Journal of Accounting and Public Policy 37 (2018) 241–253

Contents lists available at ScienceDirect

Journal of Accounting and Public Policy

journal homepage: www.elsevier.com/locate/jaccpubpol

Full length article

Overconfidence and tax avoidance: The role of CEO and CFO interaction

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ARTICLE INFO

Keywords:
Tax avoidance
Overconfidence
CEO
CFO
False Consensus Effect Theory, Upper Echelon Theory

ABSTRACT

We investigate how overconfident CEOs and CFOs may interact to influence firms' tax avoidance. We adopt an equity measure to capture overconfident CEOs and CFOs and utilize multiple measures to identify companies' tax-avoidance activities. We document that CFOs, as CEOs' business partners, play an important role in facilitating and executing overconfident CEOs' decisions in regard to tax avoidance. Specifically, we find that companies are more likely to engage in tax-avoidance activities when they have both overconfident CEOs and overconfident CFOs, compared with companies that have other combinations of CEO/CFO overconfidence (e.g., an overconfident CEO with a non-overconfident CFO), which is consistent with the False Consensus Effect Theory. Our study helps investors, regulators, and policymakers understand companies' decision-making processes with regard to tax avoidance.

"CEOs need a CFO who can help management confidently take new, calculated risks and strategize ways to grow the business."
Kathy Crusco, CFO of Crusco (2016)

1. Introduction

Overconfidence has been found to be a common personal trait among CEOs and may have an effect on CEOs' investment decisions and financial reporting choices (Goel and Thakor, 2008). Upper Echelons theory suggests that organizational behaviors reflect the personal traits of top executives (Hambrick, 2016; Hambrick and Mason, 1984),[1] and CEO overconfidence may play an important role in corporate policy setting and strategic decisions. The literature has shown that companies with overconfident CEOs are more likely to have higher-level investments (Brown and Sarma, 2007; Malmendier and Tate, 2005, 2008), more innovative activities, and greater innovation success (Galasso and Simcoe, 2011; Hirshleifer et al., 2012) relative to companies with non-overconfident CEOs. Overconfident CEOs also need stronger cash inflows as compared to non-overconfident CEOs to satisfy their investment and innovation funding needs (Richardson, 2006).

Prior studies, however, also document that overconfident CEOs tend to overestimate their ability to generate earnings, which may

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[1] Hambrick (2016) explains upper echelons theory as that top executives use their own highly personalized lenses to understand companies' strategic situations including opportunities, threats, alternatives, and likelihoods of various outcomes. These individualized understandings are based on executives' experiences, values, personalities, and other human factors. Thus, according to the theory, organizations become reflections of their top executives.

https://doi.org/10.1016/j.jaccpubpol.2018.04.004

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create discrepancies between companies' real performance and their earnings expectations, resulting in the management of financial results to meet their expectations and satisfy their confidence needs (Gilson, 1989; Hribar and Yang, 2016; Hsieh et al., 2014; Schrand and Zechman, 2012). Tax avoidance may serve as an effective earnings management tool for companies to meet their earnings target, while alleviating their tax burden and increasing cash flows (Desai and Dharmapala, 2009; Halon, 2005; Phillips et al., 2003). Therefore, overconfident CEOs are more likely to promote tax avoidance, which is reflected in lower corporate effective tax rates (Olsen and Stekelberg, 2015).

Although the impact of CEO overconfidence on corporate decision-making processes is understood, it should be noted that CEOs may rely on CFOs to execute their financial reporting decisions (Jiang et al., 2010). Feng et al. (2011) also suggest that CFOs use their financial expertise to manipulate earnings because they succumb to pressure from CEOs for earnings management. Practitioners also recognize the importance of CFOs in financial reporting-related issues and call for closer scrutiny of the backgrounds and qualifications of CFOs who assist CEOs, as their business partners, in their decision-making processes (Cox, 2013; Egon Zehnder, 2016).

AESC (2015) argues that CFOs should possess the right chemistry (e.g., matched personality traits and similar beliefs) to collaborate with CEOs for the most effective and efficient management of the company. This contention is consistent with the False Consensus Effect, a psychological theory posits that people tend to selectively expose themselves to those who possess similar personality traits and, thus, share similar beliefs and values (Bahns et al., 2017). This selective exposure may lead to a cognitive bias of judgmental consensus in a social environment and, thus, exaggerate the overconfidence effect in a social relationship for people who share similar personality traits (Aronson et al., 2015; Bauman and Geher, 2002). Following these arguments, we investigate whether companies are more likely to engage in tax-avoidance activities when they have both an overconfident CEO and overconfident CFO, relative to other CEO/CFO combinations as based on their overconfident personality traits.

We adopt an equity-based overconfidence measure (*NETBUYER*) (Campbell et al., 2011; Malmendier and Tate, 2005) to identify overconfident CEOs and CFOs. We also adopt two long-term tax-avoidance measures, *ETR5* and *CETR5* (Dyreng et al., 2008), to test our research hypothesis. Our results suggest that companies with both overconfident CEOs and overconfident CFOs exhibit the highest level of tax-avoidance relative to the other CEO and CFO overconfidence combinations, supporting our argument that overconfident CEOs set the tone at the top to promote tax avoidance, while overconfident CFOs play an important role in executing the tax-avoidance guidance issued by overconfident CEOs.

Our study contributes to the accounting literature by providing empirical evidence that the interaction between CEOs and CFOs influence companies' tax avoidance strategies. Previous studies tend to focus only on the effects of CEOs' fixed effects or personal characteristics on firms' accounting-related decisions. However, accounting-related decisions are more likely to be controlled or influenced by CFOs due to their financial expertise and their changing role in contemporary business environment from traditional financial planning to strategic planning in support of companies' strategic goals. Our study, which provides early evidence about the role of CFOs in this association, helps investors understand companies' decision-making processes in terms of tax reporting. It also helps regulators identify potential factors that might cause losses of total tax revenue, leading them to more effectively regulate companies' tax reporting by taking into account the management style of both CEOs and CFOs.

The remainder of this paper consists of the following sections. The next section provides a synthesis of related studies and develops the research hypotheses. This is followed by a discussion of the research methods. The subsequent section presents the results. We conclude our study by discussing the results and presenting directions for the future research.

2. Literature review and hypothesis development

2.1. Tax avoidance

Tax avoidance refers to corporate activities that result in any "reduction in explicit taxes," including adopting different legal (even possibly illegal) tax strategies (Dyreng et al., 2008, 2010; Hanlon and Heitzman, 2010). Tax avoidance, tax planning, and aggressive tax reporting have been compared and used interchangeably to describe corporate tax-avoidance activities (Frank et al., 2009).

The corporate tax-avoidance has been widely studied in the accounting, taxation, finance, management and law literature. Previous studies have found an increase in tax avoidance in U.S.-based public companies and a substantial variation in the levels of companies' tax avoidance (Dyreng et al., 2008; Frank et al., 2009). According to Duff (2009), tax avoidance would allow firms to defer or permanently eliminate their tax liability. For example, companies may convert a taxable item, such as dividends received from capital investments, to a tax-exempt one, such as interest received from municipal bonds investments. Companies also may transfer income to other regions or countries to obtain a relatively lower tax rate. As a result, firms pay less tax and realize greater cash flows to satisfy their needs for investments, acquisitions, and other business activities.

