# The Role of Big 4 Auditors in Tax Avoidance and Financial Reporting

**Abstract**

In 2023, PwC faced a scandal after advising the Australian government on proposed tax legislation and leaking this confidential information to its corporate clients. The fallout resulted in substantial reputational and legal repercussions for PwC and the individuals involved. The question arises as to whether PwC's actions led to discernible effects on the tax payable by Australian companies. In this study, we examine whether PwC and each of the other Big 4 audit firms are associated with corporate tax aggressive behavior. We also examine the relationship between each audit firm and earnings management. The results show that PwC is associated with more tax aggressive behavior, while PWC and EY are associated with higher earnings management.


**Keywords**: Big 4 Auditors; Corporate Tax Avoidance; Earnings Management; Financial Reporting Quality; Regulatory Oversight;

# I. Introduction

Recent public scrutiny of unethical[1] corporate tax behavior has raised concerns about the role of major accounting firms (Deloitte, PwC, KPMG, and EY, collectively known as the Big 4) in facilitating or mitigating corporate tax avoidance practices (hereafter referred to as tax aggressiveness[2]). In the United States, as in many other countries, the concerns over auditor independence, particularly regarding non-audit services such as tax planning, are central to the regulators (Public Company Accounting Oversight Board 2024; Chyz, Gal-Or, and Naiker 2023; Carr, Aier, and Cao 2021). In Australia, PwC is reported to have advised the federal government on new tax policy proposals and then used this information to advise clients on reducing taxes (Jackson and Koehn 2023)[3]. This case is the most recent of four ethical failures referred to by the IESBA in its recent report on firm culture and governance (IESBA Firm Culture and Governance Working Group 2025). While the PwC scandal raised concerns about the auditor's ethical behavior, did it make a difference for PwC clients? Do audit firms influence tax paid by their clients? Do they influence earnings management? Understanding the influence of audit firms on corporate tax behavior and earnings quality is highly important from both academic and regulatory perspectives (O'Donovan, Wagner, and Zeume 2019; Tan et al. 2024).

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[1] Jackson (2023), *Australia foiled multinationals' attempts to subvert new tax laws after PwC Australia leak. Reuters.* Available at: https://www.reuters.com/sustainability/pwc-australia-clients-staff-focus-tax-leak-faces-government-hearings-2023-05-30. and Jackson and Koehn (2023), *PwC Australia tipped off Google about government tax plans, sources say. The Sydney Morning Herald.* Available at: www.smh.com.au/business/companies/pwc-australia-tipped-off-google-about-government-tax-plans-sources-say-20230706-p5dm2p.html. Outcome of Tax Practitioners Board (TPB) investigation. (MS22-002845). The Australian Government. Retrieved from https://treasury.gov.au/sites/default/files/2023-03/foi-3269.pdf

[2] In this study, the use of "tax aggressiveness" refer to firm's actions for considering legal aspects (within the bound of tax law) to reduce tax payments. However, "tax aggressiveness" can be interpreted differently in different jurisdictions. In Australia and New Zealand, there are robust anti-tax avoidance regulations to control strategies that, while not illegal, are supposed to be exploitative of tax regulations. In this study, tax aggressiveness terminology refer to legal behaviors that may involve the excessive use of loopholes, pushing the boundaries of ethical tax planning.

[3] PwC case (referred to as the PwC scandal) is a potential violation of Section 70 and 90 of the Australian Crimes Act, related to the way govermnet officials hand confidential information. These sections deter government officials (current or former) from disclosing information (particularly sensetive information that can potentially negatively impact public interest if disclosed inappropriately) that are obtained during their position as a governemtal officers without permission (Section 70). In PwC case, the specific PwC partner was not a government employee, his access to those information during his consultations appointment is considered confidential, therefore subject to this section. Focused on handling "official secrets", Section 90 is intended to deter disclosure or misuse of governmental information which is critical to public safety and national security.

Given the recent public scrutiny of auditing practices in Australia and substantial criticism of related regulations and standards, this study attempts to better understand the broader impact of firms' auditor choices and their financial behavior. We examine Australian companies' financial statements to assess whether individual Big 4 auditors clients are likely to have lower tax liabilities and higher earnings management.

Prior literature presents contrasting findings on the relationship between a firm's choice of auditors (among Big 4 auditors) and tax strategies and the impact on their earnings management practices. Although some literature provides evidence on the quality-enhancing role of corporate engagement with Big 4 auditors in reducing earnings management and shaping tax strategies (Eshleman and Guo 2014; Kanagaretnam et al. 2016; Chyz et al. 2021), others document persistent earnings management, despite using services provided by Big 4 auditors (D.-F. Huang and Chang 2016). Additionally, Habib and Hasan (2016) and Houqe, Ahmed, and Van Zijl (2017) demonstrate that while high-quality auditors and auditor-provided tax services can reduce the risk of stock price crashes and earnings management, their effectiveness varies, particularly for firms with specific strategic characteristics like innovative business models or being part of business groups.

The contrasting arguments in prior studies suggest the need for a deeper investigation of how Big 4 firms impact corporate tax behavior and their reporting quality, particularly in Australia. We aim to provide a clearer picture of this relationship that has become crucial with the growing public focus on corporate tax behavior.

To address the research questions in this study, we analyze 7,658 firm-year observations from publicly listed Australian companies. Following prior studies (H.H. Huang et al. 2016; Cen et al. 2017; M.M. Hasan, Lobo, and Qiu 2021), we use two measures of corporate tax aggressiveness—one based on accounting and the other on cash. These measures help us capture all corporate tax strategies, whether accounting- or cash-based, addressing potential

limitations in each approach. Additionally, we use two measures of earnings management. We use discretionary accruals quality (DAQ) and return-adjusted discretionary current accrual (RDCA), which have been used frequently in prior literature due to their complementary measurement structure (McNichols 2002; Srinidhi, Gul, and Tsui 2011).

Our results show that while there is no uniform effect for all Big 4 auditors, specific firms, particularly PwC, significantly influence corporate tax behavior and earnings management. Our analyses show variances in the influence of Big 4 auditors on corporate tax behavior and earnings management across Australian publicly listed firms. The findings show that PwC clients are associated with higher tax aggressiveness and lower effective tax rates. Our additional alternative and time-based analysis reveal a persistent role of PwC in higher corporate tax aggressiveness, mainly in earlier years of our study period. Our findings further show that firms audited by EY and PwC have higher levels of earnings management.

We use several robustness analyses, ensuring the reliability of our main findings in this study. We exclude individual Big 4 auditors, perform temporal analysis, and employ pairwise comparisons to highlight PwC's unique impact. We used the Lewbel (2012) approach to address endogeneity and entropy balancing. We also excluded loss-making firms and further conducted a difference-in-difference (DID) analysis to isolate the effect of the 2016 PwC scandal. Together, these tests confirm the validity of our findings and underscore the role of auditor choice in shaping corporate financial behavior.

The findings of this study have significant implications for literature, practice, and regulation. The findings challenge the assumption that all Big 4 auditors uniformly constrain aggressive tax strategies and earnings manipulation (J.R. Francis and Wang 2008). By revealing that firms audited by PwC, in particular, are associated with higher levels of tax aggressiveness and earnings management, the study suggests that the effectiveness of auditors in promoting financial transparency may vary significantly depending on the auditor. As the

findings show that the choice of auditor significantly impacts corporate tax behavior and financial reporting quality, it adds complexity to the audit quality framework that requires closer attention to examining individual auditors in future studies.

The paper is structured as follows: it begins with a review of the relevant literature and theoretical background for the hypotheses. Then, it describes the measures and sample structure. The empirical results section presents descriptive statistics and key findings, followed by robustness tests. Finally, the paper concludes with a summary of the main findings and a discussion of their implications.

## II.    Literature review and hypotheses development

Agency theory, which explains the potential conflict of interest between stakeholders and managers, provides an appropriate framework for investigating the association between the choice of auditors and corporate tax behavior and their earnings management (T.M. Jones 1995). These conflicts of interest are particularly relevant in corporate tax aggressiveness and earnings management. Managers' engagement with aggressive tax strategies and earning manipulation practices to meet personal performance targets or boost short-term financial results are misaligned with the business's long-term objectives and stakeholders. Within the context of the agency theory, this study investigates whether the choice of auditors (among Big 4 audit firms) facilitates corporate tax aggressiveness and earnings quality, increasing impact on the existing agency conflicts between agents and a broad group of stakeholders.

Apart from the primary auditing services provided by big accountancy firms, they provide a range of other services, such as tax advisory or financial consultancy, to private and publicly listed firms nationwide or internationally. While some studies show that companies that engage their auditor for tax services have more adequate and accurate tax reserves (Gleason and Mills 2011), recent studies have shown that auditor involvement in tax planning or tax compliance degrades audit quality (Chyz, Gal-Or, and Naiker 2023), and that regulators restrictions of

aggressive tax services were followed by improved quality of the income tax accrual (Carr, Aier, and Cao 2021; Public Company Accounting Oversight Board 2024). Previous scandals, such as the Panama Papers in 2016, increased the likelihood of these big accountancy firms facilitating inappropriate tax strategies, such as tax havens for multinational companies (Obermaier and Obermayer 2017). For instance, KMPG and PwC firms were found to be in tax havens such as Gibraltar, Switzerland, Luxembourg, Jersey, and the Cayman Islands. Additionally, the earlier scandals in 2014, known as the Luxembourg Leaks, reveal the facilitating role of PwC in more than 500 confidential tax arrangements with the Luxembourg government (Nesbitt, Outslay, and Persson 2017). The special tax rulings allowed firms to funnel substantial profit through Luxembourg, using complex financial structures, loyalty fees, and intra-firm loans, leading to a significantly lower tax rate. Moreover, these big accountancy firms provide advisory services to local and international governments, often on tax rules and related policies that can indirectly push for a particular change at national or international levels. Their expertise and experiences in providing such a service may contribute to the increasing corporate tax aggressiveness issues, leading to increasing concerns about their potential involvement in structuring corporate tax behavior. The potential conflict of interest between managers and stakeholders, proposed by agency theory, provides an appropriate framework to investigate the association between corporate choice of auditors (Big 4 firms) and tax aggressiveness as well as earnings management (J.Z. Chen, Elemes, and Lobo 2023). The role of these auditors in facilitating or constraining such practices can thus have significant implications for corporate governance and financial transparency.

Despite the extensive media scrutiny of the Big 4 accounting firms for their involvement in corporate tax aggressiveness-related practices, surprisingly, little academic focus has been on their role. One notable exception is Bankman (2004), arguing that these major accounting firms have developed many of the most significant tax shelters. A few other studies, such as those

by C. Jones, Temouri, and Cobham (2018) and J.Z. Chen, Elemes, and Lobo (2023), provide detailed discussions on the Big 4's involvement in promoting various tax aggressiveness schemes. However, much of this research is based on case studies, which, while insightful, do not offer the comprehensive firm-level empirical analysis needed to generalize these findings.

