, Maksimovic, and Williams (1990).

reveals the true bidder value, such as that in Eckbo, Giammarino, and Heinkel (1990). In our model, the bidder and target firms are always fairly valued, and the focus is on how those fair values change in response to new takeover-related information.

The target stock price and the prior takeover probability are normalized to zero prior to the signal s (a nonzero prior takeover probability is considered in Section 3.5.2 below). After receiving s, the market forms the posterior density $g(S|s)$ and revises the takeover probability to $\pi(s) > 0$, causing the following target stock price runup:

$$V_R = \pi(s)E[B|s, bid] = \int_K^\infty Bg(S|s)dS, \tag{1}$$

where $K \equiv \frac{\gamma}{\theta}C$ is the threshold synergy value for a rational bidder to go ahead with a bid (net bidder gains are negative for $S < K$).

The subsequent (surprise) bid announcement causes the market to revise the target price to V_P, where

$$V_P = E[B|s, bid] = \frac{1}{\pi(s)} \int_K^\infty Bg(S|s)dS = \frac{1}{\pi(s)} V_R. \tag{2}$$

V_P is the expected final bid value to the target. In this setting, the observed initial bid premium should equal V_P plus random variation (uncorrelated noise) due to remaining uncertainty about the synergies accruing to the target. There may also be residual uncertainty about the success of the initial offer, e.g. driven by potential competing bidders or target resistance. This uncertainty, which attenuates the market reaction to the initial bid announcement in Figure 1, is incorporated into the empirical analysis below.

Combining Eq. (1) and (2), the markup $V_P - V_R$ is (dropping the argument s):

$$V_P - V_R = \frac{1 - \pi}{\pi} V_R, \tag{3}$$

We are interested in the general properties of this markup projection and, in particular, when it has a constant slope (independent of the rumor s) as assumed in the prior takeover literature.

Proposition 1: *Suppose the rumor in the runup period contains information about the takeover likelihood ($\frac{d\pi}{ds} > 0$) and the conditional expected deal value ($\frac{dV_P}{ds} > 0$). Then the following holds:*

(i) The markup projection (Eq. 3) does not have a constant slope (nonlinearity). The degree of nonlinearity depends on the sharing of the net synergy gains between the bidder and the target.

(ii) A linear markup regression yields a slope which is strictly greater than -1 (including zero and positive). The regression slope is a constant equal to -1 if and only if the rumor does not affect the conditional deal value ($\frac{dV_P}{ds} = 0$).

Proof: To prove the nonlinearity in part (i), it suffices to show that the slope of the markup projection changes as the signal s changes. Using Eq. (3):

$$\frac{d[V_P - V_R]/ds}{dV_R/ds} = \frac{-V_P \frac{d\pi}{ds} + (1-\pi)\frac{dV_P}{ds}}{V_P \frac{d\pi}{ds} + \pi \frac{dV_P}{ds}} = \frac{1-\pi}{\pi} - \frac{1}{\pi} w_\pi, \tag{4}$$

where the last expression follows after dividing the numerator and the denominator by πV_p and where

$$w_\pi \equiv \frac{\frac{d\pi/ds}{\pi}}{\frac{d\pi/ds}{\pi} + \frac{dV_P/ds}{V_P}}.$$

Nonlinearity follows by contradiction: vary the signal s so that $\pi \to 0$ from above. For the slope (Eq. 4) to remain constant, w_π must go to 1. With $w_\pi = 1$, the slope is -1 everywhere (the only constant slope possible). However, $w_\pi = 1$ requires $\frac{dV_P}{ds} = 0$, which contradicts the assumption of $\frac{dV_P}{ds} > 0$.

To prove part (ii) that the linear slope is greater than -1, factor out $\frac{dV_p}{ds}$ from Eq. (4) to yield

$$\frac{d[V_P - V_R]/ds}{dV_R/ds} = \frac{(1-\pi) - \frac{V_P d\pi}{dV_P}}{\pi + \frac{V_P d\pi}{dV_P}} = -1 + \frac{1}{\pi + \frac{V_P d\pi}{dV_P}}. \tag{5}$$

Since the last term is always positive for deals that might happen and thus be observed ($\pi > 0$), the sum of the two terms must be larger than -1. A linear projection will provide an average of the ratio of derivatives across the signal spectrum, which must also be greater than -1.[2] ∎

Figure 2 visualizes the nonlinearities. Figure 2A shows the valuations V_R, V_P and $V_P - V_R$ as

[2] Proof that the nonlinear form may have an internal maximum (that the derivative of Eq. 4 is negative) is found in Appendix A.3 using the uniform posterior distribution. Thus a zero slope coefficient for a linear projection is also within the range of possible coefficients when bids are uncertain ($\pi < 1$).

a function of the size of the signal s. Figure 2B shows the corresponding markup projection by transforming the horizontal axis from the signal s to the runup V_R.[3] The figure assumes a normal posterior distribution for S, $\theta = 0.5$, $\gamma = 1$, and a bid cost C which is set low relative to the uncertainty in S. Appendix A.3 shows the closed forms of these functions and their derivatives under the uniform distribution.

In Figure 2A, V_R approaches V_P in a convex fashion: for low signals, V_R is close to zero because bidders are near indifferent to making offers. With our choice of parameter values, $S > C$ and so V_P has a positive intercept (the target always receives a positive net benefit from a bid).[4] The markup $V_P - V_R$ first increases and then decreases in s. When s is low, the negative impact of s on the surprise $(1 - \pi)$ that a bid takes place is more than offset by the positive effect of s on the deal quality, causing both the runup and the markup to increase. After a point, the markup begins to fall as the surprise $1 - \pi$ declines faster than deal quality improves. At high signals, the bid is highly anticipated (π approaches 1) and the markup approaches zero.[5]

In Figure 2B, the markup projection is initially concave for low values of the signal, followed by a gradual inflection that creates a convexity for highly probable deals. As mentioned in the introduction, the positive (concave) portion of the projection corrects the traditional intuition of a negative relation between runups and markups under deal anticipation. Moreover, the conventional approach is to assume a negative slope of -1, while the average slope in the general form in Figure 2B is always strictly greater than -1. Because the slope of the general markup projection is not constant, and may be zero as well as positive, the linear markup regressions in Schwert (1996) do not have the power to reject the deal anticipation hypothesis.

As shown explicitly in Appendix A.3, the slope of the function is influenced by the sharing rule (θ, γ) and the relation between bid costs (C) and uncertainty in S. For example, if $\theta = \gamma$, the markup $V_P - V_R$ starts at a zero intercept. Also, if the bidder bears all of the costs ($\gamma = 1$), and if the uncertainty in S is low in comparison to bid costs (in Appendix A.3, this corresponds to $\Delta < C$), then the markup starts at a high intercept and progresses negatively towards zero (with

[3]This transformation is possible because V_R is monotonic in s and thus has an inverse.

[4]The condition for going ahead with a bid, $S > \frac{\gamma C}{\theta}$, does not necessarily guarantee $S > C$. For example, $S < C$ if γ is much smaller than θ.

[5]With the normal distribution, π never reaches one. With the uniform distribution in Appendix A.3, $\pi = 1$ at the point where the entire range of S given the signal is above the threshold $K = \frac{\gamma C}{\theta}$, and the expected markup becomes zero.

no positively sloped part). Finally, Appendix A.3 proves that the markup function has a maximum, as also illustrated in Figure 2B.

2.2 Adding a target stand-alone value change

The previous section considered deal anticipation but no stand-alone value change in the target runup. In this section we add the possibility of a target stand-alone value change, and consider implications for the form of the markup projection. A key result is that there exists a rational equilibrium where the runup fully reveals the stand-alone value change to the merging partners. Let T denote the change in the target's stand-alone value during the runup period. Assume T is exogenous to the takeover process, i.e. T does not impact the synergy S or the bid probability π.[6] Stock market participants observe T and, as before, the signal s. As highlighted in the introduction, the merger partners do not observe T directly but estimate this value from knowing S and observing the runup V_{RT} (we add subscript "T" to indicate the case with a stand-alone value change in the runup period).

Since, by definition, T should accrue to the target whether or not the merger takes place, we assume that bidders agree to transfer an estimate of T to the target if there is a merger (by marking up the offer price), and that the market is aware of this transfer policy. Let $E(T|V_{RT})$ and $E[\pi B(s)|V_{RT}]$ denote the merger partners' conditional expectation of T and $\pi B(s)$ given V_{RT}. The market, after observing T and s, prices the target so as to create the following runup:

$$V_{RT} = (1-\pi)T + \pi[B(s) + E(T|V_{RT})], \tag{6}$$

where $B(s) = E[B(S|s)]$. Eq. (6) shows that the target runup depends on the merger partners' estimate of T, which itself is based on the runup (a feedback loop). If $E(T|V_{RT}) - T > 0$, the bidder overpays for the target. However, if the merger partners have rational expectations, the runup will fully reveal T and s to them and rule out over- or underpayment for T:

Proposition 2: *In equilibrium, market feedback through the target stock runup fully reveals T.*

[6] The cost of extending a bid might be related to the target size so changes in stand-alone value might impact C and therefore $\pi(s)$ indirectly. We do not consider this issue here.

Proof: If the bidder and target firms have rational expectations, the runup must be consistent with those expectations, which means that

$$V_{RT} = E(T|V_{RT}) + E[\pi B(s)|V_{RT}]. \tag{7}$$

Equilibrium requires that Eq. (7) = Eq. (6). There exists only one set of expectations that solves this equality: $E(T|V_{RT}) = T$ and $E[\pi B(s)|V_{RT}] = \pi B(s)$. To see this, let the merging partners have any expectations for T and $\pi B(s)$ that satisfy Eq. (7). Knowing that Eq. (6) must also hold, they can deduce a set of pairs of T and $\pi B(s)$ consistent with V_{RT}, Eq. (6) and their own expectation of T. If this set contains anything other than their original expectations, they will revise expectations accordingly. A revision in expectations simultaneously causes a revision in V_{RT} through Eq. (6). Expectations consistent with Eq. (7) can only be consistent with Eq. (6) when $E(T|VRT) = T$ and $E[\pi B(s)|V_{RT}] = \pi B(s)$.[7] Appendix A.4 shows an example of how merging partners can infer T, s and $\pi B(s)$ from observation of V_{RT} based on incorrect initial expectations of T and s. ■

Given full revelation of T in equilibrium, the observed runup becomes

$$V_{RT} = \pi E[B + T|s, bid] + (1 - \pi)T = V_R + T. \tag{8}$$

Subtracting T on both sides yields the *net runup*, $V_{RT} - T$, which is the portion of the runup related to takeover synergies only. Moreover, once a bid is made, it is fully marked up by the stand-alone value increase:

$$V_{PT} = E[B + T|s, bid] = V_P + T. \tag{9}$$

Since both V_{RT} and V_{PT} include T, the effect of T nets out in the markup $V_{PT} - V_{RT}$ which remains unchanged from section 2.1. The markup projection is now:

$$V_{PT} - V_{RT} = \frac{1-\pi}{\pi}(V_{RT} - T), \tag{10}$$

which also contains the nonlinearity.

[7]The full revelation of T and s through V_{RT} is similar to the revelation expectations through market prices discussed in Grossman (1989).

2.3 Markup projection with costly feedback loop

Up to this point, we have characterized the properties of markup projections assuming rational investor expectations of the takeover synergy gains, and shown that in equilibrium, market feedback allows the merging parties to infer the target stand-alone value change in the runup period. We now introduce a third case in which we, without loss of generality, again focus solely on the runup V_R driven by market anticipation of synergy gains (i.e. $T = 0$). In this case, the market knows that bidders always mark up the planned offer price with the entire runup V_R before announcing the offer. This creates a market feedback loop which is different from the one considered in Section 2.2: the bidder now "pays twice" for the expected offer premium reflected in V_R. Rational bidders may agree to this extra takeover cost provided the bidder's net takeover gain remains positive following the markup. Our purpose is not to justify this particular negotiation outcome but to derive testable implications for the markup projection.[8]

Let the superscript "*" indicate the case with a costly feedback loop. The new bidder threshold is $K^* = \frac{\gamma C + V_R^*}{\theta}$, which is increasing in V_R^* (the runup is now endogenous). We have that

$$V_R^* = \pi^* \{E[B|s, bid] + V_R^*\} = \int_{K^*}^{\infty} [B + V_R^*] g(S|s) dS = \frac{\pi^*}{1 - \pi^*} E[B|s, bid]. \tag{11}$$

Substituting Eq. (11) into Eq. (3) yields:

$$V_P^* - V_R^* = E[B|s, bid]. \tag{12}$$

Intuitively, since a forced transfer of the runup to the target increases the rational minimum bid threshold to K^*, observed bids will now have greater total synergies relative to the situation without a costly feedback loop. As stated in Proposition 3, this positive effect on total synergies in observed bids *increases* with the runup transfer:

Proposition 3: *Suppose target runups reflect deal anticipation, and that merger negotiations force rational bidders to mark up the offer price with the runup (costly feedback loop). The markup is*

[8] In our model where synergy gains are fairly priced, this is the only way to introduce a costly runup into the analysis. Alternatively, target runups would be costly if bidders hope to gain from purchasing undervalued target assets.

now a positive and monotonic function of the runup (Eq. 12). The costly feedback loop is rejected if a linear markup regression produces a negative slope.

See Appendix A.1 for the proof. Figure 3A shows the valuations and, of particular interest in this case, the deal probability π^* as a function of the signal s.[9] Given the higher bid threshold K^*, the deal probability π^* is lower for any signal s relative to the probability π without a costly feedback loop. Moreover, π^* remains strictly less than one throughout the range of s (converging to 0.5, the value of $1-\theta$ in the figure) because it remains uncertain whether a bidder will meet the minimum bid threshold K^* also when s is large. This is in contrast to the situation without a feedback loop: for the same parameter values, the probability π would have reached a value of one at the point where $\pi^* = 0.37$ in Figure 3A.

