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Audit Materiality and Audit Effort: Evidence From Materiality Benchmarks

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The Financial Reporting Council is the first auditing standard-setting body to require audit materiality threshold disclosure. Audit materiality thresholds are a function of auditor benchmark choices and percentage rates chosen for the benchmarks. This study investigates the association between audit effort and audit materiality thresholds, auditor benchmark choices and auditors' use of benchmarks computed based on non-Generally Accepted Accounting Principles (non-GAAP) measures. The study uses expanded audit reports of 328 FTSE-350 companies with 2015 year-ends. The research finds a negative association between audit effort (proxied by audit fees) and audit materiality thresholds. The analysis provides new evidence on the association between audit effort and auditor benchmark choices. First, it reveals that audit effort is negatively associated with asset rather than other (profit/adjusted profit/revenue) benchmark choices. Second, it finds that audit effort is positively associated with non-GAAP benchmarks, indicating that auditors spend more time on their audits when there are unusual events.

1. Introduction

Audit materiality thresholds (derived by multiplying a percentage rate by a chosen benchmark) are a critical auditor planning judgement driving the entire audit approach. Understanding auditor planning judgements regarding audit materiality thresholds is important because the judgements drive the audit approach, including the extent of audit procedures (Financial Reporting Council (FRC), 2016b). Audit materiality thresholds are quantitative amounts applied in the conduct of audits. Our study is prompted by the FRC's introduction of expanded audit reports in the UK in 2012, requiring extensive disclosure of audit materiality thresholds for the first time. Heretofore, audit materiality data could only be obtained indirectly (e.g. Eilifsen & Messier, 2015; Martinov & Roebuck, 1998). We provide insights into how auditors plan their audits by examining the association between audit effort and audit materiality thresholds. Steinbart (1987) explains that audit materiality threshold judgements involve the choice of a benchmark, which we also examine. We further explore whether auditor GAAP/non-GAAP benchmarks relate to audit effort. Auditor GAAP benchmarks are computed using information obtained from financial statements prepared in accordance with applicable accounting standards (for UK-listed group entities the applicable accounting standards are International Financial Reporting Standards). Auditor non-GAAP benchmarks are GAAP benchmarks adjusted for financial statement line items (e.g. restructuring charge). Auditor benchmark choices (in particular, non-GAAP benchmarks) are important as they may directly

impact audit quality. If non-GAAP benchmarks result in higher materiality thresholds, they could reduce the scope of audit procedures and audit evidence gathered (Hallman et al., 2022).

Martinov & Roebuck (1998) call for researchers to analyse audit materiality thresholds more directly. To address this call, we hand-collect audit materiality threshold data (including underlying auditor benchmark choices) from expanded audit reports of 328 FTSE-350 companies with 2015 year-ends. Our study differs from prior audit effort and audit materiality threshold research because we examine whether auditor benchmark choices relate to audit effort. To our knowledge, no study examines whether underlying auditor benchmark choices relate to audit effort, possibly because the data was (until now) not available.

Non-GAAP metrics (i.e. alternative performance measures) have become increasingly prevalent in financial reporting (Anderson et al., 2021; Black et al., 2018, 2021; Campbell et al., 2022; Chen et al., 2021). However, there is limited research on auditors' non-GAAP benchmarks (Brody et al., 2003; FRC, 2015, 2016a), Hallman et al. (2022) being an exception. We extend the non-GAAP literature in auditing by examining whether auditors' use of non-GAAP benchmarks is associated with audit effort.

We make two contributions to audit effort and audit materiality threshold literature. First, we extend literature examining audit effort and audit materiality thresholds. Choudhary et al. (2019) find that "looser" materiality thresholds (amounts at the high end of normal materiality ranges) are associated with less audit effort. Our materiality threshold is based on the direct materiality quantum (disclosed in expanded audit reports), unlike Choudhary et al.'s (2019) auditor judgement proxy (materiality looseness) (obtained from Public Company Accounting Oversight Board (PCAOB) US inspection data). We extend Choudhary et al.'s (2019) US study to a UK context, as it cannot be assumed that US findings (based on PCAOB inspection data) are generalisable to a UK context. Moreover, there are important differences between the UK and US settings. For example, audit regulation is different. To date, US regulators (i.e. PCAOB) do not require auditors to disclose audit materiality thresholds in their expanded audit reports. This provides us with a unique opportunity to examine audit materiality threshold disclosures included in expanded audit reports of large UK-listed companies. Corporate governance regulations and enforcement laws are notably different and there is less litigation risk in the UK (Elsayed & Elshandidy, 2020). The distinct context motivates us to examine audit effort and audit materiality thresholds in the UK. We show that for a large sample of UK-listed companies there is a negative association between audit effort (proxied by audit fees) and audit materiality thresholds. Our insights are important because audit materiality thresholds influence the entire audit approach and the extent of audit procedures (FRC, 2016b).