The UK Parliament's Public Accounts Committee (2015) raised concerns about the role of big accounting firms in corporate tax aggressiveness, particularly PwC. The report of findings from the International Consortium of Investigative Journalists revealed that PwC secured advanced tax rulings for companies with Luxembourg authorities. While PwC's Head of Tax denied marketing tax aggressiveness schemes, he admitted the firms create bespoke tax strategies for individual clients. The committee criticized the lack of clarity between acceptable tax practices and aggressive tax planning, suggesting PwC's Code of Conduct may obscure its involvement in exploiting international tax loopholes.

In Australia, recent controversies on the role of PwC in breaching confidentiality on government proposals for multinational tax legislation between 2013 and 2016 exacerbate the concerns raised by the UK Parliament's Public Accounts Committee. Within this period, a PWC partner shared internal government information with other PwC colleagues, enabling them to alert their multinational clients to adopt a quick, aggressive tax strategy in response to the Multinational Anti-Avoidance law (Ratnatunga 2023). After an investigation by the *Australian Financial Review*, the partners involved were dismissed from PwC and deregistered by the Tax Practitioners Board for dishonesty (Chenoweth 2023)[4]. After the Australian Financial Review newspaper revealed the scandal, PwC dismissed more than 700 staff and "dozens" of partners (Clun and Kruger 2024). PwC had failed to properly address the misconduct or hold its partners accountable, according to the report by the Senate Finance and

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[4] A detailed description of the events and issues is reported in Tadros (2024). An enquiry for the Australian Parliamentary Joint Committee on Corporations and Financial Services has recently been completed.

Public Administration References Committee (SFPARC) (Dumay, Ricceri, and Guthrie 2024; Ratnatunga 2023). Their report on June 2023 accused PwC of attempting to conceal the issue and further requested full PwC cooperation and disclosure of all partners' roles in the breach with future inquiries in the breach.

Prior literature shows that auditors receive marginally higher compensation and fees to provide services that help firms develop aggressive tax strategies (Beale 2003; Securities and Exchange Commission (SEC) 2006). Additionally, some studies establish a relationship between higher audit compensation and aggressive corporate tax behavior (Donohoe and Knechel 2014; Mills 1998). Moreover, the study by McGuire, Omer, and Wang (2010) provides evidence of a higher level of tax aggressiveness for firms that receive non-audit services from tax-expert auditors. Gravelle (2009) investigated how the US government loses tax revenue due to the profit-shifting practices by organizations and individuals to low-tax jurisdictions, commonly known as tax havens. The resulting losses are mainly due to the inadequate disclosure and requirements for administration reforms around related disclosure. They call for higher public and regulatory scrutiny, ensuring corporate taxes are managed and paid as relevant regulations intend. Additionally, C. Jones, Temouri, and Cobham (2018) provide evidence of a strong relationship between the use of Big 4 auditor's services and the size of a multinational firm's tax haven network, arguing that public policy regarding the role of auditors in corporate tax strategies can significantly impact on corporate aggressive tax behavior. Chyz et al. (2021) also provide evidence for the higher level of corporate tax aggressiveness for firms using tax-related services from auditors. The recent report by the IESBA Firm Culture and Governance Working Group (2025) recommends additional ethical accountability standards in major accounting firms, ensuring their role alignment as an auditor with the public interest.

Given the prior finding in the literature and the evidence on the role of auditors in structuring corporate tax behavior, the choice of audit firm is likely to impact corporate tax aggressiveness. These big accounting firms often provide various tax-related services across audit services, substantially impacting a firm's tax strategies and tax payments. Consistent with the evidence in prior literature, the impact can be different between Big 4 firms, with some more closely engaged with higher levels of tax aggressiveness. This has led us to the following hypothesis:

*H1: There is a negative association between Big 4 auditors and tax expense.*

There is ample research investigating the impact of auditors on corporate earnings quality. High-quality auditors, such as those of Big 4 firms, due to their expertise and exposure to litigation risks, are supposed to positively impact corporate earnings quality, reducing potential manipulation of financial reports (DeAngelo 1981). This notion was supported by Krishnan and Visvanathan (2011), arguing that when auditors provide both audit and non-audit services, the extended understanding of a firm's operations and risks allows them to perform a more effective audit, thereby improving the accuracy and quality of financial reporting through reduced earnings management. Habib and Hasan (2016) provide further insights by showing that auditor-provided tax services can lower stock price crash risk by reducing earnings management. Other studies criticize this notion by revealing that some Big 4 audit firms may be linked to higher corporate earnings management and, thus, lower quality of financial reporting. J.R. Francis and Wang (2008), for example, demonstrated that Big Four audit firms positively impact corporate earnings quality only in highly scrutinized environments; this positive effect diminishes in less regulated environments. Van Tendeloo and Vanstraelen (2008) also highlight the constraining effect of Big 4 auditors on earnings management, particularly in private firms within high-tax alignment countries, emphasizing the role of audit quality in maintaining financial integrity only in highly regulated environments. Ratzinger-Sakel (2013) argues that providing both audit and non-audit services compromises auditor

integrity and independence; thus, it results in sluggish monitoring and oversight that can facilitate corporate earnings manipulation. Furthermore, D.-F. Huang and Chang (2016) find that firms that use non-audit services such as tax-related services and suffer from poor tax-related governance strategies are more likely to be involved with higher earnings management. Their study suggests that the mechanism to achieve a higher-quality corporate financial reporting through lower earnings management is by strengthening a firm's internal tax-related systems. Additionally, a persistent lower financial reporting quality for those firms that use services from Big 4 auditors has been documented by Alhadab and Clacher (2018). Similarly, recent study by J.Z. Chen, Elemes, and Lobo (2023) found that U.K. private firms audited by Big 4 auditors tend to have higher discretionary accruals. This provides evidence suggesting that Big 4 auditors may limit income-increasing earnings management.

In summary, the results of prior studies recommend that the association between the choice of auditors and earnings management is complex. Various factors, including engaged audit firms and the regulatory environment, can influence it. This literature supports the notion that firms audited by Big 4 firms may engage in higher levels of earnings management, leading to poor quality of financial reporting. Therefore, we propose the following second hypothesis:

*H2: There is a positive relationship between Big 4 auditors and earnings management.*

### III.    Research framework

*Corporate tax aggressiveness*

In order to investigate corporate tax behavior in relation to the choice of Big 4 auditor, we have measured corporate tax aggressiveness using two measures frequently used in prior literature (H.H. Huang et al. 2016; Cen et al. 2017). Our first measure of corporate tax aggressiveness is the result of dividing income tax by pre-tax book income after excluding special items; this measure is known as the accounting effective tax rate (ACC_ETR) in the

literature (Hanlon and Heitzman 2010). ACC_ETR indicates corporate tax strategies, resulting in aggressive permanent savings on tax expenses (Dyreng, Hoopes, and Wilde 2016). Our second measure of corporate tax aggressiveness is the cash-based effective tax rate (Cash_ETR). This measure considers cash tax paid after dividing it by pre-tax book income after deducting special items. Our second measure considers all tax-related strategies, saving annual tax payments, thus covering potential limitations of ACC_ETR (M.M. Hasan, Al-Hadi, et al. 2017). Consistent with prior research, we restrict ACC_ETR and Cash_ETR to fall within the range of 0 to 1. We use the transformed variables of ACC_ETR and Cash_ETR in our correlation and regression analyses for easier interpretation.

### *Earnings management*

We use two metrics to assess earnings quality. First, we measure discretionary accruals quality (DAQ) by calculating the absolute value of the difference between actual and estimated accruals. This considers current, historical, and prospective cash flows, sales, long-term assets, operating cycles, and sales volatility (McNichols 2002; J. Francis et al. 2005). Second, we use performance-adjusted discretionary accruals, known as Return-Adjusted Discretionary Current Accruals (RDCA). This measure incorporates various performance variables into the accrual expectation model, accounting for the scale of operations and performance (Kothari, Leone, and Wasley 2005; Srinidhi, Gul, and Tsui 2011). Our discretionary accruals quality (DAQ) is derived from the absolute value of the residual obtained by performing annual cross-sectional regressions for 48 industry categories (Fama and French 1997), including all firms in year t. The regression equation is as follows.

$$\Delta WC_{it} = \beta_{0i} + \beta_{1j}CFO_{i,t-1} + \beta_{2j}CFO_{i,t} + \beta_{3j}CFO_{i,t+1} + \beta_{4j}\Delta Sale_{i,t} + \beta_{5j}PPE_{i,t1}$$
$$+ \varepsilon_{it} \qquad (1)$$

Where $i$ signifies the firm and $t$ signifies the year. Following J. Francis et al. (2005), operating non-cash working capital changes is used for the dependent variable.

$\Delta WC_{it}$ is measured as $(\Delta CAss_{it} - \Delta Cash_{it}) - (\Delta CL_{it} - \Delta ST\ Debt_{it})$. Cash and short-term debt are removed due to their non-representation for operating accruals. Changes are for two consecutive periods $t$-1 and $t$.

$\Delta CAss_{it}=$ current assets change,

$\Delta Cash_{it}=$ cash balance change,

$\Delta CL_{it}=$ current liabilities change (short-term debt are included),

$\Delta ST\ Debt_{it}=$ short-term debt change, and

$CFO_{it}=$ operating cash flow (extracted from cash statements).

All variables are scaled by total assets. A high DAQ value indicates poor accrual quality. According to P.M. Dechow, Dichev, and McNichols (2002), firm size, sales volatility, cash flow volatility, the absolute value of the change in working capital, and the operating cycle are intrinsic firm-specific characteristics related to DAQ.

