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# The role of procedural rationality in debiasing acquisition decisions of overconfident CEOs

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## Abstract

**Research Summary:** In corporate acquisitions, overconfident chief executive officers (CEOs) often make biased decisions, subsequently paying unjustifiably high acquisition premiums. We investigate the predeal process in which the acquisition premium is decided upon and, drawing from procedural rationality theory, argue that the pursuit of greater procedural rationality through slow-paced predeal processes reduces the tendency of overconfident CEOs to inflate acquisition premiums. The empirical results based on a sample of acquisitions involving publicly held US firms show that overconfident CEOs tend to pay high acquisition premiums, replicating earlier findings of such a relationship. More importantly, the results show that the tendency of overconfident CEOs to overpay for acquisitions decreases under conditions in which the predeal processes are slower in pace.

**Managerial Summary:** CEOs often exhibit excessively high levels of confidence in their ability to make successful corporate acquisitions. Driven by the belief in their ability, overconfident CEOs often end up overpaying for acquisitions. Our study provides suggestive evidence that setting a slow acquisition process pace is an important prerequisite for an acquiring firm and its board of directors to attenuate the inflating effect of

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CEO overconfidence on acquisition premiums. Our arguments and results imply that boards of directors should slow the pace of predeal acquisition processes if their CEO is exhibiting signs of overconfidence.

#### KEYWORDS

acquisitions, CEO overconfidence, debiasing, predeal process, procedural rationality

## 1 | INTRODUCTION

Acquisition decisions are susceptible to cognitive biases of chief executive officers (CEOs) (Duhaime & Schwenk, 1985). Overconfidence, defined as an exaggerated belief in one's own judgment and abilities (Fischhoff, Slovic, & Lichtenstein, 1977), is among the most common and most widely studied biases of CEOs (Picone, Dagnino, & Minà, 2014). In acquisitions, overconfidence often manifests itself when CEOs overestimate their ability to extract acquisition benefits and, therefore, overpay for acquisitions (Hayward & Hambrick, 1997; Malmendier & Tate, 2008; Roll, 1986). Despite substantial evidence that CEO overconfidence leads to biased acquisition decisions and, in particular, unjustifiably large acquisition premiums, potential means for mitigating this bias remain surprisingly unexplored in strategy research.

To address this gap, we investigate the predeal processes of acquisitions in which the magnitude of the acquisition premium is contemplated. Drawing from procedural rationality theory (Simon, 1976, 1978), we theorize that the pursuit of procedural rationality in the predeal process helps mitigate the acquisition premium-inflating effect of CEO overconfidence. Procedural rationality is the extent to which a decision process reflects intention and efforts to collect and analyze all available information to make the best decision possible under the circumstances (Simon, 1976, 1978). Because careful execution of the decision process requires time, a slow pace for the decision process is a central prerequisite for procedural rationality (Fredrickson & Mitchell, 1984; Perlow, Okhuysen, & Reppenning, 2002). Accordingly, our main argument is that a slow pace for the predeal process is an important prerequisite for an acquirer and its board to conduct thorough due diligence and valuation, gradually uncover critical information, perform deep and systematic analyses on the basis of that information, and consider input from various deal stakeholders, thereby reducing the likelihood that an overconfident CEO engages in rushed decision-making that leads to unreasonably high acquisition premiums.

We test our argument using a sample of acquisitions involving publicly held firms in the United States. We leverage the mandatory filings that publicly listed firms involved in acquisitions submit to the Securities Exchange Commission (SEC) to code information about the predeal processes. In regression analyses utilizing these novel data, we find a positive association between CEO overconfidence and the magnitude of the acquisition premium, replicating earlier findings of such a relationship (e.g., Hayward & Hambrick, 1997). More importantly, we find that the acquisition premium-inflating effect of CEO overconfidence is substantially reduced when a slow pace of the predeal process allows more procedurally rational acquisition decision-making.

Our study provides several insights. First, extending theory on procedural rationality to the acquisition domain allows us to identify a debiasing mechanism that attenuates the acquisition premium-inflating effect of CEO overconfidence. Our study thus makes an important

contribution to the literature on managerial overconfidence, which has generally stopped at identifying the impacts of managerial overconfidence on strategic decisions, rarely investigating how to mitigate them (Picone et al., 2014). More broadly, we address a call for a shift in focus from studying how managerial biases affect strategic decisions toward studying how to manage the decision environments in which managers make such decisions (Powell, Lovallo, & Fox, 2011). In doing so, we extend and complement seminal research on cognitive biases and decision-making in organizations, which has offered important insights into how managing the organizational environment in which managers make decisions helps correct the inherent errors in managerial cognition (McNamara, Moon, & Bromiley, 2002; Sutcliffe & McNamara, 2001). Finally, our study advances a process theory of acquisitions by showing that the predeal process pace has an indirect yet substantial effect on acquisition outcomes (Jemison & Sitkin, 1986; Pablo, Sitkin, & Jemison, 1996).

## 2 | THEORY AND HYPOTHESES

### 2.1 | CEO overconfidence and acquisition premium decisions

While confidence is an important leadership quality, decision-making implications of its excess level—overconfidence—“may be catastrophic” (Picone et al., 2014, p. 447). Overconfidence<sup>1</sup> refers to the degree to which individuals overestimate the accuracy of their abilities, knowledge, and judgments (Camerer & Lovallo, 1999; Fischhoff et al., 1977). Whereas the extent and nature of overconfidence may vary among individuals (Klayman, Soll, Gonzalez-Vallejo, & Barlas, 1999) and for an individual over time (Billett & Qian, 2008), the effect of overconfidence on decision-making is “perhaps the most robust finding in the psychology of judgment” (De Bondt & Thaler, 1995, p. 389). Drawing upon psychology research, strategy scholars have accumulated extensive evidence that CEO overconfidence affects strategic decisions, typically in an adverse manner. For example, overconfident CEOs have been found to be likely to conduct risky product introductions (Simon & Houghton, 2003), engage in socially irresponsible activities (Tang et al., 2015), and repeat inaccurate management earnings forecasts (Chen et al., 2015).