Second, we provide evidence from materiality benchmarks, which extends prior studies: Choudhary et al. (2019), Hallman et al. (2022) and Quick et al. (2022). We examine how underlying benchmark choices influence audit effort in two ways. We provide evidence on the association between audit effort and auditor benchmark choices, which to our knowledge has not been examined before. We show that audit effort is negatively associated with asset rather than other (profit/adjusted profit/revenue) benchmark choices. These new insights are important because they reveal how underlying benchmark choices influence how auditors plan their audits. Hallman et al. (2022) examine auditors' use of non-GAAP benchmarks and managers' use of non-GAAP metrics, but they do not examine whether auditors' use of non-GAAP benchmarks affects total audit effort. We extend Hallman et al.'s (2022) study of non-GAAP materiality benchmarks by examining the association between audit effort and non-GAAP benchmarks. We show that audit effort is positively associated with non-GAAP benchmarks, indicating that auditors spend more time on their audits when there are unusual events. These new insights are important because they reveal how auditors' use of non-GAAP benchmarks may not adversely affect the amount of work auditors perform, which prior studies suggest (Brody et al., 2003; Hallman et al., 2022).

We structure our paper as follows. Section 2 reviews the background, summarises audit effort and materiality literature, and develops the hypotheses for testing. Section 3 describes our research methods. In Section 4, we present and discuss results, including robustness testing. In Section 5, we summarise and offer concluding comments for our examination of audit effort and audit materiality thresholds.

2. Background and Hypotheses

Following the 2008 financial crisis, the FRC required auditors to disclose audit materiality thresholds to improve transparency about audits (FRC, 2015). Christensen et al. (2020), Gutierrez et al. (2018), Lennox et al. (2022), Minutti-Mezza (2021), Moroney et al. (2021), Quick et al. (2022) and Reid et al. (2019) discuss how regulators introduced expanded audit reports to reduce the information gap and to make auditing more transparent. The FRC is the first auditing standard-setting body to require audit materiality threshold disclosure (effective from October 2012). Now, for the first time, researchers have access to this data which heretofore was only available indirectly (e.g. Eilifsen & Messier, 2015; Martinov & Roebuck, 1998). Little research exists on the relation between audit effort and audit materiality thresholds. Bolt et al. (2022), Christensen et al. (2020) and Houghton et al. (2011) find that stakeholders do not understand the concept of audit materiality. Moreover, Christensen et al. (2020) suggest that users do not understand the inverse relationship between audit materiality thresholds and audit effort. We motivate our research from what we perceive as the lack of investor understanding of the inverse relationship. We consider how understanding the relation between audit effort and audit materiality thresholds (in particular, underlying

benchmark choices) is important, given its influence on firms' audit methodology. We therefore develop three hypotheses to test the association between audit effort and audit materiality thresholds.

