Is corporate tax avoidance associated with investment efficiency?

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Abstract: The purpose of this study is to examine the association between investment efficiency and corporate tax avoidance. Using a large sample of U.S. firms over the period 1993-2016, we show that there is a positive association between corporate tax avoidance activities and investment inefficiency. Moreover, we find that the association is mediated by financial statement readability, financial statement comparability and product market competition. Our results are robust to alternative measures of both tax avoidance and investment inefficiency. Propensity score matching (PSM), difference-in-difference (DID), and two-stage least squares (2SLS) regression analyses confirm our results and mitigate any potential endogeneity issues that might result from the effect of omitted variables, reverse causality or model misspecification.

Keywords: Investment efficiency, Cash tax saving, Tax avoidance, Financial statement obscurity, Product market competition, Financial statement comparability.

JEL classification: M2, M40, M41, H26.

1. Introduction

This study examines the association between corporate tax avoidance activities and investment efficiency[1]. We predict that firms' participation in tax avoidance activities will lead them to invest inefficiently. We are motivated to undertake such a study because firm value is largely affected by managers' decisions, and decisions relating to investment represent some of the most important decisions for a firm in terms of dollar amount of capital outlay, and in determining the ability of the firm to achieve its strategic and business objectives (Hubbard, 1998). Shareholders therefore require firm managers to invest prudently so that the firm will be able to increase its value and shareholder welfare maximization. Further, tax avoidance by firms may affect their ability to achieve investment targets through an increase in tax savings[2] (Armstrong et al., 2012; Graham et al., 2014; Leone, 2008) and also in influencing the level of governance and control in place (Dyreng, Hanlon, & Maydew, 2008; Hanlon & Heitzman, 2010).

[1] Investment efficiency denotes an event whereby firms partake in a venture that produces positive net present value (NPV) and there are no market frictions, such as agency costs or information asymmetry (Jensen & Meckling, 1976; Myers, 1977; Jensen, 1986; Biddle et al., 2009).

[2] For instance, Mills et al., (1998) find that the tax planning strategy of the firm is estimated an average return of approximately $4 for each $1 invested in tax planning. Wilson (2009) estimates an average return of approximately $12 for each $1 in fees paid related to tax shelters (ignoring any associated in house costs).

Following Eisdorfer, Giaccotto, and White (2013), we measure investment efficiency as the difference between real and predictable investment in order to reflect the degree to which a firm departs from its optimum investment strategy. The real investment of a firm is calculated by dividing gross capital outlays by book value of total assets at the commencement of the year. The firm's predictable level of investment is proxied by the median investment in the industry during the year. Following prior literature (e.g. Rego, 2003; Wilson, 2009; Dyreng et al., 2010; Hoi et al., 2013), we employ the accounting effective tax rate as our key proxy of tax avoidance. A lower accounting effective tax rate denotes a higher level of tax avoidance (Dyreng et al., 2010).

Using a large sample of U.S. firms from 1993 to 2016, we show that the there is a positive association between corporate tax avoidance activities and investment inefficiency. In terms of economic significance, decreasing the accounting effective tax rate (*GAAP_ETR*) by 1% (i.e. higher tax avoidance) increases investment by 2.51% amongst firms that are over-investing. Moreover, we find that the effect of corporate tax avoidance activities on investment inefficiency is mediated by financial statement obscurity, financial statement comparability and product market competition. Our results are robust to the use of alternative tax avoidance and investment inefficiency proxies. PSM, DID and 2SLS analyses confirm our results and mitigate any potential endogeneity issues that might result from the effect of omitted variables, reverse causality or model misspecification.

The findings of this study are important for several reasons. Firstly, we contribute to the literature examining the consequences of corporate tax avoidance. Edwards et al. (2016) find that cash generated from tax planning represents an important source of funds within corporations, and firms with financial constraints are more likely to engage in tax avoidance activities. Our study provides evidence that firms' cash tax savings from avoidance activities are not used efficiently. Secondly, we contribute to the investment efficiency literature by providing evidence on how efficiently firms use cash tax savings from tax avoidance activities to fund their investments. Prior studies investigate the association between investment efficiency and financial reporting quality (Biddle & Hilary, 2006; Biddle et al., 2009; Chen et al., 2011; Cheng et al., 2013; Balakrishnan et al., 2014), accounting conservatism (Lara et al., 2016), auditor characteristics (Bae et al., 2016), or corporate social responsibility (Benlemlih & Bitar, 2018). However, there is a paucity of work that examines the association of corporate tax avoidance and investment efficiency. Green and Kerr (2016) find that firms use cash tax savings from tax avoidance activities on new investments but they do not provide evidence as to whether this internally-generated cash is used efficiently. Blaylock (2016) and Khurana et

al. (2018) are among the first papers to investigate the issue of tax avoidance and investment efficiency. Our study differs from prior studies in this area in a number of ways. While we find a positive association between tax avoidance and investment inefficiency for both overinvestment and underinvestment, Blaylock (2106) does not find a significant relation and Khurana et al. (2018) only find a significant association for overinvestment. In addition, our measure of investment efficiency differs from that used by Blaylock (2016) and Khurana et al. (2018) in that it relies on the regression residuals of Richardson (2006)'s method to define overinvestment and underinvestment. While Khurana et al. (2018) examine the impact of managerial ability and corporate governance on the relation between corporate tax avoidance and investment efficiency, we investigate the mediation effect of product market competition, financial statement obscurity and financial statement comparability on this relationship. Our study, therefore adds to the literature by providing evidence of the direct and indirect (mediating) effect of corporate tax avoidance on investment efficiency. In doing so, this study contributes to the debate as to whether the firm benefits economically from increased levels of tax avoidance, and the role of product market competition, financial statement obscurity and financial statement comparability have in constraining agency related effects such as rent extraction, information asymmetry and opportunistic managerial activities that may exacerbate the corporate tax avoidance-investment inefficiency relation.

The rest of this paper is as follows. Section 2 examines the theory and develops our hypotheses. Section 3 outlines the research design. Section 4 presents the empirical results, and Section 5 describes additional analyses. Finally, conclusions are discussed in Section 5.

2. Literature review and hypotheses development

2.1. Investment efficiency and tax avoidance

Prior research has examined corporate tax avoidance from a cost-benefit perspective, where the paybacks from reduced taxes are weighed against costs pertaining to obscure financial reporting, penalties and fines, reputation and regulation (Shackelford & Shevlin, 2001; Scholes et al., 2008; Hanlon & Heitzman, 2010). Mills et al. (1998) corroborate the fact that for each dollar spent on tax planning, the firm retains approximately four dollars in tax commitments. This finding indicates that tax avoidance is a value-enhancing activity owing to its ability to increase cash flows via decreased explicit taxes. Because tax expenditure is normally one of the major expenditures on firms' income statements, it appears logical that tax planning benefits would be substantial. Robinson et al. (2010) posit that numerous firms regard their tax unit as a profit centre.

According to the pecking order theory, there is no optimum level of cash, and cash functions only as a link between retained earnings and investment requirements. Hence, firms may avoid tax even if they have enough internal resources to fund their investments. In the presence of information asymmetry, the cost of external funding is higher than the cost of internal funding. Therefore, firms are inclined to use internally generated funds before they pursue external funding. Edwards et al. (2016) provide evidence that tax planning could be employed as an internal source of funding to enable financially distressed firms with tax savings to access worthy investment ventures. Thus, tax avoidance could be a value increasing firm action. Firms use tax avoidance to grow their internal resources and to reduce capital rationing. As external funding gets expensive, or less available, in the presence of information asymmetry, the incremental returns from cash tax savings, as internally generated funds, become more important (Edwards et al., 2016; Leone, 2008).

Prior research indicates that tax avoidance can be considered along with other investment opportunities available to management (Armstrong et al., 2012; McGuire, Omer & Wilde, 2014; Mayberry, 2012; Green & Kerr, 2016). Thus, to the extent that the benefits of generating cash tax saving through tax avoidance activities exceed the associated costs, firms maximizing profits would consider the opportunity to reduce tax burdens (Mills, Erickson & Maydew, 1998; Goh et al., 2016; Hanlon & Heitzman, 2010; Hanlon et al., 2017).

One of the most important determinants of the value of a firm is managers' decisions in relation to investment as such decisions can significantly affect the returns of the shareholders (Hubbard, 1998). Therefore, shareholders usually expect a firm's management to invest shrewdly, to increase its value and result in higher returns. In capital markets without any frictions, firms invest if the marginal returns are higher than the marginal cost, i.e. they invest in investment projects that produce positive net present value (NPV). The imperfections that exist in the capital market, such as 'agency problems' and 'information asymmetry' hinder investment efficiency and, hence, result in either overinvestment or underinvestment (Jensen & Meckling, 1976; Myers, 1977; Myers & Majluf, 1984; Jensen, 1986).

Firms with cash flows generated from tax avoidance may face the agency problem by investing in projects that are not value-enhancing (Jensen, 1986). Self-serving managers would utilise their freedom of choice in taking decisions that advantage them, if there is an absence of appropriate surveillance (Shleifer & Vishny, 1997). Hence, managers with extra cash savings from tax avoidance could potentially invest in negative NPV projects, leading to sub-optimal overinvestment. Harvey, Lins and Roper (2004) show that overinvestments are likely to occur in firms with a large available cash flow. Moral hazard arises when firm managers

embark on overinvestment choices for personal profit or "empire building", i.e. to expand their firms beyond optimal size to gain more power and benefits for themselves (Aggarwal and Samwick, 2006; Avery et al., 1998; Blanchard, Lopez-de-Silanes, and Shleifer 1994; Hope and Thomas, 2008; Stulz 1990).

Firms with cash savings from tax avoidance could be susceptible to underinvestment when their managers forgo investments that produce positive NPVs (Biddle et al., 2009). Previous literature on underinvestment show that risk-averse managers who are concerned about their career may avoid risky but optimal investment projects, if they perceive that such projects will place their own personal welfare at risk (Shavell, 1979; Lambert, 1986). Similarly, Brito and John (2002), from the perspective of risk avoidance, find that managers will avoid making highly risky investment projects because they are afraid of losing control of the firm. Managers with cash-based compensation may refrain from investing in positive but risky investment projects to enhance their current compensation (Rajagopalan and Finkelstein, 1992; Rajagopalan, 1997). Alternatively, underinvesting firms may forego positive NPV projects because their management may prefer to pursue a 'quiet life' (Bertrand and Mullainathan, 2003).

