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CEO overconfidence and IRS attention

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ABSTRACT

We examine the likelihood that the US Internal Revenue Service (IRS), in its enforcement role, will accord particular attention to firms that are managed by CEOs who exhibit over-confidence, given that such CEOs may be more aggressive in their tax policies and strategies. Using data from 7757 firms, we find that this is indeed the case. Such attention is even more pronounced in the instance of overconfident CEOs whose firms are financially constrained and/or financially distressed. We also find that the IRS has augmented its audit processes to give more attention to overconfident CEOs during and post financial crisis. This may be due to the increased vulnerability of their firms to external shocks, which consequently increases the incentives to embark on tax avoidance strategies, value-destroying investments, and/or highly biased financial reporting (and forecasting responses) to tax authorities. Our results are robust after accounting for the possibility of endogeneity and using a wide range of specifications, measures, and econometric models.

1. Introduction

Corporate tax avoidance has become a widespread phenomenon in the current business world (Kovermann and Velte, 2019). Thomsen and Watrin (2018) report that one out of 10 firms in the US had an effective tax rate of less than 20%. In fact, the effective tax rate in the US has declined over the last 25 years (Dyreng et al., 2017). This has raised serious challenges for tax enforcement agencies (Slemrod et al., 2001). Kubick et al. (2017) conclude that the probability of detection encourages more accurate reporting of income. Similarly, Hoopes et al. (2012) observe that a higher probability of IRS checking reduces the aggressiveness of firms' tax strategies. While it is evident that the Internal Revenue Service (IRS) would be seriously looking to deter tax avoidance, the nature of the relationship between tax avoidance and IRS enforcement is yet to be understood properly (Kubick et al., 2017). Particularly, little is known about how the IRS selects public taxpaying firms for audit examination (Bozanic et al., 2017), a question of increasing salience given that the IRS has endured budget austerity in recent years (Nessa et al., 2020). In this paper, we argue that an aggressive tax avoidance policy could be an outcome of managerial overconfidence; that is, a tendency of individuals to overestimate their own acumen, mastery and prospects. From a risk management perspective, overconfident CEOs have the tendency to underestimate the riskiness of their actions when they implement business strategy and organizational policy. In the context of tax avoidance and IRS audit, overconfident CEOs will tend to be too optimistic in estimating the ex-ante value/gains from tax avoidance, resulting in aggressive tax strategies, thereby generating undue attention from the IRS ex-post. Hence, the probability of the IRS selecting a firm managed by an overconfident CEO for audit purposes will increase as overconfidence stimulates seemingly suboptimal behaviour concerning key corporate decisions and outcomes.

The literature on the relationship between IRS scrutiny and firms that are involved in aggressive tax strategies is very limited and recent; what is known is that operating losses and tax loss carry forwards, GAAP, ETR, UTBs and DTAs[1] are all factors that may attract the IRS's attention (Bozanic et al., 2017). Recently, Fox and Wilson (2019) extended the literature through examining how financial restatements and internal control weaknesses serve as valuable signals to the IRS of an aggressive corporate culture of noncompliance. They concluded that financial restatements represented a strong signal to the IRS, helping the rapid identification of noncompliance (ibid.). Similarly, the IRS may

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[1] Generally accepted accounting principles (GAAP), effective tax rate (ETR), unrecognized tax benefits (UTBs) and deferred tax assets (DTAs).

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also select audit targets based on the possibility of suspected participation in abusive transactions (Nessa et al., 2020). We extend the "IRS Attention" literature by proposing that CEO overconfidence is another strong signal that the IRS may follow in selecting firms that might be engaging in an aggressive tax avoidance practice. Research suggests that firms respond to tax changes on the individual or corporate level (Dasilas and Grose, 2019). On the individual level, Dyreng et al. (2010) contend that CEOs help mould tax policies through their "tone at the top", which may involve altering the functional areas of the firm, directing resource allocations, and setting the tax director's compensation. Moreover, for overconfident CEOs, investment in tax avoidance strategies may represent an effective earnings management tool that eases their tax burden and improves their firms' internal cash flows (Hsieh et al., 2018). Considering these behavioural traits of CEOs that support aggressive tax policies within the firms, we argue that the IRS may select firms with overconfident CEOs as potential audit targets.

In addition, we highlight the extent to which the CEO overconfidence-IRS Attention nexus is moderated by factors such as financial constraints, financial distress and vulnerability to external shocks (i.e., financial crisis). The IRS mandates a strict review and analysis of firms' financial accounting disclosures (i.e., financial statements) as part of its audit planning process, and emphasizes the need to constantly augment its existing private information set (Hoopes et al., 2012; De Simone et al., 2019). Moreover, if overconfident CEOs are often associated with corporate tax avoidance (either directly or indirectly) and highly biased financial reporting and forecasting responses to tax authorities, then examining portions of their firm's 10-K disclosures could reveal vital company details that have not been reported to the IRS, such as narrative descriptions of the firm's goals, management style, intentions behind mergers and acquisitions, and estimations about future business prospects (Bozanic et al., 2017). Hence, firms managed by overconfident CEOs should receive greater IRS Attention.

Empirically, we follow Malmendier and Tate (2005, 2008) and Aktas et al. (2019), and utilize the executive's revealed beliefs from option exercise behaviour to measure CEO overconfidence. In our robustness tests, we follow Kaplan et al. (2021) and Otto (2014) to measure CEO overconfidence based on earnings guidance. To capture the attention the IRS pays to firms (IRS Attention), we use the novel dataset of IRS downloads of firms' annual reports (i.e., 10-Ks) from Bozanic et al. (2017). Although the IRS's usage of firms' financial disclosures may sometimes encourage firms to reduce the level of transparency in their disclosure choices, the "multi-audience problem" mitigates these effects, given that firms provide information not only to their investors but also to their competitors and other stakeholders (Bhojraj et al., 2004). Hence, firms have some interest in showing transparency towards their stakeholders, whilst simultaneously minimizing the likelihood that the disclosed tax information will be used against them by the IRS (Mills et al., 2010). We undertake the empirical analysis on a sample of US firms spanning the period from 2004 to 2015. Consistent with our hypothesis, we provide strong evidence that firms with overconfident CEOs tend to have greater IRS Attention. Employing a battery of robustness checks, we confirm the following three alternative explanations for the relation between CEO overconfidence and IRS Attention: (1) financial constraints; (2) financial distress; and (3) the financial crisis.

Accordingly, this study makes at least four primary contributions to the existing literature. First, we contribute to the financial accounting and tax accounting literatures (e.g., corporate tax avoidance, tax aggressiveness, tax policy) at the individual decision-maker level, rather than at the industry or firm level. Financial misreporting may signal an aggressive corporate culture, which may be fundamental for aggressive tax reporting, possibly for purposes other than shareholder value-maximization (Chyz, 2013; Biggerstaff et al., 2015). Moreover, corporate taxation has substantial costs and implications for firms' strategic policy, and tax aggressive policies or avoidance strategies can increase internal cash flows and ease financial constraints for overconfident firms (Edwards et al., 2015).

Secondly, the cockroach theory holds that, where one problem surfaces, there follow more problems that will surface in its wake. As such, where the IRS observes fraudulent activities, such as the deliberate misapplication of the GAAP, and starts to question the quality of the firm's financial information and exploring whether such quality issues might extend to tax filings, these actions may, in turn, initiate a cognitive response towards financial restatements (Fox and Wilson, 2019). Inherently, financial restatements are of particular interest to the IRS and accordingly are likely to garner greater attention. In doing this, we therefore seek to bridge the gap between behavioural finance and corporate financial reporting by showing that the effect of overconfidence is not only related to the choice (highly biased vs. less biased reporting; more conservative vs. less conservative reporting) and level of misstatements (intentional vs unintentional), but also extends to the level of IRS Attention accorded to overconfident firms in the process of regulating and enforcing tax laws.

Third, our evidence contributes to the stream of research examining the information users of EDGAR,[2] information acquisition via EDGAR, and their potential impact on corporate outcomes (e.g., Drake et al., 2015; Drake et al., 2017). We highlight the interplay between private disclosures to tax authorities and public disclosures to other stakeholders. The IRS data (Bozanic et al., 2017) provides vital insights into how the IRS may use the tax footnote data from public financial disclosures in its audit planning process to develop a "roadmap" for monitoring tax avoiding firms, and/or to augment its existing private information set on firm conditions, performance and reporting. We provide evidence to show that the IRS accesses publicly available financial disclosures in pursuit of historical tax-related information. Moreover, it is hoped that documenting the CEO overconfidence effect on IRS Attention will stimulate greater research attention from academics, practitioners and corporations interested in the IRS's response to corporate tax avoidance and its use of firm disclosures for both audit selection and support. For many years now, there has been a strong drive in the US and many other countries to more closely align CEO interests with those of shareholders, inter alia through providing shares as part of the reward package. If a CEO has a high personal stake in the firm, this might suggest that agency issues are reduced, making other shareholders better off as well. Yet, if this behaviour attracts tax investigations, then the relative merits of CEOs holding significant stock in the firm may be significantly less than what is commonly assumed.

Fourth, our findings suggest that there exists an inherent information asymmetry[3] between the IRS and firms, which consequently affects firms' willingness to report tax information. These information asymmetries increase the likelihood of CEOs investing in tax avoidance strategies and value-destroying investments, and submitting highly biased financial reporting (and forecasting responses) to tax authorities particularly when their firms are financially constrained, financially distressed and more vulnerable to external shocks (financial crisis). Hence, these conditions moderate the overconfidence-attention relation.

The remainder of the paper proceeds as follows: Section 2 briefly develops our main hypotheses. Section 3 details the data sources and methodology along with our variable specifications. Sections 4 and 5

[2] The Electronic Data Gathering, Analysis, and Retrieval system (EDGAR) is a repository of mandatory Security and Exchange Commission (SEC) disclosures hosted by the SEC.

[3] Information asymmetries between firm managers and lenders usually occur when insiders have better information about the firm's past and future economic performance and, consequently, about the firm's default risk (Bharath et al., 2008). Kubick et al. (2017) argue that the IRS enjoys an information advantage which arises from closer proximity and thus firms are less tax-aggressive when they are in closer proximity to the IRS. Along this line, Desai et al. (2007) suggest that the tax enforcement role of the IRS represents a vital corporate governance mechanism towards alleviating information asymmetry between controlling shareholders and outside investors.

present our primary empirical results and further analyses. Section 6 concludes the paper.

2. Literature review and empirical hypotheses

2.1. Corporate tax avoidance, CEO overconfidence and IRS attention

An effective tax system not only benefits the government by raising adequate revenue to finance public expenditure, but also, through ensuring greater transparency as to how much money a corporate really makes, could increase real firm value through reducing the scope for corporate insiders to extract private benefits (Desai et al., 2007; Desai and Dharmapala, 2009). Moreover, the classical principal-agent theory (Jensen and Meckling, 1976) postulates that tax avoidance could benefit managers as they can use this as a bargaining tool to improve their compensation packages (Desai and Dharmapala, 2006). Performance-linked CEO compensation mechanisms, such as share options or other contingent financial benefits, might encourage managers to focus on tax strategies (see Hanlon and Heitzman, 2010; Armstrong et al., 2015 for details on tax avoidance theories and explanations). Although tax avoidance might benefit corporate shareholders as it helps profit maximization, the existence of an agency problem eventually may lead the managers to use this to maximize their own performance-based rewards, even if shareholders ultimately end up being saddled with a costly investigation (Hanlon and Heitzman, 2010). As a result, corporate tax avoidance has attracted growing attention in academic literature (Dyreng et al., 2017). Formally speaking, tax avoidance may be defined as a deliberate effort by firms, either following legal or illegal means, to reduce tax liabilities (Lee et al., 2015).

In general terms, CEO overconfidence may have either a direct or an indirect impact on tax avoidance. A direct effect might exist when the net expected returns to tax avoidance increase with CEO overconfidence, particularly if overconfident CEOs estimate higher returns or lower costs to investments on account of tax avoidance (Chyz et al., 2019). The extra returns from tax avoidance may comprise a reduction in accounting tax expense and cash tax outflows (Dyreng et al., 2018). The costs of tax avoidance include explicit tax costs, to the extent that tax positions are overturned, and a variety of other costs, such as tax strategy implementation costs, implicit taxes, costs of IRS audits and subsequent litigation, and reputational penalties (Rego and Wilson, 2012; Gallemore et al., 2014). CEO overconfidence may alter the perceived costs vs benefits, and consequently lead to higher expected net returns from tax avoidance (Chyz et al., 2019). In the case of indirect effects, overconfident CEOs often overestimate their ability to generate earnings, thus creating discrepancies between their firms' actual performance and perceived earnings (Schrand and Zechman, 2012). These discrepancies can induce executives adopting proactive measures in the management of financial results in order to achieve their expectations and overconfidence goals (e.g., high levels of investment activities, dividend payouts, etc.) (Hribar and Yang, 2016). For overconfident CEOs, investment in tax avoidance strategies may represent an effective earnings management tool towards attaining their earnings target, whilst easing their tax burden and improving internal cash flows.

Taxpayers' characteristics and their reporting behaviour are vital information that provides valuable signals to the IRS about the potential audit targets. Bozanic et al. (2017) state that, due to resource constraint, the IRS will rely on signals to elect audit targets, rather than going through the costly procedure of examining a vast number of firms. Fox and Wilson (2019) observe that the IRS uses public information such as corporate restatement and internal control weakness as one such signal. They conclude that restatements signal possible tax misreporting and merit additional inspection. Presley and Abbott (2013) argue that overconfident CEOs tend to be unjustifiably optimistic about a firm's financial status: they are more likely to pursue aggressive accounting policies and believe that those are realizable in due course. Schrand and Zechman (2012) conclude that overconfident CEOs tend to show optimistic bias in their assessment about the firm's financial position, and therefore end up intentionally misstating their earnings. Therefore, we contend that these managerial traits of CEOs should in turn be incorporated in how the IRS selects public taxpaying firms for examination. We therefore propose that:

H1a. CEO overconfidence will be positively related to IRS Attention.

One of the main arguments to support our hypothesis above is that overconfident CEOs tend to avoid taxes, and hence the IRS should be more vigilant about the firms they head. We further argue that the overconfidence-IRS attention link would be stronger if overconfident CEOs actively pursued aggressive tax policies. Marr and Murray (2016) note that recent budget cuts led to a significant reduction in enforcement staff within the IRS. Building on this notion of budgetary austerity and how this might impact on IRS audit rate, Nessa et al. (2020) find that the former negatively affects the audit rate set by the IRS. Therefore, in the atmosphere of the IRS's limited resources, a fundamental question is how best to use these limited audit resources to maximize compliance (Gilpatric et al., 2011). Bozanic et al. (2017) state that, due to resource constraints, the IRS will rely on valuable signals from the public information a firm puts out to elect audit targets rather than going through the costly procedure of examining a vast number of firms (see also, Fox and Wilson, 2019). Existing research also highlights the increased prevalence of aggressive tax policies by firms, and this may be bound up with CEO overconfidence (see Chyz et al., 2019). We therefore propose that:

H1b. The overconfidence-IRS Attention relationship is strengthened when CEOs adopt more aggressive and deliberate tax policies and strategies.