2.1. Audit Effort and Audit Materiality Thresholds

Auditors must consider materiality in determining the extent, timing and nature of their audit procedures (FRC, 2010). Prior studies examine the association of audit effort and financial or audit factors, earnings management (Caramanis & Lennox, 2008) and financial reporting misstatements (Lobo & Zhao, 2013). Zhang & Shailer (2021) examine changes in audit effort and changes in auditors' disclosures of risks of material misstatement (disclosed in expanded audit reports). Prior studies (Eilifsen & Messier, 2015; Martinov & Roebuck, 1998) have called for researchers to analyse audit materiality thresholds in a more direct way. Amiram et al. (2017), Choudhary et al. (2019) and Quick et al. (2022) answer the call by examining audit materiality thresholds directly in expanded audit reports or PCAOB inspection data. Quick et al. (2022) focus on how auditors apply materiality in practice by providing evidence on actual benchmarks used and materiality rationales. Amiram et al. (2017) examine the association between financial statement user demands and audit materiality thresholds by accessing FTSE-350 audit materiality data from expanded audit reports. However, Amiram et al. (2017) do not examine audit effort and audit materiality thresholds. Choudhary et al. (2019) examine audit materiality thresholds directly by accessing PCAOB inspection data for a US sample by examining the properties (e.g. client characteristics) and implications (e.g. financial statement restatements) of audit materiality thresholds. Choudhary et al. (2019) measure audit materiality thresholds as rankings based on 10 equal categories, from strictest to loosest, loosest being outside the normal range of materiality. They find that looser materiality judgements (i.e. higher materiality values) are associated with fewer audit hours and lower audit fees. Extending the work of Choudhary et al. (2019), we examine audit effort and audit materiality thresholds for a large UK sample. Choudhary et al. (2019) and the auditing standards indicate that the extent of audit effort varies inversely with the audit materiality threshold amount. Therefore, as reflected in Hypothesis 1 (H1), we expect that audit effort will be lower when the audit materiality threshold is higher, while controlling for client complexity and other auditor and client characteristics.

H1. Audit effort is negatively associated with audit materiality thresholds.

2.2. Audit Effort and Auditor Benchmark Choices

Eilifsen & Messier (2015), FRC (2015, 2016a), Martinov & Roebuck (1998) and Quick et al. (2022) examine the components of audit materiality thresholds (i.e. auditor benchmark choices and benchmark percentage rates). Eilifsen & Messier (2015) and Martinov & Roebuck (1998) examine internal audit firm guidance and find auditors adopt a wide range of benchmarks.

Quick et al. (2022) find auditors adopt six categories of benchmarks (profit before tax, assets, equity, revenue, expenses, and other). Studies examining audit materiality thresholds (Choudhary et al., 2019; FRC, 2015, 2016a) also find auditors adopt a wide variety of benchmarks. Amiram et al. (2017) include benchmark choices (profit before tax, or other) as an indicator variable in their examination of financial statement user demands and audit materiality thresholds. However, Amiram et al. (2017) do not include a direction for their prediction. To our knowledge, no study examines whether the underlying auditor benchmark choices relates to audit effort. The auditing standards (FRC, 2010) indicate that auditor benchmark choices depend on the client company's circumstances. Therefore, we expect that audit effort may change because the client company's nature and circumstances may change, and auditors may perform more/less work. However, our prediction is non-directional in Hypothesis 2 (H2), because of the limited research in this area. We expect that audit effort will be associated with auditor benchmark choices, while controlling for client complexity and other auditor and client characteristics.

H2. Audit effort is associated with auditor benchmark choices.

2.3. Audit Effort and Auditor Non-GAAP Benchmarks

Prior research examines non-GAAP metrics (i.e. alternative performance measures) in financial reporting (Anderson et al., 2021; Black et al., 2018, 2021; Campbell et al., 2022; Chen et al., 2021). There is limited research on non-GAAP benchmarks in auditing (Brody et al., 2003). Brody et al. (2003) investigate auditors' use of non-GAAP benchmarks, following evidence emerging on materiality at hearings into Enron's collapse. They question Enron's auditors Arthur Andersen's use of 'normalised' income for computing Enron's materiality in 1997, which resulted in a materiality threshold of $55 million. Brody et al. (2003) compare the unadjusted errors in 1997 ($51 million when reported net income was $105 million) against guidance at the time on computing materiality. They conclude that $51 million is material when using 5% or 10% of current-year net income but is immaterial when using total assets, total revenues or normalised income benchmarks. Quick et al. (2022) find that auditors mostly use adjusted profit or normalised earnings to determine materiality (e.g. they find that 115 auditors reports in 2015 (out of 240 using profit before tax as a benchmark) use adjusted profit before tax). Eilifsen & Messier (2015) examine internal audit firm guidance and find that seven of the eight largest US audit firms use adjusted income (i.e. non-GAAP benchmark) as a benchmark choice. Hallman et al. (2022) examine auditors' use of non-GAAP benchmarks and managers' use of non-GAAP metrics. Hallman et al. (2022) find that 61% of UK audits use non-GAAP benchmarks which results in a higher materiality threshold 88% of the time. As part of their study, Hallman et al. (2022) explore whether auditor reliance on a non-GAAP benchmark affects audit scoping decisions on complex estimates. They