As suggested by Shackelford and Shevlin (2001), there is a tradeoff between aggressive financial reporting and tax avoidance. Theoretically, higher taxable income should be associated with higher net income. Thus, firms have to sacrifice tax benefits for better financial results and vice versa. Firms' earnings numbers, however, are not always positively associated with their taxable income (e.g., Boynton et al., 2005; Frank et al., 2009; Hanlon et al., 2005). Increased financial income that is associated with decreased taxable income might represent abnormal earnings manipulation activities and tax avoidance (Halon, 2005; Phillips et al., 2003).

Firms' tax reporting can also be influenced by firm-specific factors. Klassen (1997) finds that firms' insider equity ownership is positively associated with aggressive tax reporting for high tax-rate firms. He argues that increased insider ownership concentration, as a firm-specific characteristic, reduces pressure and public scrutiny from external investors, thus motivating managers to behave more aggressively to satisfy their self-interests. Chen et al. (2010) find that family-owned firms tend to forgo tax benefits and behave less aggressively in regard to their tax reporting, relative to non-family-owned firms, to avoid other non-tax costs and potential

penalties. Further, corporate governance quality, institutional ownership, debt policy, and international operations also are associated with companies' tax-avoidance behavior (Dyreng et al., 2008; Graham, 2003; Graham and Tucker, 2006; Khurana and Moser, 2013; Shackelford and Shevlin, 2001).

In addition to firm-specific characteristics, top executives may generate a significant impact on companies' tax avoidance. Upper Echelons theory suggests that top executives, such as CEOs and CFOs, interpret their opportunities and threats and make decisions on significant corporate policies through their own highly personalized lens (Hambrick and Mason, 1984). An executive's experience, personality, and other human factors have the potential to drive these individualized corporate decisions. Therefore, organizational behavior, such as tax avoidance, can be viewed as a reflection of top executives' attitudes and preferences. Dyreng et al. (2010) use a unique database of high-level executives' movement across firms to examine the impact of top executives on corporate GAAP effective tax rates. They find that the actions of corporate top executives, including both CEOs and CFOs, are important determinants of corporate tax avoidance. Desai and Dharmapala (2006) and Rego and Wilson (2012) also document that executives' incentives are associated with corporate tax-avoidance activities. How intrinsic personal traits motivate executives to engage in tax avoidance, however, is still unclear. We argue that overconfidence, a personal trait of many top executives, may affect executives' decision-making on tax avoidance.

2.2. Effects of CEO overconfidence on tax avoidance

Overconfidence is a tendency to overestimate one's knowledge and capabilities, resulting in expecting more desirable or even unrealistic outcomes (Bhandari and Deaves, 2006; Gilson, 1989; Taylor and Brown, 1988; Weinstein, 1980). Overconfidence among CEOs is more prevalent than among the general population because overconfident managers are more likely to be promoted to CEO when competing with non-overconfident managers (Goel and Thakor, 2008).

Overconfident CEOs tend to overestimate their abilities and the probability of achieving good and rewarding performance. They are highly committed to their performance goals, such as bonuses and professional reputation, for self-interest (Gilson, 1989). The optimistic bias of overconfident CEOs would affect their decision making in regard to corporate reporting. For example, Schrand and Zechman (2012) find that overconfident CEOs are more likely to make intentional misstatements when their actual performance does not meet their expectations. Overconfident CEOs also tend to issue more debt and overvalue corporate investment projects, thus investing in risky projects (Hackbarth, 2008; Heaton, 2002). They tend to have higher investment levels and are more likely to engage in mergers and acquisitions (Brown and Sarma, 2007; Malmendier and Tate, 2005, 2008). Consequently, more financial resources need to be allocated to support the high levels of investment activities (Richardson, 2006). Thus, overconfident CEOs need to produce higher levels of income to meet their earnings expectations while, at the same time, allocating more economic resources to additional investments and business expansion. Engaging in tax-avoidance activities may help overconfident CEOs to alleviate corporate tax burdens and to provide more financial resource for their investment projects.

The literature has documented that overconfidence-related personal traits of CEOs could affect companies' tax-reporting policies. For example, Olsen and Stekelberg (2015) find that CEO narcissism is associated with lower effective tax rates, indicating that companies with narcissistic CEOs are more likely to engage in tax-avoidance activities. They also argue that narcissistic CEOs tend to report higher uncertain tax benefits as evidence of avoiding taxes.[2] Nevertheless, they argue that their measure of narcissism is a personal trait that is different from overconfidence.[3]

There may be various techniques for companies with overconfident CEOs to engage in tax-avoidance activities. For example, Ferris et al. (2013) suggest that overconfident CEOs engage in more international mergers and acquisitions. International business operations, especially in nations or regions with lower tax rates, may help companies effectively reduce their tax liabilities and, thus, may serve as a tool for overconfident CEOs to satisfy their investment ambitions and to avoid paying more taxes on their profits, resulting in lower taxes.[4] Although overconfident CEOs may exert their strong policy preference for avoiding taxes, they may not understand the specific techniques of tax avoidance and, thus, need to rely on CFOs to execute their policy guidance.

2.3. Effects of CEO and CFO interaction on tax avoidance

The role of CFOs in business has not attracted much attention, as compared to that of CEOs, in the accounting and taxation literature. There are a limited number of studies that investigate how CFO-related factors affect corporate decision making. For example, Geiger and North (2006) examine the level of accounting accruals after CFO changes and find that CFO changes may significantly decrease discretionary accruals. Ge et al. (2011) suggest that CFOs exercise their own styles in companies' financial reporting choices. Jiang et al. (2010) use a sample of S&P 1500 firms to examine the relationship between CEO/CFO stock option

[2] Olsen and Stekelberg (2015) also discussed other explanations of uncertain tax benefits and find empirical evidence of a positive association between uncertain tax benefits and CEO narcissism.

[3] Narcissism is usually related to other personal traits (e.g., selfishness, vanity, praise-seeking), which are not usually related to overconfidence (Young et al., 2015). Although Olsen and Stekelberg (2015) include CEO overconfidence as part of their controls, their overconfidence measure is based on abnormal asset growth and detect CEO overconfidence by using firm-level data indirectly. The *NETBUYER* measure, which we adopt in this study, utilizes CEO stock transaction data to provide a direct measure of CEO overconfidence based on the CEO's personal behavior.

[4] Apple Inc.'s CEO Tim Cook, in his interview with the Washington Post, emphasizes that many multinational companies, such as Apple Inc., choose to keep their overseas profits overseas to expand international business because they would face a huge amount of tax liability if they brought these earnings back to the United States. Cook specifically argued that, if Apple Inc. brought their overseas earnings back, they would face a 35 percent federal tax and 5 percent state tax. Thus he prefers to technically keep the money out of the U.S. (Johnson, 2016; McGregor, 2016).

compensation and unethical financial reporting behavior. They find that both CEO and CFO equity incentives are significantly associated with reported earnings numbers that meet or exceed analysts' forecasts and that the effect of this association is stronger for CFOs than for CEOs. Thus, they conclude that CFOs, who are financial experts and are responsible for financial reporting, actually exercise stronger influence than do CEOs on companies' earnings management activities. Similarly, Zheng (2012) differentiates the roles of CEOs and CFOs, based on their job responsibilities, to examine how an overconfident personality affects companies' business activities. She argues that CFOs are responsible for corporate financial policies and reporting processes, whereas CEOs have a greater impact on investments and acquisition-related decisions. She then relates these two roles with different financial outcomes to examine the relationships between CEOs' and CFOs' overconfident personalities and financial outcomes. Her results show that overconfident CFOs play an important role, even outweighing that of CEOs, in firms' financial-related decision making, such as debt versus equity financing.

