Merger Negotiations with Stock Market Feedback

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Norwegian School of Economics, May 27, 2011

Stock market feedback loops:

> *The notion that economic agents take corrective actions based on information inferred from security price changes*

This notion has been applied in a wide range of contexts:

- Equilibrium analysis
- Using stock price information to regulate firms
- Stock prices and corporate investments
- Withdrawn takeovers and SEOs

Our context is merger negotiations over the offer price

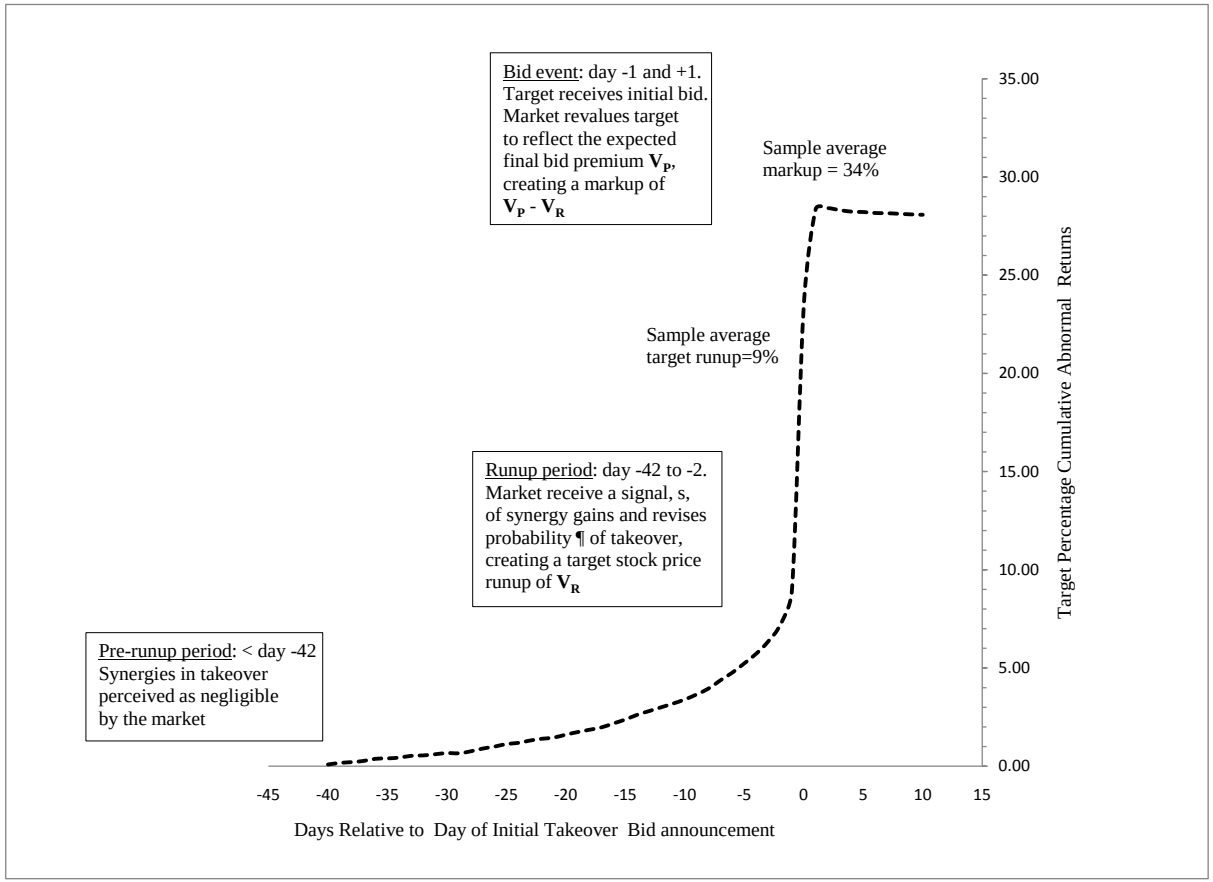
Offer price bargaining:

- Bargaining in the "shadow" of an auction
- Auction theory provide principles for optimal bidding
  - Bid jumps and preemptive bidding
  - Toeholds and overbidding
  - Winners curse adjustment

But takeover process not a standard auction:

- Seller cannot commit to sell
- Stock market pricing may influence bids

Figure 1: Information arrival process in event time.



Our research questions:

Q1: What are rational pricing implications of deal anticipation?

Q2: Do bidders correct the offer price based on target runup?

Q3: Do bidders rationally adjust for runup transfers

Q4: Do toehold acquisitions raise runups and offer premiums?

Early influential work:

Schwert (1996):

- N=1,523 M&As from 1975–1991
- $\textit{Offer premium} = a + b\textit{Runup}$
- Schwert predicts a slope coefficient of 0 under deal anticipation and 1 under "markup pricing"
- $CAR(-41, 126) = 0.156 + 1.075 CAR(-41, -1)$
- *"The evidence...suggests that, all else equal, the [pre-bid target stock price] runup is an added cost to the bidder."*

Schwert's conclusion is puzzling

- Do bidders place no weight on deal anticipation despite market "rumors"?

- What about evidence that target runup is reversed absent a control change?

- What about target incentives to overstate the stand-alone case?

Q: Is Schwert's linear regression framework consistent with rational market pricing under deal anticipation?

Information environment

- Market receives signal s about synergy gains S.
- S known to bidder and target. Market knows only the distribution over S given the signal.
- Negotiations establishes a sharing rule θ for S and γ for bidding cost C.
- Rational bidding threshold: $K = \frac{\gamma C}{\theta}$.
- Target benefit function: $B(S, C)$ $(= 0$ when $S < K)$.
- Prior takeover probability $\pi(0)$ and prior target stock price normalized to zero.

Rational market pricing conditional on the rumor s:

- Target runup prior to the first bid announcement:

$$V_R = \pi(s)E_s[B(S,C)|s,bid] = \int_K^\infty B(S,C)g(S|s)dS \quad (1)$$

- Expected final offer and markup at first bid announcement:

$$V_P = E_s[B(S,C)|s,bid] = \frac{1}{\pi(s)}V_R \quad (2)$$

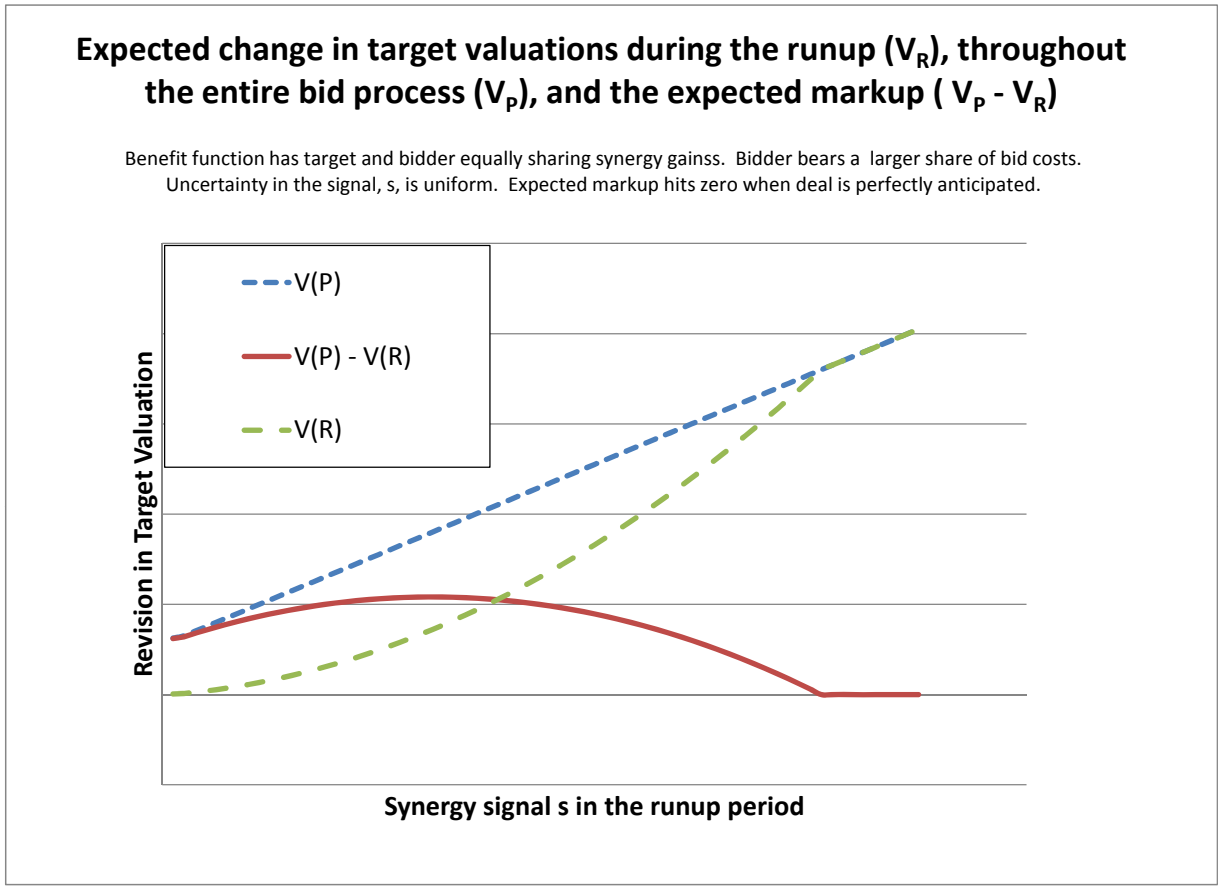
$$V_P - V_R = \frac{1-\pi(s)}{\pi(s)}V_R \quad (3)$$

Deal anticipation:

Proposition 1: *With deal anticipation, the projection of* $V_P - V_R$ *on* V_R *is nonlinear in the signal* s*. Moreover, the degree of non-linearity depends on the sharing of synergy gains, net of bidding costs, between the bidder and the target.*

Lemma 1: *With deal anticipation, and as long as the takeover probability* π *is a function of the synergy gains* S*, a linear projection of* $V_P - V_R$ *on* V_R *yields a slope coefficient that is strictly greater than -1, and the coefficient need not be different from zero.*

Figure 2A: Target revaluations under deal anticipation (uniform).



Betton, Eckbo, Thompson and Thorburn (2011)

Figure 2B: Target valuations under deal anticipation (normal).