2.2. CEO overconfidence and IRS Attention – the moderating role of financial constraint, financial distress and financial crisis

Tax avoidance by overconfident CEOs may be greater when the firm faces financial constraints, is going through financial distress and/or during a general financial crisis. There is sufficient literature to support the conjecture that financially constrained firms that are managed by overconfident CEOs pursue more aggressive tax planning strategies, as evidenced by (i) higher current and future unrecognized tax benefits, (ii) lower short- and long-run current and future effective tax rates, (iii) increase in tax haven usage for their material operations, and (iv) higher proposed audit adjustments from the IRS (Chen and Lai, 2012; Law and Mills, 2015). However, taxes have significant implications/costs for a firm and more aggressive tax policies can therefore increase internal cash flows, and hence ease financial constraints and misalignments between investment returns and perceived financing costs (Edwards et al., 2015; Kubick and Lockhart, 2017). This is particularly true since overconfident CEOs often perceive their firms as undervalued and thus view external finance as more costly (Malmendier and Tate, 2005, 2008).

Barberis and Thaler (2003) and Hackbarth (2009) suggest that overconfidence may lessen the underinvestment and risk-shifting problems (both of which are shareholder-bondholder conflicts) associated with CEOs (Ataullah et al., 2018). Overconfident CEO are likely to overestimate their ability and their firm's future performance, but underestimate the probability that their actions may lead to bankruptcy or financial distress (Ataullah et al., 2018). The latter underestimation increases the option value of waiting to risk-shift in a real-option model and hence mitigates the incentive to shift risk (Hackbarth, 2009). Firms that are financially distressed are more likely to be up against their borrowing constraints (Harrison and McMillan, 2003), and hence, when managed by overconfident CEOs, these firms may be more likely to invest in tax avoidance strategies, and report highly biased financial and forecasting responses to tax authorities primarily to underestimate and/or conceal their high bankruptcy risk, and achieve their investment goals.

In the wake of the 2008 financial crises, CEOs' overconfidence and their associate appetite for excessive risk taking have been widely blamed for corporate failures (Bui et al., 2020; Minhat and Abdullah, 2016; Yu, 2014). Ho et al. (2016) conclude that firms that were managed by overconfident CEOs accumulated greater leverage prior to the crisis, which thus made these firms very susceptible to shocks during the crisis. More specifically, overconfident CEOs were associated with greater loan defaults, reduced performance, greater likelihood of financial distress and expected default probability, and higher likelihood of CEO turnover/failure during the crisis (Dell'Ariccia and Marquez, 2006). Accordingly, their firms are likely to be much worse off than their peers after the end of a credit boom. Hence, they may be more likely to seek to identify and pursue more explorative, opaque and aggressive strategies (such as tax avoidance) in order to mitigate these adverse consequences. In such an instance, we expect that these actions should mandate greater attention from the IRS. In light of the above discussions, we propose that:

H2a. CEO overconfidence will attract more IRS Attention when the firm faces financial constraint.

H2b. CEO overconfidence will attract more IRS Attention when the firm is going through financial distress.

H2c. CEO overconfidence will attract more IRS Attention during and post financial crisis.

3. Methodology

3.1. Data sources and sampling

To construct the sample, we obtain the CEOs' stock and option holdings from ExecuComp and Boardex database, and the financial and accounting information from Compustat. We obtain the IRS data from Zahn Bozanic's website (see Bozanic et al., 2017). For CEO data, we used both ExecuComp and BoardEx (from WRDS) datasets to obtain coverage of the independent variables that is as complete as possible. We first download CEO data from ExecuComp data via WRDS. We begin by using CEOANN, which indicates that the executive served as CEO for all or most of the indicated fiscal year. Using only CEOANN= "CEO" to select the sample of CEOs results in 24,508 observations. However, in working with and merging ExecuComp data we observe that it contains false negatives (for some executives, the observations do not have the flag set to CEO, even though we confirm that they are CEO observations). To enable a comprehensive examination of our topic, we go further to use other relevant criteria on the ExecuComp data to extend our CEO sample where the IRS data is available but CEO data is missing (after the first criteria of selection). First, we use PCE= "CEO" where PCEO implies "CURRENT YEAR CEO". We notice that there are 4515 observations where the CEO is classified as current year CEO but the annual CEO flag in criteria 1 failed to indicate this. Hence, where the CEO data is not available in criteria 1, we replace it with criteria 2 (file attached). Second, we use TITLE, i.e., the title of the named executive officer for the most recent year on file, by dropping all titles without the mention of "CHIEF EXECUTIVE OFFICER" or "CEO". In doing this, we observe that there are 9779 observations with the title that includes "CHIEF EXECUTIVE OFFICER" or "CEO" but the observations are neither classified by the CEO flag nor PCEO. As such, where the data is missing, we follow up to the company's website to verify the information and to use the data. Lastly, for firms that have IRS data and yet could not meet the above criteria, we proceed to collect their data from Boardex. Boardex provides data on all board executives within the firm based on their salary, cash and share bonuses, and details of all equity awards – regular stock options and Long-Term Incentive Plan awards. Just as in criteria 1, we correct this by further searching within the executive role variable based on their roles in their director profiles and in their employment history. The initial sample comprises the intersection of firms that are included in the above-mentioned databases over the period 2004–2015. The sample period starts from 2004 and ends in 2015 due to the unavailability of data on IRS Attention prior to 2004 and after 2015. We exclude firms in the financial (SIC codes between 6000 and 6999) and utility (SIC codes between 4900 and 4999) sectors from the sample because of the regulated nature of these sectors (Lartey et al., 2020). We also exclude observations with missing values in the measurement of key dependent and independent variables. To limit the effect of outliers, we winsorize all continuous variables at the top and bottom 1%. The final sample consists of 50,844 firm-year observations with 7757 unique firms.

3.2. Estimation method

In this section, we model the empirical relation between CEO overconfidence and IRS Attention. Specifically, we employ the following econometric framework:

$$Attention_{i,t} = \alpha + \beta Overconfidence_{i,t} + \beta X_{i,t} + \omega_i + \varepsilon_{i,t} \quad (1)$$

Where i denotes the ith firm and t denotes fiscal year. Attention is the firm-level measures of IRS Attention defined in Section 3.3.1, Overconfidence is the measure of the CEOs' beliefs and tendency to overestimate (underestimate) returns (risks) to investments by year t, X is the vector of the control variables employed in our analysis, α and β are parameters, and ω_i is a firm-specific effect. We control for time fixed effects by including time dummies in all estimations. To control for possible heteroscedasticity and autocorrelation within firms, the estimated standard errors of the regression coefficients are clustered at the firm level.

3.3. Measurement of variables

3.3.1. IRS Attention

As noted above, we use the IRS Attention measure developed by Bozanic et al. (2017), which captures the IRS's use of firms' financial accounting disclosures via 10-K downloads. Inherently, the 10-K reveals vital company details that may not be reported to the IRS. These unreported details include narrative descriptions of company goals, management style, intentions behind M&A activities, and estimations about future business prospects (Bozanic et al., 2017). Thus, this measure offers novel evidence on the intensity with which the IRS reviews annual reports, possibly to utilize the tax footnotes as a "roadmap" or to augment the IRS's existing private information set. By using data on the timing and frequency with which the IRS accesses firms' annual reports (i.e., 10-Ks), IRS Attention is measured as the number of times in year t that a computer with an IRS IP address downloaded any of firm i's 10-Ks from EDGAR during the fiscal year. Unlike other studies that examine IRS enforcement activity using micro- or macro-data provided directly by the IRS (for e.g., Gleason and Mills, 2002; Guedhami and Pittman, 2008; El Ghoul et al., 2013; Hanlon et al., 2014), this measure captures IRS activity from data generated independent of the IRS. Moreover, the multi-audience nature of firm disclosures enhances the suitability of the measure since it is under less manipulation from firms.

For robustness purposes, we also utilize two alternative measures of IRS Attention that are weighted to more accurately reflect the importance of larger institutions (firm size). These are the Asset-Weighted IRS Attention and Capitalization-Weighted IRS Attention. Specifically, the original IRS Attention measure is weighted by total assets and total market capitalization of the firm, hence reflecting the relative importance and performance of institutions as captured by larger assets and equity market performance (Zheng, 1999). Higher values indicate greater IRS Attention. These measures have been proven by several valid tests in prior studies (Hoopes, Mescall and Pittman, 2012; Li et al., 2019; Fu et al., 2019).

3.3.2. CEO overconfidence

Our main proxy for overconfidence follows Malmendier and Tate (2005) and Aktas et al. (2019). The measure incorporates the CEOs' inherent beliefs and tendencies via their preference to not exercise stock options in a timely manner, relative to what would be rationally optimal for a risk-averse undiversified CEO (Hall and Murphy, 2002). Simply, the intuition is that, if a CEO's wealth is undiversified, a rational CEO will exercise deep in-the-money options in a timely manner. Hence, when the CEO is overconfident in his/her ability to keep the firm's stock price rising and profit from expected price increases, s/he will retain deep in-the-money options. The overconfidence measure (Holder67) is a variable equal to unity, if the CEO persistently (i.e., more than twice during the tenure period) postpones the exercise of 67% in-the-money options at least twice during the tenure period, and zero otherwise. We compute option moneyness as the per-option realizable value scaled by the estimated average exercise price (Campbell et al., 2011), where the per-option realizable value is computed as the total realizable value of exercisable options scaled by the number of exercisable options. The estimated average exercise price of the options is computed as the fiscal year-end stock price less the realizable value per option.

For robustness purposes, we follow prior literature (e.g. Kaplan et al., 2021; Otto, 2014) to measure CEO overconfidence based on earnings guidance. We collect earnings (EPS) forecasts and realizations from the Institutional Brokers' Estimate System (IBES) to produce two additional measures of overconfidence. First, we create the variable "High Forecast" by comparing the EPS forecasts released by a firm with the EPS that were eventually realized (Otto, 2014). Specifically, High Forecast is an indicator variable that equals 1 when a firm's EPS forecast exceeds realized EPS. Where a given firm provides an EPS range forecast rather than a point estimate, High Forecast equals 1 if the lower bound of the range exceeds the realized EPS. High Forecast captures more optimistic CEO beliefs about earnings, as higher values denote a larger fraction of forecasts that appear to be too high ex-post. Secondly, we create the variable "Point Estimate" based on whether or not a firm issues a point or range EPS forecast (Huang and Kisgen, 2013). A more confident CEO should be more likely to issue a point estimate (Kaplan et al., 2021). Therefore, Point Estimate is an indicator variable which equals 1 when a firm provides a point EPS forecast and equals 0 when a firm provides a range EPS forecast.

In further analysis, we further categorize overconfident CEOs into low (Holder30) versus high (Holder100) degree of confidence (Hribar and Yang, 2016; Humphery-Jenner et al., 2016). Given that overconfident CEOs allow exercisable stock options to go very deep in the money before exercising, we define Holder30 as where the CEO exercises stock options that are less than 30% in the money and does not hold other exercisable options that are greater than 30% in the money. This creates a variable which takes a value of unity if a CEO at least once during the tenure period holds an option until its final year of duration and the option is at least 40% in the money entering the last year, and zero otherwise. On the other hand, Holder100 is a variable equal to unity when the CEO at least once during the tenure period holds stock options that are at least 100% in the money, and zero otherwise.

3.3.3. Control variables

In line with empirical studies (Bozanic et al., 2017; Beladi et al., 2018; Li et al., 2019; Aktas et al., 2019; Danso et al., 2019) and for purposes of mitigating any chance of omitted variables, we control for other conventional firm-level and CEO-specific characteristics that are likely to affect IRS Attention. These are firm size, Tobin's Q, return on assets, leverage, earnings volatility, dividend, tax avoidance, financial constraint, investment, firm age, real and accrual earnings management, CEO age, CEO gender, CEO tenure and compensation. The incorporation of the executive/governance controls addresses residual endogeneity concerns that executive/governance characteristics may lead to overconfidence (Malmendier et al., 2015) as well as IRS Attention via tax avoidance/earnings management (Olsen and Stekelberg, 2015; Hsieh

Table 1
Description of variables.