We use current performance-adjusted discretionary accruals to measure earnings quality. Previous research (Ashbaugh, LaFond, and Mayhew 2003) emphasizes the importance of focusing on current accruals, as they give managers more discretion in the short term. The scale of a firm's operations determines the non-discretionary component of current accruals, such as accounts receivable and inventory changes. Any part of the accruals not attributed to the size of operations is considered discretionary. Discretionary accruals include managers' subjective estimations of firm performance and those not proportional to the firm's size or performance, indicating earnings management (Kothari, Leone, and Wasley 2005). Thus, performance-adjusted discretionary current accruals indicate earnings quality. DAQ, seen as performance-adjusted abnormal accruals, balances the size of operations with sales, PPE investment, and firm performance based on current, past, and future cash flows. Kothari, Leone, and Wasley (2005) proposed an alternative approach where sales and PPE investment represent the scale of operations, and performance is adjusted by incorporating ROA, resulting in return-adjusted

discretionary current accruals (RDCA). We use an extended version of the Ashbaugh, LaFond, and Mayhew (2003) model to analyze the SCM and RDCA magnitude relationship. Following Gul, Fung, and Jaggi (2009) and Srinidhi, Gul, and Tsui (2011), we calculate our dependent variable (RDCA) for earnings quality, adding ROA instead of revenue growth in the Biddle, Hilary, and Verdi (2009) model.

$$\Delta TA_{it} = \beta_{0i} + \beta_{1j}1/Assets_{i,t-1} + \beta_{2j}\Delta Sales_{i,t} + \beta_{3j}PPE_{i,t1} + \beta_{4j}ROA_{i,t-1}$$
$$+ \varepsilon_{it} \qquad\qquad (2)$$

We define total accruals (TA) as the change in non-cash current assets minus the change in current liabilities (excluding the current portion of long-term debt) minus depreciation and amortization, all scaled by lagged total assets. In this context, $\Delta$Sales represents the change in sales scaled by lagged total assets, while $1/Assets_{it-1}$ and $PPE_{it}$ represent net property, plant, and equipment scaled by lagged total assets. We also estimate a model like the Jones and modified-Jones models but augmented to include $ROA_{it}$ or $ROA_{it-1}$. This approach allows us to compare the effectiveness of performance matching versus including a performance measure in the accrual's regression.

**Empirical data**

The financial data are collected from the Eikon (Refinitiv) database. The primary sample included all publicly listed Australian firms available in the database from 2016 to 2022, excluding firms in the financial industry. The initial sample had 10,881 observations from 2,267 unique firms. After removing missing data, we need to calculate our main dependent variables (tax aggressiveness and earnings management), independent variables (Big 4 auditors), and control variables. After this screening, we end up with 7,658 firm-year observations for the accounting effective tax rate (ACC_ETR) and the cash effective tax rate (Cash_ETR) tax aggressiveness measures. Table 1, Panel A summarizes the sample selection process. Panel B of Table 1 summarizes the distribution of our sample across industry sectors

and their corresponding auditing companies, distinguishing between those audited by the Big 4 firms and those not. The 'Materials' sector has the highest representation, with 38% of the total (2,915 observations). The 'Healthcare,' 'Industrial,' and 'Information Technology' sectors each account for 10% of the total observations. Following these, the 'Energy' sector represents 8.91% of the sample, the 'Consumer Cyclical' sector 8.51%, the 'Real Estate' sector 5.22%, and the 'Communication Services' and 'Consumer Staples' sectors 4.47% and 4.15%, respectively. The last four columns of Panel B help to understand the audit landscape across different industries in our study by showing the distribution of firms audited by the Big 4 (KPMG, EY, Deloitte, and PwC) compared to those not audited by these firms. For instance, in the 'Materials' sector (the largest sector in our study), 28.34% of firms are audited by Big 4 firms. In the healthcare sector, 35.07% of firms are audited by Big 4 firms, whereas the industrial sector shows that nearly half (49.49%) are audited by Big 4 auditors. The 'Consumer Cyclical' and 'Real Estate' sectors have the highest proportions of Big 4 audits, with 60.28% and 66.25% respectively. Big 4 firms are engaged with almost 40% of firms in our sample, which highlights our investigation's importance on the implication of the choice of Big 4 auditors for corporate financial reporting and tax behavior. Panel C of Table 1 displays the industry distribution of firms audited by individual big 4 auditors separated by industry. The 'Materials' sector is the largest for all auditors, with EY having the highest representation in this sector. PwC has a relatively higher representation in the 'Consumer Cyclical' and 'Real Estate' sectors, and Deloitts show a stronger presence in the 'industrials' sector.

*[INSERT Table 1]*

**Empirical models**

To assess the relationship between corporate tax aggressiveness and the choice of Big 4 Auditors, we employ the following empirical models:

$$Tax\ Avoidance/Earnings\ Management_{i,t} = \beta_0 + \beta_1 KPMG_{i,t} + \beta_2 EY_{i,t} + \beta_3 Deloitte_{i,t} +$$

$$\beta_4 PwC_{i,t} + \beta_5 Controls_{i,t} + Fixed\_Effects_{it} + \varepsilon_{it} \qquad (3)$$

In our models, Tax Aggressiveness/Earnings Management represents either corporate tax aggressiveness or earnings management for firm $i$ in year $t$. In Model 1, BIG4 represents a dummy variable representing any Big 4 firms. In Model 2, the KPMG, EY, Deloitte, and PwC are dummy variables indicating whether the firm is audited by one of these Big 4 auditors, respectively.

Following previous literature (M.M. Hasan, Lobo, and Qiu 2021; Bauckloh et al. 2021), we include several control variables, accounting for other elements that can impact the relationship in our hypothesis. These control variables include firm size (Size), property, plant, and equipment (PPE), inventory (Inv), research and development expenditure ratio (RDINT), and market price to book value of equity (PB) to capture fundamental firm characteristics. PPE and inventory are crucial as tax rules and accounting standards related to these items can affect firm-level tax. We include return on assets (ROA) and revenue growth (Growth) as profitable firms face higher marginal tax rates but also possess more significant resources for tax planning, which can reduce their tax burden (J.Z. Chen, Elemes, and Lobo 2023). The cash ratio (Cash) is included because firms with higher cash reserves have less incentive to avoid taxes (Hanlon, Maydew, and Saavedra 2017). Financial leverage (Leverage) is included because of its link to tax debt. It can diminish corporate motivation for additional tax planning or encourage firms to avoid taxes to retain cash for debt repayment (Badertscher, Katz, and Rego 2013). Corporate governance (GOV) performance is also included due to its potential impact on corporate strategies that can influence tax aggressiveness and earnings quality. Fixed effects for year, firm, and industry are incorporated to control for firm-specific time-invariant heterogeneity and year and industry-specific characteristics. Appendix A provides detailed definitions of all variables used in this study.

## IV.    Empirical findings

**Overview of descriptive statistics**

Panel D of Table 1 shows the univariate statistics for the variables in our regression analyses. The mean (median) accounting-based effective tax rate (ACC_ETR) is 18.08% (12.45%), and the cash-based effective tax rate (Cash_ETR) has a mean (median) of 25.89% (19.31%), indicating tax expenses relative to income, which are in line with prior literature (M.M. Hasan, Lobo, and Qiu 2021; Mnif and Tahri 2024). The discretionary accruals quality measure (DAQ) has a mean of 2.0033 and a standard deviation of 0.6111, suggesting firm earnings quality variability. This aligns with previous findings (Srinidhi, Gul, and Tsui 2011; Waweru and Prot 2018). The research and development capital expenditure ratio (RDCA) averages 1.6989, indicating considerable investment in R&D. Firm size (Size) averages 17.6962 (equivalent to $64 million), showing the sample includes moderately large firms and consistent with Ferguson, Francis, and Stokes (2003). The property, plant, and equipment ratio (PPE) has a mean of 0.3397, indicating significant fixed asset investment. Inventory (Inv) has a mean of 0.0475, with a median of 0, reflecting minimal inventory for many firms. Research and development intensity (RD) averages 1.7172, indicating varied investment in innovation. The mean return on assets (ROA) is -0.2891, suggesting many firms experienced losses, this is consistent with the study by Carson et al. (2012). The growth rate (Growth) has a mean of 0.0025, indicating stable revenue trends. The price-to-book ratio (PB) has a mean of 1.2182, reflecting moderate market valuation. The cash ratio (Cash) averages 0.9571, indicating high liquidity. Financial leverage (Lev) averages 0.3589, showing varied debt usage and consistent with prior literature (J.R. Francis and Wang 2008; Carson et al. 2012). The corporate governance score (GOV) averages 3.9095, indicating high governance standards. We use the natural logarithm of this composite index measure of corporate governance to bring it to a common scale for analysis.

Table 2 presents our main variables' variance inflation factor (VIF) test results and Pearson correlations. The VIF values range from 1.03 to 2.26, suggesting no multicollinearity concerns among the variables. The Pearson correlation analysis reveals several significant relationships. Both tax aggressiveness measures (ACC_ETR and Cash_ETR) show negative correlations with the discretionary accruals quality measure (DAQ) and Return-Adjusted Discretionary Current Accruals (RDCA), implying that firms with higher tax aggressiveness tend to have poorer earnings quality and lower R&D investments. Firm size (Size) shows a positive correlation with both ACC_ETR (0.250) and Cash_ETR (0.163), suggesting that larger firms tend to have higher effective tax rates. Return on assets (ROA) positively correlates with both tax aggressiveness measures, highlighting that more profitable firms tend to have higher tax rates than expected. However, growth (Growth) does not correlate significantly with tax aggressiveness measures. The price-to-book ratio (PB) negatively correlates with ACC_ETR and Cash_ETR, suggesting that firms with higher market valuations relative to book value tend to engage more in tax aggressiveness. The cash ratio (Cash) also negatively correlates with tax aggressiveness measures, indicating that firms with more cash reserves tend to avoid taxes less. Financial leverage (Lev) has a weak correlation with tax aggressiveness measures. Corporate governance (GOV) has slight negative correlations with tax aggressiveness measures, indicating that firms with better governance practices might engage less in tax aggressiveness. The results also show a negative relationship between earnings management (measured by DAQ and RDCA) and firm size (Size) (-0.127 and -0.133), indicating that smaller firms may exhibit poorer earnings quality. Additionally, both DAQ and RDCA negatively correlate with ROA (-0.091 and -0.422, respectively), suggesting that firms with poorer earnings quality tend to be less profitable. Overall, the correlations among the variables are consistent with our expectations and prior studies.

*[INSERT Table 2 HERE]*

**Main regression results**

*Big 4 audit firms and tax aggressiveness*

Table 3 shows the results of regression analyses, examining the association between firms audited by Big 4 auditors and corporate tax aggressiveness. We use two alternative corporate tax aggressiveness measures as dependent variables in columns (1) and (2) ACC_ETR and Cash_ETR. The findings show a significant association between PwC and lower corporate tax expenses among Big 4 auditors (KPMG, EY, Deloitte, and PwC). This indicates that firms audited by PwC have a statistically significant negative association with ACC_ETR (-0.0247, $p < 0.01$) and Cash_ETR (-0.0180, $p < 0.05$), thus a higher level of tax aggressiveness. A change from PwC to another auditor (i.e., a change from 1 to 0 in the PWC dummy variable) gives rise to a change of -0.0247 (-2.5%) in ACC_ETR and 0.0180 (1.8%) in Cash_ETR. This result indicates that auditors have a varying influence on corporate tax behavior, with firms audited by PwC engaging actively in aggressive tax behaviors.