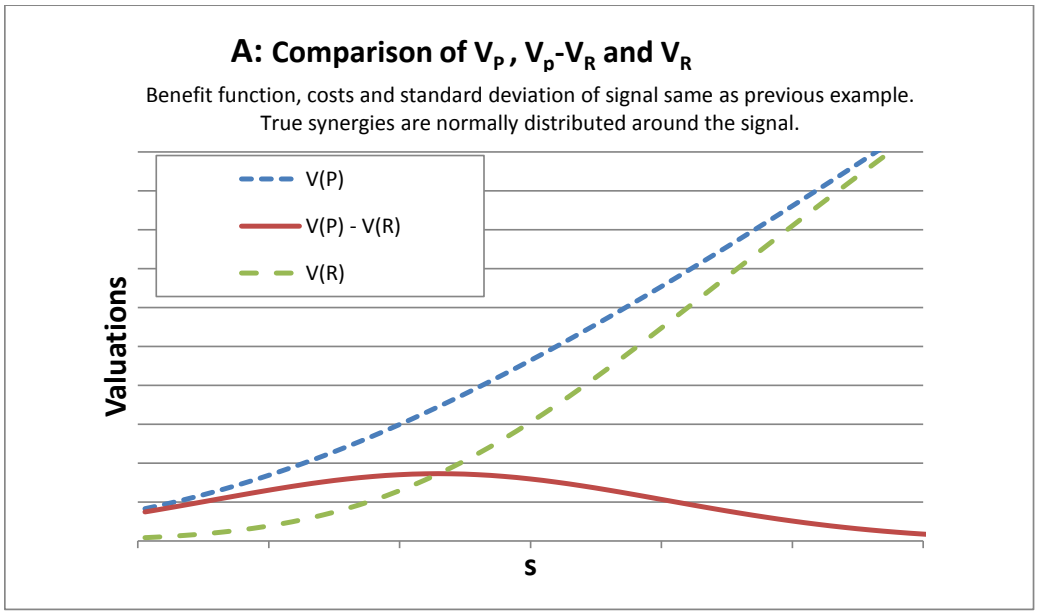
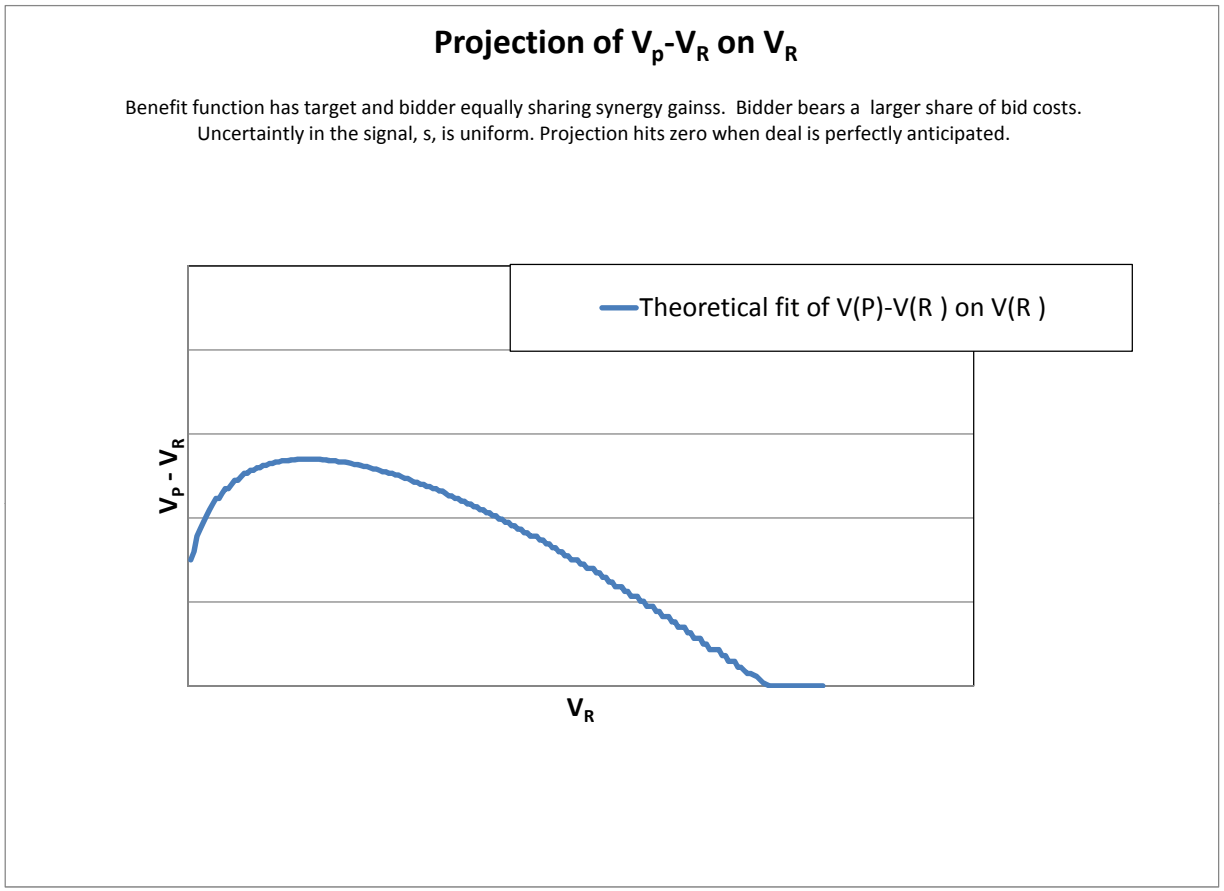
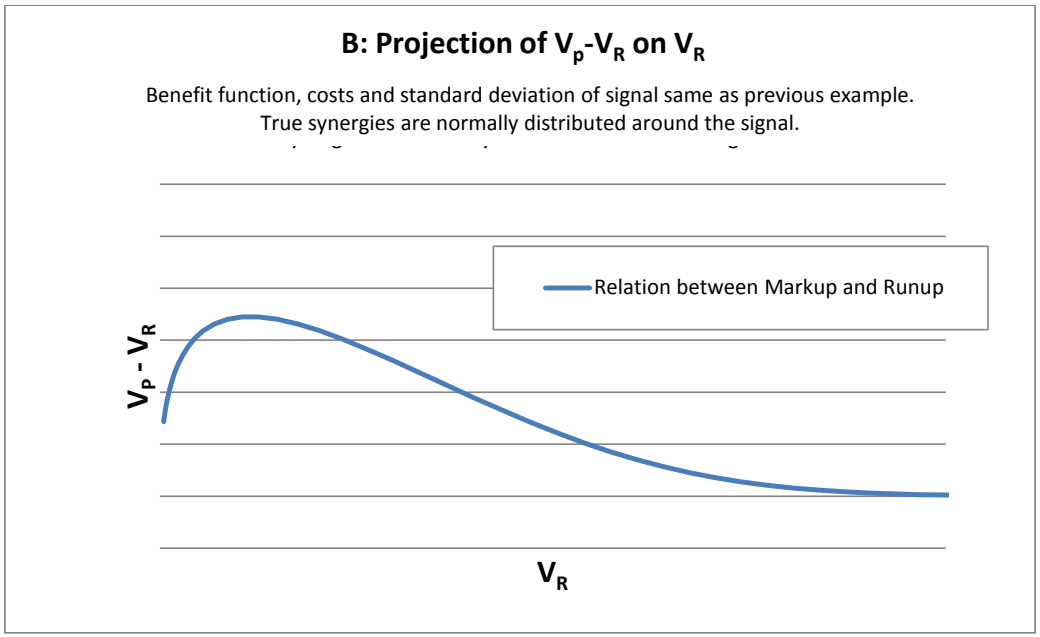


Figure 2C: Markup projections under deal anticipation (uniform).



Betton, Eckbo, Thompson and Thorburn (2011)

Figure 2D: Target valuations under deal anticipation (normal).



Adding a known target stand-alone value change T

- Target runup:

$$V_{RT} = \pi(s)E_s[B(S,C)+T|s,bid]+[1-\pi(s)]T = V_R+T \quad (4)$$

- Expected final offer and markup at first bid announcement:

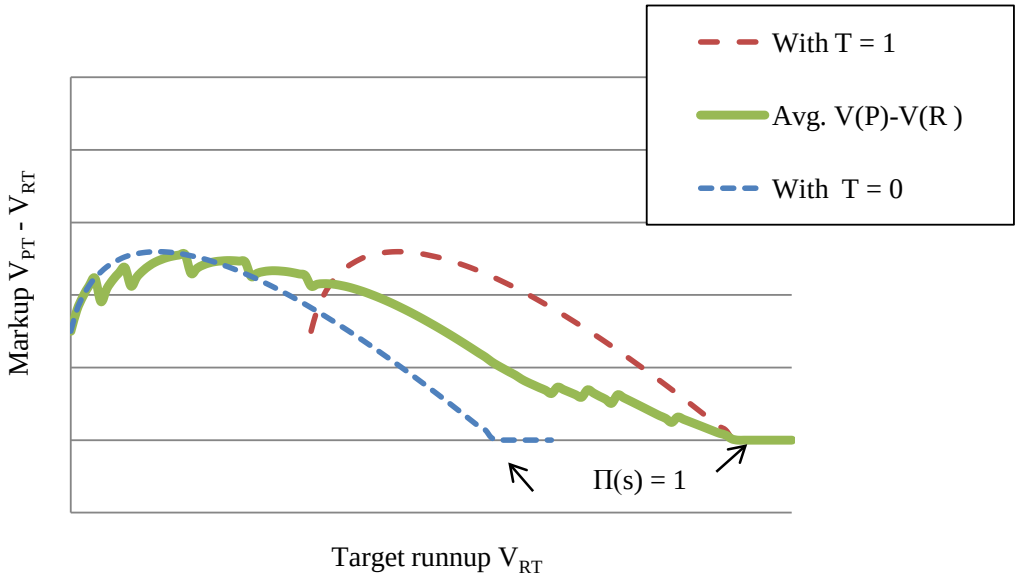
$$V_{PT} = E_s[B(S,C)+T|s,bid] = V_P+T \quad (5)$$

$$V_{PT} - V_{RT} = \frac{1-\pi(s)}{\pi(s)}[V_{RT} - T] \quad (6)$$

Deal anticipation and stand-alone value change:

Proposition 2: *Adding a known stand-alone value change T to the target runup, where T is independent of S, lowers the slope coefficient in a projection of markup on runup towards zero. A slope coefficient less than zero, or the projection being nonlinear, implies that a portion of the runup is driven by deal anticipation and substituting for the markup.*

Figure 3: Markup projections with stand-alone change T in runup. Solid line (Avg.): vertical markup summation across different Ts



Deal anticipation with runup fed into the offer price

- New rational bidding threshold: $K^* = \frac{\gamma C + V_R}{\theta}$
- Deal probability $\pi(s)$ now decreasing function of the runup.
- The runup now a function of itself:

$$V_R^* = \pi^*(s, V_R) E_s[B(S, C)|s, bid] + V_R,$$

- This process converges to the same (nonlinear) expression as equation (3), except the probability $\pi(s)$ is lower for any signal.
- Markup is again a positive function of the runup, because the deal benefits increase faster than the deal probability declines as signals improve.