Although CFOs may generate a significant impact on companies' financial decisions, they do not act alone, i.e., without CEOs' explicit or implicit policy guidance and support. As CEOs' business partners, CFOs exert decision power to deliver desirable business results by collaborating with CEOs on various financial-related business decisions (Feng et al., 2011; Jiang et al., 2010). Feng et al. (2011) compare CEOs' and CFOs' equity incentives in companies involved in accounting manipulation with matched non-manipulation counterparts as a means to distinguish the different roles played by CEOs and CFOs. Their results suggest that CFOs' incentives are not directly related to material accounting manipulations and that CEOs play a leading role in earnings management. CEOs with higher equity incentives tend to exert stronger pressure on CFOs to collaborate with them in accounting manipulations to satisfy their equity-incentive interests. These results indicate that CFOs, when succumbing to the tone at the top and collaborating with CEOs, may generate a significant impact on companies' financial decisions. Consistently, the Securities and Exchange Commission's (SEC) recent regulations (e.g., Section 906 of the Sarbanes-Oxley Act, effective July 30, 2002; Section 302 of the Sarbanes-Oxley Act, effective August 29, 2002; The SEC June 27 Order in 2002) require both CEOs and CFOs to take responsibility for corporate financial reports, reflecting an understanding of the CEO and CFO collaboration on financial reporting and policy decisions.

The results of practitioners' surveys also suggest that CFOs, in the contemporary business context, are expected not only to exercise their financial expertise but also to become more involved in managing the business, including participation in strategic management and risk control (Consero, 2013; Egon Zehnder, 2016). For example, Egon Zehnder (2016)[5] interviewed 20 leading CFOs from large companies worldwide to understand the roles of CFOs in business operations. The analysis of the interviewees' responses suggests that CEOs, in the current business context, expect CFOs not only to exercise their expertise but also to participate more in different business activities, such as strategic management and risk-control practices. Consero (2013) surveyed corporate CEOs and summarized that CFOs are expected to interact significantly and successfully with CEOs on strategic decision making, as their financial department also acts as a strategic partner for their organization. Thus, CFOs' capabilities of communicating and building close relationships with CEOs may be critical to their own career development. CFOs should possess the right chemistry to collaborate with CEOs to effectively support the CEO/CFO partnership.

As suggested by the False Consensus Effect theory, people tend to work closely with those who possess similar personality traits as a means to pursue similar beliefs and values, thereby achieving consensus agreements (Bahns et al., 2017). This tendency may lead to a cognitive bias and exaggerate overconfidence effects when achieving false consensus (Aronson et al., 2015; Bauman and Geher, 2002). Specifically, when overconfident CEOs collaborate with overconfident CFOs, their similarities in overconfident judgment and decision making may lead to stronger overconfident effects, resulting in more overconfident activities.

Prior empirical studies have not considered how CFOs may interact with CEOs when they possess similar or different personalities (i.e., overconfidence) on tax-reporting issues. Dyreng et al. (2010) suggested that CEOs affect firms' tax-avoidance behavior by setting the tone at the top and exerting pressure or providing incentives to CFOs or tax directors who have knowledge of tax reporting. Whether CFOs engage in tax-avoidance activities, however, might depend on their attitudes toward tax avoidance. Based on survey results of 20 CFOs from leading companies worldwide, Egon Zehnder (2016) concludes that the CEO/CFO partnership requires a personality match to ensure a successful collaboration on business decisions. Thus, overconfident CFOs may have more successful interactions with overconfident CEOs to affect companies' tax-avoidance policy due to their goal congruence. Specifically, with an overconfident CEO's tax-avoidance guidance, an overconfident CFO could be more motivated than a non-overconfident CFO to execute the CEO's guidance and engage in such activities because the CEO's guidance is likely to be consistent with the CFO's own expectations of the company's business strategy. In contrast, without the assertion of tax avoidance from CEOs, overconfident CFOs could be less likely to engage in tax-avoidance activities due to the lack of policy guidance. Therefore, we argue that the positive association between CEO overconfidence and tax-avoidance activities is contingent upon CFO overconfidence. This leads to our hypothesis:

Hypothesis. Firms with overconfident CEOs are more likely to engage in tax-avoidance activities when they have overconfident CFOs, relative to having non-overconfident CFOs.

[5] Egon Zehnder is a professional services firm. It was founded in 1964 and currently operates with 69 offices in 41 countries around the world. The company provides various professional services, including board advisory services, executive search and assessment, leadership planning and development, and business advisory. The company also publishes leadership insights with regard to business leadership trends or issues identified by their consultants. Examples of their published insights can be found at http://www.egonzehnder.com/us/leadership-insights.html.

3. Research methods

3.1. Overconfidence measures

Hall and Murphy (2002) introduced the certainty-equivalence framework to analyze top executives' behavior with regard to their option packages. The basic assumption of this framework is that options granted for risk-averse executives who do not have diversified investment portfolios would be exercised immediately on the day of vesting to realize the benefits. Based on this framework, Malmendier and Tate (2005) argue that CEOs' investment portfolios are highly influenced by the idiosyncratic risks of their firms due to restrictions on hedging or diversifying their investments. Unlike external investors, CEOs cannot hedge their investment risk by short-selling company stock, and their human capital is highly related to the firm's economic performance. Therefore, rational CEOs would be less likely to become a net purchaser of their company's stock due to their under-diversified investment portfolio. Overconfident CEOs, however, would be more likely to become net purchasers due to their unrealistic expectations of their company's future performance.

Following Zheng (2012), we apply this net purchaser logic to generate an equity-based measure to identify both overconfident CEOs (*NETBUYER*) and overconfident CFOs (*NETBUYER_CFO*). First, we extract CEO and CFO stock transaction data from the Thomson Reuters Database to evaluate whether an executive is a net purchaser of his or her company's stock in each year across our sample period. Then, to ensure that we have sufficient data to observe the behavior of an executive, we follow Malmendier and Tate (2005) to eliminate firm-year observations if an executive appears in our sample period for less than five years. Finally, if an executive exhibits net purchasing behavior of his or her company's stock more than 50% of the time during our sample period, the executive is identified as overconfident. Thus, both *NETBUYER* and *NETBUYER_CFO* are indicator variables in which the value of 1 indicates overconfidence; 0 indicates otherwise.

3.2. Tax-avoidance measures

We adopt two tax-avoidance measures based on a long-run (five year) GAAP Effective Tax Rate (*ETR5)* and a long-run (five year) Cash Effective Tax Rate (*CETR5*) to avoid significant year-to-year variations on a single-year tax-avoidance measure (Chen et al. 2010; Dyreng et al., 2008; Hope et al. 2013; Lennox et al. 2013; Lisowsky et al. 2013). As expressed in Eq. (1), the first measure, *ETR5,* is the ratio of total tax expense over the most recent five years scaled by total pre-tax income net of total special items over the same period. It detects a company's tax avoidance via its permanent book-tax differences, such as investments in municipal bonds and participation in tax shelters.

$$ETR5_{it} = \frac{\sum_{t=1}^{t=t+4} TXT_{it}}{\sum_{t=1}^{t=t+4} PI_{it} - \sum_{t=1}^{t=t+4} SPI_{it}} \tag{1}$$

where

TXT = total income tax expense
PI = pre-tax book income
SPI = special items (material nonrecurring).