Because overconfidence bias typically occurs in complex judgments, it is not surprising that acquisition-related decisions have been recognized as susceptible to CEO overconfidence (Picone et al., 2014). In particular, overconfident CEOs repeatedly have been found to be likely to pay unreasonably high acquisition premiums (Hayward & Hambrick, 1997; Malmendier & Tate, 2008; Roll, 1986). While paying some acquisition premium is justified by control over the target, expected deal synergies, or unique resources of the target firm (e.g., Laamanen, 2007), overpayment typically has negative performance consequences for the acquirer (e.g., Beckman & Haunschild, 2002; Schijven & Hitt, 2012; Varaiya & Ferris, 1987). Extending this line of inquiry, we propose three ways in which overconfidence impairs CEO judgment during the predeal process, resulting in unreasonably high acquisition premiums.

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<sup>1</sup>Recent research thoroughly explained the differences between CEO overconfidence and related constructs, such as CEO hubris or CEO narcissism (e.g., Chen, Crossland, & Luo, 2015; Schumacher, Keck, & Tang, 2020; Tang, Qian, Chen, & Shen, 2015). We point to this research for details. In short, this research notes that unlike CEO overconfidence, which occurs due to bounded cognitive abilities, CEO hubris may also be socially induced. Similarly, CEO narcissism is a broader concept than CEO overconfidence, also including a CEO's need for social attention and praise.

First, overconfident CEOs have excessive conviction about having accurate and sufficient information to make decisions (Ben-David, Graham, & Harvey, 2013; Hiller & Hambrick, 2005) and thus are likely to quickly form opinions about acquisition price, often independent of the time-consuming due diligence of the target. Because overconfident CEOs expect positive outcomes of their decisions (Shipman & Mumford, 2011), they are likely to exaggerate the potential benefits of acquisition decisions to the board by, for instance, overestimating synergies from an acquisition (Brown & Sarma, 2007). Overconfident CEOs also pay less attention to risks and feel confident in their own ability to mitigate them (Kahneman & Lovallo, 1993; Klayman et al., 1999). They are, therefore, likely to be less patient to incorporate risks that are gradually uncovered by due diligence and thus more likely to underestimate costs of implementing an acquisition. As a result of overestimating benefits and underestimating obstacles involved in an acquisition, overconfident CEOs are likely to quickly agree to a high acquisition premium.

Second, when confronted with complex decisions, overconfident CEOs tend to rely on their own “recipes” for effective decision-making and apply their own “success formulas,” engaging less in careful and time-demanding analyses before making decisions (Picone et al., 2014). Such routinized responses may lead overconfident CEOs to commit to a high acquisition price early in the bargaining process (Neale & Bazerman, 1985). Consequently, the acquirer is likely to find it more difficult to deal with pressures for rushed deal closure, change the course of bargaining as the discussions with the target evolve, and reduce the premium, even when revelations in due diligence would justify such an adjustment (Puranam, Powell, & Singh, 2006).

Third, overconfident CEOs exhibit a strong “internal locus of control” (Hayward & Hambrick, 1997), favor highly centralized decision-making (Hiller & Hambrick, 2005), and accordingly tend to limit time for the decision inputs of others (Tang et al., 2015). In acquisitions, overconfident CEOs are thus less likely to take the time to seek expert opinions by internal stakeholders such as finance executives or external stakeholders such as deal advisors (Graham, Harvey, & Puri, 2015), whose assessments of deals typically emerge from gradual and rigorous quantitative analyses and tend to reduce acquisition prices to more reasonable levels (Kim, Halebian, & Finkelstein, 2011). Consequently, firms that forego such opportunities to extensively discuss deal implications from multiple perspectives are more likely to overpay for acquisitions. Taken together, the above arguments lead to the following baseline hypothesis:

**Baseline Hypothesis.** *CEO overconfidence is positively associated with the acquisition premium.*

## 2.2 | The role of procedural rationality in debiasing acquisition premium decisions

Because individual decision-makers are boundedly rational and biased in their decision-making, firms design processes to compensate for these limitations of cognitive abilities (Simon, 1947). These processes are aimed at fostering high-quality decisions via comprehensiveness—extensive gathering and processing of information (e.g., Fredrickson, 1984), formalization—use of systematic analyses for assessment of and choosing among alternatives (e.g., Wally & Baum, 1994), and inclusiveness—the involvement of various stakeholders in the decision process (e.g., Dean & Sharfman, 1993). In other words, in the face of individual bounded rationality, firms aim to improve decision quality via procedural rationality (Simon, 1976, 1978).