The conventional intuition in the takeover literature is that, under full markup of the runup, markups are unrelated to runups (Schwert, 1996). Proposition 3 shows instead that, because the effect of the feedback loop is to cause the markup to reflect a surprise element for *all* values of s, the markup will be continually increasing in both the signal and in the endogenous runup. Figure 3B illustrates this effect: the markup is monotonically increasing in the runup, approaching a near-linear form already for low values of the signal s and V_R. It is therefore straightforward that the costly feedback hypothesis is rejected if a linear markup regression produces a negative slope.

2.4 Deal anticipation and bidder returns

In our model, bidders share in the takeover gains. Let ν denote bidder valuations, again measured in excess of the stand-alone valuation at the beginning of the runup period. At the moment of a bid announcement, but without knowing precisely what the final bid is, we have that

$$\nu_P = \frac{1}{\pi(s)} \int_K^\infty (S - C - B) g(S|s) dS = \frac{1}{\pi(s)} \nu_R. \tag{13}$$

The observed valuation of the bidder after the bid is announced includes an uncorrelated random error around the expectation in equation (13) driven by the resolution of the synergy S around its conditional expectation.

[9] The parameters underlying Figure 3 are $\theta = 0.5$, $\gamma = 1$, $C = 1$, and $\Delta = 4$ (the uncertainty in the synergy, see Appendix A.3).

Proposition 4: *Let G denote the bidder net gains from the takeover ($G = S - C - B$). For a fixed benefit function G, market efficiency and rational bidding behavior imply the following:*
(i) Bidder and target synergy gains are positively correlated: $Cov(G, B) > 0$.
(ii) Bidder synergy gains and target runup are positively correlated: $Cov(G, V_R) > 0$.
(iii) The sign of the correlation between G and target markup $V_P - V_R$ is ambiguous.

See Appendix A.2 for the proof. Rational bidding in our context means that the bidder decides to bid based on the correct value of K, which implies a bidder expected benefit ν_P that is increasing and concave in the target runup. Part (ii) of Proposition 2 suggests that the most powerful test for deal anticipation in bidder returns comes from regressing the bidder gains on the target runup—where the predicted positive sign involves less estimation error. We follow this suggestion below.

3 Testing for rational deal anticipation

3.1 Summary of model predictions

Table 1 summarizes several empirical hypotheses nested within the rational deal anticipation framework of Section 2. For notational simplicity, we suppress the subscript T in the target runup (so V_R now includes the target's stand-alone value change, if present). The first column shows the theoretical form of the economic model, while columns two and three describe the associated empirical tests.

We begin with Proposition 1 which states that, under deal anticipation, the markup is nonlinear in the runup. The first task is therefore to test for this type of implied nonlinearity, illustrated earlier in Figure 2B. Using a flexible functional form (the beta function), we perform goodness-of-fit tests for nonlinearity against the hypothesis that the markup projection is linear. Moreover, if the true projection is nonlinear, imposing linearity should produce a slope coefficient that is strictly greater than -1 (part (ii) of Proposition 1).

Alternatively, what if takeover signals do *not* cause deal anticipation? If the market systematically ignores the information in takeover signals (a type of conditional market inefficiency), markups will be independent of runups. This alternative hypothesis predicts a slope of zero in the linear markup regression. This prediction is, however, indistinguishable from a zero average slope caused by rational market deal anticipation and therefore not included in Table 1 (the evidence below, however, strongly rejects independence between markups and runups).

Proposition 2 shows that the nonlinearity from deal anticipation holds even if the market observes both a takeover signal s and a target stand-alone value change T over the runup period. That is, rational expectations by the merging parties reveal T through equilibrium market pricing. However, Proposition 2 also implies that the cross-sectional variation in T may attenuate the nonlinearity caused by deal anticipation in the runup, reducing test power. We therefore repeat the tests for nonlinearity after adjusting target runups for an estimate of the cross-sectional variation in T. As explained below, our adjustment for the variation in T exploits the equilibrium condition underlying Proposition 2, and it is therefore nested within our theory.

We then address the implications of the costly feedback loop hypothesis, under which the portion of the runup caused by deal anticipation is added to the offer premium. According to Proposition 3, the markup is now increasing *everywhere* in the runup, and so rational deal anticipation implies a strictly positive slope coefficient in the linear markup regression. Rational deal anticipation further implies that bidder takeover gains are increasing in the *target* runup (Proposition 4). We test this proposition by regressing the estimated bidder gain ν on the target runup (with additional firm- and deal-specific control variables), where the predicted slope is positive.[10]

Finally, the empirical analysis examines two additional linear regression specifications addressing offer price effects of exogenous shocks to the target runup. These additional regressions provide information on the question of whether merger negotiations lead to offer price adjustments reflecting fundamental drivers of the target runup. The first driver of the target runup is the (exogenous) contemporaneous market return, and the second is a major block trade in the target shares such as a bidder toehold purchase. We test whether either of these two factors fuel target runups and result in increased offer premiums.

[10]The same slope coefficient is predicted to be negative if bidders systematically make value-reducing bids (whether or not there exists a costly feedback loop).

3.2 Characteristics of the takeover sample

As summarized in Table 2, we sample control bids from SDC using transaction form "merger" or "acquisition of majority interest", requiring the target to be publicly traded and U.S. domiciled. The sample period is 1/1980-12/2008. In a control bid, the buyer owns less than 50% of the target shares prior to the bid and seeks to own at least 50% of the target equity.

The bids are grouped into takeover contests. A takeover contest may have multiple bidders, several bid revisions by a single bidder or a single control bid. The initial control bid is the first control bid for the target in six month. All control bids announced within six months of an earlier control bid belong to the same contest. The contest ends when there are no new control bids for the target over a six-month period or the target is delisted. This definition results in 13,893 takeover contests. We then require targets to (1) be listed on NYSE, AMEX, or NASDAQ; and have (2) at least 100 days of common stock return data in CRSP over the estimation period (day -297 through day -43);(3) a total market equity capitalization exceeding $10 million on day -42; (4) a stock price exceeding $1 on day -42; (5) an offer price in SDC; (6) a stock price in CRSP on day -2; (7) an announcement return for the window [-1,+1]; (8) information on the outcome and ending date of the contest; and (9) a contest length of 252 trading days (one year) or less. The final sample has 6,150 control contests.

Approximately three-quarters of the control bids are merger offers and 10% are followed by a bid revision or competing offer from a rival bidder. The frequency of tender offers and multiple-bid contests is higher in the first half of the sample period. The initial bidder wins control of the target in two-thirds of the contests, with a higher success probability towards the end of the sample period. One-fifth of the control bids are horizontal. A bid is horizontal if the target and acquirer has the same 4-digit SIC code in CRSP or, when the acquirer is private, the same 4-digit SIC code in SDC.[11]

Table 3 shows average premiums, markups, and runups, both annually and for the total sample. The initial offer premium is $\frac{OP}{P_{-42}} - 1$, where OP is the initial offer price and P_{-42} is the target stock closing price or, if missing, the bid/ask average on day -42, adjusted for splits and dividends. The

[11]Based on the major four-digit SIC code of the target, approximately one-third of the sample targets are in manufacturing industries, one-quarter are in the financial industry, and one quarter are service companies. The remaining targets are spread over natural resources, trade and other industries.

bid is announced on day 0. Offer prices are from SDC. The offer premium averages 45% for the total sample, with a median of 38%. Offer premiums were highest in the 1980s when the frequency of tender offers and hostile bids was also greater, and lowest after 2003. The next two columns show the initial offer markup, $\frac{OP}{P_{-2}} - 1$, which is the ratio of the offer price to the target stock price on day -2. The markup is 33% for the average control bid (median 27%).

The target runup, defined as $\frac{P_{-2}}{P_{-42}} - 1$, averages 10% for the total sample (median 7%), which is roughly one quarter of the offer premium. While not shown in the table, average runups vary considerably across offer categories, with the highest runup for tender offers and the lowest in bids that subsequently fail. The latter is interesting because it indicates that runups reflect the probability of bid success, as expected under the deal anticipation hypothesis. The last two columns of Table 3 show the net runup, defined as the runup net of the average market runup ($\frac{M_{-2}}{M_{-42}} - 1$, where M is the value of the equal-weighted market portfolio). The net runup is 8% on average, with a median of 5%.

3.3 Are markup projections nonlinear?

Table 4 shows the results of estimating the markup projection on our sample of 6,150 initial takeover bids. Our main model specifications are model (1) and model (2) in Table 4. The remaining three models in the table represent robustness checks. The table shows the constant term and slope from estimating the baseline linear markup projection, along with test statistics for nonlinearity. All estimates are produced using the beta distribution, denoted $\Lambda(v, w)$ where v and w are shape parameters determined by the data:

$$V_P - V_R = a + b\frac{(V_R - min)^{(v-1)}(max - V_R)^{w-1}}{\Lambda(v,w)(max - min)^{v+w-1}} + \epsilon. \tag{14}$$

Here, max and min are respectively the maximum and minimum V_R in the data, a is an overall intercept, b is a scale parameter, and ϵ is a residual error term. The estimated shape parameters v and w determine whether the beta density suggests the projection is concave, convex, peaked at the left, right or both tails, unimodal with the hump toward the right or left, or linear.[12]

[12]If the parameters are $v = 1$ and $w = 2$ or vice versa, a least squares fit of the markup to the runup (allowing a and b to vary) produce an a and b that replicates the intercept and slope coefficient in a linear (OLS) regression (reported in Table 4). The intercept and slope need to be translated because v and w impose a particular slope and

Beginning with the first hypothesis in Table 1 (nonlinearity), recall that Figure 2B suggests a unimodal fit with the hump to the left and the right tail convex and falling to zero as the takeover signal increases and deals become increasingly certain. Figure 4 plots our sample total runups and total markups as defined in row (1) of Table 4 using three alternative estimated functions: (i) the best linear fit (constrained to have $v = 1$ and $w = 2$ or vice versa), (ii) the best nonlinear monotonic fit (constrained to have $v \leq 1$), and (iii) the best nonlinear fit (unconstrained) of the markup on the runup.

The unconstrained empirical fit in Figure 4 is strikingly similar to the theoretical shape in Figure 2B with normally distributed signal errors. The hump to the left in Figure 4 is driven by a subset of takeovers with low runups and, yet, with lower markups than predicted by either a linear or a nonlinear-but-monotonic fit. Takeovers of poorly performing targets are not uncommon—there are targets with negative runups in about 30% of our sample. We return to the issue of negative runups in Section 3.4 below.

The last three columns in Table 4 show three goodness-of-fit likelihood ratio (LR) test statistics applied to the data in Figure 4. The likelihood ratio is calculated as $LR = \left(\frac{SSE(constrained\ model)}{SSE(unconstrained\ model)}\right)^{\frac{N}{2}}$ where SSE is the sum of squared errors for the constrained and the unconstrained model specifications, respectively, and N is the sample size. For large samples, $-2ln(LR) \sim \chi^2(d)$, where d is the number of model restrictions (Theil, 1971, p. 396). We have verified that this likelihood ratio test statistic shows close correspondence to χ^2 distribution near the 1% significance level when using simulated, linear markups with normal errors.

Of the three LR statistics in Table 4, the first, $LR1$, tests for nonlinearity against the alternative of a linear form ($d = 2$). The second, $LR2$, tests nonlinearity against monotonicity ($d = 1$). The third, $LR3 \equiv LR1 - LR2$, tests monotonicity against linearity ($d = 1$). The 1% critical value for $LR1$ is 9.2, while for $LR2$ and $LR3$ it is 6.6. With a single exception ($LR3$ for model (5) in Table 4), all the reported LR values substantially exceed their respective 1% cutoff points. All the $LR1$ values strongly reject linearity in favor of the unrestricted nonlinear form. Moreover, all the $LR2$ values reject monotonicity in favor of non-monotonicity. Finally, with the exception of model (5), the $LR3$ values also reject linearity against monotonicity.[13]

intercept on the data, which a and b modify.

[13]We have also performed test for nonlinearity exploiting the residual serial correlation in the data. While less powerful than the LR tests, the residual correlation tests also support nonlinearity over linearity.

The results of the baseline linear regressions in Table 4 are also interesting as they have direct implications for the existence of our costly feedback loop hypothesis. Recall from Proposition 3 and Table 1 that the existence of a costly feedback loop implies a *positive* slope in the *linear* markup projection. The estimated linear slope coefficient in Table 4 for model (1) is -0.24 with a t-value of -11.0. Also, the slope coefficient estimate is consistently negative and highly significant in all of the other model specifications in the table. Jointly with the evidence of nonlinearity of the markup projection, this evidence constitutes a strong rejection of a costly feedback loop where the bidder "pays twice" for the target runup.

3.4 Adjusting runups for stand-alone value changes

While the Rational Expectations Equilibrium (REE) fully reveals the target stand-alone value T to the merger participants (Proposition 2), T remains unobservable to the econometrician. By inspection of Eq. (10), when markups are projected on total runups (with no adjustment for T), the cross-sectional variation in T will appear as noise unrelated to the markup. The effect is to attenuate the nonlinear impact of the synergy signal s on the relation between the runup and the markup (which is driven by the deal-anticipation component of the runup only), akin to an errors-in-variables bias in the estimated slope.

