

Online Appendix for

“How Do Valuations Impact Outcomes of Asset Sales with Heterogeneous Bidders?”

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The impact of market conditions on valuations in takeover auctions

This section expands the analysis of the impact of market conditions on properties of strategic and financial bidders’ valuations in takeovers. For type $t \in \{s, f\}$ and auction i , write the estimate of average log-valuation premiums in (2) as a function of period p_i , in which the auction occurs, and the number of bidders N_i :

$$\hat{\mu}_t(p_i, N_i) = X'_{i,-p,-N} \hat{\beta}_{t,-p,-N} + \log N_i \hat{\beta}_{t,N} + \sum_{j \in \mathbb{J}} \mathbf{1}_{p_i=j} \hat{\beta}_{t,j} + \sum_{j \in \mathbb{J}} \mathbf{1}_{p_i=j} \log N_i \hat{\beta}_{t,j,N}. \quad (\text{A1})$$

Here, (1) $X_{i,-p,-N}$ are all controls that do not include period dummies and the number of bidders; (2) $p_i \in \{\text{dot-com, post dot-com, pre crisis, crisis, post crisis}\}$ denotes the period; (3) the post dot-com period is the baseline period; (4) $\mathbf{1}_{p_i=j}$, $j \in \mathbb{J} = \{\text{dot-com, pre crisis, crisis, post crisis}\}$ are dummies for all other periods. As explained in Section 3.1, assume that the number of bidders proxies for ex-ante heterogeneity of bidders within a type observable to competitors but not to the researcher. Then, the average log-valuation of the ex-ante strongest bidder of type t in auction i in the baseline period is given by $\hat{\mu}_t(\text{post dot-com}, 1) = X'_{i,-p,-N} \hat{\beta}_{t,-p,-N}$. The average log-valuation across all bidders of type t in auction i in the baseline period is $\hat{\mu}_t(\text{post dot-com}, N_i)$. The average log-valuation of the ex-ante strongest bidder of type t in auction i in any other period is $\hat{\mu}_t(j, 1)$, $j \in \mathbb{J}$. Finally, the average log-valuation across all bidders of type t in auction i in any other period is $\hat{\mu}_t(j, N_i)$, $j \in \mathbb{J}$. The actual average valuation premium of any bidder in any period can be obtained from parameters of log-valuations using equation (1).

I use the introduced notation to explore the economic impact of market conditions on valuations. Consider a target from the baseline post dot-com period, who has a period-typical market value, \$476 million, and a typical number of bidders, 12. Suppose that strategic and financial bidders have period-typical average valuations of 24.9% and 15.4%, and period-typical dispersions of valuations of 27.6% and 17.1%, as shown in Table 6. These numbers imply $\hat{\mu}_s(\text{post dot-com}, 12) = 0.199$, $\hat{\sigma}_s(\text{post dot-com}) = 0.218$, $\hat{\mu}_f(\text{post dot-com}, 12) = 0.132$, $\hat{\sigma}_f(\text{post dot-com}) = 0.147$. Suppose that target characteristics remain otherwise unaffected as it moves through economic periods. To interpret changes in valuations across periods, I use estimates provided in Table 5.

In the baseline period, the average valuation of the ex-ante strongest strategic and financial bidder is higher than that across all bidders of the same type in an auction by $e^{-\hat{\beta}_{s,N} \times \log(12)} - 1 = 35.1\%$ and 15.5% , which corresponds to a $1.249 \times 1.351 = 68.7\%$ and 33.3% premium above the target value. In dollar terms, the average valuation of the ex-ante strongest strategic and financial bidder is higher than that across all bidders of the same type by $\$476 \times (0.687 - 0.249) = \208 and $\$85$ million. Next, compared to the baseline period, during the dot-com and the crisis period the average valuation of the ex-ante strongest financial bidder is higher by $e^{\hat{\beta}_{f,dc} + \frac{(\hat{\sigma}_f(\text{post dot-com})e^{\hat{\gamma}_{f,\text{dot-com}}})^2 - \hat{\sigma}_f(\text{post dot-com})^2}{2}} - 1 = 28.8\%$ and 22.1% , which corresponds to a $1.333 \times 1.288 = 71.7\%$ and 62.8% premium above the target value. In dollar terms, if the target value is unaffected by a period, the average valuation of the ex-ante strongest financial bidder increases between periods by $\$183$ and $\$140$ million. The target value in periods of economic downturn has to drop by $45-50\%$ to erase this dollar increase. Finally, compared to the baseline period, during the dot-com and the crisis period the average valuation across all financial bidders in an auction is higher by $e^{\hat{\beta}_{f,\text{dot-com}} + \hat{\beta}_{f,\text{dot-com},N} \log(12) + \frac{(\hat{\sigma}_s(\text{post dot-com})e^{\hat{\gamma}_{f,\text{dot-com}}})^2 - \hat{\sigma}_f(\text{post dot-com})^2}{2}} - 1 = 11.5\%$ and -6.7% , which corresponds to a 28.7% and 7.7% premium above the target value. In dollar terms, if the target value is unaffected by a period, the average valuation across all financial bidders increases between periods by $\$63$ and $-\$37$ million. The average valuation of both the ex-ante strongest strategic bidder and across all strategic bidders in an auction is substantially more stable over time.