Pursuing procedural rationality in the decision process requires incremental deliberations over time, which is why a slow pace of the decision process is considered a central prerequisite of procedural rationality (e.g., Forbes, 2005; Perlow et al., 2002). Moreover, compared to latent constructs such as decision process comprehensiveness, formalization, or inclusiveness, decision process pace can be more clearly measured, allowing a more objective comparison of the extent of procedural rationality across decision processes (e.g., Forbes, 2005; Papadakis, 1998). A slow decision process pace is argued to increase the likelihood that (a) relevant information is uncovered and processed properly, ensuring the reliability of decision inputs; (b) systematic analyses are used, preventing critical steps in the decision process from being skipped; and (c) multiple stakeholders voice opinions, ensuring that the overall effect of a decision is well understood (e.g., Hickson, Butler, Cray, Mallory, & Wilson, 1986; Mintzberg, Raisinghani, & Theoret, 1976; Perlow et al., 2002).

Research on acquisitions has long recognized the benefits of conceptualizing acquisitions in terms of decision processes and has emphasized the importance of the due diligence and bargaining processes, during which the acquisition opportunity is re-evaluated and assumptions about the target are tested against new information, as critical for acquisition outcomes (Jemison & Sitkin, 1986; Pablo et al., 1996). Building upon this conceptualization and the research on procedural rationality, we consider that in the acquisition context, procedural rationality is reflected in the slow pace of the predeal processes during which the acquisition premium is contemplated. We theorize that under conditions in which the predeal process is slow-paced, the proclivity of an overconfident CEO to pay unreasonably high acquisition premiums is mitigated in at least three ways.

First, the slower the predeal process pace is, the more time the acquirer has to uncover and thoroughly process essential due diligence information about targets. This allows the acquirer board to prevent an overconfident CEO from using due diligence to seek only information that supports that CEO's initial synergy estimation and valuation and to ignore any disconfirming evidence (Klayman & Ha, 1987). In a similar vein, moving slowly and carefully increases the likelihood that deal-related risks and costs are unearthed and made salient (Coff, 1999). Although an overconfident CEO may attach unreasonably high initial values to targets, the revelation of new information via due diligence helps prevent premature settling on deal terms by pressuring an overconfident CEO to better justify or revise valuation decisions. When forced to move slowly from the outset, the discovery of new negative information about targets makes it more difficult even for an overconfident CEO to refrain from reducing the acquisition price.

Second, a slower predeal process provides the time necessary to follow protocols and makes it less likely that important steps in the process are skipped (Judge & Miller, 1991). When the predeal process is less rushed, the board has sufficient time to use intermediate decision steps to crosscheck the CEO's position (Saaty, 1990). Whereas this is likely to frustrate an overconfident CEO, it also decreases the likelihood that the CEO early on makes promises regarding the acquisition premium to the target firm (Graebner & Eisenhardt, 2004). This is important because once such a promise has been made, it is difficult to revert in later stages of negotiations and can jeopardize the acquirer's bargaining position (Narayanan & Fahey, 1982), driving the realized acquisition price upwards. In addition, moving slowly and incrementally makes it more likely to identify a target's inflated assessments of its assets during due diligence or to spot potential opportunistic behaviors by the target (Coff, 1999), which even an overconfident CEO who prefers fast closure would not want to go unnoticed.

Third, the slower the predeal process is, the more time the board has to seek and analyze decision input from a broad range of stakeholders (Judge & Miller, 1991; Perlow et al., 2002)



and confront an overconfident CEO with such an input (Schweiger, Sandberg, & Rechner, 1989). While time consuming, the involvement of multiple stakeholders helps identify acquisition implications that an overconfident CEO might otherwise not consider (Li & Tang, 2010). For instance, internal or external experts can provide independent opinions about the risks involved in a deal (Kim et al., 2011; Tversky & Kahneman, 1974). Moreover, when the predeal process provides sufficient time to engage with multiple stakeholders, the decision feedback becomes triangulated and less ambiguous, increasing its weight even with an overconfident CEO (Chen et al., 2015; Lichtenstein & Fischhoff, 1980). Thus, when the predeal process is slow in pace, the overconfident CEO and the board are more likely to reach a more objective deal valuation, and an unjustifiably high acquisition premium becomes a less likely outcome. Taken together, these arguments lead to the following hypothesis:

**Main Hypothesis.** *The positive association between CEO overconfidence and the acquisition premium becomes weaker (less positive) as the predeal process slows in pace.*

### 3 | METHODS

#### 3.1 | Sample and data

We obtained acquisitions by S&P 500 firms from 2001 to 2018 from the SDC database. Due to our focus on acquisition premiums, we considered acquisitions of publicly listed targets, and we applied sample screening criteria that are common in the acquisition literature.<sup>2</sup> The focus of this study is on the private predeal process, which ends when the acquirer publicly announces an acquisition offer (Boone & Mulherin, 2007). We manually coded data on the predeal processes from the filings submitted to the SEC by acquirers and targets in connection to acquisitions. We accessed these filings via Edgar platform. Item 1005 of SEC Regulation M-A explains the obligation of the target or the potential acquirer to disclose information about the predeal process between the merging parties prior to the public announcement of an acquisition. Details of the predeal process are contained in the following documents: DEFM14A, S-4, TO-T, and 14D-9 filed in connection with the acquisition; the target's DEF14 statement for the year prior to the acquisition; and the acquirer's DEF14 statement and 10-K report for the year following the acquisition (Heitzman, 2011). Specifically, information of interest is reported in the document section typically titled "Background of the Merger." Acquisition-related filings were unavailable or incomplete for 4.4% of acquisitions (cf. Boone & Mulherin, 2007). We removed these acquisitions from our sample. For each remaining acquisition, we read the entire merger background section in detail to code information about the predeal process. We then matched the acquisition sample with the Compustat and CRSP databases to obtain accounting and

<sup>2</sup>We excluded transactions labeled divestitures, spin-offs, recaps, repurchases, minority stake purchases, self-tenders, exchange offers, and leveraged buyouts as well as transactions associated with real estate investment trusts, closed-end mutual funds, states, public administration, banks and other firms in the financial services and utilities sectors, which may be driven simply by financial motives (Haspeslagh & Jemison, 1991). We further excluded deals in which the acquirer obtained less than 50% of the target's equity and deals with a transaction value lower than \$50 million to ensure the strategic importance of deals and the central involvement of acquitting CEOs in the acquisition process (e.g., Hayward & Hambrick, 1997).

financial information for the acquirers and targets and with the ExecuComp database to obtain information about the demographic characteristics and financial compensation of CEOs. The final sample included 349 acquisitions.