Our findings for control variables show a positive association between firm size (Size), inventory (Inv), and ACC_ETR and Cash_ETR. This shows larger firms and firms with higher inventory levels face higher effective tax rates (Richardson and Lanis 2007; Cheng et al. 2012). Also, profitable firms face higher tax rates, as expected. PPE is shown to be negatively related to ACC_ETR, and research and development intensity (RDINT) is negatively related to both ACC_ETR and Cash_ETR, suggesting that firms with more fixed assets and those who invest more in R&D exercise more tax aggressiveness (Gao, Yang, and Zhang 2016). The results also show that firms with higher market value (PB) and higher liquidity (Cash) engage more in tax aggressiveness (I. Hasan, Hoi, et al. 2017). Lastly, firms with higher debt (Leverage) experience higher tax rates, as evidenced by a positive association with ACC_ETR.

*Big 4 audit firms and earnings management*

The regression analysis results evaluating the association between the firms audited by Big 4 auditors and earnings management are presented in Table 4. Two alternative measures of earnings management are used in columns (1) and (2): discretionary accruals quality (DAQ) and return-adjusted discretionary current accruals (RDCA); the findings indicate that among the Big 4 auditors (KPMG, EY, Deloitte, and PwC), only EY and PwC are significantly associated with higher levels of earnings management. Specifically, firms audited by EY show a significant positive relationship with both DAQ (0.0415, $p < 0.05$) and RDCA (0.0830, $p < 0.01$), suggesting poorer earnings quality. A change from EY to another firm is associated with an increase of 0.0415 in DAQ and an increase of 0.083 in RDCA. Similarly, firms audited by PwC exhibit a significant positive relationship with DAQ (0.0659, $p < 0.01$) and RDCA (0.1307, $p < 0.01$).

Regarding the control variables, firm size (Size) is negatively associated with RDCA, and equipment (PPE) and research and development intensity (RDINT) are negatively related to both DAQ and RDCA, indicating that larger firms, also those with higher fixed assets and higher R&D spending tend to have better earnings quality (De Meyere, Vander Bauwhede, and Van Cauwenberge 2018). Also, profitable firms tend to have better earnings quality, as evidenced by the negative and significant association between return on assets (ROA) and DAQ and RDCA (Ghosh, Gu, and Jain 2005; P. Dechow, Ge, and Schrand 2010). Inventory (Inv) and price-to-book ratio (PB) show a positive association with both DAQ and RDCA, indicating that firms with higher inventory levels and those with high market valuation have poorer earnings quality (Fama and French 1995). This positive association is similar to liquidity (Cash) and debt ratio (Leverage), indicating that firms with higher liquidity or higher debt have poorer earnings quality (Chada and Varadharajan 2023).

**Pairwise comparisons of Big 4 Auditors**. We also performed a post-estimation Wald test to examine whether the impact of PwC on corporate tax aggressiveness and earnings management is statistically different from other Big 4 auditors. The pairwise comparison results show that the association between firms audited by PwC and aggressive tax strategies and earnings management is significantly distinct from KPMG, EY, and Deloitte ($p < 0.01$ in all cases). These additional robustness tests consistently support our main findings, confirming the unique association between firms audited by PwC and higher corporate tax aggressiveness and earnings management among the Big 4 auditors.

<p align="center">*[INSERT Table 3 and 4 HERE]*</p>

*Difference-in-Difference (DID) analysis*

We perform an additional analysis, using the 2016 PwC scandal as a natural experiment to further evaluate the impact of PwC on corporate tax aggressiveness. Following this approach, we extend the period of our analysis, leveraging pre-scandal data (2013-2015) and post-scandal data (2016-2022) to examine whether the changes in the tax aggressiveness for firms audited by PwC are related to the 2016 where the PwC scandal revealed. This analysis provides us with a comparison of the changes in the tax behavior for firms audited by PwC (treatment group) against those audited by other auditors (control group) while controlling for main differences, such as firm, industry, and time trends. The results of DID (presented in Table 5), consistent with our main findings, indicate a significant reduction in effective tax expenses for firms audited by PwC for the post-scandal period. This reinforces our main conclusion that the incident impacted corporate tax aggressiveness and shows that there was a significantly greater effect from 2016, when the leaks took place.

<p align="center">*[INSERT Table 5 HERE]*</p>

**Robustness tests**

*Alternative models of estimation*

**Exclusion of individual Big 4 firms**. We use an alternative method of analysis that systematically excludes individual Big 4 auditors from the main estimation models as robustness analyses and present the results in Table 6. Panel A of this table presents the results of the influence of Big 4 auditors on corporate tax aggressiveness, followed by Panel B for such an influence on corporate earnings management. The results for the control variables are suppressed for brevity.

The findings confirm the main findings by consistently showing that firms audited by PwC remain associated with aggressive corporate tax strategies across all models. Our main findings were based on systematically resampling and excluding individual Big 4 auditors from the models. Firms audited by PwC show a significant negative association with ACC_ETR (1) and Cash_ETR (2). This confirms our main findings that firms audited by PwC actively engage with higher tax aggressiveness than those audited by other Big 4 auditors. These findings further support that the auditor choice can significantly impact a firm's tax behavior.

Similarly, the results in Panel B of Table 6 confirm the robustness of our main findings on the relationship between firms audited by Big 4 auditors and earnings management. The results confirm that firms audited by PwC and EY among Big 4 firms remain significantly associated with higher levels of earnings management, as indicated by poorer earnings quality. When PwC is excluded from the model, the coefficients associated with the remaining auditors (KPMG, EY, and Deloitte) generally lose significance, except for EY, which still shows a positive and significant relationship with DAQ and RDCA. This further highlights the distinctive association between firms audited by PwC and earnings management practices, reinforcing that firms audited by PwC and EY are likelier to engage in such practices.

Overall, the robustness checks presented in Table 6 strengthen the evidence that PwC uniquely facilitates tax aggressiveness and earnings management among its clients.

*[INSERT Table 6 HERE]*

**Temporal (year-by-year) analysis.** Table 7 presents the results of the Year-by-Year regression analysis, examining the relationship between the choice of Big 4 auditors and corporate tax avoidance (Panel A) and earnings management (Panel B) across individual years from 2016 to 2022. The control variables are suppressed for brevity. The results are consistent with our main findings, revealing that firms audited by PwC are associated with higher levels of tax aggressiveness, particularly in the earlier years of the study. Specifically, firms audited by PwC show a significant relationship with tax aggressiveness from 2016 through 2018. EY audited firms also show a notable pattern, particularly in 2016, that is significantly associated with higher tax aggressiveness for EY clients. The other Big 4 auditors, KPMG and Deloitte, do not exhibit consistent or significant relationships with tax aggressiveness across most years, further highlighting PwC's unique role in influencing aggressive tax strategies.

Panel B of Table 7 present the results of the Year-by-Year analysis, examining the relationship between the choice of Big 4 auditors and earnings management from 2016 to 2022. The results indicate that firms audited by PwC and EY are significantly associated with higher levels of earnings management in certain years. PwC audited firms show poorer earnings quality in 2019 to 2021, and EY audited firms in 2021 and 2022. KPMG and Deloitte audited firms have not shown consistent or significant relationships with earnings management across the years, reinforcing the distinct role of PwC and EY in shaping corporate earnings quality.

*[INSERT Table 7 HERE]*

**Excluding Loss-Making firms**. We exclude firms with negative pre-tax profits from our main analysis, ensuring that our tax aggressiveness measures are meaningful. This addresses the potential distortions in our tax aggressiveness measure, which are less meaningful for loss-

making firms. Although not explicitly presented here due to brevity, the additional analyses reinforce our main findings. Firms audited by PwC remain associated with higher levels of tag aggressiveness. The results for other Big 4 auditors (Deloitte, KMPJ, and EY) show no significant relationship with tax aggressiveness. These additional tests reinforce the robustness of our main conclusions, showing that the exclusion of loss-making firms does not materially alter our main findings.

*Entropy balancing*

To enhance the reliability and validity of our results, we employ entropy balancing as a robustness check, which has been used frequently in related literature studies (e.g., M.M. Hasan, Lobo, and Qiu (2021); Arifin, Hasan, and Kabir (2020)). This method reweights control data groups, ensuring that covariates' mean, variance, and skewness are balanced. It also helps to reduce the potential biases caused by design choices (Hainmueller 2012). We present the result of this method in Table 8, which addresses potential endogeneity after ensuring the comparability of the treatment and control groups. This method involves several stages. Based on whether PwC audits a firm or not, we first define both treatment and control groups. Then, we define the covariates, a set of variables to be balanced among the groups, including all the variables. We then applied entropy balancing to reweight the control group observations, ensuring that these covariates were well-balanced. Finally, we re-estimated the regressions on the balanced sample.

Panel A of Table 8 compares the covariate balance between the treated (PwC-audited firms) and control groups before and after applying entropy balancing. Initially, there were noticeable differences in the covariates' means, variances, and skewness. However, these differences were substantially reduced after applying entropy balancing, indicating that the groups became more comparable. Panel B presents the regression results based on the entropy-balanced sample, examining the relationship between the choice of Big 4 auditors and corporate tax

aggressiveness (measured by ACC_ETR and Cash_ETR) and earnings management (measured by DAQ and RDCA). The results reinforce the earlier findings. Firms audited by PwC are significantly associated with higher levels of tax aggressiveness, as indicated by its negative coefficients for ACC_ETR (-0.0302, $p < 0.01$) and Cash_ETR (-0.0235, $p < 0.01$). Firms audited by PwC are also positively associated with earnings management, with significant positive coefficients for DAQ (0.0436, $p < 0.10$) and RDCA (0.0244, $p < 0.10$). Firms audited by EY also show a significant negative relationship with ACC_ETR (-0.0227, $p < 0.05$), suggesting an association with tax aggressiveness. At the same time, Deloitte is negatively associated with RDCA (-0.0701, $p < 0.05$), indicating better earnings quality for firms it audits. Firms audited by KPMG, however, do not show significant relationships in this analysis.

These findings, supported by the entropy balancing method, strengthen the robustness of the earlier results, confirming that firms audited by PwC, and to a lesser extent, EY, and Deloitte, are linked to more aggressive tax behavior and earnings management practices.

*[INSERT Table 8 HERE]*

***Propensity-Score-Matched Sample***

Table 9 presents the results of a propensity score matching (PSM) analysis, conducted as a robustness test to control for selection bias by matching firms audited by PwC (treatment group) with similar firms not audited by PwC (control group), following the approach of (Al-Hadi, Taylor, and Richardson 2022).

Panel A shows the results of the first-stage matching, where firm characteristics such as size, property, plant, and equipment (PPE), inventory, R&D intensity (RDINT), and others were used to match PwC-audited firms with comparable non-PwC firms. Panel B presents the second-stage regression results based on the matched sample, with control variables suppressed for brevity. The results show that firms audited by PwC are significantly associated with higher tax aggressiveness (ACC_ETR and Cash_ETR) and earnings management (DAQ and RDCA).