Altogether, consistent with Martos-Vila et al. (2013), time variation in financial valuations is economically important and can reach hundreds of millions of dollars. The impact of periods of economic activity on valuations appears to be stronger for the ex-ante strongest financial bidder as compared to an average financial bidder. This finding explains why during the crisis, financial acquirers pay substantially higher premiums despite low levels of financial participation. A caveat

is that, in practice, participation can also change between periods, affecting the above analysis.

An alternative way to show that financial bidders become much stronger competitors in crises is to decompose the winning bidders' private valuation component into shares retained by the bidder and received by the target through the payment. Fig. 1 in the appendix shows the distribution of the ratio of the winning bid to the expected valuation of strategic and financial acquirers across five periods. Intuitively, the *winning slack*, which is defined as 100% minus the depicted ratio, captures the expected share of the private valuation component retained by the winning bidder and hence its ability to increase the payment if faced with stronger competition. Formally, for each strategic or financial acquirer in the sample, the expected valuation conditional on all auction characteristics and outcomes is

$$\mathbb{E} \left[V_i^{(1)} | X_i, b_{i,1}, t_{i,1} \right] = \mathbb{E} \left[V_i^{(1)} | X_i, V_i^{(1)} \geq b_{i,1}, V_i^{(2)} \leq b_{i,1}, t_{i,1} \right], \quad (\text{A2})$$

where $V_i^{(k)}$, $k \in \{1..N_i\}$ is the k -th highest valuation among N_i bidders. By properties of order statistics, the expected valuation of the winning bidder has a truncated log-normal distribution with parameters $X_i' \hat{\beta}_{t_{i,1}}$ and $\hat{\sigma}_{t_{i,1}}^2$ on interval $[b_{i,1}, \infty)$.

The next-to-last row of graphs in Fig. 1 shows that the average winning slack of financial bidders in the crisis period increases to 16.0% from the sample-average of 8.6%. Moreover, there are four instances of the slack exceeding 15%, which is rare in the remaining data, and no instances of the slack below 5%. Fig. 1 thus confirms the finding that top financial bidders are much stronger competitors in crises.

References

Martos-Vila, M., Rhodes-Kropf, M., Harford, J., 2013. Financial vs. strategic buyers. Unpublished working paper. London Business School, Harvard University, and University of Washington.

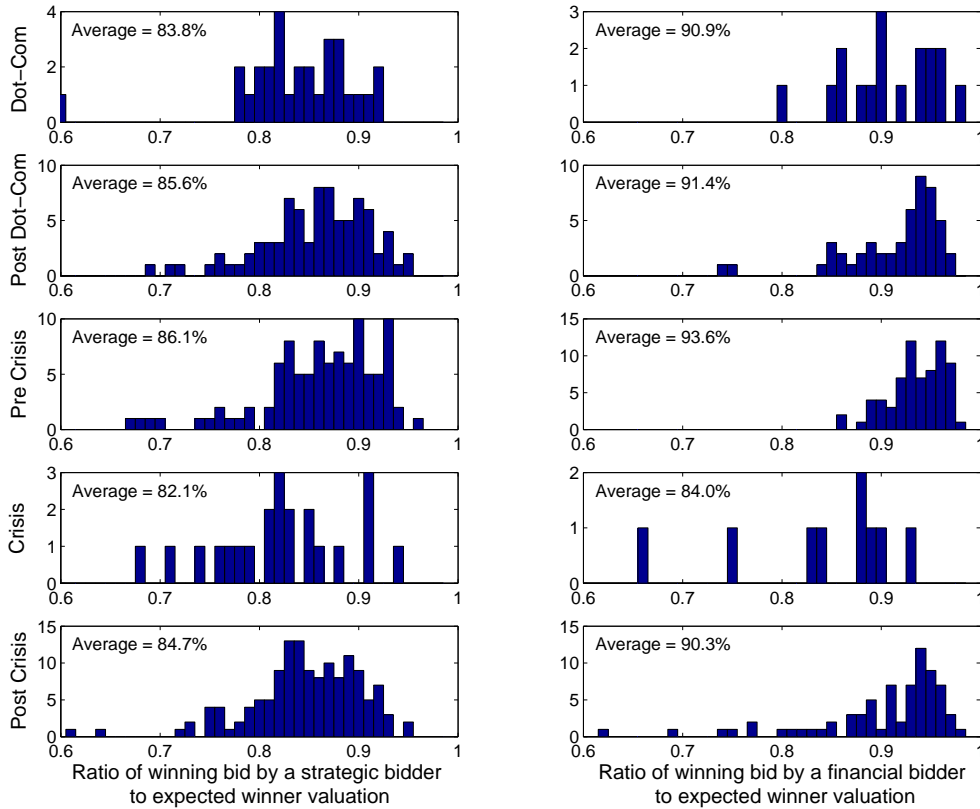


Figure 1: **Distribution of the winning slack by periods: the case of target-specific dispersions of private valuations.** The figure shows histograms of 1-*Winning Slack* for strategic and financial bidders across five time periods: crisis (September 2008–2009), dot-com (2000–2001), post dot-com (2002–2005), pre crisis (2006–August 2008), and post crisis (2010–2012). 1-*Winning Slack* is defined as the ratio of the winning bid to the ex-post mean valuation of the winner, conditional on the observable winning bid. Higher winning slack means that a bidder is able to raise its bid more if faced with stronger competition. The top-left corner of each histogram shows the average value of 1-*Winning Slack* in a given period. The average value across all periods is 85.1% for strategic bidders and 91.4% for financial bidders.