Table 1. Population and Company-level Sample Size

	No. of companies
Population: FTSE-350 companies	350
Companies audited by non-Big 4 auditors	(9)
Companies audited by non-UK auditors not applying FRC (2013)	(10)
Companies listed for the first time in November 2015	(3)
Overall sample of companies	328

examine complex estimate ranges in financial statement footnotes. Hallman et al.'s (2022, p. 24) findings suggest that "auditors are more likely to rely on a non-GAAP benchmark when doing so reduces the extent of required audit procedures surrounding complex estimates". However, Hallman et al. (2022) do not examine whether auditors' use of non-GAAP benchmarks affects total audit effort. Therefore, we investigate whether audit effort is associated with auditors' non-GAAP benchmarks. On the one hand, we expect auditors to increase audit effort (i.e. hours and expertise) for unusual events (e.g. restructuring). On the other hand, drawing from the Enron case (Brody et al., 2003) and Hallman et al. (2022), auditors may attempt to reduce work effort (and consequently audit quality) by adopting non-GAAP benchmarks. Therefore, our prediction is non-directional in Hypothesis 3 (H3) because of these two conflicting arguments. We expect that audit effort will be associated with auditor non-GAAP benchmarks, while controlling for client complexity and other auditor and client characteristics.

H3. Audit effort is associated with auditor non-GAAP benchmarks.

3. Research Methods

This section describes the population and sample, the data collection process, the variables tested in the research and the analytical approach adopted.

3.1. The Sample

The population comprises all financial and non-financial companies listed on the London Stock Exchange included in the FTSE-350 Index. **Table 1** summarises the population and sample of companies (328). We exclude 22 companies from the population of 350 companies for the reasons identified in **Table 1**. We use the overall sample of 328 companies for Hypothesis 1 and Hypothesis 2. To test Hypothesis 3, the GAAP/non-GAAP benchmark is based on the full sample (328 companies). For the non-GAAP recurring/non-recurring exclusion, there are 153 companies with exclusions in non-GAAP benchmarks. For the non-GAAP/GAAP threshold difference variable, 128 companies have positive non-GAAP/GAAP threshold differences.

3.2. Data Collection

We hand-collect audit fees (a proxy for audit effort) and audit materiality data (i.e. audit materiality thresholds, auditor benchmark choices, non-GAAP benchmarks) from expanded audit reports, notes to the financial statements and audit committee reports in each company's 2015 year-end (from 1 January 2015 to 31 December 2015) annual reports. Audit Analytics did not provide audit fee information for UK-listed companies at the time of data collection. **Appendix 1** illustrates materiality data in expanded audit reports. Consistent with Quick et al. (2022), we choose 2015 year-ends because the timing is approximately two years post implementation of expanded audit reports (FRC, 2013). We expect audit materiality threshold disclosures to be more consistent after the first year of implementation because the first year may have implementation issues (FRC, 2015). **Table 2** lists the variable definitions (including transformation) and their data sources.

3.3. Audit Effort Measure

In each of our three hypotheses, the dependent variable is audit effort. We adopt audit fees as a proxy measure for audit effort (Choudhary et al., 2019; Lobo & Zhao, 2013). Some studies examining audit effort (Caramanis & Lennox, 2008; Choudhary et al., 2019) use audit hours to proxy audit effort, but this data is not available for our study. We consider total audit fees an appropriate measure for audit effort. Total audit fees are a product of audit labour quantity (i.e. hours), audit labour quality (i.e. charge-out rates) and contain premiums for riskier audits (Lobo & Zhao, 2013). Audit fees is a continuous variable and is generally measured as the natural logarithm of audit fees paid (Choudhary et al., 2019; Lobo & Zhao, 2013).

