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RESEARCH ARTICLE

Self-serving attribution and managerial investment decision

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Abstract

This study examines whether managerial overconfidence coupled with self-attribution bias distorts the investment decisions of firms. To this end, we investigate the impact of overconfidence on asymmetric investment cash flow sensitivity (ICS). We find that managerial overconfidence affects ICS in a downward-sticky direction, which is reinforced by overconfidence coupled with managerial self-attribution. The results for both unconstrained and constrained firms are qualitatively consistent with those for the overall sample; however, the constrained subsample provides slightly weaker results. Thus, our findings indicate that managerial overconfidence and self-attribution to recent successes may induce managers to make excessive investment commitments.

KEYWORDS
investment cash flow sensitivity, overconfidence, self-attribution bias

JEL CLASSIFICATION
G02, G31

1 | INTRODUCTION

Overconfidence is a well-documented cognitive bias that is described in the field of psychology as an ego-based pathology, like narcissism (Allen & Evans, 2005; Owen & Davidson, 2009; Petit & Bollaert, 2012).[1] Narcissistic and exaggerated self-confidence lead to flawed and biased processing in decision-making (Erev et al., 1994), which may impair moral awareness, resulting in unethical behavior (Craig & Amernic, 2011; McManus, 2018; Petit & Bollaert, 2012; Reynolds, 2006, 2008). Such unethical behavior may lead to fraud (Rijsenbilt & Commandeur, 2013), financial scandals (Chen, 2010),[2] and other destructive outcomes (Ben-David et al., 2008; Choi et al., 2018; Hayward & Hambrick, 1997; Malmendier & Tate, 2008).

Managerial overconfidence theorists (MOTs) in the field of financial economics have explored the implications of managerial overconfidence with regard to managers' biased decision-making. Managerial overconfidence is a well-known explanation for distortions in corporate investment. In addressing the agency problem and managers' empire-building incentives,[3] previous literature has documented the positive association of these issues with investment cash flow, especially considering firms' financing constraints (Andres, 2011; Fazzari et al., 1988, 2000; George et al., 2011; Hovakimian & Hovakimian, 2009; Hubbard, 1998; Jensen, 1986; Lensink et al., 2001; Richardson, 2006; Stulz, 1990). Additionally, MOTs describe how managerial overconfidence can induce greater investment cash flow sensitivity (ICS) and lead to higher agency costs (Heaton, 2002; Huang et al., 2011; Lin et al., 2005; Malmendier & Tate, 2005).

Consequently, our examination of the assertions of MOTs and related methodology highlights some issues. First, MOTs adopt an incomplete analysis model that is inconsistent with the ICS operating mechanism they postulate. Viewing the different directions of cash flow changes as a driver of investment, they employ a simple linear model that cannot simultaneously capture both cases of cash flow change. Therefore, in this study, we examine whether managerial overconfidence intensifies a symmetric or asymmetric ICS pattern, or indeed whether it actually stimulates ICS. Second, when measuring the degree of ICS, most MOTs focus on financially "constrained" firms. Hence, in the current study, we seek to examine the impact of managerial overconfidence on financially "unconstrained" firms, which include the majority of public entities.

We develop an adjusted asymmetric model to examine whether and how managerial overconfidence affects ICS. To conduct a more in-depth investigation into this relationship, we utilize Malmendier and Tate's (2005) measure, which captures optimistic managerial views as seen in a chief executive officer's (CEO) option-exercising behavior.[4] Furthermore, we focus on the moderating role of self-attribution bias in the link between overconfidence and ICS. Our rationale is based on the psychology literature (e.g., Farwell & Wohlwend-Lloyd, 1998), which describes how narcissistic overconfidence is associated with over-optimism about one's own performance and

[1] Psychology research suggests that the overconfidence syndrome overlaps with narcissism considerably in terms of both attitudes and behaviors (Petit & Bollaert, 2012).

[2] Chen (2010) stated that narcissism among CEOs can largely explain several major financial accounting scandals, including those involving Enron, WorldCom, Parmalat, and Satyam.

[3] The empire-building tendency of executives is a popular explanation for managerial overinvestment (Baumol, 1959; Williamson, 1964; Grossman & Hart, 1982; Jensen, 1986, 1993; Stulz, 1990; Hart & Moore, 1995; Zwiebel, 1996; Harris & Raviv, 1998; Stein, 2003). Managers may have an excessive interest in running large firms as opposed to "merely" profitable ones, indicating that their interests diverge from those of stockholders (Stein, 2003).

[4] Besides the measures developed by Malmendier and Tate (2005), Ben-David et al. (2008) and Santner and Weber (2009) used survey results about the distribution of CEO forecasts, whereas Lin et al. (2005) utilized management forecast errors.

self-attribution for successful task outcomes. Hirshleifer (2001) described the association between overconfidence and self-attribution bias as follows: "overconfidence and biased self-attribution are static and dynamic counterparts; self-attribution causes individuals to learn to be more overconfident rather than converging to an accurate self-assessment" (Billett & Qian, 2008, p. 1037). To obtain more conclusive evidence, we apply another measure of biased cognitive perception, that is, narcissistic disorder, intensified by the self-attribution fallacy, to the asymmetric ICS model.

In our analysis, we utilize a sample of 15,446 firms in the US capital market for the period 2000–2020. Our results are as follows. First, we find that managerial overconfidence induces ICS to move in an asymmetric and sticky direction. Second, the stickiness degree of ICS increases with prior successful firm performance. In relation to the subsample tests, the results for unconstrained firms are somewhat stronger, whereas those for constrained firms are slightly weaker. These results are qualitatively consistent with the results for the overall sample. Overall, these findings imply that managerial overconfidence may induce aggressive investment commitment irrespective of internal or external financing constraints.

Like other works related to CEO overconfidence on firms' policies, our study is limited by an endogeneity issue, despite using various econometric methods to mitigate this issue. To address this concern, we use a wide range of controls, namely, industry, and firm effects that could play a role in this dynamic. Furthermore, as stated by Malmendier and Tate (2005), we do not consider that endogeneity dramatically affects our main conclusion, because boards consider the CEO's overconfidence before appointing them to their position. In other words, the board that chooses an *overconfident* CEO should be mindful of the negative aspects linked to this personality trait, such as distorted investment behavior, and proactively address them by implementing explicit measures.

This study makes three contributions to the literature. First, our findings complement the MOT literature by identifying the limits of a simple linear model and subsequently re-characterizing the asymmetric ICS link to capture the different directions of cash flow changes. Second, in line with Malmendier and Tate (2005), the mainstream literature measures managerial overconfidence as the option-exercising behavior of CEOs. We complement the reinforced narcissism measure, which reflects the self-attribution fallacy, by postulating that managerial overconfidence is strengthened by managers' prior successful experience. Furthermore, we explicitly highlight the possibility that narcissistic managers tend to conduct imprudent and avoidable overinvestments. Finally, we extend the scope of relevant literature by examining the ICS of both constrained and unconstrained firms. Our findings highlight that overconfident managers may participate in sub-optimal investment decisions in unconstrained firms rather than constrained firms.

2 | LITERATURE, MOTIVATION, AND HYPOTHESIS DEVELOPMENT

The psychology literature has documented that overconfidence is related to narcissistic personality disorder, which causes individuals to develop an exaggerated sense of pride and belief in their own talent, judgment, and ability to obtain positive outcomes (Alba & Hutchinson, 2000; Goel & Thakor, 2008; Hackbarth, 2008; Keren, 1991; Koriat et al., 1980; Kruger & David, 1999; Lichtenstein & Fischhoff, 1977; Lichtenstein et al., 1982; Shefrin, 2001a; Soll & Klayman, 2004). In characterizing narcissistic personality disorder, related literature (Keren, 1991; Larrick et al., 2007; Lichtenstein et al., 1982; Merkle & Weber, 2011; Moore & Healy, 2008; Soll, 1996; Svenson, 1981; Taylor & Brown, 1988) draws on miscalibration and better-than-average bias. Moore and Healy (2008)

defined miscalibration as "excessive precision in one's belief," whereas the better-than-average effect refers to the "overplacement of one's performance relative to others" (Baker & Nofsinger, 2010). With such miscalibration, overconfident CEOs may incorrectly assess the value of potential projects based on irrational beliefs, whereas better-than-average bias effect compels managers to overestimate future performance or project returns based on their overly optimistic views of their ability. This explanation for overconfidence, based on "miscalibration" and the "better-than-average effect," reflects bias in CEOs' overestimation of future payoffs on their investments.