As shown in Eq. (2), our second measure, *CETR5,* calculates companies' cash effective tax rate by using the total taxes paid in cash over the last five years scaled by total pre-tax income net of total special items over the same period of time. It considers both permanent and temporary book-tax differences.

$$CETR5_{it} = \frac{\sum_{t=1}^{t=t+4} TXPD_{it}}{\sum_{t=1}^{t=t+4} PI_{it} - \sum_{t=1}^{t=t+4} SPI_{it}} \tag{2}$$

where

TXPD = total taxes paid in cash.

Following the literature (e.g., Dyreng et al., 2008; Hope et al., 2013), we truncate both measures to the range [0, 1] and remove firm-year observations with negative total pre-tax income, net of total special items, over the last five years.

3.3. Main model

To test the interaction effect of CEO overconfidence and CFO overconfidence on companies' tax avoidance, we adopt a multivariate regression model, as expressed in Eq. (3), with *ETR5* and *CETR5* as the dependent variables. We include *NETBUYER* and *NETBUYER_CFO* as the independent variables and an interaction term of CEO overconfidence and CFO overconfidence (*NETBUYER* × *NETBUYER_CFO*) to investigate whether the association between CEO overconfidence and tax avoidance is contingent upon CFO overconfidence. We expect to observe that the interaction term of *NETBUYER* × *NETBUYER_CFO* is negatively associated with

both tax-avoidance measures.

$$TAXAVOIDANCE_{it} = \beta_0 + \beta_1 NETBUYER_{it} + \beta_2 NETBUYERCFO_{it} + \beta_3 NETBUYER \times NETBUYERCFO_{it} + \beta_4 MTB_{it} + \beta_5 LEV_{it} + \beta_6 LOGAT_{it} + \beta_7 FI_{it} + \beta_8 PPE_{it} + \beta_9 INATNG_{it} + \beta_{10} EQINC_{it} + \beta_{11} RD_{it} + \beta_{12} ROA_{it} + \beta_{13} CNOL_{it} + \beta_{14} CFO_{it} + \beta_{15} ACCRUALS_{it} + \beta_{16} MASCORE_{it} + Year_{it} + Ind_{it} + \varepsilon_{it} \quad (3)$$

We include various firm-specific characteristics to control for possible factors that may affect firms' tax-avoidance activities. Previous studies (e.g., Chen et al., 2010; Cheng et al., 2012; Mills et al., 1998; Rego, 2003; Stickney and McGee, 1983; Zimmerman, 1983) suggest that the complexity of business operations and economies of scale could be associated with a company's tax avoidance. Larger companies and companies with more complicated operations may have more resources to seek tax shelters and avoid taxes. Therefore, we include a series of variables, including market-to-book ratio (*MTB*), leverage ratio (*LEV*), natural logarithm of total assets (*LOGAT*), income from foreign operations (*FI*), total plant, property and equipment (*PPE*), intangible assets (*INTANG*), income related to the equity method (*EQINC*), and research and development activities (*RD*) to control for firms' business complexity and economies of scale. We expect these variables to be positively associated with tax avoidance. We also include return on asset (*ROA*) and change in net operating loss (*CNOL*) as proxies for companies' need to avoid income taxes (Chen et al., 2010; Rego, 2003). Cash flow from operating activities (*CFO*) also is included as a control variable and is expected to be positively associated with tax avoidance (Frank et al., 2009). In addition, we control for companies' total accruals (*ACCRUALS*), as Frank et al. (2009) report a positive association between companies' earnings management activities and tax avoidance. Finally, we adopt the managerial ability score (*MA_SCORE*), developed by Demerjian et al. (2012), to control for management abilities, as Koester et al. (2016) find that higher-ability managers are more likely to engage in strategic tax-planning activities. In our regression model, as expressed in Eq. (3), we also control for industry and year fixed effects and cluster the standard errors on firm identifier.[6] Appendix A presents the definitions of all variables in the model.

3.4. Sample selection

We extracted our sample from Compustat and Thomson Reuters databases. Our sample period spans 10 years, from 2004 to 2014. Table 1 presents our sample selection criteria and our final sample size for our empirical models, with *ETR5* and *CETR5* as the dependent variables. The number of original firm-year observations of CEO and CFO stock transactions extracted from Thomson Reuters totaled 38,090. We eliminated 23,297 firm-year observations of less than five years' stock transaction data for a CEO or a CFO. We further eliminated 8481 firm-year observations with any missing values to construct the CEO and CFO overconfidence measures. We then merged CEOs' and CFOs' stock transaction data from Thomson Reuters with financial data from Compustat and eliminated observations with missing values for control variables, yielding 1848 firm-year observations for models with *ETR5* as the dependent variable and 1962 firm-year observations for models with *CETR5* as the dependent variable.

4. Results

4.1. Descriptive statistics

Table 2 presents the descriptive statistics of the variables in our regression models. As shown, the average total tax expense in our sample is 29.5 percent of pre-tax income (*ETR5* = 0.295), and average cash tax payment is 22.4 percent of pre-tax income (*CETR5* = 0.224). The mean values of these two measures are similar to those reported in Dyreng et al. (2008, 2010), suggesting that our sample representativeness is reasonable. Approximately 5.5–5.9 percent of CEOs are identified as overconfident, and about 4.1–4.5 percent of CFOs are identified as overconfident. The proportion of overconfident CEOs identified in our sample is similar to that reported in Hribar and Yang (2016).

The firms in our sample present a market-to-book ratio of 3.726 and 3.665 and leverage ratios of 0.208 and 0.201, for *ETR5* and *CETR5* sample groups, respectively. The natural logarithm of total assets has a mean value of 7.106 for the *ETR5* sample group and 7.053 for the *CETR5* sample group. These measures are similar to those reported in Dyreng et al. (2008). The pre-tax income of our sample firms in the *ETR5* and *CETR5* models are 3 and 2.9 percent of their total assets, respectively. Our sample firms for the *ETR5* (*CETR5*) model have about 27.7 (26.4) percent of total assets as *PPE* and 25.9 (25.2) percent of total assets as intangibles. Also similar to the findings of Dyreng et al. (2008), our sample firms have an equity income of 0.0004 (both *ETR5* and *CETR5*), suggesting that most of the firms in our sample have very limited equity income. Further, our sample firms in the *ETR5* and *CETR5* models spend 2.8 and 3.1 percent of their total assets, on average, for research and development and generate about 15 percent income from their total assets. Very few firms in our sample report changes in tax-loss carry forward, as indicated in the mean values of *CNOL*. The mean values of cash flow from operations are 15.5 and 15.3 percent of total assets, and average discretionary accruals are −6.2 percent and −6.1 percent of total assets for the *ETR5* and *CETR5* sample firms, respectively. Finally, managerial ability scores present mean values of 0.025 and 0.026 for the *ETR5* and *CETR5* sample firms, respectively.