3.4. Materiality Variables

The variables of interest in our three hypotheses are materiality variables. Hypothesis 1 tests whether audit effort is associated with audit materiality threshold (AMT). Audit materiality threshold is a continuous variable with a monetary value. To compare audit materiality thresholds across companies, we scale the audit materiality threshold by company size (Amiram et al., 2017; Gutierrez et al., 2018) by expressing audit materiality threshold as a percentage of total assets. The variable of interest in Hypothesis 2 is auditor benchmark choices (B'MARKS). We code auditor benchmark choices as an asset or other benchmark indicator variable (Amiram et al., 2017). Asset benchmarks include benchmarks based on total assets or net assets. Other benchmarks are profits, adjusted profits or other (e.g. revenue) benchmarks. The variable of interest in Hypothesis 3 is non-GAAP benchmarks. We operationalise non-GAAP benchmarks in three ways. We code auditor benchmark choices as an indicator GAAP/non-GAAP benchmark (Hallman et al., 2022). The second non-GAAP benchmark measure is non-GAAP recurring/non-recurring exclusions (EXCL). Recurring/non-recurring exclusions are financial statement line items likely/unlikely to occur in the future (e.g. interest expense/restructuring charge) (Black et al., 2018). The third non-GAAP benchmark measure is non-

Table 2. Definition and Measurement of Variables

Variable	Definition and measurement (Data source)
Audit effort: dependent variable	
AUDITFEE	Audit effort: Natural logarithm of audit fees in £GBP millions (hand-collected from annual reports)
Materiality: variables of interest (all hand-collected from expanded audit reports and annual reports)	
AMT	Audit materiality threshold: Monetary value of audit materiality threshold scaled by total assets * 100
B'MARKS (1/0)	Auditor benchmark choices: Indicator variable: 1 = assets; 0 = other[1]
NONGAAP (1/0)	GAAP/non-GAAP benchmark: Indicator variable: 1 = non-GAAP benchmark; 0 = GAAP benchmark
EXCL (1/0)	Non-GAAP recurring/non-recurring exclusions: Indicator variable 1 = excluding recurring items; 0 = excluding non-recurring items
T'HOLDDIFF	Non-GAAP/GAAP threshold difference: Monetary amount of positive difference between actual non-GAAP audit materiality threshold and estimated GAAP audit materiality threshold (GAAP profit benchmark (profit/loss before tax) * non-GAAP % rate) in £GBPm[2]
Control variables	
Client complexity	
#RISKS	Number of risks reported by auditor in audit report (hand-collected from expanded audit reports)
RESTRUCT	Restructuring and acquisition costs/gain recorded as exceptional items in the annual report scaled by total assets * 100 (hand-collected from annual reports)
LISTINGS (1/0)	Listings: Indicator variable: 1 = company lists on another stock exchange in addition to London Stock Exchange; 0 = company lists on London Stock Exchange only (hand-collected from corporate website/annual reports)
NEWCLIENT (1/0)	New client of audit firm: Indicator variable: 1 = new client of audit firm in current year; 0 = not a new client of audit firm in current year (hand-collected from annual reports)
Other auditor and client characteristics	
AUDBUSY (1/0)	Audit busyness: Indicator variable: 1 = busy: company year-end 15 December to 31 March; 0 = non-busy: other year-end (hand-collected from annual reports)
TENURE	Auditor tenure: Natural logarithm of number of years the audit firm has been auditing the company (hand-collected from annual reports)
CLIENTSIZE	Client size: Natural logarithm of company's equity market value in £GBP millions (obtained £GBP value from Datastream)
ACMTG	Audit committee meetings: Natural logarithm of number of audit committee meetings in 2015 (hand-collected from annual reports)
AGE	Company age: Natural logarithm of number of years since a company's incorporation (obtained from FAME)
LEV	Leverage: Long-term debt/total assets * 100 (obtained from Datastream)
EARNS Δ (1/0)	Earnings change (i.e. profit before tax change): Indicator variable: 1 = positive profit before tax change (2015 – 2014); 0 = negative profit before tax change (hand-collected from annual reports)
AUDFIRM CONTROLS (1/0)	Audit firm: Four indicator variables 1 = PwC; 2 = KPMG; 3 = Deloitte; 4 = EY (hand-collected from expanded audit reports)
INDCONTROLS (1/0)	Industry: Five indicator variables 1 = Financials; 2 = Technologies; 3 = Consumers; 4 = Resources; 5=Industrials (obtained from FTSE sector classification)[3]

Key:

1: Other benchmarks include profit, adjusted profit and other (e.g. revenue) benchmarks

2: Non-GAAP/GAAP threshold difference: Appendix 1 (Note 1)

3: We source industry from the FTSE Industry Classification Benchmark. The FTSE and Dow Jones launched the Industry Classification Benchmark in 2005 and segregates markets into 10 industries within the macro-economy. We combine similar industries, which results in five industry sectors for analysis.

