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Chief financial officer overconfidence and earnings management

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ABSTRACT

This study explores the relationship between overconfident Chief Financial Officers (CFOs) and earnings management. Through the lens of upper echelons and overconfidence theories, and using a large sample of 14,156 observations of US firms from 1999 to 2021 inclusive, our study finds that overconfident CFOs are positively associated with earnings management. We show that overconfident CFOs use earnings management to reduce earnings volatility, given that a smooth performance can release their financing pressure. In doing this, we rule out another possible explanation of overconfident CFOs engaging in earnings management to pursue high compensation. Our findings pass a series of robustness tests, including entropy balancing, the Difference-in-Differences test based on the propensity score matching sample (PSM-DID), and alternative measures of main variables. Our study provides a new determinant of earnings management that has more explanatory power than CFO demographic traits – i.e. CFO cognitive biases. Our findings nonetheless show the "bright" side of CFO overconfidence, helping investors, regulators, and policymakers understand overconfident CFOs' financial reporting decisions.

1. Introduction

Overconfidence, also known as "the root of all cognitive biases", is considered a manager's vital psychological trait that significantly affects firm decisions (e.g. investment, financing, and risk management) (Bazerman & Moore, 2013). Due to Chief Executive Officers (CEOs) setting the tone at the top, most studies only investigate the influence of CEO overconfidence (i.e. Chen et al., 2020; Hsieh et al., 2014; Lin et al., 2020; Malmendier & Tate, 2005).

Malmendier et al. (2022) raise one concern, that this singular attention might generate some biased inferences, as it ignores the role of other managers who are primarily

responsible for the outcome of a particular realm. Given that CFOs, rather than CEOs, are in charge of financing decisions (Mian, 2001), Malmendier et al. (2022) show that CFO overconfidence dominates CEO overconfidence in the choice of external finance method and leverage. In addition to Malmendier et al. (2022), a growing number of studies shed light on CFO overconfidence. After controlling for CEO overconfidence, these studies remain to discover that CFO overconfidence is positively associated with cost stickiness (Ben-David et al., 2013; Chen et al., 2022) and hoarding bad news (Qiao et al., 2022). Prior findings indicate that overconfidence biases CFOs' forecasting, risk-taking, and information disclosure. Such cognitive bias might also be associated with the CFOs' other decisions where they play a more vital role than other managers.

Earnings management is a practice influencing financial reporting primarily at the CFOs' discretion. Specifically, Geiger and North (2006) suggest significant changes in discretionary accruals surrounding the appointment of a new CFO. Jiang et al. (2010) find that the CFO equity incentive is stronger than that of the CEO in explaining firms' earnings management activities. Peni and Vähämaa (2010) show that earnings management is affected more by the CFOs' gender than by the CEOs'. This piece of evidence implies that CFOs have vital roles in earnings management decisions.

Previous studies have competing views on earnings management. On the one hand, some suggest that earnings management can improve the information value of earnings through communicating private information, thereby benefiting financial reporting users' decision-making (e.g. Arya et al., 2003; Holthausen, 1990; Jiraporn et al., 2008). On the other hand, much evidence shows that managers use aggressive earnings management to pursue personal gains, thereby impairing financial reporting users' interests (e.g. Chen et al., 2017; Francis et al., 2016; Nguyen & Soobaroyen, 2019; Schrand & Zechman, 2012). For example, Enron's aggressive earnings management led to financial fraud, causing serious damage to stakeholders' wealth and the American economy (Davis, 2002). In addition to Enron, Lucent, Cendant, and MicroStrategy abused earnings management, resulting in more than 34 billion dollars in stock market losses in three days (Magrath & Weld, 2002). The above discussion shows that the impact of earnings management on financial report users' decisions and interests is substantial, and has kept earnings management attracting the constant attention of researchers.

Surprisingly, current earnings management studies overlook the significance of CFO overconfidence. This study fills this gap. We predict there is a positive relationship between CFO overconfidence and earnings management. From the perspective of information signalling, previous studies show that managers tend to use earnings management to convey private information. Specifically, managers would like to present a smoother earnings stream to signal their firms' earnings stability, reducing the cost of borrowing (Gassen & Fülbier, 2015; Jung et al., 2013; Li & Richie, 2016; Minton & Schrand, 1999; Trueman & Titman, 1988). According to the upper echelons and overconfidence theories,[1] prior studies suggest that overconfident CFOs perceive external funding to be costly as they deem the market to undervalue their firms' performance (Ben-David et al., 2013; Malmendier et al., 2022). In this case, as CFOs are responsible

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[1]Upper echelons theory states that managers' cognitive biases can explain their decisions (Hambrick & Mason, 1984). Overconfidence theory discover four overconfidence manifestations: over-optimism (Weinstein, 1980), the above-average effect (Svenson, 1981), miscalibration(Alicke, 1985), and the illusion of control (Taylor & Brown, 1988)., which will be discussed in detail in the next section.

for financing, we predict that overconfident CFOs might tend to use earnings management to smooth earnings, hence reducing the cost of borrowing.

Another potential explanation for the positive relationship between CFO overconfidence and earnings management is that overconfident CFOs manipulate earnings to seek personal financial gains. Adopting the agency theory framework,[2] prior studies show that CFOs might opportunistically utilise earnings management to seek higher compensation (Jiang et al., 2010; Watts & Zimmerman, 1978). This incentive might be stronger for overconfident CFOs since they have incentive-heavy compensation contracts (Humphery-Jenner et al., 2016).

Using a large sample of data (14,156 observations) on US companies from 1999 to 2021 inclusive, we find a positive relationship between CFO overconfidence and earnings management. The positive association is more profound when the firms have more volatile performance or have external financing needs. These findings indicate that overconfident CFOs, due to financing concerns, manage earnings to provide smooth earnings. Our findings pass a series of robustness tests, including entropy balancing, the Difference-in-Differences test based on the Propensity Score Matching sample (PSM-DID), and alternative measures of main variables. In an additional test, we rule out an alternative explanation of the positive relationship between CFO overconfidence and earnings management, relating to the CFOs seeking personal gains.

This study contributes to the earnings management, CFO, and overconfidence literature. Although few studies document significant relationships between CFO demographic traits and earnings management (Barua et al., 2010; Peni & Vähämaa, 2010), Ge et al. (2011) argue that CFOs' psychological traits explain their financial reporting decisions better than demographic traits. Consistently, when we incorporate CFO overconfidence in testing the determinants of earnings management, most coefficients on male CFOs become insignificant. Thus, our study provides a new determinant of earnings management that has more explanatory power than CFO demographic traits. Further, after controlling for CEO overconfidence, the effect of CFO overconfidence on earnings management remains significant, but that of CEO overconfidence has become insignificant. This finding provides more fruitful evidence to support the literature suggesting that the CFO has a dominant effect on earnings management (Geiger & North, 2006; Jiang et al., 2010; Peni & Vähämaa, 2010).

Moreover, our study closely relates to Ham et al. (2017) which first sheds light on the relationship between one CFOs' psychological trait, narcissism, and earnings management. They suggest that narcissistic CFOs engage in earnings management to pursue personal wealth at the expense of others. However, we find that overconfident CFOs, in contrast to narcissistic CFOs, use earnings management for financing purposes rather than self-interest, which enriches the study of the psychological characteristics of CFOs. Also, overconfident CFOs' earnings management incentives reveal the positive result of CFO overconfidence, adding to the literature discussing the advantages and disadvantages of managerial overconfidence (Chen et al., 2022; Malmendier et al., 2022; Qiao et al., 2022).