The above empirical results show that the nonlinearity predicted by rational deal anticipation appears in the data even without adjustment for variation in T. Nevertheless, we are interested in whether adjusting for T improves the nonlinear empirical fit in Figure 4. In particular, adjusting for T may help improve the estimation when total target runups are *negative* (indicating poorly performing targets). In our model, a negative runup is driven by a negative T which is larger in magnitude than the (positive) expected takeover gains, and occurs in 30% of our sample of 6,150 bids.[14]

Recall that, in the REE (Eq. 8):

$$V_R = T + \pi B(s).$$

Assume T and s are independent, and that T has an unconditional mean of zero (unconditional

[14]Subtracting the market return over the runup period from the total runup produces a net runup which is negative in 38% of the total sample.

on V_{RT}). Then the following is a best linear unbiased estimate (BLUE) of T given observations on V_R:

$$E(T|V_R) = \alpha + \beta V_R, \tag{15}$$

$$\beta = Var(T)/[Var(T) + Var(\pi B(s))] \quad \text{and} \quad \alpha = -\beta E(\pi B(s)) = -\beta E(V_R).$$

The BLUE forecast of the partial anticipation component πB of the runup is therefore

$$\widehat{\pi B(s)} = V_R - E(T|V_R) = (1-\beta)V_R + \beta E(V_R). \tag{16}$$

Eq. (16) describes what we call the *adjusted runup*—a transformation of the observed V_R that accounts for the fact that a higher V_R likely has higher T, but not one-for-one as it also depends on $Var(\pi B(s))$. *Ceteris paribus*, the greater $Var(T)$ the lower is the weight placed on the observed runup (and more weight on the cross-sectional average runup) when estimating the deal anticipation component $\pi B(s)$. Conversely, the higher is $Var(\pi B(s))$ the lower is β, and the greater is the weight given to the observed runup.

Application of Eq. (16) requires estimates of β and $E(V_R)$ for each contest. As an estimate of $E(V_R)$ it is natural to use the mean of the runups for the entire sample, which is 9.8%. The estimate of β requires the two variances $Var(T)$ and $Var(\pi B(s))$ for each firm. It is not possible to observe a unique $Var(\pi B(s))$ for each target because a given deal has a single realization of s. But if we assume that each s is a drawing from a stationary distribution, then a natural surrogate for $Var(\pi B(s))$ is the increase in cross-sectional variability for targets during the runup period relative to an equivalent period that is not influenced by realizations of s. This is because the different realizations of s contribute to cross-sectional variability in runups. Therefore, to estimate $Var(\pi B(s))$, we measure the cross-sectional variance of target returns during the runup period and subtract the cross-sectional variance of target returns during the 41 days just prior to the runup period (the "41-day pre-runup period"). This difference is 0.010, or about 17% of the total cross-sectional variance during the runup period.

To estimate $Var(T)$, it is tempting to use a simple target time series return variance in a 41-day period not influenced by merger rumors. However, such an estimate contains substantial measurement error. For example,in our sample the slope coefficient in a regression of the target return variance from the 41-day pre-runup period on the return variance estimated from a 41-day period beginning one year prior to the runup period is only 9%. Thus, we create a target-specific estimate of $Var(T)$ by giving 9% weight to the target's time-series variance estimate over the estimation period (approximately one year prior to the runup) and 91% weight to the average time-series estimate across the sample. Combining these estimates of $Var(T)$ with the cross-sectional estimate of $Var(\pi B(s))$ produces an average β in our sample of 0.873 with a minimum (maximum) of 0.850 (0.973).[15]

Interestingly, our runup adjustment succeeds in pulling in the tails of the runup data. The minimum adjusted runup is -2% rather than -83% for the unadjusted runups. Moreover, in the total sample, only 12 deals indicate a negative adjusted runup. Intuitively, the model recognizes that most of the negative runup must be a change in stand-alone value. This is true at the high end also, where the maximum adjusted runup is 37% rather than 244% for the raw runups. Because we are pulling in the runups by a factor of 87% (the average β), the linear slope reported for model (2) in Table 4 is now a much larger $b = -1.79$, which also strongly rejects the costly feedback hypothesis.[16]

The results of the nonlinear fit of markups to adjusted runups are shown as model (2) in Table 4. This nonlinear fit yields a slight improvement over model (1): the $LR1$ and $LR2$ test statistics are now 100.9 and 43.8, respectively, up from 98.1 and 38.4. Also, while not shown in a figure, when we project the adjusted runups on markups, the empirical fit continues to show a distinct hump at the lower end of the runup values. Moreover, this time, the hump occurs over the *positive* range of adjusted target runups.

Our BLUE estimator suggests a likely scenario for the interpretation of the runup given by the parties to merger negotiations. First, the amount of T in the *average* deal, which has a total runup of about 10%, is expected to be zero (the entire 10% reflects average deal anticipation). Second, a deal with a runup greater than 10% is expected to have some positive T in it, provided by the

[15]We use the entire estimation period to estimate the time series $Var(T)$ in an effort to reduce the inevitable estimation error although it potentially introduces additional error due to non-stationarity. Our basic conclusions are robust to how we estimate parameters. Whatever time period is used to estimate the unique target return variance, changing the weight given to the individual estimates does not affect the relative ranking of betas, just the spread between them. As shown in Eq. (16), however, the multiplication of $(1-\beta)$ and V_R influences the relative rankings of the adjusted runups. While we had no priors on this, the correlation between β and V_R in our sample is 0.078.

[16]If we give no weight to individual variances in the estimation of β and instead pull everything in by the same percentage, the slope goes from the -0.24 we show for model (1) to -1.68 with the identical t-statistic as model (1) in the table. This makes sense as -0.24/(1-0.87) is about -1.7.

estimate of $\beta(V_R - E(V_R))$. Conversely, deals with runups less than 10% are expected to have T less than zero (negative change in stand alone value).

Interestingly, using our simple correction for changes in stand-alone value makes a dramatic impact on the range of anticipated takeover gains. This adjustment moves the distribution of $\widehat{\pi B(s)}$ more tightly around the average of 9.8% so that the expected takeover gain in only 12 of the 6,150 bids (0.2%) are estimated to be negative after the adjustment. Within our model of course, even these contain negative estimation error. But a BLUE estimator does not fully correct for this implication of the theory because it does not impose the constraint that the market anticipation must be positive in our model.

3.5 Robustness issues

We perform three additional important robustness checks, the results of which are shown in projections (3) - (5) in Table 4. These exploit alternative ways of measuring runups and markups, and the effect of incorporating estimates of bid success probability and information available to the market prior to the runup period, which may help predict takeovers.[17]

3.5.1 The probability of bid success

As defined earlier, the theoretical premium variable V_P is the expected premium conditional on the initial bid. Some bids fail, in which case the target receives zero premium. Presumably, the market reaction to the bid adjusts for an estimate of the probability of an ultimate control change. This is apparent from Figure 1 where the target stock price on average runs up to just below 30% while the average offer premium in Table 3 is 45% (unadjusted for market movements). To account for this effect, we multiply the initial offer price with an estimate of the target success probability (where target failure means that no bidder wins the contest).

The success probability is estimated using logit, where the dependent variable takes on a value of one if the target (according to the SDC) is ultimately acquired either by the initial bidder or a rival bidder, and zero otherwise. The explanatory variables are as defined in Table 5 and the results of the probit estimation is reported in the first two columns of Table 6. The probit regressions for

[17] We have verified that plots based on the alternative definitions of runups and markups discussed below remain consistent with the general concave then convex shape shown in the theoretical Figure 2B. The plots are available upon request.

contest success are significant with a pseudo-R^2 of 21%-22%. The difference between the first and the second column is that the latter includes two dummy variables for the 1990s and the 2000s, respectively.[18] The probability that the takeover is successful increases significantly with the size of the target, and is higher for public acquirers and in horizontal transactions. Bids for targets traded on NYSE or Amex, targets with a relatively high stock turnover (average daily trading volume, defined as the ratio of the number of shares traded and the number of shares outstanding, over days -252 to -43), and targets with a poison pill have a lower likelihood of succeeding.

A high offer premium also tends to increase the probability of takeover success, as does a relatively small run-down from the 52-week high target stock price. Moreover, the coefficients for three dummy variables indicating a positive bidder toehold in the target (*Toehold*), a stock consideration exceeding 20% of the bidder's shares outstanding thus requiring acquirer shareholder approval (> 20% *new equity*), and a hostile (vs. friendly or neutral) target reaction (*Hostile*), respectively, are all negative and significant. Finally, contests starting with a tender offer are more likely to succeed, as are contests announced in the 1990s and the 2000s. The dummy variable indicating an all-cash bid generates a significantly negative coefficient only when controlling for the time period (Column 2).[19]

There are a total of 6,103 targets with available data on the characteristics used in the logit estimation. For each of these, we multiply the markup with the estimated success probability computed using the second model in Table 6 (which includes the two decade dummies). This markup is then used in the nonlinear projection (3) reported in Table 4. The likelihood ratio tests $LR1$ and $LR2$ strongly reject linearity and monotonicity against nonlinearity, and $LR3$ also rejects linearity against monotonicity.[20]

[18] All takeovers in the early 1980s were successful, prohibiting the use of year dummies.

[19] Table 6, in columns 3-6, also shows the coefficients from probit estimations of the probability that the initial control bidder wins the takeover contest. The pseudo-R^2 is somewhat higher for this success probability, ranging from 22% to 28%. Columns 3 and 4 use the same models as the earlier estimations of contest success, while columns 5 and 6 add a variable capturing the percent of target shares owned by the initial control bidder at the time of the bid (*Toehold size*). Almost all explanatory variables generate coefficients that are similar in size, direction, and significance level to the ones in the probit regressions of contest success. The reason is that in the vast majority of successful contests, it is the initial bidder who wins control of the target. The only difference between the probability estimations is that the existence of a target poison pill does not substantially affect the likelihood that the initial bidder wins. The larger the initial bidder toehold, however, the greater is the probability that the initial bidder wins.

[20] We also attempted to adjust for the probability of success by restricting the sample to the 5,035 targets which we know did succeed (the unconditional success probability is 5,035/6,150=0.82). The results of the LR tests for this subsample is indistinguishable from the results of model (3) reported Table 4.

3.5.2 Information prior to the runup period

Up to this point, we have assumed that the market imparts a negligible likelihood of a takeover into the target price before the beginning of the runup period (day -42 in Figure 1). To start the runup period around two calender months prior to the first bid is common in the empirical takeover literature, beginning with Bradley (1980). Moreover, the large markups in our data (on average 33%, Table 3) indicate that the offer announcement is a significant news (surprise) event. Nevertheless, in this section we check whether including information prior to day -42 in the computation of the runup changes our empirical results.

Suppose the market has already received a signal z on event day -42. Moreover, the market receives a second signal s during the runup period. Now, a bid is made if $s+z$ exceeds a threshold level of synergy gains. Working through the valuations, there is one important change. Define $V_0 = \pi(z)E(B|z)$ as the expected value of takeover prospects on event day -42 given z and a diffuse prior on s. The runup and the bid premium are now measured relative to V_0 instead of zero:

$$V_R - V_0 = \pi(s+z)E_{s+z}[B|s+z, bid] - \pi(z)E(B|z), \tag{17}$$

and the premium is

$$V_P - V_0 = E_{s+z}[B|s+z, bid] - \pi(z)E(B|z) = \frac{1}{\pi(s+z)}[V_R - V_0]. \tag{18}$$

In other words, in order to investigate the nonlinear influence of market anticipation prior to the runup period, one must add back V_0 to both the runup and the bid premium. Since the influence of V_0 is a negative one-for-one on both quantities, markups are not affected.

In order to unwind the influence of a possibly known takeover signal z prior to the runup period, we use the following three deal characteristics defined earlier in Table 5: *Positive toehold*, *Toehold size*, and the negative value of $52-$ *week high*. The positive toehold means that the bidder at some point in the past acquired a toehold in the target, which may have caused some market anticipation of a future takeover. Moreover, it is reasonable to assume that the signal is increasing in the size of the toehold.

Using these variables, the model in row (4) of Table 4 implements two multivariate adjustments to the model in row (1). The first adjustment, as dictated by eq. (17), augments the runup by adding R_0, where R_0 is the projection of the total runup ($\frac{P_{-2}}{P_{-42}} - 1$) on *Positive toehold*, *Toehold size*, and the negative value of $52 - week\ high$. The second adjustment is to use as dependent variable the "residual markup" U_P, which is the residual from the projection of the total markup, $\frac{OP}{P_{-2}} - 1$, on the deal characteristics used to estimate the success probability π in Table 6 while excluding *Positive toehold*, *Toehold size*, and $52 - week\ high$ which are used to construct the augmented runup.

Model (4) in Table 4 shows the linear and nonlinear projections of the residual markup on the augmented runup. The linear slope remains negative and highly significant (slope of -0.21, t-value of -12.1). Thus, the costly feedback hypothesis is rejected also with the adjusted runups. Moreover, the three LR values confirm that the goodness-of-fit of the nonlinear form of the markup projection is significantly better than either the linear or the monotonic forms, and that monotonicity fits better than linearity.[21]

3.5.3 Measuring of markups using CAR

The last projection in Table 4, model (5), uses cumulative abnormal stock returns (CAR) to measure both the markup, $CAR(-1, 1)$, and the runup, $CAR(-42, -2)$. CAR is estimated using the market model. The parameters of the return generating model are estimated on stock returns from day -297 through day -43. The CAR uses the model prediction errors over the event period (day -42 through day +1). Although measurement error in CAR lowers test power, the likelihood ratio test statistics $LR1$ and $LR2$ again strongly reject linearity. However, with $LR3 = 1.8$, the best monotonic fit is now indistinguishable from the linear fit, a result not critical for our theory.[22]

In sum, the empirical models (1) - (5) in Table 4 support the presence of deal anticipation in target runups, while at the same time rejecting the hypothesis that merger negotiations force bidders to systematically mark up offer prices with the runup. This conclusion fails to support the

[21] While not shown here, in this experiment the shape looks similar to the other nonlinear fits except that the right tail tips upward slightly.