GAAP/GAAP threshold difference (T'HOLDDIFF). We examine the extent of positive non-GAAP/GAAP threshold difference. Positive non-GAAP/GAAP threshold difference is the excess of audit materiality threshold (using a

non-GAAP benchmark) over the estimated GAAP audit materiality threshold (i.e. using a GAAP benchmark (e.g. profit before tax)). A copy of the coding instructions is available from the authors on request.

3.5. Control Variables

In line with prior studies (Choudhary et al., 2019; Lobo & Zhao, 2013) and auditing standards (FRC, 2016b), we control for client complexity and other auditor and client characteristics in our regressions. First, we include four client complexity variables because client complexity influences audit strategy and the extent of audit procedures (FRC, 2016b): (i) number of risks identified by auditor in audit report (#RISKS) (Hallman et al., 2022; Lennox et al., 2022; Sierra-García et al., 2019); (ii) restructuring costs scaled by total assets (RESTRUCT) (Choudhary et al., 2019; Lobo & Zhao, 2013); (iii) the company lists on another exchange in addition to the London Stock Exchange (LISTINGS) (Amiram et al., 2017); and (iv) new client of audit firm (NEWCLIENT) (Choudhary et al., 2019). We control for new client of audit firm for two reasons: (i) complexity; and (ii) competitive pricing. We acknowledge that competitive tenders and first-time audits (which may have increased because of mandatory audit firm rotation) can influence audit fees (i.e. lower recovery levels). Therefore, we control for audit firm rotation (i.e. new client of audit firm). Following prior studies, we control for other auditor and client characteristics that may influence audit effort. These control variables include audit busyness (AUDBUSY) (Amiram et al., 2017), auditor tenure (TENURE) (Choudhary et al., 2019), client size (CLIENTSIZE) (Amiram et al., 2017), audit committee meetings, a proxy variable for audit committee due diligence (ACMTG) (Keune & Johnstone, 2012), company age (AGE) (Amiram et al., 2017; Smith, 2021), leverage (LEV) (Amiram et al., 2017; Choudhary et al., 2019: Gutierrez et al., 2018) and earnings change (EARNS Δ) (Smith, 2021). Finally, like Choudhary et al. (2019), we include two sets of indicator variables (i.e. dummy variables) in all regressions to represent audit firm (AUDFIRM CONTROLS) and client industry (IND CONTROLS).

3.6. Statistical Tests

We test our three hypotheses using Ordinary Least Squares (OLS) regression. We use OLS regression as the multivariate technique to test the hypotheses because it allows us to estimate the linear relationship between audit effort and auditor materiality threshold variables (while controlling for other factors). We adopt a linear regression model because we measure the dependent variable (i.e. audit effort) as a continuous variable (i.e. AUDITFEE).

3.7. Empirical Models

We test three empirical models in this study. Model 1 tests the prediction in H1 that audit effort is negatively associated with audit materiality thresholds.

Model 1. Audit Effort and Audit Materiality Thresholds

$$\begin{aligned}
\text{AUDITFEE} = \alpha i &+ \beta_1 \text{AMTi} + \beta_2 \text{\#RISKSi} \\
&+ \beta_3 \text{RESTRUCTi} + \beta_4 \text{LISTINGSi} \\
&+ \beta_5 \text{NEWCLIENTi} + \beta_6 \text{AUDBUSYi} \\
&+ \beta_7 \text{TENUREi} + \beta_8 \text{CLIENTSIZEi} + \beta_9 \text{ACMTGi} \quad (1) \\
&+ \beta_{10} \text{AGEi} + \beta_{11} \text{LEVi} + \beta_{12} \text{EARN}\Delta \text{i} \\
&+ \gamma 1 \text{AUDFIRM CONTROLSi} \\
&+ \gamma 2 \text{IND CONTROLSi} + \varepsilon i
\end{aligned}$$

Where i is a client company, αi is the intercept, β1 to β12 are the standardised estimates of the relationship between each corresponding predictor and audit effort, γ1 and γ2 are audit firm and industry effects included in the model and εi are the model's residuals.

Model 2 tests the prediction in H2 that audit effort is associated with auditor benchmark choices.

