

Round-Number Bidding as an M&A Strategy

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ABSTRACT

Round-number initial offers are pervasive in many bargaining situations. Such behavior is puzzling, given that making precise offers has been shown to be a superior strategy. To resolve this inconsistency, we examine offers in the market for mergers and acquisitions. We find that round-number offers are prevalent among initial bids for target companies. Following the initial bid, round-number offers have a higher probability of being increased, a lower probability of encountering challenging bids, and a shorter time to deal closure. This suggests that round numbers are often chosen strategically as a signal by impatient bidders who are willing to take a slight drive-up of price to secure a timely purchase and as a preemptive move to prevent competing bidders from entering.

I. Introduction

In negotiations, making the first offer can yield a bargaining advantage. Existing evidence suggests that people respond not only to the magnitude but also to the numerical features of first offers. One feature is rounding. Studies have documented sharp spikes in the distribution of initial offer prices at round numbers. This “round-number bias” of initial offers is prevalent in the housing market (Pope, Pope, & Sydnor, 2015), the stock market (Harris, 1991; Ikenberry & Weston, 2007; Johnson, Johnson, & Shanthikumar, 2007; Thomas & Morwitz, 2005), eBay’s Best Offer bargaining platform (Backus, Blake, & Tadelis, 2019), and many other contexts.¹

Despite the prevalence of rounding, research on bargaining has consistently demonstrated that rounding generates “worse” outcomes for the bidder, such as unfavorable closing prices and recipients being less likely to accept the offer (Janiszewski & Uy, 2008; Mason et al., 2013; Thomas, Simon, & Kadiyali, 2010; Zhang & Schwarz, 2011). The reason why rounded offers are so prevalent, even though they lead to unfavorable bidder outcomes, remains unclear.

The focal nature of round numbers is one of the most common explanations for the prevalence of round numbers in negotiations. Recent work by Pope et al. (2015) examines round numbers as focal points in negotiated real estate prices and argues that round numbers must be useful in facilitating bargaining because they are disproportionately frequent. Round numbers also serve as cognitive reference points (Rosch, 1975) or as goals that individuals use to motivate themselves (Allen et al., 2017; Pope and Simonsohn, 2011). Although few studies have focused explicitly on the effects of uncertainty, we provide evidence below that when valuation is more uncertain, first bidders are more likely to use rounding as a heuristic.

¹ Studies show rounding patterns in forecasts of earnings per share (Dechow & You, 2012), CEO salary and bonus compensation (Jorgensen, Patrick, & Soderstrom, 2020), and even marathon and baseball game performance (Allen et al. 2017; Markle et al., 2018; Pope & Simonsohn, 2011), which involve risky decision making or goal setting.

A recent paper by Backus et al. (2019) offers an alternative, strategic explanation for the bunching of round numbers from the perspective of sellers: if round numbers are a credible signal of eager (impatient) sellers, then by signaling weakness, a seller will attract buyers faster who rationally anticipate a better deal. Backus et al. found strong evidence of behavior consistent with a cheap-talk signaling equilibrium where round-number listings sell faster on the market than similar precise-number listings. In other words, they suggest that some market participants willingly signal a weak bargaining position by strategically choosing a round number, say \$100, rather than a higher precise number such as \$102, to secure a timely sale, albeit at a less advantageous price for the seller.

Drawing from the Backus et al. (2019) signaling theory, our study considers the round-number bias in the market for corporate acquisitions. We posit a similar line of reasoning, taking the perspective of buyers: eager (impatient) buyers use round numbers to signal their willingness to pay more to attract the target's attention, secure an advantageous position among competing bidders, and ultimately buy faster. Indeed, preemptive bidding theory (Fishman, 1988; 1989) suggests that if there is potential competition, an initial bidder could deter a rival by making an offer that signals a high valuation for the target.

The M&A market is different from other markets that have been studied, such as the real estate market and the eBay platform, where the seller moves first, posting a price. In M&A deals, the buyer – in this case, the potential acquirer (the bidder) – starts by announcing an offer based on its knowledge and valuation of the target. Prior studies have argued that pricing at precision is beneficial in one-to-one bargaining situations where the seller faces a single potential buyer and bargains by making iterative proposals and counteroffers. In the M&A market, however, initiating bidders need to take potential competitors into account.

Our research utilizes SDC Mergers and Acquisitions data from 1981 to 2017. We include all-cash or all-stock deals, excluding transactions with a mix of cash and stock. By assessing the initial transaction value announced by the acquirer (i.e., the total value of consideration it aims to pay to the target at the time of announcement), we find patterns of sharp spikes around round offers at multiples of \$10, \$5, \$1, and \$0.5 million, resembling the “round-number bias” observed in previous studies. We find that round-number initial offers lead to higher final offers, shorter duration from the announcement of a bid to the target’s approval, and less likelihood of encountering challenging offers. These findings are consistent with the cheap-talk signaling theory and provide a strategic rationale for round-number bidding in acquisition situations. We also examine initial bids that are rounded in *price per share*. Consistent with Hukkanen & Keloharju (2019), we find that such bids for public company targets have a greater likelihood of challenging offers, longer contest duration, and higher probability of bid withdrawal. Thus, we find evidence of strategic benefits for rounding the *total offer price* but not the *price per share*.

II. Prior literature and theory

Our aim is to resolve two seemingly inconsistent findings in the literature: (1) round-number offers are prevalent in many bargaining situations, and (2) round-number offers tend to yield inferior outcomes for the bidders who make them. We argue that round-number offers lead to inferior outcomes with respect to price but can yield other benefits by speeding up deal closure and reducing the likelihood of competing bids. In reviewing the literature below, we focus first on why round-number offers have been found to be inferior to precise offers. We then turn to arguments explaining why round-number offers are so commonly observed.

The advantage of precise offers in negotiating situations

Numerous studies (e.g., Harris, 1991; Janiszewski & Uy, 2008; Pope et al., 2015; Thomas &

Morwitz, 2005; Thomas et al., 2010; Zhang & Schwarz, 2011) have addressed the preference for round versus precise offers by examining how parties respond in negotiating situations. These studies provide evidence that precise offers can secure a distributive advantage, shift the deal closer to the bidder's expectations, and eventually lead to favorable outcomes for the bidder. However, these studies fail to establish the reason why people make round-number initial bids, as they suggest that people are either hardwired to do so or unaware of this precision advantage.

Two rationales have been proposed to explain why a precise offer may improve the initial bidder's bargaining outcome: anchoring and attribution of competence (Loschelder et al., 2016). Mason et al. (2013) argue that the first offer has a bargaining advantage in that it serves as an anchor for the negotiation. The counteroffer is often based on the previous offers that a negotiator received. More precise numbers create a finer-grained mental scale that leads people to adjust away from anchors in smaller steps, making the anchor more potent. The more precise an opening offer, the more it anchors counteroffers (Epley and Gilovich, 2001, 2006; Janiszewski & Uy, 2008; Lee et al., 2018).

The attribution of competence explanation suggests that precision influences social perceptions; a precise offer price makes the bidder appear more informed, and a precise value is viewed as more valid and reasonable. More precise numbers suggest a more confident (Jerez-Fernandez, Angulo, & Oppenheimer, 2014) and competent (Mason et al., 2013) counterpart. The acquirer hints at its confidence, believability, and reasonability in the valuation of the target by expressing its bid more precisely, making the target more willing to close the deal with a party they consider more competent (Schley & Peters, 2013; Zhang & Schwarz, 2011).

Why round number offers are so common

Prior studies give several explanations for the prevalence of round numbers. A simple view is

that people are hardwired to choose round numbers because they are cognitively least costly. People often speak and write about round numbers rather than discrete numbers (Dehaene & Mehler, 1992; Jansen & Pollmann, 2001). Mason et al. (2013) document that experienced executives tend to make round initial offers if they were not told otherwise since it has been a tacit norm in negotiations.

Focal point theory (Schelling, 1960) suggests another explanation for this trend in round numbers. From experimental studies, Janssen (2006) argues that bargainers seek to identify initial bargaining positions that have some special reasons for being credible, and these bargaining positions serve as focal points that influence the subsequent conduct of negotiations and their outcomes. He further suggests that fair splits, which often occur as round numbers, are potential focal points that facilitate coordination in bargaining. Other studies provide visual and statistical evidence that round numbers serve as cognitive reference points or goals, and as a result produce bunching of performance at these round numbers (Allen et al., 2017; Pope & Simonsohn, 2011; Rosch, 1975). Moreover, when people are not sure about their valuation of a subject, a salience of round numbers chosen in the past induces them to select round numbers within a range of valuations over which the person cannot distinguish her feelings (Pope et al., 2015). Plott and Zeiler (2005) report that 82% of their participants set initial valuation that was a \$0.50 increment, although subjects could, in principle, set very precise thresholds for their valuations. Apart from round numbers, the target's 52-week high or recent peak prices serve as salient reference points in offer prices or judgmental anchors for purposes of valuation in M&A (Baker, Pan, & Wurgler, 2012).

These studies on cognition and focal point theory base their results on experimental and observational evidence, while considering underlying psychological processes. Nevertheless,

they fail to explain why actors persist in these behaviors despite evidence that rounding yields worse outcomes with respect to negotiated prices. To bridge this gap, we propose two explanations for rounding of initial prices: valuation uncertainty and cheap talk signaling.

Round numbers become more salient when the precise value of an object is unclear. Hence, if uncertainty increases, rounding should become more frequent. Although this idea seems implicit in the cognition and focal point studies, there has been little explicit recognition of the relationship and few empirical tests. One exception is Bradley et al. (2004), which documents a connection between the integer pricing of IPOs and the standard deviation of subsequent returns. In the context of M&A, potential acquirers make bids for target companies about which they have incomplete information. When this uncertainty is greater, it is harder for acquirers to formulate a credible, precise bid, leading them to apply rounding as a heuristic. We posit that uncertainty acts as a moderator by raising the cognitive cost of determining a precise value.

Yet even when bidders have adequate information to formulate a precise bid, they may choose not to do so for strategic reasons. Backus et al. (2019) show that many sellers find it beneficial to signal bargaining weakness to sell their items faster, albeit at lower prices. Buyers and sellers have the incentive to overstate the strength of their initial position in an effort to extract surplus, but this results in a loss of efficiency if an agreement is not reached. Sellers can, however, credibly signal their private information to reduce frictions in negotiations. Specifically, impatient sellers can use round numbers to signal their willingness to cut prices in order to sell faster. Backus *et al.* document a trade-off: round-number asking prices elicit lower offers, but more of them and sooner.

To test this idea, Backus et al. (2019) look at buyer and seller engagement on eBay's Best Offer sales mechanism, where sellers first post a listing price and then buyers can either choose

the ‘Make Offer’ button to negotiate the price with the seller or the ‘Buy it Now’ button to immediately purchase at the listing price.² They find that, on average, round-number sellers receive lower first offers from buyers and settle on lower final prices than nearby precise-number sellers. Choosing round-number listings and receiving lower offers are prevalent even among the most experienced sellers.

Backus et al. (2019) document a separating equilibrium using an empirical framework for studying signaling games. Within their framework they find three kinds of evidence. First, sellers who use round-number asking prices behave differently from those who use precise numbers: sellers who use round numbers are more likely to accept a given offer and less aggressive in their counteroffers. Second, round-number listings receive more viewer clicks than precise-number listings, suggesting that buyers correctly infer these round listings to be more attractive offers. Also, buyers are more likely to engage in negotiations (i.e., bargain on prices) with round-number sellers, suggesting that round numbers are a signal of a seller’s willingness to take a price cut. Third, they document a trade-off between price and the time and likelihood of sale: the round-number listings are compensated for their lower sale price by a faster arrival of offers and a higher probability of sale.

Our analysis takes the buyer’s standpoint and extends the Backus et al. findings to the M&A market. As indicated by many empirical M&A studies, protracted deal duration defers efficiency gains, raises legal costs, and creates diversion of managerial attention from other lucrative deals and investment opportunities. Thus, acquirers typically prefer a more rapid deal completion (Bainbridge, 1990; Dikova, Sahib, & Van Witteloostuijn, 2010). If round numbers are a credible

² Upon clicking the Make Offer button, a prospective buyer is prompted for submitting an offer, which triggers an email to the seller to accept, decline or make a counteroffer. Once the seller responds, the buyer is prompted to accept and check out, or make a counteroffer. Backus et al. (2019) collect data on listed prices (from the seller), first offers (from the buyer who chooses the Make Offer option), and counteroffers (from the seller who responds to the buyer’s first offers and so on) for the Best Offer listings.

signal of these eager buyers, then by signaling weakness (i.e., by offering a higher round-number price), a buyer can attract sellers faster and reach deal completion sooner.