[6] Although Olsen and Stekelberg (2015) suggest including firm fixed effects to isolate the impact of CEO overconfidence on a firm's tax policy, due to the limited number of CEO changes in our sample, the results could be biased by some anomalous firms with multiple short-tenured CEOs when we include firm fixed effects in our model. Malmendier and Tate (2005) discuss a similar concern about the low within-firm variation of CEO overconfidence in their study that investigated the impact of CEO overconfidence on corporate investment. Therefore, we estimate our regression models with standard errors that cluster on individual firm identifiers.

Table 1
Sample selection.

	DV = ETR5	DV = CETR5
Firm year observations of firms with CEO or CFO data available from Thomson Reuters	38,090	
– Firm year observations of firms with a CEO or CFO who have less than five-year data in Thomson Reuters	23,297	
– Firm year observations with any missing value for CEO & CFO overconfidence measures	8481	
– Firm year observation with any missing value for dependent variable and missing value necessary for control variables	4464	4350
=Firm year observation for data analysis	1848	1962

Table 2
Descriptive statistics.

Variable	Mean	S.D.	25th Pctl.	Median	75th Pctl.
Panel A: DV = ETR5[a] (*N* = 1848)					
ETR5	0.295	0.106	0.239	0.315	0.364
NETBUYER	0.055	0.228	0.000	0.000	0.000
NETBUYER_CFO	0.041	0.197	0.000	0.000	0.000
MTB	3.726	3.044	1.883	2.870	4.353
LEV	0.208	0.208	0.011	0.171	0.324
LOGAT	7.106	1.572	5.957	7.030	8.216
FI	0.030	0.046	0.000	0.006	0.049
PPE	0.277	0.279	0.084	0.174	0.376
INTANG	0.259	0.252	0.035	0.198	0.413
EQINC	0.000	0.002	0.000	0.000	0.000
RD	0.028	0.043	0.000	0.000	0.046
ROA	0.150	0.105	0.082	0.128	0.193
CNOL	0.005	0.047	0.000	0.000	0.001
CFO	0.155	0.093	0.093	0.140	0.201
ACCRUALS	−0.062	0.071	−0.097	−0.056	−0.023
MA_SCORE	0.025	0.145	−0.062	−0.013	0.068
Panel B DV = CETR5[a] (*N* = 1962)					
CETR5	0.224	0.131	0.129	0.230	0.304
NETBUYER	0.059	0.235	0.000	0.000	0.000
NETBUYER_CFO	0.045	0.207	0.000	0.000	0.000
MTB	3.665	2.739	1.892	2.864	4.352
LEV	0.201	0.196	0.007	0.167	0.322
LOGAT	7.053	1.542	5.892	6.973	8.148
FI	0.029	0.041	0.000	0.006	0.048
PPE	0.264	0.255	0.081	0.169	0.363
INTANG	0.252	0.240	0.034	0.195	0.405
EQINC	0.000	0.001	0.000	0.000	0.000
RD	0.031	0.045	0.000	0.004	0.054
ROA	0.146	0.098	0.079	0.125	0.192
CNOL	0.002	0.035	0.000	0.000	0.001
CFO	0.153	0.087	0.092	0.139	0.200
ACCRUALS	−0.061	0.065	−0.097	−0.056	−0.022
MA_SCORE	0.026	0.137	−0.061	−0.010	0.069

[a] All continuous variables are winsorized at the 1st and 99th percentiles except for *ETR5* and *CETR5*, which are winsorized at 0 and 1, respectively.

Table 3 presents the Pearson correlation coefficients. As shown, *NETBUYER* is negatively and significantly correlated with both *ETR5* and *CETR5*. *NETBUYER_CFO* is positively and significantly associated with *NETBUYER* but not associated with *ETR5* or *CETR5*. The variance inflation factor values of all variables in our model (untabulated) are below the 10.00 cutoff point (Belsley et al., 1980), indicating that multicollinearity is not a concern for our regression analyses.

4.2. Empirical analysis

4.2.1. Dependent variable = ETR5

We adopt Eq. (3) as the main model to test our hypothesis. Table 4 presents the empirical results, with *ETR5* as the dependent variable. In Columns A and B of Table 4, we report the main effect of CEO and CFO overconfidence on companies' tax-avoidance behavior. As shown in these two columns, neither *NETBUYER* nor *NETBUYER_CFO* is significantly associated with *ETR5*, suggesting that CEOs and CFOs do not affect firms' tax avoidance as an individual executive. Column C of Table 4 presents the results of the interaction effect of CEO overconfidence and CFO overconfidence on companies' tax-avoidance activities. The results show a negative and significant association between *NETBUYER* × *NETBUYER_CFO* and *ETR5* ($p = 0.036$), suggesting that companies with an overconfident CEO and an overconfident CFO are more likely to engage in tax-avoidance activities. Thus, our hypothesis is supported.

Table 3
Spearman Correlation Table.

Variable[a,b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Panel A: DV = ETR5 (N = 1848)															
1.ETR5	**−0.04**	−0.01	0.03	**−0.04**	−0.06	**−0.24**	**0.09**	**−0.04**	0.00	**−0.30**	**0.10**	−0.03	**0.05**	−0.02	**−0.04**
2.NETBUYER	1.00	**0.45**	**−0.06**	**0.04**	**−0.13**	**−0.09**	**0.12**	**−0.08**	−0.01	0.00	**−0.07**	0.03	**−0.07**	−0.01	−0.01
3.NETBUYER_CFO		1.00	**−0.04**	0.01	**−0.10**	**−0.06**	−0.01	0.03	−0.03	−0.03	**−0.06**	−0.03	**−0.08**	0.03	−0.03
4.MTB			1.00	−0.03	**−0.05**	**0.20**	**−0.04**	**−0.09**	0.00	**0.13**	**0.46**	−0.04	**0.43**	**−0.10**	**0.16**
5.LEV				1.00	**0.22**	**−0.06**	**0.33**	**0.29**	**0.10**	**−0.25**	**−0.26**	**0.05**	**−0.19**	−0.02	**−0.18**
6.LOGAT					1.00	**0.15**	**0.14**	**0.07**	**0.17**	**−0.11**	**−0.25**	0.00	**−0.14**	**−0.04**	**0.09**
7.FI						1.00	**−0.16**	−0.01	0.02	**0.19**	**0.22**	−0.01	**0.15**	**0.11**	**0.16**
8.PPE							1.00	**−0.41**	**0.07**	**−0.31**	−0.03	0.04	**0.23**	**−0.32**	**−0.06**
9.INTANG								1.00	0.02	0.04	**−0.11**	−0.01	**−0.14**	**0.07**	**−0.07**
10.EQINC									1.00	**−0.13**	0.00	0.00	−0.02	**0.06**	**−0.10**
11.RD										1.00	−0.03	**0.07**	**0.08**	**−0.12**	**0.26**
12.ROA											1.00	**−0.10**	**0.71**	**0.05**	**0.26**
13.CNOL												1.00	**−0.07**	**−0.05**	−0.03
14.CFO													1.00	**−0.58**	**0.28**
15ACCRUALS														1.00	**−0.12**
16. MA_SCORE															1.00
Panel B: DV = CETR5 (N = 1962)															
1.CETR5	**−0.09**	−0.02	**−0.04**	**−0.09**	−0.02	**−0.06**	**−0.13**	**0.04**	**0.04**	**−0.29**	**0.08**	**0.07**	**−0.08**	**0.11**	**−0.12**
2.NETBUYER	1.00	**0.49**	**−0.07**	0.03	**−0.12**	**−0.10**	**0.08**	**−0.09**	−0.01	0.00	**−0.09**	0.02	**−0.09**	0.00	−0.03
3.NETBUYER_CFO		1.00	**−0.04**	0.01	**−0.10**	**−0.05**	**−0.04**	0.01	**−0.04**	−0.01	**−0.08**	−0.04	**−0.11**	0.03	**−0.05**
4.MTB			1.00	**−0.05**	**−0.07**	**0.16**	**−0.05**	**−0.09**	−0.02	**0.16**	**0.47**	**−0.05**	**0.45**	**−0.11**	**0.19**
5.LEV				1.00	**0.26**	**−0.06**	**0.31**	**0.26**	**0.13**	**−0.25**	**−0.25**	**0.05**	**−0.21**	−0.01	**−0.16**
6.LOGAT					1.00	**0.18**	**0.18**	**0.08**	**0.22**	**−0.17**	**−0.21**	**0.05**	**−0.13**	−0.03	**0.08**
7.FI						1.00	**−0.16**	0.00	0.03	**0.16**	**0.20**	0.01	**0.13**	**0.12**	**0.14**
8.PPE							1.00	**−0.42**	**0.09**	**−0.33**	−0.02	**0.04**	**0.22**	**−0.31**	**−0.07**
9.INTANG								1.00	0.01	0.01	**−0.12**	0.01	**−0.15**	**0.07**	**−0.07**
10.EQINC									1.00	**−0.15**	−0.03	0.02	**−0.05**	**0.07**	**−0.11**
11.RD										1.00	−0.03	−0.02	**0.09**	**−0.11**	**0.27**
12.ROA											1.00	**−0.10**	**0.70**	**0.06**	**0.25**
13.CNOL												1.00	**−0.09**	**−0.04**	**−0.04**
14.CFO													1.00	**−0.54**	**0.28**
15.ACCRUALS														1.00	**−0.13**
16.MA_SCORE															1.00