Deal anticipation with runup fed into the offer price

Proposition 3: *The hypothesis that runups caused by deal anticipation are transferred from bidders to targets is rejected by a negative or no average relation between markups and runups.*

Figure 4A: Markup projections without runup feedback

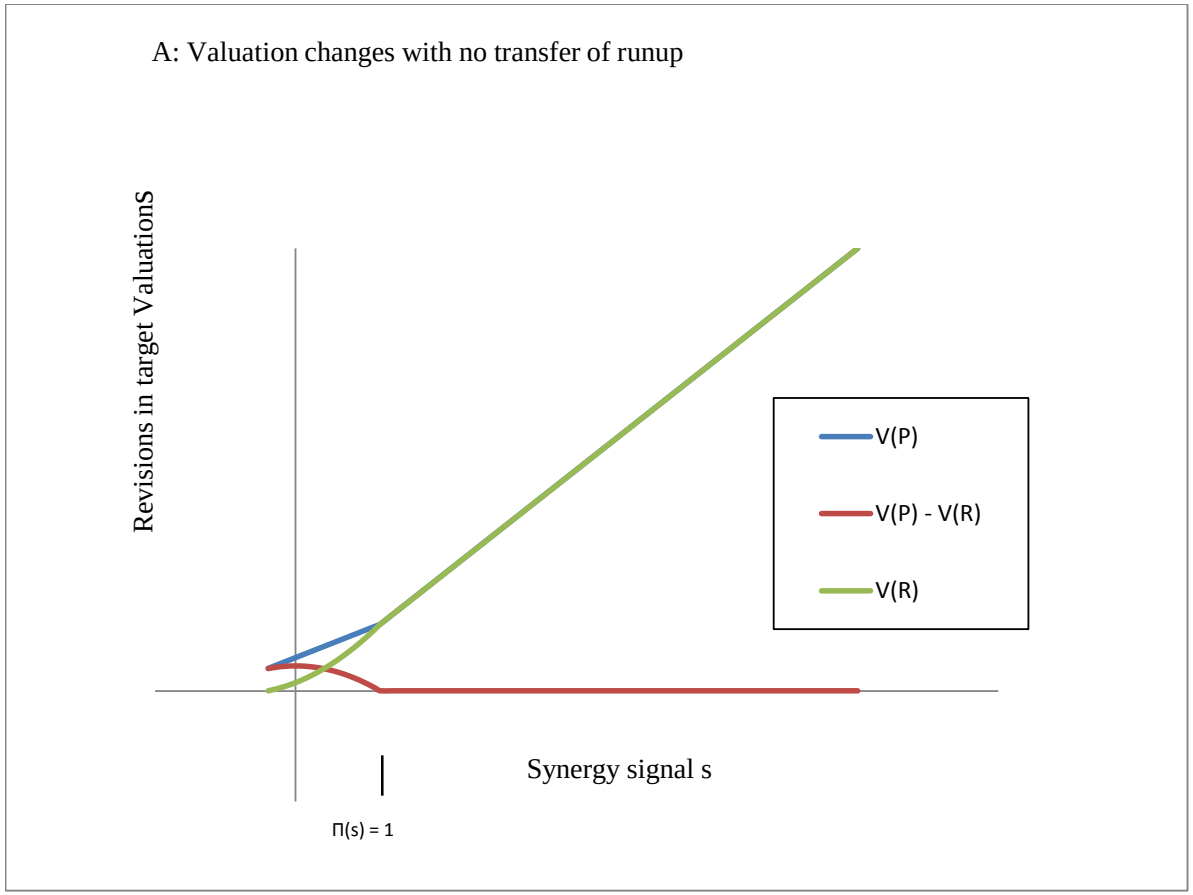
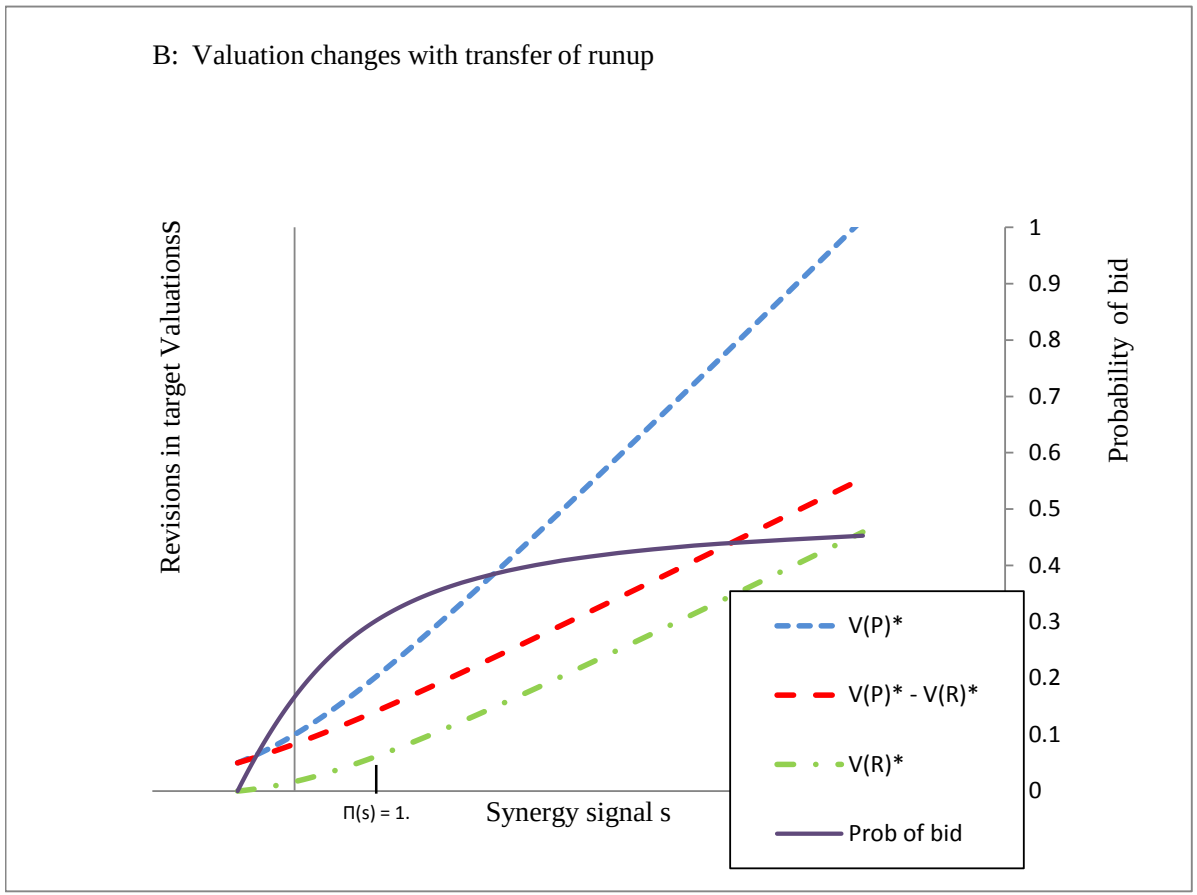