Variables	Description
Independent Variables	
Holder67	An indicator variable equal to one if CEO hold options with average moneyness of at least 67% during the fiscal year.
Holder100	An indicator variable equal to one if CEO hold options with average moneyness of at least 100% during the fiscal year.
Holder30	An indicator variable equal to one if CEO hold options with average moneyness of less than 30% during the fiscal year.
High Forecast	An indicator variable that equals 1 when a firm's EPS forecast exceeds realized EPS.
Point Estimate	an indicator variable which equals 1 when a firm provides a point EPS forecast, and zero otherwise.
Dependent Variables	
IRS Attention	The number of times in year t that a computer with an IRS IP address downloaded any of firm i's 10-Ks from EDGAR during the fiscal year.
Asset-Weighted IRS Attention	IRS Attention scaled by the total assets of the firm. This measure captures any increases in IRS attention where the attention surges with the firms' size.
Capitalization-Weighted IRS Attention	IRS Attention scaled by the total market capitalization of the firm. This measure captures any increases in IRS Attention where the attention surges with firm's equity market performance.
Firm Specific Controls	
Firm size	The natural logarithm of the book value of Total Assets.
Tobin's Q	The market value of assets divided by the book value of assets. It proxies for growth prospects.
Return on assets	Return on assets is the operating income before depreciation divided by the book value of assets. It serves as a proxy for profitability and the availability of internal funds.
Book leverage	The summation of the book value of long-term debt and debt in current liabilities divided by market value of assets.
Earnings volatility	The standard deviation of a firm's return on assets over the previous five years (inclusion in the sample necessitates a firm to have at least three years of data during the prior five years).
Dividend	An indicator variable equal to one if a firm pays common dividends, and zero otherwise.
Tax Avoidance	Total tax expense over the most recent five years scaled by total pre-tax income minus total special items over the same period. It captures tax avoidance via the firm's permanent book-tax differences, such as investments in municipal bonds and participation in tax shelters.
Financial Constraint	The firm's interest expenditures scaled by total assets. It proxies for a firm's capabilities of obtaining loans when internal funds are insufficient. Where internal funds are insufficient, financial constraints are greater and thus, the higher the financing cost.
Investment	The net capital expenditure (capital expenditure minus depreciation) divided by the book value of total property, plant and equipment.
Firm Age	The natural logarithm of the time between when a firm goes public and the end of the fiscal year.
Forecast Lead	The average number of days between the date on which a forecast was issued and the end date of the relevant fiscal period.
Forecast Width	The relative width of each forecast range (i.e., the difference between the upper and the lower bound of the forecast), divided by the midpoint of the range.
Discretionary Accruals (DA)	The discretionary accruals in year t estimated from the modified Jones model: $\frac{TA_{i,t}}{AT_{i,t-1}} = b_0\left(\frac{1}{AT_{i,t-1}}\right) + b_1\left(\frac{\Delta SALES_{i,t}}{AT_{i,t-1}}\right) + b_2\left(\frac{PPE_{i,t}}{AT_{i,t-1}}\right) + b_3\left(\frac{IBXI_{i,t-1}}{AT_{i,t-1}}\right) + \varepsilon_{i,t}$ where TA is total accruals (i,e,. the difference between net income and cash flow from operations); AT is total assets; ΔSales is the change in revenues; PPE is the gross value of property, plant, and equipment; and IBXI is income before extraordinary items. The coefficient estimates from this equation is used to estimate the firm-specific normal accruals (NA) $NA_{i,t} = b_0\left(\frac{1}{AT_{i,t-1}}\right) + b_1\left(\frac{\Delta SALES_{i,t}}{AT_{i,t-1}}\right) + b_2\left(\frac{PPE_{i,t}}{AT_{i,t-1}}\right) + b_3\left(\frac{IBXI_{i,t-1}}{AT_{i,t-1}}\right)$ Discretionary accruals (DA) is the absolute value of the difference between total accruals and the fitted normal accruals, defined as: $\left\|DA_{i,t}\right\| = \left\|\frac{TA_{i,t}}{AT_{i,t-1}} - NA_{i,t}\right\| = \varepsilon_{i,t}$

(continued on next page)

Table 1 (*continued*)

Variables	Description
Real Earnings Management (REM)	The combined measure of the three standardized real earnings management proxies that equals ABCFO - ABPROD - ABDISX (Fang et al., 2021; Roychowdhury, 2006). $\frac{CFO_{i,t}}{AT_{i,t-1}} = b_0\left(\frac{1}{AT_{i,t-1}}\right) + b_1\left(\frac{SALES_{i,t}}{AT_{i,t-1}}\right) + b_2\left(\frac{\Delta SALES_{i,t}}{AT_{i,t-1}}\right) + \varepsilon_{i,t}$ $\frac{PROD_{i,t}}{AT_{i,t-1}} = b_0\left(\frac{1}{AT_{i,t-1}}\right) + b_1\left(\frac{SALES_{i,t}}{AT_{i,t-1}}\right) + b_2\left(\frac{\Delta SALES_{i,t}}{AT_{i,t-1}}\right) + b_3\left(\frac{\Delta SALES_{i,t-1}}{AT_{i,t-1}}\right) + \varepsilon_{i,t}$ $\frac{DISX_{i,t}}{AT_{i,t-1}} = b_0\left(\frac{1}{AT_{i,t-1}}\right) + b_1\left(\frac{SALES_{i,t}}{AT_{i,t-1}}\right) + \varepsilon_{i,t}$ where CFO is cash flow from operations; PROD is production costs (i.e., sum of COGS and change in inventories); DISX denotes discretionary expenditures (i.e., the sum of advertising expenses, R&D expenses, and SG&A). The abnormal CFO (ABCFO), abnormal production costs (ABPROD), and abnormal discretionary expenses (ABDISX) are the absolute values of the difference between the actual values and the normal levels predicted from the equations.
DTAX	The discretionary permanent book-tax difference for a firm in year *t-1* (Hasan et al., 2017; Frank et al., 2009). $DTAX_{i,t}$ is the residual, $\varepsilon_{i,t}$, from the regression: $PERM_{i,t} = \alpha + \beta_1 INTANG_{i,t} + \beta_2 UNCON_{i,t} + \beta_3 MII_{i,t} + \beta_4 CSTE_{i,t} + \beta_5 \Delta ANOL_{i,t} + \beta_6 PERM_{i,t-1} + \gamma_i + \varepsilon_{i,t}$ Where $PERM_{i,t} = BI_{i,t} - \left[\frac{CFTE_{i,t} + CFOR_{i,t}}{STR_{i,t}}\right] - \left[\frac{DTE_{i,t}}{STR_{i,t}}\right]$, and $PERM_{i,t-1}$ PERM for firm i in year t-1. $BI_{i,t}$ is pre-tax book income; $CFTE_{i,t}$ is current federal tax expense; $CFOR_{i,t}$ is current foreign tax expense; $DTE_{i,t}$ is deferred tax expense; $STR_{i,t}$ is statutory tax rate; $INTANG_{i,t}$ is goodwill and other intangibles; $UNCON_{i,t}$ is income (loss) reported under the equity method; $MII_{i,t}$ is income (loss) attributable to minority interest; $CSTE_{i,t}$ is current state income tax expense; $\Delta ANOL_{i,t}$ is change in net operating loss carry forwards, and γ_i is a three-digit industry effect. Fiscal year effects are accounted for using time dummies. FollowingFrank et al. (2009), we set all missing values to zero.
CEO Specific Controls	
CEO Age	CEO Age is the natural logarithm of the CEO's age at the time he/she becomes CEO.
CEO Tenure	CEO tenure is the natural logarithm of number of years the CEO has served in the position as of the end of the fiscal year. It is an additional proxy for CEO power.
Compensation	The natural logarithm of CEOs total compensation over the fiscal year. The sum of salary, bonus, total value of restricted stock granted, total value of stock options granted (estimated using Black-Scholes), long-term incentive payouts, and other compensation.
CEO Gender	An Indicator variable equal to 1 if the CEO is female, and zero otherwise

The table presents the mnemonics and description of each dependent and independent variable used in this paper.

et al., 2018) and thus cause a spurious association between CEO overconfidence and IRS Attention. Table 1 provides a summary of all the key variables used in our main analyses and their descriptions.

4. Results and discussion

4.1. Descriptive statistics and bivariate correlations

Table 2 provides the summary statistics of the variables for our empirical analysis. Panel A presents the aggregate summary statistics for all firm-level characteristics. Our first proxy for the dependent variable (IRS Attention) shows that, on average, the IRS downloaded the annual reports (10-Ks) of firms in our sample 31 times. Further, the weighted measures (Asset-Weighted IRS and Cap-Weighted IRS), show that, on average, firms in our sample have a 43% and 45% probability of attracting the attention of the IRS. On average, the option-based overconfidence measure identifies a proportion of 29.8% of overconfident CEOs-years, with an average of 30 10-K downloads annually, and a 51% and 52% likelihood of attracting the attention of the IRS when the relative importance and performance of institutions proxied by greater assets and equity market performance are incorporated into IRS decision-making. The proportion of overconfident CEOs-years is slightly larger than the 27.72% reported by Aktas et al. (2019) because our sample includes firm-year observations with market value of equity < 25 million. We capture the effect of market equity and firm size via the weighted measures of IRS Attention. Also, because we exclude observations with missing values in the dependent measures, the proportion of overconfident CEOs increases across time and by cross section, particularly in periods after the financial crisis. The overconfidence subsample has a significantly higher tax avoidance rate, firm size, Tobin's Q, ROA, leverage, dividend pay-out, earnings volatility, investment, firm age and CEO compensation.

In Table 3, we present the correlation between all the variables employed in our analysis. We first note that the correlations between our dependent variables (IRS Attention, Asset-Weighted IRS and Cap-Weighted IRS) are very high, hence suggesting that all the three alternative measures capture similar information (i.e., IRS Attention). A preliminary insight into the relationship between CEO overconfidence and IRS Attention is also demonstrated by the correlation matrix. We observe that the correlation (but not necessarily causal relationship) between each of the three measures of IRS Attention and CEO overconfidence (Holder67) is positive and significant (at the 1% level). Regarding the control variables, the correlation among them shows that there is no issue of multicollinearity. In general, the findings from both descriptive summary and the correlation matrix suggest that none of the variables suffer from any momentous biases (e.g., limited variation and heterogeneity or large outliers) that may likely plague our regression results.

4.2. CEO overconfidence and IRS attention

In Table 4, we present the empirical results of the impact of CEO overconfidence on the main measure of IRS Attention. Models 3 and 4 (5 and 6) incorporate firm fixed effects (industry fixed effects). The interpretation of the findings is based on models 5 and 6, which fully incorporate year and industry effects (using three-digit SIC). The other OLS models serve as robustness checks. The results show that CEO overconfidence (Holder67) is positively and significantly related to IRS Attention at the 1% level. This significant impact is achieved irrespective of whether we introduce the control variables or the firm or industry effects. The estimated coefficients imply that, economically, a point increase in overconfidence is associated with an increase in IRS download of firms' annual reports by about 11–62%.

We provide strong support for the positive relationship between CEO overconfidence and IRS Attention by using the alternative measures (i.e., Asset-Weighted IRS and Cap-Weighted IRS) in Table 5. Across all the models, Holder67 retains its positive effect on IRS Attention (at the 1% level) even when the relative importance and performance of institutions as proxied by greater assets and equity market performance is incorporated into IRS decision-making. Economically, we observe that a point increase in overconfidence is associated with an increase of about 8–46% (23–26%) in IRS Attention weighted by total assets (and market capitalization). Overall, these findings confirm Hypothesis 1a and are consistent with the view that overconfident CEOs tend to avoid corporate taxation via their preference for investments in tax avoidance strategies, value-destroying investments, and highly biased financial reporting (and forecasting responses) to tax authorities (Kubick and Lockhart, 2017; Hsieh et al., 2018; Chyz et al., 2019) and, because of this, firms managed by them are more likely to attract greater IRS Attention. As such, the intensity (timing and frequency) with which the IRS accesses a firm's annual reports (i.e., 10-Ks) to augment its existing private information set and for evidence of tax avoidance is high when the firms' CEOs are overconfident. This overconfidence effect is true even when the relative importance and performance of institutions as

Table 2
Descriptive statistics.

	Non-overconfident CEOs					Overconfident CEOs (Holder67)					Full Sample				
	Mean	S.D.	Min	P50	Max	Mean	S.D.	Min	P50	Max	Mean	S.D.	Min	P50	Max
IRS Attention	10.22	23.71	1.00	30.00	337.00	30.11 * **	11.41	10.00	52.00	450.00	30.83	13.37	0.00	1.00	450.00
Asset-Weighted IRS	0.42	0.16	0.00	0.43	1.00	0.51 * **	0.22	0.01	0.50	1.00	0.43	0.22	0.00	0.44	1.00
Cap-Weighted IRS	0.44	0.17	0.00	0.44	1.00	0.52 * **	0.24	0.09	0.51	1.00	0.45	0.23	0.00	0.45	1.00
High-Forecast	0.76	0.43	0.00	1.00	1.00	0.78 * **	0.41	0.00	1.00	1.00	0.78	0.41	0.00	1.00	1.00
Point-Forecast	0.08	0.28	0.00	0.00	1.00	0.24 * **	0.43	0.00	0.00	1.00	0.21	0.41	0.00	0.00	1.00
Firm Size	1.74	1.20	0.58	1.58	1.85	2.22 * **	1.25	1.72	2.11	2.53	3.29	1.25	0.58	2.17	2.53
Tobin's Q	1.45	2.30	0.02	1.17	12.86	5.51 * **	1.41	0.00	1.50	19.42	4.87	1.32	0.00	1.43	19.42
ROA	0.57	2.25	-4.71	0.16	1.58	2.06 * **	1.93	-1.93	1.13	9.02	1.01	1.96	-4.71	0.13	9.02
Leverage	0.07	2.03	-0.97	0.06	1.21	1.98 * *	5.58	-1.00	0.02	5.32	1.77	4.80	-1.00	0.02	5.32
Earnings Vol.	0.08	1.14	0.00	0.03	49.67	2.95 * **	3.43	0.00	0.06	23.22	2.60	3.11	0.00	0.06	23.22
Dividend	0.44	0.50	0.00	0.00	1.00	0.56 * **	0.44	0.00	0.00	1.00	0.62	0.45	0.00	0.00	1.00
Tax Avoidance	0.26	3.40	-1.05	0.29	1.65	0.40 * **	0.51	0.03	0.23	2.52	0.42	0.41	-1.05	0.08	2.52
Fin. Const.	0.02	0.29	0.00	0.01	14.69	0.69 * **	3.85	0.29	0.31	6.58	0.62	3.29	0.00	0.31	6.58
Investment	-0.18	2.23	-1.37	-0.03	1.11	0.72 * *	4.91	-3.50	0.23	12.37	0.66	2.34	-3.50	-0.03	12.37
Firm Age	3.08	0.69	0.10	3.05	4.18	2.30 * **	1.03	0.70	2.40	4.18	2.38	1.03	0.10	2.51	4.18
CEO Age	2.68	2.14	0.13	2.08	3.97	3.02 * **	4.08	0.92	1.85	4.47	2.99	3.92	0.13	1.88	4.47
CEO Tenure	1.88	1.02	0.76	1.81	3.68	2.14 * **	1.27	0.52	1.99	9.70	2.11	1.25	0.52	1.96	9.70
Compensation	2.48	0.90	0.05	2.35	9.55	2.54 * **	1.05	0.12	2.42	11.33	2.53	1.03	0.05	2.41	11.33
Gender	0.76	0.19	0.00	1.00	1.00	0.11 * **	0.31	0.00	0.00	1.00	0.20	0.40	0.00	0.00	1.00
DA	0.09	0.11	-0.00	0.02	0.35	1.28 * **	0.43	0.05	0.24	4.37	1.24	0.40	-0.00	0.29	4.37
RAM	0.03	0.02	-0.00	0.01	0.64	0.06 * **	0.03	0.02	0.13	2.76	0.09	0.07	-0.00	0.13	2.76
Observations	35,672					15,172					50,844				

This table presents the summary on firm and CEO characteristics for firms managed by overconfident vs rational CEOs. The sample comprises 50,844 firm-year observations with 7757 US firms (excluding utilities and financials) over the period 2004–2015. The variable descriptions are provided in Table 1 above. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

captured by greater assets and equity market performance are incorporated into IRS decision-making.