Our study also makes theoretical contributions. The upper echelons theory implies that managers' cognitive biases affect their decisions (Hambrick & Mason, 1984). As

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[2]According to agency theory, an agency problem occurs when agents, such as the CFO, make a decision that contradicts the interests of the shareholders (principals) (Jensen & Meckling, 1976).

executives' cognitive biases are difficult to observe, early empirical studies use executives' demographic characteristics as proxies for cognitive biases based on the suggestion by Hambrick and Mason (1984). However, this practice is controversial as overconfidence, rather than demographic traits, is the origin of all cognitive biases (e.g. Ge et al., 2011). Given that Malmendier and Tate (2005) create a novel overconfidence measurement to make the empirical capture of overconfidence more valid, we adopt this method modified by Campbell et al. (2011) and provide significant findings that are consistent with the overconfidence theory. Therefore, our study provides empirical evidence to bridge the gap between overconfidence and upper echelons theories.

Finally, our study has strong implications for financial report users. Previous research only focuses on the overconfident CEOs' earnings management decisions (Hsieh et al., 2014; Schrand & Zechman, 2012). Such a singular investigation may undermine financial report users' ability to achieve a comprehensive understanding of the forcefulness of top managers' cognitive biases on accounting information. Our study can enhance financial report users' understanding that the real effect of managerial overconfidence on earnings management decisions originates from CFO overconfidence. In addition, our research shows the "bright side" of CFO overconfidence by revealing that overconfident CFOs engage in earnings management to improve the firm's financing ability rather than for their own interests. This finding also partly answers the puzzle of why boards continue to hire overconfident CFOs, despite some research showing the adverse consequences of CFO overconfidence (Chen et al., 2022; Qiao et al., 2022).

The remainder of this paper is arranged as follows: Section 2 provides the theoretical framework, literature review, and hypotheses development. The data and research design are described in section 3. Section 4 reports the main results. Underpinning mechanisms are tested in section 5. Several robustness tests are conducted in section 6. Section 7 presents the results of some additional analyses, and section 8 concludes the study.

2. Theoretical framework, literature review, and hypotheses development

Given the high likelihood of overconfidence among top executives (Bernardo & Welch, 2001; Goel & Thakor, 2008), a growing number of studies investigate how this bias affects managers' decisions, including financial policies (e.g. dividend payout and cash holding) (Chen et al., 2020; Deshmukh et al., 2013), investments (e.g. M&A, innovation, and CSR) (Hirshleifer et al., 2012; Malmendier & Tate, 2005; Sauerwald & Su, 2019) and operations (e.g. cost and risk management) (Chen et al., 2022; Kim et al., 2016; Qiao et al., 2022), using overconfidence theory and upper echelons theory.

Upper echelons theory documents that managerial cognitive biases influence their decisions (Hambrick & Mason, 1984). Cognitive bias stems from overconfidence (Bazerman & Moore, 2013). Overconfidence has four manifestations, as suggested by overconfidence theory, encompassing over-optimism, the above-average effect, miscalibration, and the illusion of control. Specifically, over-optimistic individuals perceive the probability of fortunate events to be greater than the probability of unfortunate ones (Weinstein, 1980). The above-average effect is people's perception that their abilities are superior to others (Svenson, 1981). Miscalibration means that people might overestimate their ability to reduce future uncertainty and make correct forecasts (Alicke, 1985), comparable to the "illusion of control". The latter implies that people have a false belief in their ability to affect an incident, even if the event is entirely unintentional (Taylor & Brown, 1988).

In the context of managerial decisions, financing decisions are significantly determined by CFO overconfidence. Specifically, Hackbarth (2008) provides theoretical evidence that overconfident managers are more likely to issue new debt and choose higher debt levels when they need external financing. Overconfident managers overestimate their firm's future performance and hence regard external funding as excessively costly. Because variations in views about future cash flows are typically more sensitive to stock prices, overconfident managers believe that issuing equity is more expensive than issuing debt. Therefore, firms with overconfident managers tend to issue debt rather than equity when they require external financing. Consistent with Hackbarth (2008), Malmendier et al. (2022) show empirical evidence that overconfident CFOs tend to use debt financing as they perceive equity financing to be more costly. They further highlight that firms' financing choices depend on CFO overconfidence rather than CEO overconfidence.

When overconfident CFOs are confronted with the (overestimated) high cost of external funding, they may seek a solution to reduce this cost, hence strengthening the firms' financing ability. A common method admitted by CFOs to achieve this aim is to restrict earnings volatilities via manipulating earnings (Dichev et al., 2013). This idea is consistent with survey findings of Graham et al. (2005), which show that CFOs desire stable earnings to reduce the cost of capital, even at the cost of sacrificing long-term firm value. Thus, we anticipate that overconfident CFOs have the incentive to decrease earnings volatility by manipulating earnings, thereby lowering what they perceive to be overpriced financing costs.

One might be concerned that earnings manipulation is easily detected (Cohen et al., 2008). If aggressive earnings management is detected, the CFO, as the principal accounting decision maker, might lose credibility among stakeholders (Goel & Thakor, 2003) and escalate their turnover risk (Collins et al., 2009). However, overconfident CFOs have high-risk tolerance (Ben-David et al., 2013; Chen et al., 2022) and are thereby more likely to ignore or underestimate the detection risk than their rational counterparts. Therefore, the high detection risks may not lessen the incentives of overconfident CFOs to use earnings management.

Based on the above discussions, we propose our first hypothesis.

H1: There is a positive association between overconfident CFOs and earnings management.

If overconfident CFOs manage earnings because they are keen to strengthen the ability of external financing by signalling performance stability, we should expect this incentive to be stronger if their firms have more volatile performance or have external financing needs.

Volatile performance increases creditors' perceptions of firms' risks. Earnings volatility undermines earnings predictability and increases information risk, resulting in creditors' inability to accurately forecast the firm's future performance during the credit-granting decision-making stage (Graham et al., 2005). Besides, cash flow volatility exacerbates firms' default risks, potentially leading to firms' failure to pay principal and interest in full and on time (Brogaard et al., 2017).

To restrict creditors' high perceived risk, managers use earnings smoothing as an information signal to convey private information (Merton, 1974). This notion is further supported by Trueman and Titman (1988). They create a model where firms smooth earnings to lessen creditors' perceived bankruptcy risk, resulting in lower

borrowing costs. Empirical evidence also suggests stable earnings are negatively associated with the cost of debt (e.g. Gassen & Fülbier, 2015; Jung et al., 2013; Li & Richie, 2016; Minton & Schrand, 1999; Sha et al., 2021). Therefore, we predict that overconfident CFOs faced with highly volatile performance are more likely to smooth earnings through earnings management, thereby reducing the cost of debt.

In addition, as overconfident CFOs believe that their equity is undervalued, it is possible that their earnings smoothing incentives are derived from mitigating the perceived equity undervaluation and reducing the cost of equity. Specifically, Francis et al. (2004) document a negative relationship between smooth earnings and the cost of equity. However, McInnis (2010) finds no significant relationship between earnings volatility and the cost of equity and argues that the equity market does not drive managers to favour smooth earnings. Given the debatable relationship between earnings smoothing and the cost of equity, we estimate that the incentives of overconfident CFOs to manipulate earnings may not be changed significantly by equity issues.

Based on the above discussions, we propose our second and third hypotheses.

H2: The positive relationship between overconfident CFOs and earnings management is more pronounced when firms have more volatile performance.

H3: The positive relationship between overconfident CFOs and earnings management is more pronounced when firms have external financing needs.

3. Data and research design

3.1 Sample and data

Our main sample is based on 14,156 observations of US firms from 1999 to 2021.[3] We obtain information about executive compensation from ExecuComp. We define the CFO position according to executive titles in ExecuComp, including chief financial officer, CFO, controller, treasurer, finance, and vice president-finance (Jiang et al., 2010). We collect financial data from the CRSP/Compustat Merged database (CCM). We gather institutional ownership and governance data from the Thomson-Reuters 13F database and the BoardEx database, respectively. Financial firms (SIC:6000-6999) and utility firms (SIC:4900-4999) are excluded since their operational and financial structures vary from those of other businesses. The detailed sample selection construction is shown in Table 1. Following previous studies (e.g. Hribar & Nichols, 2007), we winsorise all continuous variables (except for absolute value) at the 1st and 99th percentiles and all absolute values of continuous variables at the 99th percentiles to eliminate the impact of outliers.