Drawing on the psychology literature, MOTs in financial economics postulate that managerial overconfidence strengthens the degree of ICS, especially for more constrained firms (Heaton, 2002; Huang et al., 2011; Lin et al., 2005; Malmendier & Tate, 2005). According to the ICS literature, free cash flow (FCF) is commonly used as a proxy for the agency problem and subsequent empire-building incentives (Andres, 2011; Fazzari et al., 1988, 2000; George et al., 2011; Hovakimian & Hovakimian, 2009; Hubbard, 1998; Jensen, 1986; Lensink et al., 2001; Richardson, 2006; Stulz, 1990). The FCF hypothesis, proposed by Jensen (1986), posits that managers with high FCF levels are more likely to invest in operations or projects that have a negative net present value for the purpose of increasing their perquisite consumption. Hence, when cash flow is low, managers have fewer opportunities for empire-building and, thus, reduce their investment to avoid negative career consequences. The FCF hypothesis predicts a linear association between cash flow and ICS. Furthermore, MOTs articulate that the degree of ICS depends on managerial preferences with regard to funding sources (Heaton, 2002; Huang et al., 2011; Lin et al., 2005; Malmendier & Tate, 2005; Wang et al., 2009). Managers have preferences for way to source finance investments: First, they use internal funds; subsequently, they choose lower risk securities; and finally, they rely on higher risk securities as a last resort (Gombola & Marciukaityte, 2007; Muller & Brettel, 2012; Myers & Majluf, 1984). Overconfident managers who overestimate the value of projects tend to overinvest sufficient internal funds when their company has sufficient internal funds (i.e., a high level of FCF). Meanwhile, in a situation wherein the company has insufficient FCF, overconfident managers tend to underinvest, believing that the capital market undervalues their firms' shares. Hence, given that equity financing has a higher cost and information risk than debt financing, managers are more reluctant to issue equity to avoid underpriced securities and higher cost of equity. Likewise, when a firm's internal funds are exhausted, the manager may forgo investments, because debt financing demands a higher rate of return. Therefore, although overconfident managers optimistically predict the success of investment projects, the deficit in internal cash flows deters their investment because external parties (i.e., debtholders and shareholders) demand a higher cost of capital to compensate for higher information risk.

However, we question this one-sided mechanism of managerial overconfidence as postulated by MOTs. As managers can essentially assess both the returns and capital costs while considering potential projects, managerial overconfidence can simultaneously affect the returns and costs of a project. If overconfident managers believe that their return on their investment will cover the high cost of equity, they are more likely to use their equity despite the considerable costs involved. Therefore, we must characterize the binary (returns vs. capital costs) mechanisms of the effects of managers' optimism. Furthermore, because MOTs' linear ICS model cannot concurrently differentiate the two cases (i.e., 1) the value of ICS when cash flow decreases and 2) the ICS value when cash flow increases), this limit leads us to specify an asymmetric ICS model that divides the cash flow changes into two ranges: when a firm has sufficient internal financing resources ($\Delta cash\ flow > 0$) and when it does not have sufficient internal financing resources ($\Delta cash\ flow < 0$).

Figure 1 shows both the symmetry and asymmetry scenarios in this relation. The downward-sloping line passes through point s and intersects the bottom horizontal line symmetrically around

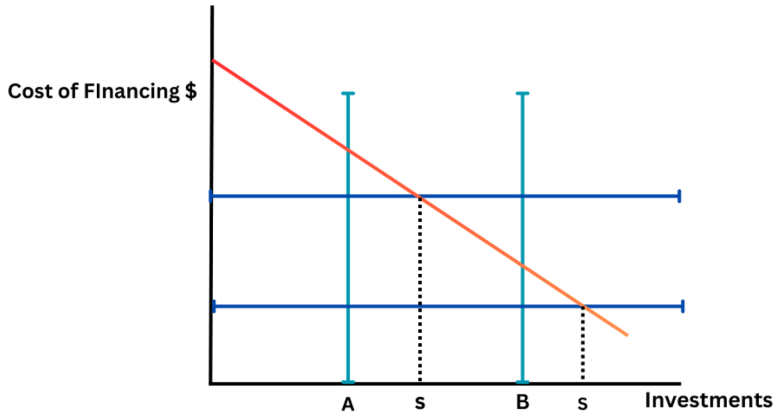

FIGURE 1 Asymmetry of investment cash flow sensitivity. [Colour figure can be viewed at wileyonlinelibrary.com]

point B. Small fluctuations around B do not affect investment, and it remains at s. This indicates no FCF investment sensitivity but high external finance sensitivity. For an asymmetrical scenario, the downward-sloping line falls from points B to s when FCF falls from B, indicating no reduction in investment. However, a rise in FCF from B to B + s increases investment by B + s. This demonstrates asymmetry. If FCF is at A, all investment is internally funded at the intersection of the second vertical line and the horizontal axis. Small fluctuations in FCF lead to symmetric investment fluctuations if marginal returns are linear. If the initial FCF is in the region of s, a fall means no reduction in investment, but a rise does increase investment. This reflects asymmetry.

It is noteworthy that the direction of asymmetry depends on the relationship between the perceived marginal return to investment, the perceived cost of external finance, and the perceived cost of internal funds. If the perceived marginal return is higher than the cost of external finance minus the cost of internal funds, the asymmetry is downward, as depicted in the graph of Figure 1. However, if the difference between the two costs is greater than the perceived marginal return, the asymmetry is in the opposite direction.

In this study, based on the theory of oversensitive investment, wherein cash flows provide sufficient internal funds, we introduce the deficient internal funds in our discussion. Even if external financing is costly, to execute (potential) investments, firms should depend on debt or equity financing when internal cash is exhausted. At the same time, managers may consider the additional costs of issuing securities if their firms' securities are too undervalued. However, overconfident managers who underestimate the riskiness of future outcomes (Hackbarth, 2008) have different tastes in external costly financing. As overconfident managers expect the returns on their investments to cover the high costs of capital, they do not refrain from external fundraising. Hence, even when FCF decreases, overconfident managers—even those in a constrained environment—do not reduce their investment amount too rapidly. Furthermore, because managers in unconstrained firms have access to abundant external financing opportunities, their external fundraising capability strongly induces them to avoid underinvestment. Consequently, when there are sufficient internal funds, overconfident managers tend to overinvest. However, even when their cash flow is exhausted, such managers are reluctant to reduce their level of investment despite the high costs of external financing. Thus, ICS becomes weaker when FCF decreases rather than increases. In line with this discussion, we propose the following hypothesis:

HYPOTHESIS I. *Investment cash flow sensitivity in firms with overconfident CEOs becomes stickier when cash flow decreases than when it increases.*

Next, the psychology literature related to *self-attribution bias* indicates that managers tend to eventually learn from the outcomes of their investment decisions and appropriately adjust their beliefs regarding their ability to process information (Baker & Nofsinger, 2010; Hastorf et al., 1970; Koellinger et al., 2007; Langer & Roth, 1975; Miller & Ross, 1975; Zuckerman, 1979). Farwell and Wohlwend-Lloyd (1998) described how narcissism is associated with optimistic expectations of one's own performance and how it is reinforced by self-attribution for a successful task outcome. Thus, following favorable outcomes, successful managers gain more confidence in their judgment via a mechanism that involves learning and self-attribution, even when the outcome is independent of their prior decisions (Baker & Nofsinger, 2010; Ben-David et al., 2008).

The behavioral finance literature applies the intensifying impact of the self-attribution fallacy to financial decision-making as well as trade behavior (Gervais & Odean, 2001; Hilary & Menzly, 2006) and acquisition behavior (Aktas et al., 2007; Billett & Qian, 2008; Doukas & Petmezas, 2007; Malmendier & Tate, 2008; Moeller et al., 2005). For example, Gervais and Odean (2001) showed that traders became overconfident after observing a series of past successes. Testing Roll's (1986) hubris hypothesis, Malmendier and Tate (2008) found that CEO overconfidence can explain their takeover actions, and more overconfident CEOs tend to complete more mergers. Moreover, Moeller et al. (2005) showed that value-destroying acquisition deals tend to occur in firms that have prior successful acquisitions.

The previous psychology literature suggests that CEOs are expected to be more overconfident when they have the prior successful performance. In such cases, CEOs tend to assess future payoffs more excessively through the self-attribution mechanism. Accordingly, the second hypothesis is centered on the accelerating effect of this self-attribution fallacy on ICS. When FCF increases, managers with strong overconfidence based on self-belief and prior successful experience are more likely to participate in higher levels of overinvestment. This is because overconfident managers with prior successful performance overestimate the outputs of projects and undervalue project risks to a greater degree than their unsuccessful peers do. In the case of a transiently low FCF, overconfident CEOs with past successes might maintain a considerable level of investment based on their experience that the returns from projects compensated for the high costs of external financing. This argument predicts a stickier ICS in firms with more successful overconfident managers. Therefore, we propose the following hypothesis:

HYPOTHESIS II. *The stickiness degree of investment cash flow sensitivity in firms with overconfident CEOs is significantly intensified by prior successful firm performance.*

3 | METHODOLOGY, DATA, AND STATISTICS

3.1 | Measuring managerial overconfidence

As proxies for managerial overconfidence, we use Malmendier and Tate's (2005, 2008) measures, which are commonly used in behavioral finance literature. Malmendier and Tate (2005) developed the *Holder 67* and *Longholder* measures based on the option-exercising behaviors of CEOs.[5] We

[5] Besides the timing at which options are exercised to identify overconfidence, Malmendier and Tate (2005) employed the habitual acquisition of company stock as a third measure, known as *Net Buyer*.

construct two metrics of managerial overconfidence: *Long_Holder* and *Holder_67*. *Long_Holder* is an indicator variable that identifies CEOs who have held an option until its year of expiration at least once during their tenure, even if the option is at least 40% in-the-money when entering its final year. We calibrate the 40% exercise threshold using Hall and Murphy's (2002) model. *Holder_67* is an indicator variable that identifies CEOs who fail to exercise options that have 5 years until their expiration, despite a 67% (or more) increase in stock price since the option grant date. *Long_Holder* is a backward-looking measure that relaxes the requirement for CEOs to hold their options until expiration, whereas *Holder_67* focuses on CEOs' decision to exercise the option in the fifth year prior to expiration. In line with Malmendier and Tate (2008), we consider the 5 years before expiration as the earliest time-point, as the options of most of the US sample firms have a 10-year duration and are fully vested only after the fourth year. Therefore, we exclude the small number of option packages that have 5 years until expiration and are not fully vested. Both these indicator variables capture the level of managerial overconfidence based on CEOs' overly optimistic views of future firm performance, which stems from their own abilities and efforts.