[22] While not shown here, plots of the estimated projection using the CAR definitions of markup and runup appears similarly nonlinear as the plot in Figure 4, but with a somewhat less pronounced hump at the beginning. Also, nonlinearity is enhanced by subtracting from the runup a market-model alpha measured over the year prior to the runup. A consistent explanation is that recent pre-runup negative target performance indicates synergy benefits to the takeover (e.g. inefficient management) which are factored into offer premiums. We also find that bid premiums are significantly negatively correlated with prior market model alphas, further supporting this argument.

view that target runups increase bidder takeover costs in observed takeover bids.

3.6 Do bidder returns reflect deal anticipation?

Proposition 4 states that, when bidders and targets share in the takeover gains, bidder gains (ν_P) and *target* runups (V_R) are positively correlated. That is, market anticipation of shared takeover gains increases the stock prices of both bidders and targets. Bidder gains are decreasing in the target runup only if bidders fail to rationally compute the correct bid threshold level K and accept value-decreasing deals.

We test this proposition empirically using the 3,691 publicly traded bidders in our sample. We estimate ν_P as the cumulative abnormal bidder stock return from event day -42 through the day following the first public bid announcement, $BCAR(-42, 1)$. The estimation of $BCAR$ uses a Market Model regression estimated over the period from day -297 through day -43 relative to the initial offer announcement date.

We examine the correlation between $BCAR(-42, 1)$ and target runups two ways. First, in Figure 5, we examine the functional form when $BCAR(-42, 1)$ is plotted against the target runup. Here, the target runup is defined as in Figure 4: $V_R = \frac{P_{-2}}{P_{-42}} - 1$. Second, we estimate the slope coefficients in multivariate linear regressions of $BCAR$ on alternative definitions of the target runup to show robustness of the correlation estimate.

As has been widely reported in the literature, bidder announcement returns are noisy and on average indistinguishable from zero (Betton, Eckbo, and Thorburn, 2008a). Consistent with this, in our sample, $BCAR(-42, -1)$ averages a statistically insignificant -1.5% with a standard deviation of 17.9. From Moeller, Schlingemann, and Stulz (2005) we also know that bidder announcement returns are unusually negative the two-year period 1999-2000. In our sample, $BCAR(-42, 1)$ averages -4.7% across our 529 observations from these two years, with a standard deviation of 25.3%. Thus, we add an intercept dummy for these two years in our cross-sectional regressions.

Figure 5 shows the estimated linear and nonlinear functional forms of the projection of $BCAR$ on the target runup. Both forms are generated using the beta-function (Eq. 14). The empirical projection in Figure 5 is increasing and concave over the entire range of runups. As noted in the figure heading, our likelihood ratio test rejects linearity in favor of a nonlinear, monotonically increasing shape. Also, while not shown here, when $BCAR(-42, 1)$ is projected on the augmented target runup (defined earlier in Table 4), the nonlinear shape is almost identical.

Table 7 presents the results of the linear cross-sectional regressions with $BCAR(-42, 1)$ as dependent variable. Since the key independent variable is the target runup, do not report the individual slope coefficients for most of the remaining regressors (referred to as "control variables" in the table). The firm- and deal-specific control variables are explained in a footnote to the table. As before in Table 4, the target runup variable is estimated four different ways: total runup, net runup, augmented runup, and market model runup.

Notice first that the six intercept terms in Table 7 range from a significant -2.0% to an insignificant -0.9%, where inclusion of the control variables drives the intercept term to become statistically insignificant. Inclusion of the control variables also raise the regression R^2, to a high of 4%. Of the control variables, *Relative size* and *All cash* receive significantly positive coefficients, while target share turnover ($Turnover$) receives a significantly negative coefficient.

Consistent with the nonlinear estimation in Figure 5, the target runup receives a positive and significant coefficient in all six models in Table 7. In model (1), which uses the total target runup, the coefficient on the target runup is 0.046 with a p-value of 0.008. With the control variables (model 2), the slope coefficient is a virtually unchanged 0.049. In model (3), the target runup is net of the market return over the runup period and it receives a coefficient of 0.074 (p-value $<$ 0.001) without controls and 0.077 with control variables (model 4). In model (5), the target runup is the $Augmented\ Target\ Runup$ from Table 4 (to account for information about merger activity prior to the runup period). The slope coefficient is now 0.046, again highly significant. Finally, Table 7 reports the projection of $BCAR$ on the market model target runup $CAR(-42, 2)$. The slope coefficient is 0.148 (p-value < 0.001), again as predicted by Proposition 2. These results are similar when we estimate Table 7 using the subsample of all-cash offers only.

Overall, the results of Figure 5 and Table 7 support the proposition that bidders and targets share in the takeover gains anticipated by the stock market and impounded into stock prices during the runup period.

4 Premium effects of shocks to target runups

In this section we examine the effect on the runup and the offer premium of target stock price shocks during the runup period using two instruments. The first is represented by significant block trades in the target shares. The second is the market return over the runup period, which affects the target stand-alone value. The empirical effects of these instruments complement the analysis in Section 3 above in terms of examining the hypothesis that target runups reflect deal anticipation, and whether runups are costly for bidders.

4.1 Target share block trades (toehold purchases)

We identify toehold purchases using the "acquisitions of partial interest" data item in SDC, where the buyer seeks to own less than 50% of the target shares. As shown in Table 8, over the six months preceding bid announcement [-126,0], the initial control bidders in our sample acquire a total of 136 toeholds in 122 unique target firms. Of these stakes, 104 toeholds in 94 different targets are purchased over the 42 trading days leading up to and including the day of the announcement of the initial control bid. Thus, less than 2% of our initial control bidders acquire a toehold in the runup period. The typical toehold acquired by the initial bidder in the runup period is relatively large, with a mean of 12% (median 9%).[23]

We also collect toehold purchases by rival control bidders (appearing later in the contest) and other investors. As it turns out, rival bidders acquire a toehold in the runup period for only 3 target firms. The average size of these rival short-term toeholds are 7%. Other investors, not bidding for control in the contest, acquire toeholds in 73 target firms (1% of target firms) during the 42 days preceding the control bid. The announcement of 21% (18 of 85) of these toeholds coincide with the announcement of the initial control bid, suggesting that rumors may trigger toehold purchases by other investors.

[23]Evidence of toeholds is also presented in Betton and Eckbo (2000) and Betton, Eckbo, and Thorburn (2009). However, those papers do not single out toeholds purchased in the runup period. The timing of the toehold purchase during the runup period is important for its ability to generate takeover rumors. We find that two-thirds of the initial control bidders' toehold acquisitions in the runup period are announced on the day of or the day before the initial control bid [-1,0]. Since the SEC allows investors ten days to file a 13(d), these toeholds have most likely been purchased sometime within the 10-day period preceding and including the offer announcement day. For these cases, the target stock-price runup does not contain information from a public Schedule 13(d) disclosure (but will of course still reflect any market microstructure impact of the trades). The remaining short-term toeholds are all traded and disclosed in the runup period.

Columns 1 and 2 of Table 9 report results of regressions with the target net runup as dependent variable. These regressions test for the impact of toehold acquisitions in the runup period, and whether this impact in turn affects offer premiums (markup effects). The dummy variables *Stake bidder* and *Stake other* indicate toehold purchases by the initial control bidder and any other bidder (including rivals), respectively, in the runup window through day 0. The regressions also control for the bidder's total toehold position at the bid (*Toehold size*), which includes toeholds that the bidder has held for longer periods. Notice first that both *Stake bidder* and *Stake other* have a significant and positive impact on the net runup. At the same time, *Toehold size* enters with a negative and significant sign. Thus, only short-term toehold purchases have a positive impact on target runups.[24]

In table 9, *Toehold size* receives a statistically significant and negative coefficient in all four offer premium regressions. That is, as reported elsewhere in the literature (Betton and Eckbo, 2000; Betton, Eckbo, and Thorburn, 2009), bidders with toeholds pay significantly lower premiums. More important for this paper, the two indicators of short-term toehold purchases (*Stake bidder* and *Stake other*) do not affect offer premiums. A consistent explanation is that, while short-term toehold acquisitions tend to increase runups, the negotiating parties identify this toehold effect as endogenous to the takeover process and thus do not mark up the offer in response.[25]

4.2 Market movements over the runup period

Recall that Eq. (10) shows the effect on the markup projection of a stand-alone value change T in the runup period. T is by definition exogenous to the takeover synergies, and thus represents an exogenous shock to the runup. Rearranging Eq. (10):

$$V_P = \frac{1}{\pi}(V_R - T) + T. \tag{19}$$

[24]Several of the other control variables for the target net runup i Table 9 receive significant coefficients. The smaller the target firm (*Target size*, defined as the log of target equity market capitalization) and the greater the relative drop in the target stock price from its 52-week high (52-*week high*, defined as the target stock return from the highest price over the 52 weeks ending on day -43), the higher the runup. Moreover, the runup is higher when the acquirer is publicly traded and in tender offers, and lower for horizontal takeovers. The inclusion of year-fixed effects in the second column does not change any of the results.

[25]Because the toehold purchase decision is endogenous, we developed and tested a Heckman (1979) correction for endogeneity by including the estimated Mill's ratio in Table 9. The coefficient on the Mill's ratio is not statistically significant, and it is therefore not included here. Details are available in Betton, Eckbo, and Thorburn (2008b).

This says that the net runup $V_R - T$ should be unrelated to the surrogates for T, so the one-for-one relation between the offer premium and the surrogates for T should hold in a univariate regression setting.[26] We therefore examine Eq. (19) using the linear regressions reported in Table 9 (again, the variables are as defined in Table 5).

Possible proxies for T include the cumulative market return over the runup period, a CAPM benchmark (beta times the market return), or an industry adjustment. All of these are subject to their own varying degrees of measurement error. However, since any adding back of stand-alone value changes would have to be agreed upon by both the target and the bidder, a simpler measure is probably better. We therefore use the the variable $Market\ runup$—the market return during the runup period—as our proxy for T.[27]

Columns 3–6 in Table 9 show that the coefficient on $Market\ runup$ is highly significant and close to unity in all four offer premium regressions. This is evidence that merger negotiations allow the market-driven portion of the target return to flow through to the target in the form of a higher offer premium—on a virtual one-to-one basis. Also as expected from Eq. (19), the variable $Net\ runup$ (target runup net of the market return) is highly significant when included as an explanatory variable for the offer premium. Inclusion of $Net\ runup$ substantially increases the regression R^2 (from approximately 8% to 34%) but without significantly altering the size of the coefficient on $Market\ runup$.[28]

5 Conclusions

There is growing interest in informational feedback loops from market prices to economic agents, in our case the parties to merger negotiations. Specifically, how do managers of bidder and target firms interpret the significant (on average 10%) target stock price runup typically observed prior to signing the merger agreement? If all parties have rational expectations, do equilibrium target price

[26]In the case where premiums are *not* marked up for changes in stand-alone value, premiums and surrogates for changes in stand-alone value should be uncorrelated while the net markup should be negatively correlated with surrogates for changes in stand-alone value.

[27]We also tried the market-adjusted industry return over the runup period as a candidate surrogate for T. As it turned out, this variable does not add explanatory power to the regressions in Table 9.

[28]The offer premium regressions also show that premiums are decreasing in $Target\ size$ and in 52-$week\ high$, both of which are highly significant. Offer premiums are also higher in tender offers and when the acquirer is publicly traded. The greater offer premiums paid by public over private bidders is also reported by Bargeron, Schlingemann, Stulz, and Zutter (2007).

changes reveal to the bidder and target the magnitude of the two sources of the runup—change in target stand-alone value and expected deal value? Or, does the information in the runup affect the terms of the merger deal, for example, by causing the bidder to "pay twice" by marking up the offer price with the runup (costly feedback loop)? If target runups reflect deal anticipation by the market, what are the implications for *bidder* stock returns? Does the potential for fueling target runups deter bidders from acquiring target shares (toeholds) in the market prior to the deal?

We address all of these issues with a novel theoretical framework and large-scale empirical analysis based on the theory. The theoretical analysis turns out to provide an important correction to the conventional intuition about the relationship between target runups and offer price markups (the surprise effect of the deal announcement) under rational deal anticipation. Moreover, our large-sample results provide significant support for the existence of deal anticipation in target runups and strongly reject the notion that bidders tend to "pay twice" for the target runup. Target runups do not appear to distort the takeover process at the intensive margin.

In our model, where takeovers are driven by shared synergies, the target shares are fairly priced following takeover rumors received by the market (rational deal anticipation). Much of the theoretical insight comes from the reasonable assumption that takeover rumors tend to affect not only the market's perception of the probability of a takeover bid (which is implicit in the conventional intuition) but also of the deal value should a bid take place. With cross-sectional variation in both the takeover probability and the conditional deal value, projections of markups on runups do not have a constant slope, and so cannot be tested using the linear regression approach reported elsewhere in the takeover literature.

Furthermore, in our model, the market receives a takeover signal and learns the magnitude of the target's stand-alone value change over the runup period. The merging partners only sees the target runup, which leads to the question of how they decipher the two sources of the runup. Interestingly, we prove that rational expectations on the part of the negotiating parties implies that the runup fully reveals both sources of the total runup in equilibrium. Thus, in the rational expectations equilibrium (REE), the bidder does not overpay for the target.