Slemrod (2004), Crocker and Slemrod (2005) are among the first to view corporate tax avoidance within the agency framework. Managers, under the agency perspective, could potentially relinquish investments with positive NPVs, when the projects involved are bankrolled by cash tax saving from tax avoidance activities. There is mixed evidence on the relationship between tax avoidance and investment efficiency. While Blaylock (2016) does not find an association of tax avoidance and investment efficiency, Khurana, Moser and Raman (2018) document a significant positive relationship between tax avoidance and overinvestment. Khurana et al. (2018) also investigate the role of managerial ability and corporate governance on this relation. They find that firms with high (low) managerial ability, or firms with strong (weak) corporate governance, increase (decrease) investment efficiency when there is high level of tax avoidance.

On the basis of the aforementioned discussions, increased tax savings through tax avoidance activities may lead managers to invest inefficiently. We therefore state our hypothesis as follows:

H1: There is a positive relationship between corporate tax avoidance and investment inefficiency.

2.2. Financial statement obscurity

In an environment with less-transparent information, managers have the opportunity to engage in rent extraction or other self-serving activities (Bushman et al., 2004). Obscurity of financial information can have a number of financial reporting effects. An obscure financial reporting environment is manifested in less-readable annual financial reports. For instance, Li (2008) argues that firms with annual reports that are harder to read tend to have lower reported earnings. Guay et al. (2016) show that firms issue more managerial forecasts of sales, cash flows and earnings per share in order to mitigate the negative effect of less-readable annual reports. Previous studies (You and Zhang, 2009; Miller, 2010; Rennekamp, 2012; Lawrence, 2013) argue that the reactions of investors to less-readable disclosure reports are weaker, indicating that the readability may affect capital market efficiency.[3] Based on this evidence, less-readable annual reports lead to reduced transparency or increased obscurity (Balakrishnan et al. 2019).

Prior literature (Desai and Dharmapala, 2006, 2008, 2009; Desai et al., 2007) suggest that firms with free cash flow by undertaking tax avoidance may produce less transparent financial statements in an effort to hide their tax avoidance activities from taxing authorities. In firms with less transparent financial statements and high levels of free cash flow, managers may redirect tax savings to overinvestment activities to grow the firm beyond its optimal size for empire building purposes (Aggarwal and Samwick, 2006; Desai and Dharmapala, 2009) or underinvestment for their own personal benefits such as enhancing compensation or pursuing "quite life" (Rajagopalan, 1997; Bertrand and Mullainathan, 2003). Biddle et al. (2009) find that less readable financial reports are associated with more overinvestment and underinvestment. In an obscure financial reporting environment, managers could potentially have a higher chance to engage in corporate tax avoidance and to use tax savings to fund investments that will benefit themselves which leads to overinvestment, or forego positive NPV projects which leads to underinvestment. We therefore hypothesize that financial statement obscurity has an indirect impact on the relationship between tax avoidance and investment inefficiency. We state our second hypothesis in the following form:

[3] Readability refers to the ease with which a reader can process and comprehend written texts. In terms of financial disclosure readability, the Securities and Exchange Commission (SEC) provides some very specific guidance in recommending that managers employ plain English attributes by avoiding writing constructs like passive voice, weak or hidden verbs, superfluous words, legal and financial jargon, numerous defined terms, abstract words, unnecessary details, lengthy sentences, and unreadable design and layout in their financial disclosures (SEC, 1998).

H2: Financial statement obscurity mediates the association between corporate tax avoidance and investment inefficiency.

2.3. Financial statement comparability

Previous research proposed that accounting information is critical to a well-functioning capital market (Bushman & Smith, 2001; Healy & Palepu, 2001; Lambert et al., 2007). Accounting information gives information to all relevant stakeholders and enables them to assess and benchmark their levels of investment efficiency with that of their peers within a particular industry (Bushman & Smith, 2001; Beyer et al., 2010; Armstrong et al., 2010). The Financial Accounting Standards Board (FASB, 2010) emphasizes the importance of accounting comparability in investment decision-making, by stating that rational decision-making requires accounting information that is comparable, to evaluate similarities and differences in investment opportunities properly. Accounting comparability is enhanced when economic events are reflected properly in accounting numbers.

The central point of information-based theory is the significance of managers' capability and inducement to conceal very important information from investors (Kim et al., 2016). Comparability enables information about similar peers to be available to external investors and, hence, makes it stress-free for investors to assess financial statement information from similar firms (Kim et al., 2016). De Franco et al. (2011) argue that accounting comparability lowers the cost of information acquisition and increases the overall quantity and quality of information accessible to decision-makers. This should help firm managers to make better investment decisions and to be more efficient in research and development (R&D) investments. Chen et al. (2018) find that more profitable acquisition choices are made by acquirers when the selected firms' financial statements are more comparable with those of rival firms in the industry. Habib et al. (2017) show that financial statement comparability significantly reduces corporate cash holdings. Sohn (2016) finds that the level of real earnings management (REM) by managers increases with the degree of their firms' accounting comparability with other firms whereas the level of accrual-based earnings management (AEM) decreases. Kim et al. (2016) observe that predictable crash risk decreases with financial statement comparability.

Desai and Dharmapala (2006) develop a theoretical agency framework in which information asymmetry gives managers greater opportunities to engage in more tax avoidance activities. Armstrong et al. (2010) argue that high quality accounting information can reduce information asymmetry and alleviate agency problem. Chen and Lin (2017) shows that restraining agency costs will simultaneously reduce the degree of corporate tax avoidance

because it is easier to recognise tax avoidance transactions in a greater information transparency environment. Higher financial statement comparability results in lower information acquisition and processing costs and increases the quality and quantity of available information regarding the firm (De Franco et al, 2011; Kim et al., 2016; Kim et al., 2013). Therefore, it is expected that higher financial statement comparability is associated with higher financial reporting transparency and lower information asymmetry, which in turns lower the agency cost of tax avoidance. Qingyuan and Lumeng (2018), in a study of non-financial Chinese listed firms, find the higher level of financial statement comparability results in the lower the degree of corporate tax avoidance. On the basis of the arguments above, we develop the following hypothesis:

H3: Financial statement comparability mediates the association between corporate tax avoidance and investment inefficiency.

2.4. Product market competition

Resource-based theory proposes that resources are the definitive source for the creation and preservation of competitive advantage (Wernerfelt, 1984). If the entry of any new firms into the market weakens the competitive advantage of existing rival firms, then those firms may engage in actions to discourage the new firm from entering the industry (Darrough & Stoughton, 1990). Helfat and Peteraf (2003) contend that the resource-based perspective needs to include the beginning, growth and advancement of organisational resources and competencies, gradually. Therefore, they present an all-inclusive and exciting perspective: the 'dynamic resource-based theory', in which the basis of a firm's competitive advantage (i.e., its resource base) develops over a period and may also shift over time. Consequently, firms may forgo positive NPV projects and invest inefficiently, in order to become competitive.

The separation of ownership and control will induce managers to divert firms' resources for managements' own benefit (Jensen & Meckling, 1976). Greater competition may induce firm management to engage in tax avoidance to facilitate the funding of financing and investment activities so that the firm can perform or, in fact, survive, in such a competitive market. According to Valta (2012), when product market competition is strong, the cost of borrowing for publicly traded manufacturing firms is raised. Consequently, competition may force managers to accumulate cash flows to create enough internal liquidity for firms' operations. As a result, firm investment may decline with an increase in competition.

When firms have superior product market control, failed tax strategies are less likely to influence their competitive positions. Product market control, thus, facilitates more risk-taking

behaviour. For instance, firms with superior product market control have the ability to carry less cash and pay higher dividends than firms operating in a more competitive market, because extreme competition acts as a barrier to firms with lower market power, making them hold more cash to meet competitive pressures (Hoberg et al., 2014). Consequently, Schmidt (1997) establishes that an intensification of competition escalates the probability of liquidation with greater inducements to managers, making them work harder in a bid to retain their positions. Moreover, competition may induce managers make unprofitable investments to increase the size of the firm for their personal gain or for "empire building" (Jensen, 1986).

Competition in the product market can also be viewed as a governance mechanism that compels managers to restrain from engaging in conflict with shareholders. Extreme competition has the potential to decrease managerial inefficiency and make managers increase firm efficiency (Alchian 1950; Stigler 1958). Nickell (1996) finds that when competition is measured using the numbers of competing firms, or the levels of rent that monopolists take, the competitive process becomes linked to a considerably higher rate of growth in total factor productivity. In addition, extreme competition can aid in monitoring and appraising managers (Holmstrom, 1982; Nalebuff & Stigliz, 1983; Hart, 1983) as managers are persuaded to increase the profits of the firm (Fee & Hadlock, 2004; Giroud & Mueller, 2010). Guadalupe and Perez-Gonzales (2006) posit that extreme competition in the product market limits the degree of private control gains that corporate insiders extract. In sum, these arguments put forward that extreme competition in the product market will constrain managers from acting in ways that conflict with the interests of shareholders (Hart 1983). Based on the aforementioned evidence, product market competition may have mediating effects on the relation between investment inefficiency and tax avoidance. On the basis of the analysis above, we state our hypothesis as follows:

H4: Product market competition mediates the association between corporate tax avoidance and investment inefficiency.

3. Research design

3.1. Sample selection

Our sample initially consists of all firms from the *Compustat* database from 1993 to 2016. The commencement year of our sample is 1993 which the year that the U.S. Financial Accounting Standards Board (FASB) published FAS 109 regarding the accounting for income taxes. This originally results in 277,692 firm-year observations. The sample is subsequently reduced to 190,663 firm-year observations after taking out utility industries two-digit code 49

(9,885 observations) and financial firms two-digit code 60–69 (77,144 observations). Utility firms are eliminated, since their capital structures are usually associated with greater amounts of debt and, thus, the calculation of the numerous tax avoidance proxy methods is affected. Financial firms are taken out due to the key variances in their utilisation of accounting guidelines and derivation of accounting approximations in relation to other firms and the dissimilar supervisory restrictions they face.