Model 2. Audit Effort and Auditor Benchmark Choices

$$\begin{aligned}
\text{AUDITFEE} = \alpha i &+ \beta_1 B \text{'MARKSi} \\
&+ \beta_2 \text{\#RISKSi} + \beta_3 \text{RESTRUCTi} \\
&+ \beta_4 \text{LISTINGSi} + \beta_5 \text{NEWCLIENTi} \\
&+ \beta_6 \text{AUDBUSYi} + \beta_7 \text{TENUREi} \\
&+ \beta_8 \text{CLIENTSIZEi} + \beta_9 \text{ACMTGi} \quad\quad (2) \\
&+ \beta_{10} \text{AGEi} + \beta_{11} \text{LEVi} \\
&+ \beta_{12} \text{EARN}\Delta \text{i} \\
&+ \gamma 1 \text{AUDFIRM CONTROLSi} \\
&+ \gamma 2 \text{IND CONTROLSi} + \varepsilon i
\end{aligned}$$

Model 3 tests the prediction in H3 that audit effort is associated with auditor non-GAAP benchmark choices. We operationalise auditor non-GAAP benchmarks in three ways: (1) GAAP/non-GAAP benchmark (NONGAAP); (2) non-GAAP recurring/non-recurring exclusions (EXCL); and (3) non-GAAP/GAAP threshold difference (T'HOLDDIFF). We discuss the three measures in Section 3.4.

Model 3. Audit Effort and Auditor Non-GAAP Benchmarks

$$\begin{aligned}
\text{AUDITFEE} = \alpha i &+ \beta 1 (\text{NONGAAP/EXCL/T'HOLDDIFF}) i \\
&+ \beta 2 \#\text{RISKS} i + \beta 3 \text{RESTRUCT} i + \beta 4 \text{LISTINGS} i \\
&+ \beta 5 \text{NEWCLIENT} i + \beta 6 \text{AUDBUSY} i \\
&+ \beta 7 \text{TENURE} i + \beta 8 \text{CLIENTSIZE} i \\
&+ \beta 9 \text{ACMTG} i + \beta 10 \text{AGE} i \\
&+ \beta 11 \text{LEV} i + \beta 12 \text{EARN}\Delta i \\
&+ \gamma 1 \text{AUDFIRM CONTROLS} i \\
&+ \gamma 2 \text{IND CONTROLS} i + \varepsilon i
\end{aligned} \qquad (3)$$

4. Results

This section reports the results of testing our three hypotheses. We first present our descriptive statistics, followed by the regression results for each hypothesis. We conclude the section by considering robustness testing.

4.1. Descriptive Findings

Table 3 reports descriptive univariate statistics for all variables (Panel A: continuous variables and Panel B: categorical variables). On average, audit fees (AUDITFEE) are £GBP 45 million. The standard deviation is large. Choudhary et al. (2019) find a mean audit fee of $USD 3 million for their PCAOB sample. Gutierrez et al. (2018) find a mean audit fee of £GBP 13.084 million for their UK sample of companies with a premium listing on the London Stock Exchange. Amiram et al. (2017) scale audit fees by total assets. Therefore, it is not possible to make meaningful comparison. The mean audit materiality threshold (AMT) is 0.63% (Table 3) which is similar to Amiram et al. (2019), who report a mean threshold of 0.0061. On average, auditors compute audit materiality thresholds at less than 1% of total assets. Auditors extensively adopt non-GAAP benchmarks (49%: 160 of 328 companies) and this is consistent with the FRC's (2015) finding of 50% (76 of 153 companies adopt adjusted profit benchmarks). Hallman et al. (2022) find that auditors adopt non-GAAP benchmarks for 41% of their sample.

Bivariate Statistics

Table 4 (Pearson correlation matrix) presents pairwise correlations among the variables. We adopt the following ranges respectively for high, medium, and low correlations ± 0.50 and ± 1; ± 0.30 and ± 0.49; below ± 0.29 (Cohen, 1988). We find a marginally high significant correlation (0.51) between AUDITFEE and AMT. Amiram et al. (2017) find a significant correlation of 0.25 between audit fees and audit materiality thresholds. We find significant medium correlations between AUDITFEE and the other materiality variables (B'MARKS and NONGAAP). The bivariate results provide preliminary evidence that AUDITFEE is significantly associated with the materiality variables. The correlations between AUDITFEE and two of our control variables are high and significant (i.e. >0.50) (#RISKS and CLIENTSIZE).