[a] All continuous variables are winsorized at the 1st and 99th percentiles except for ETR5 and CETR5, which are winsorized at 0 and 1, respectively.

[b] Coefficients shown in bold are significant at $p < 0.10$ (two-tailed test).

For the control variables, our results show that companies that are highly valued by the market (*MTB*, $p = 0.014$) tend to have higher *ETR5*. In contrast, companies that have more debt (*LEV*, p = 0.000) tend to have lower *ETR5*. Companies that report more foreign income (*FI*, $p = 0.011$) are likely to have more resources for tax planning and, thus, have lower *ETR5*. Research and development (*RD*, $p < 0.001$) also is negatively associated with *ETR5*, suggesting that companies that allocate more financial resources to research and development are likely to have lower *ETR5* due to high deductible expenditures. Moreover, cash flow from operating activities (*CFO*, $p = 0.072$) is marginally and negatively associated with *ETR5*, suggesting that companies pay less tax to save for greater cash flow. Finally, companies that score high on managerial ability (*MA_SCORE*, $p = 0.015$) tend to have lower *ETR5*, indicating more tax-avoidance activities.

We also provide a visual illustration of the interaction effect by using the coefficients of the intercept, the main effects, and the interaction term from our regression model, as reported in Column C of Table 4, to interpret results. As shown in Fig. 1, when companies have both overconfident CEOs and overconfident CFOs, they tend to exhibit the lowest *ETR5*, relative to other CEO/CFO combinations. More specifically, when CFOs are overconfident, the *ETR5* of companies with an overconfident CEO are significantly higher than that of companies with a non-overconfident CEO ($p = 0.046$). When CFOs are non-overconfident, however, there is no significant difference in *ETR5* for companies with or without an overconfident CEO. Thus, the association between CEO overconfidence and tax-avoidance policy is contingent upon CFOs' overconfidence. With the assistance of overconfident CFOs in terms of tax-reporting issues, firms with overconfident CEOs are more likely to have their tax-avoidance guidance being executed effectively.

4.3. Dependent variable = CETR5

Table 5 presents the empirical results, with *CETR5* as the dependent variable. As shown in Column A of the table, *NETBUYER* is negatively and significantly associated with *CETR5* ($p = 0.045$), suggesting that companies with an overconfident CEO are likely to have lower *CETR5*. In Column B of Table 5, we present an examination of the direct effect of CFO overconfidence and companies' tax avoidance and find insignificant results. We use the full interaction model in Eq. (3) to examine our hypothesis. Column C of Table 5 presents the results. As predicted, *NETBUYER* × *NETBUYER_CFO* is negatively related to *CETR5* ($p = 0.020$). The results also appear

Table 4
CEO/CFO Overconfidence and Tax Avoidance (DV = ETR5).

Variable[a]	Predicted sign	Column A[b]		Column B[b]		Column C[b]	
		Estimate	Pr > |t|	Estimate	Pr > |t|	Estimate	Pr > |t|
Intercept		0.330	< .001	0.328	< .001	0.335	< .001
NETBUYER	–	−0.023	0.127			0.002	0.924
NETBUYER_CFO	–			−0.019	0.232	0.028	0.170
*NETBUYER*NETBUYER_CFO*	–					−0.095	0.036
MTB	–	0.003	0.021	0.003	0.020	0.003	0.014
LEV	–	−0.091	0.000	−0.092	0.000	−0.095	0.000
LOGAT	–	−0.002	0.253	−0.002	0.287	−0.002	0.187
FI	–	−0.234	0.007	−0.231	0.008	−0.219	0.011
PPE	–	0.041	0.099	0.040	0.114	0.039	0.116
INTANG	–	0.033	0.129	0.035	0.114	0.035	0.109
EQINC	–	1.113	0.574	0.910	0.640	1.262	0.517
RD	–	−0.499	< .001	−0.509	< .001	−0.506	< .001
ROA	?	0.140	0.108	0.142	0.105	0.135	0.115
CNOL	?	0.010	0.866	0.007	0.911	0.004	0.943
CFO	–	−0.165	0.075	−0.162	0.079	−0.166	0.072
ACCRUALS	–	−0.094	0.168	−0.095	0.167	−0.098	0.158
MA_SCORE	–	−0.050	0.020	−0.050	0.019	−0.052	0.015
Year Fixed Effects		Yes		Yes		Yes	
Industry Fixed Effects		Yes		Yes		Yes	
Cluster Standard Errors by Firm		Yes		Yes		Yes	
Obs.		1848		1848		1848	
Adj. R^2		0.275		0.274		0.280	

[a] Variables are defined in Appendix A. All continuous variables are winsorized at the 1st and 99th percentiles except for ETR5 which is winsorized at 0 and 1.
[b] *p*-values are adjusted to one-tailed based on predicted signs.