Moreover, Wiltermuth, Gubler, and Pierce (2022) find evidence that round numbers influence perceptions of value, such that the market perceives previous prices at or above a round number to yield disproportionately higher subsequent valuations than numbers just below the threshold. These buyers may subsequently benefit more by reselling at a higher price. This is consistent with our prediction that buyers may pay a small premium to reach the round number benchmark to signal high valuations and perhaps resell more in the future.

III. Hypotheses

The discussion above suggests that valuation uncertainty and cheap talk signaling contribute to the use of round number initial bids in the market for business acquisitions. We draw from the uncertainty and signaling explanations to assess how the incidence of rounding may be related to firm and transaction characteristics. Moreover, we examine how rounding may affect four dimensions of outcomes: price paid, time to completion, frequency of competing offers, and rate of bid withdrawal. We formalize our expectations as a set of testable hypotheses.

Likelihood of rounding

We posit that potential acquirers are more likely to resort to rounding when they lack sufficient information about the target to formulate a precise bid. While an acquirer can always create a precise bid in an effort to appear to be well-informed and establish a strong bargaining anchor, without adequate information the anchor may be misplaced, and such efforts may not be credible. A superior strategy for a less informed bidder may be to propose a round number initial bid which signals the bidder's eagerness to bargain with the target.

Although we cannot directly observe the bidder's uncertainty about the value of the target,

we have some good indicators. The value of private targets tends to be more uncertain than that of public targets, given that the stock price of publicly traded firms establishes an observable benchmark. Other indicators in our data relate to the financial sophistication and industry knowledge of bidders, which enable them to develop a more precise valuation of the target.

Hypothesis 1: *Rounding is more likely when the bidder is more uncertain about the value of the target.*

M&A outcomes associated with rounding

According to the cheap-talk signaling theory, round numbers can be chosen strategically as a signal by buyers who are willing to pay a premium in an effort to attract sellers, close the deal sooner, and deter potential competitors. For example, an eager buyer may choose to round up its initial offer to \$120 rather than \$118.43 to attract the seller's attention and get the seller's approval sooner.

There are two ways that buyers would potentially end up paying more when using the round-number strategy. First, assuming that the buyer is rounding up and not down, they pay a premium in the initial bid. Second, a bidder can hint at its willingness to negotiate by expressing its bid at a rounded level. Past research has found that precise initial offers are associated with smaller price changes, because a precise offer serves as strong anchor for the negotiation and a signal of confidence (e.g., Janiszewski and Uy, 2008; Mason et al., 2013). Moreover, the Backus et al. (2019) cheap talk signaling theory predicts that round number bidders will be more open to accepting counteroffers, in an effort to close the deal faster. The target may perceive the signal of a round-number offer as an opportunity to bargain and raise the bid further. Therefore, we posit the following hypothesis:

Hypothesis 2: *Round initial offers are more likely to lead to higher final offers.*

According to the signaling theory, buyers with round-number listings aim to speed up the deal completion process. In a competitive bidding contest, rounding can be used to deter later bids, making the auction end earlier. In a one-to-one negotiation scenario, where there is just one acquirer and one target, a rounded offer is more likely to be above the target's reservation price. Hence, the target is more likely to be satisfied with the offer and accept the transaction sooner. Therefore, we propose that:

Hypothesis 3: *The time from bid announcement to completion of a deal (i.e., contest duration) is shorter for round initial offers.*

Other potential acquirers may view round offers as large and “preemptive” bids and may avoid entering a bidding contest against an ostensibly more aggressive bidder, potentially triggering a bidding war. Therefore, bidders may use round initial bids to deter potential competing bidders and reduce their chance of being outbid. This leads to our fourth hypothesis:

Hypothesis 4: *Round initial offers are less likely to receive challenging offers than precise initial bids.*

Our final hypothesis relates to the likelihood that the bidder will ultimately close the deal with the target. Our discussion so far suggests that if a bidder offers a rounded-up price to deter competition and close the deal quickly, it is more likely to complete the transaction. However, round number initial offers could be linked to a higher probability of deal failure for reasons relating to the uncertainty and signaling explanations.

When rounding is in response to uncertainty about the value of the target, there is a greater chance that the bid is set too high given the lack of information. After negotiations begin the bidder learns more about the target. If the bidder discovers that the target's value is below the initial bid, it may choose to back out of the deal rather than reduce the offer. Thus, uncertainty

leads to more “errors” in the original bid and a higher likelihood of bid failure.

Second, round offer bidders who are impatient may perform less thorough scrutiny at the initial stages of target evaluation. Managers from round offer bidders may be hubris-infected, overbidding for the deal, which could lead ex-post to disappointment (Aktas, de Bodt, & Roll, 2006). When performing due diligence following their initial offer, such bidders may realize their over- evaluation.

These mechanisms, which lead to rounded bids, can signal to the target that the bidder does not have a good idea of the appropriate price. Managers of the targets, who may care about how competent their future business partner is, may view impatient bidders as less trustable and competent (Mason et al., 2013), making them more likely to turn down the offer. Targets may be more willing to close the deal with a party they consider more informed and competent, given the many challenges associated with post-merger integration (e.g., Epstein, 2004; Shrivastava, 1986).

These arguments imply the following hypothesis:

Hypothesis 5: *Round initial offers decrease the likelihood that the initial bidder can close the deal with the target.*

IV. Data and empirical results

Sample restriction and key variable description

We collected offers announced between January 1st, 1981 and August 31st, 2017 from the Securities Data Corporation’s (SDC) mergers and acquisition database. For inclusion in our sample, the acquirer and the target must be firms in the United States, and the proposal must be an offer indicated by SDC either as a merger or acquisition of majority of interest. We also require that the offer is not classified as a repurchase, recapitalization, restructuring, or joint

venture. The acquirer must acquire over 90 percent of the target's shares. The initial deal value must be reported in US currency.

We focus on the initial value of transaction proposed by the bidder at the merger announcement (or at most within six months of the announcement date of the transaction). SDC reports 'initial offer' as the total value of consideration the acquirer offers to pay to the target, excluding fees and expenses³. SDC obtains these figures from publicly available domains such as stock exchange filings, company press releases, various news wires, and agencies, etc. SDC provides an indicator of whether the deal value is amended from the initial to the final transaction. We also looked into deal synopsis on SDC and documentations on Factiva to double-check the initial value of transaction.

Each deal in our sample must indicate its status of completion, as either "completed" or "withdrawn." We exclude offers that have the deal status of pending, tentative, or unknown. For successful transactions, the duration of the takeover contest is defined as the number of calendar days between the announcement of the initial offer and the completion date of the deal, following Betton et al. (2008) in the computation of the duration of takeover contests.

We limit our sample to bids between \$0.8 million and \$1 billion. This is because bids less than \$0.8 million are unlikely to be rounded to the nearest round number of \$1 million. Our requirements yield a total of 11,328 offers. We further classify offers into four different groups: private target acquisition by cash only (22%), private target acquisition by stock only (37%),

³ Most of the deals in SDC only document their initial value of transaction. We follow standard practice and use the first official (public) bid for the target to start the contest (Betton, Eckbo, & Thorburn, 2008). Some deals also report initial price per share of the offer, especially for publicly listed targets in common US stock markets (e.g., NYSE, NASDAQ, AMEX etc.). For public deals that have initial price per share, 58.3% of the cash offers are rounded in terms of price per share, whereas only 14.1% of the stock offers are rounded in terms of price per share. (Definition of rounded price per share: if the stock price is between \$1 and \$20, any integer number price per share is rounded; if the stock price is between \$20 and \$200, any price per share set at the \$5 or \$10 mark is rounded; if the stock price is between \$200 and \$500, any price per share set at the \$10 mark is rounded. We require the initial offer to be at least \$5 per share (Bradley et al., 2004; Hukkanen & Keloharju, 2019). We recover missing initial share price from Zephyr.

public target acquisition by cash only (24%), and public target acquisition by stock only (17%). We exclude stock-and-cash mixed offers.

Distinguishing between private and public targets and by method of payment is warranted for several reasons. Acquisitions of public and private firms have different negotiation processes (Capron & Shen, 2007), and the choice of cash or stock payments affects how the deal value is structured (Miller & Segall, 2017). Unlike a public target, a private target does not have a publicly-traded stock nor a readily obtainable market price to serve as objective measures of the company's market value. Also, private companies are not required to prepare audited financial statements on a regular basis according to generally accepted accounting principles (GAAP). Thus, the buyer lacks a valuation benchmark that encompasses a broad set of information (Datar, Frankel, & Wolfson, 2001).

Payment in cash represents a straightforward way of acquiring another company, whereas payment in stock can add to the complexity of transactions. Unlike cash deals, which can be agreed upon at the initial offer price, stock deals have to go through additional procedures from initial bid to deal completion, such as determining the distribution of ownership, the exchange ratio, and the reasonable shares acquired. Moreover, cash offers do not require bidder shareholder approval, giving the bidder management more discretion in formulating the bid. For private deals made in cash, the acquirer can simply offer X amount of money to the target.

Thus, we expect rounding to be most prevalent in situations where cash is offered for a private company. We expect less rounding in acquisitions of public companies because there is less uncertainty about the appropriate price. (While the stock price of a public firm establishes an observable market value, there is uncertainty about potential synergies with the buyer and hence the acquisition premium that can be justified.) Moreover, when the target has a publicly-traded

stock, acquirers may pay a specific price per share, expressed as a premium over the market price. Stock offers for public companies are often negotiated by exchange ratio, for which rounding is less likely to occur. Thus, rounding of the acquirer's bid is likely to depend upon the method of payment as well as the target type.

Differences between private and public targets in the acquisition process and in reporting and regulatory requirements may also affect the degree of rounding in announced deal outcomes. All acquisition bids for public companies must be announced due to SEC regulations, However, bids for private companies may not be disclosed until the deal is completed. Private final offers, private withdrawn deals, and private competing bids are less likely to appear in the news (and therefore to be reported in the SDC database). In general, bidders face less competition in the market for private acquisitions and low publicity regarding the acquisition process of private targets (Capron & Shen, 2007). Initial news of the takeover is usually provided in Filing 425, which contains only summary information. Full merger proxy filings, which contain the background to the merger section and takeover information, are often unavailable for uncompleted deals (available only when the failure occurs at a relatively advanced stage of the process), and are usually only available for public firms (Aktas et al., 2016). Contracts for purely private-private deals are rarely made publicly available (Coates, 2010).

Given these limited reporting requirements, the SDC data on bids for private companies may omit many, perhaps most, bids that were unsuccessful. Initial negotiations with private targets may not be disclosed, and we may fail to observe bids for private targets that were successfully challenged by subsequent acquirers.⁴ For such bids, SDC may not accurately record the initial value and the extent of subsequent price changes. By comparison, we expect that our data on

⁴ Consider that in our sample, public bidders account for 77% of the unsuccessful bids for private targets but only 50% of the unsuccessful bids for public targets.

bids for public companies avoids such reporting omissions.⁵ Thus, the effects of rounding on bid price changes, bidder competition, and success rate can be assessed most reliably for public targets.

Evidence of round numbers as focal points

For the full sample, the data show sharp spikes at round numbers in the distribution of initial offers, especially at offers divisible by ten, five, one, and one-half million.⁶ Figure 1 provides density histograms for transactions with initial offers of deal value at different ranges. Figure 1(A) shows excess mass in the distribution for initial offers at numbers divisible by \$1 million and a few by one-half million when we restrict the sample to deals from \$0.8 million to \$10 million. Figure 1(B) offers a broader view by extending the sample size to larger offers within the range of \$10 million to \$100 million. It shows sizeable levels of mass in initial offers divisible by \$5 million. Approximately 45% of the initial offers are announced at an integer or one decimal place rather than two or more decimal places (with the bid specified in \$millions). Figure 2 investigates the degree to which the initial bids are clustered at certain numbers if the initial bid is announced with decimals. Decimals are most likely to occur at half a million, and then at tenth million (\$), indicating that initial offers divisible by half a million may also serve as focal points or round numbers.