The sample is then reduced to 69,332 firm-year observations after leaving 121,331 firm-year observations due to missing financial data for calculating variables in the main regression. A summary of our sample selection is presented in Panel A of Table 1, and the industry distribution of firms is in Panel B. We winsorize the data at the 1st and 99th percentiles to decrease the probability that outliers affect our results.

[Insert Table 1 Here]

3.2. Investment efficiency measure

Following Eisdorfer et al. (2013), we estimate investment efficiency by using the difference between real and predictable investment to measure the degree to which a firm departs from its optimal investment strategy (Richardson, 2006). The real investment of a firm is calculated by dividing gross capital expenditures by book value of total assets at the commencement of the year. We also estimate a firm's predictable investment using the midpoint investment in the industry (using the four-digit SIC code) during the year. If the four-digit group comprises less than five observations, we use a three-digit code, and if that new group comprises less than five observations, we use a two-digit code. We adopt three measures of investment efficiency: (1) *ABS_INV* refers the absolute value of the difference between the firm's actual investment and its industry median investment; (2) *Underinvestment* if this difference is negative; (2) *Overinvestment* if this difference is positive.

3.3. Tax avoidance measure

Hanlon and Heitzman (2010) contend that the most frequently used proxies for tax avoidance are tax expenses and book–tax differences projected from financial reports. They also claim that actual business choices, like investment and capital structure, are affected by taxable income, taxes, and book–tax differences. We employ the accounting effective tax rate ($GAAP\_ETR_{i,t}$), which has been used extensively in previous studies (e.g. Rego, 2003; Wilson, 2009; Dyreng et al., 2010; Hoi et al., 2013), as our key proxy estimation of tax avoidance.

Furthermore, in discussing the recent studies of Graham et al. (2014), Armstrong et al. (2012) and Robinson et al. (2010), Edwards et al. (2016) suggest that managers who engage in tax avoidance usually tend to focus on strategies that reduce financial statement expense. $GAAP\_ETR_{i,t}$ has a direct impact on earnings and is the most commonly used measure of tax avoidance. This measure of effective tax rate captures a broad range of tax strategies including those with both highly certain and uncertain outcomes. $GAAP\_ETR_{i,t}$ is computed as total tax expense (consisting of current and deferred tax expenditure) scaled by pre-tax book income minus special items. This particular tax avoidance proxy looks at tax avoidance measures that affect firms' net income (Robinson et al. 2010) and is used to evaluate the firm's overall tax burden and level of tax avoidance (e.g., Rego, 2003; Wilson, 2009; Dyreng et al., 2010; Hoi et al., 2013). Lower $GAAP\_ETR_{i,t}$ values denote higher amounts of tax avoidance (Dyreng et al., 2010).

3.4. Financial statement obscurity measure

We follow Bonsall and Miller (2017) and Bonsall et al. (2017) and used the Bog Index (*BOG*) as our measure of financial statement obscurity. High levels of BOG indicate less readable documents (i.e. more obscurity). The Bog Index is reported by Editor Software's plain English software, StyleWriter. The Bog Index is measured as the sum of three multifaceted components:

Bog Index = sentence Bog + Word Bog - Pep

3.5. Product market competitive measure

We determine product market competition (*PMC*) using the fluidity measure of Hoberg et al. (2014), which estimates variation in the product space of a firm as a result of decisions made by rivals. This estimation is formulated by analysing words in the product description section of a firm from its 10-K, and how they compare to the changes in the 10-K product words of competitor firms. Precisely, fluidity is the "cosine" relationship between a firm's identifiable word use vector and the total competitor firms' word modification vector. Hence, fluidity concentrates on product space undercurrents and variations in the products of competitor firms as well as how these variations are related to the present product offerings of a firm (Hoberg et al., 2014).

3.6. Financial statement comparability measure

We employ the financial statement comparability estimation of De Franco et al. (2011), in which they define comparability as the familiarity connecting the accounting systems of two firms in plotting economic phenomena into financial statements. Following De Franco et al. (2011), we run the following model using the preceding 16 quarters of data:

$$\text{EARNINGS}_{it} = \alpha_1 + + \beta_1 \text{RETURN}_{it} + \varepsilon_{it} \quad (1)$$

where *EARNINGS* refers to the quarterly net income before extraordinary items deflated by the market value of equity in the preceding quarter. *RETURN* refers to the firm's stock return during the quarter. The estimated coefficients ($\alpha\hat{}_i$ and $\beta\hat{}_i$) and ($\alpha\hat{}_j$ and $\beta\hat{}_j$) refer to the accounting functions of firm *i* and firm *j*, respectively. In measuring the similarity of accounting functions between firm *i* and firm *j*, De Franco et al (2011) assume that firm *i* and firm *j* have the same return, i.e. they experience the same economic events ($RETURN_{it}$). They compute accounting reactions of firms *i* and *j* to the same economic phenomena (RETURN_{it}) as follows:

$$E(EARNINGS)_{iit} = \widehat{\alpha_i} + \widehat{\beta_i} RETURN_{it} \quad (2)$$

$$E(EARNINGS)_{ijt} = \widehat{\alpha_i} + \widehat{\beta_j} RETURN_{it} \quad (3)$$

where $E(EARNINGS)_{iit}$ denotes the forecast earnings of firm *i* given firm *i*'s accounting function and the returns of firm *i* in quarter *t*. $E(EARNINGS)_{iit}$ is the forecast earnings of firm *j* given firm *j*'s accounting function and firm *i*'s returns in quarter *t*. Following De Franco et al. (2011), the comparability score between firm *i* and firm *j* ($COMP_{ijt}$) is computed as negative one (−1) times the average absolute difference between the forecast earnings of firm *i* and of firm *j* over the previous 16 quarters:

$$COMP_{ijt} = -\frac{1}{16} \times \sum_{t-15}^{t} \left| E(EARNINGS)_{iit} - E(EARNINGS)_{ijt} \right| \quad (4)$$

Greater values of $COMP_{ijt}$ indicate smaller difference between $E(EARNINGS)_{iit}$ and $E(EARNINGS)_{ijt}$, that is, higher financial statement comparability between firms *i* and *j* (De Franco et al. 2011). Following De Franco et al. (2011), we use the average of all of firm *i*'s comparability scores during the whole year to measure comparability of firm *i*'s financial statements.[4]

[4] We also use a different measure of firm-year level accounting comparability. It is calculated as the average of the largest four and ten comparability combinations for firm *i* and other firms in the same 2-digit SIC in a given year. The results are very much similar.

3.7. Control variables

Following the previous literature (e.g. Biddle et al., 2009; Cheng et al., 2013, Bae et al., 2016, Esidorfer et al., 2013, Lara et al., 2016, Biddle and Hilary, 2006), we include control variables that are related to investment efficiency. Precisely, we include *SIZE, MTB, Z-SCORE, Tangible, K, K_IND, CFOSale, SLACK, DIV, AGE, LOSS, CFO5SD, SALE5SD, INV5SD, CASH,* and *OP_CY*. We compute *SIZE* by using natural logarithm of total assets. *MTB* is a firm's market-to-book ratio, calculated as the ratio of the market value of equity scaled by the book value of equity. *Z-SCORE* refers to financial distress by means of Altman's (1968), an extensively used model of bankruptcy forecast. *Tangible* is the ratio of property, plant and equipment (PPE) to total assets. *K* is the ratio of long-term debt to the summation of long-term debt and the market value of equity. *K_IND* is the mean of *K* values of firms in the similar SIC 3-digit industry. We compute *CFOSale*, as operating cash flows over sales. *SLACK* is the ratio of cash to property, plant and equipment (PPE). *DIV* is an indicator variable equal to one when the firm paid a dividend, and zero otherwise. *AGE* refers to firm age, calculated as the natural logarithm of difference between the first year when the firm appears in the CRSP database and the current year. *LOSS* is an indicator variable that takes the value of one if net income before extraordinary items is negative, and zero otherwise. *CFO5SD* refers to the standard deviation of a firm's scaled operating cash flows computed over the prior five years. *SALE5SD* is the standard deviation of a firm's scaled sales calculated over the prior five years. *INV5SD* indicates the standard deviation of a firm's scaled investment computed over the prior five years. We require three out of five observations for *CFO5SD*, *SALE5SD*, and *SINV5SD* to be included in our sample. We measure *CASH* as the ratio of cash and short-term investments to assets. *OP_CY* refers to the log of receivables to sales plus inventory to cost of goods sold (COGS) multiplied by 360.

3.8. Regression model

In order to determine whether corporate tax avoidance increases investment inefficiency, we employ the following baseline model:

$$INVEFF_{i,t} = \alpha_0 + \beta_1 GAAP\_ETR_{it} + \beta_2 SIZE + \beta_3 MTB + \beta_4 ZSCORE + \beta_5 Tangible + \beta_6 K + \beta_7 K\_IND + \beta_8 CFOSALE + \beta_9 SLACK + \beta_{10} DIV + \beta_{11} AGE + \beta_{12} LOSS + \beta_{13} CFO5SD + \beta_{14} SALE5SD + \beta_{15} INV5SD + \beta_{16} CASH + \beta_{17} OPCY + Firm + Year + \varepsilon \quad (5)$$

where *INVEFF* refers to investment inefficiency, and can take three measures: *ABS_INV*, *Underinvestment*, and *Overinvestment*. *GAAP_ETR* is total tax expense (consisting of current and deferred tax expenditure) scaled by pre-tax book income minus special items. All control variables are defined in the previous section (Section 3.7)

Following Robin and Zhang (2015), Habib et al. (2017) for testing mediation effects, we estimate the following regressions to differentiate the direct effects of corporate tax avoidance on investment inefficiency from the indirect effects (i.e. through product market competition (*PMC*), financial statement obscurity (*BOG*), and financial statement comparability (*COMP*)):

$$INVEFF_{i,t} = \alpha_0 + \beta_1 MV_{it} + \beta_2 GAAP\_ETR_{it} + \sum_{j=2}^{m} \beta_j Control\ Variables_{it} + \sum \beta_t Firm_t + \sum \beta_t Year_t + \varepsilon_{it} \quad (6)$$

$$MV_{i,t} = \alpha_0 + \alpha_1 GAAP\_ETR_{it} + \sum_{j=2}^{n} \alpha_j Control\ Variables_{it} + \sum \alpha_t Firm_t + \sum \alpha_t Year_t + \varepsilon_{it} \quad (7)$$

Equation (6) shows how the mediation variables (*MV*) affect investment inefficiency. There are three mediation variables: *BOG*, *PMC* and *COMP*. The presence of *GAAP_ETR* in Equation (6) allows for the possibility that *GAAP_ETR* may have a direct effect on investment inefficiency. Equation (7) illustrates how *GAAP_ETR* can affect investment inefficiency through the mediating variable channels (indirect effects).