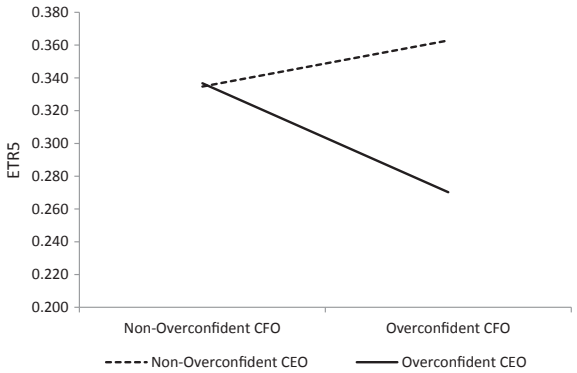

Fig. 1. CEO/CFO overconfidence and tax avoidance (DV = ETR5).

visually in Fig. 2. Consistent with our hypothesis, Fig. 2 shows that companies generate the lowest *CETR5* when they have both overconfident CEOs and overconfident CFOs, relative to other CEO/CFO overconfidence combinations. Specifically, there is no significant difference in *CETR5* for companies with non-overconfident CFOs, regardless of the confidence level of the companies' CEOs. When CFOs are overconfident, however, *CETR5* is significantly lower for companies with an overconfident CEO, relative to companies with a non-overconfident CEO ($p = 0.005$).

The results for the control variables are similar to those with *ETR5* as the dependent variable. Specifically, companies that generate greater income (*ROA*, $p = 0.000$) and change of net operating loss (*CNOL*, $p = 0.002$) tend to have higher *CETR5* because these companies have a greater need to avoid taxes. Companies that are highly leveraged (*LEV*, $p = 0.003$) and invest more in fixed tangible assets (*PPE*, $p = 0.007$) tend to have lower *CETR5*. Research and development (*RD*, $p < 0.001$) also is negatively associated with *CETR5*. In addition, companies that generate greater cash flow (*CFO*, $p < 0.000$) and have higher levels of *ACCRUALS* ($p = 0.001$) tend to have lower *CETR5*. Finally, companies with more capable managers (*MA_SCORE*, $p = 0.001$) tend to have lower *CETR5*.

Overall, our results suggest that the role of CEO overconfidence in companies' tax-avoidance activities is contingent upon CFO overconfidence. When an overconfident CEO promotes tax-avoidance activities, overconfident CFOs are more likely to develop the same attitude toward tax avoidance due to their similar beliefs of the company's business situation and are, thus, more likely to collaborate on tax-avoidance activities. Non-overconfident CFOs, however, are less likely to overestimate companies' earnings and to

Table 5
CEO/CFO Overconfidence and Tax Avoidance (DV = CETR5).

Variable[a]	Predicted sign	Column A[b]		Column B[b]		Column C[b]	
		Estimate	Pr > |t|	Estimate	Pr > |t|	Estimate	Pr > |t|
Intercept		0.300	< .001	0.295	< .001	0.306	< .001
NETBUYER	–	−0.039	0.045			−0.010	0.377
NETBUYER_CFO	–			−0.026	0.149	0.034	0.279
*NETBUYER*NETBUYER_CFO*	–					−0.106	0.020
MTB	–	−0.002	0.130	−0.002	0.132	−0.002	0.334
LEV	–	−0.074	0.003	−0.074	0.003	−0.078	0.003
LOGAT	–	−0.003	0.217	−0.002	0.261	−0.004	0.154
FI	–	0.104	0.283	0.114	0.243	0.122	0.208
PPE	–	−0.085	0.009	−0.086	0.008	−0.087	0.007
INTANG	–	0.032	0.208	0.034	0.174	0.033	0.189
EQINC	–	4.425	0.178	4.048	0.210	4.724	0.148
RD	–	−0.714	< .001	−0.722	< .001	−0.726	< .001
ROA	?	0.311	0.000	0.313	0.000	0.305	0.000
CNOL	?	0.300	0.002	0.293	0.002	0.297	0.002
CFO	–	−0.394	0.000	−0.387	0.000	−0.396	0.000
ACCRUALS	–	−0.300	0.001	−0.299	0.001	−0.308	0.001
MA_SCORE	–	−0.088	0.001	−0.088	0.001	−0.090	0.001
Year Fixed Effects		Yes		Yes		Yes	
Industry Fixed Effects		Yes		Yes		Yes	
Cluster Standard Errors by Firm		Yes		Yes		Yes	
Obs.		1962		1962		1962	
Adj. R^2		0.291		0.288		0.295	

[a] Variables are defined in Appendix A. All continuous variables are winsorized at the 1st and 99th percentiles except for ETR5 which is winsorized at 0 and 1.
[b] *p*-values are adjusted to one-tailed based on predicted signs.

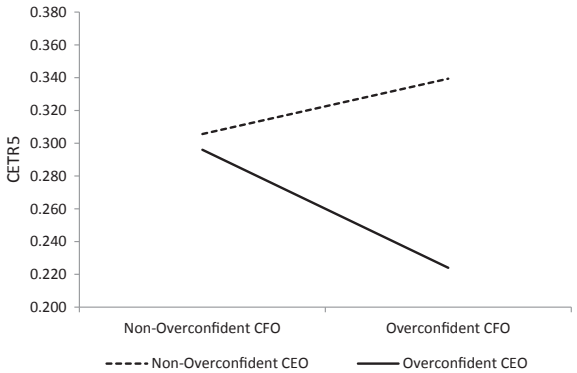

Fig. 2. CEO/CFO overconfidence and tax avoidance (DV = CETR5).

agree with the business strategy or investment plans promoted by overconfident CEOs; thus, they are less likely to collaborate with overconfident CEOs to reduce companies' tax burdens by engaging in tax-avoidance activities. In contrast, when companies have non-overconfident CEOs, both overconfident and non-overconfident CFOs are less likely to engage in tax-avoidance activities due to a lack of guidance and roadmap from the CEOs.

4.4. Robustness tests

We also adopt two alternative approaches for CEO and CFO overconfidence to examine the robustness of our results. First, we follow Schrand and Zechman (2012) to develop a measure (*OC_FIRM5*) for CEO overconfidence, using firm-level investing and financial activities. *OC_FIRM5* combines five factors, including (1) greater than zero industry-adjusted excess investment, (2) greater than zero industry-adjusted net dollars of acquisitions, (3) greater than zero industry-adjusted debt-to-equity ratio, (4) convertible debt or preferred stock indicator, and (5) equal to zero dividend yield. If a firm presents at least three out of the five factors in a firm year, the CEO of the firm will be classified as an overconfident CEO for that firm year. By using this method, the overconfident CEO measure creates some variation between CEO overconfidence and a firm effect. We then adopt an executive option-based

Table 6
Robustness tests, using alternative overconfidence measures.