Firms audited by EY also show a significant positive relationship with DAQ and RDCA (0.0494, p < 0.01 and 0.1802, p < 0.01) but no significant relationship with ACC_ETR and Cash_ETR. In this analysis, firms audited by KPMG and Deloitte do not exhibit significant associations with either tax aggressiveness or earnings management.

These findings reinforce the earlier results, indicating that firms audited by PwC are more prone to tax aggressiveness and earnings management, even after controlling for selection bias through propensity score matching.

*[INSERT Table 9 HERE]*

### *Robustness analyses using lagged variable*

Table 10 presents the results of a robustness test using lagged independent variables. Following prior research (I. Hasan, Hoi, et al. 2017; M.M. Hasan, Al-Hadi, et al. 2017), this approach is employed to address potential endogeneity concerns, particularly the possibility that the dependent variables could influence the current values of the explanatory variables. By using lagged variables, we ensure that the independent variables precede the outcomes in time, which helps to mitigate issues related to reverse causality. Control variables are suppressed in this table for brevity.

The results indicate that firms audited by PwC are significantly associated with tax aggressiveness and earnings management. Using lagged variables in this robustness test reinforces the earlier findings, confirming that firms audited by PwC are mainly associated with aggressive tax aggressiveness and earnings management practices. The results also highlight that firms audited by EY and Deloitte may influence earnings management, albeit in different directions.

*[INSERT Table 10 HERE]*

*Endogeneity analysis*

A concern with the results reported earlier is the potential omission of firm characteristics that could be correlated with the choice of Big 4 auditors and corporate tax aggressiveness or earnings management, leading to biased findings. In addition to this concern, there is concern over reverse causality regarding the fact that firms more engaged in tax aggressiveness may choose specific audit firms. We address these concerns by controlling for firm characteristics influencing tax aggressiveness and earnings management and using firm-fixed effects to mitigate unobserved heterogeneity. However, to further diminish endogeneity concerns, we use the Lewbel (2012) approach consistent with prior studies (e.g., Mavis et al. (2020); Y. Chen et al. (2021); M.M. Hasan, Lobo, and Qiu (2021)), generating instruments within the existing model by leveraging the heterogeneity in the error term. We refrain from claiming to resolve endogeneity fully. However, this method helps us provide more robust evidence of the relationship between the choice of Big 4 auditors and corporate financial practices. The results are not presented for brevity. According to these results, firms audited by PwC remain significantly associated with tax aggressiveness and earnings management. This suggests that firms audited by PwC are more likely to engage in tax aggressiveness and more actively in earnings management, which is consistent with our main findings.

The results for the control variables generally align with expectations. For instance, firm size (Size) is positively related to ACC_ETR and negatively related to RDCA, suggesting that larger firms have higher effective tax rates and better earnings quality. The significant results of the weak instrument test (Kleibergen-Paap rk Wald F statistic) and the Hansen J statistic confirm the validity and strength of the instruments generated through the Lewbel approach. These findings reinforce the earlier results by demonstrating that firms audited by PwC, and to some extent, EY, and Deloitte, are associated with higher tax aggressiveness and earnings management.

## V.      Conclusions

We explore the relationship between the choice of Big 4 auditors and corporate tax aggressiveness and earnings management, using a sample of all publicly listed Australian firms from 2016 to 2022. Our findings reveal important insights on whether the choice of auditor can influence corporate financial behavior. Our analysis shows that among the Big 4 audit firms, PwC clients stand out with a significant association with higher levels of tax aggressiveness, showing lower effective tax rates. Our further analysis of individual audit clients and further temporal analysis confirm our main findings on the unique impact of PwC on shaping corporate tax practices. This persistent pattern across several alternative investigation models implies that PwC facilitates tax aggressiveness strategies. Corroborating the argument in prior literature (Hanlon, Hoopes, and Shroff 2014; Iazzi et al. 2023; Chyz et al. 2021), our findings raise critical concerns about the auditor's role in shaping both corporate tax compliance and financial reporting behavior. Additionally, our findings demonstrate that EY and PwC audited firms have poorer financial reporting quality. Their clients are more likely to practice higher earnings management and, therefore, lower earnings quality, raising critical concerns about the auditor's role in ensuring high-quality corporate financial disclosure. Our further investigation of individual firms and temporal analysis confirms these findings, showing PwC and EY's clients to have higher earnings management levels, particularly in our study's earlier years.

Several limitations in our study require to be acknowledged. Our findings are limited to the Australian context; thus, they may not completely represent global trends or corporate behavior in different regulatory settings. Furthermore, despite the findings of this study on the association between the choice of auditors and corporate tax and reporting practices, it is important to acknowledge that these associations do not imply causation or misconduct by any of the auditors, such as PwC or EY. Our findings must be interpreted in the context of our data pattern rather than definitive evidence of auditors' or clients' intentional actions. The findings

of this study also limited the potential unobserved elements that can influence the analyses and results. Though widely used in prior literature, the measures for corporate tax aggresiveness and earnings management may not fully capture the complex corporate financial and disclosure behaviors. A further limitation is the inability to analyze whether auditors providing auditing and tax services impact corporate tax behaviors due to data limitations. Future research could address this by separating tax services from other non-audit services or exploring similar relationships in countries or regions with varied regulatory frameworks. Expanding the analysis over an extended period would help understand how auditor influence evolves. Additionally, research that aims to establish causality using methodologies such as natural experiments would deepen our understanding of the direct impact of auditor selection on corporate behavior.

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# Tables

**Table 1**
Sample selection and distribution

| Panel A: Process of sample selection | |
| --- | --- |
| Filtering | Observations |
| Observations for the 2016-2022 period in the Refinitiv database after duplicates removal | 10,881 |
| Less: dropped observations due to insufficient dependent variables | 2,867 |
| Total observation data available 2016–2019 | 8,014 |
| Less: Missing observations for control variables | 356 |
| Final sample 2016-2022 | 7,658 |

| Panel B: Industry distribution | Observations | % | Big 4 Audited | % | Non-Big 4 Audited | % |
| --- | --- | --- | --- | --- | --- | --- |
| Materials | 2,915 | 38.06 | 826 | 28.34 | 2089 | 71.66 |
| Health Care | 787 | 10.28 | 276 | 35.07 | 511 | 64.93 |
| Industrial | 782 | 10.21 | 387 | 49.49 | 395 | 50.51 |
| Information Technology | 780 | 10.19 | 214 | 27.44 | 566 | 72.56 |
| Energy | 682 | 8.91 | 258 | 37.83 | 424 | 62.17 |
| Consumer Cyclical | 652 | 8.51 | 393 | 60.28 | 259 | 39.72 |
| Real Estate | 400 | 5.22 | 265 | 66.25 | 135 | 33.75 |
| Communication Services | 342 | 4.47 | 159 | 46.49 | 183 | 53.51 |
| Consumer Staples | 318 | 4.15 | 184 | 57.86 | 134 | 42.14 |
| Total | 7,658 | 100 | 2,962 | 38.68 | 4,696 | 61.32 |

| Panel C: Industry distribution by Big 4 auditors | PwC (%) | KPMG (%) | EY (%) | Deloitte (%) |
| --- | --- | --- | --- | --- |
| Materials | 21.31 | 29.8 | 33.08 | 25.4 |
| Health Care | 11.22 | 7.45 | 9.96 | 8.31 |
| Industrial | 12.22 | 20.06 | 6.85 | 15.5 |
| Information Technology | 7.53 | 8.02 | 5.78 | 8.15 |
| Energy | 7.81 | 7.16 | 9.42 | 10.38 |
| Consumer Cyclical | 13.49 | 7.02 | 16.38 | 15.34 |
| Real Estate | 11.51 | 9.17 | 9.64 | 4.79 |
| Communication Services | 5.97 | 6.45 | 5.25 | 3.67 |
| Consumer Staples | 8.94 | 4.87 | 3.64 | 8.46 |

| Panel D: Summary statistics | | | | | |
| --- | --- | --- | --- | --- | --- |
| Variables | Mean | STD | p25 | Med | p75 |
| ACC_ETR | 0.1808 | 0.2256 | 0.0000 | 0.1245 | 0.2898 |
| Cash_ETR | 0.2589 | 0.2622 | 0.0587 | 0.1931 | 0.3374 |
| DAQ | 2.0033 | 0.6111 | 1.7516 | 2.2739 | 2.3990 |
| RDCA | 1.6989 | 0.7139 | 1.2696 | 1.8753 | 2.0737 |
| Size | 17.6962 | 2.3644 | 15.9956 | 17.3366 | 19.1318 |
| PPE | 0.3397 | 0.4090 | 0.0164 | 0.1555 | 0.5926 |
| Inv | 0.0475 | 0.0934 | 0.000 | 0.000 | 0.0499 |
| RD | 1.7172 | 3.2094 | 0.2745 | 1.423 | 3.1848 |
| ROA | -0.2891 | 0.8689 | -0.3077 | -0.072 | 0.0487 |
| Growth | 0.0025 | 0.9447 | 0.0321 | -0.032 | 0.0318 |
| PB | 1.2182 | 0.7956 | 0.6831 | 1.0647 | 1.6194 |
| Cash | 0.9571 | 0.9474 | 0.2069 | 0.6136 | 1.4897 |
| Lev | 0.3589 | 0.5807 | 0.2755 | 0.0198 | 9.0720 |
| GOV | 3.9095 | 0.1471 | 3.7987 | 3.8757 | 3.9810 |

Panel A in this table shows sample selection procedures. Panel B shows the sample distribution by industry classification, following by industry distribution by Big 4 auditors in Panel C and Panel D shows univariate statistics for the variables of this study. All continuous variables are winsorised at the 1% and 99% thresholds. The definitions of variables are detailed in Appendix A.