3.2 Measurement

3.2.1 Earnings management measurement
This study uses accrual-based earnings management as a proxy for earnings management. Accrual-based earnings management is a way to manipulate earnings by changing

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[3]Our sample period starts in 1999 as corporate governance information (control variables) in BoardEx is available beginning in 1999.

Table 1. Sample selection.

Steps	Details	Observations
Step 1	Initial observations from CCM database (1999–2021)	141,075
Step 2	Exclude observations without CFOs' compensation information in the ExecuComp database	(101,992)
Step 3	Exclude observations without board information in the BoardEx database	(5,403)
	Observations with data available in CCM, ExecuComp, and BoardEx databases[a]	33,680
Step 4	Exclude observations in the financial industry (SIC:6000-6999)	(6,783)
Step 5	Exclude observations in the utility sector (SIC:4900-4999)	(1,555)
	Observations before deleting the missing values in various regressions	25,342
Step 6	Number of observations after deleting observations with missing values for the main sample	14,156

[a]Since Thomson-Reuters 13F database only discloses information that firms have institutional investors, we retain institutional ownership information in the matched sample (i.e. data available in CCM, ExecuComp and Thomson-Reuters 13F database). We replace institutional ownership with zero for unmatched sample (i.e. data available in CCM and ExecuComp and unavailable in Thomson-Reuters 13F database). This step is not listed in the Table 1, because no observation is deleted.

accounting estimates or methods, which are primarily determined at the CFO's discretion (Baker et al., 2019; Jiang et al., 2010). Dechow et al. (1995) introduce the modified Jones model, which is widely utilised in the research on accrual-based earnings management. In line with Hsieh et al. (2014), we use the modified Jones model. At least 15 observations are required for each industry year group (Zang, 2012). The modified Jones model is as follows:

$$\frac{TA_{it}}{A_{it-1}} = \beta_0 + \beta_1 \frac{1}{A_{it-1}} + \beta_2 \frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}} + \beta_3 \frac{PPE_{it}}{A_{it-1}} + \varepsilon_{it}, \quad (1)$$

where, TA_{it} is the total accrual calculated from the cash flow statement (CCM variable: IBC–(OANCF–XIDOC)).[4] β_0 is the unscaled intercept.[5] ΔREV_{it} is the change of revenue (REVT–L. REVT). ΔREC_{it} is the change of accounts receivable (RECT–L. RECT). PPE_{it} is the property, plant, and equipment (PPEGT). A_{it-1} is the lagged total asset (L. AT). The discretionary accrual (AEM_{it}) is the estimated residual from Equation (1).

We use the absolute value of AEM_{it} ($AbsAEM_{it}$) since it captures accrual reversals following AEM (Cohen et al., 2008), and no specific directions for AEM are predicted by our hypotheses.

3.2.2 Overconfidence measurement
The option-based technique suggested by Malmendier and Tate (2005) is the broadly utilised managerial overconfidence measure in existing research (Campbell et al., 2011; Hsieh et al., 2018; Huang et al., 2016) and is the most robust compared to alternative interpretations (Malmendier & Tate, 2015). Thus, this study adopts the option-based method to measure CFO and CEO overconfidence.

Malmendier and Tate (2005) use managers' option exercise behaviours to measure overconfidence. If managers put off exercising options that are more than 67% in the money, they are overconfident. Because the ExecuComp database lacks detailed data for calculating moneyness prior to 2006, we use the average moneyness of the CFOs'

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[4]In the measurements of AEM, the item names in parentheses are from the CCM.
[5]Following recommendations from Kothari et al. (2005), Collins et al. (2017) and Lara et al. (2020), this study includes an unscaled intercept in the regression of the modified Jones model to incorporate the impact of firm growth and performance. The results remain qualitatively similar when the unscaled intercept is excluded.

(CEOs') option portfolio to measure CFO (CEO) overconfidence following Campbell et al. (2011). First, we divide the total realisable value of the exercisable options (Execu-Comp variable: OPT_UNEX_EXER_EST_VAL) by the number of exercisable options (OPT_UNEX_EXER_NUM) to calculate the average realisable value per option.[6] Next, the average exercise price per option is calculated by extracting the average realisable value per option from the stock price at the fiscal year-end (PRCC_F). Finally, we use the average realisable value per option divided by the average exercise price per option to get the average moneyness of the options.

$Holder67CFO_{it}$ ($Holder67CEO_{it}$) is an indicator variable that equals one if CFOs (CEOs) are reluctant to exercise vested options that are no less than 67% in the money for the first time, and zero otherwise. CFOs (CEOs) would remain in their classification until the end of their tenure (Hirshleifer et al., 2012).[7] In addition, we change the threshold to eliminate the bias of choosing the threshold on the overconfidence measure. $Holder100CFO_{it}$ ($Holder100CEO_{it}$), an indicator variable, equals one if CFOs (CEOs) delay exercising vested options that are larger than 100% in the money for the first time, and zero otherwise. CFOs (CEOs) would remain to be recognised as such until the end of their tenure (Hirshleifer et al., 2012).

3.3 Main model

For testing the relationship between CFO overconfidence and numerous control factors on earnings management, our study adopts the following regression:

$$
\begin{aligned}
AbsAEM_{it} = {} & \beta_0 + \beta_1 OverCFO_{it} + \beta_2 OverCEO_{it} + \beta_3 MaleCFO_{it} + \beta_4 MaleCEO_{it} + \beta_5 MTB_{it} \\
& + \beta_6 CashFlow_{it} + \beta_7 ROA_{it} + \beta_8 FirmSize_{it} + \beta_9 Leverage_{it} + \beta_{10} FirmAge_{it} \\
& + \beta_{11} AbsREM_{it} + \beta_{12} Big4_{it} + \beta_{13} HighLitigationRisk_{it} + \beta_{14} InsHoldings_{it} \\
& + \beta_{15} CEOduality_{it} + \beta_{16} BoardSize_{it} + \beta_{17} BoardIndependence_{it} \\
& + Firm\,fixed\,effects + Year\,fixed\,effects + \varepsilon_{it},
\end{aligned}
$$

(2)

where, the dependent variable, the absolute value of accrual-based earnings management ($AbsAEM_{it}$), is measured by the modified Jones model (Dechow et al., 1995; Zang, 2012). The variable of interest is the overconfident CFO ($OverCFO_{it}$), proxied by $Holder67CFO_{it}$ and $Holder100CFO_{it}$. Following Campbell et al. (2011), Hirshleifer et al. (2012), and Chen et al. (2022), we use managers' option exercise behaviours to measure overconfidence. We expect β_1 to be positive, confirming the positive association between overconfident CFOs and earnings management.

We control for CEO overconfidence ($OverCEO_{it}$), proxied by $Holder67CEO_{it}$ and $Holder100CEO_{it}$, as overconfident CEOs are positively associated with earnings management decisions (Hsieh et al., 2014). Our study also considers including top managers' gender, as prior studies suggest that CFO gender ($MaleCFO_{it}$) and CEO gender ($MaleCEO_{it}$) sway earnings management practice (e.g. Barua et al., 2010; Gupta et al., 2020).

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[6]In the measurement of overconfidence, the variable names in parentheses are from the ExecuComp database.
[7]The results remain qualitatively similar when we require CFOs to hold vested options that are no less than 67% in the money at least twice (Malmendier & Tate, 2005).