Variable[a]	Predicted sign	Column A - ETR5[b]		Column B - CETR5[b]	
		Estimate	Pr > |t|	Estimate	Pr > |t|
Intercept		0.273	< .0001	0.301	< .001
OC_FIRM5	–	0.012	0.124	−0.006	0.252
HOLDER67_CFO	–	0.015	0.009	0.004	0.578
*OC_FIRM5*HOLDER67_CFO*	–	−0.022	0.010	−0.023	0.026
MTB	–	0.001	0.395	−0.002	0.032
LEV	–	−0.019	0.107	−0.048	0.008
LOGAT	–	−0.003	0.133	−0.002	0.258
FI	–	−0.384	< .001	−0.024	0.396
PPE	–	0.013	0.553	−0.046	0.033
INTANG	–	−0.004	0.399	−0.004	0.409
EQINC	–	1.233	0.051	1.144	0.086
RD	–	−0.181	0.027	−0.255	0.005
ROA	*?*	0.108	0.143	0.271	< .001
CNOL	*?*	0.072	0.221	0.218	< .001
CFO	–	−0.021	0.421	−0.329	< .001
ACCRUALS	–	−0.027	0.387	−0.185	0.002
MA_SCORE	–	−0.016	0.248	−0.053	0.022
Year Fixed Effects		*YES*		*YES*	
Industry Fixed Effects		*YES*		*YES*	
Cluster Standard Errors by Firm		*YES*		*YES*	
Obs.		3895		4103	
Adj. R^2		0.161		0.148	

[a] Variables are defined in Appendix A. All continuous variables are winsorized at the 1st and 99th percentiles except for ETR5 which is winsorized at 0 and 1.
[b] *p*-values are adjusted to one-tailed based on predicted signs.

overconfidence measure (*HOLDER67_CFO*), developed by Malmendier and Tate (2005, 2008), and Campbell et al. (2011), to evaluate CFO overconfidence. *HOLDER67_CFO* captures CFOs' option-exercising behavior for at least five years for CFOs to exist in our sample and suggests that a greater delay of exercising 'in the money' options may reflect an overconfident personality of a CFO. Thus, we replace the CEO and CFO overconfidence measure in our main model with *OC_FIRM5* and *HOLDER67_CFO* to reexamine our research hypothesis and report results in Table 6.

As shown in Column A of Table 6, the coefficient of the interaction term (*OC_FIRM5*HOLDER67_CFO, P = 0.010*) is negative and highly significant, indicating that a combination of overconfident CEO and overconfident CFO is associated with the lowest *ETR5*. We then replace *ETR5* with *CETR5* and use the alternative measures for CEO and CFO overconfidence to examine the robustness of our main results with *CETR5*. The results, as shown in Column B of Table 6, are highly consistent with the results of *ETR5*, with a significant negative coefficient of the interaction term *OC_FIRM5*HOLDER67_CFO* ($p = 0.026$), thus providing further support for our main findings.[7]

5. Conclusion

In this study, we investigate the association between CEO/CFO overconfidence interaction and companies' tax avoidance. Specifically, we try to understand how CEOs and CFOs are intertwined to influence companies' tax-avoidance activities when they possess similar or different levels of overconfidence traits. We use two long-run tax-avoidance measures to estimate companies' tax-avoidance behavior and an equity-based overconfidence measure to identify overconfident CEOs and CFOs. Our results suggest that companies with both overconfident CEOs and overconfident CFOs are more likely to engage in tax-avoidance activities when compared to companies with other CEO/CFO overconfidence combinations. Our results are robust to various confidence measures. Our findings imply that, although CEOs might not possess tax expertise, they affect companies' tax behavior by creating the tone at the top in the company to promote tax avoidance (Olsen and Stekelberg, 2015). We also report that overconfident CFOs play an important role in facilitating overconfident CEOs to execute the guidance and roadmap of tax avoidance that the CEO promotes.

Our study extends and contributes to the growing literature with regard to the determinants of companies' tax avoidance by providing empirical evidence that overconfident CEOs and overconfident CFOs may interact to play a significant role in determining companies' tax-avoidance behavior, suggesting that CEOs and CFOs are more likely to cooperate if both of them possess the same personality traits. Our results may help tax authorities understand the roles played by both CEOs' and CFOs' personalities in corporate tax reporting. Future studies should also investigate the specific techniques that companies may adopt to implement a tax-avoidance plan to further help tax authorities regulate corporate tax reporting.

[7] In addition, we also reduce the five-year limitation to three- or four-year periods to capture executive overconfidence. We repeat the above analyses and observe overall consistent results.

We also contribute to the application of False Consensus Effect theory in the management field by providing empirical evidence that executives tend to selectively expose themselves to those who possess similar personality traits, and, thus, similar beliefs and values (Bahns et al., 2017), to collaborate and achieve their business goals. This application emphasizes the importance of understanding whether executives interact with each other in other accounting activities. Future studies could consider the joint impact of CEOs and CFOs on different corporate accounting policies, such as financial reporting, cost accounting and information assurance.

Acknowledgements

We thank Martin Loeb (editor) and the anonymous referees for their valuable comments and suggestions, which helped us improve the paper significantly for which we are grateful. We thank Patricia O'Brien, Oktay Urcan, Michael Kimbrough, Lawrence Gordon, Musa Subasi, Rebecca Hann, Nan Zhou, Robert Felix, Emanuel Zur, Ari Yezegel, Mohammad J. Abdolmohammadi, Jean Bedard, and Mikhail Pevzner for their valuable insights. We also thank participants of research workshops at Clark University, University of Maryland, California State University Northridge and Morgan State University for their comments and suggestions. The paper has also benefitted from the feedbacks during presentations at AAA 2017 annual conference.

Appendix A

Definitions of variables

Variables	Definitions (Data items)
TAX AVOIDANCE	Tax avoidance levels, measured by (1) ETR5, or (2) CETR5
ETR5	total tax expense over the last five years scaled by total pre-tax income minus total special items over the same period
CETR5	total taxes paid in cash over the last five years scaled by total pre-tax income minus total special items over the same period of time
NETBUYER	Equals to 1 if a CEO is classified as an overconfident CEO based on the net buyer criteria; 0 otherwise
NETBUYER_CFO	Equals to 1 if a CFO is classified as an overconfident CFO based on the net buyer criteria; 0 otherwise
MTB	Market value (CSHO∗PRCC_F) scaled by total common/ordinary equity(CEQ)
LEV	Total debt (DLTT + DLC) scaled by total assets at the beginning of the year (AT)
LOGAT	Natural logarithm of total assets at beginning of the year (AT)
FI	Pre-tax income for year t (PIFO) scaled by total assets at the beginning of the year (AT)
PPE	Net PPE for year t (PPENT) scaled by total assets at the beginning of the year (AT)
INTANG	Total intangible assets (INTAN) scaled by total assets (AT) at beginning of the year
EQINC	Equity income for year t (ESUB) scaled by total assets at the beginning of the year (AT)
RD	R&D expense for year t (XRD) scaled by total assets (AT)
ROA	Pre-tax income (PI) net of special items (SPI) scaled by total assets at beginning of the year (AT)
CNOL	Change in tax-loss carry forward (TLCF) from year t-1 to year t scaled by total assets (AT) at the beginning of the year
CFO	Net cash flow of operating activities (OANCF) scaled by total assets (AT) at beginning of the year
ACCRUALS	Income before extraordinary items (cash flow) (IBC) –net cash flow from operating activities/ (OANCF) + extraordinary items and discontinued operations (Cash Flow) (XIDOC) scaled by total assets at the beginning of the year (AT)
MA_SCORE	The residual from a firm efficiency estimation model used in Demerjian et al. (2012). Data is available at http://faculty.washington.edu/pdemerj/data.html
OC_FIRM5	Equals to 1 if a firm lead by a CEO presents at least three out of the five factors describing a firm's overconfident behavior in a firm year; 0 otherwise
HOLDER67_CFO	Equals to 1 if a CFO is classified as an overconfident CFO based on the holder67 criteria; 0 otherwise

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