**Table 2**

Correlation matrix

| Variables | VIF | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) ACC_ETR | 2.26 | 1.0000 | | | | | | | | | | | | | |
| (2) Cash_ETR | 1.50 | 0.447* | 1.0000 | | | | | | | | | | | | |
| (3) DAQ | 1.38 | -0.044* | -0.058* | 1.0000 | | | | | | | | | | | |
| (4) RDCA | 1.35 | -0.069* | -0.057* | 0.454* | 1.0000 | | | | | | | | | | |
| (5) Size | 1.32 | 0.250* | 0.163* | -0.127* | -0.133* | 1.0000 | | | | | | | | | |
| (6) PPE | 1.32 | 0.118* | 0.125* | -0.325* | -0.263* | 0.179* | 1.0000 | | | | | | | | |
| (7) Inv | 1.28 | 0.161* | 0.127* | -0.0020 | -0.039* | 0.162* | 0.138* | 1.0000 | | | | | | | |
| (8) RD | 1.2 | -0.163* | -0.126* | -0.176* | -0.124* | -0.148* | 0.092* | -0.146* | 1.0000 | | | | | | |
| (9) ROA | 1.13 | 0.136* | 0.089* | -0.091* | -0.422* | 0.403* | 0.059* | 0.070* | -0.057* | 1.0000 | | | | | |
| (10) Growth | 1.12 | -0.0120 | -0.0110 | -0.0080 | -0.0050 | -0.0110 | 0.0010 | -0.0020 | 0.027* | 0.0070 | 1.0000 | | | | |
| (11) PB | 1.10 | -0.059* | -0.023* | 0.184* | 0.185* | -0.183* | -0.180* | -0.030* | -0.0140 | -0.166* | -0.0070 | 1.0000 | | | |
| (12) Cash | 1.09 | -0.156* | -0.108* | 0.092* | 0.067* | -0.273* | -0.162* | -0.208* | 0.221* | -0.024* | 0.0110 | 0.069* | 1.0000 | | |
| (13) Lev | 1.03 | -0.0060 | -0.019* | 0.073* | 0.298* | -0.184* | -0.0030 | 0.033* | -0.056* | -0.356* | -0.0100 | -0.0050 | -0.129* | 1.0000 | |
| (14) GOV | 1.29 | -0.022* | -0.032* | -0.042* | -0.036* | 0.055* | 0.039* | -0.036* | 0.086* | 0.019* | 0.024* | -0.049* | 0.044* | -0.0150 | 1.0000 |

This table presents the results of the variance inflation factor (VIF) test and Pearson correlations for the main variables, asterisks ***, **, and * signify statistical significance at the 1%, 5%, and 10% thresholds (two-tailed), respectively.

**Table 3**
Relation between Big 4 auditors and tax aggressiveness

| Dep. Var. = | (1) ACC_ETR | (2) Cash_ETR |
|---|---|---|
| KPMG | 0.0124 | 0.0016 |
| | (0.0076) | (0.0073) |
| EY | -0.0026 | 0.0028 |
| | (0.0068) | (0.0065) |
| Deloitte | 0.0079 | -0.0040 |
| | (0.0078) | (0.0074) |
| PWC | -0.0247*** | -0.0180** |
| | (0.0078) | (0.0074) |
| Size | 0.0137*** | 0.0087*** |
| | (0.0013) | (0.0012) |
| PPE | -0.0153*** | -0.0070 |
| | (0.0059) | (0.0056) |
| Inv | 0.1517*** | 0.1255*** |
| | (0.0230) | (0.0219) |
| RDINT | -0.0034*** | -0.0021*** |
| | (0.0007) | (0.0006) |
| ROA | 0.0164*** | 0.0103*** |
| | (0.0026) | (0.0025) |
| Growth | -0.0005 | -0.0007 |
| | (0.0020) | (0.0019) |
| PB | -0.0087*** | -0.0030 |
| | (0.0026) | (0.0025) |
| Cash | -0.0053** | -0.0032 |
| | (0.0026) | (0.0024) |
| Leverage | 0.0086*** | 0.0017 |
| | (0.0015) | (0.0014) |
| GOV | -0.0088 | 0.0034 |
| | (0.0137) | (0.0130) |
| Constant | -0.0908 | -0.0850 |
| | (0.0562) | (0.0534) |
| Yr, Firm & Ind FE | Yes | Yes |
| Observations | 7,658 | 7,658 |
| Adjusted $R^2$ | 0.1457 | 0.1205 |
| Wald Tests: | | |
| PwC vs. KPMG | f = 16.57 p = (0.0000) | f = 5.16 p = (0.0023) |
| PwC vs. EY | f = 6.73 p = (0.0015) | f = 6.64 p = (0.0015) |
| PwC vs. Deloitte | f = 12.07 p = (0.0005) | f = 2.50 p = (0.0011) |

This table presents the panel regression results of the analyses, examining the relationship between Big 4 auditors and tax aggressiveness. Columns (1) and (2) are the dependent variables (ACC_ETR and Cash_ETR), two alternative tax aggressiveness measures, respectively. Standard errors (robust) are reported in brackets, asterisks ***, **, and * signify statistical significance at the 1%, 5%, and 10% thresholds (two-tailed), respectively.

**Table 4**
Relation between Big 4 auditors and earnings management

|  | (1) | (2) |
|---|---|---|
| Dep. Var. = | DAQ | RDCA |
| KPMG | 0.0198 | 0.0224 |
|  | (0.0184) | (0.0234) |
| EY | 0.0415** | 0.0830*** |
|  | (0.0164) | (0.0208) |
| Deloitte | 0.0047 | 0.0266 |
|  | (0.0186) | (0.0237) |
| PWC | 0.0659*** | 0.1307*** |
|  | (0.0188) | (0.0239) |
| Size | 0.0003 | -0.0567*** |
|  | (0.0031) | (0.0039) |
| PPE | -1.0138*** | -0.7287*** |
|  | (0.0142) | (0.0181) |
| Inv | 0.6097*** | 0.4706*** |
|  | (0.0552) | (0.0703) |
| RDINT | -0.0159*** | -0.0243*** |
|  | (0.0016) | (0.0020) |
| ROA | -0.0289*** | -0.2717*** |
|  | (0.0063) | (0.0080) |
| Growth | 0.0010 | 0.0063 |
|  | (0.0049) | (0.0063) |
| PB | 0.0351*** | 0.0282*** |
|  | (0.0063) | (0.0080) |
| Cash | 0.0405*** | 0.0254*** |
|  | (0.0062) | (0.0079) |
| Leverage | 0.0242*** | 0.0386*** |
|  | (0.0035) | (0.0045) |
| GOV | 0.0291 | 0.1051** |
|  | (0.0328) | (0.0418) |
| Constant | 2.1626*** | 2.4559*** |
|  | (0.1349) | (0.1717) |
| Yr, Firm & Ind FE | Yes | Yes |
| Observations | 7,658 | 7,658 |
| Adjusted $R^2$ | 0.5601 | 0.4773 |
| Wald Tests: |  |  |
| PwC vs. KPMG | f = 4.45 p = (0.0034) | f = 15.15 p = (0.0001) |
| PwC vs. EY | f = 1.43 p = (0.2316) | f = 3.37 p = (0.0664) |
| PwC vs. Deloitte | f = 7.38 p = (0.0066) | f = 13.19 p = (0.0003) |

This table presents the results of panel regression analyses examining the relationship between Big 4 auditors and corporate earnings management. The dependent variables in Columns (1) and (2) are two alternative measures of Discretionary Accruals Quality (DAQ) and Return-Adjusted Discretionary Current Accruals (RDCA), respectively. Standard errors (robust) are reported in brackets, asterisks ***, **, and * signify statistical significance at the 1%, 5%, and 10% thresholds (two-tailed), respectively.

**Table 5**
Difference-in-Difference (DID) analysis

| Dep. Var. = | (1)<br>ACC_ETR | (2)<br>Cash_ETR |
|---|---|---|
| DID | -0.0203*** | -0.0136** |
| | (0.0067) | (0.0063) |
| Size | 0.0119*** | 0.0074*** |
| | (0.0010) | (0.0009) |
| PPE | -0.0137** | -0.0071 |
| | (0.0054) | (0.0050) |
| Inv | 0.1196*** | 0.0998*** |
| | (0.0200) | (0.0186) |
| RDINT | -0.0041*** | -0.0027*** |
| | (0.0006) | (0.0006) |
| ROA | 0.0118*** | 0.0072*** |
| | (0.0022) | (0.0020) |
| Growth | -0.0005 | -0.0005 |
| | (0.0017) | (0.0015) |
| PB | -0.0071*** | -0.0025 |
| | (0.0023) | (0.0021) |
| Cash | -0.0052** | -0.0027 |
| | (0.0022) | (0.0020) |
| Leverage | 0.0070*** | 0.0013 |
| | (0.0013) | (0.0012) |
| GOV | -0.0094 | 0.0028 |
| | (0.0118) | (0.0110) |
| Constant | -0.0671 | -0.0682 |
| | (0.0482) | (0.0450) |
| Yr, Firm & Ind FE | Yes | Yes |
| Observations | 9,166 | 9,166 |
| Adjusted $R^2$ | 0.1408 | 0.1250 |

This table presents a Difference-in-Difference (DID) analysis, examining the impact of PwC scandal in 2016 on corporate tax aggresiveness. Columns (1) and (2) are the dependent variables (ACC_ETR and Cash_ETR), two alternative tax aggressiveness measures, respectively. Standard errors (robust) are reported in brackets, asterisks ***, **, and * signify statistical significance at the 1%, 5%, and 10% thresholds (two-tailed), respectively.

**Table 6**

Alternative estimation models

**Panel A: Relation between Big 4 auditors and tax aggressiveness**

| | (1) | | | | (2) | | | |
|---|---|---|---|---|---|---|---|---|
| | No PWC | No Deloitte | No EY | No KPMG | No PWC | No Deloitte | No EY | No KPMG |
| Dep. Var. = | ACC_ETR | | | | Cash_ETR | | | |
| KPMG | 0.0132 | 0.0104 | 0.0095 | | 0.0033 | 0.0027 | 0.0001 | |
| | (0.0078) | (0.0076) | (0.0078) | | (0.0074) | (0.0073) | (0.0074) | |
| EY | -0.0017 | -0.0042 | | -0.0033 | 0.0043 | 0.0040 | | 0.0021 |
| | (0.0070) | (0.0068) | | (0.0067) | (0.0066) | (0.0065) | | (0.0065) |
| Deloitte | 0.0091 | | 0.0056 | 0.0087 | -0.0021 | | -0.0057 | -0.0041 |
| | (0.0079) | | (0.0078) | (0.0076) | (0.0075) | | (0.0075) | (0.0074) |
| PWC | | -0.0265*** | -0.0287*** | -0.0254*** | | -0.0168** | -0.0204*** | -0.0187** |
| | | (0.0078) | (0.0080) | (0.0078) | | (0.0075) | (0.0076) | (0.0075) |
| Constant | -0.1037* | -0.0991* | -0.0884 | -0.1385** | -0.1145** | -0.0828 | -0.0877* | -0.0862 |
| | (0.0595) | (0.0575) | (0.0558) | (0.0579) | (0.0568) | (0.0532) | (0.0530) | (0.0531) |
| Yr, Firm & Ind FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 6,954 | 7,032 | 6,724 | 6,960 | 6,954 | 7,032 | 6,724 | 6,960 |
| Adjusted $R^2$ | 0.1420 | 0.1499 | 0.1457 | 0.1393 | 0.1146 | 0.1185 | 0.1124 | 0.1172 |