## 3.2 | Variables and measurements

### 3.2.1 | Dependent variable

We measured *acquisition premium* as the percentage difference between the purchase price and the target firm's market value 4 weeks prior to the date of acquisition public announcement (Haunschild, 1994). We calculated premiums based on the four-week time lag because information leakage right before the public announcement of an acquisition can cause distortions in the stock price, making premiums calculated based on short-term windows smaller than those calculated based on longer-term windows (Laamanen, 2007).

### 3.2.2 | Independent variable

To test our baseline hypothesis, we used a stock option-based measure of CEO overconfidence that relies on the premise that a CEO who persistently postpones exercising in-the-money stock options is overconfident regarding the future prospects of that CEO's firm compared to its market's evaluation (Malmendier & Tate, 2005). *CEO overconfidence* was a binary measure that took a value of 1 if at least twice during the sample period the acquirer CEO continued to hold stock options with greater than 100% moneyness (the stock price was more than 100% greater than the exercise price) and 0 otherwise (Campbell, Gallmeyer, Johnson, Rutherford, & Stanley, 2011). We classified a CEO as overconfident from the year in which that CEO first exhibited this stock option behavior and that CEO retained this classification in subsequent years unless that CEO exercises stock options in the future at less than 30% moneyness, treating CEO overconfidence as an attribute that may vary over time (Campbell et al., 2011).

We chose this over other empirical operationalizations of CEO overconfidence for several reasons. Recent reviews indicate that the stock option-based measure is most frequently used in the management and finance literature (Malmendier, 2018; Picone et al., 2014), allowing a comparison of findings across studies. Furthermore, Malmendier (2018, p. 70) suggests that scholars seeking to operationalize CEO overconfidence should pick "a credible empirical measure that is not just 'any' proxy for the bias in question, but one that aims for situational similarities." Our measure reflects CEOs' decision-making regarding their firm stock options, directly capturing CEOs' overestimation of future firm value creation. This translates directly into CEO decision-making regarding acquisition premiums, indicating a CEO's overestimation of acquisition value creation. Most importantly, Kaplan, Sorensen, and Zakolyukina (2020) validated the stock option-based measure of CEO overconfidence using a proprietary set of detailed assessments of CEO candidates' personal dispositions and showed that it correlates highly with the typical characteristics of overconfident individuals identified in the psychology literature. In particular, they found that CEOs categorized as overconfident based on their stock option behavior underinvest in gathering information, possess low analytical skills, and are not receptive to feedback (Klayman et al., 1999; Larwood & Whittaker, 1977), which are characteristics we underscore in our theory.



### 3.2.3 | Moderator variable

To test our main hypothesis, we created a measure of acquisition process pace based on prior research on decision pace (e.g., Baum & Wally, 2003; Wally & Baum, 1994), yet we departed from this research by using objective data. Our approach thus addresses some of the concerns associated with prior survey-based research on process pace in strategic decisions, where respondents' "responses may be affected by social bias including reports about processes that are more rational and behaviors that are more decisive than experienced in real life" (Baum & Wally, 2003, p. 1124). Prior research has measured decision process pace as the time between the first reference to a deliberate action and the point in which a commitment to act was made (Judge & Miller, 1991; Wally & Baum, 1994). In acquisitions involving public firms, such as those in our sample, "the first reference to a deliberate action" is made when the acquirer signs the nondisclosure agreement (NDA) with the target, denoting the beginning of the formal predeal process, while "the commitment to act" typically occurs at the point in which the acquirer makes the public announcement of the acquisition bid (Boone & Mulherin, 2007). Using acquisition-related SEC filings, we identified for each acquisition in our sample the date on which the acquirer and target signed the NDA as well as the date on which the deal was publicly announced. We then measured *acquisition process pace* with the number of days between these two dates, which we transformed natural logarithm (Forbes, 2005). High values of this variable indicated that the predeal process was slow in pace, whereas low values indicated that the predeal process was fast in pace.

### 3.2.4 | Control variables

We controlled for a number of factors at the deal, target, acquirer and CEO levels that influence acquisition premiums. We accounted for potential synergies between the acquirer and the target with *acquisition relatedness*—a dummy variable that took a value of 1 if the acquirer and the target shared a common two-digit SIC and 0 otherwise (Beckman & Haunschild, 2002). A target firm's bargaining power increases in the presence of competing bidders. We thus controlled for the *number of bidders* other than the focal bidder that had placed a bid during the predeal process (Boone & Mulherin, 2007). Premium varies according to the *payment method* for an acquisition (Ghosh & Ruland, 1998), which we controlled for by calculating the proportion of acquisition payment made in cash as opposed to stock. We added a dummy indicating whether an acquisition started as a *tender offer* because target management often initially resists tender offers, resulting in higher premiums (Comment & Schwert, 1995). To control for the influence of advisors (Golubov, Petmezas, & Travlos, 2012), we incorporated two control variables, *acquirer advisors* and *target advisors*, both counting the number of financial advisors hired to assist firms in the predeal process. Because premium and the predeal process pace are influenced by the anticipated likelihood of deal completion (Officer, 2003), we incorporated two dummies, *acquirer termination fee* and *target termination fee*, taking the value of 1 if the deal agreement included acquirer and target termination fee, respectively, and 0 otherwise.