Additionally, we develop a strong measure of overconfidence to reflect the self-attribution fallacy. According to the psychology literature, CEOs tend to be more overconfident when they have prior good performance owing to a learning and self-attribution mechanism (Hastorf et al., 1970; Koellinger et al., 2007; Langer & Roth, 1975; Miller & Ross, 1975; Zuckerman, 1979). Thus, managers' overconfidence in their assessment of optimistic future estimates may intensify when there are prior favorable firm outcomes. In this analysis, we view accounting-based operating performance as their prior outcomes, because it represents managers' resource-allocation decisions (Yang, 2015). To avoid any bias arising from the factors that reflect financing choice, tax arbitrage, or accounting method, we utilize pre-tax operating cash flow returns (OCFR) in our analysis. Following Ghosh (2001), Healy et al. (1992), Linn and Switzer (2001), Yen et al. (2013), and Yang (2015), we define OCFR as sales minus the cost of goods sold and the selling, general, and administrative expenses plus depreciation and goodwill expenses. In response to Healy et al.'s (1992) critique of the industry median benchmark (Ghosh, 2001), we adjust the OCFR by taking the difference between the firm's OCFR and the industry median of OCFR in the same industry. Additionally, to allow interfirm comparisons, we deflate the OCFR by assets employed, using market values that represent the opportunity cost of the assets. Finally, we calculate the $Prior\_Performance$ measure by dividing the Fama–French 48 industry-adjusted pre-tax operating cash flows by the market value of assets in year $t-1$. This approach allows us to capture the prior favorable outcomes derived from managerial decisions.

3.2 | Models

To examine the effect of managerial overconfidence on the relationship between cash flow and investment, Lin et al. (2005) and Malmendier and Tate (2005) included an interaction term between cash flow and proxies for managerial overconfidence. We employ their specification to test our two hypotheses and estimate the following models:

$$\begin{aligned} I_{i,t} &= \beta_0 + \beta_1 \times C_{i,t} + \beta_2 \times DC_{i,t} + \beta_3 \times C_{i,t} \times DC_{i,t} + \beta_4 \times Overconfidence_{i,t} + \beta_5 \times C_{i,t} \\ &\times DC_{i,t} \times Overconfidence_{i,t} + All\ the\ other\ interaction\ terms_{i,t} \\ &+ \sum_{c=6}^{10} \beta_c \times Controls + \varepsilon_i \end{aligned} \tag{1}$$

$$I_{i,t} = \beta_0 + \beta_1 \times C_{i,t} + \beta_2 \times DC_{i,t} + \beta_3 \times C_{i,t} \times DC_{i,t} + \beta_4 \times Overconfidence_{i,t} + \beta_5 \times C_{i,t} \times DC_{i,t} \times Overconfidence_{i,t} + \beta_6 \times Prior\_Performance_{i,t-1} + \beta_7 \times C \times DC_{i,t} \times Overconfidence_{i,t} \times Prior\_Performance_{i,t-1} + All\ the\ other\ interaction\ terms_{i,t} + \sum_{c=8}^{12} \beta_c \times Controls + \varepsilon_i \quad (2)$$

where $I_{i,t}$ represents the investment of firm i in year t, normalized by the lagged book value of assets; and $C_{i,t}$ is the operating FCF of firm i in year t. $DC_{i,t}$ is a dummy variable that equals 1 if the operating cash flows in year t are lower than 1 in year $t-1$, and 0 otherwise. In Equation (1), we examine the asymmetric sensitivity between cash flow and investment derived from managerial overconfidence by including a dummy variable if a firm has lower internal cash flows (DC) in the linear ICS estimation regression. In Equation (2), we add the interaction term $Prior\_Performance$ to the asymmetric ICS specification to reflect the intensification of managerial overconfidence due to prior successful performance. In Equation (1), consistent with previous empirical evidence (Lin et al., 2005; Malmendier & Tate, 2005), our model predicts that the β_1 coefficient will be significantly positive and that the β_2 coefficient on C will be significantly negative. The negative value of the β_2 coefficient indicates a smaller investment reaction when cash flow decreases. More importantly, we expect that the β_5 coefficient will be negative, indicating that the degree of ICS' downward stickiness is greater for overconfident than for non-overconfident managers. In Equation (2), Hypothesis II predicts that the coefficient is negative, as the degree of ICS asymmetry is greater for overconfident managers with more prior successes than for those with fewer prior successes.

Following the ICS literature, we include the following control variables to control for the effects of ICS on capital and operational expenditure: book leverage (George et al., 2011), firm size (Malmendier & Tate, 2005), FCF ratio (Andres, 2011), the ratio of market value to book value of equity (Lin et al., 2005), and asset intensity (Chen et al., 2012). We also include industry fixed effects (based on the 48 Fama–French classifications) and year fixed effects in our main panel regressions. Table 1 presents the definitions for all variables used in this study.

3.3 | Data and statistics

We derive our research data from the Execucomp, Compustat, and Center for Research in Securities Prices (CRSP) databases for the period 2000–2020. We consolidate the data obtained from the Execucomp and Compustat databases to construct the overconfidence variables. Next, we utilize the merged Compustat and CRSP databases to construct the ICS, cost stickiness, and other economic variables. We exclude all financial firms (standard industrial classification [SIC] codes: 6000-6999) and utility firms (SIC codes 4900-4949), because these are highly regulated industries. We obtain the Fama–French 48 industry classifications from Kenneth French's website. Our sample comprises 15,466 firm-year observations, including firms listed on the S&P 1500 Index and those excluded from the index but still being traded.[6]

[6] The Execucomp database comprises only about 2500 firms listed in the S&P 1500 index and firms that are excluded from the S&P 1500 Index but are still being traded, thereby limiting the size of our sample.

TABLE 1 Definitions of the dependent and independent variables.

Variables	Definitions
Dependent variable	
I	Capital expenditure of firm i in year t, normalized by the lagged book value of assets
Independent variables	
C	Operating cash flows of firm i in year t
DC	Dummy variable is equal to 1 if operating cash flows in year t are lower than 1 in year $t-1$, and 0 otherwise
Holder_67	Dummy variable is equal to 1 for all CEO years after the CEO fails to exercise a 67% in-the-money option at least twice with 5 years remaining in the duration
Long_Holder	Dummy variable equal to 1 for a CEO who at some point during their tenure held an option package until the last year before expiration
$Prior\_Performance$	Fama–French 48 industry-adjusted pre-tax operating cash flows divided by market value of assets in year $t-1$
$SIZE$	Natural logarithm of book value of assets of firm i in year t
LEV	Natural logarithm of book value of debts divided by book value of assets of firm i in year t
FCF	Natural logarithm of operating free cash flow divided by net income of firm i in year t
INT	Natural logarithm of book value of assets divided by sales of firm i in year t
Q	Ratio of market value to book value of equity of firm i in year t

Note: This table presents the definition of the key variables used in this study. The variables are constructed based on three databases: Center for Research in Securities Prices (CRSP), COMPUSTAT, and Execucomp, for the period 2000–2020. Following Anderson et al.'s (2003) variable construction procedure, our sample comprises 15,446 firm-year observations, excluding financial and utility firms.

Table 2 presents the descriptive statistics for all the variables used in the regression analysis. The average capital expenditure, normalized by the lagged book value of assets, is approximately 6.7%. The average ratio of the pre-tax operating cash flow to the market value of assets is approximately 12%. One of the main controls, asset concentration, shows an average value of 105.1%.

4 | EMPIRICAL RESULTS

4.1 | Impact of overconfidence on ICS

In our analysis, we first test for the presence of potentially asymmetric ICS derived from managerial overconfidence. Hypothesis I posits that the reduction in ICS generated by managerial overconfidence is more significant when FCF decreases rather than increases. In Table 3, Panel A presents the coefficient estimates for the panel regression with the Petersen standard errors. The results for the baseline model without an overconfidence measure (column 1) show that C has a significantly positive β_1 coefficient (coefficient = 0.0019, t-statistic = 7.39) and the β_3 coefficient of CDC is also significantly positive (coefficient = 0.0023, t-statistic = 4.5).

TABLE 2 Descriptive statistics of dependent and independent variables.