4. Results

4.1. Descriptive statistics

Table 2 reports the descriptive statistics of the variables we used in the baseline model of regression (5). The mean (median) of our dependent variable (*ABS_INV*) is 0.04 (0.02). The median value of our *ABS_INV* variable is very close to the median value of 0.013 reported in

Eisdorfer et al. (2013). We find that the mean (median) value of our *GAAP_ETR* variable is 0.24 (0.29) which is consistent with prior studies (Hasan, Hoi, Wu, & Zhang, 2017; Gaertner, 2014; Bird & Davis-Nozemack, 2016). Finally, the mean (median) values of our control variables are similar to those reported in the previous tax avoidance literature (Biddle et al., 2009; Cheng et al., 2013; Bae et al., 2016; Lara et al., 2016).

[Insert Table 2 Here]

The Pearson correlation results are presented in Table 3. We observe that *ABS_INV* is correlated with *GAAP_ETR* significantly and negatively ($p < 0.01$), thus, providing some preliminary support for H1 that corporate tax avoidance is positively related to investment inefficiency. Moreover, the control variables (*SIZE, MTB, Z_SCORE, Tangible, K, K_IND, CFOSALE, SLACK, DIV, AGE, LOSS, CFO5SD, SALE5SD, INV5SD, CASH,* and *OP_CY*) are also correlated significantly with the dependent variable, *ABS_INV,* at $p < 0.01$.

[Insert Table 3 Here]

4.2. Regression results

The regression results of investigating the relationship between tax avoidance and investment inefficiency are presented in Table 4. In this table, *GAAP_ETR* is used as a proxy for tax avoidance, the dependent variable in Column (1) is *ABS_INV,* whereas the dependent variables in Columns (2) and (3) are *Underinvestment* and *Overinvestment*, respectively. As evidenced in Column (1) of Table 4, the coefficient of the *GAAP_ETR* variable is -0.0082 with p-value < 0.01, signifying that the accounting effective tax rate is associated negatively with the absolute value of the difference between the real and predicted investment. In other words, firms having higher levels of tax avoidance show a greater propensity for investment inefficiency. Similar results are observed in Columns (2) and (3) where the coefficient of the *GAAP_ETR* variable is significantly negative with p-value < 0.01, for both *Underinvestment* and *Overinvestment.* Lower accounting effective tax rates are correlated with higher levels of both under-investment and over-investment. In terms of economic significance, decreasing the accounting effective tax rate (*GAAP_ETR*) by 1% (i.e. higher tax avoidance) increases firm investment by 2.51% among firms that are over-investing. Our results support the first hypothesis H1 that there is a positive correlation between corporate tax avoidance and investment inefficiency. For our control variables, the coefficient estimates are consistent with prior studies (Biddle et al., 2009; Cheng et al., 2013; Bae et al., 2016; Lara et al., 2016).

[Insert Table 4 Here]

4.3. Mediation results

In this section, we test the mediation effects of three variables, i.e., financial statement obscurity (*BOG*), financial statement comparability (*COMP*) and product market competition (*PMC*), on the relationship between tax avoidance (*GAAP_ETR)* and investment inefficiency. Mediation is said to happen when (i) the independent variable (*GAAP_ETR*) has a considerable effect on the mediators (*BOG, COMP,* and *PMC*); (ii) the independent variable (*GAAP_ETR*) has a considerable effect on the dependent variable (*ABS_INV, Underinvestment,* and *Overinvestment*) when excluding the mediators; (iii) the mediator (*BOG, COMP,* or *PMC*) yields a considerable and distinctive influence on the dependent variable (*ABS_INV, Underinvestment,* and *Overinvestment*); and (iv) the influence of the independent variable (*GAAP_ETR)* on the dependent variable (*ABS_INV, Underinvestment,* and *Overinvestment*) is diminished considerably when the mediator (*BOG, COMP,* or *PMC*) is included in the model. A reduction of the significant relationship between the independent variable (*GAAP_ETR)* and dependent variable (*ABS_INV, Underinvestment,* and *Overinvestment*) in path (iv) is consistent with partial mediation (Baron & Kenny, 1986; Wood et al., 2008; Fairchild and MacKinnon, 2009). The significance of the partial mediation effect is tested using the Sobel test (Sobel, 1982).

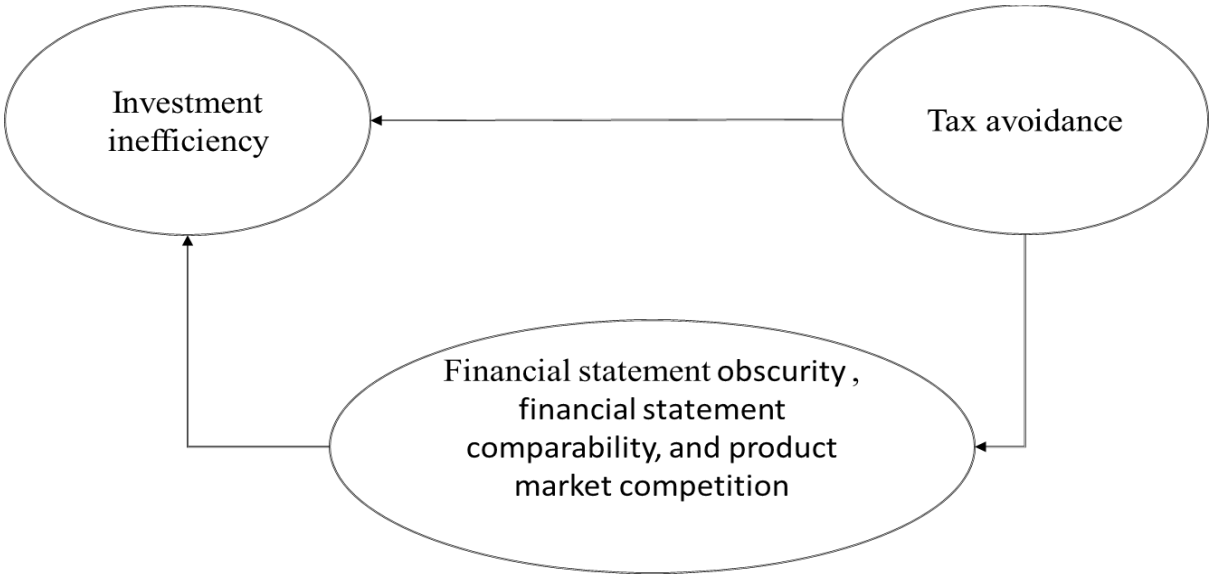

Figure 1: indicate the mediation effect of (Financial statement obscurity , financial statement comparability, and product market competition on the association between tax avoidance and investment inefficiency.

Following previous literature (e.g. Robin and Zhang, 2015; Habib et al., 2017), we tabulate the direct and indirect effects of tax avoidance on investment inefficiency. Table 5 presents the mediation test of financial statement obstruction (*BOG*) on the relation between tax avoidance and investment inefficiency. Model (1) indicates the regression model without the mediator whereas Model (2) indicates the regression with the mediator. In Model (1), the coefficients of *GAAP_ETR* are negative and statistically significant for all three measures of investment inefficiency (namely, *ABS_INV, Underinvestment,* and *Overinvestment)*, indicating that more tax avoidance results in more investment inefficiency.

The coefficients of *BOG* in Model (2) are positively and statistically significant for all measures of investment inefficiency (*ABS_INV*, *Overinvestment* and *Underinvestment*), implying that financial statement obscurity increases investment inefficiency. The coefficients of *GAAP_ETR* in Model (2), which includes the mediator *BOG,* are significantly negative at $p<0.01$ and slightly lower compared to those in Model (1) for all measures of investment inefficiency, indicating a significant mediation effect of *BOG* on the relationship between tax avoidance and investment inefficiency. The coefficient of indirect effect is also negative and significant at ($p<0.05$ or better) for all three measures of investment inefficiency which supports our second hypothesis H2. The Sobel test is significant at the 5% level or better for all measures of investment inefficiency. In summary, we find that a lower accounting effective tax rate (*GAAP_ETR)* directly and indirectly increases the level of investment inefficiency. The results in Table 5 indicate a statistically significant mediation influence of financial statement obscurity (*BOG*) on the association between tax avoidance and investment inefficiency.

[Insert Table 5 Here]

Table 6 presents the mediation test of financial statement comparability (*COMP*) on the relation between tax avoidance and investment efficiency. In Model (1) which does not include the mediator (*COMP),* the coefficients of *GAAP_ETR* are negative and statistically significant for *ABS_INV, Underinvestment,* and *Overinvestment.* This suggests that a high level of tax avoidance results in a high level of investment inefficiency. When we include the mediator *COMP* in Model (2), the coefficients of *COMP* are significantly negative at $p <.05$ and slightly smaller compared to those in Model (1) for all three measures of investment inefficiency, suggesting a significant mediation effect of *COMP* on the relationship between tax avoidance and investment inefficiency. Our finding implies that a high level of financial statement comparability decreases the level of investment inefficiency. The coefficient of indirect effect is significantly negative at the 5% significance level or better for all three measures of investment inefficiency. The Sobel test is significant at the 5% level or better for *ABS_INV*,

Overinvestment, and *Underinvestment.* Our finding supports the third hypothesis H3 that financial statement comparability significantly mediates the relationship between tax avoidance and investment inefficiency significantly.