The acquisition premium depends on the *target size*, which we measured by the natural logarithm transformed number of target employees (Kim et al., 2011). A target that is experienced in acquisitions is better able to negotiate high premiums (Cuypers, Cuypers, & Martin, 2016). We thus controlled for *target acquisition experience*, measured as the number of acquisitions the

target had completed prior to the focal acquisition. Since this measure exhibited positive skewness and certain targets had not carried out acquisitions, we transformed this measure by taking the natural logarithm of 1 plus the number of acquisitions. Firms with large slack and high performance are perceived as more attractive targets and thus receive higher premiums (Hayward & Hambrick, 1997). Accordingly, we controlled for *target slack* with the ratio of the target's assets divided by its liabilities and *target performance* with return on assets, both measured using financial data from the year preceding the year of the deal announcement. If the target may help the acquirer access growth opportunities, the acquirer will offer a high premium. To control for *target growth opportunities*, we used the market-to-book value ratio of the target's equity, which we determined by dividing the target's preacquisition market value by its book value of equity (Laamanen, 2007). Since high-tech firms are difficult to value (Reuer, Tong, & Wu, 2012), we included *target high-tech* as a dummy variable that took a value of 1 if the SDC database classifies target as high-tech and 0 otherwise.

Prior acquisition experience also helps acquirers make premium decisions, whereas size, financial slack, and high performance may enable acquirers to pay high premiums (Kim et al., 2011). We thus controlled for *acquirer size*, *acquirer acquisition experience*, *acquirer slack*, and *acquirer performance* using the same measures as for these characteristics of targets. We also accounted for the characteristics of acquirer CEOs that may simultaneously affect CEO overconfidence and the acquisition premium (Malmendier & Tate, 2008) by controlling for *acquirer CEO age*, measured in years; *acquirer CEO tenure*, calculated as the number of years since the CEO appointment; *acquirer CEO duality*, which was a dummy equal to 1 if the acquiring CEO is also the chairman of the board and 0 otherwise; and *acquirer CEO ownership*, measured as the percentage of the acquirer's stock owned by the CEO (Hayward & Hambrick, 1997).

If the acquirer CEO feels pressure or drive to complete an acquisition, which often happens during acquisition waves (McNamara, Halebian, & Dykes, 2008), that CEO is likely to strive for a fast-paced predeal process and to pay a high acquisition premium. We identified industry-level acquisition waves following Harford (2005) and then created a dummy *acquisition wave*, taking the value of 1 if the deal took place during a wave and 0 otherwise. Finally, we incorporated *year dummies* to account for the differences in the regulatory environment and the ease of financing acquisitions.

### 3.3 | Analysis

Acquisitions in our sample were not observed randomly. We therefore accounted for potential sample selection bias using the two-stage procedure (e.g., Malhotra, Zhu, & Reus, 2015). From the set of completed acquisitions between publicly listed US firms that took place during our sample period, we assigned acquisitions included in our final sample a value of 1 and all other acquisitions a value of 0. We ran a first-stage probit model to estimate the probability of selecting an acquisition from our sample by regressing this dummy variable on the set of deal characteristics as well as industry and year dummies (Malhotra et al., 2015). We calculated the *inverse Mills ratio* and included it in our second-stage regression models as an additional control variable. We tested our hypotheses using generalized least squares (GLS) regressions. Because some acquirers engaged in more than one acquisition in our sample, we account for the dependence between observations by clustering the acquirers and producing robust clustered standard errors.

## 4 | RESULTS

Table 1 presents the descriptive statistics and cross-correlations of the variables. Table 2 presents the results of our hypothesis tests. Model 1 is a baseline specification comprising all control variables. This model indicates, for example, that acquisition premiums increase with target growth opportunities ( $\beta = .10, p = .06$ ), target termination fee ( $\beta = .54, p = .03$ ), and acquirer CEO age ( $\beta = .13, p = .03$ ). In contrast, acquisition premiums decrease with acquirer CEO tenure ( $\beta = -.10, p = .02$ ) and acquirer CEO ownership ( $\beta = -.06, p = .02$ ).

We test our baseline hypothesis, which proposes that CEO overconfidence increases the acquisition premium, in Model 2. In support of this hypothesis, and replicating prior research (e.g., Hayward & Hambrick, 1997; Malmendier & Tate, 2008), the coefficient estimate for CEO overconfidence helps predict acquisition premiums ( $\beta = .27, p = .03$ ). In Appendix S1, we demonstrate the robustness of this result with an alternative measure of CEO overconfidence.

We use Model 3 to test our main hypothesis, predicting that the premium-inflating effect of CEO overconfidence diminishes as the acquisition process becomes slower in pace. The interaction coefficient offers evidence in support of this hypothesis ( $\beta = -.20, p = .05$ ). We plot this interaction effect graphically in Figure 1. This figure suggests that when the predeal process is slow in pace (solid line; mean + *SD*), CEO overconfidence has a rather small effect, increasing premium for only a few percentage points. In contrast, when the acquisition process is fast in pace (dashed line; mean - *SD*), the amplifying effect of CEO overconfidence on premiums is substantially larger. This interpretation is supported by the results of simple slope analysis; the slope of the relationship between CEO overconfidence and premium decreases as the acquisition process pace moves from fast ( $\beta = .22, p = .00$ ) to slow ( $\beta = .03, p = .69$ ).