⁵ Consistent with this disparity in reporting requirements, our sample shows large differences between private versus public targets in rates of bid withdrawal and challenges to initial bids. For private offers (cash and stock) about 5% to 6% of the takeover bids failed, whereas the withdrawn rate is much higher for public offers: about 22% of public cash offers and 13% of public stock offers did not get completed. Very few challenging offers are reported for private target acquisitions, whereas 14% of public cash offers and 3% of public stock offers encountered a competing bid.

⁶ We did tests to examine the amount of probability mass immediately below versus immediately above the rounded number over the entire sample as well as subsamples (e.g., cash offers for private or public companies). If bids are rounded up, and rounding is more likely if the value of a precise offer falls immediately below a rounded value, we would observe an asymmetry pattern with less mass below versus above strong or moderate focal points. (Note that rounded bids could also be set above the adjacent round number.) We found only weak support for such a pattern in the main sample or subsamples. This suggests that the probability of rounding is approximately constant (i.e., all precise values, whether above or below a round number, are approximately equally likely to be rounded).

A fundamental issue is how “rounding” should be defined. Figures 1 and 2 suggest that a simple categorization might classify bids as rounded if the bid takes on a multiple of ten, five, one, or one-half million in US dollars. A more precise categorization must account for the “granularity” of the rounding. For example, consider two bids made at the same multiple of one-half million dollars, but with different total size. Most observers would view a bid of, say, \$1.5 million as rounded, but not a bid of \$100.5 million.

To classify an initial bid as rounded or not, we applied the following rubric, which has the desirable property of being adjustable and scale invariant. First, we identified the largest round increment (ten, five, one, one-half or one-tenth million dollars) that the offer may contain.⁷ We then computed the granularity of rounding, defined as the largest round increment divided by the total value of the offer. This allows us to apply screens at various granularity cutoffs (e.g., >1%, >2% and >4%) to define alternative measures of rounding and perform sensitivity analysis.⁸ We adopt the 2% cutoff as the default in the discussion below.

While most of our analysis is focused on rounding of the total offer value, for public targets rounding can also occur in the offer price per share. (Share price rounding can be categorized using the same granularity cutoffs.) We assess how both types of rounding of the initial bid may impact subsequent price changes, contest duration, bidder competition, and success rate.

Degree of rounding associated with target type and payment method

Table 1 shows how the degree of rounding, based on the 2% granularity cutoff, varies by type of target firm (private versus public) and method of payment (cash versus stock). We refer to the

⁷ *Ten million* takes the value of one if the initial offer value is divisible with ten million dollars. *Five million* equals one if the initial offer value is divisible with five million but not with ten million dollars, and so on, with *Tenth million* equal to one if the initial offer value is divisible by \$0.1 million but not with \$0.5 million.

⁸ For example, the 1% cutoff defines as rounded all bids made at multiples of \$1 million up to a total offer of \$100 million (as well as multiples of \$0.5 million up to \$50 million, multiples of \$0.1 million up to \$10 million, etc.). Similarly, the 2% cutoff defines as rounded bids at multiples of \$1 million up to \$50 million; the 4% cutoff accepts bids at multiples of \$1 million up to \$25 million, and so forth.

transaction types that are defined by these combinations as: private/cash, private/stock, public/cash and public/stock. The pattern in Table 1 is consistent with our prediction that rounding of initial deal value should be more frequent in the case of private targets, whose value is more uncertain than that of public companies. Of the private/cash initial offers, 46.4% are rounded, as compared with 19.3% of the private/stock offers, 6% of the public/cash offers, and 5.4% of the public/stock offers. In general, we observe less rounding for stock offers (although such offers are sometimes rounded in terms of share price).

Table 2 Panel A reports summary statistics for the full sample, including means, standard deviations, medians, and extreme values for the round number indicator, success rate, contest outcome, and control variables. Table 2 also gives definitions of all the measures used in the study. Summary statistics for the four subsamples are reported in Appendix Table A1.

Likelihood of round-number initial offers

Table 3 reports the results of a logit regression which estimates the likelihood of observing a round-number first offer as a function of acquirer/target characteristics and bid attributes. The results are robust across the three alternative granularity levels used to define rounded bids. (In these and subsequent logit regressions, standard errors are in parentheses; p-values are in the line below; marginal effects evaluated at variable means are in brackets.)

The estimates in Table 3 are supportive of the notion that rounding becomes more likely when the bidder faces greater uncertainty about the value of the target (Hypothesis 1). The negative coefficients for public target, financial acquirer, presence of acquirer's advisors, financial target and horizontal offer are all consistent with this hypothesis. The marginal effects for public targets imply that bids for public companies were about 23 percentage points less likely to be rounded, in line with the differential in Table 1. Large effects are also indicated for

financial acquirers (or acquirers aided by financial advisors), which have expertise in business valuation techniques and thus are able to place more precise bids for target companies. Other effects suggest that it is easier to value companies in the financial sector as well as those located in the acquirer's own industry.

The results in Table 3 are also broadly supportive of the cheap talk signaling motive for rounding. In particular, cash offers have a large positive coefficient in the regressions. The simplicity and directness of a rounded offer made in cash strengthens the signal that the acquirer is eager for a quick deal and may be willing to bargain. Moreover, tender offers - made directly to shareholders at a specified premium over the existing stock price - are less likely to be rounded. It seems reasonable that managers, rather than shareholders, are the agents who may be receptive to a round number signal of the total value of their company.

Many of these estimated effects are large, and the binary nature of most measures facilitates quantitative interpretation and comparison. Consider the estimates in regression 3.2, where the mean of the dependent variable denotes an average rate of rounding of 19.6 percent, based on a 2% granularity cutoff. Acquiring a public target has a marginal effect of -0.23, i.e., acquisitions of public targets had 23 percentage points lower likelihood of eliciting a round-number bid, evaluated at the mean of the sample. Another large effect is evident for cash offers; a 13.7 percentage point greater likelihood of rounding is associated with cash bids. Smaller effects are shown for financial acquirers and financial targets: the likelihood of a precise initial offer was 3.3 percentage points greater when the target was a financial company and 2.9 points greater when the acquirer was a financial company.⁹

⁹ We also tested for the possibility that acquirers place more precise bids as they get more experience with acquisitions. We regressed the likelihood of round initial offer on the number of times that the acquirer has placed a bid for any target prior to the current offer. (To control for the fact that we observe no deal before 1981, we dropped the first ten years of our sample.) The coefficient on prior number of offers appeared positive but was not significant at conventional levels.

Change from initial bid to final deal value

SDC reports the Deal Value was Amended Flag (VALAMEND) if there was a change in the consideration paid.¹⁰ Out of 11,328 observations in our entire sample, 640 observations (5.6%) changed value from initial bidding to final closing of the deal (either increases or decreases). A two-way tabulation of frequency counts of round-number offers and the value amended flag is provided in Table 4. Table 4(a) includes the full sample with a total of 11,328 observations. Table 4(b) through (e) includes subsamples of private/cash, private/stock, public/cash and public/stock respectively. We adopt the 2% cutoff as the default definition of rounding.

For public targets, the breakdown in Table 4 shows that rounded deals were more likely to have their value raised after the initial bid. In the subsample of cash-only bids for public targets, 22% of the rounded offers were increased, compared to 7.4% of the non-rounded offers. In the subsample of stock-only bids for public targets, 19.4% of the rounded offers were increased, compared to 2.8% of the non-rounded offers. Thus, for public targets, the rounded deals were increased almost three times as often as the non-rounded deals in the case of cash offers, and over six times as often in the case of stock offers.

Due to reporting issues and less visibility of bids in private target acquisitions, we are less likely to observe different initial and final offers for private targets. Consistent with such a sampling bias, 10% of the public/cash and 6% of the public/stock acquisitions have changes in final offers, as compared to only 5% and 3% of the private/cash and private/stock acquisitions. Perhaps due to this bias, the simple breakdown in Table 4 for private targets gives only weak

¹⁰ This indicator is a code that is set to “I” if the value of the deal was increased, and to “D” if the value decreased. If a deal does not include the Value Amended Flag, it could be that the consideration amount or share price did not change, and we term these transactions as constant. To confirm the accuracy of this indicator we further looked into deal synopsis for further details about the previous considerations and searched through Factiva for company announcements and transaction history for each of the deal that has the value amended flag. The deal amended flag is consistent with the information provided by these sources as we look for initial and final value of transaction.

evidence that rounded initial bids were more likely to be increased for stock-only offers, and no evidence for cash-only offers.

Table 5 reports logit regressions that estimate the likelihood of increasing an offer after the initial bid, after controlling for bid characteristics and year fixed effects.¹¹ We estimated separate specifications for each of the four subsamples (private/cash, private/stock, public/cash, and public/stock), and within each subsample we tested at different granularity cutoffs. In addition to the dummy variable for rounded total offers, in the public target subsamples we include a second dummy for bids made at round-number prices per share.

Table 5 shows that after inclusion of the controls, the round number total offer dummy is significant in all regressions at standard significance levels, consistent with Hypothesis 2. The effect is also quantitatively large in the regressions corresponding to cash offers for public targets. Consider regression 5.8, where the estimated marginal effect of 0.064 implies that for rounded initial total offers there was a 6.4 percentage point greater likelihood of observing a higher final offer. This magnitude is similar to the marginal effects of the presence of competing bidders (0.058), and it is almost as large as the overall fraction of bids that were increased in this subsample (0.083).

For public targets, Table 5 also includes the round-offer share price dummy as an explanatory variable. Its estimated coefficient is positive in the case of cash offers, indicating that initial bids with rounded share prices tended to be followed by increases in the final offer. As compared with the effect of rounded total offers, however, the magnitude is much smaller.

Tables 6(A) and 6(B) examine the price premiums shown by the initial and final bids for

¹¹ We've re-run our regressions from Table 5 to 9 by adding industry fixed effects (acquirer's first 2-digit SIC code). We've also performed regressions by limiting our sample from 1991 to 2017 (to deal with potential data inconsistency before 1991). Results are consistent with our present result, with minor change in magnitude of effects and significance.

public targets. Since acquisitions are often anticipated, we followed common practice by computing these premiums as a ratio, with the denominator being the target's stock price 42 trading days prior to the date of the initial bid (Schwert, 1996). We regressed these premiums on the rounding dummies and a set of control variables.

Table 6(A) shows a small premium of about 8.2% for rounded total cash offers (applying the 2% cutoff for rounding). The estimates appear smaller, and in some cases negative, for other cutoffs and for stock offers or rounded share price offers. Thus, we find limited evidence that rounded offers had a larger premium than non-rounded offers in the initial bid.

Table 6(B) reports comparable results based on the final offer. Here we observe a price premium of about 15.6% in the case of rounded total cash offers, applying 2% cutoff. Thus, the final offer premium was about 7 percentage points higher than the initial bid premium shown in Table 6(A). Similar increases between the initial and final bid prices are shown at the other granularity cutoffs and also for stock offers. These estimated final bid premiums range from 1.5% to 12.1%, confirming that acquirers who made rounded total price bids tended to pay a small premium, with most of the premium arising from price increases made after the initial bid.

Duration to completion

Table 7 reports OLS regression results relating contest duration to rounding of the initial bid and other characteristics. We define contest duration as the number of calendar days from the initial offer announcement to the completion of the deal. Note that SDC reports effective/completion date of a deal only if it gets completed, so this variable is conditional on the deal being successful. Sample size is reduced for this reason and also because SDC sometimes does not record the completion date. We right censor duration at two years or 730 days.