[Insert Table 6 Here]

Table 7 presents the mediation test of product market competition (*PMC*) on the relationship between tax avoidance and investment efficiency. There are two models presented in Table 7: Model (1) shows the regression model without the mediator, while Model (2) refers to the regression that includes the mediator. As can be seen from Model (1), the coefficients of *GAAP_ETR* are negative and statistically significant for all measures of investment inefficiency, indicating that more tax avoidance results in more investment inefficiency. The coefficient of the mediating variable (*PMC*) in Model (2) is positive and statistically significant ($p < .01$) for *ABS_INV* and *Overinvestment,* implying that product market competition increases the level of overinvestment. However, the coefficient is negative and statistically significant ($p < .10$) for *Underinvestment*, indicating that product market competition decreases the level of underinvestment. The coefficient for the indirect effect is significant at p-value<0.10 or better and the Sobel test is also significant at the 10% level or better for all three measures of investment inefficiency. Our results provide evidence to support the final hypothesis, H4, that product market competition mediates the association between tax avoidance and investment inefficiency significantly.

[Insert Table 7 Here]

5. Additional analysis

5.1. Corporate Tax Avoidance Alternative Methods

To check for the robustness of our empirical results reported in Table 4, we use alternative tax avoidance measures (*CASH_ETR* and *SHELTER)* to investigate the relationship between investment inefficiency and tax avoidance.

5.1.1. Cash_ETR

CASH_ETR is computed as the cash tax paid (as disclosed in the cash flow statement) scaled over pre-tax accounting profit. This variable measures the proportion of cash tax paid in a particular year relative to a firm's profit. In accordance with Dyreng et al. (2010), low *CASH_ETR* values signify high levels of tax avoidance. We replace *GAAP_ETR* by *CASH_ETR,* and re-run Equation (5). The results are presented in Panel A of Table 8.

In Column (1) of Panel A, we observe that the coefficient of *CASH_ETR* is -0.0087 with p-value < 0.01, signifying that lower *CASH_ETR* is significantly correlated with higher *ABS_INV*. In another words, the higher the firm's level of tax avoidance, the greater its propensity for investment inefficiency. In Columns (2) and (3) which includes only observations of *Underinvestment* and *Overinvestment*, we also find that the coefficients of *CASH_ETR* are -0.0014 and -0.0148, respectively with p-value < 0.10 or better. Our results suggest that lower *CASH_ETR* (i.e. higher tax avoidance) is associated with higher levels of underinvestment and overinvestment. In short, our results in Table 8 Panel A are very much similar to those reported in Table 4, giving more evidence to support the first hypothesis H1.

5.1.2. SHELTER

SHELTER is computed using Wilson's Tax Shelter model which examines how the firm-level features are connected with tax sheltering actions (Wilson, 2009). In his model, he runs a logistic regression of a binary variable (*SHELTER* = 1, 0) against a set of independent variables that are correlated with tax sheltering, such as book–tax differences, discretionary accruals, leverage, total assets, return on assets, foreign pre-tax income and R&D expenditure. While it is likely that Wilson's Tax Shelter model produces noisy (i.e. out-of-sample) estimates, previous studies find that it offers a realistic proxy measure of tax avoidance (Hoi et al., 2013; Kim, Li & Zhang, 2011; Rego & Wilson, 2012). We consider a firm to participate in tax sheltering actions when the forecasted shelter odds can be found in the top quintile of the distribution. In line with Wilson (2009), a higher value of SHELTER signifies a higher chance of engaging in tax avoidance. We replace *GAAP_ETR* variable in Equation (5) is by the *SHELTER* variable, and re-estimate the regression model, presenting the results in Panel B of Table 8. It is found that the coefficients of *SHELTER* for *ABS_INV*, *Underinvestment* and *Overinvestment* are 0.0037, 0.0007 and 0.0074, respectively, with p-value < 0.10 or better. Our findings suggest that firms with higher tax sheltering actions (i.e. higher tax avoidance) exhibit greater propensity for investment inefficiency. Our first hypothesis H1 is still supported using a different measure of tax avoidance[5].

[Insert Table 8 Here]

[5] We apply another test by using a subsample of the total number of subsidiaries of a firm incorporated in an OECD (2006) listed tax haven scaled by the total number of subsidiaries. Our findings provide further support for H1.

5.2. Alternative measure of investment efficiency

In this section, we use a different measure of investment efficiency as a robustness test. Following Biddle et al. (2009), we use the residuals from the regression model below to measure the level of investment inefficiency.

$$Investment_{i,t} = \beta_0 + \beta_1\ REVGRWTH\%_{i,t-1} + \varepsilon_{i,t} \quad (8)$$

where *Investment* is the sum of the current year R&D expenditure, capital expenditure, and acquisition expenditure, less cash receipts from sale of property, plant, and equipment, scaled by total assets at the beginning of the year. *REVGRWTH* is the firm's sales growth at year *t-1*.

Following Biddle et al. (2009), Equation (8) is estimated for each industry-year, and the residuals from Equation (8) are sorted into quartiles. Firms are then classified into three groups: underinvestment firms (firms with residuals in the bottom quartile, i.e., the most negative residuals), overinvestment firms (firms with residuals in the top quartile, i.e., the most positive residuals), and the benchmark group (firms with residuals in the middle two quartiles). A multinomial logit model is subsequently estimated to predict the likelihood that a firm will be in one of the two extreme quartiles as opposed to the middle quartiles.

Using the alternative measure of investment inefficiency of Biddle et al. (2009), we re-estimate the regression model (5) and present the results in Table 9. It is clear that the *GAAP_ETR* variable is significantly negative with p-value <0.01 for firms with underinvestment and overinvestment. Our results show that firms that engage in tax avoidance activities are more prone to overinvestment and underinvestment. These results confirm that firms with a high levels of tax avoidance exhibit greater propensity for investment inefficiency. Our results are similar to those reported in Table 4, and robust to a different measure of investment efficiency.

[Insert Table 9 Here]

5.3. Propensity score matching (PSM)

Armstrong, Jagolinzer and Larcker (2010) contend that propensity score matching (PSM) decreases the prospect for bias owing to confounding variables. The objective of propensity score matching is to attain covariate equilibrium between treatment and control groups. We divide our sample into two groups based on the yearly mean level of *GAAP_ETR*. Firms below the median of *ETR* form the treatment group (*ETR_DM* =1) and those above the median of *ETR* form a control group (*ETR_DM* = 0). Covariate equilibrium is attained when the determinants of the treatment group (*ETR_DM* = 1) are comparable between the two groups

(*ETR_DM* = 0 or 1). As a robustness check of our main regression results detailed in Table 4, we apply a propensity matching analysis in two main stages (see, e.g., Rosenbaum and Rubin, 1983; Armstrong et al., 2012; Lennox et al., 2013, Shipman et al., 2017). First, we run logit regression models for *ETR_DM* with the same set of control variables as in Equation (5). Essentially, the addition of these controls guarantees accurate equilibrium between treated and untreated subjects in the matched sample, which is one of the main principles of PSM (Austin, 2011; Shipman et al., 2017). The regression results of the first-stage logit model is presented in Panel A of Table 10. In Table 10 Panel B, none of the added covariates is remarkably distinct between the treatment (*ETR_DM*=1) and the control (*ETR_DM*=0) sub-samples, suggesting strong corroboration for our estimates.

Second, we form "nearest-neighbour" matched pairs for *ETR_DM* based on the propensity scores. The estimated coefficients in Panel A are used to calculate the propensity score for each firm-year observation. In a majority of the cases, the propensity scores are matched to two decimal places in the analysis. In Panel C of Table 10, it is shown that there is a statistically significant difference between the treated and control groups across all measures of investment inefficiency. We report the regression results based on the matched samples in Panel D of Table 10. Consistent with the results presented in Table 4, we continue to find that the coefficient of GAAP_ETR is significantly negative with p-value < 0.01 (being -0.0092, -0.0057, and -0.0266 for *ABS_INV*, *Underinvestment*, and *Overinvestment,* respectively). This implies that the higher a firm's level of tax avoidance, the greater its propensity for investment inefficiency. Consequently, this result supports our conjecture for H1 that there is a positive correlation between corporate tax avoidance and investment inefficiency.

[Insert Table 10 Here]

5.4. Difference-in-Difference analysis

It is possible our main regression results reported in Table 4 could be affected by endogeneity (e.g. direction of causality) leading to biased regression coefficients. We conduct a difference-in-difference (DID) test to address the potential issue of endogeneity in our study (e.g., Wooldridge, 2010; Roberts & Whited, 2013). We use the Schedule Uncertain Tax Positions (UTP) as our exogenous event. Schedule UTP requires corporations that disclose uncertain tax positions in their financial statements to provide additional information in their income tax returns regarding uncertain tax positions that affect US federal income tax liabilities. Schedule UTP (effective from 15th December, 2010) should be lodged with a

corporation's income tax return for the 2010 tax year onwards under Treasury Regulation Section 1.6012-2(a)(4) and (5).

To apply the DID test based on a Schedule UTP event, we split our sample into two sub-period groups initially by creating an indicator variable *UTP_10,* equal to 1 if the sample is post-event (2010-2016), and 0 if pre-event (1987-2009). The *UTP_10* variable distinguishes the consequence of tax avoidance on investment inefficiency before the Schedule UTP event (control group) and after the Schedule UTP event (treatment group). We then create interaction terms *GAAP_ETR*UTP_10*, *GAAP_ETR*UTP_10*BOG*, and estimate the following regression model:

$$\begin{aligned} INVEFF_{i,t} = \alpha_0 + \beta_1 GAAP\_ETR_{it} + \beta_2\, UTP_{10} + \beta_3\, GAAP\_ETR_{it} * UTP_{10} + \beta_4\, BOG \\ + \beta_5\, GAAP\_ETR_{it} * UTP_{10} * BOG + \beta_{11} SIZE + \beta_{12} MTB + \beta_{13} ZSCORE \\ + \beta_{14} Tangible + \beta_{15} K + \beta_{16} K\_IND + \beta_{17} CFOSALE + \beta_{18} SLACK \\ + \beta_{19} DIV + \beta_{20} AGE + \beta_{21} LOSS + \beta_{22} CFO5SD + \beta_{23} SALE5SD \\ + \beta_{24} INV5SD + \beta_{25} CASH + \beta_{26} OPCY + Firm + Year \\ + \varepsilon \end{aligned} \quad (9)$$

The regression results for the DID test are shown in Table 11. We find *GAAP_ETR* is associated with our three measures of investment inefficiency negatively. Firms that engage in more tax avoidance are more likely to invest inefficiently. Implementation of the UTP means that there will be a greater nexus between financial reporting and tax reporting as firms now have to provide data and information in their financial statements aligned with what they are reporting in their tax filings. The coefficient on the interaction term between *GAAP_ETR*UTP_10*, which represents the DID, is negative and significant in all three models with p-value < 0.05 or better. Post implementation of UTP reporting requirements in 2010, despite the greater nexus between financial and tax reporting, we see that the relation between *GAAP_ETR* and all measures of investment inefficiency are further magnified. For instance, in Column (1) of Table 11, the coefficient of *GAAP_ETR* in the period post implementation of UTP is -0.0070 + (-0.2707) = -0.2777 for *ABS_INV*. Similar results are reported in Columns (2) and (3) for *Underinvestment* and *Overinvestment*.