Taking other possible factors into account, our study controls for firm growth opportunities proxied by the market-to-book ratio (MTB_{it}), firm performance proxied by cash flow ($CashFlow_{it}$), and return on asset (ROA_{it}), which have a significant link to discretionary accruals (Kothari et al., 2005; Zang, 2012). We control for some other firm characteristics that are regarded as determinants of earnings management practice, such as firm size ($FirmSize_{it}$) (Dechow & Dichev, 2002; Zang, 2012), leverage ($Leverage_{it}$) (DeFond & Jiambalvo, 1994; Hsieh et al., 2014), and firm age ($FirmAge_{it}$) (Capalbo et al., 2018; Gul et al., 2009). Additionally, our study controls real earnings management ($AbsREM_{it}$) because managers strategically use different methods (Cohen et al., 2008; Zang, 2012).

We also control for the external monitoring, including the Big Four auditing firms ($Big4_{it}$), litigation risk ($HighLitigationRisk_{it}$), and institutional ownership ($InsHoldings_{it}$) (Boahen & Mamatzakis, 2020; Egan & Xu, 2020; Fraser et al., 2004; Koh, 2007; Matsumoto, 2002; Roychowdhury, 2006) and internal governance, encompassing CEO duality ($CEOduality_{it}$), board size ($BoardSize_{it}$) and board independence ($BoardIndependence_{it}$) (Man & Wong, 2013). The CEO duality ($CEOduality_{it}$) also can reflect CEO power (DeBoskey et al., 2019). We control this effect, as Friedman (2014) finds that powerful CEOs can pressure CFOs to manipulate earnings. Finally, we include firm and year dummies to control the time-invariant firm and year effects. Detailed variable measurements are outlined in Appendix A.

4. Main results

4.1 Descriptive statistics

Table 2 shows the descriptive statistics. We find a similar mean value (0.049) of $AbsAEM$ as reported in prior studies (Cohen et al., 2008). Further, 55.2% of CFOs indicated by the mean value of $Holder67CFO$ are overconfident, which implies that overconfidence is a common characteristic among CFOs.[8] This proves the point made by Black and Gallemore (2013) and Malmendier et al. (2022) that only examining CEO overconfidence and ignoring CFO overconfidence might underestimate the significance of overconfidence. The summary statistics for the control variables are in line with previous studies. For instance, the mean values of the MTB, $InsHoldings$, and $Leverage$ are similar to the findings of Ali and Zhang (2015).

4.2 Pairwise correlations

We conduct the Pearson correlation test. As shown in Online Appendix A, the correlations of $Holder67CFO$ ($Holder100CFO$) with the other control variables do not exceed 0.5, and the variance-inflating factors (VIFs) (not tabulated for brevity) of all independent variables are less than the threshold of 10 (Gujarati et al., 2012), implying that multicollinearity is not an issue when interpreting the regression results. The Pearson correlation coefficient between CFO and CEO overconfidence is high, which means that both should be taken into account to mitigate the omitted variable bias.

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[8]Chen et al. (2022) identify 51% of CFOs as overconfident CFOs, using the same overconfidence measurement for the period from 1992 to 2015 inclusive.

Table 2. Descriptive statistics.

	N	Mean	SD	p25	Median	p75
AbsAEM	**14,156**	**0.049**	**0.054**	**0.015**	**0.034**	**0.062**
Holder67CFO	**14,156**	**0.552**	**0.497**	**0**	**1**	**1**
Holder67CEO	14,156	0.654	0.476	0	1	1
Holder100CFO	**14,049**	**0.430**	**0.495**	**0**	**0**	**1**
Holder100CEO	14,080	0.544	0.498	0	1	1
MaleCFO	14,156	0.906	0.292	1	1	1
MaleCEO	14,156	0.966	0.182	1	1	1
MTB	14,156	3.143	4.232	1.500	2.364	3.867
CashFlow	14,156	0.105	0.081	0.063	0.103	0.150
ROA	14,156	0.041	0.107	0.018	0.054	0.091
FirmSize	14,156	7.439	1.583	6.308	7.318	8.440
Leverage	14,156	0.214	0.184	0.041	0.197	0.325
FirmAge	14,156	3.151	0.660	2.639	3.135	3.738
AbsREM	14,156	0.274	0.262	0.089	0.196	0.373
Big4	14,156	0.905	0.294	1	1	1
HighLitigationRisk	14,156	0.094	0.291	0	0	0
InsHoldings	14,156	0.537	0.404	0	0.706	0.876
CEOduality	14,156	0.516	0.500	0	1	1
BoardSize	14,156	2.174	0.245	1.946	2.197	2.303
BoardIndependence	14,156	0.808	0.168	0.714	0.833	0.900
VolEarnings	9,923	0.045	0.055	0.012	0.025	0.053
VolCFO	9,923	0.039	0.033	0.017	0.029	0.049
EFN	11,026	0.424	0.494	0	0	1
DebtIssuer	13,653	0.384	0.486	0	0	1
EquityIssuer	13,236	0.372	0.483	0	0	1

Notes: This table presents summary statistics. The sample consists of 14,156 firm-year observations from 1999 to 2021 in US firms with financial, executive compensation, and board data available from CCM, ExecuComp and BoardEx. See Appendix A for variable definitions. Variables of interest are marked in bold.

4.3 Regression results – CFO overconfidence and earnings management (H1)

Table 3 displays the results of the estimating Equation (2) which show the association between CFO overconfidence and earnings management. The full sample estimations are listed in columns (1) and (2), while the analyses based on the entropy balancing sample are shown in columns (3) and (4).

Holder67CFO (*Holder100CFO*) has a positive coefficient at a 1% (1%) significance level in column (1) ((2)), indicating a statistically significant positive association between overconfident CFOs and earnings management. These results also have economic significance. *Holder67CFO* (*Holder100CFO*) will lead to a 12.2% increase in *AbsAEM* at the mean.[9] Therefore, we show statistically and economically significant evidence that overconfident CFOs are positively associated with earnings management, supporting hypothesis 1 (H1).

To improve the robustness of the initial results, we use a more restrictive approach: entropy balancing, as it essentially recalibrates the observation weights by adjusting for systematic and random differences in the control variables.[10] Specifically, to construct a sample to test earnings management, all observations with overconfident CFOs are reweighted to match observations with non-overconfident CFOs, based on the control variables used in Equation (2). The samples are matched on the mean, variance, and skewness of covariate distribution. Columns (3) and (4) show the results of using the

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[9]12.2% = 0.006/0.049 × 100%, where 0.006 is the coefficient of *Holder67CFO* (*Holder100CFO*) and 0.049 is the mean value of *AbsAEM*

[10]We thank the anonymous referee for this suggestion.

Table 3. The relationship between CFO overconfidence and earnings management activities.

