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Variables in dollar terms versus in rate terms: The case of market feedback on merger negotiations☆

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ABSTRACT

This paper shows a sharp contrast between theoretical predictions of merger negotiations when takeover markup and runup are measured in dollar vs rate terms. It argues that the empirical tests by an influential study cannot reject the hypothesis of a costly feedback loop as the authors claim. Using markup and runup in standardized dollar terms, it provides evidence that is consistent with both hypotheses of rational deal anticipation and a costly feedback loop. This exercise demonstrates the importance and necessity of differentiating regressions with variables in dollar terms and in rate terms to avoid drawing inaccurate or even false conclusions.

1. Introduction

How do takeover bidders react to the market feedback on merger negotiations? Do they have to pay higher takeover costs if the target stock prices experience substantial pre-offer runups? In a seminal study, Schwert (1996) reports that in a large sample of takeovers, bidding firms markup their offers almost equal to the runups. This finding implies that markup pricing prevails in the competition for corporate control (see also Betton, Espen Eckbo, and Thorburn (2008)). Recently, Betton, Espen Eckbo, Thompson and Thorburn (2014, BETT hereafter) develop an empirically testable model of takeover that permits stock market feedback on takeover rumors.[1] The model assumes that the information of takeover negotiations is leaked in the form of rumors which send a signal to the market of the ongoing negotiations. An important insight generated by the model is that takeover rumors or signals reveal the information of "both the deal probability and the deal-specific takeover synergies conditional on a bid." Rational investors use the signal "to update not only the takeover probability but also the conditional value" of synergies. With this endogenous deal probability, the bidders have different offering strategies depending on whether the market is operating under rational deal anticipation or there is a costly feedback loop in the takeover negotiations. The model predicts that in a linear regression of takeover markup on runup, the slope coefficient is greater than −1 under rational deal anticipation. However, the coefficient is strictly positive if there is a costly feedback loop from takeover runup to markup. BETT conducts a thorough and solid empirical analysis to test the two competing hypotheses. Based on the negative slope coefficients of their linear regressions, the authors claim that their empirical results support the hypothesis of rational deal anticipation and reject that of a costly feedback loop.

This paper is concerned by the lack of connection between the theory and the empirical tests in BETT. The theoretical predictions made by the takeover model are based on markup and runup in terms of dollar values, whereas the various empirical tests conducted by BETT use the rates of markup and runup. We argue that the relationship between markup and runup in dollar terms is different from that between the rates of markup and runup. To this end, we establish, under the BETT framework, that the slope coefficient of a linear regression of the markup rate against the runup rate can be negative under both the

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[1] Research on mergers and acquisitions is extensive. For a general survey, see Betton et al. (2008); for rumors on mergers and acquisitions and their effects on pricing, see, for example, Jarrell and Poulsen (1989), Pound and Zeckhauser (1990), and Zivney, Bertin, and Torabzadeh (1996).

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hypotheses of rational deal anticipation and a costly feedback loop. Thus, in contradiction to their claim, BETT's empirical results do not reject either hypothesis.

To see the point intuitively, let us consider a numerical example. Following BETT's notation, V_R is the runup of the target firm's value after the market receives a signal of the potential takeover and V_P is the market's valuation of the target's deal value conditional on the bid announcement (i.e., the takeover premium). Both V_R and V_P are in dollar terms. Assuming that the initial value of the target is V_I,[2] then the target's market value after stock price run-up but just before takeover announcement is $V_I + V_R$ and its value after takeover announcement is $V_I + V_P$. In turn, the target's markup in dollar terms is $V_I + V_P - (V_I + V_R) = V_P + V_R$, and the rates of runup and markup can be defined by $R_R = \frac{V_R}{V_I}$ and $R_M = \frac{V_P - V_R}{V_I + V_R}$. BETT empirically examines various forms of the following regression model,

$$R_M = \tilde{a} + \tilde{b} R_R, \tag{1}$$

and the results are reported in their Table IV. Here we use $\tilde{a} = 0.36$ and $\tilde{b} = -0.24$ from model (1) in Table IV of BETT to generate a dataset of R_M and R_R, which is illustrated in Panel A of Fig. 1, where R_R is exogenous, ranging from 0 to 30%. Since $V_R = V_I R_R$ and $V_P - V_R = V_I(1 + R_R)R_M$, we obtain dollar-value runups and markups in Panel B that correspond to the rates of runups and markups in Panel A. Fig. 1 shows that although the dataset presents a negative correlation between the rates of runup and markup, the corresponding correlation between dollar-value runup and markup is actually positive. In other words, a negative estimate of $\tilde{b}$ in regression (1) does not secure a negative slope b in the regression of dollar-value markup, $V_P - V_R$, against dollar-value runup, V_R; i.e.,

$$V_P - V_R = a + bV_R. \tag{2}$$

Therefore, the empirical results reported in Table IV of BETT do not contradict the hypothesis of rational deal anticipation, nor do they provide evidence rejecting the hypothesis of a costly feedback loop.