4.3. Robustness checks: CEO overconfidence based on earnings forecasts

To ensure robustness of our previous results, Tables 6 and 7 report regression results of the two EPS-based measures of overconfidence against IRS Attention. In all regression models, we include additional controls for "Forecast Lead" and "Forecast Width" to account for the forecasting behavior of the CEOs. Forecast Lead captures the differences in the timing of EPS forecasts and is measured as the average number of days between the date on which a forecast was issued and the end date of the relevant fiscal period. On the other hand, Forecast Width accounts for the average width of the EPS ranges that are forecast by the CEOs. Forecast Width is measured as the relative width of each forecast range (i.e., the difference between the upper and the lower bound of the forecast), divided by the midpoint of the range. Where the EPS forecast is a point estimate, we set the relative width to zero. These controls are vital given that range forecasts are classified as optimistic if the lower bound of the forecast exceeds the ex-post realized EPS. Therefore, all else equal, forecasts that specify a wider range are less likely to be classified as optimistic. In addition, the average width of the EPS forecasts may signal a CEO's confidence in the forecasts such that a more confident CEO would be more likely to issue a narrower forecast range (Otto, 2014).

Similar to the results under Holder67, both earnings-based measures (High Forecast and Point Forecast) are positively related to the IRS measures and significantly so at the 1% level. Economically, we observe that a point increase in High Forecast is associated with an increase of about 21–23%, 11–13% and 4–10% in IRS Attention, Asset-Weighted-IRS Attention and Capitalization-Weighted-IRS Attention, respectively. The other EPS-based measure, Point Estimate, is associated with an increase of about 12–45%, 4–36% and 13–31% in IRS Attention, Asset-Weighted-IRS Attention and Capitalization-Weighted-IRS Attention, respectively. Overall, this evidence suggests that the notion of CEO overconfidence is associated with the intensity (timing and frequency) with which the IRS accesses a firm's annual reports (i.e., 10-Ks) to augment its existing private information set and for evidence of tax avoidance is valid.

4.4. CEO overconfidence based on relatively high vs relatively low confidence

Our results indicate that firms managed by overconfident CEOs are more likely to attract greater attention from the IRS. In this section, we put the magnitude of the effects of CEO overconfidence on IRS Attention in perspective, and show that our results are robust to alternative overconfidence measures and econometric methods. Specifically, we augment our baseline specification to replace the Holder67 measure with Holder100 (CEOs with relatively high confidence) and Holder30 (CEOs with relatively low confidence). The results are reported in Table 8. Again, the interpretation of the results is based on models 3, 6, 9 and 12, which fully incorporate year fixed and industry effects. We note that the results show that high CEO confidence rather than low CEO confidence leads to greater IRS Attention. Particularly, we observe that, while firms managed by high-confident CEOs exhibit a positive and significant impact on IRS Attention, firms managed by low-confident CEOs are negatively associated with IRS Attention. Relative to rational CEOs, the likelihood of attracting the attention of the IRS is 15–39% greater for a firm with a high-confident CEO. For low-confident CEOs, the likelihood of attracting the attention of the IRS is 22–35% lessened relative to irrational CEOs. Overall, we find evidence consistent with our earlier findings that, the more overconfident a CEO is, the greater the likelihood of investing in tax avoidance strategies which mandate greater IRS Attention. This confirms the robustness of our results that the CEO overconfidence effect is not an artefact of functional form misspecification biases.

5. Further tests

5.1. Isolating the effect of tax avoidance

In this section, we perform further tests to highlight various channels through which the overconfidence and IRS Attention relation may manifest. First, for overconfident CEOs, investment in tax avoidance strategies may represent an effective earnings management tool that

Table 3
Correlation matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
IRS Attention	1.00																					
Asset-Weighted IRS	0.77 * **	1.00	1.00																			
Cap-Weighted IRS	0.67 * **	0.97 * **	1.00																			
Holder67	0.16 * **	0.13 * **	0.11 * **	1.00																		
High-Forecast	0.05 * **	0.12 * **	0.12 * **	0.22 * **	1.00																	
Bound-Forecast	0.10 * **	0.00	0.01	0.15 * **	0.28 * **	1.00																
Firm Size	0.08 * **	0.19 * **	0.17 * **	0.14 * **	0.03 * **	0.13 * **	1.00															
Tobin's Q	-0.01	-0.07 * **	-0.07 * **	0.01 * **	-0.03 * **	0.06 * **	0.04 * **	1.00														
ROA	0.00	0.00	0.01	-0.01	-0.01	-0.02 * **	0.00	-0.01 * **	1.00													
Leverage	-0.01	-0.07 * **	-0.07 * **	0.01 * **	0.02 * **	-0.05 * **	0.03 * **	0.10 * **	0.00	1.00												
Earnings Vol.	-0.02 * **	-0.13 * **	-0.12 * **	0.03 * **	0.02 * **	0.06 * **	0.07 * **	0.19 * **	0.02 * **	0.19 * **	1.00											
Dividend	0.14 * **	0.13 * **	0.10 * **	-0.12 * **	-0.05 * **	-0.13 * **	-0.22 * **	-0.02 * **	0.00	-0.02 * **	-0.04 * **	1.00										
Tax Avoidance	0.21 * **	0.31 * **	0.31 * **	0.21 * **	0.21 * **	0.20 * **	-0.01	-0.00	0.00	-0.00	-0.00	0.02 * **	1.00									
Fin. Const.	-0.00	-0.04 * **	-0.03 * **	0.01	0.02 * **	0.05 * **	0.01	0.04 * **	0.00	0.29 * **	0.12 * **	-0.01	-0.00	1.00								
Investment	0.00	0.02 * **	0.02 * **	-0.01	-0.01	0.03 * **	-0.01	-0.00	0.00	-0.00	-0.01	0.01 * **	0.00	-0.00	1.00							
Firm Age	0.19 * **	0.29 * **	0.27 * **	-0.24 * **	-0.02 * **	-0.07 * **	-0.19 * **	-0.05 * **	0.01	-0.01 * **	-0.04 * **	0.22 * **	0.01	-0.01	0.02 * **	1.00						
CEO Age	-0.04 * **	-0.05 * **	-0.09 * **	0.03 * **	0.02 * **	0.06 * **	-0.01	-0.03 * **	-0.01	-0.03 * **	-0.05 * **	-0.06 * **	-0.02 * **	-0.01 * **	0.01	-0.04 * **	1.00					
CEO Tenure	-0.05 * **	-0.08 * **	-0.07 * **	0.07 * **	-0.04 * **	0.10 * **	0.07 * **	0.00	-0.00	-0.00	0.01 * **	-0.13 * **	-0.00	0.01	-0.10 * **	-0.06 * **	-0.01	1.00				
Compensation	-0.05 * **	0.36 * **	0.37 * **	0.02 * **	0.15 * **	0.10 * **	0.04 * **	-0.06 * **	-0.00	0.01	-0.01	-0.13 * **	-0.01	-0.00	0.01	0.04 * **	-0.16 * **	0.20 * **	1.00			
CEO Gender	0.19 * **	0.09 * **	0.07 * **	-0.25 * **	-0.11 * **	-0.22 * **	-0.14 * **	-0.02 * **	0.01	-0.02 * **	-0.04 * **	0.17 * **	0.01 * **	-0.01	0.01	0.29 * **	-0.05 * **	-0.07 * **	-0.11 * **	1.00		
DA	0.00	0.00	0.00	0.00	-0.00	-0.00	0.00	0.01	-0.00	0.01	0.26 * **	-0.00	0.00	-0.02 * **	-0.00	0.00	-0.00	0.01	0.01	-0.00	1.00	
REM	0.00	0.01	0.01	-0.00	-0.01	0.01	-0.01	-0.02 * **	0.04 * **	-0.07 * **	-0.19 * **	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01	0.00	0.56 * **	1.00

This table presents the correlation matrix for the data. The sample and variable definitions are as described in Table 1. * ** indicates significance at 1% or better.

Table 4
Overconfidence on IRS Attention.

	(1)	(2)	(3)	(4)	(5)	(6)
Holder67	0.657 * **	0.322 * **	0.230 * **	0.112 * **	0.622 * **	0.344 * **
	(0.046)	(0.095)	(0.051)	(0.043)	(0.049)	(0.107)
Firm Size		0.043 * *		0.047 * *		0.043 * *
		(0.018)		(0.022)		(0.021)
Tobin's Q		-0.003		0.018		0.003
		(0.009)		(0.026)		(0.011)
ROA		0.003 * **		0.003 * *		0.001
		(0.001)		(0.002)		(0.001)
Leverage		0.056		-0.027		-0.045
		(0.107)		(0.183)		(0.120)
Earnings Vol.		-0.004		-0.004		-0.004
		(0.003)		(0.005)		(0.005)
Dividend		-0.245 * **		-0.028		-0.342 * **
		(0.060)		(0.091)		(0.080)
Tax Avoidance		0.102 * **		0.103 * **		0.101 * **
		(0.002)		(0.004)		(0.002)
Fin. Const.		0.458		0.384 * *		0.423
		(0.677)		(0.179)		(0.810)
Investment		-0.009		0.003		-0.019
		(0.009)		(0.009)		(0.014)
Firm Age		-0.337 * **		0.682 * **		-0.348 * **
		(0.038)		(0.187)		(0.043)
CEO Age		0.071 * **		0.007		0.072 * **
		(0.010)		(0.014)		(0.012)
CEO Tenure		0.033 *		-0.044		0.095 * **
		(0.019)		(0.052)		(0.027)
Compensation		0.135 * **		0.002		0.161 * **
		(0.029)		(0.027)		(0.034)
CEO Gender		-0.143 * *		-0.177		-0.113
		(0.069)		(0.170)		(0.084)
DA		0.001		0.001		0.008
		(0.002)		(0.002)		(0.006)
REM		0.004		0.006		0.019
		(0.004)		(0.005)		(0.012)
_cons	44.275 * **	45.160 * **	44.760 * **	43.181 * **	44.058 * **	44.347 * **
	(0.045)	(0.158)	(0.049)	(0.544)	(0.049)	(0.189)
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm Effect	No	No	Yes	Yes	No	No
Industry Effect	No	No	No	No	Yes	Yes
N	50,844	49,549	50,844	49,549	50,844	49,549
r2	0.061	0.088	0.066	0.059	0.122	0.198
N_clust	7757	7678	7757	7678	7757	7678

This table presents the OLS estimation results of the effects of CEO overconfidence on IRS Attention. Standard errors robust to heteroscedasticity and clustering within firm-level are given in parentheses. All variable definitions are as described in Table 1. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

eases their tax burden and improves their firms' internal cash flows (Hsieh et al., 2018). Therefore, we examine the behavioural traits of CEOs that support aggressive tax policies that are more likely to get their firms selected by the IRS as potential audit targets. We rely on two measures of tax avoidance to capture different aspects of corporate tax planning. First, the effective tax rates (ETR), which is measured as total tax expense over the most recent five years scaled by total pre-tax income minus total special items over the same period. ETR captures the consequences of broad tax avoidance practices that reduce the firm's taxes relative to its pre-tax accounting income such as through investment in municipal bonds and participation in tax shelters (Hasan et al., 2017). Second, to capture more risky tax avoidance, we use Frank et al.'s (2009) discretionary permanent book-tax difference measure (DTAX) (Table 1 reports the detailed definitions of the variables in the DTAX estimation). DTAX captures more aggressive and deliberate corporate tax avoidance practices of overconfident CEOs. Higher ETR or DTAX implies a greater extent of corporate tax avoidance.

In Table 9, we augment our baseline specification to include interactions between the overconfidence indicator and variables for tax avoidance. In models 1–4, we also introduced a high (ETR>P75) vs low (ETR<P25) tax avoidance measure for firms. In models 5–8, we further divide the DTAX, based on their signs, into negative and positive discretionary tax avoidance, and test their impact on overconfidence and IRS Attention. A positive residual (High DTAX) implies that the firm is engaged in aggressive and deliberate corporate tax avoidance practices, and vice versa for a negative residual (Low DTAX). We observe that the estimated impact of CEO overconfidence on IRS Attention remains unchanged. The coefficients on all the overconfidence-tax avoidance interaction variables are positive and statistically significant. Following the grouping of firms into high vs low tax avoidance subsamples, we observe that, although the coefficients on all the overconfidence-tax avoidance interaction variables are statistically significant (at the 1% level), the relation is positive for overconfident CEOs associated with high tax avoidance motives but negative for those with low tax avoidance motives. A key explanation for these results is that, if overconfident CEOs are often associated with corporate tax avoidance (either directly or indirectly), then examining portions of their firms' 10-K disclosures could reveal vital company details that have not been reported to the IRS, such as narrative descriptions of the firms' goals, management style, intentions behind mergers and acquisitions, and estimations about future business prospects (Bozanic et al., 2017). This is consistent with Hypothesis 1b that, inherently, an aggressive tax avoidance policy could be an outcome of managerial overconfidence; hence, increasing the probability of the IRS selecting a firm for audit purposes. Simply, for overconfident CEOs who tend to support more aggressive and deliberate tax policies/strategies within their firms, the

Table 5
Overconfidence on IRS Attention.