Sample	(1)	(2)	(3)	(4)
	Full sample		Entropy balancing sample	
Holder67CFO	0.006***		0.004***	
	(0.001)		(0.001)	
Holder67CEO	0.001		0.002	
	(0.001)		(0.001)	
Holder100CFO		0.006***		0.005***
		(0.001)		(0.002)
Holder100CEO		0.002		0.003*
		(0.001)		(0.002)
MaleCFO	0.003	0.003	0.003	0.005*
	(0.002)	(0.002)	(0.003)	(0.003)
MaleCEO	0.001	0.001	−0.002	−0.004
	(0.004)	(0.004)	(0.005)	(0.006)
MTB	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
CashFlow	−0.010	−0.009	−0.066***	−0.057**
	(0.019)	(0.019)	(0.023)	(0.023)
ROA	−0.167***	−0.168***	−0.090***	−0.101***
	(0.016)	(0.016)	(0.023)	(0.022)
FirmSize	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Leverage	−0.015**	−0.015**	−0.012	−0.012*
	(0.006)	(0.006)	(0.007)	(0.007)
FirmAge	−0.021***	−0.021***	−0.022***	−0.020***
	(0.005)	(0.005)	(0.006)	(0.005)
AbsREM	0.061***	0.061***	0.069***	0.069***
	(0.005)	(0.005)	(0.007)	(0.006)
Big4	−0.001	−0.001	−0.003	−0.002
	(0.004)	(0.004)	(0.005)	(0.004)
HighLitigationRisk	0.003	0.003	0.003	0.001
	(0.002)	(0.002)	(0.003)	(0.003)
InsHoldings	0.004	0.003	−0.001	−0.004
	(0.004)	(0.004)	(0.004)	(0.004)
CEOduality	−0.001	−0.001	−0.002	−0.002
	(0.002)	(0.002)	(0.002)	(0.002)
BoardSize	−0.007	−0.007	−0.009*	−0.003
	(0.004)	(0.004)	(0.005)	(0.005)
BoardIndependence	0.001	0.002	0.005	0.002
	(0.005)	(0.005)	(0.006)	(0.006)
Constant	0.111***	0.112***	0.119***	0.100***
	(0.019)	(0.018)	(0.022)	(0.021)
Observations	14,062[a]	13,892	14,062	13,892
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.276	0.277	0.309	0.315

[a]The reason why the observations in the regression are different from those in the original sample is that 94 singleton observations were deleted from the regression (Stata code: reghdfe).

Notes: The results of the relationship between overconfident CFOs and earnings management are shown in this table. The dependent variable is *AbsAEM*. The standard errors clustering at the firm level are displayed in parentheses. The significance levels of 10%, 5%, and 1% are indicated by *, **, and ***, respectively. See Appendix A for variable definitions. Variables of interest are marked in bold.

entropy-balancing sample. The coefficients of *Holder67CFO* and *Holder100CFO* are statistically and economically positive, indicating that our findings are robust.[11]

Turning to the result of the control variables, after considering *Holder67CFO* (*Holder100CFO*), the coefficient on *Holder67CEO* (*Holder100CEO*) becomes insignificant or

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[11]Since the entropy balance method is more restrictive, we only show the results of the entropy balance method in the following analyses.

marginally significant and has a smaller magnitude than *Holder67CFO* (*Holder100CFO*). These findings suggest that CFO overconfidence outweighs CEO overconfidence in earnings management, consistent with prior studies' findings (Baker et al., 2019; Jiang et al., 2010). The results of other control variables are generally consistent with prior studies. For example, *MaleCFO* has a statistically significant positive coefficient in column (4). A male CFO will have a 10.2% (=0.005/ 0.049 × 100%) increase in *AbsAEM* at the mean, consistent with the findings of Barua et al. (2010). *FirmAge* has a significantly negative coefficient in columns (1) to (4), implying that firms with a long history use fewer earnings management (Gul et al., 2009).

5. Underpinning mechanisms

5.1 CFO overconfidence, earnings management, and firm performance volatility (H2)

We conjecture that overconfident CFOs aim to reduce earnings volatility by manipulating earnings. This section conducts subsample analyses to explore this prediction further. If overconfident CFOs tend to smooth earnings, this incentive should be stronger when firms have higher performance volatility. Empirically, we use earnings volatility (*VolEarnings*) and cash flow volatility (*VolCFO*) to capture firm performance volatility following previous studies (Jayaraman, 2008).[12] The higher value of *VolEarnings* and *VolCFO* means more volatile performance. We separate the sample based on the median value of *VolEarnings* (*VolCFO*) into two subsamples, high and low *VolEarnings* (*VolCFO*). As shown in Panel A of Table 4, we find that the coefficients on *Holder67CFO* and *Holder100CFO* are significant, with higher economic magnitude, only in firms with high *VolEarnings*. We find similar results (Panel B of Table 4) when we split the sample based on the alternative proxy of performance volatility, *VolCFO*. These findings are consistent with our expectation that the positive relationship between overconfident CFOs and AEM is more pronounced in firms with more volatile performance, supporting hypothesis 2 (H2).

5.2 CFO overconfidence, earnings management, and external financing needs (H3)

Overconfident CFOs deem that their firms are undervalued by the capital market, resulting in costly external funding (Ben-David et al., 2013; Malmendier et al., 2022). We predict that if overconfident CFOs have to use external funds, they tend to use more earnings management to provide the stable earnings that creditors prefer.

Empirically, first, we separate the sample into two subsamples based on the dummy variable, external financing needs (*EFN*),[13] and test whether overconfident CFOs are more likely to use earnings management when firms need external funding. As shown in Panel A of Table 5, the coefficients on *Holder67CFO* and *Holder100CFO* are only significant in columns (1) and (3) when firms need external financing. Next, we conduct two subsample analyses based on issuing debt (*DebtIssuer*) and issuing equity (*EquityIssuer*) to further investigate this.[14] In the first test, we find that *Holder67CFO* and *Holder100CFO* only have a significantly positive and larger coefficient in columns (1) and

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[12]See Appendix A for detailed *VolEarnings* and *VolCFO* measures.
[13]See Appendix A for detailed *EFN* measure.
[14]See Appendix A for detailed *DebtIssuer* and *EquityIssuer* measures.

Table 4. CFO overconfidence, earnings management, and firm performance volatility.

	Panel A: Subsample – earnings volatility			
	(1)	(2)	(3)	(4)
Group variable: *VolEarnings*	High	Low	High	Low
Holder67CFO	0.006*	−0.001		
	(0.003)	(0.002)		
Holder100CFO			0.008**	0.001
			(0.003)	(0.002)
Constant	0.083	0.065**	0.067	0.080***
	(0.058)	(0.030)	(0.058)	(0.030)
Controls	Yes	Yes	Yes	Yes
Observations	4,788	4,735	4,717	4,656
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.252	0.349	0.265	0.345
Panel B: Subsample – cash flow volatility				
	(1)	(2)	(3)	(4)
Group variable: *VolCFO*	High	Low	High	Low
Holder67CFO	0.005*	−0.000		
	(0.003)	(0.002)		
Holder100CFO			0.007**	0.001
			(0.003)	(0.002)
Constant	0.038	0.138***	0.060	0.132***
	(0.050)	(0.035)	(0.048)	(0.033)
Controls	Yes	Yes	Yes	Yes
Observations	4,799	4,694	4,735	4,606
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.257	0.298	0.263	0.310

Notes: The results of the subsample analyses based on earnings volatility and cash flow volatility are shown in this table. If the value of earnings volatility (cash flow volatility) is higher than the sample median, it belongs to the high earnings volatility (cash flow volatility) group; otherwise, it belongs to the low earnings volatility (cash flow volatility) group. The dependent variable is *AbsAEM* and controls are consistent with Equation (2). The standard errors clustering at the firm level are displayed in parentheses. The significance levels of 10%, 5%, and 1% are indicated by *, **, and ***, respectively. See Appendix A for variable definitions. Variables of interest are marked in bold.

(3) of Panel B (Table 5) when firms have debt issues. In the second test, we find that both *Holder67CFO* and *Holder100CFO* have significantly positive coefficients in columns (1) to (4) of Panel C (Table 5), but the coefficients between the two groups, equity issuers and non-equity issuers, are insignificant, indicating that overconfident CFOs' earnings management decisions are not significantly affected by equity issue incentives. This finding might be because the relationship between earnings smoothness and the cost of equity is unclear (McInnis, 2010) and undermines overconfident CFOs' incentive to manipulate earnings when they issue equity.

Overall, we find that the positive relationship between overconfident CFOs and earnings management is more pronounced when firms have external financing needs, particularly debt financing, supporting hypothesis 3 (H3).

6. Robustness tests

We conduct numerous tests to mitigate certain potentially endogenous problems. We use the PSM-DID to mitigate the problem of reverse causation. We also change the measurement of earnings management to further mitigate mismeasurement.