**Panel B: Relation between Big 4 auditors and earnings management**

| | (1) | | | | (2) | | | |
|---|---|---|---|---|---|---|---|---|
| | No PWC | No Deloitte | No EY | No KPMG | No PWC | No Deloitte | No EY | No KPMG |
| Dep. Var. = | DAQ | | | | RDCA | | | |
| KPMG | 0.0219 | 0.0205 | 0.0342 | | 0.0398* | 0.0278 | 0.0516** | |
| | (0.0178) | (0.0185) | (0.0185) | | (0.0230) | (0.0237) | (0.0235) | |
| EY | 0.0441*** | 0.0422** | | 0.0473*** | 0.0981*** | 0.0881*** | | 0.1055*** |
| | (0.0159) | (0.0165) | | (0.0165) | (0.0205) | (0.0211) | | (0.0209) |
| Deloitte | 0.0038 | | 0.0162 | 0.0097 | 0.0388* | | 0.0507** | 0.0450* |
| | (0.0180) | | (0.0186) | (0.0187) | (0.0233) | | (0.0237) | (0.0237) |
| PWC | | 0.0667*** | 0.0816*** | 0.0725*** | | 0.1364*** | 0.1642*** | 0.1569*** |
| | | (0.0190) | (0.0191) | (0.0190) | | (0.0243) | (0.0243) | (0.0241) |
| Constant | 2.0895*** | 2.1075*** | 2.3026*** | 2.1961*** | 2.4446*** | 2.4011*** | 2.6507*** | 2.6595*** |
| | (0.1356) | (0.1410) | (0.1452) | (0.1415) | (0.1757) | (0.1800) | (0.1848) | (0.1796) |
| Yr, Firm & Ind FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 6,954 | 7,032 | 6,724 | 6,960 | 6,954 | 7,032 | 6,724 | 6,960 |
| Adjusted $R^2$ | 0.6010 | 0.5619 | 0.5807 | 0.5686 | 0.5150 | 0.4792 | 0.5105 | 0.4924 |

This table shows the findings of regression analyses evaluating the association between Big 4 auditors and tax aggressiveness (Panel A) and earnings management (Panel B) using an alternative estimation model, excluding each Big 4 auditor one at a time. The dependent variables in columns (1) and (2) are alternative measures of ACC_ETR and Cash_ETR for tax aggressiveness and Discretionary Accruals Quality (DAQ) and Return-Adjusted Discretionary Current Accruals (RDCA) for earnings management, respectively. Control variables are suppressed for brevity. Standard errors (robust) are reported in brackets, asterisks ***, **, and * signify statistical significance at the 1%, 5%, and 10% thresholds (two-tailed), respectively.

**Table 7**

Year-by-Year analysis

Panel A: The relation between Big 4 auditors and tax avoidance

| | (1) | | | | | | | (2) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| | ACC_ETR | | | | | | | Cash_ETR | | | | | | |
| KPMG | -0.0136 | 0.0058 | 0.0206 | 0.0343* | 0.0164 | 0.0201 | 0.0001 | 0.0078 | 0.0040 | 0.0084 | -0.0083 | 0.0013 | -0.0194 | 0.0144 |
| | (0.0230) | (0.0194) | (0.0197) | (0.0184) | (0.0185) | (0.0183) | (0.0213) | (0.0244) | (0.0208) | (0.0205) | (0.0192) | (0.0124) | (0.0140) | (0.0136) |
| EY | -0.0502** | -0.0004 | -0.0185 | -0.0133 | -0.0026 | 0.0240 | 0.0565*** | 0.0019 | 0.0172 | -0.0078 | 0.0043 | -0.0097 | -0.0142 | 0.0205* |
| | (0.0201) | (0.0173) | (0.0176) | (0.0166) | (0.0169) | (0.0166) | (0.0185) | (0.0213) | (0.0186) | (0.0184) | (0.0173) | (0.0113) | (0.0128) | (0.0118) |
| Deloitte | -0.0167 | -0.0173 | 0.0129 | -0.0074 | 0.0299 | 0.0503** | 0.0380 | -0.0033 | -0.0004 | -0.0008 | -0.0165 | -0.0156 | 0.0117 | 0.0165 |
| | (0.0221) | (0.0196) | (0.0195) | (0.0181) | (0.0187) | (0.0196) | (0.0244) | (0.0234) | (0.0210) | (0.0203) | (0.0190) | (0.0126) | (0.0150) | (0.0156) |
| PWC | -0.0499** | -0.0482** | -0.0395** | -0.0205 | 0.0016 | -0.0036 | 0.0036 | -0.0283 | -0.0321 | -0.0171 | -0.0344* | -0.0156 | -0.0287** | 0.0290** |
| | (0.0234) | (0.0198) | (0.0201) | (0.0193) | (0.0188) | (0.0187) | (0.0222) | (0.0248) | (0.0212) | (0.0210) | (0.0202) | (0.0126) | (0.0143) | (0.0142) |
| Constant | -0.0863 | -0.0084 | -0.1547 | -0.4597*** | 0.1525 | 0.0075 | 0.0661 | -0.1976 | 0.2313 | -0.1386 | -0.4093*** | -0.0271 | 0.0010 | -0.0353 |
| | (0.1723) | (0.1473) | (0.1468) | (0.1367) | (0.1388) | (0.1312) | (0.1564) | (0.1824) | (0.1579) | (0.1532) | (0.1428) | (0.0931) | (0.1007) | (0.1000) |
| Yr, Firm & | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,057 | 1,212 | 1,272 | 1,221 | 973 | 991 | 932 | 1,057 | 1,212 | 1,272 | 1,221 | 973 | 991 | 932 |
| Adjusted $R^2$ | 0.1907 | 0.2006 | 0.1849 | 0.2273 | 0.0515 | 0.0378 | 0.0517 | 0.0845 | 0.1198 | 0.1213 | 0.1483 | 0.0380 | 0.0387 | 0.0488 |

Panel B: The relation between Big 4 auditors and earnings management

| | (1) | | | | | | | (2) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| | DAQ | | | | | | | RDCA | | | | | | |
| KPMG | 0.0244 | 0.0651 | 0.0382 | 0.1140* | -0.0253 | -0.0314 | 0.0753 | -0.0343 | 0.0171 | 0.0118 | -0.0020 | 0.0263 | 0.0001 | 0.0298 |
| | (0.0536) | (0.0651) | (0.0546) | (0.0666) | (0.0471) | (0.0589) | (0.0587) | (0.0658) | (0.0230) | (0.0366) | (0.0193) | (0.0274) | (0.0193) | (0.0275) |
| EY | 0.0438 | 0.0633 | 0.0771 | 0.0858 | 0.0145 | 0.1012* | 0.0699* | 0.1146* | -0.0107 | 0.0548 | 0.0028 | 0.0321 | 0.0068 | 0.0703*** |
| | (0.0469) | (0.0569) | (0.0487) | (0.0594) | (0.0422) | (0.0528) | (0.0528) | (0.0592) | (0.0210) | (0.0334) | (0.0176) | (0.0250) | (0.0168) | (0.0239) |
| Deloitte | 0.0430 | -0.0329 | 0.0641 | 0.0729 | -0.0683 | -0.0268 | -0.0152 | -0.0114 | 0.0139 | 0.0764** | -0.0066 | 0.0434 | 0.0175 | 0.0856*** |
| | (0.0515) | (0.0624) | (0.0550) | (0.0670) | (0.0467) | (0.0584) | (0.0578) | (0.0648) | (0.0233) | (0.0370) | (0.0207) | (0.0294) | (0.0221) | (0.0315) |
| PWC | 0.0505 | 0.0741 | 0.0885 | 0.1640** | 0.0807* | 0.1803*** | 0.0936 | 0.2072*** | -0.0172 | 0.0187 | -0.0087 | -0.0146 | -0.0039 | 0.0133 |
| | (0.0546) | (0.0662) | (0.0557) | (0.0679) | (0.0481) | (0.0602) | (0.0614) | (0.0689) | (0.0233) | (0.0370) | (0.0198) | (0.0280) | (0.0201) | (0.0286) |
| Constant | 2.2993*** | 2.7252*** | 2.2318*** | 2.9647*** | 2.0116*** | 1.6658*** | 1.4095*** | 1.3172*** | 2.3491*** | 2.8243*** | 2.3649*** | 2.7140*** | 2.4148*** | 2.3611*** |
| | (0.4012) | (0.4867) | (0.4142) | (0.5049) | (0.3513) | (0.4396) | (0.4354) | (0.4882) | (0.1724) | (0.2740) | (0.1389) | (0.1970) | (0.1419) | (0.2019) |
| Yr, Firm & | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,057 | 1,057 | 1,212 | 1,212 | 1,272 | 1,272 | 1,221 | 1,221 | 973 | 973 | 991 | 991 | 932 | 932 |

Panel A: The relation between Big 4 auditors and tax avoidance

| | (1) | | | | | | | (2) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| Adjusted R$^2$ | 0.6716 | 0.6312 | 0.5137 | 0.3062 | 0.5672 | 0.4976 | 0.4677 | 0.4982 | 0.6819 | 0.6809 | 0.6853 | 0.6485 | 0.6171 | 0.6552 |

This table presents the results of the Year-by-Year panel regression analyses examining the relationship between Big 4 auditors and corporate tax avoidance (Panel A) and earnings management (Panel B). The dependent variables in columns (1) and (2) are alternative measures of ACC_ETR and Cash_ETR for tax avoidance and Discretionary Accruals Quality (DAQ) and Return-Adjusted Discretionary Current Accruals (RDCA) for earnings management, respectively. Control variables are suppressed for brevity. Robust standard errors are presented in parentheses, with ***, **, and * indicating statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

**Table 8**
Robustness analysis: Entropy balancing

Panel A: Balance of covariate

Unweighted

| Variables | Treated group | | | Baseline group | | |
|---|---|---|---|---|---|---|
| | Mean | Variance | Skewness | Mean | Variance | Skewness |
| Size | 19.99 | 4.352 | -0.189 | 17.46 | 5.128 | 0.546 |
| PPE | 0.424 | 0.258 | 1.546 | 0.331 | 0.157 | 1.456 |
| Inv | 0.4242 | 0.258 | 1.546 | 0.3312 | 0.1574 | 1.456 |
| RDINT | 0.0627 | 0.0089 | 1.762 | 0.046 | 0.0087 | 2.673 |
| ROA | 1.034 | 7.45 | -0.0308 | 1.786 | 10.54 | 0.7213 |
| Growth | -0.0553 | 0.2374 | -11.1 | -0.3128 | 0.8013 | -6.291 |
| PB | -0.0316 | 0 | 10.54 | 0.0005 | 0.9826 | 36.09 |
| Cash | 1.158 | 0.398 | 1.064 | 1.224 | 0.6564 | 0.7165 |
| Leverage | 0.6083 | 0.4358 | 1.694 | 0.9923 | 0.9308 | 1.141 |
| Gov | -1.302 | 1.841 | -1.999 | -1.615 | 2.442 | -0.1954 |