	Asset-Weighted-IRS			Capitalization-Weighted-IRS		
	(1)	(2)	(3)	(4)	(5)	(6)
Holder67	0.429 * **	0.081 * **	0.464 * **	0.228 * **	0.255 * **	0.242 * **
	(0.121)	(0.023)	(0.137)	(0.063)	(0.027)	(0.065)
Firm Size	0.085 *	0.058 * *	0.108 * *	0.039 * **	0.082 * **	0.050 * **
	(0.044)	(0.027)	(0.047)	(0.014)	(0.008)	(0.015)
Tobin's Q	-0.653 * *	-0.505 * *	-0.662 * *	0.495 * **	0.504 * **	0.446 * **
	(0.260)	(0.257)	(0.289)	(0.127)	(0.055)	(0.136)
ROA	0.006	0.000	0.007	-0.003 * *	-0.001	-0.003 *
	(0.005)	(0.001)	(0.007)	(0.002)	(0.001)	(0.002)
Leverage	-0.614	-0.819 * *	-0.765	-1.336 * **	-1.185 * **	-1.232 * **
	(0.454)	(0.367)	(0.563)	(0.150)	(0.120)	(0.148)
Earnings Vol.	-0.287 * *	-0.238 * **	-0.322 * *	0.007	0.020 * **	0.005
	(0.120)	(0.073)	(0.128)	(0.009)	(0.004)	(0.013)
Dividend	-0.213 * **	0.161	-0.302 * **	0.201 * **	0.134 * **	0.207 * **
	(0.077)	(0.153)	(0.109)	(0.034)	(0.037)	(0.037)
Tax Avoidance	0.103 * **	0.100 * **	0.103 * **	0.101 * **	0.101 * **	0.101 * **
	(0.002)	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)
Fin. Const.	0.172 * *	0.034	0.176 * *	0.299 *	0.276	0.195
	(0.074)	(0.043)	(0.088)	(0.174)	(0.216)	(0.169)
Investment	0.000	0.033	-0.029	0.010	0.015	0.011
	(0.027)	(0.061)	(0.039)	(0.015)	(0.024)	(0.020)
Firm Age	-0.432 * **	-0.137	-0.489 * **	-0.072 * *	-0.028	-0.087 * **
	(0.109)	(0.392)	(0.121)	(0.029)	(0.094)	(0.031)
CEO Age	0.042	0.015	0.055	-0.042 * **	-0.054 * **	-0.042 * **
	(0.030)	(0.017)	(0.038)	(0.009)	(0.009)	(0.010)
CEO Tenure	-0.311 * **	0.074	-0.419 * **	0.025	0.045	0.002
	(0.088)	(0.125)	(0.148)	(0.020)	(0.037)	(0.027)
Compensation	-0.054	-0.101 *	-0.047	-0.413 * **	-0.245 * **	-0.422 * **
	(0.134)	(0.061)	(0.157)	(0.061)	(0.022)	(0.064)
CEO Gender	0.149	-0.090 * *	0.130	0.347 * **	0.123 * **	0.322 * **
	(0.110)	(0.042)	(0.124)	(0.063)	(0.036)	(0.062)
DA	-0.006	0.000	-0.012	0.000	0.000	-0.000
	(0.004)	(0.001)	(0.009)	(0.001)	(0.000)	(0.002)
REM	0.013	0.008	0.019	0.005	0.001	0.005
	(0.023)	(0.009)	(0.034)	(0.005)	(0.002)	(0.007)
_cons	-1.662	-3.488	-1.782	-3.868 * **	-2.643 * **	-3.986 * **
	(1.015)	(2.280)	(1.104)	(0.441)	(0.436)	(0.433)
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm Effect	No	Yes	No	No	Yes	No
Industry Effect	No	No	Yes	No	No	Yes
N	49,549	49,549	49,549	49,549	49,549	49,549
r2	0.240	0.147	0.286	0.609	0.595	0.690
N_clust	7678	7678	7678	7678	7678	7678

This table presents the OLS estimation results of the effects of CEO overconfidence on alternative measures of IRS Attention. Standard errors robust to heteroscedasticity and clustering within firm-level are given in parentheses. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

IRS may more likely select their firms as potential audit targets.

5.2. Addressing potential endogeneity

In this section, we address one key caveat to our results: the issue of potential endogeneity through omitted variables ("unobserved heterogeneity"), simultaneity (reverse causality) or measurement errors, thus the concern that CEO overconfidence may be correlated with a variable that has been omitted from the analysis but that partly determines IRS Attention. Also, where CEOs' past performance is driven by aggressive tax policies or tolerance for investments in tax avoidance strategies, they may tend to remain highly overconfident (Chyz et al., 2019). Where a measurement error (i.e., a mismeasurement of a key variable such as overconfidence) is present in an empirical model, this could produce biased regression coefficients. Therefore, while we control for firm and year fixed effects, and firms are included only if they have variables to construct our key dependent and independent variables, we took extra steps to address any potential endogeneity issues and show that our findings remain robust.

We re-estimate our main models using the 2-step Generalized Method of Moments (GMM) (Blundell and Bond, 1998). In line with prior literature on overconfidence (e.g. Bruin et al., 2012; Ho et al., 2016), we employ the age of the CEO (CEO Age) as instrumental variable. Empirically, the relation between CEO Age and the degree of confidence is driven by how cognitively demanding a task, such as hiding tax or financial information from the IRS, is (Bruin et al., 2012). Additionally, it has been argued that, in more demanding jobs, overconfidence is likely to come with seniority (Ho et al., 2016)[4]; surviving in such roles may impart a feeling of invincibility. In the two-stage model, we treat overconfidence as an endogenous variable that we instrument with CEO Age in the first stage. Specifically,

Stage 1. We regress overconfidence on the instrument and other exogenous variables of the model

$$P\left(Overconfidence_{i,t} = 1|CEO \quad Age_{i,t}, X_{i,t}\right) = L\left(\delta_1 + \quad \delta CEO \quad Age_{i,t} + \theta' X_{i,t} + \omega_i + v_t + \quad \varepsilon_{i,t}\right)$$

Stage 2. We replace overconfidence in the main regression in Eq. (1) with the fitted value of overconfidence derived from the first stage:

[4] We, however, do not imply that the instrument has a direct economic impact on IRS Attention. Therefore, CEO Age may not be correlated with the error term in the second-stage regression.

Table 6
Overconfidence on IRS Attention - EPS forecast.

	IRS Attention			Asset-Weighted-IRS			Capitalization-Weighted-IRS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
High Forecast	0.227 * **	0.207 * **	0.207 * **	0.128 * **	0.105 * **	0.120 * **	0.095 * **	0.039 * *	0.081 * **
	(0.062)	(0.073)	(0.068)	(0.011)	(0.013)	(0.012)	(0.023)	(0.018)	(0.025)
Firm Size	0.060 * *	0.011	0.065 * *	0.008	-0.001	0.010	-0.024 * **	-0.072 * **	-0.031 * **
	(0.025)	(0.028)	(0.029)	(0.006)	(0.001)	(0.009)	(0.009)	(0.006)	(0.009)
Tobin's Q	0.013	0.041	0.044	0.038 * **	0.022 * **	0.024 *	-0.798 * **	-0.574 * **	-0.753 * **
	(0.021)	(0.039)	(0.031)	(0.011)	(0.008)	(0.012)	(0.031)	(0.035)	(0.034)
ROA	0.003 * **	0.003 *	0.001	0.000	0.000	0.000 *	0.003 * *	0.001	0.003 * *
	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Leverage	0.237	-0.022	0.174	-0.108 * *	-0.043 *	-0.116 *	0.698 * **	1.140 * **	0.669 * **
	(0.178)	(0.275)	(0.207)	(0.052)	(0.024)	(0.061)	(0.096)	(0.117)	(0.098)
Earnings Vol.	0.016 *	-0.013 *	0.139	0.013	0.004	0.361 *	-0.021 * **	-0.034 * *	-0.265 * **
	(0.009)	(0.007)	(0.176)	(0.016)	(0.004)	(0.190)	(0.007)	(0.014)	(0.077)
Dividend	-0.224 * **	-0.041	-0.313 * **	-0.025	-0.002	-0.010	-0.153 * **	-0.065 *	-0.140 * **
	(0.070)	(0.113)	(0.095)	(0.016)	(0.007)	(0.021)	(0.030)	(0.038)	(0.032)
Tax Avoidance	0.102 * **	0.104 * **	0.102 * **	0.101 * **	0.100 * **	0.101 * **	0.100 * **	0.101 * **	0.101 * **
	(0.002)	(0.004)	(0.002)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Fin. Const.	-0.070	-0.134	-0.294	0.523	0.717 * **	0.064	0.154 * **	0.083 * **	0.140 * **
	(0.207)	(0.242)	(0.263)	(0.626)	(0.226)	(0.686)	(0.021)	(0.022)	(0.019)
Investment	-0.031	0.032	-0.087	-0.075 *	0.044 * **	-0.067	-0.025	-0.103 * *	-0.011
	(0.030)	(0.061)	(0.056)	(0.043)	(0.016)	(0.055)	(0.031)	(0.041)	(0.032)
Firm Age	-0.417 * **	0.902 * **	-0.433 * **	-0.010	-0.047 * *	-0.012	0.002	-0.137	0.016
	(0.046)	(0.233)	(0.052)	(0.014)	(0.019)	(0.018)	(0.020)	(0.085)	(0.021)
CEO Age	0.094 * **	-0.004	0.094 * **	0.023 * **	-0.008 * *	0.022 * *	0.028 * **	0.056 * **	0.031 * **
	(0.017)	(0.024)	(0.021)	(0.007)	(0.003)	(0.009)	(0.008)	(0.012)	(0.009)
CEO Tenure	0.049 *	-0.097	0.124 * **	0.041 * **	0.059 * **	0.070 * **	-0.015	-0.045	0.019
	(0.029)	(0.079)	(0.041)	(0.009)	(0.015)	(0.013)	(0.018)	(0.039)	(0.023)
Compensation	0.151 * **	-0.002	0.195 * **	0.036 * **	0.013 * **	0.044 * **	0.297 * **	0.253 * **	0.311 * **
	(0.040)	(0.041)	(0.051)	(0.011)	(0.004)	(0.014)	(0.020)	(0.023)	(0.022)
CEO Gender	-0.157 * *	-0.146	-0.144 *	-0.142 * **	0.014 * **	-0.132 * **	-0.111 * **	0.016	-0.093 * **
	(0.069)	(0.179)	(0.086)	(0.012)	(0.005)	(0.012)	(0.028)	(0.035)	(0.030)
Forecast width	0.001	0.000	0.000	0.002 * **	-0.000	0.002 * *	0.006 * **	0.008 * **	0.006 * **
	(0.003)	(0.003)	(0.005)	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)	(0.002)
Forecast Lead	-0.000	-0.000	-0.000	0.000 * **	0.000	0.000 * **	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DA	0.003	0.003	0.012	-0.000	-0.000	0.001 *	0.001 * *	0.001 *	-0.001
	(0.002)	(0.003)	(0.009)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
REM	0.013	0.013	0.012	0.006 * *	0.000	0.013 * *	-0.003	0.002	0.012 *
	(0.010)	(0.009)	(0.020)	(0.003)	(0.001)	(0.006)	(0.004)	(0.003)	(0.007)
_cons	45.434 * **	42.821 * **	44.490 * **	0.105 *	0.118	0.165 * *	4.197 * **	2.548 * **	4.280 * **
	(0.181)	(0.672)	(0.225)	(0.064)	(0.075)	(0.081)	(0.145)	(0.357)	(0.150)
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Effect	No	Yes	No	No	Yes	No	No	Yes	No
Industry Effect	No	No	Yes	No	No	Yes	No	No	Yes
N	47,842	47,842	47,842	47,842	47,842	47,842	47,842	47,842	47,842
r2	0.085	0.064	0.210	0.147	0.136	0.261	0.768	0.647	0.827
N_clust	7322	7322	7322	7322	7322	7322	7322	7322	7322

This table presents the OLS estimation results of the overconfidence-attention nexus using earnings-based overconfidence measure. Standard errors robust to heteroscedasticity and clustering within firm-level are given in parentheses. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

$$Attention_{i,t} = \alpha + \quad \beta\widehat{Overconfidence}_{i,t} + \beta' X_{i,t} + \omega_i + \nu_t + \quad \varepsilon_{i,t}$$

where L is the logistic distribution, $Overconfidence_{i,t}$ is an indicator variable equal to one if firm i in year t is managed by an overconfident CEO, and zero otherwise, $\widehat{Overconfidence}_{i,t}$ is the predicted value of overconfidence from the first-stage regression, $CEO\ Age_{i,t}$ is the age of CEO, $X_{i,t}$ is a vector of control variables from firm i in year t (see Table 1), ω_i and ν_t capture firm fixed effects and year effect, respectively, and $\varepsilon_{i,t}$ is the random error.

Table 10 reports the 2-step estimation results with GMM standard errors. Model 1 reports the first-stage results relating CEO overconfidence to CEO Age and other exogenous variables of the model. Consistent with the hypothesized economic intuition between our instrument and CEO overconfidence, the first-stage results show that overconfidence is positively related to CEO Age, and the coefficient is statistically significant at the 1% level. Also, our diagnostic tests confirm the relevance and validity of our tests.[5] Models 2, 3 and 4 report the second-stage regression results of IRS Attention on the fitted value of overconfidence and the corresponding exogenous control variables. The coefficients of CEO overconfidence on the three variations of IRS Attention are positive and significant (at the 1% level) across all the models. These results corroborate our core findings which suggest that a higher degree of CEO confidence increases the level of IRS Attention

[5] The Hansen J-statistics p-values are all in excess of 0.1, indicating that the over-identifying restrictions are valid (e.g., Baum et al., 2003). Also, the Kleibergen-Paap rk Wald F statistics, compared with the Stock-Yogo IV critical values, rule out weak instrument problems: they are all larger than the rule-of-thumb minimum of 10 (Baum, 2006).

Table 7
Overconfidence on IRS Attention – EPS forecast.