Variables	Mean	Std. Dev.	Lower quartile	Median	Upper quartile
Dependent variables					
I	0.067	0.016	0.059	0.070	0.078
Independent variables					
C	0.070	8.505	0.049	0.099	0.168
DC	0.433	0.496	0.000	0.000	1.000
$Holder\_67$	0.613	0.487	0.000	1.000	1.000
$Long\_Holder$	0.254	0.435	0.000	0.000	1.000
$Prior\_Performance$	−0.968	6.524	−0.755	−0.221	−0.007
$SIZE$	7.139	1.577	6.018	6.980	8.120
LEV	−0.806	0.550	−1.062	−0.680	−0.446
FCF	0.475	0.958	0.123	0.475	0.878
INT	0.050	0.677	−0.371	0.001	0.421
Q	3.853	62.074	1.486	2.316	3.734

Note: This table summarizes the descriptive statistics of the dependent/independent variables investigated in this study's empirical analysis. We utilize three databases: the Center for Research in Securities Prices (CRSP), COMPUSTAT, and Execucomp, for the period 2000–2020. Our sample comprises 15,446 firm-year observations, excluding financial and utility firms.

The Fama–MacBeth regression (Panel B of Table 3) provides similar results, showing that the coefficients on C (coefficient = 0.0039, t-statistic = 3.10) and $C \times DC$ (coefficient = 0.1094, t-statistic = 2.26) are significant and positive. These results suggest that, on average, a firm's investment tends to increase when cash flow increases. However, investment significantly decreases when the firm has lower internal cash flow sources. These results confirm Jensen's (1986) FCF hypothesis. In Panel A of Table 3, however, the results in columns 2 and 3 for the *Holder_67* and *Long_Holder* models show that all the β_3 coefficients of $C \times DC \times Overconfidence$ are significantly negative (column 2: coefficient = −0.0016, t-statistic = −1.72; column 3: coefficient = −0.0047, t-statistic = −2.86), whereas the corresponding β_3 coefficients of $C \times DC$ are insignificant and significantly positive, respectively. In Table 3, Panel B reports results similar to those shown in Panel A. The β_5 coefficients on $C \times DC \times Overconfidence$ in columns 2 and 3 are significantly negative (column 2: coefficient = −0.0789, t-statistic = −1.94; column 3: coefficient = −0.0297, t-statistic = −2.42).

These results indicate that overconfidence drives ICS in an asymmetric and downward-sticky direction. This finding is consistent with our prediction and robust for two different proxies of overconfidence. Furthermore, the results contradict the view that overconfidence plays a more elasticity-inducing role when there is a proportional or linear relationship between changes in cash flow and investment (Heaton, 2002; Lin et al., 2005; Malmendier & Tate, 2005).

4.2 | Impact of self-attributed overconfidence on ICS

We employ a portfolio sorting approach to examine the relationship between prior operating performance and investment level under an overconfident CEO (Table 4). If the overconfident CEOs experience prior success in operating a firm, there should be an intensifying impact of prior firm performance on the relationship between managerial overconfidence and investment level. To

TABLE 3 Impact of chief executive officer (CEO) overconfidence on investment cash flow sensitivity.

Panel A	**Baseline model column 1**	***Holder_67* column 2**	***Long_Holder* column 3**
(Panel regression with Petersen Std. errors)	**Estimate (*t*-stat)**	**Estimate (*t*-stat)**	**Estimate (*t*-stat)**
C	0.0019 (7.39)***	0.0027 (5.90)***	0.0031 (7.07)***
DC	−0.0013 (−0.68)	−0.0053 (−1.50)	0.0021 (0.78)
$C \times DC$	0.0023 (4.50)***	0.0019 (1.38)	0.0028 (3.09)***
Overconfidence		0.0118 (4.36)***	0.0073 (1.74)*
$C \times DC \times Overconfidence$		−0.0016 (−1.72)*	−0.0047 (−2.86)***
All the interaction terms	N/A	Yes	Yes
SIZE	−0.0069 (−11.88)***	−0.0060 (−9.32)***	−0.0061 (−9.49)***
LEV	−0.1613 (−94.62)***	−0.1622 (−84.13)***	−0.1634 (−84.01)***
FCF	0.0115 (13.04)***	0.0113 (11.49)***	0.0112 (11.35)***
INT	0.0541 (40.99)***	0.0537 (35.94)***	0.0538 (35.84)***
Q	0.0001 (1.47)	0.0001 (1.62)	0.0001 (1.45)
Intercept	0.5901 (116.10)***	0.5750 (97.05)***	0.5827 (102.21)***
Year fixed effects	Yes	Yes	Yes
Fama–French 48 industry fixed effects	Yes	Yes	Yes
N	15,446	15,446	15,446
Adjusted R^2	0.4496	0.4506	0.4489
Panel B	**Baseline model column 1**	***Holder_67* column 2**	***Long_Holder* column 3**
(Fama–MacBeth cross-sectional regression)	**Estimate (*t*-stat)**	**Estimate (*t*-stat)**	**Estimate (*t*-stat)**
C	0.0039 (3.10)***	0.0299 (2.43)**	0.0057 (3.14)***
DC	−0.0032 (−0.53)	−0.0027 (−0.98)	−0.0073 (−1.21)
$C \times DC$	0.1094 (2.26)**	0.1358 (1.54)	0.1252 (2.16)**

(Continues)

TABLE 3 (Continued)

Panel B (Fama–MacBeth cross-sectional regression)	Baseline model column 1 Estimate (*t*-stat)	*Holder_67* column 2 Estimate (*t*-stat)	*Long_Holder* column 3 Estimate (*t*-stat)
Overconfidence		0.0056	0.0014
		(3.25)***	(1.32)
$C \times DC \times Overconfidence$		−0.0789	−0.0297
		(−1.94)**	(−2.42)**
All the interaction terms	N/A	Yes	Yes
SIZE	−0.0109	−0.0107	−0.0110
	(−2.82)***	(−2.83)***	(−2.88)***
LEV	−0.1585	−0.1586	−0.1586
	(−21.24)***	(−21.01)***	(−21.56)***
FCF	0.0086	0.0086	0.0086
	(5.54)***	(6.34)***	(5.35)***
INT	0.0634	0.0661	0.0636
	(13.52)***	(13.18)***	(12.96)***
Q	−0.0006	−0.0006	−0.0006
	(−1.50)	(−1.46)	(−1.59)
Intercept	0.6273	0.6187	0.6276
	(16.12)***	(15.02)***	(16.44)***
N	15,446	15,446	15,446
Average adjusted R^2	0.4876	0.4907	0.4896

Note: Panel A: This table presents the estimation results for the panel regression of CEO overconfidence on firms' investment sensitivity to cash flow. The *t*-statistics are reported in parentheses and adjusted for two-way clustered standard errors at the firm level; we allow for heteroskedasticity and arbitrary within-firm correlation based on Petersen's (2009) methodology. "***," "**," and "*" indicate statistical significance at the 1%, 5%, and 10% levels, respectively.Panel B: This table presents the time-series average estimation results for the Fama–Macbeth cross-sectional regression of CEO overconfidence on firms' investment sensitivity to cash flow. The *t*-statistics are adjusted for Newey–West autocorrelations with three lags and are reported in parentheses. "***," "**," and "*" indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

test the prediction, we sort firms into quintiles based on their operating performance prior to the fiscal year-end for firms with overconfident CEO. We use *Holder_67* variable to classify firms with overconfident CEO. Table 4 shows that the investment of firms with overconfident CEO monotonically increases as prior operating performance increases. When comparing the "Is" of the two extreme quintiles, we find that the difference is statistically significant at the 5% level. This result is consistent with our conjecture that the investment level of firms with an overconfident CEO is magnified, especially when they have previous experience in the successful operation of a firm. Thus, the evidence supports our prediction of the self-attributing behavior of overconfident CEOs.

To test Hypothesis II, we run a modified regression (Equation 2) after including the interaction term for overconfidence with prior successful performance in the former asymmetric ICS model. Panel A of Table 5 shows the estimates of panel regressions with Petersen standard errors. In columns 1 and 2, we use *Holder_67* and *Long_Holder*, respectively. As predicted, the

TABLE 4 Impact of prior operating performance on the investment of firms with overconfident chief executive officers (CEOs)—portfolio sorting approach.

Mean	Quintiles based on prior operating performance					
	*Q*1	*Q*2	*Q*3	*Q*4	*Q*5	*Q*5 − *Q*1 (*t*-stat)
I of firms with overconfident CEOs	0.0385	0.0327	0.0598	0.0793	0.1027	0.0642 (2.65)**

Note: This table presents the mean values of *I* in five quintile firms with overconfident CEOs, sorted based on the firms' prior operating performance over the sample period. The right-hand column provides the differences in the mean values of *I* between firms with the largest and lowest quintiles, respectively. "**" indicates statistical significance at the 5% level.

results indicate that all the β_7 coefficients of $C \times DC \times Overconfidence \times Prior\_Performance$ are significantly negative (column 1: coefficient = −0.0028, *t*-statistic = −1.79; column 2: coefficient = −0.0042, *t*-statistic = −4.08), whereas the coefficients of $C \times DC \times Overconfidence$ are insignificant and significantly negative.