We are interested in the portion of the runup driven by deal anticipation (which is unobservable to the econometrician) and use the REE condition to form a best linear unbiased (BLUE) estimator for the positive expected deal value. The estimator recognizes that, for a given runup, targets with more volatile stock returns are more likely to have experienced a stand-alone value change. It is remarkably successful: of the 30% negative target runups in our sample (which, according to our model, must have experienced a negative stand-alone value change over the runup period), only 0.2% remain negative after the empirical adjustment. The rational deal anticipation theory receives particularly strong empirical support—and the costly feedback loop hypothesis is particularly strongly rejected—when we base our tests on the adjusted runups.

The model delivers several additional testable implications nested within the same theoretical framework. For example, the existence of a costly feedback loop implies that the projection of markups on runups is strictly *positive*—and not zero as the previous literature has suggested. Moreover, the rational expectations framework implies a positive correlation between *bidder* takeover gains and *target* runups—hitherto unexplored in the literature. This implication follows naturally from our assumption that bidder and targets share in the total synergy gains from the takeover. Finally, the model predicts that shocks to the target runup which are exogenous to the synergy gains are passed on to the target through a higher offer price.

Our empirical analysis provide significant empirical support for these additional predictions as well. In particular, the data strongly confirms that estimated bidder takeover gains are increasing in target runups, which fails to support that target runups increase bidder takeover costs. Moreover, we study toehold purchase in the runup period, which we show fuel target runups *without* increasing offer premium. Thus, target runups are also unlikely to deter toehold purchases. Finally, we study offer premium effects of exogenous shocks to target runups (exogenous to the takeover synergy gains) which, in our model are passed to the target through higher offer prices without distorting bidder incentives. Our surrogate for such exogenous shocks is the market return over the runup period, which we show increases the offer premium almost one for one.

A Appendix

A.1 Proof of Proposition 3

The proof has two steps. We first show that $\frac{dV_R^*}{ds} > 0$, where V_R^* is defined in equation (11). Second, we show that the markup $V_P^* - V_R^*$ is positive and monotone in V_R^*. The derivative of V_R^* is:

$$\frac{dV_R^*}{ds} = \frac{E(B)}{(1-\pi^*)^2}\frac{d\pi^*}{ds} + \frac{\pi^*}{1-\pi^*}\frac{dE(B)}{ds}. \tag{20}$$

The second term in (20) is positive by assumption. Thus, $\frac{dV_R^*}{ds} > 0$ if $\frac{d\pi^*}{ds} > 0$. Using Leibnitz rule,

$$\frac{d\pi^*}{ds} = \int_{K^*}^{\infty} g'(S|s)dS - g(K^*)\frac{dK^*}{ds}. \tag{21}$$

Since the first term in (21) cannot be negative, $\frac{d\pi^*}{ds} > 0$ if $\frac{dK^*}{ds} > 0$ and the second term is smaller than the first term. Rational bidding implies that $\frac{dK^*}{ds}$ has the same sign as $\frac{dV_R^*}{ds}$.[29] But this implication is violated if $\frac{dV_R^*}{ds} < 0$: for $\frac{dV_R^*}{ds}$ to be negative, $\frac{d\pi^*}{ds}$ must also be negative, which means that the second term in (21) must be large enough to outweigh the first term. However, this requires $\frac{dK^*}{ds} > 0$, which contradicts rational bidding when $\frac{dV_R^*}{ds} < 0$. With $\frac{dV_R^*}{ds} > 0$ there is no contradiction.[30] The proof is complete when we also show that $\frac{d(V_P^*-V_R^*)}{ds} > 0$. For this we use Eq. (3), which as a general implication of market rationality must also hold for the case with a runup transfer. Finally, by inspection of Eq. (12), $V_P^* - V_R^*$ is increasing in s.

A.2 Proof of Proposition 4

For part (i) of Proposition 4, recall that we have assumed that, if a bid is made, the bidder and target share in the synergy gains ($0 < \theta < 1$), implying $0 < \frac{dB}{dS} < 1$. It follows immediately that both the bidder and target gains increase in S throughout the entire range of S wherein bids are possible. This includes ranges over which bids are certain given the signal, s.[31]

[29] $\frac{dK^*}{ds}$ measures the change in the lower limit on bidder takeover benefits caused by an increase in the runup transfer V_R^*. If s increases V_R^*, it must also increase K^*.

[30] $\frac{dV_R^*}{ds} > 0$ when $\frac{d\pi^*}{ds} > 0$, $\frac{dK^*}{ds} > 0$, and the second term in (21) is smaller than the first term.

[31] In the case of our closed form example with the uniform distribution used above, write out the target gain, $B = (1-\theta)S - (1-\gamma)C$, and the bidder gain, $G = \theta S - \gamma C$. Clearly, both B and G are increasing (and linear) in S. In the example, and measuring $Cov(G, B)$ as the product of the derivatives of G and B w.r.t. S, $Cov(G, B) = \theta(1-\theta)$. This means that the expected "slope coefficient" of a projection of G on B equals $\theta/(1-\theta)$.

To prove the rest of Proposition 4 it is necessary to work with the conditional distribution of s given S, which we denote $f(s|S)$. Knowledge of $f(s|S)$ is required to determine the expected value of the runup for a given observed S, revealed when the bid is made. When S is revealed through the bid, s is random in the sense that many signals could have been received prior to the revelation of S.

In part (ii) of Proposition 4, the covariance between the target runup and the bidder gains is the covariance between the expected runup, at a given S, and the bidder gains, at the same S. This covariance is measured by the product of derivatives so it suffices to show that the derivative of the expected runup is always positive to prove the second part of the proposition. To prove the last part (iii) of the proposition, it must be shown that the derivative of the markup is not always less than $1-\theta$ for all S.

While proof of parts (ii) and (iii) can be generalized, we focus on the case where the prior distribution of S is diffuse and the posterior distribution of S, given s is uniform (our closed-form example). With diffuse prior, the law of inverse probability implies that $f(s|S)$ is proportional to the posterior distribution of S given s, or $f(s|S) \sim U(S-\Delta,\ S+\Delta)$. We now have

$$E(V_R) \propto \int_{S-\Delta}^{S+\Delta} V_R(s) f(s|S) ds \tag{22}$$

Since $f(s|S)$ is a constant in our case, differentiation by S through Leibnitz rule gives the simple form:

$$\frac{dE(V_R)}{dS} = V_R(S+\Delta) - V_R(S-\Delta) \tag{23}$$

Since V_R is increasing in s, this establishes that the $Cov(G, E(V_R)) > 0$ for all viable bids including bids which are certain.

Part (iii) of Proposition 4 relates to $Cov(G,\ E(V_R))$. Since the target markup equals $B - E(V_R)$, we need to evaluate the sign of the derivative of this difference with respect to S. Define $E[M(S)] = B - E(V_R)$. Applying similar logic,

$$\frac{dE(M)}{dS} = (1-\theta) - [V_R(S+\Delta) - V_R(S-\Delta)] \tag{24}$$

since the second term need not be less than $1-\theta$, the covariance between bidder gain and expected target markup need not be positive in a sample of data drawn over any range of S. Thus, there is no clear covariance between bidder gain and target markup.

A.3 Markup projection under uniform uncertainty

Suppose the posterior distribution of S given s is uniform: $S|s \sim U(s-\Delta,\ s+\Delta)$. The density is $g(S|s) = \frac{1}{s+\Delta-(s-\Delta)} = \frac{1}{2\Delta}$, and the takeover probability is $\pi(s) = Prob[S \geq K] = \frac{s+\Delta-K}{2\Delta}$. Since $B = (1-\theta)S - (1-\gamma)C$, we have that

$$\begin{aligned} V_P &= \frac{1}{\pi(s)} \int_K^{s+\Delta} Bg(S|s)dS \\ &= \frac{2\Delta}{s+\Delta-K} \int_K^{s+\Delta} [(1-\theta)S - (1-\gamma)C] \frac{1}{2\Delta} dS \\ &= \frac{1}{s+\Delta-K} \left\{ \frac{(1-\theta)S^2}{2} - (1-\gamma)CS \right\}_K^{s+\Delta} \\ &= \frac{1}{s+\Delta-K} \left\{ \frac{1-\theta}{2}[s+\Delta-K][s+\Delta+K] - (1-\gamma)C[s+\Delta-K] \right\} \\ &= \frac{1-\theta}{2}(s+\Delta+K) - (1-\gamma)C. \end{aligned} \tag{25}$$

Moreover, $V_R = \pi(s)V_P = \frac{s+\Delta-K}{2\Delta}V_P$. The derivatives with respect to s are (using $K = \frac{\gamma C}{\theta}$):

$$\frac{dV_P}{ds} = \frac{1-\theta}{2} \quad \text{and} \quad \frac{dV_R}{ds} = \frac{(1-\theta)(s+\Delta) - (1-\gamma)C}{2\Delta}. \tag{26}$$

Over the range where the bid is uncertain (when some values of S given s are below K):

$$\frac{d[V_P - V_R]/ds}{dV_R/ds} = \frac{-(1-\theta)s + (1-\gamma)C}{(1-\theta)(s+\Delta) - (1-\gamma)C}, \tag{27}$$

which is a function of s (nonlinearity). The ratio in equation (27) contains the parameters θ, γ and C, which determine the sharing of synergies net of bidding costs. Finally, define $k \equiv (1-\gamma)C$ and $q \equiv 1-\theta$. The second derivative of the markup projection (the derivative of (27) with respect to s) is $\frac{-q^2\Delta}{[q(s+\Delta)-k]^2} < 0$, i.e., the markup projection has a maximum.

A.4 Revelation of T under uniform ucertainty

We illustrate how the target stand-alone value change T and the synergy signal s are revealed through the equilibrium market pricing process with a simple exmple. Suppose market expectations of S are diffuse before observing the signal and that, after observing s and T, S is distributed conditionally uniform: $S|s \sim U(s-\Delta,\ s+\Delta)$ with $\Delta = 0.2$. Also, prior to observing the runup, it is common knowledge that the bidder and target believe that T is distributed uniform with mean zero and range ± 0.1. Finally, the following parameters are know to all: $C = 0.05$, $\gamma = 1$, and $\theta = 0.5$ (so the target benefit is $B = 0.5S$, and the bid threshold is $K = \frac{\gamma}{\theta}C = 0.1S$).

Recall from Eq. (6) that the market computes the following runup after observing s and T:

$$V_{RT} = T + \pi[B(s) - T + E(T|V_{RT})] \tag{28}$$

where $B(s) \equiv E[B(S|s)]$ is the market's expectation of the target takeover benefit, and $E(T|V_{RT})$ is the bidder and target expectation of T conditional on observing the runup. Moreover, the bidder and target, who know S, estimate s and T after observing V_{RT} (Eq. 7 in the text):

$$V_{RT} = E(T|V_{RT}) + E[\pi B(s)|V_{RT}].$$

Suppose investors observe $s = 0.2$ and $T = 0.05$, which implies $B(s) = \theta(S|s) = (0.5)(0.2) = 0.1$ and

$$\pi = Prob[S \geq K] = \frac{s + \Delta - K}{2\Delta} = (0.2 + 0.2 - 0.1)/0.4 = 0.75.$$

Thus, with perfect revelation of T and s, the (equilibrium) runup would be $V_{RT} = T + \pi B(s) = 0.05 + 0.75(0.1) = 0.125$.

However, the market would compute V_{RT} based on $E(T) = 0$ to arrive at a runup of $V_{RT} = 0.05 + 0.75[0.1 - 0.05 + 0] = 0.0875$. As seen by the target and bidder firms, this particular V_{RT} could be achieved with a continuum of T, s pairs, given $E(T) = 0$. Using Eq. (28), the merger partners can infer a set of compatible T, s pairs by expressing T as a finction of s::

$$\begin{aligned}
V_{RT} &= T + \pi[B(s) - T + 0] \\
0.0875 &= T + \frac{s+0.1}{0.4}(0.5s - T) \\
T &= (0.0875 - \frac{s+0.1}{0.4}0.5s)/(1 - \frac{s+0.1}{0.4}). \qquad (29)
\end{aligned}$$

The merger partners can see from Eq. (29), that V_{RT} imposes a particular density (pdf) on T that must be consistent with their pdf on s, whatever that might be. They will either revise their expectations of T or rule out all T not equal to zero (admitting that another T is correct would imply irrational expectations).

To complete the example, suppose the merging partners believe that the only feasible s lie in the range from 0 to 0.2. Then this rules out any T other than those in the range 0.05 to 0.1167, causing the merging partners to revise their expectations of T to within this range. Suppose they pick the average of the high and low, which is 0.08333. To be consistent with this expectation, the market will set V_{RT} using Eq. (28) and generate $V_{RT} = 0.05 + 0.75(0.1 - 0.05 + 0.08333) = 0.15$. This new runup revises the bidder and target line relating s and T:

$$T = [0.15 - \frac{s+0.1}{0.4}(0.5s + 0.08333)]/(1 - \frac{s+0.1}{0.4}). \qquad (30)$$

On this line, the point $T = .08333$ is feasible and consistent with an $s = 0.1863$. Had investors actually observed $s = 0.1863$, however, they must have also seen $T = 0.0733$. Otherwise, the first iteration would not have led to $V_{RT} = 0.0875$. Rational targets and bidders should then revise their expectation of T toward 0.0733.

Indeed, the merging partners can infer T and s exactly by finding the T, s pair that simultaneously solves Eq (29) and Eq. (30). If there is more than one solution, another iteration would be required until the unique T, s pair reveals itself. In our example there is only one solution to Eq. (29) = Eq. (30). That solution is $s = 0.2$ which implies $T = 0.5$.

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Figure 1
Percent average target runup, markup and total offer premium in event time.

The figure plots the percent average target abnormal (market risk adjusted) stock return over the runup period (day -42 through day -2) and the announcement period (day -1 through day 1) for the total sample of 6,150 U.S. public targets (1980-2008).