Table 7 shows that bids made at round numbers of the total offer price have a shorter contest

duration than those made at precision. Regression 7.2 indicates that on average, round-number initial offers close about 11 days sooner than precise-number bids, where the mean contest duration is about 87 days. In the case of public/cash offers, regression 7.8 shows that such deals closed more than 15 days sooner on average. Thus, Table 7 provides strong evidence supporting Hypothesis 3.¹²

For public targets, Table 7 includes a dummy variable denoting that the bidder made their initial offer at a rounded *price per share*. Such offers experienced longer contest duration, about six days on average for cash deals and 12 days for stock deals. These findings are consistent with those of Hukkanen and Keloharju (2019) but are in strong contrast with our findings for rounded total offer bids. In general, our results imply that a cash bidder who wants to complete the deal quickly should round the total amount of the offer, not the price per share.¹³

Likelihood of competing offers

Table 8 examines whether bid roundness affects the likelihood that the target receives outside offers which challenge the original bid. Among the public/cash offers in our sample, the target received a competing offer 13.8% of the time. Competing bids are rare for private targets in our sample and are observed for only 3.4% of private/cash offers and 0.2% of private/stock offers. This is consistent with the fact that bidders normally face relatively little competition in the market for private acquisitions, and there is limited publicity, so competing offers may go unreported (Capron & Shen, 2007).

Table 8 provides strong evidence that when cash bids for public targets were placed at round

¹² We looked at the percentage of rounded total offers for each year to see if the likelihood of rounding coincides with merger waves. We found that rounding was more likely to happen around the early 1980s (when 35% of the deals were rounded) and descended to an average rate of 20%, which does not coincide with merger waves.

¹³ In addition to OLS, to assess contest duration we utilized Heckman, Poisson, and Cox proportional hazards models (Hukkanen & Keloharju, 2019; Luypaert & De Maeseneire, 2015). Those results were consistent with OLS, with minor changes in magnitude and significance.

numbers of the total acquisition price, they were less likely to be followed by competing bids. In Regression 8.8, such offers have a marginal effect of -0.052; i.e., the chance of a competing offer was 5.2 percentage points lower when the initial bid was rounded. This magnitude is substantial, amounting to 38% of the subsample mean (0.138). Even in the raw data the effect is clear: within the public/cash offer subsample the average rate of competing offers was 8% for rounded bids versus 14% for non-rounded bids. These results suggest that potential acquirers may use round initial bids to deter competing bidders and reduce their chance of being outbid, consistent with Hypothesis 4.

Table 8 also shows a reduction in competing offers for private targets when the acquirers' bid was rounded and made in cash, similar to what is observed for public targets. However, rounded stock-only bids for private targets tended to be followed by an increased rate of competing offers. One possibility is that private targets are skeptical when rounded bids are monetized by stock and are elicited to seek other potential suitors. Nevertheless, the infrequency of competing offers for private targets makes these results hard to interpret, as they are based on a very small number of cases.

Table 8 also shows an increase in competing offers for public targets when the initial bid was made at a rounded *price per share*. For cash bids, the estimated effect is opposite in sign to the one indicated for rounded total offer price. Such results are consistent with the idea that the target may view rounding of the share price as a signal that the bidder lacks information on the acquisition premium that can be justified. In this situation, the target may seek alternative offers to establish the value of the company and/or find a more competent bidder. This is consistent with the findings of Hukkanen and Keloharju (2019) and the wealth of studies that demonstrate inferior outcomes for initial bidders that use rounded rather than precise bids.

Likelihood of withdrawing a bid

Our final analysis, in Table 9, investigates the relationship between initial bid precision and subsequent withdrawal of the bid. For public targets the average withdrawn rate was 21.7% for cash offers and 12.8% for offers made in stock. By comparison, in the subsamples for private targets the average withdrawn rate was only 5.4% for cash offers and 6.2% for stock offers. Again, it seems likely that this differential arises because many unsuccessful private offers go unreported.

The logit regressions in Table 9 show large effects for some of the control variables: bids were more likely to be withdrawn when they were hostile or when there was a competing bidder; withdrawal was less likely when the bidder was better informed, due to the presence of financial advisors or because the target was in the acquirer's own industry. None of the regressions show an effect that is statistically significant at conventional levels for round number total offers except in the case of stock offers made to private targets, where a very small positive marginal effect is estimated. Thus, with respect to round number total offers there is little evidence supporting Hypothesis 5.

By comparison, for initial offers set at a round number price per share of the target's publicly traded stock, Table 9 reveals a substantial link to bid failure. Here, the marginal effect is 0.060 for cash offers, which is appreciable relative to the average rate of bid withdrawal, 0.217. Thus, we find evidence supporting Hypothesis 5 in situations where the potential acquirer chose to round its bid as a *price per share* rather than a total offer price. This is consistent with the idea that such round number bidders were less informed or less competent - or were perceived as such by their targets.

V. Discussion and Conclusions

Initial offers made at round-number values are observed with remarkable frequency in many sectors of the economy. In our sample, nearly two-thirds of initial cash offers for private targets were made using round numbers, with rounded bids occurring at lower but still sizable rates for public targets and non-cash offers. One contribution of our study is to document in the context of business acquisitions what others have found in a variety of bargaining situations. More importantly, we offer explanations for the prevalence of rounding in the M&A context, and we show that rounding can have strategic benefits under some conditions.

We have proposed two causal mechanisms to explain the prevalence of rounding: valuation uncertainty and market signaling. Our study demonstrates how these mechanisms affect the likelihood of rounding and how rounding can influence post-bid developments, including price changes, competing offers, completion speed, and deal failure. The findings help to resolve a paradox in the literature: round initial offers are pervasive even though they have been found to typically yield worse outcomes for the bidder with respect to price and deal completion.

Our analysis supports the notion that rounding becomes more likely as valuation uncertainty increases. We have shown that rounding occurs much more frequently in bids for private companies. Private companies lack the benchmark valuation that is readily observable in the stock market for publicly traded firms. In addition, we have shown that rounding is less frequent in the presence of indicators denoting superior information and valuation skills (financial acquirer, financial advisors, horizontal offer). We argue that more uncertainty about the target's value makes it harder to formulate a precise offer, causing bidders to fall back on rounding as a heuristic. In this way, uncertainty acts as a key moderator in the decision to submit a rounded bid. Few prior studies have had data suitable for making such an assessment.

Our findings on market signaling are more complex. We have pointed to two different signals associated with rounding that have been considered in the literature. One comes from studies in the literature on bargaining which show that first movers experience superior outcomes when they formulate their bid more precisely. Here, the signaling element is an attribution of competence effect: a precise offer price makes the bidder appear more informed. (Precise bids also set a stronger anchor, which favors the initial bidder in subsequent bargaining.) Conversely, a round number offer signals that the bidder is less informed and potentially less competent. Such a perception is also consistent with the notion of uncertainty as a moderator, inducing bidders who possess limited knowledge of the value of their target to submit a rounded bid.

The second signaling-based explanation for rounding is the cheap talk strategy proposed by Backus et al. (2019), who provide a theoretical model as well as empirical documentation on the use of the strategy by sellers on the eBay platform. We have translated this strategy to the M&A context, arguing that round numbers are chosen as a signal by impatient buyers who are willing to take a slight drive-up of price to secure a timely purchase, and as a preemptive move to prevent competing bidders from entering. Such buyers seek quick execution rather than the objective of obtaining the best price (the outcome typically assessed in the bargaining literature).

While we find evidence supporting both signaling explanations, our main results, which focus on rounding of the initial offer's total value, are remarkably consistent with the cheap talk signaling strategy. We have shown that when the initial bid's total value is rounded, it tends to be followed by subsequent increases in the offer price, shorter contest duration, and fewer competing offers. As expected, offers in cash provide a more potent signal than offers in stock, and our results are most definitive in the case of cash deals for public companies, where our sample of attempted acquisitions is most complete.

As an alternative to rounding the total offer value, potential acquirers can round the offer price per share of the target company. Our findings suggest that the latter type of rounding sends a negative signal with respect to the knowledge or competence of the potential acquirer. Bids with a rounded price per share in our sample were associated with subsequent increases in the offer price, longer contest duration, more competing offers, and higher likelihood of bid withdrawal. Thus, rounded share price offers led to inferior outcomes for bidders. This is consistent with the findings of Hukkanen and Keloharju (2019) and other results in the bargaining literature.

Thus, rounding may provide two very different signals: one is that the bidder is eager to complete the deal quickly; the other is that the bidder is uncertain or only weakly informed about the target's value. Note that the first signal is explicitly chosen by the potential acquirer to obtain a strategic benefit, whereas the second is transmitted as an undesirable byproduct of rounding. (A poorly informed bidder can eschew rounding by selecting a precise offer, but such bids may lack credibility.) How do targets distinguish between the two signals? We have no clear answer, but the divergence in our results for total price rounding versus share price rounding is suggestive. When the total bid value is rounded, our results suggest that many targets perceive the cheap talk signal, whereas when the target's share price is rounded, the attribution of competence signal seems to be dominant. Moreover, rounding of total bid value may provide a financial "trophy" that appeals to the target company's management in a way that share price rounding would not.

Of course, such conclusions are only suggestive. Our results do not allow us to estimate a fraction of the sample for which the cheap talk signal was intentionally transmitted and successfully received. We suspect that many, if not most, of the round-number bidders in our sample resorted to rounding as a response to valuation uncertainty. Even so, the magnitude and

consistency of the estimated effects suggests that the cheap talk signaling mechanism operated in a reasonably large number of cases. We leave it to future studies to resolve these mechanisms more fully.

These findings have implications for business managers and for those engaged in financial acquisitions. Our evidence suggests that round-number initial bids are used strategically by acquirers in M&A negotiations in a manner consistent with the cheap talk signaling theory. By demonstrating the prevalence of this strategy in the M&A market, and by offering some benchmarks on the benefits and costs of the strategy, our study provides potential guidance for managers who face a choice between making a round-number bid versus a precise bid for an acquisition target. The advantages of precise bids have been well documented in the bargaining literature, and precise bids may be the best strategy for managers who seek to make acquisitions at the lowest possible price. However, bidders who place a premium on speed can use round numbers to signal bargaining weakness and their high valuation for the target, thereby accelerating the negotiation process by encouraging the target to accept the bid faster and prevent competing bidders from entering.

Our results imply that to achieve such a strategic benefit, rounding should be in the total amount of the offer—ideally made in cash—rather than in the price per share. Rounded share price offers generated inferior outcomes for bidders, a finding confirmed by others. Targets that receive a rounded share price bid may perceive bidder weakness and endeavor to find alternative suitors or find other ways to contest the bid.

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Figure 1: Histogram - Initial offer in value of transaction

Fig. 1(A): Initial offers between \$0.8 and \$10 million. Bin size is \$0.1 million.

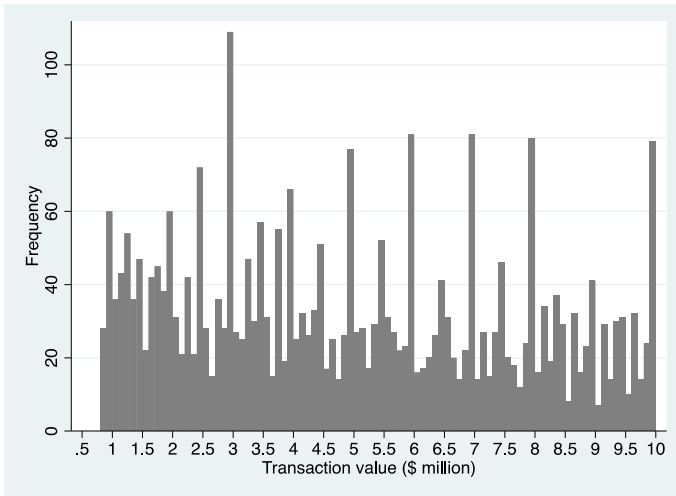


Fig. 1(B): Initial offers between \$10 and \$100 million. Bin size is \$0.5 million.

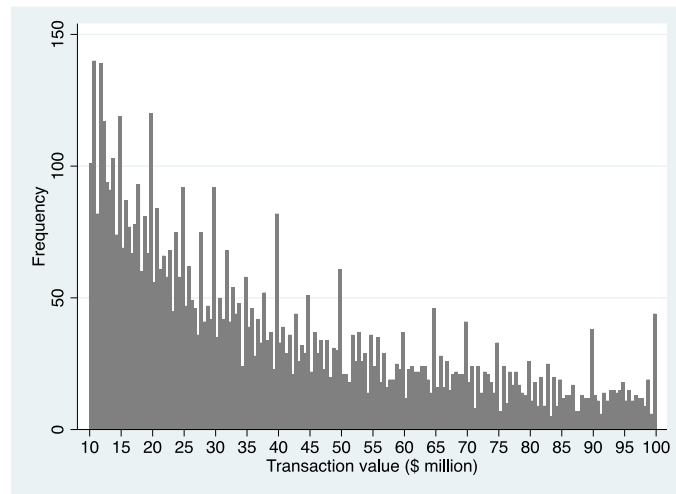


Figure 2: Distribution of decimals in value of transaction if the initial bid value is not an integer, full sample (in \$ million).