Next, Panel B of Table 5 shows the Fama–MacBeth regression results. The results are slightly weaker but remain qualitatively unchanged. The β_7 coefficients on $C \times DC \times Overconfidence \times Prior\_Performance$ in column 1 are insignificant, and those in column 2 are significantly negative (column 1: coefficient = −0.0632, *t*-statistic = −1.02; column 2: coefficient = −0.1683, *t*-statistic = −2.37). The coefficients on $C \times DC \times Overconfidence$ become significantly negative and negative, respectively. Overall, these results suggest that the degree of the downward-sticky ICS in firms with overconfident managers is amplified with prior successful performance.

4.3 | ICS tests for the unconstrained and constrained firms' subsamples

In this subsection, we examine whether our findings in Sections 3.1 and 3.2 vary across firms' financial constraints. Similar to Lin et al. (2005) and Andres (2011), we sort the sample firms into five groups based on yearly dividend yields. Firms in the top quintile are viewed as financially unconstrained, whereas those in the bottom quintile are viewed as financially constrained.

Table 6 reports the results for the subsample of financially unconstrained firms. As shown in Panels A and B of Table 6, the results of the baseline model (column 1) indicate that all the β_3 coefficients of $C \times DC$ are statistically insignificant, which contradicts the findings obtained for the full sample. These results imply that financially unconstrained firms that have relatively abundant external financing opportunities do not significantly reduce their level of investment when cash flow decreases. Meanwhile, as shown in columns 2 and 4 of Panel A in Table 6, the results derived from the use of the proxies *Holder_67* and *Long_Holder* indicate that all the β_5 coefficients of $C \times DC \times Overconfidence$ are significantly negative (column 2: coefficient = −0.0402, *t*-statistic = −3.54; column 4: coefficient = −0.0813, *t*-statistic = −3.71), whereas all the β_3 coefficients of $C \times DC$ are significantly positive. As shown in Panel B, the Fama–MacBeth regression results remain robust. These results indicate that in a financially unconstrained environment, managerial overconfidence drives ICS in a downward-sticky direction, even for firms with non-overconfident managers that demonstrate a downward-elastic ICS pattern. Therefore, the subsample results for unconstrained firms are consistent with and slightly stronger than our baseline results.

Furthermore, we examine our second hypothesis in the financially unconstrained subsample. Columns 3 and 5 in Panel A of Table 6 present the results of the panel regression with Petersen standard errors. We find that all the β_7 coefficients of $C \times DC \times Overconfidence \times$

TABLE 5 Impact of chief executive officer (CEO) overconfidence on investment cash flow sensitivity (ICS) according to prior operating performance.

Panel A	***Holder_67***	***Long_Holder***
	Column 1	**Column 2**
	Estimate	**Estimate**
(Panel regression with Petersen Std. errors)	**(*t*-stat)**	**(*t*-stat)**
C	0.0450	0.0036
	(3.70)***	(0.51)
DC	−0.0009	−0.0050
	(−0.15)	(−1.78)*
$C \times DC$	−0.0320	0.0487
	(−2.58)**	(5.01)***
$Overconfidence$	0.0219	−0.0052
	(6.15)***	(−1.15)
$C \times DC \times Overconfidence$	−0.0743	−0.0120
	(−1.14)	(−2.49)**
$Prior\_Performance$	0.0023	0.0038
	(2.87)***	(5.50)***
$C \times DC \times Overconfidence \times Prior\_Performance$	−0.0028	−0.0042
	(−1.79)*	(−4.08)***
All the interaction terms	Yes	Yes
SIZE	−0.0073	−0.008
	(−9.23)***	(−10.02)***
LEV	−0.1656	−0.1660
	(−75.65)***	(−75.02)***
FCF	0.0105	0.0099
	(9.63)***	(9.02)***
INT	0.0632	0.0635
	(35.35)***	(35.03)***
Q	0.0001	0.0001
	(1.68)*	(1.75)*
Intercept	0.5803	0.6002
	(79.37)***	(84.84)***
Year fixed effects	Yes	Yes
Fama–French 48 industry fixed effects	Yes	Yes
N	15,446	15,446
Adjusted R^2	0.4648	0.4638
Panel B	***Holder_67***	***Long_Holder***
	Column 1	**Column 2**
	Estimate	**Estimate**
(Fama–MacBeth cross-sectional regression)	**(*t*-stat)**	**(*t*-stat)**
C	0.1189	0.0413
	(2.09)**	(2.06)**
DC	−0.0015	−0.0038
	(−1.43)	(−0.93)

(Continues)

TABLE 5 (Continued)

Panel B	*Holder_67*	*Long_Holder*
	Column 1	Column 2
	Estimate	Estimate
(Fama–MacBeth cross-sectional regression)	(*t*-stat)	(*t*-stat)
$C \times DC$	0.1057	0.0932
	(1.68)	(1.78)*
$Overconfidence$	0.0304	−0.0037
	(4.32)***	(−1.42)
$C \times DC \times Overconfidence$	−0.1589	−0.1208
	(−2.34)**	(−1.51)
$Prior\_Performance$	0.0031	0.0035
	(4.73)***	(4.93)***
$C \times DC \times Overconfidence \times Prior\_Performance$	−0.0632	−0.1683
	(−1.02)	(−2.37)**
All the interaction terms	Yes	Yes
SIZE	−0.0129	−0.0129
	(−3.61)***	(−3.69)***
LEV	−0.1653	−0.1603
	(−18.09)***	(−21.47)***
FCF	0.0128	0.0078
	(2.41)**	(3.91)***
INT	0.0709	0.0663
	(11.27)***	(12.73)***
Q	−0.0003	−0.0010
	(−0.79)	(−1.62)
Intercept	0.6428	0.6503
	(16.87)***	(18.32)***
Interaction terms	Yes	Yes
N	15,446	15,446
Average adjusted R^2	0.5046	0.4926

Note: Panel A: This table presents the time-series average estimation results for the Fama–Macbeth cross-section regression of CEO overconfidence on firms' investment sensitivity to cash flow based on their prior operating performance. The *t*-statistics are adjusted for Newey–West autocorrelation with three lags and are reported in parentheses. "***," "**," and "*" indicate statistical significance at the 1%, 5%, and 10% levels, respectively.Panel B: This table presents the estimation results for the panel regression of CEO overconfidence on firms' investment sensitivity to cash flow based on their prior operating performance. The *t*-statistics are reported in parentheses and adjusted for two-way clustered standard errors at the firm level; we allow for heteroskedasticity and arbitrary within-firm correlation based on Petersen's (2009) methodology. "***," "**," and "*" indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

$Prior\_Performance$ and the coefficients of $C \times DC \times Overconfidence$ are significantly negative. Additionally, the Fama–MacBeth regression results (Panel B of Table 6) show that all the β_7 coefficients of $C \times DC \times Overconfidence \times Prior\_Performance$ are significantly negative; these findings are qualitatively consistent with the findings reported in Panel A of Table 6. This

TABLE 6 Impact of chief executive officer (CEO) overconfidence and prior operating performance on investment cash flow sensitivity (ICS): subsample with financially unconstrained firms.

Panel A	Baseline model	*Holder_67*		*Long_Holder*	
	Column 1 Estimate	Column 2 Estimate	Column 3 Estimate	Column 4 Estimate	Column 5 Estimate
(Panel regression with Petersen Std. errors)	(*t*-stat)	(*t*-stat)	(*t*-stat)	(*t*-stat)	(*t*-stat)
C	0.0391	0.0193	0.0464	0.0443	0.1022
	(2.61)**	(1.83)*	(2.64)**	(2.54)**	(2.46)**
DC	−0.0065	0.0005	−0.0031	−0.0089	−0.0193
	(−1.20)	(0.05)	(−0.30)	(−1.30)	(−2.62)**
$C \times DC$	0.0321	0.0341	0.0158	0.0815	0.1032
	(1.26)	(2.73)**	(1.38)	(2.57)**	(2.90)***
Overconfidence		0.0053	0.0205	−0.0026	−0.0029
		(0.68)	(2.18)**	(−0.25)	(−0.76)
$C \times DC \times Overconfidence$		−0.0402	−0.0925	−0.0813	−0.1024
		(−3.54)***	(−3.14)***	(−3.71)***	(−3.43)**
Prior_Performance			−0.0026		0.0014
			(−0.63)		(0.45)
$C \times DC \times$ *Overconfidence* $\times$ *Prior_Performance*			−0.0262		−0.0383
			(−1.85)*		(−2.73)**
All the interaction terms	N/A	Yes	Yes	Yes	Yes
SIZE	−0.0133	−0.0137	−0.0152	−0.0138	−0.0151
	(−15.43)***	(−14.42)***	(−13.53)***	(−14.34)***	(−13.36)***
LEV	−0.1842	−0.1944	−0.1841	−0.1965	−0.1864
	(−59.24)***	(−53.69)***	(−48.81)***	(−53.26)***	(−48.51)***
FCF	0.0108	0.0094	0.0106	0.0091	0.0098
	(7.20)***	(5.64)***	(5.92)***	(5.37)***	(5.41)***
INT	0.0588	0.0556	0.0704	0.0553	0.0694
	(22.20)***	(18.84)***	(21.95)***	(18.60)***	(21.52)***
Q	−0.0003	−0.0003	−0.0002	−0.0002	−0.0002
	(−4.51)***	(−3.45)***	(−2.45)**	(−3.41)***	(−2.42)**
Intercept	0.6269	0.6195	0.6454	0.6242	0.6583
	(74.34)***	(62.91)***	(56.53)***	(65.73)***	(60.44)***
Interaction terms	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Fama–French 48 industry fixed effects	Yes	Yes	Yes	Yes	Yes
N	3089	3089	3089	3089	3089
Adjusted R^2	0.4440	0.4367	0.4581	0.4357	0.4559