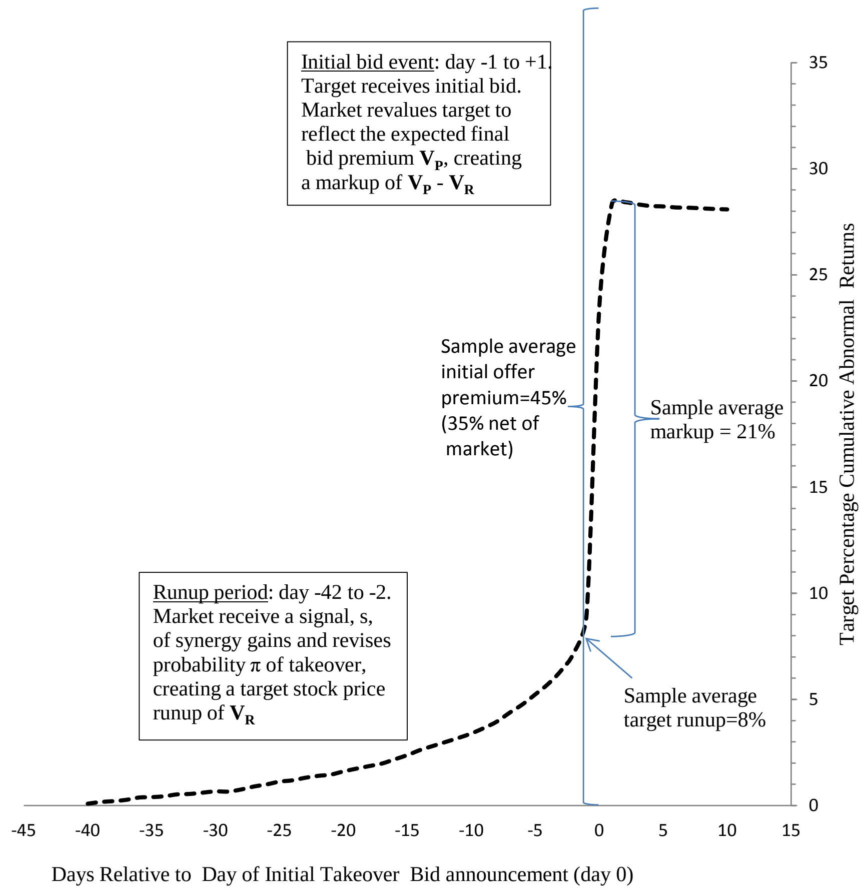


Figure 2

Target valuation changes and markup projection under rational deal anticipation.

The market receives a synergy signal (rumor) s in the runup period. V_R is the target runup conditional on s, V_P is the expected final offer price, $V_P - V_R$ is the markup, and π is the probability of a takeover given s. The uncertainty in the synergy S given s has a normal distribution. The takeover benefit function has target and bidder equally sharing synergy gains ($\theta = 0.5$), while bidder bears the bid cost ($C = 0.3$ and $\gamma = 1$). Panel B plots the corresponding markup projection

$$V_P - V_R = \frac{1-\pi}{\pi} V_R,$$

after transforming the horizontal axis from the signal s to the target runup. The exact functional forms are found in Appendix A.3 for the case of uniform posteriors for S.

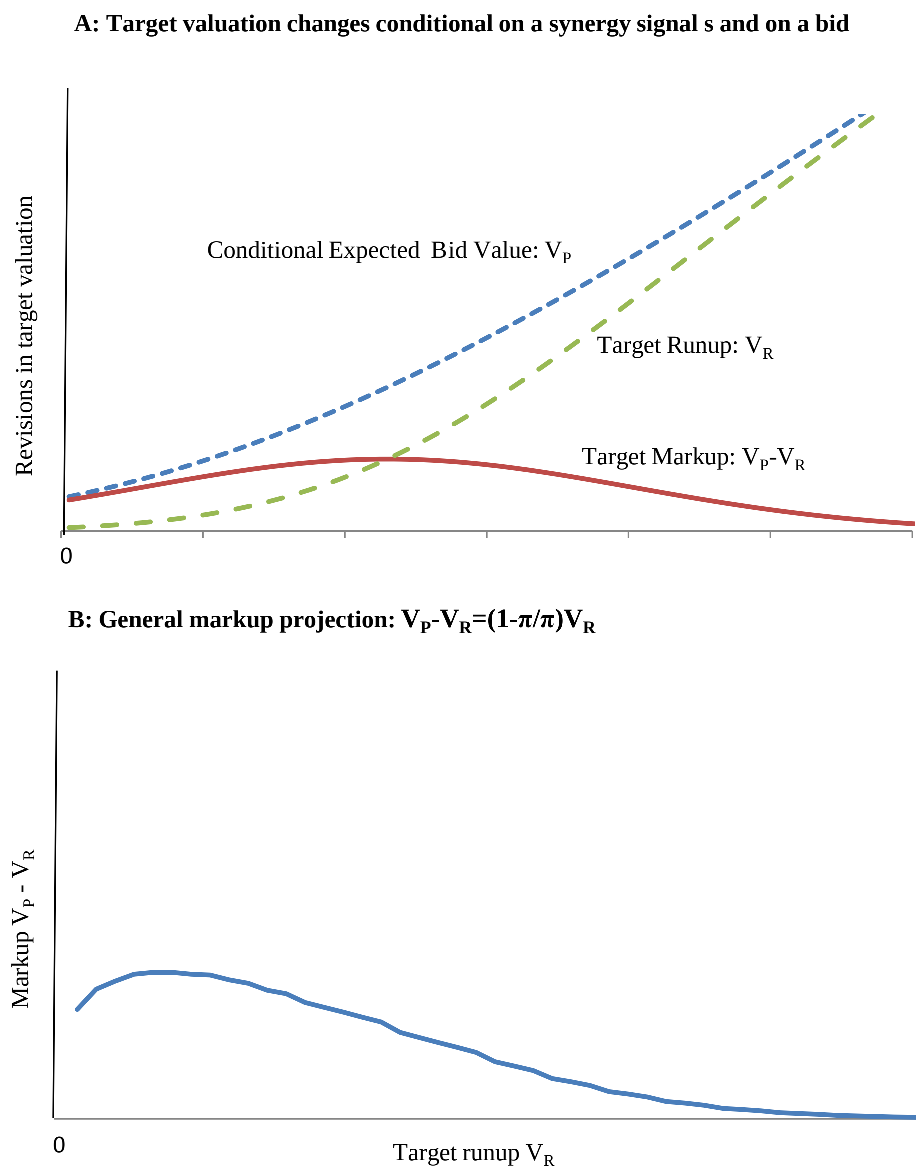
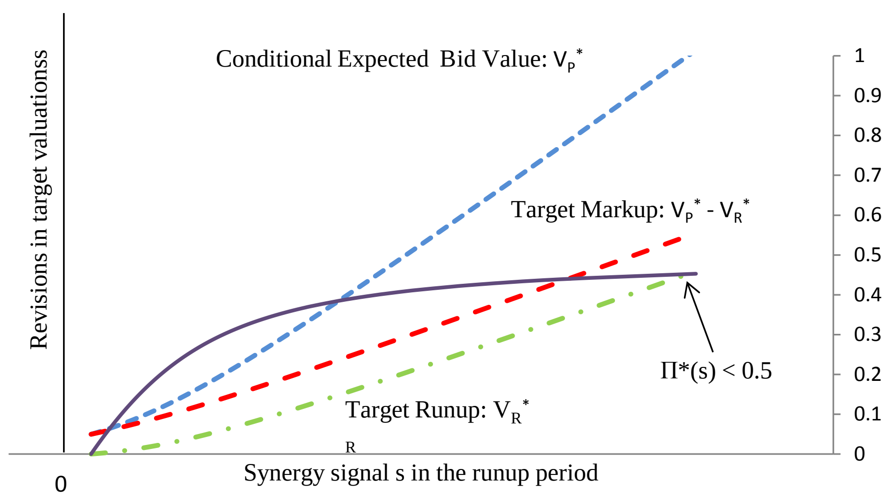


Figure 3
Markup projections with costly feedback loop (runup transferred to target).

In this illustration, the synergy S is distributed uniform around the signal s with $\theta = 0.5$ and $\gamma = 1$. Bidding cost are $C = 1$ and the uncertainty in S is $\Delta = 4$. Including V_R in the bid lowers the conditional probability of a takeover (shown in the right-side vertical axis of Panel A) as it eliminates relatively low-synergy takeovers from the sample, and this probability converges to $\theta = 0.5$. Panel B shows the projection of the markup on the runup corresponding to Panel A.

A: Target valuation changes with transfer of runup to target



B: Projection of V_p*-V_R* on V_R* with transfer of runup to target

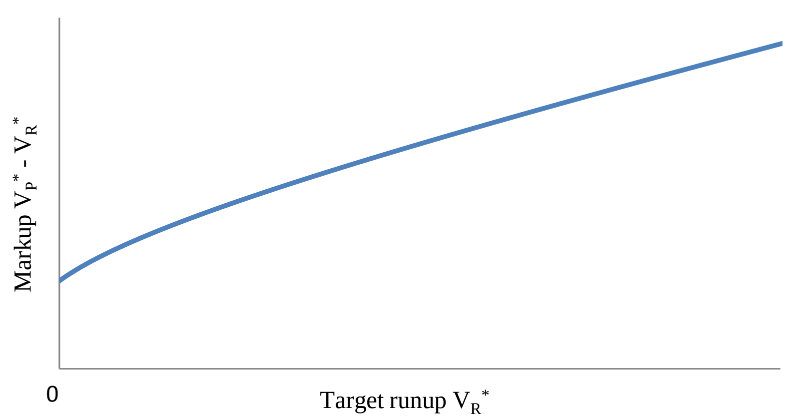


Figure 4
Markup projections for the total sample of 6,150 bids, 1980-2008.

The markup is measured as $\frac{OP}{P_{-2}} - 1$, where OP is the offer price and P_{-2} is the target stock price on day -2 relative to the first offer announcement date, and the runup is $\frac{P_{-2}}{P_{-42}} - 1$. The form in Eq. (14) is used to contrast best linear fit with best monotone and best flexible fit.

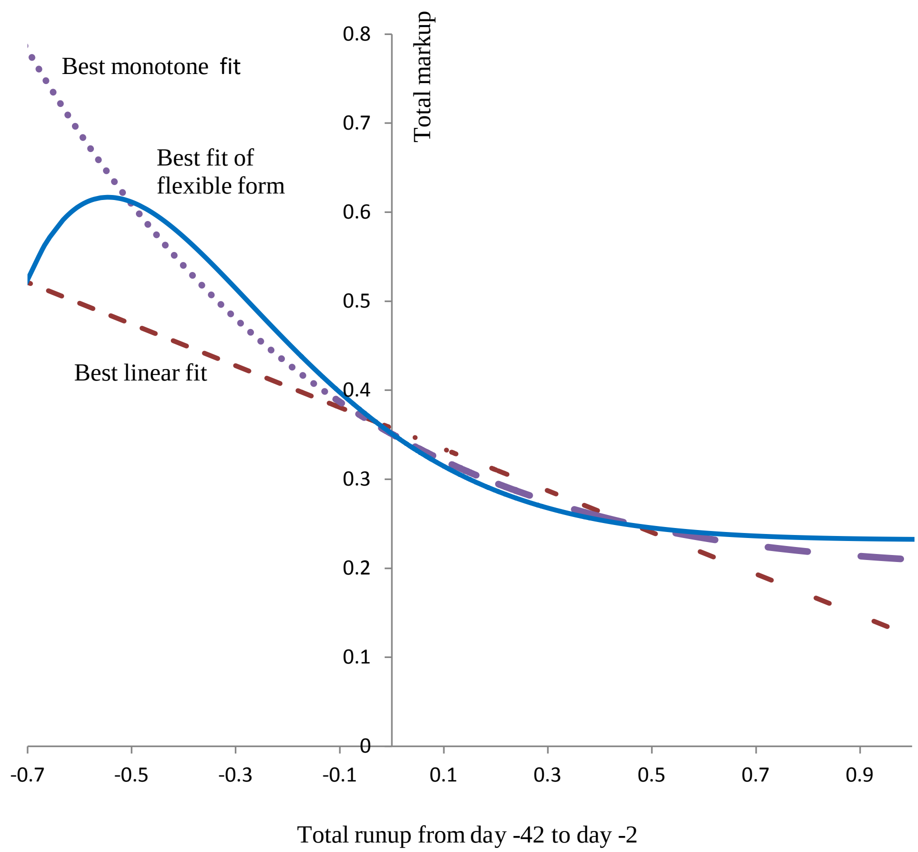


Figure 5
Projections of bidder gains on target runups for 3,689 of public bidders, 1980-2008.

Bidder takeover gains (ν_P) is measured as $BCAR(-42,1)$ relative to the first announcement date of the offer. The target runup is $\frac{P_{-2}}{P_{-42}} - 1$, where P_{-2} is the target stock price on day -2 relative to the first offer announcement date. The form in Eq. (14) is used to contrast linear fit with best fit. A likelihood-ratio (goodness-of-fit) test rejects linearity in favor of a nonlinear form in the data.