Figure 4B: Markup projections with runup feedback



Betton, Eckbo, Thompson and Thorburn (2011)

Table 1: Sample selection

Selection criteria	Source	exclusions	N
Initial control bids, US public targets, 1/80-12/08	SDC		13,893
Bidder owns <50% of target	SDC	46	13,847
Target firm public	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
Contest ending date available	SDC	324	6,414
Contest shorter than 252 trading days	SDC	264	6,150
Final sample			6,150

Table 2: Average runup and offer premium:

Offer premium $\frac{OP}{P_{-42}} - 1$		Markup $\frac{OP}{P_{-2}} - 1$		Runup $\frac{P_{-2}}{P_{-42}} - 1$		Net runup $\frac{P_{-2}}{P_{-42}} - \frac{M_{-2}}{M_{-42}}$	
mean	median	mean	median	mean	median	mean	median
0.45	0.38	0.33	0.27	0.10	0.07	0.08	0.05

Nonlinear estimation

- Beta distribution $\Lambda(v, w)$ with shape parameters v and w:

$$Markup = \alpha + \beta[(r - min)^{(v-1)}(max - r)^{w-1}/\Lambda(v, w)(max - min)^{v+w-1}] + \epsilon$$

- Least squares fit over all four parameters to identify a best non-linear shape (starting values: $v = 1, w = 2$)
- A linear projection when the true form is nonlinear generates residual serial correlation ("Brownian Bridge")
- First-order residual serial correlation is calculated after ordering the data by runup.

Robustness checks:

Our estimation controls for

- The probability that the contest leads to a change in target control (as a check on the uncertainty of first bid outcome)
- Information prior to the runup period which may cause deal anticipation (as a check on the size of the runup)
- Use of the market reaction to the bid to proxy markup (as a check on our use of bid prices directly)
- Use of multiple control variables (as a check on multivariate determinants of runups and offer premiums)

Markup measure $V_P - V_R$	Runup measure V_R	Linear projection $V_P - V_R = a + bV_R$	Linear res. ser. corr.	Nonlinear res. ser. corr.
Total markup	Total runup	$a = 0.36$	0.030	0.015
$\frac{OP}{P_{-2}} - 1$	$\frac{P_{-2}}{P_{-42}} - 1$	b=-0.24 (-11.9)	(2.36)	(1.15)
Total markup	Total runup	$a = 0.36$	0.045	0.027
$\frac{OP}{P_{-2}} - 1$	$\frac{P_{-2}}{P_{-42}} - 1$	$b = -0.22$ (-10.1)	(3.21)	(2.19)
Expected markup	Total runup	$a = 0.31$	0.027	0.016
$\pi[\frac{OP}{P_{-2}} - 1]$	$\frac{P_{-2}}{P_{-42}} - 1$	$b = -0.17$ (-9.5)	(2.11)	(1.25)

Figure 2D: Target valuations under deal anticipation (normal).

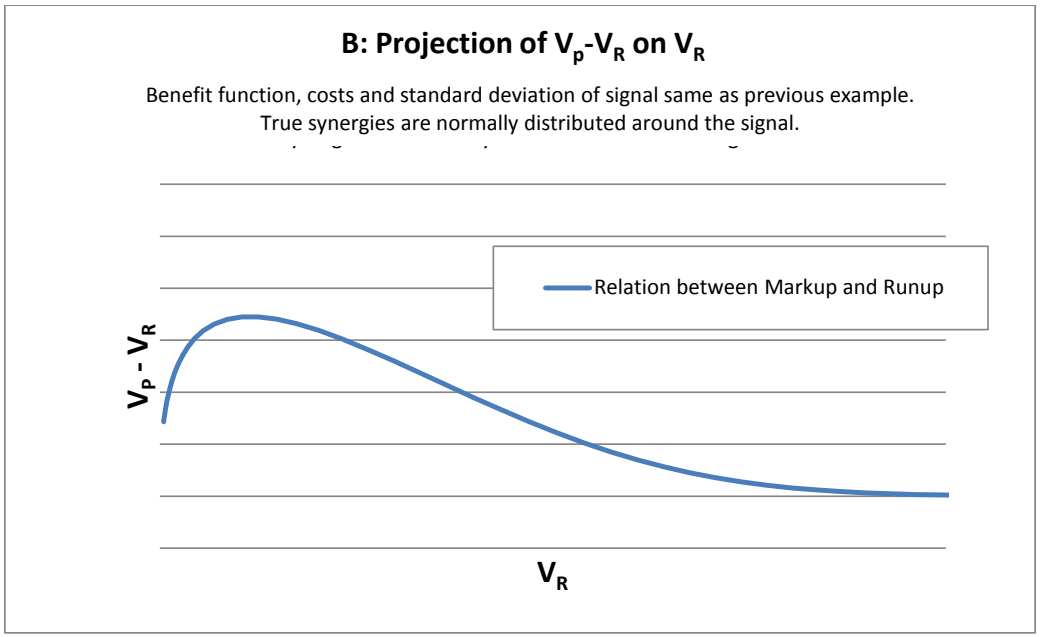


Figure 5A: Empirical markup projections (using offer prices)