We also sought to ensure that endogeneity does not bias our results. Specifically, we were concerned that an unobserved factor, such as the acquirer's preparedness for an acquisition or acquisition motive, could affect both the acquisition process pace (moderator) and acquisition premium (dependent variable). Recent research in econometrics suggests that testing moderation effects that involve endogenous variables with a simple linear regression approach is consistent with more complex two-stage approaches and that "in interaction models the researcher can always perform valid statistical inference for the interaction term without the use of standard IV [instrumental variable] exclusion restrictions" (Bun & Harrison, 2019, 824). Nevertheless, to ensure that our findings are not biased, we addressed endogeneity with the control function approach (Wooldridge, 2015). We present this analysis, which demonstrated that our findings are not affected by endogeneity, in Appendix S1.

Finally, our theory implies that paying an unjustifiably high acquisition premium is a biased decision that is likely to have negative performance implications for the acquirer. Indeed, prior research in management and finance has shown that paying a high premium has a negative effect on acquisition performance (e.g., Beckman & Haunschild, 2002; Schijven & Hitt, 2012; Varaiya & Ferris, 1987). We corroborated this relationship with our sample.

## 5 | DISCUSSION

### 5.1 | Theoretical implications

A bias is a systematic pattern of deviation from norms of rationality in judgment (Tversky & Kahneman, 1974). In the domain of strategy, scholars have identified various biases of

TABLE 1 Descriptive statistics and correlations

Variables	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Acquisition premium	30.57	29.86													
2. CEO overconfidence	0.36	0.48	.08												
3. Acquisition process pace	4.17	0.94	-.29	.02											
4. Acquisition relatedness	0.72	0.45	.09	.10	-.16										
5. Number of bidders	0.60	1.54	-.04	.10	-.01	-.02									
6. Payment method	70.31	38.84	-.04	.00	-.04	-.10	.07								
7. Tender offer	0.26	0.44	-.03	-.06	-.02	.03	-.11	.29							
8. Acquirer advisors	1.22	1.06	.26	-.03	-.24	.19	-.10	-.16	-.05						
9. Target advisors	1.39	0.65	.14	.02	-.04	.10	-.05	-.12	-.07	.25					
10. Acquirer termination fee	0.21	0.41	.14	-.06	-.03	.07	.08	-.27	-.18	.24	.06				
11. Target termination fee	0.78	0.42	.13	-.03	.08	-.03	.09	.08	-.03	.03	.07	.25			
12. Target size	7.24	2.13	.19	-.13	-.17	.03	-.05	-.10	-.08	.44	.22	.20	.15		
13. Target acquisition experience	0.51	0.64	.18	-.11	-.06	-.12	.05	.03	-.04	.16	.10	.13	.15	.29	
14. Target slack	3.24	2.91	-.01	.10	.04	.07	-.05	.12	.06	-.07	-.12	-.11	-.01	-.15	-.11
15. Target performance	-0.05	0.29	.14	-.01	-.05	-.04	.02	-.05	-.13	.18	.08	.13	.05	.41	.20
16. Target growth opportunities	3.20	5.59	.14	.12	-.02	.09	-.01	.02	-.02	.06	-.01	-.07	-.02	.02	-.02
17. Target high-tech	0.59	0.49	-.07	.06	.05	.03	-.03	.25	.18	-.16	-.07	-.18	.01	-.22	-.07
18. Acquirer size	10.15	1.39	-.02	-.17	-.03	-.19	-.07	.26	.08	-.10	.03	-.14	.11	.23	.07
19. Acquirer acquisition experience	1.27	0.96	-.04	.02	.05	-.09	.07	.30	.13	-.14	-.07	-.09	.23	.00	.12
20. Acquirer slack	2.08	0.92	-.14	.21	.11	.02	-.03	.11	.09	-.11	-.12	-.10	.02	-.19	-.14
21. Acquirer performance	0.08	0.06	-.01	.08	.04	-.09	-.03	.20	.07	-.15	.00	-.07	.04	.02	-.05
22. Acquirer CEO age	56.46	5.65	.15	.02	-.02	.01	-.05	-.17	-.07	.08	.10	.09	.01	.03	.04
23. Acquirer CEO tenure	7.10	5.81	-.03	.18	.04	-.04	.04	-.07	.01	-.05	.02	.03	.01	.02	.04
24. Acquirer CEO duality	0.60	0.49	-.01	-.10	-.03	-.09	-.03	-.03	.05	-.14	-.09	-.11	-.02	-.01	-.09

TABLE 1 (Continued)

Variables	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
25. Acquirer CEO ownership	0.48	2.34	.02	-.06	-.08	.02	-.01	-.06	-.09	.04	-.02	.02	.04	-.01	.19
26. Acquisition wave	0.07	0.26	.01	-.03	.00	-.05	-.10	.05	-.01	.07	.04	.02	-.01	.09	.00
Variables	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.			
15. Target performance	-.02														
16. Target growth opportunities	.12	.15													
17. Target high-tech	.25	-.28	.08												
18. Acquirer size	-.13	-.09	-.06	.10											
19. Acquirer acquisition experience	.06	-.13	.01	.40	.44										
20. Acquirer slack	.31	-.03	.03	.21	-.28	.04									
21. Acquirer performance	.18	.00	.02	.13	.09	.05	.30								
22. Acquirer CEO age	-.08	.09	.07	-.12	-.07	-.11	-.05	.06							
23. Acquirer CEO tenure	.00	.07	.03	.04	-.15	.05	.01	-.13	.33						
24. Acquirer CEO duality	-.06	-.07	.03	-.05	.15	-.03	-.15	.07	.18	.11					
25. Acquirer CEO ownership	.05	.05	-.01	-.14	-.06	-.03	-.07	-.11	.17	.15	.09				
26. Acquisition wave	-.07	.08	-.06	-.09	.06	.08	.04	-.06	.08	.07	-.04	-.01			