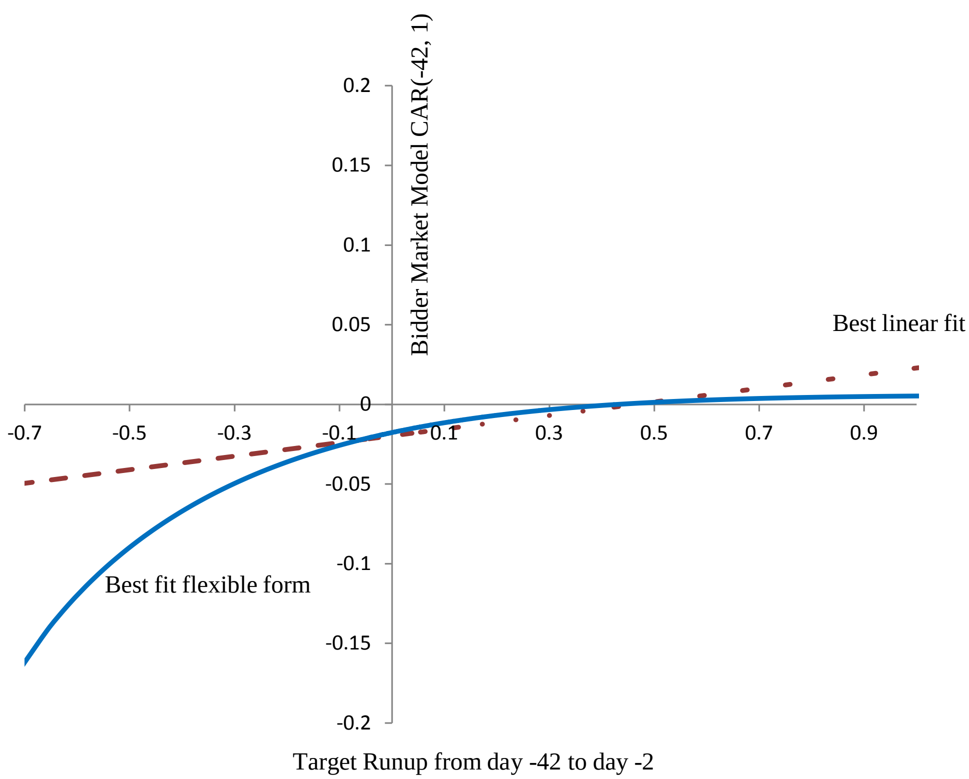


Table 1
Summary of models and empirical predictions

This table shows the main empirical predictions of the deal anticipation theory developed in Section 2. For notational simplicity, we suppress subscript T in the target runup (so V_R includes the target's stand-alone value change T, if present). Moreover, $V_P - V_R$ is the total markup, where V_P is the target deal value. The estimation also includes a number of control variables which are not shown here (defined in Table 5). The tests are performed on a total sample of 6,150 publicly traded U.S. targets, 1980-2008.

Economic model	**Econometric model**	**Predictions**
A. Propositions 1 and 2—deal anticipation in runups (markup projection is nonlinear)		
$V_P - V_R = \frac{1-\pi}{\pi} V_R$	$V_P - V_R = \Lambda(V_R)$	Goodness-of-fit tests against linearity[a]
	$V_P - V_R = a + bV_R + e$	Linear slope b strictly greater than -1[b]
		Correction for cross-sectional variation in T
		Robustness of the estimate of V_R and V_P
B. Proposition 3—deal anticipation with costly feedback loop (markup projection is positive)		
$V_P^* - V_R^* = E[B\|s, bid]$	$V_P - V_R = a + bV_R + e$	Slope b is positive everywhere: $b > 0$[c]
C. Proposition 4—deal anticipation and rational bidding (bidder gains $G > 0$)		
$Cov(G,\ V_R) > 0$	$\nu_P = a + bV_R + e$	ν_P is an estimate of G: $b > 0$[d]
D. Other nested hypotheses—offer premium effects of shocks to target runup		
$V_P = \frac{1-\pi}{\pi}(V_R - T) + T$	$V_P = a + b(V_R - R_M) + cR_M + e$	Market return R_M creates T: $b, c > 0$
	$V_R = a + b\alpha + e$	Toehold purchase of α fuels runup: $b > 0$
	$V_P = a + bV_R + c\alpha + e$	Costly feedback: $b, c > 0$

[a] $\Lambda(v, w)$ denotes the beta-function which is used below to identify the (possibly nonlinear) shape of the markup function.
[b] With deal anticipation (nonlinearity), the linear slope coefficient is an average across the data and must be strictly greater than -1. The linear slope under deal anticipation may otherwise be negative, zero or positive.
[c] The markup projection is nonlinear but strictly increasing in the runup. Thus, evidence of a zero or negative linear regression slope rejects the costly feedback hypothesis.
[d] Value-destroying bidding implies $b < 0$.

Table 2
Sample selection

Description of the sample selection process. An initial bid is the first control bid for the target in 126 trading days (six months). Bids are grouped into takeover contests, which end when there are no new control bids for the target in 126 trading days. All stock prices p_i are adjusted for splits and dividends, where i is the trading day relative to the date of announcement (day 0).

Selection criteria	Source	Number of exclusions	Sample size
All initial control bids in SDC (FORMC = M, AM) for US public targets during the period 1/1980-12/2008	SDC		13,893
Bidder owns <50% of the target shares at the time of the bid	SDC	46	13,847
Target firm has at least 100 days of common stock returns in CRSP over the estimation period (day -297 to -43) and is listed on NYSE, AMEX or NASDAQ	CRSP	4,138	9,109
Deal value > $10 million	SDC	1,816	7,293
Target stock price on day -42 > $1	CRSP	191	7,102
Offer price available	SDC	239	6,863
Target stock price on day -2 available	CRSP	6	6,857
Target announcement returns [-1,1] available	CRSP	119	6,738
Information on outcome and ending date of contest available	SDC	324	6,414
Contest shorter than 252 trading days	SDC	264	6,150
Final sample			6,150

Table 3
Sample size, offer premium, markup, and runup, by year

The table shows the mean and median offer premium, markup, target stock-price runup and net runup for the sample of 6,150 initial control bids for U.S. publicly traded target firms in 1980-2008. The premium is $(OP/P_{-42}) - 1$, where OP is the price per share offered by the initial control bidder and P_i is the target stock price on trading day i relative to the takeover announcement date ($i = 0$), adjusted for splits and dividends. The markup is $(OP/P_{-2}) - 1$, the runup is $(P_{-2}/P_{-42}) - 1$ and and the net runup is $(P_{-2}/P_{-42}) - (M_{-2}/M_{-42})$, where M_i is the value of the equal-weighted market portfolio on day i.

	Sample size	Offer premium $\frac{OP}{P_{-42}} - 1$		Markup $\frac{OP}{P_{-2}} - 1$		Runup $\frac{P_{-2}}{P_{-42}} - 1$		Net runup $\frac{P_{-2}}{P_{-42}} - \frac{M_{-2}}{M_{-42}}$	
Year	N	mean	median	mean	median	mean	median	mean	median
1980	10	0.70	0.69	0.53	0.34	0.15	0.19	0.10	0.12
1981	35	0.60	0.48	0.40	0.36	0.15	0.13	0.16	0.14
1982	48	0.53	0.48	0.34	0.32	0.15	0.10	0.13	0.09
1983	58	0.49	0.50	0.33	0.35	0.12	0.12	0.10	0.08
1984	115	0.51	0.43	0.45	0.32	0.07	0.05	0.06	0.06
1985	161	0.40	0.34	0.26	0.22	0.11	0.10	0.08	0.06
1986	209	0.40	0.36	0.26	0.23	0.12	0.09	0.08	0.06
1987	202	0.39	0.36	0.32	0.25	0.07	0.07	0.06	0.03
1988	270	0.56	0.47	0.35	0.29	0.15	0.10	0.12	0.08
1989	194	0.54	0.43	0.39	0.30	0.11	0.07	0.07	0.03
1990	103	0.53	0.49	0.49	0.41	0.05	-0.00	0.05	-0.01
1991	91	0.55	0.46	0.40	0.33	0.12	0.09	0.08	0.05
1992	106	0.57	0.51	0.40	0.35	0.13	0.08	0.11	0.08
1993	146	0.48	0.43	0.36	0.33	0.10	0.07	0.08	0.05
1994	228	0.44	0.42	0.34	0.31	0.08	0.07	0.07	0.07
1995	290	0.47	0.39	0.33	0.27	0.11	0.09	0.06	0.04
1996	319	0.40	0.37	0.27	0.24	0.11	0.07	0.07	0.04
1997	434	0.41	0.38	0.26	0.23	0.13	0.12	0.09	0.08
1998	465	0.46	0.37	0.37	0.26	0.08	0.07	0.05	0.03
1999	496	0.55	0.45	0.37	0.30	0.15	0.11	0.12	0.08
2000	415	0.53	0.45	0.38	0.34	0.13	0.06	0.12	0.08
2001	270	0.55	0.46	0.40	0.34	0.11	0.08	0.12	0.09
2002	154	0.52	0.36	0.42	0.32	0.09	0.03	0.12	0.06
2003	189	0.47	0.34	0.30	0.23	0.13	0.08	0.09	0.05
2004	195	0.30	0.26	0.24	0.21	0.06	0.04	0.03	0.02
2005	230	0.30	0.27	0.25	0.21	0.05	0.04	0.04	0.03
2006	258	0.31	0.27	0.25	0.21	0.05	0.03	0.03	0.02
2007	284	0.31	0.28	0.29	0.23	0.02	0.02	0.00	0.00
2008	175	0.34	0.30	0.40	0.34	-0.04	-0.04	0.01	0.00
Total	6,150	0.45	0.38	0.33	0.27	0.10	0.07	0.08	0.05

Table 4
Projections of markups ($V_P - V_R$) on runups (V_R)

Rational deal anticipation implies [Eq. (3)]:

$$V_P - V_R = \frac{1-\pi}{\pi} V_R,$$

where π is the probability of a takeover bid conditional on the synergy signal s in the runup period. The nonlinear projection is

$$V_P - V_R = a + b\frac{(V_R - min)^{(v-1)}(max - V_R)^{w-1}}{\Lambda(v,w)(max - min)^{v+w-1}} + \epsilon,$$

where $\Lambda(v,w)$ is the beta distribution with shape parameters v and w, max and min are respectively the maximum and minimum V_R in the data, a is an overall intercept, b is a scale parameter, and ϵ is a residual error term. When constraining the shape to be linear, the model delivers OLS estimates of a and b, which are reported below. LR is the likelihood ratio test statistic, distributed $\chi^2(d)$. $LR1$ tests nonlinearity against linearity ($d = 2$, 1% critical value 9.2). $LR2$ tests monotonicity against linearity ($d = 1$, critical value 6.6). $LR3 \equiv LR1 - LR2$ tests nonlinearity against monotonicity ($d = 1$, critical value 6.6). Total sample of 6,150 initial control bids for U.S. public targets.

	Markup measure $V_P - V_R$	Runup measure V_R	Linear projection	$LR1$	$LR2$	LR3
(1)	Total markup $\frac{OP}{P_{-2}} - 1$	Total runup $\frac{P_{-2}}{P_{-42}} - 1$	$a = 0.36$ $b = -0.24$ ($t = -11.9$)	98.1 (p<0.001)	38.4 (p<0.001)	59.7 (p<0.001)
(2)	Total markup $\frac{OP}{P_{-2}} - 1$	Adjusted runup[a] $(1-\beta)V_R + \beta E(V_R)$	$a = 0.51$ $b = -1.79$ ($t = -12.1$)	100.9 (p<0.001)	43.8 (p<0.001)	57.1 (p<0.001)
(3)	Expected markup[b] $\pi[\frac{OP}{P_{-2}} - 1]$	Total runup $\frac{P_{-2}}{P_{-42}} - 1$	$a = 0.31$ $b = -0.17$ ($t = -9.5$)	137.1 (p<0.001)	62.2 (p<0.001)	74.9 (p<0.001)
(4)	Residual markup[c] U_P	Augmented runup[d] $(\frac{P_{-2}}{P_{-42}} - 1) + R_0$	$a = 0.36$ $b = -0.21$ ($t = -12.1$)	225.9 (p<0.001)	89.8 (p<0.001)	136.1 (p<0.001)
(5)	Market Model[e] $CAR(-1,1)$	Market Model[c] $CAR(-42,-2)$	$a = 0.22$ $b = -0.09$ ($t = -6.7$)	18.6 (p<0.001)	16.8 (p<0.001)	1.8 (p=0.180)

[a] This projection uses the runup adjusted for the cross-sectional variation in target stand-alone value (equation 16 in the text). V_R is the total runup in model (1), and the average β used to adjust V_R is 0.873, with a max (min) of 0.973 (0.850), respectively. See the text for details of the estimation of adjustment parameter β.

[b] This projection is for the subsample with available data on the target–, bidder– and deal characteristics used to estimate the probability π of bid success in Table 6. The projection includes the effect of these variables by multiplying the total markup with the estimated value of π.

[c] Residual markup, U_P, is the residual from the projection of the total markup, $\frac{OP}{P_{-2}} - 1$, on the deal characteristics used to estimate the success probability π in Table 6, excluding *Positive toehold*, *Toehold size*, and $52 - week\ high$ which are used to construct the augmented runup. Variable definitions are in Table 5.

[d] The enhancement R_0 in the augmented runup adds back into the runup the effect of information that the market might use to anticipate possible takeover activity *prior* to the runup period. R_0 is the projection of the total runup $(\frac{P_{-2}}{P_{-42}} - 1)$ on the deal characteristics *Positive toehold*, *Toehold size*, and the negative value of $52 - week\ high$, all of which may affect the prior probability of a takeover (prior to the runup period). The augmented runup is the total runup plus R_0. Variable definitions are in Table 5.

[e] Target cumulative abnormal stock returns (CAR) are computed using the estimated Market Model parameters: $r_{it} = \alpha_i + \beta_i r_{mt} + u_{it}$, where r_{it} and r_{mt} are the daily returns on stock i and the value-weighted market portfolio, and u_{it} is a residual error term. The estimation period is from day -297 to day -43 relative to the day of the announcement of the initial bid.