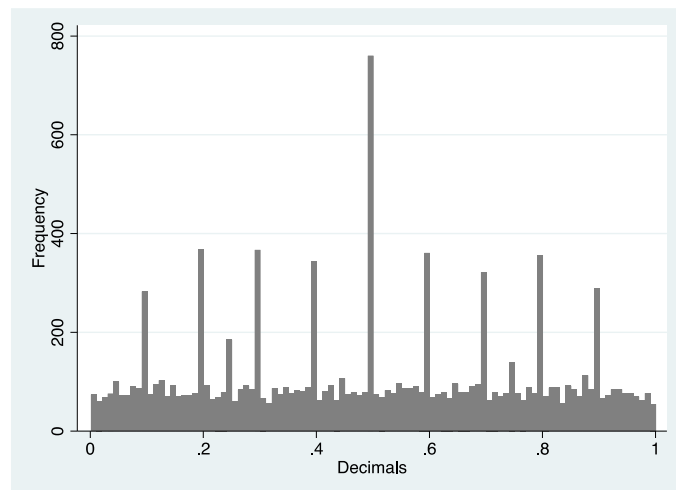


Table 1: Degree of rounding by target type and method of payment

		Method of payment	
		Cash offer	Stock offer
Target type	Private Target	46.4%	19.3%
	Public Target (Publicly traded stock)	6.0%	5.4%

Table 2: Summary statistics

Panel A reports means, standard deviations, and extreme values for the key variables for the *entire sample* without any restriction. All initial bids are at least \$0.8 million and at most \$1 billion (\$), made between January 1st, 1981 and August 31st, 2017.

Financial acquirer (target) equals one if the acquirer (target) is in the financial industry, i.e., the firm has first-two digit SIC code ranging from 60 to 67, fitting the industrial category of finance, insurance, and real estate. *Horizontal offer* equals one if the target and the bidder are in the same first 2-digit SIC code industry, this is to show the business relatedness of the bidder and the target. *Hostile offer* refers to an unsolicited offer or hostile target management reaction in the SDC data. *Public acquirer (target)* equals one if the acquirer (target) is listed on an exchange. *Cash offer* equals one if the consideration offered by the acquirer in its offer for the target in the transaction is cash, instead of hybrid or stock offering. *Tender offer* equals one if the offer is classified as a tender offer by SDC. *Transaction value* is the value offered for the target based on the initial offer in millions reported by SDC. *Competing offer* flag equals one if a third party launched an offer for the target while this original bid was pending. *Contest duration* is the number of calendar days between the announcement of the initial offer and the completion date of the deal. Note that SDC only reports effective/completion date of a deal if it is completed, so this variable is conditional on the deal is successful. We define *round number* as one if the offer is a multiple of ten, five, one, or half million dollars, and the granularity measure is greater or equal to 2%, zero otherwise. *Acquirer advisor* equals one if there is at least one financial advisor used by acquiring company, zero otherwise. *Failure* flag equals one if the deal does not get completed.

Panel A: Full Sample, without restriction on consideration type

	N	Avg	Std dev	Min	25%	Median	75%	Max
Hostile offer	11,328	0.02	0.14	0	0	0	0	1
Tender offer	11,328	0.09	0.29	0	0	0	0	1
Public acquirer	11,328	0.78	0.41	0	1	1	1	1
Public target	11,328	0.41	0.49	0	0	0	1	1
Cash offer	11,328	0.46	0.50	0	0	0	1	1
Horizontal offer	11,328	0.44	0.50	0	0	0	1	1
Financial acquirer	11,328	0.41	0.49	0	0	0	1	1
Financial target	11,328	0.33	0.47	0	0	0	1	1
Transaction value	11,328	123.96	188.52	0.80	12	40.81	145.09	1000
Acquirer advisor	11,328	0.35	0.48	0	0	0	0	1
Round-number total offer	11,328	0.20	0.40	0	0	0	0	1
Contest duration	8,344	120.64	90.40	1	50	104	168	727
Competing offer	11,328	0.05	0.21	0	0	0	0	1
Failure	11,328	0.11	0.31	0	0	0	0	1

Table 3
Likelihood of rounding associated with bid attributes

This table reports results from a logit regression which explains the likelihood of making a round-number initial offer, with variables measuring bid attributes and acquirer/target characteristics. The dependent variable is an indicator for round-number offer. Specifications (1) to (3) report the results of using the 1%, 2%, and 4% granularity cutoffs for the round-number definition. All independent variables are defined in Table 3. All initial bids are cash or stock offers for public or private targets for at least \$0.8 million and at most \$1 billion, made between 1981 and 2017.

VARIABLES	(1) 1%	(2) 2%	(3) 4%
Financial acquirer	-0.308	-0.285	-0.331
<i>standard error</i>	(0.088)	(0.093)	(0.106)
<i>p-value</i>	0.000	0.002	0.002
<i>marginal effects</i>	[-0.044]	[-0.033]	[-0.026]
Financial target	-0.215	-0.253	-0.243
<i>standard error</i>	(0.0918)	(0.0970)	(0.110)
<i>p-value</i>	0.019	0.009	0.027
<i>marginal effects</i>	[-0.031]	[-0.029]	[-0.019]
Hostile	0.695	0.721	0.402
<i>standard error</i>	(0.192)	(0.213)	(0.284)
<i>p-value</i>	0.000	0.001	0.157
<i>marginal effects</i>	[0.099]	[0.084]	[0.031]
Tender offer	-1.307	-1.330	-1.422
<i>standard error</i>	(0.143)	(0.167)	(0.222)
<i>p-value</i>	0.000	0.000	0.000
<i>marginal effects</i>	[-0.186]	[-0.154]	[-0.111]
Public acquirer	0.105	0.042	-0.021
<i>standard error</i>	(0.072)	(0.075)	(0.082)
<i>p-value</i>	0.142	0.569	0.802
<i>marginal effects</i>	[0.015]	[0.005]	[-0.002]
Public target	-2.234	-1.987	-1.786
<i>standard error</i>	(0.081)	(0.088)	(0.106)
<i>p-value</i>	0.000	0.000	0.000
<i>marginal effects</i>	[-0.318]	[-0.230]	[-0.139]
Cash offer	1.287	1.184	1.153
<i>standard error</i>	(0.060)	(0.062)	(0.068)
<i>p-value</i>	0.000	0.000	0.000
<i>marginal effects</i>	[0.183]	[0.137]	[0.090]
Horizontal offer	-0.0178	-0.0692	-0.0726
<i>standard error</i>	(0.052)	(0.055)	(0.061)
<i>p-value</i>	0.733	0.206	0.235
<i>marginal effects</i>	[-0.003]	[-0.008]	[-0.006]
Ln (Transaction value)	0.136	-0.0270	-0.197
<i>standard error</i>	(0.020)	(0.020)	(0.023)
<i>p-value</i>	0.000	0.185	0.000
<i>marginal effects</i>	[0.019]	[-0.003]	[-0.015]
Acquirer advisor	-0.180	-0.238	-0.261
<i>standard error</i>	(0.064)	(0.069)	(0.081)
<i>p-value</i>	0.005	0.001	0.001
<i>marginal effects</i>	[-0.026]	[-0.028]	[-0.020]
Constant	-1.193	-0.769	-0.623
<i>standard error</i>	(0.311)	(0.316)	(0.342)
<i>p-value</i>	0.000	0.015	0.069
Observations	11,328	11,328	11,328
Pseudo R2	0.195	0.184	0.193
Mean	0.236	0.196	0.146

Standard errors are reported in parentheses. P-values are reported in the following line. Marginal effects evaluated at variable means are reported in brackets. Bold coefficients indicate a p-value < 0.10.

Table 4: Rounding of initial offer vs. Change in value from initial to final offer
(a) Full sample:

		Degree of rounding	
		Non-Round	Round
Change in offer	Total	9,106	2,222
	No change	94.4% (8,596)	94.2% (2,092)
	Decrease	1.6% (148)	1.2% (28)
	Increase	4.0% (362)	4.6% (102)

(b) Cash-only bids for private targets:

		Degree of rounding	
		Non-Round	Round
Change in offer	Total	1,321	1,145
	No change	93.2% (1,231)	97.3% (1,114)
	Decrease	1% (13)	0.8% (9)
	Increase	5.8% (77)	1.9% (22)

(c) Stock-only bids for private targets:

		Degree of rounding	
		Non-Round	Round
Change in offer	Total	3,368	806
	No change	97.7% (3,291)	95.6% (771)
	Decrease	1.1% (37)	1.5% (12)
	Increase	1.2% (40)	2.9% (23)

(d) Cash-only bids for public targets:

		Degree of rounding	
		Non-Round	Round
Change in offer	Total	2,611	168
	No change	90.6% (2,366)	76.2% (128)
	Decrease	2% (51)	1.8% (3)
	Increase	7.4% (194)	22% (37)

(e) Stock-only bids for public targets:

		Degree of rounding	
		Non-Round	Round
Change in offer	Total	1,806	103
	No change	94.6% (1,708)	76.7% (79)
	Decrease	2.6% (47)	3.9% (4)
	Increase	2.8% (51)	19.4% (20)

Table 5
Initial bid precision and likelihood of increasing the final offer

This table reports results from logit regressions which explain the likelihood that the offer increases from initial bid to final offer with variables measuring initial bid precision and controls. The dependent variable is an indicator set to one if the bid was increased from initial to final offer, zero otherwise. Columns for each subsample report the result of using the 1%, 2%, or 4% granularity cutoffs for the round-number definition.