The coefficient of the *BOG* variable is significantly positive for *ABS_INV, Underinvestment,* and *Overinvestment* at p-value < 0.10 or better*,* indicating that the higher the level of *BOG* (i.e., financial statement obscurity) the more likely the occurrence of inefficient investments. In addition, the interaction variable *GAAP_ETR*UTP10*BOG* is positively significant (p-value < 0.10 or better) for all three measures of investment efficiency. This result suggests that *BOG* is driving an outcome where the lower the effective tax rate and the higher the level of financial statement obscurity the greater the increase in investment inefficiency for

the post UTP period. Finally, for the control variables, we find the regression coefficients for *SIZE*, *Tangible*, K, *SLACK*, *DIV*, *AGE*, *LOSS* and *INV5SD* are with the predicted signs and statistically significant with p-value < 0.10 or better.

[Insert Table 11 Here]

5.5. Two-stage least squares (2SLS) regression analysis

We conduct a 2SLS test to address the potential issue of endogeneity (e.g., Wooldridge, 2010). Hasan, Hoi, Wu, & Zhang (2014) propose that a firm's engagement in tax avoidance activities relies on the tax avoidance practices of its industry peers. Following Hasan et al. (2014) and Cook, Moser & Omer (2017), we use industry-median tax avoidance (*ETR_MEDIAN*) as the instrumental variable to capture the endogenous variable (*GAAP_ETR*). *ETR_MEDIAN* is measured as the median value of *GAAP_ETR* in two-digit SIC code industry and year. For the first-stage regression, we use the following equation to predict *GAAP_ETR*:

$$\begin{aligned} GAAP\_ETR_{it} = {} & \alpha_0 + \beta_1 \text{ETR\_MEDIAN}_{it} + \beta_2 SIZE + \beta_3 MTB + \beta_4 ZSCORE \\ & + \beta_5 Tangible + \beta_6 K + \beta_7 K\_IND + \beta_8 CFOSALE + \beta_9 SLACK \\ & + \beta_{10} DIV + \beta_{11} AGE + \beta_{12} LOSS + \beta_{13} CFO5SD + \beta_{14} SALE5SD \\ & + \beta_{15} INV5SD + \beta_{16} CASH + \beta_{17} OPCY + Firm + Year \end{aligned} \quad (10)$$

Table 12 Column (1) reports the regression result of the first-stage regression model. We find that ETR_MEDIAN_{it} is significantly associated with $GAAP\_ETR_{it}$ (p<0.01). The second-stage regression results are shown in Table 12 Columns (2)-(4). We continue to find that the coefficient of $GAAP\_ETR_{it}$ is significantly negative with *p*-value < 0.01 for all measures of investment inefficiency (*ABS_INV*, *Underinvestment*, and *Overinvestment*). This implies that the higher a firm's level of tax avoidance, the greater its propensity for investment inefficiency. Consequently, this result provides further evidence to support our H1 that there is a positive correlation between corporate tax avoidance and investment inefficiency.

[Insert Table 12 Here]

6. Conclusion

Prior studies suggest that firms use the cash tax savings from tax avoidance activities to fund their investments. However, there is a lack of research about whether firms use cash tax savings from tax avoidance activities to fund their investments efficiently. We add to the literature by examining how efficiently this internally-generated cash is invested. Using different measures of tax avoidance and investment efficiency, we show that the there is a positive association between cash tax savings from tax avoidance activities and investment

inefficiency. Our study provides evidence that firms' cash tax savings from avoidance activities are not efficiently used. We also contribute to the literature by examining the direct and indirect (i.e. mediation) effects of corporate tax avoidance on investment efficiency. We find that the effect of cash tax savings from tax avoidance activities on investment inefficiency is mediated by product market competition, financial statement readability, and financial statement comparability. Our results are robust to endogeneity tests that control for omitted variables, reverse causality, or model misspecification problems.

Future research in this area could consider the relation between investment efficiency and the propensity of firms' to retain earnings offshore in tax haven or other jurisdictions. Some two trillion USD is currently retained offshore by U.S. multinationals with flow on implications in terms of cost of capital, the ability to borrow and the liquidity risk a firm is exposed to. These factors will have flow-on implications in terms of the ability and motivation of management to fund their investments efficiently. In particular, further work in this area would be of interest to capital market participants and governments given the economic impacts relating to employment, capital growth and capital flows.

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Appendix A: Variables definition

Variables	Definition
Dependent variables	
ABS_INV	The absolute value of the difference between the firm's actual investment and industry-year median investment.
Underinvestment	If the difference between a firm's actual investment and industry-year median investment is negative.
Overinvestment	If the difference between a firm's actual investment and industry-year median investment is positive.
Independent variables	
$GAAP\_ETR_{i,t}$	Total tax expense (consisting of current and deferred tax expenditure) scaled by pre-tax book income minus special items.
Control variables	
SIZE	Natural logarithm of market value scaled by total assets.
MTB	The ratio of the market value of equity scaled by the book value of equity.
Z-SCORE	Financial distress by Altman (1968)'s model.
Tangile	The ratio of property, plant and equipment (PPE) to total assets
K	The ratio of long-term debt to the summation of long-term debt to the market value of equity.
K_IND	The mean K values for all firms in the similar SIC 3-digit industry.
CFOSALE	The ratio of operating cash flows to sales.
SLACK	The ratio of cash to property, plant and equipment (PPE).
DIV	An indicator variable equals to one when the firm paid a dividend zero otherwise.
AGE	The difference between the first year when the firm appears in CRSP database and the current year.
LOSS	An indicator variable that takes the value of one if net income before extraordinary items is negative, and zero otherwise.
CFO5SD	The standard deviation of a firm's scaled operating cash flows over the prior five years.
SALE5SD	The standard deviation of a firm's scaled sales over the prior five years.
INV5SD	The standard deviation of a firm's scaled investment over the prior five years.
CASH	The ratio of cash and short-term investments to assets (CHE/AT) .

OP_CY	The log of receivables to sales plus inventory to COGS multiplied by 360.
Mediating variables	
BOG	The Bog Index, reported by Editor Software's Stylewriter 4, provides a comprehensive measure of a document's plain English problems, including passive voice, redundant verbs, use of jargon, and sentence complexity, among others.
PMC	Product market fluidity reveals variations in a firm's product space owing to decisions that the firm's product market rivals make. A higher value of fluidity is equivalent to the fact that a firm is faced with greater competitive pressures with respect to its product market. Following Hoberg et al. (2014), a measure of firm-level competitive pressures is built on the depiction of firms' product space and competitor moves in their 10-K's.
COMP	Firm-year level accounting comparability, which is the industry mean of comparability combinations for firm *i* and other firms in the same 2-digit SIC in a given year.

Table 1. Sample description

Panel A: Sample selection

Total number of firm-year observations from Compustat (1993-2016)	277,692
Less: Utility industries (SIC 49)	(9,885)
Less: Financial institutions (SIC 60–69)	(77,144)
	190,663
Less: missing values to compute the variables	(121,331)
Final sample	69,332

Panel B: Industry distribution

Year	N	Percent
1993	2,640	3.81%
1994	2,738	3.95%
1995	2,892	4.17%
1996	3,210	4.63%
1997	3,344	4.82%
1998	3,392	4.89%
1999	3,673	5.30%
2000	3,572	5.15%
2001	3,346	4.83%
2002	3,364	4.85%
2003	3,331	4.80%
2004	3,177	4.58%
2005	3,060	4.41%
2006	3,021	4.36%
2007	2,866	4.13%
2008	2,732	3.94%
2009	2,571	3.71%
2010	2,494	3.60%
2011	2,526	3.64%
2012	2,427	3.50%
2013	2,296	3.31%
2014	2,264	3.27%
2015	2,225	3.21%
2016	2,171	3.13%
Total	69,332	100%

Table 2. Descriptive Statistics

Variable	N	Mean	S.D.	1st quartile	Median	3rd quartile
ABS_INV	69,332	0.04	0.07	0.01	0.02	0.04
GAAP_ETR	69,332	0.24	0.18	0.04	0.29	0.37
SIZE	69,332	5.36	2.43	3.63	5.31	7.02
MTB	69,332	2.40	3.78	1.11	1.54	2.43
Z-SCORE	69,332	0.88	4.64	0.59	1.44	2.26
Tangible	69,332	0.27	0.23	0.09	0.20	0.40
K	69,332	0.16	0.21	0.00	0.08	0.25
K_IND	69,332	0.18	0.09	0.09	0.16	0.24
CFOSALE	69,332	-0.54	3.95	0.00	0.07	0.14
SLACK	69,332	2.80	10.02	0.08	0.36	1.51
DIV	69,332	0.37	0.48	0.00	0.00	1.00
AGE	69,332	2.48	0.85	1.88	2.53	3.11
LOSS	69,332	0.30	0.46	0.00	0.00	1.00
CFO5SD	69,332	0.13	0.33	0.03	0.06	0.11
SALE5SD	69,332	0.23	0.27	0.08	0.15	0.28
INV5SD	69,332	0.46	1.29	0.06	0.14	0.34
CASH	69,332	0.19	0.21	0.03	0.10	0.27
OP_CY	69,332	4.66	0.85	4.24	4.74	5.16

This table shows the descriptive statistics of all variables used in our analysis. The variables are defined in Appendix A.