TABLE 2 GLS estimates for acquisition premium

Variables	Model 1			Model 2			Model 3		
	$\beta$	SE	p	$\beta$	SE	p	$\beta$	SE	p
CEO overconfidence $\times$ acquisition process pace							-.20	0.10	.05
CEO overconfidence				.27	0.13	.03	.29	0.13	.02
Acquisition process pace	-.25	0.06	.00	-.25	0.06	.00	-.14	0.07	.05
Acquisition relatedness	.00	0.12	.98	-.01	0.13	.91	-.01	0.13	.97
Number of bidders	-.05	0.04	.23	-.06	0.04	.14	-.07	0.04	.11
Payment method	-.04	0.05	.42	-.04	0.05	.45	-.03	0.05	.51
Tender offer	.14	0.13	.29	.16	0.13	.21	.19	0.13	.14
Acquirer advisors	.11	0.06	.08	.10	0.06	.08	.11	0.06	.07
Target advisors	.06	0.05	.26	.06	0.05	.30	.05	0.05	.32
Acquirer termination fee	.02	0.13	.83	.05	0.13	.68	.06	0.13	.63
Target termination fee	.54	0.25	.03	.55	0.25	.03	.54	0.25	.03
Target size	.06	0.08	.46	.07	0.08	.38	.07	0.08	.39
Target acquisition experience	.11	0.07	.12	.12	0.07	.09	.13	0.07	.08
Target slack	.08	0.08	.32	.08	0.08	.31	.07	0.07	.34
Target performance	.02	0.10	.84	.02	0.10	.83	.02	0.10	.82
Target growth opportunities	.10	0.05	.06	.09	0.05	.09	.08	0.05	.14
Target high-tech	-.00	0.13	.99	.01	0.13	.96	.01	0.13	.92
Acquirer size	-.08	0.06	.16	-.07	0.06	.21	-.06	0.06	.30
Acquirer acquisition experience	.07	0.08	.42	.06	0.08	.43	.06	0.08	.44
Acquirer slack	-.07	0.06	.21	-.09	0.06	.11	-.07	0.06	.19
Acquirer performance	-.01	0.06	.83	-.02	0.06	.69	-.03	0.06	.61
Acquirer CEO age	.13	0.06	.03	.13	0.06	.03	.14	0.06	.02
Acquirer CEO tenure	-.10	0.04	.02	-.13	0.05	.01	-.13	0.05	.01
Acquirer CEO duality	.02	0.11	.79	.05	0.11	.63	.03	0.11	.77
Acquirer CEO ownership	-.06	0.03	.02	-.06	0.03	.03	-.04	0.03	.10
Acquisition wave	.08	0.16	.60	.10	0.15	.49	.07	0.16	.66
Inverse Mills ratio	-.10	0.06	.10	-.10	0.06	.10	-.10	0.06	.10
Wald chi-square	111.02 ( $p = .00$ )			116.32 ( $p = .00$ )			120.31 ( $p = .00$ )		

Note: Standardized coefficients are reported with clustered standard errors and  $p$ -values. Two-tailed tests for all coefficients. Year dummies are included in all models.

managers that affect strategic decisions and firm outcomes (e.g., Das & Teng, 1999; Duhaime & Schwenk, 1985). However, surprisingly little research has investigated the naturally emerging question of what firms can do to attenuate these biases. Larrick (2004, p. 334) suggests that “research on debiasing tends to be overshadowed by research demonstrating biases [because] it is more newsworthy to show that something is broken than to show how to fix it.” Our study is



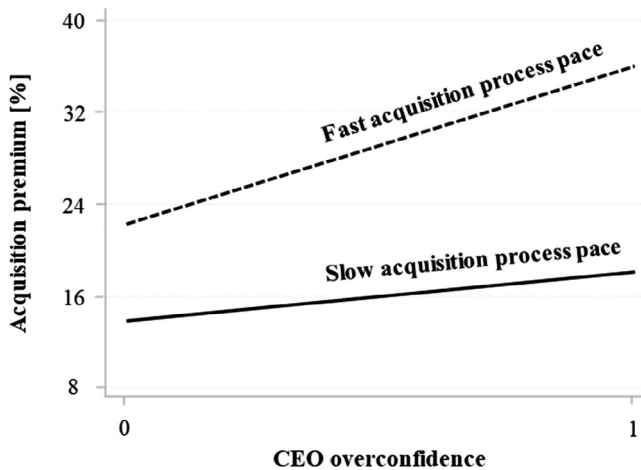


FIGURE 1 Interaction effect between *CEO overconfidence* and *Acquisition process pace*

a rare effort in the field of strategy to investigate “how to fix” managerial biases. Given the wide-reaching implications of strategic decisions for various stakeholders, how to attenuate managerial biases is an important question that awaits substantially more attention from strategy scholars (Powell et al., 2011).