	IRS Attention			Asset-Weighted-IRS			Capitalization-Weighted-IRS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Point Estimate	0.453 * **	0.123 * *	0.385 * **	0.358 * **	0.040 * **	0.359 * **	0.310 * **	0.134 * **	0.301 * **
	(0.049)	(0.057)	(0.061)	(0.030)	(0.009)	(0.033)	(0.036)	(0.034)	(0.037)
Firm Size	0.047 *	0.013	0.052 *	-0.002	-0.002	-0.001	-0.030 * **	-0.075 * **	-0.038 * **
	(0.024)	(0.028)	(0.029)	(0.006)	(0.001)	(0.009)	(0.009)	(0.006)	(0.009)
Tobin's Q	0.022	0.039	0.055 *	0.046 * **	0.022 * **	0.035 * **	-0.788 * **	-0.571 * **	-0.741 * **
	(0.021)	(0.039)	(0.031)	(0.010)	(0.008)	(0.012)	(0.031)	(0.035)	(0.034)
ROA	0.003 * **	0.003 *	0.001	0.000 * **	0.000	0.001 * *	0.003 * *	0.001	0.003 * *
	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Leverage	0.270	-0.027	0.201	-0.078	-0.041 *	-0.086	0.704 * **	1.138 * **	0.673 * **
	(0.178)	(0.276)	(0.209)	(0.049)	(0.024)	(0.057)	(0.095)	(0.116)	(0.097)
Earnings Vol.	0.017 * *	-0.015 * *	0.101	0.013	0.005	0.312 *	-0.019 * *	-0.031 * *	-0.278 * **
	(0.008)	(0.007)	(0.170)	(0.014)	(0.004)	(0.177)	(0.008)	(0.015)	(0.074)
Dividend	-0.212 * **	-0.044	-0.306 * **	-0.015	-0.001	-0.002	-0.159 * **	-0.061	-0.146 * **
	(0.070)	(0.112)	(0.095)	(0.016)	(0.007)	(0.021)	(0.030)	(0.038)	(0.032)
Tax Avoidance	0.102 * **	0.104 * **	0.102 * **	0.101 * **	0.100 * **	0.101 * **	0.101 * **	0.101 * **	0.101 * **
	(0.002)	(0.004)	(0.002)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Fin. Const.	-0.115	-0.110	-0.319	0.090	0.640 * **	-0.230	0.151 * **	0.081 * **	0.138 * **
	(0.208)	(0.242)	(0.265)	(0.589)	(0.221)	(0.644)	(0.021)	(0.022)	(0.019)
Investment	-0.037	0.037	-0.097 *	-0.079 *	0.042 * **	-0.074	-0.030	-0.107 * **	-0.018
	(0.029)	(0.061)	(0.055)	(0.044)	(0.015)	(0.056)	(0.033)	(0.040)	(0.034)
Firm Age	-0.425 * **	0.899 * **	-0.438 * **	-0.017	-0.046 * *	-0.017	-0.014	-0.141 *	0.001
	(0.046)	(0.232)	(0.052)	(0.014)	(0.019)	(0.018)	(0.020)	(0.085)	(0.021)
CEO Age	0.088 * **	-0.004	0.090 * **	0.019 * **	-0.008 * *	0.018 * *	0.028 * **	0.056 * **	0.031 * **
	(0.016)	(0.024)	(0.020)	(0.007)	(0.003)	(0.009)	(0.008)	(0.012)	(0.009)
CEO Tenure	0.032	-0.093	0.109 * **	0.028 * **	0.057 * **	0.056 * **	-0.020	-0.048	0.016
	(0.029)	(0.079)	(0.040)	(0.008)	(0.015)	(0.012)	(0.018)	(0.038)	(0.023)
Compensation	0.150 * **	-0.002	0.195 * **	0.032 * **	0.013 * **	0.040 * **	0.302 * **	0.254 * **	0.317 * **
	(0.039)	(0.041)	(0.050)	(0.010)	(0.004)	(0.013)	(0.020)	(0.023)	(0.022)
CEO Gender	-0.114	-0.147	-0.111	-0.104 * **	0.014 * **	-0.097 * **	-0.094 * **	0.016	-0.077 * **
	(0.070)	(0.179)	(0.087)	(0.009)	(0.005)	(0.010)	(0.028)	(0.034)	(0.030)
Forecast width	0.002	-0.000	0.001	0.001 *	-0.000	0.001 *	0.007 * **	0.008 * **	0.006 * **
	(0.002)	(0.003)	(0.005)	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)	(0.001)
Forecast Lead	0.000	-0.000	0.000	0.000 * *	0.000 *	0.000 * *	0.000 * **	0.000 * **	0.000 * **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DA	0.003	0.003	0.012	0.000	0.000	0.001 *	0.001 *	-0.001	-0.000
	(0.002)	(0.003)	(0.009)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
REM	0.012	0.013	0.010	0.005 * *	0.000	0.012 *	-0.003	0.002	0.012 *
	(0.010)	(0.009)	(0.020)	(0.003)	(0.001)	(0.006)	(0.004)	(0.003)	(0.007)
_cons	45.479 * **	42.849 * **	44.527 * **	-0.095	0.111	-0.160 * *	4.018 * **	2.459 * **	4.085 * **
	(0.175)	(0.665)	(0.221)	(0.060)	(0.075)	(0.078)	(0.148)	(0.360)	(0.152)
N	7842	7842	7842	7842	7842	7842	7842	7842	7842
r2	0.088	0.064	0.212	0.219	0.146	0.321	0.771	0.648	0.829
N_clust	2322.000	2322.000	2322.000	2322.000	2322.000	2322.000	2322.000	2322.000	2322.000

This table presents the OLS estimation results of the overconfidence-attention nexus using earnings-based overconfidence measure. Standard errors robust to heteroscedasticity and clustering within firm-level are given in parentheses. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

because firms managed by overconfident CEOs tend to be significantly associated with greater investments in tax avoidance strategies and/or more aggressive corporate tax policies. This particularly holds for firm behaviour where the firm has relative importance and performance as evidenced by greater assets and equity market performance. Overall, the results suggest that the findings are not plagued by endogeneity problems and that the main results reported in Tables 4 and 5 above are robust with respect to an alternative econometric model.

5.3. Exogenous shocks via changes in tax rules

We address identification issues associated with examining the relation between CEO overconfidence and IRS Attention using tax data from US states,[6] where rate changes are frequent. We utilize the changes in state tax policy via corporate tax rate changes since tax rate changes can directly affect the net present value of an investment, and hence play a significant role in determining a CEO's investment decisions (Armstrong et al., 2019). Theoretically, tax rate increments should increase the cost of corporate investments and hence result in lower capital investment by firms (Jorgenson, 1963; Hall and Jorgenson, 1967). However, CEOs may become overconfident by perceiving themselves as relatively possessing very accurate knowledge about future events and thus overestimate their ability to achieve favourable future outcomes (Lartey and Danso, 2022). Under such scenarios, changes in state tax

[6] A multistate setting provides advantages for studying the tax effect. First, we did not observe any major tax policy change at the federal level during our sample period. Secondly, state tax rate changes occur more frequently than on the federal level, and states share more homogeneous non-tax factors (e.g., culture, federal regulations, labour costs and quality) than do countries. In addition, staggered changes in state tax rates affect only a subset of firms, which makes the multistate setting more attractive than the country-level setting as an identification strategy (Kim, 2017).

Table 8
High vs Low Overconfidence on IRS Attention.

	High Confidence						Low Confidence					
	IRS Attention			Capitalization-Weighted-IRS			IRS Attention			Capitalization-Weighted-IRS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Holder100	0.352 * **	0.201 * **	0.385 * **	0.145 * *	0.215 * **	0.154 * *						
	(0.106)	(0.068)	(0.116)	(0.064)	(0.030)	(0.070)						
Holder30							-0.192 *	-0.116 *	-0.224 *	-0.342 * **	-0.264 * **	-0.346 * **
							(0.108)	(0.070)	(0.120)	(0.066)	(0.026)	(0.068)
Firm Size	0.042 * *	0.007	0.042 * *	0.041 * **	0.084 * **	0.053 * **	0.049 * *	0.008	0.049 * *	0.039 * **	0.083 * **	0.051 * **
	(0.018)	(0.022)	(0.021)	(0.014)	(0.008)	(0.015)	(0.019)	(0.022)	(0.022)	(0.014)	(0.008)	(0.015)
Tobin's Q	-0.004	0.014	0.002	0.496 * **	0.505 * **	0.447 * **	-0.000	0.020	0.005	0.495 * **	0.508 * **	0.445 * **
	(0.009)	(0.026)	(0.011)	(0.127)	(0.056)	(0.137)	(0.009)	(0.026)	(0.012)	(0.127)	(0.056)	(0.136)
ROA	0.003 * **	0.003 * *	0.001	-0.004 * *	-0.001	-0.003 *	0.003 * **	0.003 * *	0.001	-0.003 * *	-0.001	-0.003
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Leverage	0.057	-0.028	-0.043	-1.331 * **	-1.185 * **	-1.229 * **	0.063	-0.026	-0.042	-1.340 * **	-1.186 * **	-1.234 * **
	(0.107)	(0.182)	(0.120)	(0.151)	(0.120)	(0.149)	(0.107)	(0.183)	(0.120)	(0.150)	(0.120)	(0.148)
Earnings Vol.	-0.004	-0.004	-0.004	0.006	0.020 * **	0.005	-0.004	-0.004	-0.004	0.007	0.020 * **	0.005
	(0.003)	(0.005)	(0.005)	(0.009)	(0.004)	(0.013)	(0.003)	(0.005)	(0.005)	(0.009)	(0.004)	(0.013)
Dividend	-0.245 * **	-0.031	-0.341 * **	0.200 * **	0.134 * **	0.206 * **	-0.250 * **	-0.026	-0.348 * **	0.198 * **	0.139 * **	0.204 * **
	(0.060)	(0.090)	(0.080)	(0.034)	(0.037)	(0.037)	(0.060)	(0.091)	(0.080)	(0.034)	(0.037)	(0.037)
Tax Avoidance	-0.002	-0.003	-0.001	0.001	0.001	0.001	-0.002	-0.003	-0.002	0.001	0.001	0.001
	(0.001)	(0.004)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)	(0.002)	(0.001)	(0.001)	(0.002)
Fin. Const.	0.423	-1.352 *	0.398	-3.049 *	-2.765	-2.005	0.411	-1.386 *	0.395	-2.913 *	-2.741	-1.884
	(0.678)	(0.793)	(0.811)	(1.753)	(2.162)	(1.703)	(0.678)	(0.804)	(0.815)	(1.729)	(2.148)	(1.677)
Investment	-0.009	0.003	-0.019	0.011	0.015	0.011	-0.007	0.003	-0.017	0.011	0.016	0.011
	(0.009)	(0.009)	(0.014)	(0.016)	(0.024)	(0.020)	(0.008)	(0.009)	(0.013)	(0.016)	(0.025)	(0.020)
Firm Age	-0.335 * **	0.679 * **	-0.345 * **	-0.075 * *	-0.035	-0.090 * **	-0.344 * **	0.684 * **	-0.354 * **	-0.072 * *	-0.027	-0.088 * **
	(0.038)	(0.187)	(0.043)	(0.029)	(0.095)	(0.031)	(0.038)	(0.187)	(0.043)	(0.030)	(0.095)	(0.031)
CEO Age	0.070 * **	0.006	0.071 * **	-0.042 * **	-0.054 * **	-0.042 * **	0.071 * **	0.007	0.073 * **	-0.042 * **	-0.053 * **	-0.041 * **
	(0.010)	(0.014)	(0.012)	(0.009)	(0.009)	(0.010)	(0.010)	(0.013)	(0.013)	(0.009)	(0.009)	(0.009)
CEO Tenure	0.032 *	-0.045	0.094 * **	0.026	0.045	0.003	0.034 *	-0.044	0.097 * **	0.022	0.046	0.000
	(0.019)	(0.052)	(0.027)	(0.020)	(0.037)	(0.027)	(0.019)	(0.052)	(0.027)	(0.020)	(0.037)	(0.027)
Compensation	0.133 * **	0.004	0.159 * **	-0.416 * **	-0.248 * **	-0.425 * **	0.134 * **	0.001	0.160 * **	-0.410 * **	-0.245 * **	-0.419 * **
	(0.029)	(0.027)	(0.034)	(0.062)	(0.022)	(0.065)	(0.029)	(0.027)	(0.034)	(0.061)	(0.022)	(0.064)
CEO Gender	-0.093	-0.125	-0.055	0.327 * **	0.121 * **	0.302 * **	-0.230 * **	-0.196	-0.201 * *	0.338 * **	0.080 * *	0.308 * **
	(0.081)	(0.172)	(0.095)	(0.068)	(0.037)	(0.069)	(0.066)	(0.170)	(0.081)	(0.055)	(0.035)	(0.054)
DA	0.001	0.001	0.008	0.000	0.000	-0.000	0.001	0.001	0.009	0.000	0.000	-0.000
	(0.002)	(0.002)	(0.006)	(0.001)	(0.000)	(0.002)	(0.002)	(0.002)	(0.006)	(0.001)	(0.000)	(0.002)
REM	0.004	0.006	0.019	0.005	0.001	0.005	0.005	0.006	0.019	0.005	0.001	0.005
	(0.004)	(0.005)	(0.012)	(0.005)	(0.002)	(0.007)	(0.004)	(0.005)	(0.012)	(0.005)	(0.002)	(0.007)
_cons	45.134 * **	43.109 * **	44.311 * **	-3.771 * **	-2.589 * **	-3.883 * **	45.502 * **	43.282 * **	44.708 * **	-3.640 * **	-2.467 * **	-3.745 * **
	(0.166)	(0.548)	(0.186)	(0.441)	(0.437)	(0.428)	(0.127)	(0.521)	(0.158)	(0.491)	(0.444)	(0.483)
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Effect	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No
Industry Effect	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	11,043	11,043	11,043	11,043	11,043	11,043	29,801	29,801	29,801	29,801	29,801	29,801
r2	0.089	0.060	0.199	0.608	0.593	0.689	0.086	0.059	0.197	0.611	0.595	0.691
N_clust	1511	1511	1511	1511	1511	1511	3418	3418	3418	3418	3418	3418

This table presents the OLS estimation results of the effects of overconfident vs rational CEOs on IRS Attention. Standard errors robust to heteroscedasticity and clustering within firm-level are given in parentheses.
* Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

Table 9
Overconfidence on IRS Attention - Role of tax avoidance.

	Dependent Variable: IRS Attention							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Holder67	0.222 * **	0.219 * **	0.251 * **	0.208 * **	0.276 * **	0.482 * **	0.246 * **	0.571 * **
	(0.065)	(0.070)	(0.064)	(0.071)	(0.064)	(0.064)	(0.065)	(0.065)
Tax Avoidance	0.067 * **	0.067 * **	0.067 * **	0.067 * **				
	(0.021)	(0.021)	(0.021)	(0.021)				
Holder67 × Tax Avoidance	0.308 * **	0.354 * **	0.309 * **	0.351 * **				
	(0.025)	(0.024)	(0.025)	(0.024)				
Holder67 × High Tax Avoidance		0.526 * **		0.561 * **				
		(0.046)		(0.047)				
Holder67 × Low Tax Avoidance			-0.134 * **	0.114 * **				
			(0.021)	(0.018)				
DTAX					0.233 * *	0.234 * *	0.233 * *	0.233 * *
					(0.094)	(0.094)	(0.094)	(0.094)
Holder67 × DTAX					0.249 * **	0.247 * **	0.248 * **	0.248 * **
					(0.095)	(0.094)	(0.095)	(0.094)
Holder67 × High DTAX						0.346 * **		0.433 * **
						(0.032)		(0.035)
Holder67 × Low DTAX							-0.108 * **	0.136 * **
							(0.020)	(0.016)
_cons	44.306 * **	44.116 * **	44.304 * **	44.105 * **	44.213 * **	44.124 * **	44.197 * **	44.122 * **
	(0.068)	(0.070)	(0.068)	(0.071)	(0.069)	(0.070)	(0.069)	(0.070)
All other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	33,120	33,120	33,120	31,343	33,122	33,122	33,122	33,122
r2	0.173	0.186	0.173	0.189	0.142	0.150	0.143	0.151
N_clust	6110	6110	6110	5660	6111	6111	6111	6111

This table presents the OLS estimation results of the impact of the tax avoidance on the overconfidence-attention nexus. Standard error robust to heteroscedasticity and clustering at firm level are given in parentheses. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

rates may drive overconfident CEOs to overestimate their wisdom or skills beyond the average benchmark (Ho et al., 2016) whilst underestimating their risk levels and exaggerating their ability to control events (Huang et al., 2016). Hence, overconfident managers may overestimate the probability of a positive state and the prospect of investment returns when the state corporate tax rate increases. In addition, prior literature (e.g., Giroud and Rauh, 2019; Li et al., 2021) suggests that firms respond asymmetrically to staggered changes in state tax rates. For instance, firms adjust their leverage ratio or innovation when state tax rates increase but do not respond to state tax cuts (Mukherjee et al., 2017; Heider and Ljungqvist, 2015). Also, state taxation can drive a firm's location choice through the impact of average tax rates and overall profitability, particularly in the presence of economic rents (Giroud and Rauh, 2019). While state tax changes are often driven by economic conditions and are planned, this is not always the case (Mukherjee et al., 2017). To counter the effect of unplanned state income tax increases, CEOs may become unnecessarily overconfident, resulting in tax aggressive strategies such as strategic apportionment, location decisions, exploiting state credits, income shifting, and investing in assets that generate accelerated depreciation deductions.