VARIABLES	Private targets; Cash only			Private targets; Stock only			Public targets; Cash only			Public targets; Stock only		
	(1) 1%	(2) 2%	(3) 4%	(4) 1%	(5) 2%	(6) 4%	(7) 1%	(8) 2%	(9) 4%	(10) 1%	(11) 2%	(12) 4%
Round-number total offer	1.035	1.071	1.283	1.232	1.142	0.846	2.361	2.237	2.157	3.626	3.759	3.213
standard error	(0.469)	(0.444)	(0.452)	(0.262)	(0.273)	(0.321)	(0.270)	(0.297)	(0.376)	(0.411)	(0.449)	(0.502)
p-value	0.027	0.016	0.004	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000
marginal effects	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.067]	[0.064]	[0.067]	[0.003]	[0.004]	[0.004]
Round-number share price							0.276	0.241	0.234	0.270	0.215	0.397
							(0.179)	(0.177)	(0.175)	(0.370)	(0.371)	(0.342)
							0.123	0.173	0.181	0.465	0.561	0.246
							[0.008]	[0.007]	[0.007]	[0.000]	[0.000]	[0.000]
Financial acquirer	-0.407	-0.406	-0.350	0.240	0.239	0.235	-0.089	-0.053	-0.053	-0.231	-0.363	-0.344
	(0.639)	(0.640)	(0.648)	(0.498)	(0.501)	(0.498)	(0.244)	(0.240)	(0.237)	(1.217)	(1.209)	(1.121)
	0.524	0.526	0.590	0.630	0.633	0.637	0.715	0.826	0.823	0.850	0.764	0.759
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[-0.003]	[-0.002]	[-0.002]	[0.000]	[0.000]	[0.000]
Financial target	1.104	1.112	1.129	-0.038	-0.045	-0.048	0.314	0.342	0.261	0.352	0.371	0.224
	(0.656)	(0.661)	(0.672)	(0.512)	(0.516)	(0.514)	(0.264)	(0.260)	(0.257)	(1.222)	(1.212)	(1.124)
	0.092	0.093	0.093	0.940	0.931	0.926	0.234	0.189	0.310	0.773	0.759	0.842
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.009]	[0.010]	[0.008]	[0.000]	[0.000]	[0.000]
Hostile	0.972	0.941	0.935				3.603	3.549	3.525	4.001	4.083	3.974
	(0.834)	(0.836)	(0.845)				(0.275)	(0.266)	(0.260)	(0.701)	(0.668)	(0.639)
	0.244	0.260	0.268				0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]				[0.102]	[0.102]	[0.110]	[0.003]	[0.005]	[0.005]
Tender offer	4.071	4.012	4.084				0.392	0.330	0.278			
	(0.851)	(0.841)	(0.854)				(0.210)	(0.207)	(0.205)			
	0.000	0.000	0.000				0.062	0.111	0.176			
	[0.000]	[0.000]	[0.000]				[0.011]	[0.009]	[0.009]			
Public acquirer	-0.412	-0.431	-0.391	15.07	13.98	15.12	-0.486	-0.511	-0.499	-0.631	-0.568	-0.434
	(0.503)	(0.499)	(0.494)	(1.702)	(766.8)	(2,531)	(0.210)	(0.208)	(0.206)	(0.684)	(0.692)	(0.666)
	0.413	0.388	0.428	0.993	0.985	0.995	0.021	0.014	0.015	0.356	0.412	0.515
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]	[-0.014]	[-0.015]	[-0.016]	[-0.001]	[-0.001]	[0.000]
Horizontal offer	-0.505	-0.441	-0.446	-0.348	-0.345	-0.382	-0.177	-0.179	-0.219	0.443	0.591	0.533
	(0.419)	(0.418)	(0.417)	(0.271)	(0.270)	(0.270)	(0.202)	(0.201)	(0.199)	(0.302)	(0.304)	(0.290)
	0.228	0.291	0.285	0.198	0.202	0.157	0.382	0.373	0.271	0.142	0.051	0.066
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[-0.005]	[-0.005]	[-0.007]	[0.000]	[0.001]	[0.001]
Ln(Transaction value)	0.077	0.130	0.176	0.149	0.181	0.193	0.160	0.171	0.143	0.283	0.262	0.163
	(0.153)	(0.154)	(0.156)	(0.106)	(0.106)	(0.105)	(0.084)	(0.083)	(0.082)	(0.143)	(0.141)	(0.132)
	0.615	0.396	0.259	0.161	0.087	0.066	0.056	0.039	0.083	0.047	0.062	0.217
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.005]	[0.005]	[0.004]	[0.000]	[0.000]	[0.000]
Competing bidder	2.661	2.735	2.800				2.093	2.033	1.963	1.320	1.458	1.720
	(0.574)	(0.582)	(0.584)				(0.189)	(0.187)	(0.185)	(0.521)	(0.513)	(0.467)
	0.000	0.000	0.000				0.000	0.000	0.000	0.011	0.004	0.000
	[0.000]	[0.000]	[0.000]				[0.059]	[0.058]	[0.061]	[0.001]	[0.002]	[0.002]
Acquirer advisor	1.229	1.249	1.280	0.301	0.315	0.311	0.027	0.055	0.024	0.056	0.027	0.114
	(0.426)	(0.427)	(0.427)	(0.312)	(0.311)	(0.311)	(0.188)	(0.186)	(0.185)	(0.324)	(0.321)	(0.310)
	0.004	0.003	0.003	0.334	0.312	0.317	0.885	0.767	0.899	0.863	0.934	0.714
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.002]	[0.001]	[0.000]	[0.000]	[0.000]
Constant	-20.934	-20.679	-21.966	-35.402	-34.10	-35.161	-17.669	-19.733	-18.634	-21.066	-19.664	-20.105
	(1.429)	(1.673)	(1.691e+07)	(1.702)	(0)	(2,530)	(946.8)	(1.570e+06)	(1,754)	(6.307e+06)	(5.306e+06)	(1,539)
	0.000	0.000	1.000	0.983	0.989	0.989	0.985	1.000	0.992	1.000	1.000	0.000
Observations	2,466	2,466	2,466	4,174	4,174	4,174	2,779	2,779	2,779	1,909	1,909	1,909
Pseudo R2	0.689	0.690	0.693	0.147	0.139	0.125	0.322	0.308	0.293	0.304	0.289	0.234
Mean	0.040	0.040	0.040	0.015	0.015	0.015	0.083	0.083	0.083	0.037	0.037	0.037

Standard errors are reported in parentheses. P-values are reported in the following line. Marginal effects evaluated at variable means are reported in brackets. Bold coefficients indicate a p-value < 0.10.

Table 6(A)
OLS regression estimates of initial bid premium for publicly-traded targets

The dependent variable is initial bid price divided by target closing stock price as of 42 trading days prior to the announcement date. The sample omits the observations below the 2nd percentile and above 98th percentile. Year and industry fixed effects (target's first 3-digit SIC code) are included.

VARIABLES	Public targets; Cash only			Public targets; Stock only		
	(1) 1%	(2) 2%	(3) 4%	(4) 1%	(5) 2%	(6) 4%
Round-number total offer	0.044	0.082	-0.039	-0.040	-0.091	-0.028
<i>standard error</i>	(0.042)	(0.049)	(0.075)	(0.105)	(0.122)	(0.159)
<i>p-value</i>	0.299	0.092	0.596	0.701	0.457	0.859
Round-number share price	0.023	0.022	0.024	-0.064	-0.064	-0.064
	(0.015)	(0.015)	(0.015)	(0.049)	(0.049)	(0.049)
	0.137	0.147	0.125	0.193	0.193	0.195
Financial acquirer	-0.108	-0.108	-0.108	-0.010	-0.010	-0.010
	(0.023)	(0.023)	(0.023)	(0.114)	(0.114)	(0.114)
	0.000	0.000	0.000	0.927	0.929	0.928
Hostile	-0.040	-0.042	-0.037	-0.131	-0.121	-0.133
	(0.040)	(0.040)	(0.041)	(0.162)	(0.163)	(0.162)
	0.316	0.298	0.361	0.420	0.458	0.412
Tender offer	0.031	0.031	0.030	0.168	0.166	0.168
	(0.019)	(0.019)	(0.019)	(0.151)	(0.151)	(0.151)
	0.100	0.102	0.111	0.267	0.272	0.268
Public acquirer	0.016	0.016	0.016	-0.003	-0.011	-0.003
	(0.019)	(0.019)	(0.019)	(0.121)	(0.121)	(0.122)
	0.388	0.398	0.382	0.980	0.929	0.982
Horizontal offer	0.015	0.016	0.016	0.030	0.029	0.029
	(0.019)	(0.019)	(0.019)	(0.037)	(0.037)	(0.037)
	0.407	0.395	0.399	0.428	0.429	0.432
Ln (Transaction value)	-0.028	-0.027	-0.028	-0.017	-0.017	-0.017
	(0.009)	(0.009)	(0.009)	(0.018)	(0.018)	(0.018)
	0.001	0.002	0.001	0.338	0.344	0.346
Acquirer advisor	0.017	0.017	0.018	-0.028	-0.028	-0.029
	(0.017)	(0.017)	(0.017)	(0.037)	(0.037)	(0.037)
	0.310	0.308	0.291	0.446	0.444	0.432
Constant	1.609	1.602	1.616	1.918	1.925	1.917
	(0.086)	(0.086)	(0.086)	(0.269)	(0.269)	(0.270)
	0.000	0.000	0.000	0.000	0.000	0.000
Observations	1,536	1,536	1,536	729	729	729
R-squared	0.313	0.314	0.312	0.254	0.254	0.254
Mean	1.418	1.418	1.418	1.428	1.428	1.428

Standard errors are reported in parentheses. P-values are reported in the following line. Bold coefficients indicate a p-value < 0.10.

Table 6(B)
OLS regression estimates of final bid premium for publicly-traded targets

The dependent variable is final bid price divided by target closing stock price as of 42 trading days prior to the announcement date. The sample omits the observations below the 2nd percentile and above 98th percentile. Year and industry fixed effects (target's first 3-digit SIC code) are included.

VARIABLES	Public targets; Cash only			Public targets; Stock only		
	(1) 1%	(2) 2%	(3) 4%	(4) 1%	(5) 2%	(6) 4%
Round-number total offer	0.081	0.156	0.073	0.065	0.015	0.121
<i>standard error</i>	(0.044)	(0.051)	(0.078)	(0.106)	(0.124)	(0.161)
<i>p-value</i>	0.068	0.002	0.350	0.537	0.905	0.450
Round-number share price	0.027	0.026	0.028	-0.063	-0.064	-0.061
	(0.016)	(0.016)	(0.016)	(0.050)	(0.050)	(0.050)
	0.090	0.105	0.087	0.209	0.200	0.220
Financial acquirer	-0.104	-0.103	-0.103	-0.011	-0.011	-0.011
	(0.025)	(0.025)	(0.025)	(0.115)	(0.115)	(0.115)
	0.000	0.000	0.000	0.924	0.922	0.924
Hostile	0.005	0.002	0.003	-0.103	-0.097	-0.105
	(0.042)	(0.042)	(0.043)	(0.164)	(0.164)	(0.164)
	0.913	0.960	0.943	0.528	0.554	0.521
Tender offer	0.042	0.041	0.041	0.158	0.157	0.160
	(0.020)	(0.020)	(0.020)	(0.153)	(0.153)	(0.153)
	0.035	0.036	0.038	0.304	0.306	0.298
Public acquirer	0.018	0.017	0.019	-0.017	-0.021	-0.008
	(0.020)	(0.020)	(0.020)	(0.122)	(0.123)	(0.124)
	0.353	0.378	0.340	0.890	0.863	0.951
Horizontal offer	0.020	0.021	0.019	0.031	0.032	0.031
	(0.020)	(0.020)	(0.020)	(0.038)	(0.038)	(0.038)
	0.300	0.286	0.325	0.412	0.403	0.408
Ln (Transaction value)	-0.024	-0.023	-0.024	-0.014	-0.015	-0.015
	(0.009)	(0.009)	(0.009)	(0.018)	(0.018)	(0.018)
	0.006	0.011	0.006	0.421	0.400	0.411
Acquirer advisor	0.018	0.019	0.018	-0.027	-0.026	-0.026
	(0.018)	(0.018)	(0.018)	(0.037)	(0.037)	(0.037)
	0.297	0.290	0.297	0.463	0.483	0.490
Constant	1.588	1.574	1.587	1.765	1.772	1.755
	(0.090)	(0.090)	(0.090)	(0.272)	(0.273)	(0.273)
	0.000	0.000	0.000	0.000	0.000	0.000
Observations	1,537	1,537	1,537	729	729	729
R-squared	0.291	0.295	0.290	0.252	0.252	0.253
Mean	1.434	1.434	1.434	1.424	1.424	1.424

Standard errors are reported in parentheses. P-values are reported in the following line. Bold coefficients indicate a p-value < 0.10.

Table 7
Initial bid precision and contest duration

This table reports results from OLS regressions which explain the duration from initial offer announcement to completion of the offer with variables measuring initial bid precision and controls. The dependent variable *contest duration* measures the number of calendar days from the initial offer announcement to the completion of the deal, therefore all bids are completed deals. Columns for each subsample report the result of using the 1%, 2%, or 4% granularity cutoffs for the round-number definition.