Debiasing managerial decisions is challenging. The psychology literature proposes two fundamental approaches to debiasing (Fischhoff, 1982; Soll, Milkman, & Payne, 2016): (a) a “modify the decision maker” approach, seeking to equip individuals with training, knowledge and tools to help them overcome cognitive biases, and (b) a “modify the environment” approach, seeking to alter the decision environment in which individuals make decisions to spur them to process information more appropriately. Although there have been hints that providing individuals with personalized feedback and training helps individuals overcome cognitive biases (Bazerman & Neale, 1983; Idson et al., 2004), scholars generally tend to agree that attempts to modify the cognitive errors of decision-makers tend to be less conducive than interventions at the level of the environment in which they make decisions (Kahneman & Klein, 2009).

By adopting the “modify the environment” approach, deriving our argument from theory on procedural rationality, and testing it in the context of acquisition decision-making, we offer suggestive evidence that modifies the nature of the environment (i.e., modifying the pace of acquisition processes) in which strategic decisions (i.e., acquisition premiums) are made helps mitigate the effects of overconfidence, a widespread cognitive bias of CEOs. These findings are in line with an argument put forth in prior research that “different decision processes tend to accentuate [or attenuate] particular types of cognitive bias” (Das & Teng, 1999, p. 757). Our study thus demonstrates the great promise of using the “modify the environment” approach for debiasing strategic decisions and paves the way for future research to examine how different decision environments may counter the broad range of managerial biases that infect strategic decisions. Such research may have the potential to provide firms much needed advice on how to design procedurally rational decision environments.

More broadly, our findings extend and complement seminal research on cognitive biases and decision-making in organizations (McNamara et al., 2002; Sutcliffe & McNamara, 2001),

which has offered important insights into how managing the organizational setting in which decision-makers make decision choices helps correct the inherent errors in their cognition. Our findings are also consistent with Simon's (1947) idea that decision-making can be seen as the working of the two blades of a scissor where decisions are equally shaped by the cognitive apparatus of the decision-maker and the structure of the environment in which the decision-maker is embedded. Future research should continue to examine the interplay between managerial cognition and organizational practices in the strategic decisions of firms.

Our study also advances research on corporate acquisitions, in particular a process theory of acquisitions that recognizes the acquisition process as an important determinant of acquisition outcomes (Jemison & Sitkin, 1986; Pablo et al., 1996). Our findings suggest that fostering procedural rationality in the predeal process has an indirect effect, via mitigation of CEO overconfidence, on the magnitude of acquisition premiums. With these findings, we begin to respond to recent calls for more comprehensive investigation of the predeal processes (Devers et al., 2020; Welch, Pavićević, Keil, & Laamanen, 2020) and offer rare empirical evidence supporting the idea that “the differences between acquisition success and failure lie in understanding and better managing the processes by which acquisition decisions are made” (Haspeslagh & Jemison, 1991, p. 13). Interestingly, our finding that slower acquisition processes are central to reigning in the tendency of overconfident CEOs for quick decision-making runs counter to some prior research on decision-making that has often touted the advantages of fast decision-making for strategic decisions such as acquisitions (Eisenhardt, 1989, 1990).

## 5.2 | Limitations and directions for future research

Several limitations of this study are also noteworthy. First, prolonging the predeal process in acquisition may have unintended consequences. As noted by Lin and Carley (1997, p. 220), “often, a late decision, whether or not it is correct, is a useless decision and may have severe consequences for the organization.” A slow predeal process, for instance, may lead to a failure to complete a deal. Unfortunately, our data did not allow us to investigate this in a reliable way primarily because we did not observe predeal processes in noncompleted acquisitions. Future research should therefore gather primary and more fine-grained data on predeal processes to study the unintended consequences of procedural rationality (cf. McNamara et al., 2002). Second, we studied the role of procedural rationality in attenuating the premium-inflating effect of CEO overconfidence, but we did not consider the antecedents to procedural rationality. However, procedural debiasing typically requires intervention (Larrick, 2004). It is therefore important for future research to examine these antecedents. Third, we focused on acquisition premiums, yet CEO overconfidence may affect other acquisition decisions, such as whether to initiate an acquisition, which target acquisition, or how to finance an acquisition (e.g., Brown & Sarma, 2007; Malmendier & Tate, 2008). Future research should investigate whether and how these other acquisition decisions can be debiased by fostering procedural rationality in processes that precede these decisions. Fourth, in view of the limited data availability in our study, future research should revisit our findings with a more direct measure of CEO overconfidence by, for example, surveying CEOs directly on their confidence levels (Hiller & Hambrick, 2005). Finally, future research should test the generalizability of our findings beyond the context of acquisitions made by S&P 500 firms and acquisitions involving publicly listed target firms.

### 5.3 | Practical implications

Our findings suggest that acquiring firm boards should slow the pace of acquisition processes if there is evidence suggesting that their CEOs are overconfident. However, boards could face a potential tradeoff in doing so. By slowing the acquisition process, boards may miss the acquisition opportunity. In contrast, by quickly approving a promising acquisition, boards may forego opportunities to attenuate the decision biases of their CEOs that may have negative consequences for firms. On balance, however, given the general difficulties involved in evaluating targets and negotiating acquisitions, by fostering procedural rationality through a slow process pace boards are able to help managers make less biased acquisition decisions and better justify the quality of their decisions to firm shareholders.

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#### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from commercial vendors such as Thomson Reuters Securities Data (SDC) Company, US Executive Compensation Database, Compustat Database, CRSP Database, and public sources such as the electronic filing system (EDGAR) of the US Securities and Exchange Commission.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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