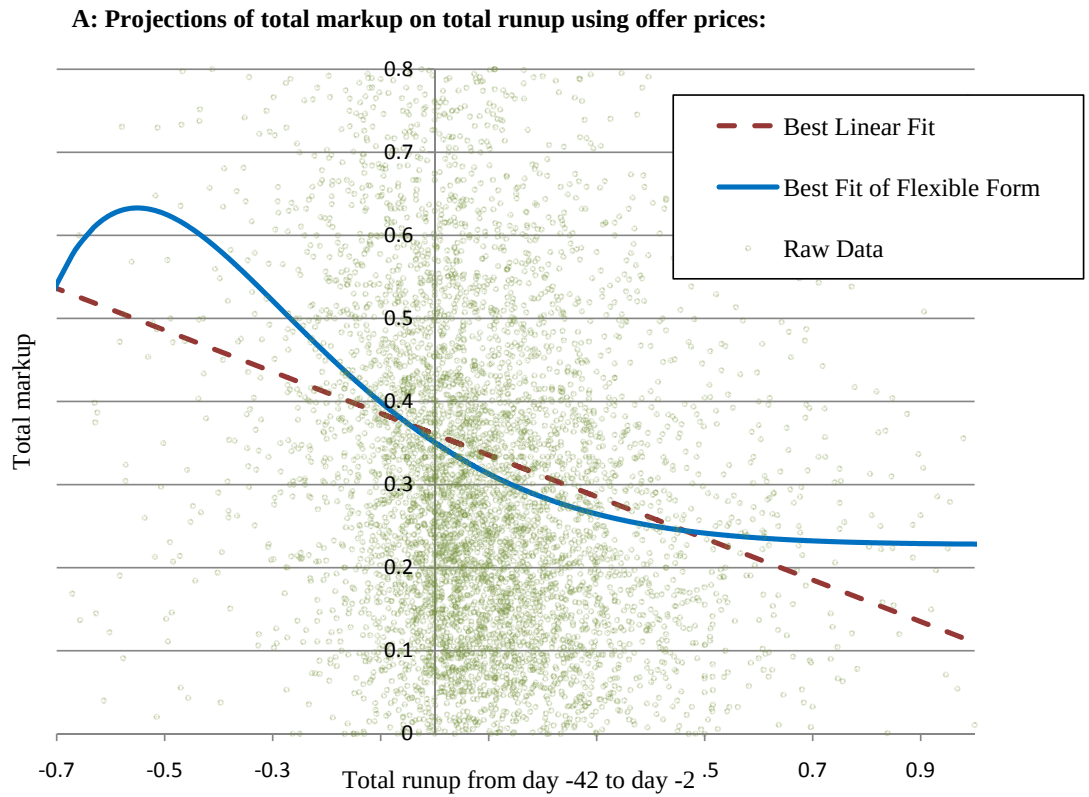
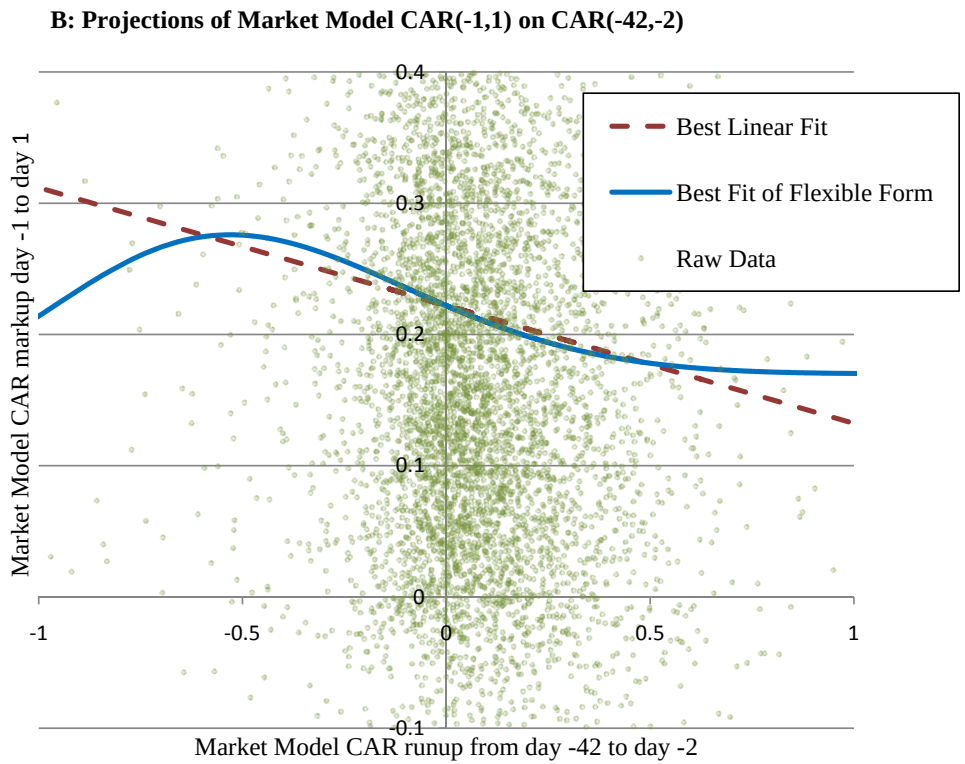


Figure 5B: Empirical markup projections (using CAR)



Bidder valuations:

$$\nu_R = \int_K^\infty (S - C - B(S, C))g(S)dS \quad \text{and} \quad \nu_P = \frac{\nu_R}{\pi(s)}$$

Projections of bidder gains on target runups:

Proposition 4: *For a fixed benefit function $G = S - C - B$, rational bidding behavior implies $Cov(G, B) > 0$ and $Cov(G, V_R) > 0$. This is true even if V_R is transferred to the target (when the bidding threshold is K^*). Thus, with rational bidding, the projection of ν_P on V_R yields a positive slope. The projection of ν_P on V_R is negative, however, if bidders transfer V_R to the target and fail to adjust the threshold from K to K^*.*

Figure 6A: Projections of bidder gains on target runup without feedback

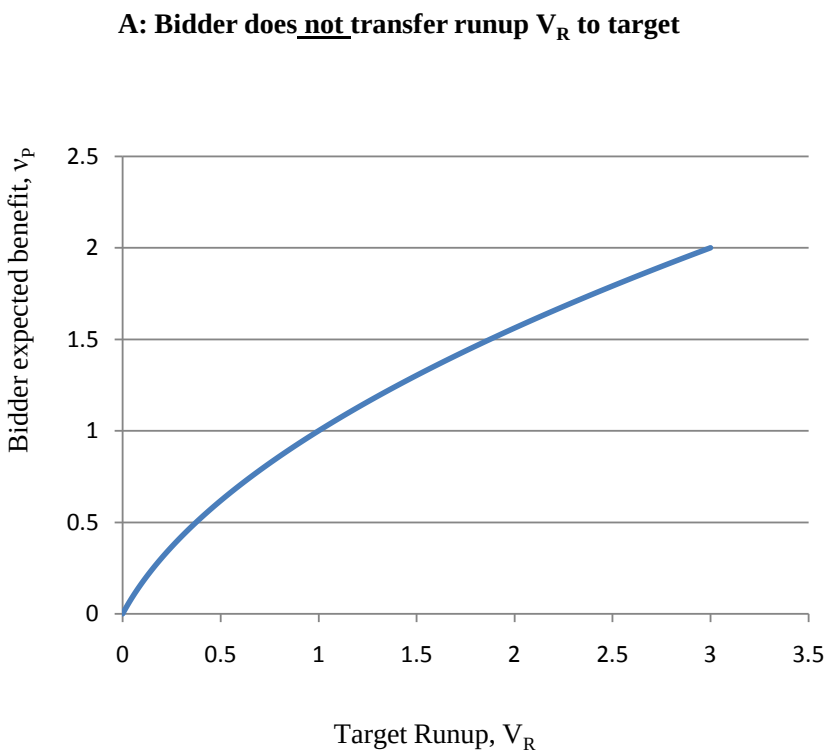


Figure 6B: Projections of bidder gains on target runup with feedback and rational bidding