Table 5
Variable definitions

Variable definitions. All stock prices P_i are adjusted for splits and dividends, where i is the trading day relative to the date of announcement ($i = 0$), and, if missing, replaced by the midpoint of the bid/ask spread.

Variable	Definition	Source
A. Target characteristics		
Target size	Natural logarithm of the target market capitalization in $ billion on day -42	CRSP
Relative size	Ratio of target market capitalization to bidder market capitalization on day -42	CRSP
NYSE/Amex	The target is listed on NYSE or Amex vs. NASDAQ (dummy)	CRSP
Turnover	Average daily ratio of trading volume to total shares outstanding over the 52 weeks ending on day -43	CRSP
Poison pill	The target has a poison pill (dummy)	SDC
52-week high	Change in the target stock price from the highest price P_{high} over the 52-weeks ending on day -43, $P_{-42}/P_{high} - 1$	CRSP
B. Bidder characteristics		
Toehold	The acquirer owns shares in the target when announcing the bid (dummy)	SDC
Toehold size	Percent target shares owned by the acquirer when announcing the bid	SDC
Stake bidder	The initial bidder buys a small equity stake in the target during the runup period through day 0 (dummy)	SDC
Stake other	Another investor buys a small equity stake in the target during the runup period through day 0 (dummy)	SDC
Acquirer public	The acquirer is publicly traded (dummy)	SDC
Horizontal	The bidder and the target has the same primary 4-digit SIC code (dummy)	SDC
>20% new equity	The consideration includes a stock portion which exceeds 20% of the acquirer's shares outstanding (dummy)	SDC
C. Contest characteristics		
Premium	Bid premium defined as $(OP/P_{-42}) - 1$, where OP is the offer price.	SDC,CRSP
Markup	Bid markup defined as $(OP/P_{-2}) - 1$, where OP is the offer price.	SDC,CRSP
Runup	Target raw runup defined as $(P_{-2}/P_{-42}) - 1$	CRSP
Net runup	Target net runup defined as $(P_{-2}/P_{-42}) - (M_{-2}/M_{-42})$, where M_i is the value of the equal-weighted market portfolio on day i.	CRSP
Market runup	Stock-market return during the runup period defined as $M_{-2}/M_{-42} - 1$, where M_i is the value of the equal-weighted market portfolio on day i.	CRSP
Tender offer	The initial bid is a tender offer (dummy)	SDC
All cash	Consideration is cash only (dummy)	SDC
All stock	Consideration is stock only (dummy)	SDC
Hostile	Target management's response is hostile vs. friendly or neutral (dummy)	SDC
Initial bidder wins	The initial bidder wins the contest (dummy)	SDC
1990s	The contest is announced in the period 1990-1999 (dummy)	SDC
2000s	The contest is announced in the period 2000-2008 (dummy)	SDC

Table 6
Probabilities of contest success and the initial control bidder wins

The table shows coefficient estimates from logit regressions for the probability that the contest is successful (columns 1-2) and that the initial control bidder wins (columns 3-6). P-values are in parenthesis. The sample is 6,103 initial control bids for public US targets, 1980-2008, with a complete set of control variables (defined in Table 5).

Dependent variable:	Contest successful		Initial control bidder wins			
Intercept	1.047	0.909	0.657	0.455	0.626	0.437
	(<0.001)	(<0.001)	(<0.001)	(0.005)	(<0.001)	(0.007)
Target characteristics						
Target size	0.137	0.085	0.148	0.094	0.150	0.096
	(<0.001)	(0.005)	(<0.001)	(0.001)	(<0.001)	(0.001)
NYSE/Amex	-0.365	-0.269	-0.435	-0.330	-0.433	-0.329
	(<0.001)	(0.005)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Turnover	-0.017	-0.019	-0.017	-0.019	-0.017	-0.019
	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)
Poison pill	-0.578	-0.513	-0.506	-0.436	-0.406	-0.341
	(0.028)	(0.053)	(0.063)	(0.114)	(0.138)	(0.219)
$52-week\ high$	1.022	1.255	0.864	1.117	0.868	1.120
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Bidder characteristics						
Toehold	-0.819	-0.688	-0.978	-0.833	-1.589	-1.419
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Toehold size					0.039	0.038
					(<0.001)	(<0.001)
Acquirer public	0.833	0.804	0.938	0.900	0.952	0.915
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Horizontal	0.248	0.211	0.276	0.226	0.281	0.232
	(0.020)	(0.050)	(0.006)	(0.025)	(0.005)	(0.022)
$>20\%\ new\ equity$	-0.585	-0.577	-0.531	-0.522	-0.536	-0.526
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Premium	0.343	0.371	0.334	0.365	0.350	0.380
	(0.001)	(<0.001)	(0.001)	(<0.001)	(<0.001)	(<0.001)
Deal characteristics						
Tender offer	2.173	2.307	1.912	2.053	1.945	2.085
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Cash	-0.148	-0.276	-0.105	-0.224	-0.114	-0.236
	(0.119)	(0.005)	(0.236)	(0.014)	(0.199)	(0.010)
Hostile	-2.264	-2.149	-3.086	-2.980	-2.994	-2.893
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
$1990s$		0.435		0.566		0.548
		(<0.001)		(<0.001)		(<0.001)
$2000s$		0.775		0.824		0.816
		(<0.001)		(<0.001)		(<0.001)
Pseudo-R^2 (Nagelkerke)	0.208	0.219	0.263	0.276	0.269	0.281
χ^2	755.1	795.8	1074.0	1129.3	1098.5	1151.8

Table 7
Effect of target runups (V_R) on bidder takeover gains (ν_P)

The table shows OLS estimates of parameters in linear cross-sectional regressions with bidder cumulative abnormal returns $\nu_P = BCAR(-42, +1)$ as dependent variable. The p-values (in parenthesis) use White (1980)'s heteroscedasticity-consistent standard errors. Total sample of initial control bids by U.S. public bidders, 1980-2008.

	Regression model					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.014 (<0.001)	-0.009 (0.215)	-0.016 (<0.001)	-0.011 (0.147)	-0.019 (<0.001)	-0.020 (<0.001)
Total Target Runup $V_R = \frac{P_{-2}}{P_{-42}} - 1$	0.046 (0.008)	0.049 (0.005)				
Net Target Runup[a] $V_R = \frac{P_{-2}}{P_{-42}} - \frac{M_{-2}}{M_{-42}}$			0.074 (<0.001)	0.077 (<0.001)		
Augmented Target Runup[b] $V_R = (\frac{P_{-2}}{P_{-42}} - 1) + R_0$					0.046 (0.009)	
Market Model Target Runup[c] $V_R = CAR(-42, 2)$						0.148 (<0.001)
1999-2000 period indicator	-0.039 (0.001)	-0.033 (0.003)	-0.040 (<0.001)	-0.034 (0.002)	-0.039 (<0.001)	-0.042 (<0.001)
Control variables[d]	no	yes	no	yes	no	no
Adjusted R^2	0.009	0.032	0.014	0.038	0.009	0.040
Sample size, N	3,691	3,689	3,660	3,691	3,624	3,623

[a] $\frac{M_{-2}}{M_{-42}}$ is the return on the equal-weighted market portfolio in the runup period (from day -42 to day -2).
[b] The enhancement R_0 in the augmented runup adds back into the runup the effect of information that the market might use to anticipate possible takeover activity *prior* to the runup period. R_0 is the projection of the total runup $(\frac{P_{-2}}{P_{-42}} - 1)$ on the deal characteristics *Positive toehold*, *Toehold size*, and the negative value of $52-$*week high*, all of which may affect the prior probability of a takeover (prior to the runup period). The augmented runup is the total runup plus R_0. Variable definitions are in table 5.
[c] Target cumulative abnormal stock returns (CAR) are computed using the estimated Market Model parameters: $r_{it} = \alpha + \beta r_{mt} + u_{it}$, where r_{it} and r_{mt} are the daily returns on stock i and the value-weighted market portfolio, and u_{it} is a residual error term. The estimation period is 252 trading days prior to day -42 relative to the day of the announcement of the initial bid.
[d] There are three categories of control variables. (1) Target characteristics: *Relative size*, *NYSE/Amex*, and *Turnover*. (2) Bidder characteristics: *Toeholdsize* and *Horizontal*.(3) Deal characteristics: *All cash*, *All stock*, and *Hostile*. See Table 5 for variable definitions. Of these variables, *Relative size* and *All cash* receive significantly positive coefficients, while *Turnover* receives a significantly negative coefficient. None of the remaining control variables receive coefficients that are significantly different from zero.

Table 8
Description of short-term toehold purchases by bidders and other investors

The table shows toehold acquisitions made by the initial control bidder, a rival control bidder, and other investors. Stake purchases are identified from records of completed partial acquisitions in SDC. The initial control bid is announced on day 0. The sample is 6,150 initial control bids for U.S. publicly traded targets, 1980-2008.

		Target stake announced in window			Total toehold on day 0
		[-126,0]	[-42,0]	[-1,0]	
A: Toehold acquired by initial control bidder					
Number of toehold purchases		136	104	70	
Number of firms in which at least one stake is purchased		122	94	63	648
In percent of target firms		2.0%	1.5%	1.0%	10.5%
Size of toehold (% of target shares) when toehold positive:	mean	12.2%	11.7%	12.7%	15.5%
	median	9.9%	9.3%	9.4%	9.9%
B: Toehold acquired by rival control bidder					
Number of toehold purchases		7	3	1	
Number of firms in which at least one stake is purchased		6	3	1	
In percent of target firms		0.1%	0.05%	0.02%	n/a
Size of toehold (% of target shares) when toehold positive:	mean	9.4%	7.0%	4.9%	
	median	9.1%	6.2%	4.9%	
C: Toehold acquired by other investor					
Number of toehold purchases		235	85	18	
Number of firms in which at least one stake is purchased		196	73	15	
In percent of target firms		3.2%	1.2%	0.2%	n/a
Size of toehold (% of target shares) when toehold positive:	mean	6.8%	8.7%	10.1%	
	median	5.4%	6.3%	7.6%	

Table 9
Premium effects of market runups and of toehold purchases in runup period

The table shows OLS coefficient estimates in regressions with target net runup ($V_R - T$) and the offer premium V_P, respectively, as dependent variables. Market rationality implies [Eq. (19) in the text]:

$$V_P = \frac{1}{\pi}[V_R - T] + T.$$

T is the target stand-alone value change in the runup period (measured here as the market return M_{-2}/M_{-42}), the net runup $V_R - T$ is $(P_{-2}/P_{-42}) - (M_{-2}/M_{-42})$, and the offer premium V_P is $(OP/P_{-42}) - 1$, where P_i is the target stock price and M_i is the value of the equal-weighted market portfolio on trading day i relative to the initial control bid date. OP is the offer price. Sample of 6,100 initial control bids for public US targets, 1980-2008, with a complete set of control variables (defined in Table 5). p-values in parentheses.

Dependent variable:	Target net runup $\frac{P_{-2}}{P_{-42}} - \frac{M_{-2}}{M_{-42}}$		Initial offer premium $\frac{OP}{P_{-42}} - 1$			
Intercept	0.116	0.282	0.616	1.073	0.494	0.778
	(<0.001)	(0.012)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Market runup			0.924	1.054	0.815	0.926
			(<0.001)	(<0.001)	(<0.001)	(<0.001)
Net runup					1.077	1.068
					(<0.001)	(<0.001)
Target characteristics						
Target size	-0.015	-0.012	-0.054	-0.048	-0.039	-0.035
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
NYSE/Amex	0.007	0.003	0.017	0.011	0.010	0.008
	(0.330)	(0.650)	(0.239)	(0.442)	(0.422)	(0.529)
Turnover	0.000	0.000	-0.001	0.000	0.001	0.000
	(0.754)	(0.986)	(0.561)	(0.775)	(0.589)	(0.698)
$52 - week\ high$	-0.042	-0.029	-0.214	-0.175	-0.169	-0.146
	(<0.001)	(0.018)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Bidder characteristics						
Acquirer public	0.032	0.032	0.046	0.052	0.012	0.018
	(<0.001)	(<0.001)	(0.001)	(<0.001)	(0.305)	(0.136)
Horizontal	-0.015	-0.013	-0.009	-0.002	0.007	0.012
	(0.036)	(0.065)	(0.536)	(0.891)	(0.555)	(0.324)
Toehold size	-0.001	-0.002	-0.003	-0.004	-0.002	-0.002
	(0.002)	(<0.001)	(<0.001)	(<0.001)	(0.014)	(0.004)
Stake bidder	0.050	0.056	-0.029	-0.012	-0.082	-0.072
	(0.043)	(0.024)	(0.560)	(0.804)	(0.051)	(0.088)
Stake other	0.125	0.126	0.089	0.093	-0.044	-0.040
	(<0.001)	(<0.001)	(0.100)	(0.084)	(0.340)	(0.382)
Deal characteristics						
Tender offer	0.037	0.028	0.094	0.076	0.055	0.046
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.001)
All cash	-0.009	0.000	-0.024	-0.002	-0.014	-0.001
	(0.209)	(0.948)	(0.112)	(0.914)	(0.278)	(0.949)
All stock	0.003	0.000	-0.005	-0.008	-0.007	-0.008
	(0.725)	(0.976)	(0.755)	(0.631)	(0.600)	(0.578)
Hostile	-0.009	-0.011	-0.005	-0.008	0.005	-0.004
	(0.521)	(0.425)	(0.865)	(0.773)	(0.825)	(0.874)
Year fixed effects	no	yes	no	yes	no	yes
Adjusted R^2	0.025	0.038	0.077	0.092	0.339	0.346
$F - value$	13.1	6.86	37.4	15.7	209.2	76.0