Fig. 1 has more general implications. Researchers often analyze price (or value) changes when developing theories or modeling to preserve tractability, and they analyze the rates of returns when empirically testing the theories to preserve the comparability in the cross-section (see, for example, Chordia and Subrahmanyam (2004), Hong and Stein (1999), and Hong, Lim, and Stein (2000)). In some cases, this distinction has no material implications for the understanding of economic forces and mechanisms. However, the negative (or positive) relationship implied by the linear regression of the rates of two random economic variables may not be retained for their dollar-value counterparts. Therefore, further examination and validation are required when the estimates from the regressions of the rates are used to test a hypothesis based on the predictions for the variables in their dollar terms. A leading example in this regard is Banerjee (2011), who shows the difference between dollar return and the rate of return by theoretically analyzing the effects of dispersion in beliefs on dollar returns separately from the effects on the rates of return.

The remainder of this paper is organized as follows. Section 2 briefly reviews the BETT model and its main findings. Section 3 presents the theoretical predictions on the relationship between the rates of runup and markup in the BETT framework. Under rational deal anticipation, they are, to a certain extent, consistent with the predictions in Proposition 1 of BETT. However, the predictions exhibit substantial differences under the hypothesis of a costly feedback loop. The key finding is that under both hypotheses, the relationship between the markup rate and runup rate can be either positive or negative, depending on the model parameters. Therefore, the sign (or the range) of the slope coefficient of linear regression (1) cannot test these hypotheses.

To empirically examine the hypotheses of rational deal anticipation and a costly feedback loop, Section 4 proposes using standardized runup and markup to test the two hypotheses; i.e., both dollar-value runup and markup are scaled by the initial value of the target. The empirical results indicate that the hypothesis of a costly feedback loop cannot be rejected and rational deal anticipation should not be considered a favored hypothesis. This claim contradicts BETT's conclusion. The final section concludes the paper.

2. A review of the BETT model

The market receives a rumor (takeover signal), s, after the negotiations of a takeover start, and the signal causes investors to anticipate a synergistic takeover. The value of total synergies for the takeover is S, which is known to the bidder and target negotiators but is unknown to the market. However, the market knows the distribution of S upon the reception of signal s, i.e., conditional probability density function $g(S|s)$ and cumulative distribution function $G(S|s)$ are public knowledge. The rule of synergy sharing is that the acquirer receives θS, while the target receives $B(S) \equiv (1-\theta)S$.

The baseline takeover model assumes rational deal anticipation; that is, the takeover offer price does not respond to the takeover runup before the offer announcement. As the bidder bears a known bidding cost C, the bid only occurs if $S > K \equiv C/\theta$. Therefore, the probability of the bid occurring can be calculated by

$$\pi = \int_K^\infty g(S|s)dS.$$

The offer premium, conditional on the offer announcement, is $V_P = \overline{B} \equiv E(B(S)|s, bid)$. In turn, the runup in dollar terms, V_R, has the following relationship with V_P:

$$V_R = \int_K^\infty B(S)g(S|s)dS = \pi V_P.$$

Therefore, the markup and runup are related through

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

Proposition 1 of BETT. *Suppose the markup projection (3) holds. When the takeover signal causes the market to infer different takeover probabilities and conditional deal values across a sample of takeovers ($d\pi/ds > 0$ and $dV_P/ds > 0$), then the linear regression (2) produces a slope coefficient b that is strictly greater than -1.*

The costly feedback loop implies that there is a runup transfer V_R^* to the target in addition to the announcement surprise $\overline{B}^* \equiv E^*(B(S)|s, bid)$. Therefore, the takeover premium has two components:

$$V_P^* = \overline{B}^* + V_R^*.$$

The superscript * indicates values and expectations computed using the new bid threshold $K^* = (C + V_R^*)/\theta$. Due to the increased bid threshold, the probability of the bid occurring now becomes

$$\pi^* = \int_{K^*}^\infty g(S|s)dS.$$

[2] It is the value before the market receives the takeover signal. BETT normalizes it to zero in the theoretical model.