Weighted

| Variables | Treated group | | | Baseline group | | |
|---|---|---|---|---|---|---|
| | Mean | Variance | Skewness | Mean | Variance | Skewness |
| Size | 19.99 | 4.352 | -0.1892 | 19.99 | 7.145 | -0.0544 |
| PPE | 0.4242 | 0.258 | 1.546 | 0.4242 | 0.1872 | 1.213 |
| Inv | 0.0627 | 0.0089 | 1.762 | 0.0627 | 0.0087 | 2.008 |
| RDINT | 1.034 | 7.45 | -0.0308 | 1.034 | 8.065 | 0.4072 |
| ROA | -0.0553 | 0.2374 | -11.1 | -0.0553 | 0.2296 | -10.63 |
| Growth | -0.0316 | 0 | 10.54 | -0.0304 | 0.0036 | 104.8 |
| PB | 1.158 | 0.398 | 1.064 | 1.158 | 0.4869 | 1.152 |
| Cash | 0.6083 | 0.4358 | 1.694 | 0.6083 | 0.5384 | 2.024 |
| Leverage | -1.302 | 1.841 | -1.999 | -1.302 | 2.055 | -1.618 |
| Gov | 3.93 | 0.0186 | 0.3567 | 3.93 | 0.0253 | 0.3488 |

Panel B: Results from the entropy-balanced sample

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Dep. Var. = | ACC_ETR | Cash_ETR | DAQ | RDCA |
| KPMG | 0.0058 | -0.0103 | 0.0208 | -0.0161 |
| | (0.0117) | (0.0100) | (0.0257) | (0.0351) |
| EY | -0.0227** | -0.0120 | 0.0352 | -0.0083 |
| | (0.0098) | (0.0085) | (0.0259) | (0.0338) |
| Deloitte | -0.0148 | -0.0104 | -0.0141 | -0.0701** |
| | (0.0107) | (0.0098) | (0.0267) | (0.0337) |
| PWC | -0.0302*** | -0.0235*** | 0.0436* | 0.0244* |
| | (0.0072) | (0.0064) | (0.0230) | (0.0293) |
| Other controls | Yes | Yes | Yes | Yes |
| Yr, Firm & Ind FE | Yes | Yes | Yes | Yes |
| Observations | 7,658 | 7,658 | 7,658 | 7,658 |
| Adjusted $R^2$ | 0.1891 | 0.1824 | 0.4162 | 0.2590 |

This table presents the results of entropy balancing regression. Panel A compares the variables' mean, variance, and skewness among treated and control groups. Panel B shows the results of the entropy balancing regression, examining the relationship between Big 4 auditors and corporate tax aggressiveness (Columns 1 and 2) and corporate earnings management (Columns 3 and 4). Standard errors (robust) are reported in brackets, asterisks ***, **, and * signify statistical significance at the 1%, 5%, and 10% thresholds (two-tailed), respectively.

**Table 9**
Robustness analysis: Propensity score matching (PSM)

| Panel A: First-stage PSM matching | |
|---|---|
| Size | 0.2216*** |
| | (0.0098) |
| PPE | 0.0860 |
| | (0.0502) |
| Inv | 0.0011 |
| | (0.0021) |
| RDINT | 0.0149 |
| | (0.0077) |
| ROA | -0.0016 |
| | (0.0030) |
| Growth | -0.6949 |
| | (0.3069) |
| PB | 0.0018 |
| | (0.0036) |
| Cash | -0.0046 |
| | (0.0037) |
| Leverage | 0.0270 |
| | (0.0140) |
| GOV | -0.0224 |
| | (0.1546) |
| Constant | 5.3091*** |
| | (0.5901) |
| Yr, Firm & Ind FE | Yes |
| Observations | 8,014 |
| Pseudo $R^2$ | 0.1557 |

| Panel B: Second-stage estimation models | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Dep. Var. = | ACC_ETR | Cash_ETR | DAQ | RDCA |
| KPMG | 0.0085 | 0.0001 | 0.0348 | 0.1225 |
| | (0.0075) | (0.0071) | (0.0189) | (0.0255) |
| EY | -0.0097 | -0.0010 | 0.0494*** | 0.1802*** |
| | (0.0066) | (0.0063) | (0.0167) | (0.0225) |
| Deloitte | 0.0041 | -0.0061 | 0.0228 | 0.0988 |
| | (0.0076) | (0.0073) | (0.0192) | (0.0259) |
| PWC | -0.0305*** | -0.0217*** | 0.0786*** | 0.0545*** |
| | (0.0076) | (0.0072) | (0.0191) | (0.0258) |
| Other controls | Yes | Yes | Yes | Yes |
| Yr, Firm & Ind FE | Yes | Yes | Yes | Yes |
| Observations | 8,014 | 8,014 | 8,014 | 8,014 |
| Adjusted $R^2$ | 0.1372 | 0.1172 | 0.5273 | 0.4559 |

This table presents the results of a propensity-score-matching analysis, evaluating the association between Big 4 auditors and tax aggressiveness (ACC_ETR and Cash_ETR) and corporate earnings management (DAQ and RDCA). Panel A shows the first-stage matching results, while Panel B presents the second-stage estimation results. Control variables are suppressed in panel B for brevity. Standard errors (robust) are reported in brackets, asterisks ***, **, and * signify statistical significance at the 1%, 5%, and 10% thresholds (two-tailed), respectively.

**Table 10**
Robustness analysis: Using lag variables

| Dep. Var. = | (1) ACC_ETR | (2) Cash_ETR | (3) DAQ | (4) RDCA |
|---|---|---|---|---|
| KPMG | 0.0177** | 0.0040 | -0.0109 | -0.0184 |
| | (0.0083) | (0.0081) | (0.0238) | (0.0303) |
| EY | -0.0112 | -0.0002 | 0.0170 | 0.0446* |
| | (0.0074) | (0.0072) | (0.0212) | (0.0270) |
| Deloitte | 0.0132 | -0.0008 | -0.0416* | -0.0274 |
| | (0.0085) | (0.0083) | (0.0245) | (0.0311) |
| PWC | -0.0226*** | -0.0272*** | 0.0429* | 0.1074*** |
| | 0.0177** | (0.0083) | (0.0243) | (0.0309) |
| Other controls | Yes | Yes | Yes | Yes |
| Yr, Firm & Ind FE | Yes | Yes | Yes | Yes |
| Observations | 6,308 | 6,308 | 6,308 | 6,308 |
| Adjusted $R^2$ | 0.1714 | 0.1301 | 0.4377 | 0.3233 |

This table presents the robustness test results using lag variables, examining the relationship between Big 4 auditors and corporate tax aggressiveness (Columns 1 and 2) and corporate earnings management (Columns 3 and 4). Columns (1) and (2) show the results for tax aggressiveness measures, while columns (3) and (4) present the results for earnings management measures. Control variables are suppressed for brevity. Standard errors (robust) are reported in brackets, asterisks ***, **, and * signify statistical significance at the 1%, 5%, and 10% thresholds (two-tailed), respectively.

# Appendices

## Appendix A: Variable definitions

| Variables | Measure | Definition/Measurement |
|---|---|---|
| Accounting Effective Tax Rate | ACC_ETR | Income tax expense scaled by pre-tax accounting profit (Hanlon, 2010). The values are truncated at 0 and 1 to prevent extreme values from skewing analyses. This represents the total tax expense per dollar of pre-tax book income. |
| Cash Effective Tax Rate | Cash_ETR | Cash income taxes paid are scaled by pre-tax accounting profit. The values are truncated at 0 and 1 to prevent extreme values from skewing analyses. This represents the cash taxes paid per dollar of pre-tax book income. |
| Discretionary Accruals Quality | DAQ | Discretionary Accruals Quality (DAQ) is computed as the absolute value of the deviation between actual accruals and estimated accruals. The estimation takes into consideration current, historical, and prospective cash flows, sales, long-term assets, operating cycles, and sales volatility (Francis et al., 2005; McNichols, 2002). This measure assesses earnings quality by evaluating how closely actual accruals align with expected accruals. |
| Return-Adjusted Discretionary Current Accruals | RDCA | $$\Delta WC_{it} = \beta_{0i} + \beta_{1j}CFO_{i,t-1} + \beta_{2j}CFO_{i,t} + \beta_{3j}CFO_{i,t+1} + \beta_{4j}\Delta Sale_{i,t} + \beta_{5j}PPE_{i,t1} + \varepsilon_{it}$$ Return-Adjusted Discretionary Current Accruals (RDCA) measures earnings quality by focusing on the discretionary component of current accruals. This metric adjusts for firm performance by incorporating the return on assets (ROA) into the accrual expectation model. RDCA captures the portion of current accruals not attributable to the size or normal operations of the firm, thus indicating potential earnings management (Ashbaugh et al., 2003; Kothari et al., 2005; Srinidhi et al., 2011). |
| Operating cash flow | OCF | Operating cash flow from cash statements. A firm's cash flow from operations divided by its total assets at the beginning of the year. |
| Working capital | WC | Change in non-cash operating working capital ($\Delta_{AR}+\Delta_{Inventory}-\Delta_{AP}-\Delta_{TP}+\Delta_{Other\ Assets\ (net)}$), where $AR$ is the accounts receivable, $AP$ is accounts payable, and $TP$ is taxes payable. The changes are measured from $t-1$ to $t$ for all other variables. |
| Company Size | Size | Natural logarithm of total assets at the end of the year. Source: Refinitiv |
| Property, plant, and equipment | PPE | The proportion of property, plant, and equipment relative to total assets at the year's end highlights the company's investment in tangible, long-term assets. Source: Refinitiv |
| Inventory | Inv | The ratio of total inventory to total assets, indicating the share of a company's assets tied up in inventory. Source: Refinitiv |
| Research and development expenditures | RDINT | The ratio of research and development (R&D) expenditures to total assets, reflecting the company's commitment to innovation and future growth. Source: Refinitiv |
| Return on assets | ROA | Return on Assets (ROA) calculated as net income divided by total assets, indicating the efficiency of the company in generating profit from its assets |
| Revenue growth | Growth | The normalized ratio of revenue growth, measuring the company's ability to increase its sales over a specified period. Source: Refinitiv |
| Market Valuation | PB | The ratio of market price for a share to its book value signifies how much market participants may pay for a each dollar book value of the company's equity. Source: Refinitiv |

| | | |
|---|---|---|
| Liquidity | Cash | The cash and cash equivalents ratio to current liabilities, assessing the company's capabilities to pay short-term committments through its liquid assets. Sources: Refinitiv |
| Debt ratio | Lev | The ratio of total debt to total assets, indicating the extent to which a company is using borrowed money to finance its assets. Sources: Refinitiv |
| Corporate governance performance | GOV | An assessment of the company's governance practices, often measured by a composite index, reflecting the effectiveness of its management, board structure, shareholder rights, and transparency. This study use the the natural logarithm of the composite index. Sources: Refinitiv |