VARIABLES	Private targets; Cash only			Private targets; Stock only			Public targets; Cash only			Public targets; Stock only		
	(1) 1%	(2) 2%	(3) 4%	(4) 1%	(5) 2%	(6) 4%	(7) 1%	(8) 2%	(9) 4%	(10) 1%	(11) 2%	(12) 4%
Round-number total offer	-15.208	-10.952	-9.657	-10.417	-9.446	-10.265	-5.062	-15.591	-19.148	-7.420	-12.350	-19.518
<i>standard error</i>	(4.114)	(4.035)	(4.336)	(3.790)	(4.035)	(4.644)	(5.869)	(6.898)	(8.735)	(7.495)	(8.104)	(9.998)
<i>p-value</i>	0.000	0.007	0.026	0.006	0.019	0.027	0.388	0.024	0.028	0.322	0.128	0.051
Round-number share price							5.766	5.836	5.896	12.036	12.172	11.965
							(2.861)	(2.858)	(2.859)	(4.905)	(4.896)	(4.881)
							0.044	0.041	0.039	0.014	0.013	0.014
Financial acquirer	26.644	27.263	27.489	29.955	30.248	30.235	18.512	18.437	18.260	2.912	3.327	3.977
	(7.783)	(7.796)	(7.801)	(6.653)	(6.653)	(6.654)	(4.295)	(4.291)	(4.292)	(11.837)	(11.834)	(11.840)
	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.806	0.779	0.737
Financial target	53.773	54.535	54.690	60.892	60.713	60.703	34.959	34.828	35.068	55.735	55.266	54.609
	(8.088)	(8.101)	(8.111)	(6.857)	(6.859)	(6.860)	(4.775)	(4.770)	(4.770)	(11.883)	(11.877)	(11.883)
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hostile	-18.159	-15.851	-14.606				70.550	72.193	71.115	84.948	86.408	82.582
	(79.794)	(79.962)	(80.027)				(10.249)	(10.257)	(10.221)	(37.705)	(37.705)	(37.623)
	0.820	0.843	0.855				0.000	0.000	0.000	0.024	0.022	0.028
Tender offer	13.829	16.399	17.720	-33.636	-33.074	-33.186	-55.691	-56.069	-55.880	-11.406	-10.895	-11.850
	(18.295)	(18.306)	(18.302)	(49.885)	(49.902)	(49.910)	(3.439)	(3.433)	(3.428)	(21.210)	(21.204)	(21.193)
	0.450	0.371	0.333	0.500	0.508	0.506	0.000	0.000	0.000	0.591	0.607	0.576
Public acquirer	-1.599	-1.889	-1.981	19.764	19.751	20.004	-3.047	-3.157	-3.278	-3.398	-3.315	-3.636
	(4.817)	(4.826)	(4.830)	(7.034)	(7.038)	(7.036)	(3.322)	(3.319)	(3.321)	(9.696)	(9.692)	(9.688)
	0.740	0.696	0.682	0.005	0.005	0.004	0.359	0.342	0.324	0.726	0.732	0.707
Horizontal offer	12.842	12.453	12.290	-3.420	-3.402	-3.225	7.188	7.163	7.067	1.106	1.034	1.128
	(3.995)	(4.003)	(4.008)	(3.265)	(3.266)	(3.265)	(3.209)	(3.205)	(3.206)	(3.306)	(3.305)	(3.303)
	0.001	0.002	0.002	0.295	0.298	0.323	0.025	0.026	0.028	0.738	0.754	0.733
Ln (Transaction value)	-2.328	-3.072	-3.370	-0.865	-1.124	-1.366	-3.077	-3.277	-3.285	-3.552	-3.665	-3.645
	(1.481)	(1.488)	(1.514)	(1.249)	(1.246)	(1.251)	(1.426)	(1.424)	(1.425)	(1.521)	(1.522)	(1.515)
	0.116	0.039	0.026	0.489	0.367	0.275	0.031	0.021	0.021	0.020	0.016	0.016
Competing bidder	4.277	4.035	3.193	93.286	93.392	92.804	19.045	18.776	18.509	22.073	21.961	21.680
	(18.378)	(18.418)	(18.442)	(39.278)	(39.303)	(39.300)	(5.454)	(5.443)	(5.451)	(12.153)	(12.129)	(12.117)
	0.816	0.827	0.863	0.018	0.018	0.018	0.000	0.001	0.001	0.070	0.070	0.074
Acquirer advisor	6.016	5.856	5.645	20.787	20.752	20.783	3.966	3.864	3.895	-2.291	-2.253	-2.320
	(4.665)	(4.675)	(4.678)	(3.945)	(3.948)	(3.949)	(3.170)	(3.166)	(3.166)	(3.707)	(3.705)	(3.704)
	0.197	0.211	0.228	0.000	0.000	0.000	0.211	0.222	0.219	0.537	0.543	0.531
Constant	235.256	233.191	227.920	35.310	35.777	35.387	122.817	127.023	128.272	162.097	162.611	162.800
	(52.421)	(52.576)	(52.523)	(29.567)	(29.600)	(29.598)	(37.904)	(37.890)	(37.947)	(39.353)	(39.336)	(39.315)
	0.000	0.000	0.000	0.232	0.227	0.232	0.001	0.001	0.001	0.000	0.000	0.000
Observations	1,493	1,493	1,493	3,048	3,048	3,048	2,158	2,158	2,158	1,645	1,645	1,645
R-squared	0.307	0.304	0.303	0.279	0.279	0.279	0.320	0.321	0.321	0.249	0.250	0.251
Mean	86.90	86.90	86.90	120.23	120.23	120.23	113.19	113.19	113.19	161.79	161.79	161.79

Standard errors are reported in parentheses. P-values are reported in the following line. Bold coefficients indicate a p-value < 0.10.

Table 8
Initial bid precision and the likelihood of competing offers

This table reports results from logit regressions with dependent variable as an indicator of whether the deal gets any competing offer, and independent variables measuring initial bid precision and controls. Columns for each subsample report the result of using the 1%, 2%, or 4% granularity cutoffs for the round-number definition.

VARIABLES	Private targets; Cash only			Private targets; Stock only			Public targets; Cash only			Public targets; Stock only		
	(1) 1%	(2) 2%	(3) 4%	(4) 1%	(5) 2%	(6) 4%	(7) 1%	(8) 2%	(9) 4%	(10) 1%	(11) 2%	(12) 4%
Round-number total offer	-1.021	-1.488	-1.713	1.128	1.406	1.617	-0.605	-0.614	-1.131	0.835	0.160	-0.139
<i>standard error</i>	(0.474)	(0.530)	(0.635)	(0.683)	(0.687)	(0.713)	(0.212)	(0.252)	(0.416)	(0.435)	(0.562)	(0.784)
<i>p-value</i>	0.031	0.005	0.007	0.099	0.041	0.023	0.004	0.015	0.007	0.055	0.776	0.859
<i>marginal effects</i>	[-0.000]	[-0.000]	[-0.000]	[0.000]	[0.000]	[0.000]	[-0.051]	[-0.052]	[-0.095]	[0.001]	[0.000]	[0.000]
Round-number share price							0.189	0.195	0.199	0.631	0.650	0.653
							(0.124)	(0.124)	(0.124)	(0.338)	(0.336)	(0.335)
							0.128	0.116	0.108	0.062	0.053	0.052
							[0.016]	[0.016]	[0.017]	[0.001]	[0.001]	[0.001]
Financial acquirer	1.382	1.388	1.416	-0.182	-0.492	-0.499	-0.200	-0.205	-0.208	0.634	0.664	0.682
	(0.734)	(0.729)	(0.728)	(1.666)	(1.866)	(1.859)	(0.169)	(0.169)	(0.170)	(0.865)	(0.856)	(0.857)
	0.060	0.057	0.052	0.913	0.792	0.788	0.238	0.226	0.220	0.463	0.438	0.426
	[0.000]	[0.000]	[0.000]	[-0.000]	[-0.000]	[-0.000]	[-0.017]	[-0.017]	[-0.017]	[0.001]	[0.001]	[0.001]
Financial target	-1.267	-1.320	-1.275	-0.470	-0.138	-0.184	-0.465	-0.484	-0.459	-0.580	-0.646	-0.668
	(0.760)	(0.761)	(0.755)	(1.673)	(1.880)	(1.872)	(0.199)	(0.199)	(0.199)	(0.867)	(0.859)	(0.860)
	0.095	0.083	0.092	0.779	0.942	0.922	0.019	0.015	0.021	0.503	0.452	0.438
	[-0.000]	[-0.000]	[-0.000]	[-0.000]	[-0.000]	[-0.000]	[-0.039]	[-0.041]	[-0.039]	[-0.001]	[-0.001]	[-0.001]
Hostile	-2.833	-2.796	-2.666				1.421	1.414	1.398	2.401	2.475	2.476
	(0.970)	(0.979)	(0.979)				(0.199)	(0.198)	(0.198)	(0.646)	(0.642)	(0.642)
	0.003	0.004	0.006				0.000	0.000	0.000	0.000	0.000	0.000
	[-0.000]	[-0.000]	[-0.000]				[0.120]	[0.119]	[0.118]	[0.003]	[0.004]	[0.004]
Tender offer	5.944	5.948	5.855				-0.480	-0.471	-0.466	1.185	1.131	1.121
	(0.998)	(0.998)	(0.987)				(0.147)	(0.146)	(0.146)	(1.218)	(1.219)	(1.219)
	0.000	0.000	0.000				0.001	0.001	0.001	0.331	0.354	0.358
	[0.000]	[0.000]	[0.000]				[-0.041]	[-0.040]	[-0.039]	[0.002]	[0.002]	[0.002]
Public acquirer	-1.048	-1.106	-1.043	15.558	15.41	15.401	-0.438	-0.437	-0.445	-1.141	-1.096	-1.087
	(0.608)	(0.605)	(0.612)	(4.728)	(4.902)	(4.828)	(0.146)	(0.146)	(0.146)	(0.512)	(0.511)	(0.511)
	0.085	0.068	0.088	0.997	0.997	0.997	0.003	0.003	0.002	0.026	0.032	0.033
	[-0.000]	[-0.000]	[-0.000]	[0.000]	[0.000]	[0.000]	[-0.037]	[-0.037]	[-0.037]	[-0.002]	[-0.002]	[-0.002]
Horizontal offer	0.680	0.640	0.515	0.109	0.0516	0.019	0.030	0.025	0.022	0.250	0.268	0.268
	(0.511)	(0.513)	(0.518)	(0.678)	(0.679)	(0.688)	(0.144)	(0.144)	(0.144)	(0.292)	(0.291)	(0.291)
	0.184	0.212	0.321	0.872	0.939	0.978	0.836	0.864	0.878	0.392	0.357	0.357
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.003]	[0.002]	[0.002]	[0.000]	[0.000]	[0.000]
Ln (Transaction value)	0.288	0.270	0.219	0.550	0.573	0.593	0.237	0.234	0.229	0.532	0.502	0.495
	(0.167)	(0.169)	(0.169)	(0.284)	(0.289)	(0.284)	(0.058)	(0.058)	(0.058)	(0.134)	(0.132)	(0.132)
	0.085	0.110	0.196	0.053	0.048	0.037	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.020]	[0.020]	[0.019]	[0.001]	[0.001]	[0.001]
Acquirer advisor	-0.017	0.019	0.032	0.353	0.367	0.396	-0.518	-0.522	-0.510	-0.542	-0.572	-0.575
	(0.531)	(0.531)	(0.530)	(0.782)	(0.797)	(0.789)	(0.134)	(0.134)	(0.134)	(0.304)	(0.303)	(0.303)
	0.974	0.972	0.952	0.652	0.645	0.615	0.000	0.000	0.000	0.074	0.059	0.058
	[-0.000]	[-0.000]	[-0.000]	[0.000]	[0.000]	[0.000]	[-0.044]	[-0.044]	[-0.043]	[-0.001]	[-0.001]	[-0.001]
Constant	-21.252	-20.623	-20.235	-20.297	-20.33	-20.349	-16.761	-16.991	-16.972	-20.151	-20.521	-20.493
	(8.654e+06)	(8.495e+06)	(1.047e+07)	(4.729)	(4.902)	(4.829)	(698.4)	(791.5)	(791.9)	(1.408)	(8.453e+06)	(5.506e+06)
	1.000	1.000	1.000	0.997	0.997	0.997	0.981	0.983	0.983	0.000	1.000	1.000
Observations	2,466	2,466	2,466	4,174	4,174	4,174	2,779	2,779	2,779	1,909	1,909	1,909
Pseudo R2	0.698	0.704	0.704	0.434	0.444	0.448	0.122	0.121	0.122	0.190	0.184	0.184
Mean	0.034	0.034	0.034	0.002	0.002	0.002	0.138	0.138	0.138	0.034	0.034	0.034

Standard errors are reported in parentheses. P-values are reported in the following line. Marginal effects evaluated at variable means are reported in brackets. Bold coefficients indicate a p-value < 0.10.

Table 9
Initial bid precision and likelihood of withdrawing the bid

This table reports results from logit regressions with dependent variable as an indicator of whether the deal fails to get completed, and independent variables measuring initial bid precision and controls. Columns for each subsample report the result of using the 1%, 2%, or 4% granularity cutoffs for the round-number definition.