Table 3. Pearson correlation results

	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	-16	-17	-18
(1) ABS_INV	1																	
(2) GAAP_ETR	-0.054***	1																
(3) SIZE	-0.101***	0.349***	1															
(4) MTB	0.096***	-0.192***	-0.253***	1														
(5) Z-SCORE	-0.050***	0.303***	0.282***	-0.537***	1													
(6) Tangible	0.306***	0.088***	0.209***	-0.116***	0.030***	1												
(7) K	-0.014***	0.073***	0.209***	-0.190***	0.018***	0.323***	1											
(8) K_IND	0.087***	0.212***	0.294***	-0.183***	0.135***	0.467***	0.408***	1										
(9) CFOSALE	-0.015***	0.211***	0.180***	-0.218***	0.284***	0.085***	0.084***	0.148***	1									
(10) SLACK	-0.059***	-0.155***	-0.170***	0.110***	-0.147***	-0.271***	-0.156***	-0.196***	-0.188***	1								
(11) DIV	-0.066***	0.223***	0.446***	-0.092***	0.123***	0.171***	0.053***	0.243***	0.105***	-0.120***	1							
(12) AGE	-0.114***	0.147***	0.237***	-0.063***	0.049***	0.037***	0.037***	0.091***	0.084***	-0.063***	0.322***	1						
(13) LOSS	0.036***	-0.457***	-0.411***	0.165***	-0.378***	-0.061***	0.053***	-0.194***	-0.250***	0.139***	-0.299***	-0.197***	1					
(14) CFO5SD	0.039***	-0.244***	-0.317***	0.377***	-0.500***	-0.129***	-0.103***	-0.158***	-0.227***	0.170***	-0.149***	-0.119***	0.252***	1				
(15) SALE5SD	0.020***	-0.128***	-0.345***	0.161***	-0.109***	-0.196***	-0.070***	-0.089***	0.013***	0.091***	-0.199***	-0.192***	0.153***	0.298***	1			
(16) INV5SD	0.067***	-0.176***	-0.195***	0.092***	-0.117***	-0.053***	-0.063***	-0.099***	-0.146***	0.092***	-0.143***	-0.191***	0.201***	0.206***	0.172***	1		
(17) CASH	-0.042***	-0.273***	-0.230***	0.195***	-0.137***	-0.401***	-0.387***	-0.411***	-0.266***	0.461***	-0.222***	-0.177***	0.224***	0.195***	0.073***	0.153***	1	
(18) OP_CY	-0.092***	-0.028***	-0.068***	0.010***	-0.039***	-0.301***	-0.131***	-0.267***	-0.153***	-0.006	-0.037***	0.034***	0.030***	0.005	-0.130***	-0.001	-0.025***	1

Table 4. Regression result – Association between tax avoidance and investment inefficiency

	(1) ABS_INV	(2) Underinvestment	(3) Overinvestment
GAAP_ETR	**-0.0082*** **	**-0.0055*** **	**-0.0251*** **
	(-4.63)	**(-6.64)**	**(-5.29)**
SIZE	-0.0031***	-0.0019***	-0.0068***
	(-20.51)	(-25.17)	(-17.08)
MTB	0.0021***	0.0000	0.0036***
	(10.52)	(-1.06)	(7.12)
Z-SCORE	0.0005***	0.0000	0.0001
	(3.66)	(1.43)	(0.11)
Tangible	0.0832***	-0.0055***	0.1261***
	(35.42)	(-4.68)	(21.72)
K	-0.0243***	0.0014*	-0.0396***
	(-16.10)	(1.89)	(-9.20)
K_IND	0.0088	0.0277***	0.0226
	(1.29)	(7.38)	(1.53)
CFOSALE	0.0000	0.0000	-0.0002
	(0.35)	(-0.69)	(-0.58)
SLACK	-0.0001***	0.0000***	-0.0006***
	(-7.24)	(4.30)	(-5.28)
DIV	-0.0067***	-0.0013***	-0.0073***
	(-10.68)	(-4.07)	(-5.21)
AGE	-0.0056***	0.0000	-0.0086***
	(-15.12)	(0.05)	(-10.28)
LOSS	-0.0046***	0.0035***	-0.0028
	(-5.74)	(10.33)	(-1.19)
CFO5SD	0.0007	-0.0011***	0.0028
	(0.40)	(-2.78)	(0.50)
SALE5SD	0.0027*	0.0001	0.0036
	(1.90)	(0.24)	(0.83)
INV5SD	0.0018***	0.0002**	0.0042***
	(5.23)	(1.96)	(4.27)
CASH	0.0101***	-0.0006	0.0172***
	(5.93)	(-0.90)	(3.41)
OP_CY	0.0018***	0.0002	0.0029**
	(3.54)	(1.28)	(2.11)
Constant	0.0335***	0.0348***	0.0569***
	(6.09)	(11.61)	(3.29)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	69,332	32,926	34,695
adj. R-sq	0.185	0.407	0.183

***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test). The variables are defined in Appendix A.

Table 5. Mediation test of financial statement obscurity (*BOG*) on the association between tax avoidance and investment inefficiency

	(1) ABS_INV	(2) Underinvestment	(3) Overinvestment
BOG index as the mediator			
Model (1) (without the mediator)			
GAAP_ETR	**-0.0063*** **	**-0.0040*** **	**-0.0199*** **
	(-3.40)	**(-4.71)**	**(-4.55)**
Other controls	Yes	Yes	Yes
Firm and Year FE	Yes	Yes	Yes
Observations	54,971	26,086	27,485
Adj. R-squared	0.19	0.41	0.19
Model (2) (with the mediator)			
GAAP_ETR	**-0.0057*** **	**-0.0039*** **	**-0.0189*** **
	(-2.68)	**(-4.59)**	**(-4.30)**
BOG	**0.0208*** **	**0.0040** **	**0.0391*** **
	(5.57)	**(2.23)**	**(4.68)**
Other controls	Yes	Yes	Yes
Firm and Year FE	Yes	Yes	Yes
Observations	54,971	26,086	27,485
Adj. R-squared	0.19	0.41	0.19
Direct effect	**-0.0057*** **	**-0.0039*** **	**-0.0189*** **
Indirect effect	**-0.0005*** **	**-0.0001** **	**-0.0010*** **
Total effect	**-0.0063*** **	**-0.0040*** **	**-0. 0199*** **
Sobel Z	-0.0005***	-0.0001**	-0.0010***
Z	(-5.06)	(-2.15)	(-4.12)
(p-value) of Sobel Z	0.00	0.03	0.00

***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test).

Table 6. Mediation test of financial statement comparability (*COMP*) on the association between tax avoidance and investment inefficiency

	(1) ABS_INV	(2) Underinvestment	(3) Overinvestment
COMP as the mediator			
Model (1) (without the mediator)			
GAAP_ETR	**-0.0073*** **	**-0.0040*** **	**-0.0215*** **
	(-3.22)	**(-3.42)**	**(-4.41)**
Other controls	Yes	Yes	Yes
Firm and Year FE	Yes	Yes	Yes
Observations	32,523	14,518	17,167
Adj. R-squared	0.22	0.40	0.22
Model (2) (with the mediator)			
GAAP_ETR	**-0.0063*** **	**-0.0035*** **	**-0.0197*** **
	(-2.74)	**(-2.98)**	**(-4.01)**
COMP	**-0.0006*** **	**-0.0002** **	**-0.0011*** **
	(-3.48)	**(-2.50)**	**(-3.14)**
Other controls	Yes	Yes	Yes
Firm and Year FE	Yes	Yes	Yes
Observations	32,523	14,518	17,167
Adj. R-squared	0.22	0.40	0.22
Direct effect	**-0.0063*** **	**-0.0035*** **	**-0.0197*** **
Indirect effect	**-0.0010*** **	**-0.0005** **	**-0.0018*** **
Total effect	**-0.0073*** **	**-0.0040*** **	**-0.0215*** **
Sobel Z	-0.0010***	-0.0005**	-0.0018***
Z	(-3.44)	(-2.48)	(-3.08)
(p-value) of Sobel Z	0.00	0.01	0.00

***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test).

Table 7. Mediation test of product market competition (*PMC*) on the association between tax avoidance and investment inefficiency

	(1) ABS_INV	(2) Underinvestment	(3) Overinvestment
PMC as the mediator			
Model (1) (without the mediator)			
GAAP_ETR	**-0.0054*** **	**-0.0037*** **	**-0.0176*** **
	(-2.87)	**(-4.02)**	**(-4.34)**
Other controls	Yes	Yes	Yes
Firm and Year FE	Yes	Yes	Yes
Observations	42,615	19,580	21,942
Adj. R-squared	0.21	0.37	0.22
Model (2) (with the mediator)			
GAAP_ETR	**-0.0048** **	**-0.0038*** **	**-0.0170*** **
	(-2.55)	**(-4.13)**	**(-4.18)**
PMC	**0.0006*** **	**-0.0001* **	**0.0007*** **
	(5.08)	**(-1.70)**	**(2.88)**
Other controls	Yes	Yes	Yes
Firm and Year FE	Yes	Yes	Yes
Observations	42,615	19,580	21,942
Adj. R-squared	0.21	0.37	0.22
Direct effect	**-0.0048** **	**-0.0038*** **	**-0.0170*** **
Indirect effect	**-0.0006*** **	**0.0001* **	**-0.0006*** **
Total effect	**-0.0054*** **	**-0.0037*** **	**-0.0176*** **
Sobel Z	-0.0005***	-0.0001*	-0.0006***
Z	(-4.72)	(1.68)	(-2.71)
(p-value) of Sobel Z	0.00	0.09	0.00

***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test).

Table 8. Additional tests - Alternative proxies of tax avoidance

Panel A: CASH_ETR as a new proxy of tax avoidance			
	(1)	(2)	(3)
	ABS_INV	Underinvestment	Overinvestment
CASH_ETR	**-0.0087*** **	**-0.0014***	**-0.0148*** **
	(-5.34)	**(-1.72)**	**(-3.70)**
Constant	0.0434***	0.0330***	0.0760**
	(4.22)	(5.41)	(2.48)
Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	30,777	13,808	16,191
adj. R-sq	0.189	0.384	0.175

Panel B: SHELTER as a new proxy of tax avoidance			
	(1)	(2)	(3)
	ABS_INV	Underinvestment	Overinvestment
SHELTER	**0.0037*** **	**0.0007***	**0.0074*** **
	(5.16)	**(1.72)**	**(5.08)**
Constant	0.0331***	0.0337***	0.0513***
	(7.00)	(12.89)	(3.46)
Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	86,486	42,529	41,889
adj. R-sq	0.182	0.404	0.179