Table 5. CFO overconfidence, earnings management, and external financing needs.

Panel A: Subsample – external financing needs				
	(1)	(2)	(3)	(4)
Group variable: *EFN*	Yes	No	Yes	No
Holder67CFO	0.007***	−0.000		
	(0.003)	(0.002)		
Holder100CFO			0.008**	0.004
			(0.003)	(0.002)
Constant	0.086*	0.125***	0.092**	0.123***
	(0.047)	(0.033)	(0.046)	(0.034)
Controls	Yes	Yes	Yes	Yes
Observations	4,339	6,105	4,260	6,015
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.386	0.243	0.379	0.251
Panel B: Subsample – debt issuer				
	(1)	(2)	(3)	(4)
Group variable: *DebtIssuer*	Yes	No	Yes	No
Holder67CFO	0.005**	0.003		
	(0.002)	(0.002)		
Holder100CFO			0.006**	0.003
			(0.003)	(0.002)
Constant	0.155***	0.099***	0.147***	0.095***
	(0.032)	(0.028)	(0.033)	(0.027)
Controls	Yes	Yes	Yes	Yes
Observations	4,930	8,197	4,859	8,090
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.353	0.328	0.366	0.328
Panel C: Subsample – equity issuer				
	(1)	(2)	(3)	(4)
Group variable: *EquityIssuer*	Yes	No	Yes	No
Holder67CFO	0.008**	0.003**		
	(0.004)	(0.002)		
Holder100CFO			0.007*	0.004***
			(0.004)	(0.002)
Constant	0.111**	0.140***	0.091*	0.122***
	(0.053)	(0.028)	(0.047)	(0.027)
Controls	Yes	Yes	Yes	Yes
The coefficient difference on overconfidence CFO proxies (Yes-No)[a]	*p-value* = 0.155		*p-value* = 0.404	
Observations	4,255	9,015	4,208	8,889
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.339	0.302	0.357	0.287

[a]We only present the coefficient difference on overconfidence CFO when the coefficient on overconfidence CFO is significant in two groups.

Notes: The results of the subsample analysis based on external financing needs, debt issuers, and equity issuers are shown in this table. If the value of the group variable (external financing needs, debt issuers, and equity issuers) is equal to one, it belongs to the "Yes" group; otherwise, it belongs to the "No" group. The dependent variable is *AbsAEM* and controls are consistent with Equation (2). The standard errors clustering at the firm level are displayed in parentheses. The significance levels of 10%, 5%, and 1% are indicated by *, **, and ***, respectively. See Appendix A for variable definitions. Variables of interest are marked in bold.

6.1 PSM-DID

One may argue that our empirical findings have a reverse causation problem. That is, firms engaged in more earnings management activities tend to hire overconfident CFOs. To address this concern, we perform PSM-DID. Specifically, according to prior research (e.g. Ahmed & Duellman, 2013; Lin et al., 2020), we use CFO turnover as the exogenous shock. In line with Huang and Kisgen (2013) and Fu and Zhang (2019), we

first restrict our sample to the three years preceding and following a CFO turnover, excluding the transition year. Second, we require the firm to have at least two years of available data prior to the CFO turnover. Third, we require a new CFO to be in charge for at least two years after the turnover year to ensure that the CFO has enough time to influence firm choices. To exclude the impact of CEO turnover, we exclude samples of simultaneous CEO and CFO turnover. We define *Treat*, an indicator variable, as equal to one if a firm changes its CFO from a non-overconfident one to an overconfident one, and it equals zero if the firm replaces a non-overconfident CFO with another non-overconfident one.[15] *Post,* an indicator variable, equals one in the first three years after CFO turnover and equals zero in the last three years before CFO turnover.[16] To select a control group, we use kernel matching. We match the treatment and control groups using the control variables in Equation (2). This procedure leaves 2,092 observations. The empirical model for DID estimation is as follows:

$$AbsAEM_{it} = \beta 0 + \beta 1 Treat_i \times Post_{it} + Controls + Firm fixed effects$$
$$+ Year fixed effects + \varepsilon_{it}, \tag{3}$$

where, the interaction term ($Treat_i \times Post_{it}$) is our variable of interest. Given that we include firm and year dummies, we exclude $Treat_i$ and $Post_{it}$ to avoid collinearity. We predict β_1 to be positive, indicating that the new overconfident CFOs tend to do more earnings management than the new CFOs who are non-overconfident. We include the same control variables as in Equation (2). Detailed variable measurements are summarised in Appendix A.

Panel A of Table 6 displays the results of PSM. As shown, *p*-values of all control variables are greater than 0.1 in the matched sample, indicating that these controls are not significantly different in the matched sample between the treatment and control groups. The results of DID are presented in panel B of Table 6. The interaction term ($Treat_i \times Post_{it}$) has a significantly positive coefficient, implying that firms with overconfident CFOs engage in more earnings management, consistent with our main finding.

6.2 Alternative measures

To eliminate the endogeneity concern from measurement errors, we change the measurement of earnings management. Some studies suggest a non-linear relationship between firm growth (or firm performance or sale growth) and accrual (e.g. Collins et al., 2017; Kothari et al., 2005). The modified Jones model, however, does not address these non-linear relationships. To capture them, Collins et al. (2017) add quintile dummies of firm performance and growth to the modified Jones model. Banker et al. (2019) argue that the quintile dummy has discontinuous jumps at the quintile boundary, resulting in bias inference. Banker et al. (2019), therefore, use a spline correction to resolve the weakness of the quantile dummy method, as the spline would catch variance both inside and outside of the quantile, improving the precision of the non-linear

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[15]For brevity in the PSM-DID test, our proxies for overconfident CFOs and CEOs are *Holder67CFO* and *Holder67CEO*, respectively. We find similar results when we use *Holder100CFO* and *Holder100CEO*.

[16]Consistent with Ge et al. (2020), the turnover year is excluded from the regression analysis in this study because both departing and replacement CFOs may impact earnings management in the turnover year.

Table 6. PSM-DID.

	Panel A: PSM						
Variables	Sample Type	Mean Treated	Control	%Reduct %Bias	|Bias|	T-test t	p > t
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Holder67CEO	Unmatched	0.650	0.406	50.300		10.440	**0.000**
	Matched	0.649	0.647	0.400	99.200	0.070	**0.942**
MaleCFO	Unmatched	0.916	0.905	3.900		0.810	0.417
	Matched	0.916	0.916	−0.200	94.600	−0.040	0.970
MaleCEO	Unmatched	0.948	0.965	−8.300		−1.810	**0.070**
	Matched	0.948	0.949	−0.800	90.100	−0.130	**0.896**
MTB	Unmatched	2.602	2.678	−1.800		−0.350	0.724
	Matched	2.610	2.586	0.600	69.500	0.100	0.918
CashFlow	Unmatched	0.094	0.088	6.600		1.410	0.158
	Matched	0.093	0.092	1.700	74.800	0.270	0.784
ROA	Unmatched	0.027	0.018	7.500		1.590	0.111
	Matched	0.027	0.025	1.500	79.800	0.260	0.796
FirmSize	Unmatched	7.147	7.796	−40.400		−8.270	**0.000**
	Matched	7.155	7.175	−1.200	97.000	−0.220	**0.827**
Leverage	Unmatched	0.217	0.241	−12.800		−2.730	**0.006**
	Matched	0.216	0.214	1.200	90.500	0.200	**0.840**
FirmAge	Unmatched	3.155	3.343	−30.000		−6.190	**0.000**
	Matched	3.155	3.157	−0.200	99.200	−0.040	**0.968**
AbsREM	Unmatched	0.262	0.254	3.200		0.690	0.488
	Matched	0.262	0.266	−1.300	58.300	−0.220	0.823
Big4	Unmatched	0.874	0.939	−22.400		−5.060	**0.000**
	Matched	0.877	0.874	0.900	96.100	0.130	**0.896**
HighLitigationRisk	Unmatched	0.089	0.111	−7.300		−1.500	0.134
	Matched	0.090	0.091	−0.400	95.100	−0.070	0.948
InsHoldings	Unmatched	0.521	0.514	1.700		0.360	0.723
	Matched	0.521	0.521	−0.100	96.900	−0.010	0.993
CEOduality	Unmatched	0.497	0.482	2.900		0.610	0.543
	Matched	0.498	0.482	3.300	−12.000	0.560	0.575
BoardSize	Unmatched	2.132	2.230	−40.800		−8.750	**0.000**
	Matched	2.133	2.138	−2.100	94.900	−0.360	**0.722**
BoardIndependence	Unmatched	0.830	0.850	−12.400		−2.610	**0.009**
	Matched	0.830	0.832	−0.900	92.800	−0.150	**0.881**
Panel B: DID							
	(1)						
Treat_i × Post_it	**0.014***						
	(0.005)						
Constant	0.139**						
	(0.062)						
Controls	Yes						
Observations	2,092						
Firm fixed effects	Yes						
Year fixed effects	Yes						
Adj. R^2	0.349						