(Continues)

TABLE 6 (Continued)

Panel B	Baseline model	*Holder_67*		*Long_Holder*	
	Column 1 Estimate	Column 2 Estimate	Column 3 Estimate	Column 4 Estimate	Column 5 Estimate
(Fama–MacBeth cross-sectional regression)	(*t*-stat)	(*t*-stat)	(*t*-stat)	(*t*-stat)	(*t*-stat)
C	0.0432	0.0245	0.0448	0.0347	0.0660
	(2.38)**	(2.56)**	(1.95)*	(2.30)**	(1.91)*
DC	−0.0031	0.0012	0.0014	−0.0072	−0.0081
	(−0.94)	(0.37)	(0.25)	(−1.51)	(−2.34)**
$C \times DC$	−0.0971	0.1155	0.1579	0.0833	0.1311
	(−0.75)	(1.88)*	(1.43)	(2.62)**	(0.71)
Overconfidence		0.0091	0.0138	0.0014	0.0049
		(1.07)	(2.42)**	(1.21)	(0.42)
$C \times DC \times Overconfidence$		−0.2669	−0.0338	−0.0524	−0.0390
		(2.42)**	(−0.24)	(−2.36)**	(−3.19)***
Prior_Performance			−0.0031		0.0009
			(−1.12)		(0.11)
$C \times DC \times$ *Overconfidence* $\times$ *Prior_Performance*			−0.8190		−0.0607
			(−1.88)*		(−2.66)**
All interaction terms	N/A	Yes	Yes	Yes	Yes
SIZE	−0.0232	−0.0127	−0.0147	−0.0232	−0.0146
	(−2.16)**	(−3.52)***	(−4.08)***	(−2.16)**	(−4.68)***
LEV	−0.1737	−0.1729	−0.1743	−0.1742	−0.1769
	(−17.77)***	(−17.90)***	(−18.45)***	(−18.22)***	(−18.80)***
FCF	0.0084	0.0087	0.0092	0.0088	0.0091
	(5.94)***	(6.56)***	(6.35)***	(6.47)***	(6.01)***
INT	0.0619	0.0622	0.0622	0.0613	0.0616
	(9.78)***	(9.45)***	(9.16)***	(9.49)***	(9.64)***
Q	−0.0022	−0.0023	−0.0024	−0.0022	−0.0023
	(−1.82)*	(−1.79)*	(−1.85)*	(−1.82)*	(−1.88)*
Intercept	0.7016	0.6273	0.6409	0.7014	0.6619
	(10.48)***	(16.91)***	(17.59)***	(10.56)***	(21.90)***
Interaction terms	Yes	Yes	Yes	Yes	Yes
N	3089	3089	3089	3089	3089
Average adjusted R^2	0.4976	0.4998	0.5001	0.4977	0.4973

Note: Panel A: This table presents the estimation results for the panel regression of CEO overconfidence on investment sensitivity to cash flow based on the prior operating performance in financially unconstrained firms. The 15,446 firm-years in Table 3 are sorted into 5 groups based on their yearly dividend yields. Firms in the top quintile are considered financially unconstrained, whereas firms in the bottom quintile are considered financially constrained. The *t*-statistics are reported in parentheses and adjusted for two-way clustered standard errors at the firm level; we allow for heteroskedasticity and arbitrary within-firm correlation based

(Continues)

TABLE 6 (Continued)

on Petersen's (2009) methodology. "***," "**," and "*" indicate statistical significance at the 1%, 5%, and 10% levels, respectively.Panel B: This table presents the time-series average estimation results for the Fama–Macbeth cross-section regression of CEO overconfidence on firms' investment sensitivity to cash flow based on their prior operating performance in financially unconstrained firms. The 15,446 firm-years in Table 3 are sorted into 5 groups based on their yearly dividend yields. Firms in the top quintile are considered financially unconstrained, whereas firms in the bottom quintile are considered financially constrained. The *t*-statistics are adjusted for Newey–West autocorrelation with three lags and are reported in parentheses. "***," "**," and "*" indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

means that, for unconstrained firms, overconfidence, intensified by prior successful experience, significantly increases the stickiness of ICS.

Turning to the constrained-firm subsample, we report the regression results in Table 7. The results for the baseline model (column 1) in Panels A and B of Table 7 show that all the β_3 coefficients of $C \times DC$ are significantly positive; these findings are not consistent with the results obtained for unconstrained firms. This result shows that for financially constrained firms, the funding deficit due to a lack of FCF or debt-financing difficulties significantly affects investment decisions. Column 2 in Panel A of Table 7 shows the results of the panel regression performed using the proxy *Holder_67*. The β_5 coefficient of $C \times DC \times Overconfidence$ is statistically insignificant. In column 4, we use *Long_Holder* as the proxy for overconfidence and find that the coefficient on the triple interaction term (β_5) is significantly negative. The Fama–MacBeth regression results (Panel B of Table 7) produce similar results obtained from the panel regressions in Panel A. Thus, the results from Table 7 suggest that the role of overconfidence in the relationship between cash flow and investments is weaker for constrained firms than for unconstrained firms. Furthermore, the results in column 3 of Panels A and B of Table 7 show that all the β_7 coefficients of $C \times DC \times Overconfidence \times Prior\_Performance$ are statistically insignificant, whereas those in column 5 show that all the β_7 coefficients of $C \times DC \times Overconfidence \times Prior\_Performance$ are significantly negative. This suggests that the results for the constrained-firm subsample regarding strong managerial overconfidence are less strong for the alternative proxies of overconfidence, although *Long_Holder* may capture overconfidence more explicitly than *Holder_67*. Thus, the constrained environment of internal or external financing may prevent managers from pursuing inefficient investments, such as empire-building.[7]

5 | CONCLUSION

The psychology and behavioral economics literature has documented that managerial overconfidence, which often manifests as biased cognitive perception, affects various corporate decisions, including firm investments. This study adds to the literature by examining the role of managerial self-attributed overconfidence in ICS. Keeping with the research purpose, we first examine

[7] We also conduct the robustness test based on leverage ratio as an alternative measure for financial constraint. The leverage ratio is defined as the natural logarithm of the book value of debts divided by the book value of assets of firm *i* in year *t*, following Anderson et al. (2003). The 15,446 sample firms from Table 3 are sorted into 5 groups based on their yearly leverage ratio. Firms in the bottom quintile are considered financially unconstrained, whereas firms in the top quintile are considered financially constrained. Then, we re-estimate the tables based on Petersen's (2009) panel estimation methodology, allowing for heteroskedasticity and arbitrary within-firm correlation. We find that our results are not qualitatively different, and thus, we consider our results based on the dividend yield to be robust. Although unreported for brevity, the results are available upon request.

TABLE 7 Impact of chief executive officer (CEO) overconfidence and prior operating performance on investment cash flow sensitivity (ICS): subsample with financially constrained firms.

Panel A	Baseline model	*Holder_67*		*Long_Holder*	
	Column 1 Estimate	Column 2 Estimate	Column 3 Estimate	Column 4 Estimate	Column 5 Estimate
(Panel regression with Petersen Std. errors)	(*t*-stat)	(*t*-stat)	(*t*-stat)	(*t*-stat)	(*t*-stat)
C	0.0017	0.0024	0.0549	0.0283	0.0139
	(5.96)***	(4.88)***	(3.74)***	(5.90)***	(2.63)**
DC	−0.0072	−0.0161	−0.0069	−0.0067	−0.0024
	(−2.40)**	(−2.82)***	(−0.98)	(−1.75)*	(−0.55)
$C \times DC$	0.0019	0.0023	0.0441	0.0022	0.0400
	(3.40)***	(1.11)	(2.96)***	(2.24)*	(3.47)***
Overconfidence		0.0187	0.0247	−0.0085	−0.0119
		(4.50)***	(4.44)***	(−2.08)**	(−1.84)*
$C \times DC \times Overconfidence$		−0.0018	−0.0702	−0.0036	−0.0169
		(−1.22)	(−3.16)***	(−2.05)*	(−0.51)
Prior_Performance			0.0009		0.0017
			(1.01)		(2.11)**
$C \times DC \times$ *Overconfidence* $\times$ *Prior_Performance*			0.00023		−0.0051
			(1.18)		(−4.16)***
All interaction terms	N/A	Yes	Yes	Yes	Yes
SIZE	0.0020	0.0065	0.0047	0.0066	−0.0035
	(2.00)*	(5.72)***	(3.18)***	(5.79)***	(2.35)**
LEV	−0.1524	−0.1522	−0.1594	−0.1541	−0.1597
	(−63.94)***	(−58.26)***	(−50.57)***	(−58.61)***	(−50.03)***
FCF	0.0119	0.0116	0.0101	0.0121	0.0103
	(9.35)***	(8.32)***	(6.29)***	(8.57)***	(6.38)***
INT	0.0527	0.0548	0.0614	0.0549	0.0603
	(26.95)***	(24.88)***	(21.93)***	(24.85)***	(22.17)***
Q	0.0001	0.0002	0.0003	0.0002	0.0004
	(1.92)*	(1.88)*	(1.89)*	(1.97)*	(2.05)*
Intercept	0.5424	0.4991	0.4970	0.5114	0.5264
	(68.28)***	(53.446)***	(40.44)***	(57.21)***	(43.89)***
Interaction terms	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Fama–French 48 industry fixed effects	Yes	Yes	Yes	Yes	Yes
N	3089	3089	3089	3089	3089
Adjusted R^2	0.4381	0.4455	0.4543	0.4420	0.4524