***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test).

Table 9. Additional test - Alternative measure of investment inefficiency using Biddle et al. (2009)

	(1) Underinvestment	(2) Overinvestment
GAAP_ETR	**-0.2855*** **	**-0.4925*** **
	(-2.94)	**(-5.69)**
SIZE	-0.0646***	-0.0425***
	(-5.12)	(-4.54)
MTB	0.0073	0.0743***
	(0.83)	(8.59)
Z-SCORE	-0.0202***	-0.0178***
	(-3.83)	(-3.31)
Tangible	0.4914***	1.2915***
	(4.55)	(15.15)
K	0.6295***	-1.3932***
	(6.85)	(-14.82)
K_IND	-7.3311***	-1.0468***
	(-23.02)	(-4.53)
CFOSALE	0.0016	-0.0173***
	(0.41)	(-4.63)
SLACK	0.0100***	-0.0003
	(6.09)	(-0.18)
DIV	-0.0355	-0.1729***
	(-0.82)	(-4.62)
AGE	0.004	-0.1878***
	(0.16)	(-9.75)
LOSS	0.1642***	-0.0906***
	(4.55)	(-2.58)
CFO5SD	-0.0593	0.0666
	(-1.03)	(1.28)
SALE5SD	0.1421**	0.0552
	(2.24)	(0.98)
INV5SD	0.0298***	0.0033
	(2.83)	(0.32)
CASH	-0.2117*	0.7358***
	(-1.90)	(8.23)
OP_CY	-0.0868***	-0.1118***
	(-3.81)	(-5.91)
Firm Cluster	YES	
Year	YES	
N	53,451	
Pseudo R2	0.0784	

***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test).

Table 10. Additional test - Propensity score matching (PSM) analysis

Panel A: First stage logit regression

	First Stage ETR
SIZE	-0.1353***
	(-27.78)
MTB	-0.0000
	(-0.02)
Z-SCORE	-0.1830***
	(-30.30)
Tangible	0.1998***
	(3.60)
K	0.2061***
	(4.70)
K_IND	-0.2171
	(-1.26)
CFOSALE	-0.0489***
	(-8.61)
SLACK	-0.0017
	(-1.39)
DIV	0.0743***
	(3.63)
AGE	-0.0253**
	(-2.34)
LOSS	0.1260***
	(5.89)
CFO5SD	0.2821***
	(6.71)
SALE5SD	0.1573***
	(4.41)
INV5SD	0.0456***
	(6.56)
CASH	0.6634***
	(11.75)
OP_CY	0.0166
	(1.18)
Constant	-0.2172
	(-1.32)
Year	Yes
Industry	Yes
N	76,229
Pes_Adj_R-square	0.0860

Panel B. Covariate balance more ETR versus less ETR sub-samples

	NN Treated	NN Control	%bias
SIZE	4.67	4.66	0.10
MTB	2.64	2.55	2.40
Z_SCORE	0.00	0.05	-1.20
Tangible	0.27	0.26	2.80
K	0.18	0.18	-0.50
K_IND	0.18	0.18	-0.90
CFOSALE	-0.60	-0.51	-3.20
SLACK	2.80	3.05	-3.00
DIV	0.29	0.29	0.80
AGE	2.40	2.39	0.30
LOSS	0.47	0.48	-2.20
CFO5SD	0.17	0.19	-5.50
SALE5SD	0.28	0.29	-4.70
INV5SD	0.61	0.65	-2.90
CASH	0.19	0.19	-1.20
OP_CY	4.66	4.67	-1.50

Panel C: Average Treatment Effects for PSM approach.

	Sample	Treated	Controls	Difference	S.E.	T-stat
ABS_INV	Unmatched	0.04	0.04	0.01	0.00	10.86
	ATT	0.04	0.04	0.00	0.00	4.07
Underinvestment	Unmatched	0.03	0.02	0.00	0.00	14.33
	ATT	0.03	0.03	0.00	0.00	3.30
Overinvestment	Unmatched	0.07	0.05	0.01	0.00	10.65
	ATT	0.07	0.06	0.01	0.00	3.40

Panel D: Second Stage - Regression result – PSM

	(1) ABS_INV	(2) Underinvestment	(3) Overinvestment
GAAP_ETR	**-0.0092*** **	**-0.0057*** **	**-0.0266*** **
	(-4.85)	**(-6.48)**	**(-5.10)**
SIZE	-0.0034***	-0.0020***	-0.0074***
	(-19.94)	(-24.26)	(-16.56)
MTB	0.0023***	-0.0001	0.0039***
	(9.74)	(-0.88)	(6.34)
Z_SCORE	0.0006***	0.0000	0.0001
	(3.63)	(0.50)	(0.12)
Tangible	0.0844***	-0.0058***	0.1298***
	(33.18)	(-4.48)	(20.34)
K	-0.0244***	0.0019**	-0.0409***
	(-15.20)	(2.30)	(-8.95)
K_IND	0.0103	0.0287***	0.0261*
	(1.47)	(7.40)	(1.68)
CFOSALE	-0.0001	-0.0001**	-0.0008
	(-0.71)	(-2.21)	(-1.00)
SLACK	-0.0001***	0.0001***	-0.0007***
	(-4.06)	(3.56)	(-3.22)
DIV	-0.0066***	-0.0012***	-0.0074***
	(-9.99)	(-3.54)	(-4.93)
AGE	-0.0057***	0.0001	-0.0091***
	(-14.32)	(0.27)	(-9.77)
LOSS	-0.0034***	0.0037***	-0.0006
	(-3.94)	(10.22)	(-0.23)
CFO5SD	-0.0002	-0.0012**	0.0000
	(-0.13)	(-2.34)	(0.00)
SALE5SD	0.0013	-0.0003	0.0004
	(0.84)	(-0.43)	(0.09)
INV5SD	0.0021***	0.0002	0.0051***
	(5.12)	(1.44)	(4.17)
CASH	0.0102***	0.0001	0.0205***
	(5.27)	(0.16)	(3.53)
OP_CY	0.0012*	0.0000	0.0014
	(1.90)	(0.17)	(0.81)
Constant	0.0367***	0.0361***	0.0662***
	(6.20)	(11.38)	(3.57)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	60,989	29,206	30,174
adj. R-sq	0.193	0.403	0.192

***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test).

Table 11. Additional test - Difference-in-Difference (DID) analysis

	(1) ABS_INV	(2) Underinvestment	(3) Overinvestment
GAAP_ETR	**-0.0070*** **	**-0.0036*** **	**-0.0212*** **
	(-3.18)	**(-3.64)**	**(-3.38)**
UTP10	-0.004	-0.0108***	-0.0052
	(-1.49)	(-6.16)	(-0.90)
GAAP_ETR*UTP10	-0.2707***	-0.1167**	-0.5439***
	(-2.79)	(-1.97)	(-2.74)
BOG	0.0112***	0.0037*	0.0189**
	(2.80)	(1.91)	(2.02)
GAAP_ETR*UTP10*BOG	**0.0615*** **	**0.0258* **	**0.1235*** **
	(2.81)	**(1.93)**	**(2.77)**
Constant	-0.0141	0.0235**	-0.0211
	(-0.76)	(2.48)	(-0.46)
Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	50,023	24,656	26,044
adj. R-sq	0.195	0.415	0.192

***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test).

Table 12. Additional test - Two-stage least squares (2SLS) regression analysis

	(1) First-stage model	(2) ABS_INV	(3) Underinvestment	(4) Overinvestment
GAAP_ETR		**-0.1405*** (-5.89)**	**-0.0836*** (-6.81)**	**-0.0251*** (-5.29)**
ETR_MEDIAN	0.2270*** (22.70)			
SIZE	0.0134*** (37.69)	-0.0014*** (-4.15)	-0.0006*** (-2.94)	-0.0043*** (-6.87)
MTB	-0.0003 (-1.62)	0.0020*** (10.39)	-0.0001 (-1.26)	0.0035*** (6.97)
Z-SCORE	0.0028*** (14.86)	0.0009*** (5.44)	0.0002*** (4.97)	0.0009 (1.58)
Tangible	-0.0260*** (-6.43)	0.0791*** (31.65)	-0.0092*** (-6.83)	0.1183*** (18.76)
K	-0.0120*** (-3.05)	-0.0259*** (-16.02)	0.0012 (1.40)	-0.0447*** (-9.39)
K_IND	-0.0367*** (-2.88)	0.0059 (0.86)	0.0279*** (6.76)	0.0125 (0.85)
CFOSALE	0.0011*** (11.12)	0.0002 (1.49)	0.0001* (1.940	-0.0000 (-0.11)
SLACK	0.0002** (2.45)	-0.0001*** (-5.58)	0.0001*** (4.98)	-0.0006*** (-4.82)
DIV	0.0009 (0.60)	-0.0066*** (-10.18)	-0.0010*** (-2.71)	-0.0078*** (-5.26)
AGE	0.0034*** (4.37)	-0.0051*** (-13.15)	0.0004** (1.99)	-0.0076*** (-8.61)
LOSS	-0.1099*** (-54.03)	-0.0194*** (-6.96)	-0.0048*** (-3.52)	-0.0315*** (-4.62)
CFO5SD	-0.0159*** (-8.96)	-0.0014 (-0.81)	-0.0025*** (-5.28)	0.0001 (0.02)
SALE5SD	-0.0082*** (-3.11)	0.0014 (0.94)	0.0001 (0.18)	-0.0019 (-0.39)
INV5SD	-0.0053*** (-11.26)	0.0010*** (2.69)	-0.0002 (-1.30)	0.0025** (2.20)
CASH	-0.0870*** (-22.79)	-0.002 (-0.73)	-0.0062*** (-5.37)	-0.0121 (-1.47)
OP_CY	-0.001 (-1.18)	0.0016*** (3.13)	0.0004* (1.78)	0.0016 (1.08)
Constant	0.1961*** (15.82)	0.0668*** (8.07)	0.0503*** (11.67)	0.1343*** (5.45)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	69,332	69,332	32,926	34,695
adj. R-sq	0.306	0.109	0.224	0.084

***, **, and * represent statistical significance at the 1%, 5%, and 10% level respectively (two-tailed test).