We therefore utilize this exogenous shock, which may affect overconfidence but may not be correlated with IRS Attention, to re-examine the relation between these variables. The staggered nature of state corporate tax changes provides a set of counterfactuals about how IRS Attention would have manifested in the absence of tax rate changes, which helps us to disentangle the effects of state tax policies from the other push/pull factors driving IRS Attention. To do this, we estimated following model:

$$Attention_{i,t} = f\Big(Overconfidence_{i,t},\quad Tax\quad Change_{i,t},\quad Overconfidence \times Tax\quad Change_{i,t},\quad Firm\quad Characteristics_{i,t-1},\quad CEO\quad Characteristics_{i,t},\quad Other\quad Controls_{i,t}\Big)$$

where Overconfidence is the proxy for CEO overconfidence (i.e., Holder67, High Forecast and Point Estimate), and Tax change denotes firms that are domiciled in a state when corporate tax rate changes[7] (i.e., increases or decreases) occurred during the sample period. These tax rate changes occurred 41 times during the sample period. All firm characteristics, CEO characteristics and other controls are defined in Table 1. Model 1 of Table 11 presents the estimation results where the key variable of interest is the interaction term between Holder67 and Tax rate change. Its coefficient is indeed positive (0.210) and significant at 5%, indicating that, on average, following a regulatory tax change and its associated upward shock to aggressive tax-planning strategies, a firm managed by an overconfident CEO receives greater attention from the IRS for audit purposes.

To further explore the dynamics of the tax rate changes, we estimate a variant of the specification replacing the Tax-rate change dummy with a set of indicator variables that capture the dynamics of the tax changes (corporate tax increases vs corporate tax cuts). These increasing (decreasing) tax rate changes occurred nine (32) times during the sample period. Model 2 (3) of Table 11 presents the estimation results where the key variable of interest is the interaction term between Holder67 and Tax rate increases (cuts). The coefficient of Holder67 × Tax Change_UP is positive and significant at 1%. On the other hand, the coefficient of Holder67 × Tax Change_DOWN is negative and significant at 10%. Further analysis shows that the magnitude of the coefficients is particularly high when corporate tax increases. Together, these findings provide strong evidence to suggest that, on average, following an upward (downward) regulatory corporate tax change, the intensity with which the IRS accesses firms' annual reports to augment its existing private information set and for evidence of tax avoidance increases (decreases) when the firms' CEOs are overconfident. Our results remain robust when High Forecast or Point Estimate is used as a regressor in place of Holder67.

[7] For more detailed information about these changes, we refer readers to Appendix A in Chow et al. (2022).

Table 10
Overconfidence on IRS Attention: 2-STEP GMM.

	First stage	Second stage		
	Overconfidence	IRS Attention	Asset-Weighted-IRS	Cap-Weighted-IRS
	(1)	(2)	(3)	(4)
CEO Age	0.582 * **			
	(0.012)			
Fitted Overconfidence		0.523 * **	0.568 * **	0.221 * *
		(0.179)	(0.208)	(0.098)
Firm Size	0.028 * **	0.003	0.075 * *	0.011
	(0.002)	(0.017)	(0.038)	(0.012)
Tobin's Q	0.009 * **	0.004	-0.526 * *	0.660 * **
	(0.003)	(0.010)	(0.250)	(0.113)
ROA	-0.000	0.003 * **	0.003	-0.003 *
	(0.000)	(0.001)	(0.005)	(0.002)
Leverage	0.032 * **	-0.028	-0.600	-1.195 * **
	(0.011)	(0.108)	(0.443)	(0.140)
Earnings Vol.	-0.001 *	0.005 *	-0.260 * *	0.008
	(0.001)	(0.003)	(0.119)	(0.010)
Dividend	-0.002	-0.223 * **	-0.185 * *	0.190 * **
	(0.006)	(0.060)	(0.077)	(0.033)
Tax Avoidance	0.100 * **	0.101 * **	0.103 * **	0.101 * **
	(0.000)	(0.002)	(0.002)	(0.001)
Fin. Const.	-0.390 * **	0.125 *	-0.209 * **	-0.411 * *
	(0.099)	(0.075)	(0.072)	(0.167)
Investment	0.004	0.003	0.001	0.006
	(0.002)	(0.006)	(0.027)	(0.017)
Firm Age	-0.007 * *	-0.310 * **	-0.426 * **	-0.046 *
	(0.004)	(0.038)	(0.105)	(0.027)
CEO Age	0.001	0.052 * **	0.007	-0.044 * **
	(0.002)	(0.010)	(0.027)	(0.008)
CEO Tenure	0.007 * **	0.024	-0.263 * **	0.015
	(0.002)	(0.019)	(0.086)	(0.019)
Compensation	-0.009 * **	0.116 * **	-0.096	-0.345 * **
	(0.003)	(0.029)	(0.131)	(0.055)
CEO Gender	-0.137 * **	-0.142	0.222	0.292 * **
	(0.009)	(0.092)	(0.136)	(0.070)
DA	0.000	-0.001	0.008 * *	-0.000
	(0.000)	(0.002)	(0.004)	(0.001)
REM	0.000	0.002	0.005	0.002
	(0.001)	(0.005)	(0.022)	(0.005)
_cons	0.473 * **	44.346 * **	-1.367	-4.632 * **
	(0.020)	(0.232)	(0.870)	(0.352)
Observations	49,540	49,540	49,540	49,540
R^2		0.455	0.232	0.575
N_clust	7678	7678	7678	7678
K-P WF statistic		72.743	72.942	72.942
K-P LM statistic		55.180	56.228	56.228
Hansen J statistic		1.184	0.752	0.628
Hansen J p-value		0.178	0.233	0.432

This table presents the two-stage GMM estimation results of the effects of CEO overconfidence on IRS attention. All models use time dummies, spells individual fixed effects and year fixed effects. Standard error robust to heteroscedasticity and clustering at firm level are given in parentheses. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

6. Further explanations for the study's results

6.1. CEO overconfidence and IRS attention – financial constraints

The evidence presented above indicates that firms managed by overconfident CEOs attract greater IRS Attention because such CEOs are associated with greater investments in tax avoidance strategies and/or more aggressive corporate tax policies. In Table 12, we augmented our baseline specification to include interactions between the overconfidence indicator and variables for financial constraints, high financial constraints (>75 P) and low financial constraints (<25 P). We measure financial constraints (i.e. the firm's ability to obtain loans) using the firm's interest expenditures scaled by total assets (Harrison and McMillan, 2003; Feenstra et al., 2014). We observe that the estimated impact of CEO overconfidence on all three measures of IRS Attention remains unaffected. The coefficients on all the overconfidence-constraint interaction variables are positive and statistically significant. To explore this outcome further, the high vs low subsample result indicates that the coefficients on all the overconfidence-constraint interaction variables are statistically significant (at the 1% level) and positive for highly constrained firms. This supports our Hypothesis 2a. Thus, highly constrained overconfident firms tend to attract greater IRS Attention. These findings are also consistent with the position of Foley et al. (2007) and Hanlon et al. (2015).

6.2. CEO overconfidence and IRS attention – financial distress

In this section, we examine the effect of financial distress on the CEO overconfidence and IRS Attention nexus. We follow bankruptcy and financial distress studies (Ivashina et al., 2005; Pindado et al., 2008; Agarwal and Taffler, 2008) to incorporate the financial health of US firms into the overconfidence-attention nexus. The Altman's (1968) Z-score model is highly adopted in predicting the health of firms (see,

Table 11
Overconfidence on IRS Attention - Exogenous shock via changes in tax rules.

	Holder67			High Forecast			Point Estimate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Holder67	0.297 * **	0.305 * **	0.278 * **	0.181 * **	0.180 * **	0.169 * **	0.256 * **	0.261 * **	0.249 * **
	(0.061)	(0.062)	(0.060)	(0.034)	(0.034)	(0.032)	(0.024)	(0.024)	(0.023)
Tax Change	0.202 * *			0.187 * *			0.147 * **		
	(0.101)			(0.088)			(0.055)		
Holder67 × Tax Change	0.210 * *								
	(0.106)								
Tax Change_UP		0.427 * **			0.259 * **			0.127 * *	
		(0.075)			(0.087)			(0.055)	
Holder67 × Tax Change_UP		0.416 * **							
		(0.080)							
Tax Change_DOWN			-0.166 *			-0.158			-0.262 *
			(0.094)			(0.319)			(0.159)
Holder67 × Tax Change_DOWN			-0.003						
			(0.031)						
High Forecast × Tax Change				0.190 *					
				(0.098)					
High Forecast × Tax Change_UP					0.203 * *				
					(0.092)				
High Forecast × Tax Change_DOWN						0.067			
						(0.361)			
Point Estimate × Tax Change							0.133 *		
							(0.068)		
Point Estimate × Tax Change_UP								0.122 *	
								(0.072)	
Point Estimate × Tax Change_DOWN									-0.325 *
									(0.194)
_cons	44.404 * **	44.395 * **	44.424 * **	44.460 * **	44.458 * **	44.474 * **	44.492 * **	44.488 * **	44.498 * **
	(0.062)	(0.062)	(0.061)	(0.037)	(0.037)	(0.036)	(0.029)	(0.029)	(0.029)
All other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	49,549	49,549	49,549	47,842	47,842	47,842	47,842	47,842	47,842
r2	0.147	0.147	0.147	0.169	0.169	0.169	0.171	0.171	0.171
N_clust	7678	7678	7678	7322	7322	7322	7322	7322	7322

This table presents the results from the OLS estimation of the impact of state tax rate change on the overconfidence-attention nexus. The definitions of all variables are provided in Table 1. Standard errors (in parentheses) are robust to heteroscedasticity and clustered at the firm level. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

Table 12
Overconfidence on IRS Attention - Role of financial constraints.

	IRS Attention				Capitalization-Weighted-IRS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Holder67	0.265 * **	0.248 * **	0.242 * **	0.207 * **	0.631 * **	0.615 * **	0.480 * **	0.427 * **
	(0.066)	(0.066)	(0.067)	(0.067)	(0.056)	(0.056)	(0.056)	(0.056)
FinConst	0.104 * *	0.109 * **	0.102 * *	0.107 * **	0.287 * **	0.292 * **	0.273 * *	0.280 * **
	(0.041)	(0.041)	(0.040)	(0.040)	(0.110)	(0.109)	(0.109)	(0.108)
Holder67 × FinConst	0.101 * *	0.107 * **	0.098 * *	0.105 * **	0.245 * *	0.251 * *	0.230 * *	0.240 * *
	(0.041)	(0.041)	(0.040)	(0.040)	(0.109)	(0.108)	(0.109)	(0.107)
Holder67 × High FinConst		0.206 * **		0.246 * **		0.190 * **		0.372 * **
		(0.025)		(0.028)		(0.063)		(0.063)
Holder67 × Low FinConst			-0.098 * **	-0.159 * **			-0.636 * **	-0.728 * **
			(0.026)	(0.030)			(0.046)	(0.045)
_cons	44.132 * **	44.086 * **	44.151 * **	44.109 * **	-5.493 * **	-5.535 * **	-5.367 * **	-5.431 * **
	(0.075)	(0.077)	(0.075)	(0.076)	(0.077)	(0.077)	(0.075)	(0.075)
All other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	30,574	30,574	30,574	30,574	30,574	30,574	30,574	30,574
r2	0.142	0.144	0.142	0.145	0.278	0.280	0.291	0.295
N_clust	5576	5576	5576	5576	5576	5576	5576	5576

This table presents the OLS estimation results of the impact of the financial constraints on the overconfidence-attention nexus. Standard error robust to heteroscedasticity and clustering at firm level are given in parentheses. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

Table 13
Overconfidence on IRS Attention - Role of financial distress.

	IRS Attention			Capitalization-Weighted-IRS		
	(1)	(2)	(3)	(4)	(5)	(6)
Holder67	0.252 * **	0.363 * **	0.215 * **	0.631 * **	0.727 * **	0.599 * **
	(0.065)	(0.070)	(0.065)	(0.055)	(0.069)	(0.057)
Z-Score	-0.164 * **	-0.177 * **	-0.177 * **	-0.582 * **	-0.593 * **	-0.593 * **
	(0.021)	(0.022)	(0.022)	(0.037)	(0.037)	(0.037)
Holder67 × Z-Score	-0.155 * **	-0.169 * **	-0.169 * **	-0.431 * **	-0.443 * **	-0.443 * **
	(0.021)	(0.022)	(0.022)	(0.086)	(0.085)	(0.085)
Holder67 × High Z-Score		-0.148 * **			-0.128 * *	
		(0.035)			(0.052)	
Holder67 × Low Z-Score			0.148 * **			0.128 * *
			(0.035)			(0.052)
_cons	44.281 * **	44.214 * **	44.214 * **	-5.529 * **	-5.587 * **	-5.587 * **
	(0.068)	(0.072)	(0.072)	(0.079)	(0.080)	(0.080)
All other controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	30,126	30,126	30,126	30,126	30,126	30,126
r2	0.160	0.161	0.161	0.281	0.281	0.281
N_clust	5491	5491	5491	5491	5491	5491

This table presents the OLS estimation results of the impact of the financial distress on the overconfidence-attention nexus. Standard error robust to heteroscedasticity and clustering at firm level are given in parentheses. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

Leary and Roberts, 2005; Almamy et al., 2016). The original Altman's (1968) Z-score is a computed as [3.3 * (EBIT/TA) + 0.99 * (Sales/TA) + 1.4 * (Retained Earnings/TA) + 1.2 * (Working Capital/TA) + 0.6 * (Market Value of Equity/TL)].[8] However, we capture a firm's degree of financial distress through using the MacKie-Mason (1990) modified Altman's Z-score by eliminating the market value of equity to TL expression from the original specification because we aim to explicitly explore a firm's risk taking and to recognize the leverage effect separately. Hence, the modified version is: [3.3 * (EBIT/TA) + 0.99 * (Sales/TA) + 1.4 * (Retained Earnings/TA) + 1.2 * (Working Capital/TA)]. Moreover, the eliminated factors of the modified Z-scores contain information captured by other variables in the model (i.e., market value of equity – Tobin's Q, and total liabilities – leverage) (Graham et al., 1998). Hence, the inclusion of the eliminated factor may create a systematic relationship with other variables in the model, consequently leading to a biased significant relation that may not be due to the presence of a true relationship between the Z-scores and the related variables.