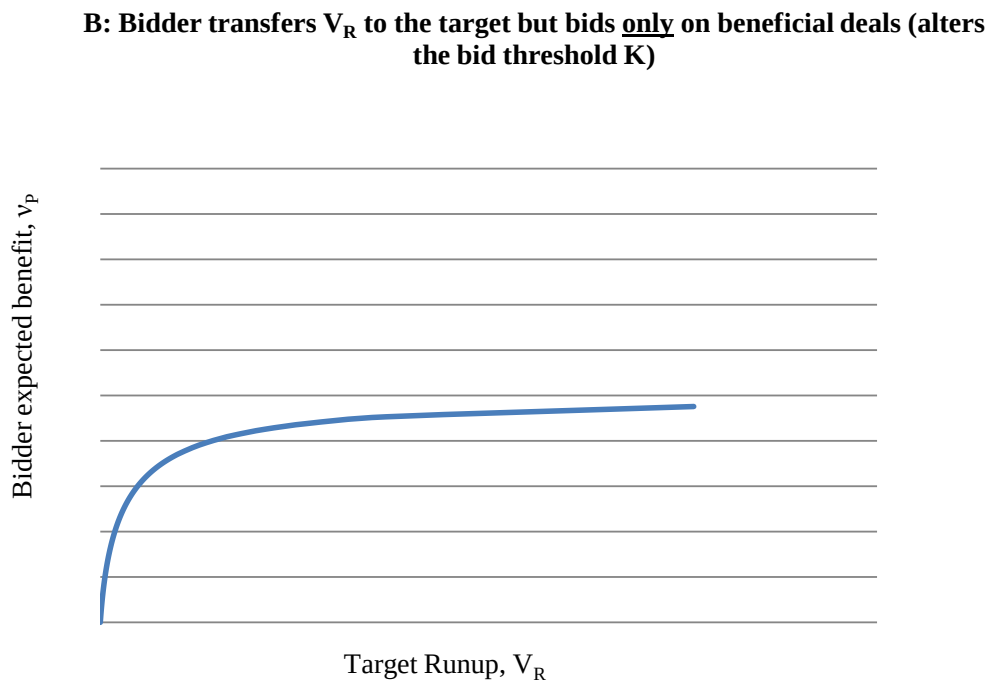
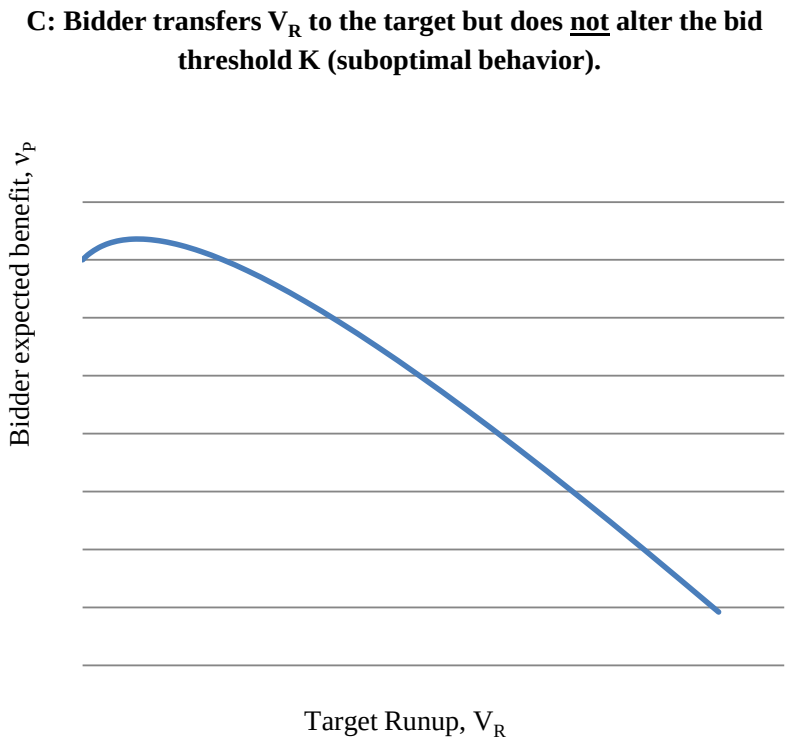


Figure 6C: Projections of bidder gains on target runup with feedback but not rational bidding



Dep var: Bidder CAR[-42,1]	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.116	-0.116	-0.110	-0.114	-0.097	-0.099
	(0.091)	(0.102)	(0.979)	(0.102)	(0.486)	(0.288)
Total Target Runup	0.049	0.054				
$V_R = \frac{P_{-2}}{P_{-42}} - 1$	(0.006)	(0.003)				
Net Target Runup			0.078	0.082		
$V_{RT} = \frac{P_{-2}}{P_{-42}} - \frac{M_{-2}}{M_{-42}}$			(0.000)	(0.000)		
Augmented Target Runup					0.049	
$V_R = (\frac{P_{-2}}{P_{-42}} - 1) + R_0$					(0.006)	
Market Model Target Runup						0.148
$V_{RT} = CAR(-42, 2)$						(0.000)
Control variables	no	yes	no	yes	no	no
Adjusted R^2	0.019	0.025	0.019	0.049	0.043	0.049
N	3,691	3,689	3,660	3,691	3,624	3,623