Notes: Panel A presents the results for PSM. Panel B presents the results of DID regression based on the PSM-matched sample. The dependent variable is *AbsAEM*, and controls are consistent with Equation (2). In the DID test, for brevity, our proxies for overconfident CFOs and CEOs are *Holder67CFO* and *Holder67CEO*, respectively. We find similar results when we use *Holder100CFO* and *Holder100CEO*. The standard errors clustering at the firm level are displayed in parentheses. The significance levels of 10%, 5%, and 1% are indicated by *, **, and ***, respectively. See Appendix A for variable definitions. Variables of interest are marked in bold.

relationship being captured. We use a spline-corrected accrual-based earnings management measure (*AbsAEM_Alter*) provided by Banker et al. (2019).[17] As shown in Table 7, *Holder67CFO* and *Holder100CFO* have a positive coefficient that remains economically and statistically significant.

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[17]See Online Appendix C.2 for detailed *AbsAEM_Alter* measure.

In addition to using accrual-based earnings management, managers might also use real earnings management (Baker et al., 2019; Zang, 2012). Thus, we change our earnings management proxy (dependent variable) to real earnings management (*AbsREM*).[18] When testing *AbsREM*, we control for top management characteristics (Overconfident CEOs proxies, *MaleCFO*, and *MaleCEO*), firm growth opportunities (*MTB*), firm characteristics (*FirmSize*, *Leverage*, *FirmAge*, *MarketShare*), external monitoring (*Big4*, *InsHoldings*), corporate governance (*CEOduality*, *BoardSize*, *BoardIndependence*) and accrual-based earnings management (*AbsAEM_Alter*), following previous studies (e.g. Hsieh et al., 2014; Roychowdhury, 2006; Zang, 2012). As presented in Table 7, the coefficients of *Holder67CFO* and *Holder100CFO* are positive and significant. Overall, this evidence suggests that different measures of earnings management do not significantly alter our inferences.

7. Additional tests

7.1 CFO overconfidence, earnings management, and earnings smoothness

To further consolidate the notion that overconfident CFOs use earnings management to smooth earnings, we investigate the relationship between overconfident CFOs' earnings management and earnings smoothness directly. We split the sample into high and low-earnings management based on the median value of *AbsAEM*. Then, we regress earnings smoothness (proxied by *Smooth1* and *Smooth2*) (Bouwman, 2014) on CFO overconfidence and controls.[19,20] We expect the relationship between CFO overconfidence and earnings smoothness to be stronger when firms use a high level of earnings management. The results are shown in Online Appendix B.1, Panels A and B. We find that earnings are smoother when overconfident CFOs use earnings management, which is consistent with our prediction.

7.2 Alternative mechanism

Although we find strong evidence that the incentive of overconfident CFOs using earnings management is to smoothen earnings and increase firms' financing abilities, someone may argue that overconfident CFOs use earnings management to pursue their own interests (i.e. higher compensation), such as from the agency perspective. Overconfident CFOs have incentive-heavy compensation contracts (Humphery-Jenner et al., 2016), which might give them more incentives to use earnings management to gain higher compensation (Jiang et al., 2010; Watts & Zimmerman, 1978).

To investigate this argument, we use two different measures to gauge the level of CFO compensation incentives: equity incentives (*CFOEquityIncentive*) (Bergstresser & Philippon, 2006) and equity intensity compensation (*CFO_PEBC*) (Humphery-Jenner et al., 2016).[21] The higher values mean stronger compensation incentives. Then, we divide our sample into two groups based on the median value of CFO compensation incentives

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[18]See Online Appendix C.1 for detailed *AbsREM* measure.
[19]See Appendix A for detailed *Smooth1* and *Smooth2* measures. Lower values mean smoother earnings.
[20]Controls are consistent with equation (2).
[21]See Appendix A for detailed *CFOEquityIncentive* and *CFO_PEBC* measures.

Table 7. Alternative measures.

Dependent variable	(1) AbsAEM_Alter	(2) AbsAEM_Alter	(3) AbsREM	(4) AbsREM
Holder67CFO	**0.002***		**0.028*****	
	(0.001)		**(0.006)**	
Holder100CFO		**0.003*****		**0.027*****
		(0.001)		**(0.007)**
Constant	0.078***	0.076***	0.671***	0.702***
	(0.015)	(0.015)	(0.125)	(0.130)
Controls	Yes	Yes	Yes	Yes
Observations	13,591	13,426	13,591	13,426
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.254	0.263	0.728	0.728

Notes: The results of the alternative measures of the main variables are shown in this table. When the dependent variable is *AbsAEM_Alter*, controls are consistent with Equation (2). When the dependent variable is *AbsREM*, we control top management characteristics (Overconfident CEOs proxies, *MaleCFO*, and *MaleCEO*), firm growth opportunities (*MTB*), firm characteristics (*FirmSize*, *Leverage*, *FirmAge*, *MarketShare*), external monitoring (*Big4*, *InsHoldings*), and corporate governance (*CEOduality*, *BoardSize*, *BoardIndependence*) and accrual-based earnings management (*AbsAEM_Alter*). The standard errors clustering at the firm level are displayed in parentheses. The significance levels of 10%, 5%, and 1% are indicated by *, **, and ***, respectively. See Appendix A for variable definitions. Variables of interest are marked in bold.

proxies. The subsample results are presented in Online Appendix B.2. We find that the positive relationship between CFO overconfidence and earnings management is significant in both high- and low-compensation incentive groups, but the coefficients between the two groups are insignificant. Thus, we discover that overconfident CFOs are not motivated by high compensation to manage earnings.

8. Conclusion

Our study focuses on the link between CFO overconfidence and earnings management. In the main, we find a significantly positive relationship between CFO overconfidence and earnings management. We further test the channels through which overconfident CFOs affect earnings management via a series of subsample analyses. This positive relationship between CFO overconfidence and earnings management is profound when firms have highly volatile performance and high external financing needs, particularly when they issue debt. These findings suggest that overconfident CFOs engage in earnings management to smoothen earnings and increase firm financing abilities. In further analysis, we rule out one potential channel – overconfident CFOs use earnings management due to compensation incentives. Our findings remain consistent after a series of robustness tests, including using entropy balancing, PSM-DID estimation, and changing the measurements of main variables.