In Table 13, we augment our baseline specification to include interactions between the overconfidence indicator and variables for Z-score and high vs low Z-score. Following Huang et al. (2016), we group firms into High vs Low Z-score firms. High (Low) Z-score is an indicator variable taking a value of one if the Z-score is greater (less) than 1.81, and zero otherwise. We observe that the estimated impact of CEO overconfidence on all three measures of IRS Attention remains unaffected. The coefficients on all the overconfidence-Z-score interaction variables are negative and statistically significant. Following the grouping of firms into high vs low Z-score subsamples, we observe that, although the coefficients on all the overconfidence-Z-score interaction variables are statistically significant (at the 1% level), the relation is positive for low Z-score firms but negative for high Z-score firms. A key explanation for these results is that low Z-score is generally an indication of high financial distress (or low credit quality), which limits a firm's ability to borrow external funds (Huang et al., 2016). This is consistent with Hypothesis 2b that financially distressed firms that are managed by overconfident CEOs are more likely to be up against their borrowing constraints (Harrison and McMillan, 2003), and thus are more likely to invest in tax avoidance strategies in order to increase internal cash flows and achieve their investments goals.

6.3. CEO overconfidence and IRS attention – financial crisis

In this section, we follow the financial crisis literature (Asimakopoulos and Asimakopoulos, 2019; Zhang and van der Schaar, 2020; Sleibi et al., 2020) and build on our baseline model to empirically test whether the 2007/08 crisis impacted on the overconfidence-attention violation nexus among US firms. To do this, we split our data into three sample periods (i.e., pre-crisis, crisis and post-crisis) and re-estimate the regression models. We present the results in Table 14. We observe that, generally, the impact of CEO overconfidence on IRS Attention is particularly manifested during the crisis and post-crisis periods. Although the positive relationship exists under all three sample periods, the statistical significance appears significant at the 5% (1%) level during the crisis (post-crisis), yet this is insignificant during the pre-crisis. Moreover, the estimated impact (measured by the size of the coefficients) of the overconfidence indicator on all three measures of IRS Attention is higher during the crisis and post-crisis periods, thus implying the IRS accorded greater attention to firms managed by overconfident CEOs during the crisis as well as post-crisis. These findings provide support for Hypothesis 2c. The probable reason for the crisis outcome is that the adverse effects of the financial crisis induced overconfident CEOs and their firms to favour more investments in tax avoidance strategies and value-destroying investments, and to submit more biased financial reporting (and forecasting responses) to tax authorities. Specifically, the manifestation of these aggressive behavioural choices of CEOs and their impact on firm outcomes, as well as the significant macroeconomic downturn during the crisis, stimulated the IRS to incorporate these factors into their audit selection and examination decisions (De Simone et al., 2019; Richardson et al., 2015). Following robust regulations over the crisis period, the post-crisis period saw a further enhancement in the overconfidence effect on IRS Attention whereby the IRS has increased the strictness of its audit selection process to account for individual-level signals of psychological and/or cognitive biases towards ensuring greater tax reporting transparency.

7. Conclusion

This study extends the existing CEO overconfidence literature by linking it with corporate taxation and IRS attention for audit. More specifically, we test the hypothesis regarding if the CEO overconfidence attracts more attention by IRS for audit to investigate corporate tax

[8] Where EBIT is earnings before interest and taxes, TA is total assets, and TL is book value of total liabilities. A higher Z-score implies a financially healthier firm (i.e., less distressed) relative to a lower Z-score firm.

Table 14
Overconfidence on IRS Attention - Role of financial crisis.

	Pre-Crisis				Crisis				Post-Crisis			
	IRS Attention		Cap-Weighted-IRS		IRS Attention		Cap-Weighted-IRS		IRS Attention		Cap-Weighted-IRS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Holder67	0.120	0.041	0.120	0.098	0.347 * *	0.362 * *	0.173 * *	0.132 * *	0.250 * **	0.400 * **	0.312 * **	0.277 * **
	(0.156)	(0.034)	(0.178)	(0.070)	(0.171)	(0.181)	(0.085)	(0.059)	(0.096)	(0.131)	(0.035)	(0.085)
Firm Size	-0.006	0.008	0.115 * **	0.084 * **	-0.065	0.076 *	0.056 * **	0.004	0.026	0.053 *	0.054 * **	0.039 * *
	(0.036)	(0.006)	(0.030)	(0.024)	(0.056)	(0.041)	(0.020)	(0.017)	(0.035)	(0.029)	(0.009)	(0.016)
Tobin's Q	0.012	-0.000	0.462 * **	0.426 * **	0.130	-0.019	0.588 * **	0.685 * **	0.041	0.005	0.675 * **	0.447 * *
	(0.051)	(0.003)	(0.129)	(0.062)	(0.103)	(0.022)	(0.128)	(0.071)	(0.043)	(0.016)	(0.054)	(0.188)
ROA	-0.003	0.001	0.004	-0.005	0.000	0.002 *	0.001	-0.005 * **	0.004 *	0.002	0.000	-0.002
	(0.006)	(0.003)	(0.029)	(0.021)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Leverage	-0.105	-0.051 * *	-0.900	-1.011 * **	0.378	-0.269 * *	-1.037 *	-1.456 * **	0.157	-0.037	-1.057 * **	-1.263 * **
	(0.195)	(0.026)	(0.596)	(0.133)	(0.585)	(0.120)	(0.549)	(0.173)	(0.316)	(0.161)	(0.197)	(0.191)
Earnings Vol.	0.023	0.001	-0.013	0.008	0.074	0.094 *	-0.246	-0.515	-0.441	0.072	0.133	-0.151
	(0.066)	(0.001)	(0.161)	(0.008)	(0.160)	(0.051)	(0.363)	(0.494)	(0.422)	(0.069)	(0.405)	(0.341)
Dividend	-0.151	-0.080 * **	0.072	0.149 * **	-0.061	-0.272 * **	0.088	0.151 * **	0.023	-0.425 * **	0.187 * **	0.227 * **
	(0.263)	(0.025)	(0.256)	(0.054)	(0.235)	(0.089)	(0.095)	(0.046)	(0.138)	(0.103)	(0.050)	(0.044)
Tax Avoidance	-0.002	0.000	0.003	0.002	-0.036	-0.013	0.102 * **	0.111 * **	-0.003	-0.002	0.100 * **	0.100 * **
	(0.007)	(0.001)	(0.009)	(0.005)	(0.036)	(0.015)	(0.014)	(0.013)	(0.006)	(0.002)	(0.001)	(0.002)
Fin. Const.	0.283	0.060 * *	-0.103	-0.438 *	0.249	0.118 *	-0.963 *	-0.038	-0.065	0.083	-0.296	-0.231
	(0.606)	(0.024)	(0.746)	(0.242)	(0.527)	(0.063)	(0.530)	(0.215)	(0.125)	(0.117)	(0.415)	(0.256)
Investment	0.064	-0.014 * *	0.115	0.107 * **	0.157	-0.034	0.228	0.028	-0.006	-0.013	0.006	0.004
	(0.099)	(0.007)	(0.160)	(0.041)	(0.155)	(0.038)	(0.176)	(0.043)	(0.009)	(0.015)	(0.019)	(0.017)
Firm Age	0.365	-0.050 * **	3.079 * **	-0.120 * **	-0.014	-0.344 * **	0.173 * **	-0.072 * *	-0.134	-0.446 * **	0.711 * **	-0.094 * *
	(0.417)	(0.012)	(0.809)	(0.041)	(0.441)	(0.051)	(0.042)	(0.032)	(0.177)	(0.056)	(0.154)	(0.037)
CEO Age	-0.016	0.005	-0.087	-0.032 * *	0.014	0.048 * **	-0.053	-0.038 * **	0.011	0.089 * **	-0.053 * **	-0.045 * **
	(0.035)	(0.003)	(0.062)	(0.016)	(0.052)	(0.014)	(0.034)	(0.010)	(0.022)	(0.016)	(0.013)	(0.011)
CEO Tenure	0.010	0.003	0.105	0.006	0.032	0.044	0.140	-0.026	-0.142	0.133 * **	0.070	0.022
	(0.083)	(0.007)	(0.182)	(0.033)	(0.192)	(0.031)	(0.230)	(0.029)	(0.099)	(0.036)	(0.057)	(0.030)
Compensation	-0.027	0.025 * **	-0.163 *	-0.405 * **	-0.002	0.122 * **	-0.216 * **	-0.397 * **	-0.048	0.193 * **	-0.190 * **	-0.422 * **
	(0.059)	(0.009)	(0.098)	(0.047)	(0.107)	(0.031)	(0.059)	(0.036)	(0.045)	(0.043)	(0.027)	(0.077)
CEO Gender	0.075	-0.059 * *	-0.022	0.198 * **	-0.134	-0.013	0.171	0.281 * **	-0.011	-0.121	0.298 * **	0.386 * **
	(0.166)	(0.027)	(0.145)	(0.056)	(0.389)	(0.093)	(0.120)	(0.058)	(0.371)	(0.107)	(0.055)	(0.085)
DA	0.003	0.001	-0.004	-0.016 *	-0.001	-0.004	-0.004	0.008 *	-0.003	0.010	-0.000	0.000
	(0.005)	(0.001)	(0.008)	(0.010)	(0.005)	(0.004)	(0.002)	(0.004)	(0.003)	(0.007)	(0.001)	(0.003)
REM	0.003	0.003	0.055 *	0.055 *	0.004	-0.003	0.003	-0.002	0.010	0.023	-0.010 * *	0.018
	(0.004)	(0.003)	(0.030)	(0.032)	(0.006)	(0.004)	(0.005)	(0.009)	(0.011)	(0.016)	(0.004)	(0.012)
_cons	43.788 * **	44.971 * **	-9.140 * **	-3.301 * **	43.550 * **	44.500 * **	-6.330 * **	-4.534 * **	44.648 * **	44.231 * **	-5.925 * **	-4.126 * **
	(1.262)	(0.057)	(1.662)	(0.306)	(1.405)	(0.194)	(1.474)	(0.253)	(0.576)	(0.241)	(0.533)	(0.518)
Firm Effect	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Industry Effect	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
N	10,207	10,207	10,207	10,207	11,806	11,806	11,806	11,806	27,526	27,526	27,526	27,526
r2	0.680	0.216	0.990	0.711	0.840	0.224	0.979	0.774	0.516	0.178	0.945	0.684
N_clust	2406	2406	2406	2406	2337	2337	2337	2337	2935	2935	2935	2935

This table presents the OLS estimation results of the impact of the global financial crisis on the overconfidence-attention nexus. Standard error robust to heteroscedasticity and clustering at firm level are given in parentheses. * Indicates significance at 10%; * * Indicates significance at 5%; * ** Indicates significance at 1%.

evasion and find strong evidence that the IRS seems to accord particular attention to firms that are managed by CEOs who exhibit overconfidence. Whilst there is a growing body of literature highlighting the risks associated with apparent increases in managerial recklessness (Papanastasopoulos and Thomakos, 2017), it is evident that systemic constraints are also in play, given that tax audits may entice boards to reign in overconfident CEOs, preventing them from doing too much damage in other areas. Yet, the gradual hollowing out of IRS capabilities through budgetary restraints may mean that, over time, this check and balance becomes less effective. When their firms lack sufficient resources for investment (i.e., financially unconstrained) or are financially constrained, the overinvestment problem associated with overconfident CEOs, and which they attempt to fix through tax avoidance strategies, stimulates greater attention from the IRS.

In this paper, we undertake empirical analysis on a sample of US firms spanning the period from 2004–2015. Consistent with our hypothesis, we provide strong evidence that firms with overconfident CEOs tend to have greater IRS Attention. We also find strong evidence that the interaction between overconfidence and tax evasion significantly increases IRS attention. Employing a battery of robustness checks, we also confirm that the CEO overconfidence and IRS attention link would be more pronounced for firms with financial constraints and firms that are going through financial distress. The overconfidence effect was also more pronounced during the 2008 financial crisis (because firms managed by overconfident CEOs are more susceptible to external shocks) and in its aftermath. Collectively, our findings show that a firm's probability of being selected for IRS examination or audit can be driven by behavioural managerial biases, in turn suggesting that recognizing the presence of these biases will help extend the literature on CEO overconfidence and corporate tax policies, and their regulation and enforcement.

In some cases, the gains from overconfidence may drive a board's preference for these characteristics, particularly when a firm's shareholders are in a position to gain from the riskier actions of overconfident executives (Hribar et al., 2013). However, it may be debated whether such benefits outweigh the costs (see Altunbaş et al., 2020), especially given that risk takers are more likely to precipitate an IRS investigation. Hence, it could be argued that boards need to take more care in appointing CEOs, taking fuller account of risk proclivities. Existing research concludes that social or reputational capital might mitigate the negative signals of past failure (Schepker and Barker, 2018), which might suggest that even dangerous risk taking does not necessarily rule out candidates for such roles. Other work concludes that failures in regulation have led to managers being enticed into dangerous directions (Lazonick and Shin, 2019); it may be impossible to filter out dangerously risk-taking CEOs through legislation, but a broader rethink of corporate governance standards might mitigate the incentives to engage in such behaviour (Lazonick and Shin, 2019). The increased prospect of an IRS investigation does not appear to have brought into play a feedback loop mitigating CEO risk taking; the phenomena of risk taking-IRS investigation was not even diminished by the shock of the 2008- financial crisis. This may well be because the systemic incentives impelling excessive risk taking are so great as to overshadow any disincentives, again pointing to a broader regulatory failure.

Regardless of whether boards are efficient in selecting and/or monitoring executives, the probable gains from the riskier actions taken by an overconfident executive are not shared by the IRS, and therefore are expected to lead to greater likelihood of selection for audit purposes. This study highlights how regulation has both formal structural and informal dimensions: a focus on the former may result in a neglect of how strategic choices regarding regulatory enforcement are moulded and remoulded by the choices of actors. This study supplements earlier work on the governmental plane (Bieling et al., 2016) through further insights as to the dynamics of this process at firm level.

We acknowledge limitations to our research. CEOs may attract IRS attention through exhibiting hubris or overconfidence, or through some or other act that may be on the IRS's internal radar screen, but not in the public domain. We also acknowledge the possibility of omitted and potentially confounding variables; however, the statistically significant relationships we encountered between an acknowledged measure of CEO overconfidence and IRS attention readily lend themselves to theoretical explanation. Further research might more closely examine more subtle, but not necessarily behaviourally driven, predictors of IRS attention.

Data Availability

Data will be made available on request.

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