Figure 6A: Projections of bidder gains on target runup without feedback

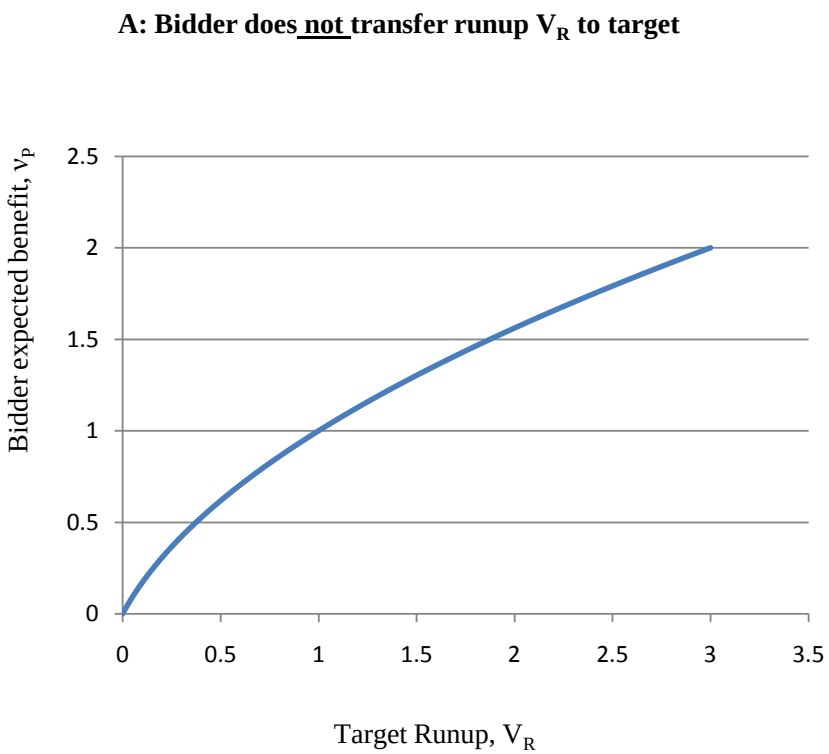


Figure 7A: Bidder gain on target runup

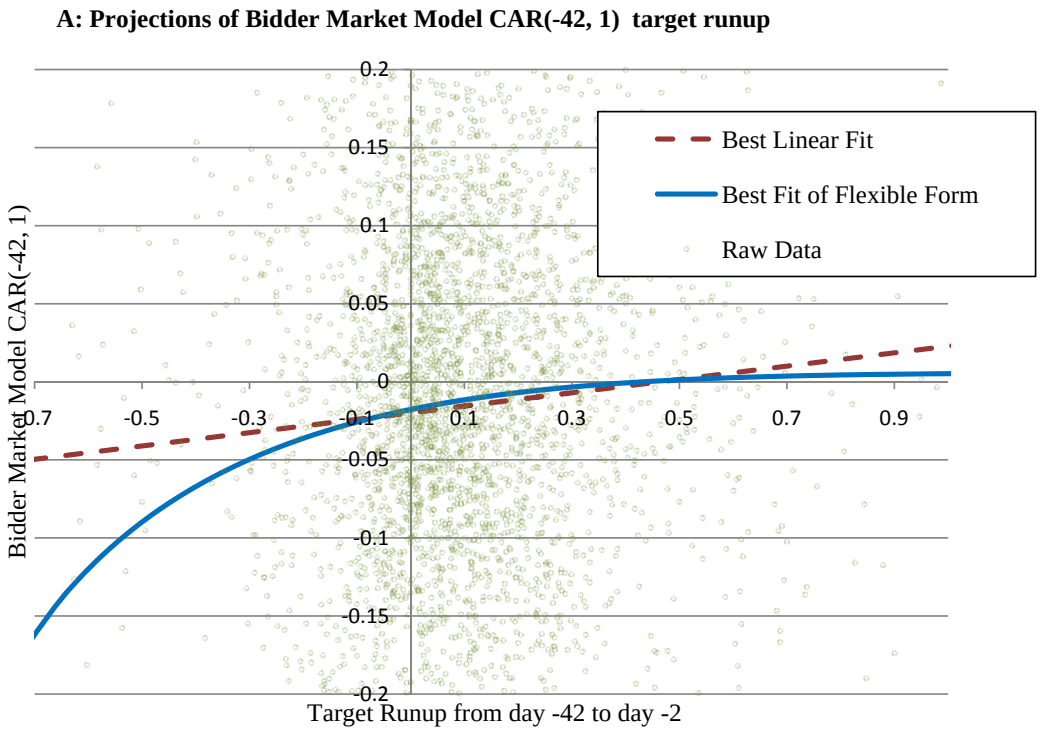
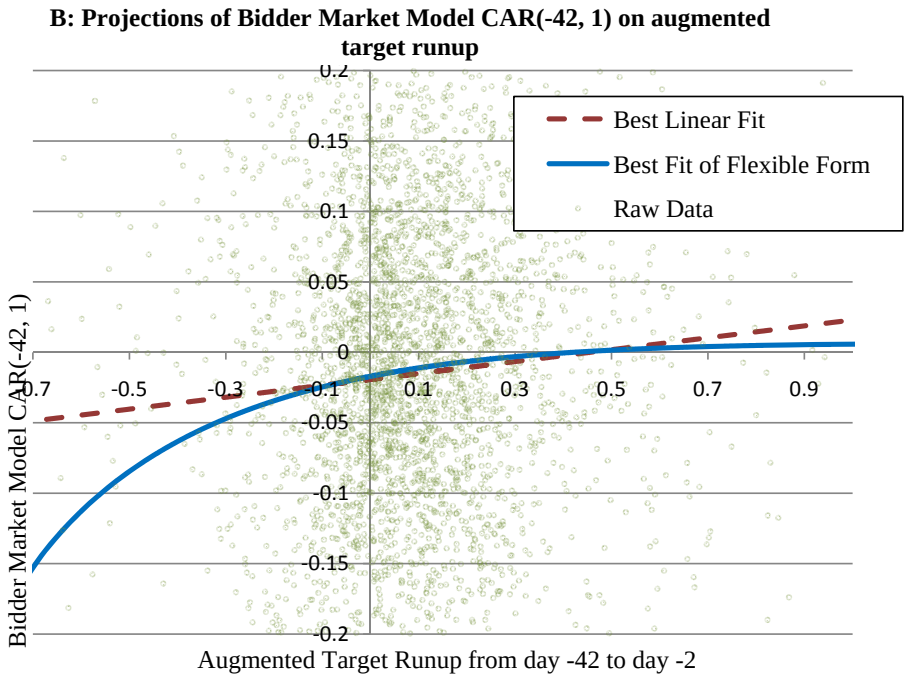


Figure 7B: Bidder gains on augmented target runup



Toehold bidding

Bidder benefits from a toehold of α percent in target

- Need only purchase $1 - \alpha$ at the full offer premium
- Get to sell the toehold to a rival winning bidder
- Expected toehold gain may deter rival bidder entry

Potential bidder toehold costs

- If no bidder wins: target share price drops
- Market illiquidity: raises toehold cost
- Target resistance: toehold benefit at expense of target
- Information: may fuel costly target runup

	Target net runup			Initial offer premium		
52 − *week high*	-0.042	-0.029	-0.214	-0.175	-0.169	-0.146
	(0.000)	(0.018)	(0.000)	(0.000)	(0.000)	(0.000)
Acquirer public	0.032	0.032	0.046	0.052	0.012	0.018
	(0.000)	(0.000)	(0.001)	(0.000)	(0.305)	(0.136)
Toehold size	-0.001	-0.002	-0.003	-0.004	-0.002	-0.002
	(0.002)	(0.000)	(0.000)	(0.000)	(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
	(0.000)	(0.000)	(0.100)	(0.084)	(0.340)	(0.382)
Market runup			0.924	1.054	0.815	0.926
			(0.000)	(0.000)	(0.000)	(0.000)
Net runup					1.077	1.068
					(0.000)	(0.000)
Year fixed effects	no	yes	no	yes	no	yes
Adjusted R^2	0.025	0.038	0.077	0.092	0.339	0.346

Betton, Eckbo, Thompson and Thorburn (2011)

Conclusions: We show that...

- With deal anticipation, projection of markups on runups is nonlinear
- Empirical projections are highly nonlinear and consistent with deal anticipation in the runup
- Empirical projections are inconsistent with a transfer of the target runup to the target
- Projections of bidder gains on target runup yield positive slope, as predicted under deal anticipation
- Bidders raise the offer price with the market runup prior to the initial bid
- Toehold acquisitions in the runup period fuel runups but *lowers* offer premiums