Our study extends and contributes to the earnings management literature by adding a new determinant, CFO overconfidence. We also find a bright side to managerial overconfidence in that overconfident CFOs use earnings management due to financing concerns rather than personal compensation incentives, thus enriching the overconfidence literature. Our findings add more empirical evidence that CFOs' cognitive bias affects their decisions, thus supporting the upper echelons and overconfidence theories. In addition, our research can assist financial reporting users in comprehending the significance of CFO overconfidence in financial reporting decisions and explain why boards

continue to hire overconfident CFOs despite evidence demonstrating the negative consequences of CFO overconfidence.

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Disclosure statement

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Appendix A Variable definitions[a]

Variables	Definition
$AbsAEM_{it}$	Modified Jones model (Dechow et al., 1995). See Appendix 3.2.1 for details.
$Holder67CFO_{it}$	An indicator variable that equals one if CFOs are reluctant to exercise vested options that are no less than 67% in the money for the first time, and zero otherwise (Campbell et al., 2011). See Section 3.2.2 for details.
$Holder67CEO_{it}$	An indicator variable that equals one if CEOs are reluctant to exercise vested options that are no less than 67% in the money for the first time, and zero otherwise (Campbell et al., 2011). See Section 3.2.2 for details.
$Holder100CFO_{it}$	An indicator variable that equals one if CFOs are reluctant to exercise vested options that are no less than 100% in the money for the first time, and zero otherwise (Hirshleifer et al., 2012). See Section 3.2.2 for details.
$Holder100CEO_{it}$	An indicator variable that equals one if CEOs are reluctant to exercise vested options that are no less than 100% in the money for the first time, and zero otherwise (Hirshleifer et al., 2012). See Section 3.2.2 for details.
$MaleCFO_{it}$	An indicator variable equals one if the CFO is a male, and zero otherwise. (Data source: ExecuComp database)
$MaleCEO_{it}$	An indicator variable equals one if the CEO is a male, and zero otherwise. (Data source: ExecuComp database)
MTB_{it}	Divide equity market value (PRCC_F × CSHO) by equity book value (SEQ) (Demerjian et al., 2020).
$CashFlow_{it}$	Cash flow (OANCF) divided by total assets (AT) (Hsieh et al., 2014).
ROA_{it}	Income Before Extraordinary Items (IB) divided by total assets (AT)
$FirmSize_{it}$	The natural logarithm of total assets (AT) (Jiang et al., 2010).
$Leverage_{it}$	The sum of long-term debt (DLTT) and short-term debt (DLC) over total assets (AT) (Hsieh et al., 2014).
$FirmAge_{it}$	The natural logarithm of the number of years, starting with the first year that firm information was available from the Compustat database (Capalbo et al., 2018). (Data source: Compustat database)
$AbsREM_{it}$	The method of Roychowdhury (2006). See Online Appendix C.1 for details.
$Big4_{it}$	An indicator variable equals one if the audit firm (AU) belongs to PwC, EY, KPMG, or Deloitte, and zero otherwise (Hsieh et al., 2014).
$HighLitigationRisk_{it}$	An indicator variable that equals one if firms' litigation risk is in the top decile of the sample, and zero otherwise (Gao et al., 2021). The coefficients from model (2) in Table 7 of Kim and Skinner (2012) are used to calculate the litigation risk. (Data source: CCM and CRSP databases)
$InsHoldings_{it}$	The percentage of ownership owned by institutional investors (INSTOWN_PERC) (Zang, 2012). (Data source: Thomson-Reuters 13F database)
$CEOduality_{it}$	An indicator variable equals one if the CEO is also the board chair, and zero otherwise (Krishnan et al., 2011). (Data source: BoardEx database)
$BoardSize_{it}$	The number of board members (Krishnan et al., 2011). (Data source: BoardEx database)
$BoardIndependence_{it}$	The number of independent non-executive directors divided by the total number of directors (El Diri et al., 2020). (Data source: BoardEx database)
$VolEarnings_{it}$	The standard deviation of earnings (IB) divided by total assets (AT) computed over the years t-4 to t (Jayaraman, 2008).
$VolCFO_{it}$	The standard deviation of cash flow (OANCF) divided by total assets (AT) computed over the years t-4 to t (Jayaraman, 2008).
EFN_{it-1}	An indicator variable that equals one if firms have external financing need at the beginning of the year, and zero otherwise (Malmendier et al., 2011). See Online Appendix C.3 for details.
$DebtIssuer_{it}$	ChangeDebt is net debt financing measured as the cash proceeds from the issuance of long-term debt (DLTIS) less cash payments for long-term debt reductions (DLTR) less the net changes in current debt (DLCCH) (Bradshaw et al., 2006). $DebtIssuer_{it}$ equals one if ChangeDebt is greater than 0, and zero otherwise.
$EquityIssuer_{it}$	ChangeEquity is net equity financing measured as the proceeds from the sale of common and preferred stock (SSTK) less cash payments for the purchase of common and preferred stock (PRSTKC) less cash payments for dividends (DV) (Bradshaw et al., 2006). $EquityIssuer_{it}$ equals one if ChangeEquity is greater than 0, and zero otherwise.
$Treat_i$	An indicator variable, it equals one if a firm changes from a non-overconfident CFO to an overconfident one, and it equals zero if a firm replaces a non-overconfident CFO with another non-overconfident one.
$Post_{it}$	An indicator variable, equals one in the first three years after CFO turnover and equals zero in the last three years before CFO turnover.

Continued.

Variables	Definition
$AbsAEM\_Alter_{it}$	The spline correction method (Banker et al., 2019). See Online Appendix C.2 for details.
$MarketShare_{it}$	The percentage of the firm's total sales (SALE) to the total industry sales (Badertscher, 2011).
$Smooth1_{it}$	The standard deviation of residuals from regressions of change in net income (NI) divided by the total asset (AT) (i.e. deltaNI/AT) on six control variables, including sales growth (percentage annual growth), size (logarithm of the market value of equity), leverage (total liabilities divided by total assets), debt issuance (percentage change in total liabilities), equity issuance (percentage change in shares outstanding), and annual asset turnover (sales divided by total assets) (Bouwman, 2014).
$Smooth2_{it}$	The standard deviation of residuals from regressions of change in net income (NI) divided by the total asset (AT) (i.e. deltaNI/AT) on the above six control variables over the standard deviation of residuals from regressions of change in cash flow (OANCF) divided by the total asset (AT) (i.e. delta OANCF/AT) on the above six control variables (Bouwman, 2014).
$CFOEquityIncentive_{it}$	ONEPCT/(ONEPCT + Salary + Bonus). The variable ONEPCT represents the dollar change in the value of the CFOs' stock and option holdings as a result of a 1% increase in the firm stock price (Bergstresser & Philippon, 2006). (Data source: ExecuComp database)
$CEOEquityIncentive_{it}$	ONEPCT/(ONEPCT + Salary + Bonus). The variable ONEPCT represents the dollar change in the value of the CEOs' stock and option holdings as a result of a 1% increase in the firm stock price (Bergstresser & Philippon, 2006). (Data source: ExecuComp database)
CFO_PEBC_{it}	The percentage of annual CFO compensation comes from option grants and stocks. Annual option awards (ExecuComp item OPTION_AWARDS_BLK_VALUE before FAS 123R (the year 2006) and OPTION_AWARDS_FV after FAS 123R) plus the annual stock grants (STOCK_AWARDS_FV) divided by total annual compensation (TDC1) (Humphery-Jenner et al., 2016) (Data source: ExecuComp database)
CEO_PEBC_{it}	The percentage of annual CEO compensation comes from option grants and stocks. Annual option awards (ExecuComp item OPTION_AWARDS_BLK_VALUE before FAS 123R (the year 2006) and OPTION_AWARDS_FV after FAS 123R) plus the annual stock grants (STOCK_AWARDS_FV) divided by total annual compensation (TDC1) (Humphery-Jenner et al., 2016)

[a]Unless otherwise noted, the source of the data is CCM.