VARIABLES	Private targets; Cash only			Private targets; Stock only			Public targets; Cash only			Public targets; Stock only		
	(1) 1%	(2) 2%	(3) 4%	(4) 1%	(5) 2%	(6) 4%	(7) 1%	(8) 2%	(9) 4%	(10) 1%	(11) 2%	(12) 4%
Round-number total offer	-0.107	-0.112	-0.206	0.305	0.317	0.329	-0.021	-0.148	-0.313	0.226	-0.119	0.124
<i>standard error</i>	(0.246)	(0.244)	(0.257)	(0.148)	(0.153)	(0.168)	(0.193)	(0.222)	(0.295)	(0.262)	(0.303)	(0.354)
<i>p-value</i>	0.663	0.646	0.423	0.040	0.039	0.050	0.913	0.504	0.288	0.387	0.695	0.726
<i>marginal effects</i>	[-0.000]	[-0.000]	[-0.000]	[0.008]	[0.009]	[0.009]	[-0.002]	[-0.015]	[-0.033]	[0.009]	[-0.005]	[0.005]
Round-number share price							0.575	0.577	0.579	0.272	0.304	0.292
							(0.123)	(0.123)	(0.123)	(0.201)	(0.200)	(0.199)
							0.000	0.000	0.000	0.176	0.129	0.143
							[0.060]	[0.060]	[0.060]	[0.011]	[0.013]	[0.012]
Financial acquirer	0.846	0.845	0.843	-0.099	-0.100	-0.100	0.283	0.282	0.282	-0.991	-0.976	-0.990
	(0.383)	(0.383)	(0.382)	(0.261)	(0.261)	(0.260)	(0.166)	(0.166)	(0.166)	(0.441)	(0.441)	(0.441)
	0.027	0.027	0.027	0.705	0.702	0.700	0.088	0.090	0.090	0.025	0.027	0.025
	[0.002]	[0.002]	[0.002]	[-0.003]	[-0.003]	[-0.003]	[0.030]	[0.029]	[0.029]	[-0.041]	[-0.040]	[-0.041]
Financial target	-0.025	-0.022	-0.031	-0.009	-0.009	-0.006	-0.766	-0.769	-0.762	0.095	0.063	0.085
	(0.380)	(0.379)	(0.378)	(0.268)	(0.268)	(0.267)	(0.180)	(0.181)	(0.180)	(0.438)	(0.439)	(0.438)
	0.947	0.954	0.935	0.974	0.974	0.983	0.000	0.000	0.000	0.829	0.885	0.846
	[-0.000]	[-0.000]	[-0.000]	[-0.000]	[-0.000]	[-0.000]	[-0.080]	[-0.080]	[-0.080]	[0.004]	[0.003]	[0.004]
Hostile	7.279	7.285	7.314				3.139	3.151	3.150	3.614	3.681	3.664
	(1.362)	(1.363)	(1.365)				(0.254)	(0.255)	(0.254)	(0.666)	(0.670)	(0.667)
	0.000	0.000	0.000				0.000	0.000	0.000	0.000	0.000	0.000
	[0.017]	[0.017]	[0.014]				[0.328]	[0.329]	[0.329]	[0.149]	[0.152]	[0.151]
Tender offer	-0.198	-0.198	-0.213				-1.902	-1.907	-1.908	-0.840	-0.828	-0.832
	(0.941)	(0.942)	(0.942)				(0.177)	(0.177)	(0.177)	(1.168)	(1.172)	(1.171)
	0.833	0.833	0.821				0.000	0.000	0.000	0.472	0.480	0.477
	[-0.000]	[-0.000]	[-0.000]				[-0.199]	[-0.199]	[-0.199]	[-0.035]	[-0.034]	[-0.034]
Public acquirer	0.003	0.002	0.002	0.534	0.538	0.533	-0.500	-0.501	-0.503	-0.569	-0.572	-0.564
	(0.274)	(0.274)	(0.274)	(0.325)	(0.325)	(0.325)	(0.147)	(0.147)	(0.147)	(0.363)	(0.363)	(0.363)
	0.991	0.993	0.995	0.100	0.098	0.101	0.001	0.001	0.001	0.117	0.116	0.120
	[0.000]	[0.000]	[0.000]	[0.014]	[0.015]	[0.015]	[-0.052]	[-0.052]	[-0.052]	[-0.023]	[-0.024]	[-0.023]
Horizontal offer	-0.002	-0.003	-0.005	-0.379	-0.378	-0.382	-0.287	-0.286	-0.287	-0.383	-0.375	-0.377
	(0.255)	(0.255)	(0.255)	(0.140)	(0.140)	(0.140)	(0.148)	(0.148)	(0.148)	(0.160)	(0.160)	(0.160)
	0.993	0.992	0.983	0.007	0.007	0.006	0.053	0.054	0.053	0.017	0.019	0.018
	[-0.000]	[-0.000]	[-0.000]	[-0.010]	[-0.010]	[-0.010]	[-0.030]	[-0.030]	[-0.030]	[-0.016]	[-0.015]	[-0.016]
Ln (Transaction value)	0.140	0.135	0.127	0.000	0.008	0.017	0.050	0.046	0.044	0.045	0.036	0.042
	(0.091)	(0.090)	(0.091)	(0.053)	(0.053)	(0.053)	(0.056)	(0.056)	(0.056)	(0.072)	(0.072)	(0.072)
	0.123	0.134	0.161	1.000	0.874	0.744	0.368	0.410	0.432	0.531	0.618	0.564
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.005]	[0.005]	[0.005]	[0.002]	[0.001]	[0.002]
Competing bidder	2.746	2.751	2.744	1.458	1.432	1.420	1.879	1.876	1.872	2.045	2.062	2.061
	(0.680)	(0.679)	(0.678)	(0.884)	(0.885)	(0.890)	(0.149)	(0.149)	(0.149)	(0.315)	(0.315)	(0.315)
	0.000	0.000	0.000	0.099	0.106	0.111	0.000	0.000	0.000	0.000	0.000	0.000
	[0.006]	[0.006]	[0.005]	[0.039]	[0.039]	[0.039]	[0.196]	[0.196]	[0.195]	[0.084]	[0.085]	[0.085]
Acquirer advisor	-0.621	-0.624	-0.627	-0.500	-0.496	-0.497	-1.275	-1.279	-1.278	-1.160	-1.163	-1.161
	(0.349)	(0.349)	(0.349)	(0.209)	(0.209)	(0.209)	(0.136)	(0.136)	(0.136)	(0.182)	(0.182)	(0.182)
	0.075	0.074	0.073	0.017	0.018	0.018	0.000	0.000	0.000	0.000	0.000	0.000
	[-0.001]	[-0.001]	[-0.001]	[-0.013]	[-0.013]	[-0.014]	[-0.133]	[-0.133]	[-0.133]	[-0.048]	[-0.048]	[-0.048]
Constant	-3.782	-3.775	-3.725	-18.925	-18.960	-18.958	-15.449	-15.422	-15.411	-15.665	-15.610	-15.649
	(1.098)	(1.100)	(1.099)	(1.078)	(2.395e+06)	(5.039e+06)	(741.7)	(741.2)	(741.2)	(5.750)	(5.743)	(5.747)
	0.001	0.001	0.001	0.000	1.000	1.000	0.983	0.983	0.983	0.998	0.998	0.998
Observations	2,466	2,466	2,466	4,174	4,174	4,174	2,779	2,779	2,779	1,909	1,909	1,909
Pseudo R2	0.391	0.391	0.392	0.0566	0.0566	0.0564	0.327	0.327	0.327	0.213	0.212	0.212
Mean	0.054	0.054	0.054	0.062	0.062	0.062	0.217	0.217	0.217	0.128	0.128	0.128

Standard errors are reported in parentheses. P-values are reported in the following line. Marginal effects evaluated at variable means are reported in brackets. Bold coefficients indicate a p-value < 0.10.

Appendix

Table A1
Summary statistics

Panel B, C, D, and E reports summary statistics of key variables for subsamples of *private cash*, *private stock*, *public cash*, and *public stock offers*. All initial bids are at least \$0.8 million and at most \$1 billion (\$), made between January 1st, 1981 and August 31st, 2017.

Pane B: Sample of private target acquisition using cash only

	N	Avg	Std dev	Min	25%	Median	75%	Max
Hostile offer	2,466	0.02	0.14	0	0	0	0	1
Tender offer	2,466	0.04	0.20	0	0	0	0	1
Public acquirer	2,466	0.71	0.45	0	0	1	1	1
Horizontal offer	2,466	0.43	0.49	0	0	0	1	1
Financial acquirer	2,466	0.32	0.47	0	0	0	1	1
Financial target	2,466	0.28	0.45	0	0	0	1	1
Transaction value	2,466	72.16	135.32	0.80	7.50	20	67	993
Acquirer advisor	2,466	0.23	0.42	0	0	0	0	1
Round-number total offer	2,466	0.46	0.50	0	0	0	1	1
Contest duration	1,493	86.90	86.84	1	27	52	129	615
Competing offer	2,466	0.03	0.18	0	0	0	0	1
Failure	2,466	0.05	0.23	0	0	0	0	1

Pane C: Sample of private target acquisition using stock only

	N	Avg	Std dev	Min	25%	Median	75%	Max
Hostile offer	4,174	0.00	0.02	0	0	0	0	1
Tender offer	4,174	0.00	0.03	0	0	0	0	1
Public acquirer	4,174	0.94	0.23	0	1	1	1	1
Horizontal offer	4,174	0.47	0.50	0	0	0	1	1
Financial acquirer	4,174	0.33	0.47	0	0	0	1	1
Financial target	4,174	0.31	0.46	0	0	0	1	1
Transaction value	4,174	46.87	92.39	0.80	6	16.09	44	918.6
Acquirer advisor	4,174	0.20	0.40	0	0	0	0	1
Round-number total offer	4,174	0.19	0.39	0	0	0	0	1
Contest duration	3,048	120.23	100.24	1	42	98	172	727
Competing offer	4,174	0.002	0.05	0	0	0	0	1
Failure	4,174	0.06	0.24	0	0	0	0	1

Pane D: Sample of public target acquisition using cash only

	N	Avg	Std dev	Min	25%	Median	75%	Max
Hostile offer	2,779	0.06	0.23	0	0	0	0	1
Tender offer	2,779	0.34	0.47	0	0	0	1	1
Public acquirer	2,779	0.47	0.50	0	0	0	1	1
Horizontal offer	2,779	0.33	0.47	0	0	0	1	1
Financial acquirer	2,779	0.50	0.50	0	0	0	1	1
Financial target	2,779	0.23	0.42	0	0	0	0	1
Transaction value	2,779	230.51	234.29	1.70	53.02	137.28	338.36	1000
Acquirer advisor	2,779	0.52	0.50	0	0	1	1	1
Round-number total offer	2,779	0.06	0.24	0	0	0	0	1
Round-number share price	2,779	0.58	0.49	0	0	1	1	1
Contest duration	2,158	113.19	77.32	2	56	92	147	700
Competing offer	2,779	0.14	0.34	0	0	0	0	1
Failure	2,779	0.22	0.41	0	0	0	0	1

Pane E: Sample of public target acquisition using stock only

	N	Avg	Std dev	Min	25%	Median	75%	Max
Hostile offer	1,909	0.01	0.11	0	0	0	0	1
Tender offer	1,909	0.01	0.08	0	0	0	0	1
Public acquirer	1,909	0.97	0.18	0	1	1	1	1
Horizontal offer	1,909	0.57	0.49	0	0	1	1	1
Financial acquirer	1,909	0.57	0.50	0	0	1	1	1
Financial target	1,909	0.57	0.50	0	0	1	1	1
Transaction value	1,909	204.35	221.94	1.04	45	118.4	285.59	1000
Acquirer advisor	1,909	0.58	0.49	0	0	1	1	1
Round-number total offer	1,909	0.05	0.23	0	0	0	0	1
Round-number share price	1,909	0.14	0.35	0	0	0	0	1
Contest duration	1,645	161.79	73.21	12	109	153	197	567
Competing offer	1,909	0.03	0.18	0	0	0	0	1
Failure	1,909	0.13	0.33	0	0	0	0	1