(Continues)

TABLE 7 (Continued)

Panel B	Baseline model	*Holder_67*		*Long_Holder*	
	Column 1 Estimate	Column 2 Estimate	Column 3 Estimate	Column 4 Estimate	Column 5 Estimate
(Fama–MacBeth cross-sectional regression)	(*t*-stat)	(*t*-stat)	(*t*-stat)	(*t*-stat)	(*t*-stat)
C	0.0887	0.1170	0.1338	0.0732	0.1087
	(2.71)**	(2.69)**	(3.87)***	(4.56)***	(1.83)*
DC	−0.0066	−0.0093	−0.0035	−0.0053	−0.0047
	(−2.17)**	(−1.82)*	(−1.27)	(−1.53)	(−1.01)
$C \times DC$	0.2033	0.2557	0.2678	0.2180	0.0744
	(2.37)**	(1.26)	(1.70)	(2.43)**	(3.89)***
Overconfidence		0.0156	0.0133	−0.0073	−0.0093
		(3.27)***	(3.78)***	(−2.12)**	(−2.32)**
$C \times DC \times Overconfidence$		−0.2087	−0.0830	−0.0299	−0.1394
		(−1.11)	(−0.67)	(−2.31)**	(−1.90)*
Prior_Performance			0.0015		0.0024
			(0.83)		(1.78)*
$C \times DC \times$ *Overconfidence* $\times$ *Prior_Performance*			0.4119		−0.0480
			(0.89)		(−3.24)***
All interaction terms	N/A	Yes	Yes	Yes	Yes
SIZE	0.0023	0.0019	0.0049	0.0016	0.0021
	(0.68)	(0.60)	(1.00)	(0.48)	(0.55)
LEV	−0.1470	−0.1497	−0.1316	−0.1458	−0.1431
	(−14.27)***	(−14.28)***	(−7.72)***	(−15.56)***	(−15.57)***
FCF	0.0088	0.0084	0.0062	0.0091	0.0094
	(3.94)***	(3.91)***	(1.60)	(3.99)***	(4.57)***
INT	0.0724	0.0764	0.0746	0.0730	0.0744
	(9.38)***	(8.30)***	(11.19)***	(9.14)***	(10.33)***
Q	0.0002	−0.0001	−0.0008	0.0002	−0.0001
	(0.39)	(−0.36)	(−1.16)	(0.37)	(−0.67)
Intercept	0.5585	0.5470	0.5534	0.5611	0.5664
	(13.65)***	(14.19)***	(15.91)***	(13.57)***	(14.29)***
Interaction terms	Yes	Yes	Yes	Yes	Yes
N	3089	3089	3089	3089	3089
Average adjusted R^2	0.4826	0.4830	0.5248	0.4894	0.4987

Note: Panel A: This table presents the estimation results for the panel regression of CEO overconfidence on firms' investment sensitivity to cash flow depending on the prior operating performance in financially constrained firms. The 15,446 firm-years in Table 3 are sorted into 5 groups based on their yearly dividend yields; the firms in the top quintile are considered financially unconstrained, whereas the firms in the bottom quintile are considered financially constrained. The *t*-statistics are reported in parentheses and adjusted for two-way clustered standard errors at the firm level; we allow for heteroskedasticity and arbitrary

(Continues)

TABLE 7 (Continued)

within-firm correlation, based on the methodology of Petersen (2009). "***," "**," and "*" indicate statistical significance at the 1%, 5%, and 10% levels, respectively.Panel B: This table presents the time-series average estimation results for the Fama–Macbeth cross-section regression of CEO overconfidence on firms' investment sensitivity to cash flow depending on the prior operating performance in financially constrained firms. The 15,446 firm-years in Table 3 are sorted into 5 groups based on their yearly dividend yields. Firms in the top quintile are considered financially unconstrained, whereas firms in the bottom quintile are considered financially constrained. The *t*-statistics are adjusted for Newey–West autocorrelation with three lags and are reported in the parentheses. "***," "**," and "*" indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

the effect of overconfidence on the asymmetric relationship between cash flow and investment. Our rationale is as follows. Owing to miscalibration and better-than-average bias, overconfident managers tend to overestimate the future payoffs on their investments in the belief that they can control future returns. Consequently, overconfident managers might have incentives to invest beyond the optimal level if their returns on investment are too low to cover the high financing costs. This situation may result in sticky ICS. Consistent with our prediction, our empirical evidence shows that managerial overconfidence drives ICS in an asymmetric and downward-sticky direction.

Additionally, psychological research suggests that overconfident individuals tend to reinforce their optimistic beliefs about future projects using a self-attribution mechanism. Hence, we hypothesize that overconfident managers, encouraged by prior favorable outcomes, amplify the stickier ICS. The results of our portfolio test and multivariate regression analysis show that the prior successful performance of overconfident managers intensifies the degree of downward-sticky ICS.

We also find that the subsample analysis for the financially unconstrained firms is slightly stronger than the results obtained for the overall sample. The subsample results for the constrained firms are qualitatively similar but slightly weaker, implying that constrained financing conditions may partially prevent overconfident managers from determining inefficient investment decisions.

Therefore, the findings of this study imply that the managerial bias, together with past experience, leads to a higher incidence of excessive commitment of firm resources.

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REFERENCES

Aktas, N., de Bodt, E., & Roll, R. (2007). *Corporate serial acquisitions: An empirical test of the learning hypothesis*. (Working Paper). University of California.

Alba, J. W., & Hutchinson, J. W. (2000). Knowledge calibration: What consumers know and what they think they know. *Journal of Consumer Research*, *27*, 123–156.

Allen, W. D., & Evans, D. A. (2005). Bidding and overconfidence in experimental financial markets. *Journal of Behavioral Finance*, *6*, 108–120.

Anderson, M., Banker, R., & Janakiraman, S. (2003). Are selling, general and administrative costs "sticky"? *Journal of Accounting Research*, *41*, 47–63.

Andres, C. (2011). Family ownership, financing constraints and investment decisions. *Applied Financial Economics*, *21*, 1641–1659.

Baker, H. K., & Nofsinger, J. R. (2010). *Behavioral finance: Investors, corporations, and markets*. John Wiley & Sons.

Baumol, W. (1959). *Business behavior, value, and growth*. Macmillan.

Ben-David, I., Graham, J. R., & Harvey, C. R. (2008). *Managerial overconfidence and corporate policies*. (Working Paper No. 13711). National Bureau of Economic Research.

Billett, M. T., & Qian, Y. (2008). Are overconfident CEOs born or made? Evidence of selfattribution bias from frequent acquirers. *Management Science*, *54*, 1037–1051.

Chen, C. X., Lu, H., & Sougiannis, T. (2012). The agency problem, corporate governance, and the asymmetrical behavior of selling, general, and administrative costs. *Contemporary Accounting Research*, *29*, 252–282.

Chen, S. (2010). The role of ethical leadership versus institutional constraints: A simulation study of financial misreporting by CEOs. *Journal of Business Ethics*, *93*, 33–52.

Choi, P. M. S., Chung, C. Y., & Liu, C. (2018). Self-attribution of overconfident CEOs and asymmetric investment-cash flow sensitivity. *The North American Journal of Economics and Finance*, *46*, 1–14.

Craig, R., & Amernic, J. (2011). Detecting linguistic traces of destructive narcissism at-a-distance in a CEO's letter to shareholders. *Journal of Business Ethics*, *101*, 563–575.

Doukas, J. A., & Petmezas, D. (2007). Overconfident managers and self-attribution bias. *European Financial Management*, *13*, 531–577.

Erev, I., Wallsten, T. S., & Budescu, D. V. (1994). Simultaneous over-and underconfidence: The role of error in judgment processes. *Psychological Review*, *101*, 519–528.

Farwell, L., & Wohlwend-Lloyd, R. (1998). Narcissistic processes: Optimistic expectations, favorable self-evaluations, and self-enhancing attribution. *Journal of Personality*, *66*, 65–83.

Fazzari, S., Hubbard, R., & Petersen, B. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, *1*, 141–195.

Fazzari, S., Hubbard, R., & Petersen, B. (2000). Investment–cash flow sensitivities are useful: A comment on Kaplan and Zingales. *The Quarterly Journal of Economics*, *115*, 695–705.

George, R., Kabir, R., & Qian, J. (2011). Investment-cash flow sensitivity and financing constraints: New evidence from Indian business group firms. *Journal of Multinational Financial Management*, *21*, 69–88.

Gervais, S., & Odean, T. (2001). Learning to be overconfident. *The Review of Financial Studies*, *14*, 1–27.

Ghosh, A. (2001). Does operating performance really improve following corporate acquisitions? *Journal of Corporate Finance*, *7*, 151–178.

Goel, A. M., & Thakor, A. V. (2008). Overconfidence, CEO selection, and corporate governance. *Journal of Finance*, *63*, 2737–2784.

Gombola, M., & Marciukaityte, D. (2007). Managerial overoptimism and the choice between debt and equity financing. *Journal of Behavioral Finance*, *8*, 225–235.

Grossman, S., & Hart, O. (1982). Corporate financial structure and managerial incentives. In J. J. McCall (Ed.), *The economics of information and uncertainty*. University of Chicago Press.

Hackbarth, D. (2008). Managerial traits and capital structure decisions. *Journal of Financial and Quantitative Analysis*, *43*, 843–882.

Hall, B. J., & Murphy, K. J. (2002). Stock options for undiversified executives. *Journal of Accounting and Economics*, *33*, 3–42.

Harris, M., & Raviv, A. (1998). Capital budgeting and delegation. *Journal of Financial Economics*, *50*, 259–289.

Hart, O., & Moore, J. (1995). Debt and seniority: An analysis of the role of hard claims in constraining management. *American Economic Review*, *85*, 567–585.

Hastorf, A. H., Schneider, D. J., & Polefka, J. (1970). *Person perception*. AddisonWesley.

Hayward, M. L., & Hambrick, D. C. (1997). Explaining the premiums paid for large acquisitions: Evidence of CEO hubris. *Administrative Science Quarterly*, *42*, 103–127.

Healy, P. M., Palepu, K. G., & Ruback, R. S. (1992). Does corporate performance improve after merger? *Journal of Financial Economics*, *31*, 135–175.

Heaton, J. B. (2002). Managerial optimism and corporate finance. *Financial Management*, *31*, 33–45.

Hilary, G., & Menzly, L. (2006). Does past success lead analysts to become overconfident? *Management Science*, *52*, 489–500.

Hirshleifer, D. (2001). Investor psychology and asset pricing. *Journal of Finance*, *56*, 1533–1597.

Hovakimian, A., & Hovakimian, G. (2009). Cash flow sensitivity of investment. *European Financial Management*, *15*, 47–65.

Huang, W., Jiang, F., Liu, Z., & Zhang, M. (2011). Agency cost, top executives' overconfidence, and investment-cash flow sensitivity: Evidence from listed companies in China. *Pacific-Basin Finance Journal*, *19*, 261–277.

Hubbard, R. (1998). Capital-market imperfections and investment. *Journal of Economic Literature*, *36*, 193–225.
Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance and takeovers. *American Economic Review*, *76*, 323–329.
Jensen, M. C. (1993). The modern industrial revolution, exit, and the failure of internal control systems. *Journal of Finance*, *48*, 831–880.
Keren, G. (1991). Calibration and probability judgements: Conceptual and methodological issues. *Acta Psychologica*, *77*, 217–273.
Koellinger, P., Minniti, M., & Schade, C. (2007). "I think I can, I think I can": Overconfidence and entrepreneurial behavior. *Journal of Economic Psychology*, *28*, 502–527.
Koriat, A., Lichtenstein, S., & Fischhoff, B. (1980). Reasons for confidence. *Journal of Experimental Psychology: Human Learning and Memory*, *6*, 107–118.
Kruger, J., & David, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, *77*, 1121–1134.
Langer, E. J., & Roth, J. (1975). Heads I win, tails it's chance: The illusion of control as a function of the sequence of outcomes in a purely chance task. *Journal of Personality and Social Psychology*, *32*, 951–955.
Larrick, R. P., Burson, K. A., & Soll, J. B. (2007). Social comparison and confidence: When thinking you're better than average predicts overconfidence (and when it does not). *Organizational Behavior and Human Decision Processes*, *102*, 76–94.
Lensink, R., Bo, H., & Sterken, E. (2001). *Investment, capital market imperfections and uncertainty: Theory and empirical results*. Edward Elgar.
Lichtenstein, S., & Fischhoff, B. (1977). Do those who know more also know more about how much they know? *Organizational Behavior and Human Performance*, *20*, 159–183.
Lichtenstein, S., Fischhoff, B., & Phillips, L. D. (1982). Calibration of probabilities: The state of the art to 1980. In *Judgment under uncertainty: Heuristics and biases*. Cambridge University Press.
Lin, Y. H., Hu, S. Y., & Chen, M. S. (2005). Managerial optimism and corporate investment: Some empirical evidence from Taiwan. *Pacific-Basin Finance Journal*, *13*, 523–546.
Linn, S., & Switzer, J. (2001). Are cash acquisitions associated with better post combination operating performance than stock acquisitions? *Journal of Banking & Finance*, *25*, 1113–1138.
Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. *Journal of Finance*, *60*, 2661–2700.
Malmendier, U., & Tate, G. (2008). Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics*, *89*, 20–43.
McManus, J. (2018). Hubris and unethical decision making: The tragedy of the uncommon. *Journal of Business Ethics*, *149*(1), 169–185.
Merkle, C., & Weber, M. (2011). True overconfidence: The inability of rational information processing to account for apparent overconfidence. *Organizational Behavior and Human Decision Processes*, *116*, 262–271.
Miller, D. T., & Ross, M. (1975). Self-serving biases in attribute of causality: Fact or fiction? *Psychological Bulletin*, *82*, 213–225.
Moeller, S., Schlingemann, F., & Stulz, R. (2005). Wealth destruction on a massive scale? A study of acquiring-firm returns in the recent merger wave. *Journal of Finance*, *60*, 757–782.
Moore, D. A., & Healy, P. J. (2008). The trouble with overconfidence. *Psychological Review*, *115*, 502–517.
Muller, A., & Brettel, M. (2012). Impact of biased pecking order preferences on firm success in real business cycles. *Journal of Behavioral Finance*, *13*, 199–213.
Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, *13*, 187–221.
Owen, D., & Davidson, J. (2009). Hubris syndrome: An acquired personality disorder? A study of US Presidents and UK prime ministers over the last 100 years. *Brain*, *132*, 1396–1406.
Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, *22*, 435–480.
Petit, V., & Bollaert, H. (2012). Flying too close to the sun? Hubris among CEOs and how to prevent it. *Journal of Business Ethics*, *108*, 265–283.
Reynolds, S. J. (2006). Moral awareness and ethical predispositions: Investigating the role of individual differences in the recognition of moral issues. *Journal of Applied Psychology*, *91*, 233–243.

Reynolds, S. J. (2008). Moral attentiveness: Who pays attention to the moral aspects of life? *Journal of Applied Psychology*, *93*, 1027–1041.
Richardson, S. (2006). Over-investment of free cash flow. *Review of Accounting Studies*, *11*, 159–189.
Rijsenbilt, A., & Commandeur, H. (2013). Narcissus enters the courtroom: CEO narcissism and fraud. *Journal of Business Ethics*, *117*, 413–429.
Roll, R. (1986). The hubris hypothesis of corporate takeovers. *Journal of Business*, *59*, 197–216.
Santner, Z., & Weber, M. (2009). How do managers behave in stock option plans? Clinical evidence from exercise and survey data. *Journal of Financial Research*, *32*, 123–155.
Shefrin, H. (2001a). Behavioral corporate finance. *Journal of Applied Corporate Finance*, *14*, 113–126.
Soll, J. B. (1996). Determinants of overconfidence and miscalibration: The roles of random error and ecological structure. *Organizational Behavior and Human Decision Processes*, *65*, 117–137.
Soll, J. B., & Klayman, J. (2004). Overconfidence in interval estimates. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *30*, 299–314.
Stein, J. C. (2003). Agency, information and corporate investment. In G. Constantinides, M. Harris, & R. Stulz (Eds.), *Handbook of the economics of finance*. Elsevier North Holland.
Stulz, R. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics*, *26*, 3–27.
Svenson, O. (1981). Are we all less risky and more skillful than our fellow drivers? *Acta Psychologica*, *47*, 143–148.
Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin*, *103*, 193–210.
Wang, X., Zhang, M., & Yu, F. (2009). Managerial overconfidence, and over-investment: Empirical evidence from China. *Frontiers of Business Research in China*, *3*, 453–469.
Williamson, O. E. (1964). The economics of discretionary behavior: Managerial objectives. In *A theory of the firm*. Prentice Hall.
Yang, D. (2015). Mergers, CEO hubris, and cost stickiness. *Emerging Markets Finance and Trade*, *51*, S46–S63.
Yen, T. Y., Chou, S., & Andre, P. (2013). Operating performance of emerging market acquirers: Corporate governance issues. *Emerging Markets Finance and Trade*, *49*, 5–19.
Zuckerman, M. (1979). *Sensation-seeking: Beyond the optimal level of arousal*. Lawrence Erlbaum Associates, Inc.
Zwiebel, J. (1996). Dynamic capital structure under management entrenchment. *American Economic Review*, *86*, 1197–1215.

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