Table 3. Descriptive Statistics of Variables

Panel A: Descriptive statistics for continuous variables (n = 328)					
Variable	Mean	Median	SD	Minimum	Maximum
AUDITFEE (£GBP)[1]	45.28	0.65	778.17	0.02	14095.27
AMT	0.63	0.48	0.82	0.00	13.31
T'HOLDDIFF	14.47	2.65	39.11	0.04	217.80
#RISKS	3.55	3.00	1.51	1.00	9.00
RESTRUCT	0.54	0.06	1.14	0.00	12.26
TENURE[1]	14.85	11.00	17.26	1.00	148.00
CLIENTSIZE[1]	6253.74	1738.68	13426.63	223.90	103354.00
ACMTG[1]	4.65	4.00	1.86	0.00	13.00
AGE[1]	35.62	20.00	36.39	1.00	136.00
LEV	18.21	13.50	19.63	0.00	1.64

Panel B: Descriptive statistics for categorical variables		
Variable	Total	% of companies
B'MARKS		
Assets	71	22%
Other	257	78%
	328	100%
NONGAAP		
Non-GAAP benchmark	160	49%
GAAP benchmark	168	51%
	328	100%
EXCL		
Excluding recurring items[3]	21	16%
Excluding non-recurring items	131	84%
	152	100%
LISTINGS		
Company also listed on another exchange	51	16%
Company lists on London Stock Exchange only	277	84%
	328	100%
NEWCLIENT		
New client of audit firm	26	8%
Not a new client of audit firm	302	92%
	328	100%
AUDBUSY		
Busy	252	77%
Non-busy	76	23%
	328	100%
EARNS Δ		
Positive earnings change	200	61%
Negative earnings change	128	39%
	328	100%
AUDFIRM CONTROLS		
PwC	100	31%
KPMG	85	26%
Deloitte	90	27%
EY	53	16%
	328	100%
IND CONTROLS		
Financials	112	34%
Technologies	13	4%
Consumers	109	33%
Resources	32	10%
Industrials	62	19%
	328	100%

Key:

1: We report five of the 10 continuous variables in Panel A before we transform them using the natural logarithm (see variable definitions in **Table 2**) and before we winsorise them (see robustness testing in Section 4.5).

Amiram et al. (2017) find a significant correlation of 0.37 between audit fees and client size. In un-tabulated results, B'MARKS is highly correlated with the financial industry (0.65). We discuss how we address this high correlation in Section 4.5.

4.2. Audit Effort and Audit Materiality Thresholds (H1)

Table 5 presents regression results for Hypothesis 1. The adjusted R-squared (measure of fit of the regression) is 0.688 and significant, which means that the regression's independent variables explain 68.8% of the variance of AUDITFEE. Consistent with H1, the results show a significant negative coefficient on AMT ($p<0.01$). Our findings suggest that audit effort is negatively associated with audit materiality thresholds, while controlling for client complexity and other auditor and client characteristics. We extend prior studies examining audit materiality thresholds for UK-listed companies (Amiram et al., 2017; Quick et al., 2022) by examining audit effort and audit materiality thresholds. Our findings support limited prior research (Choudhary et al., 2019; Martinov & Roebuck, 1998) examining audit effort and audit materiality thresholds. By analysing internal audit firm guidance, Martinov & Roebuck (1998) find that for five of the big six Australian audit firms planning materiality is a key factor in determining which financial statement items are subject to detailed risk analysis. Our findings support the findings of Martinov & Roebuck (1998). We extend Choudhary et al. (2019) by confirming (using a direct materiality quantum) the inverse relationship between audit effort and audit materiality thresholds for a large UK sample (i.e. FTSE-350 companies).

4.3. Audit Effort and Auditor Benchmark Choices (H2)

Table 6 presents regression results for Hypothesis 2. We predict a non-directional hypothesis. The results show a significant negative coefficient on B'MARKS ($p<0.01$). Our findings suggest that audit effort is negatively associated with auditor benchmark choices (i.e. asset benchmarks), while controlling for client complexity and other auditor and client characteristics. The adjusted R-squared is 0.675 and significant, which means that the regression's independent variables explain 67.5% of the variance of AUDITFEE. Prior studies (Choudhary et al., 2019; Eilifsen & Messier, 2015; FRC, 2015, 2016a; Martinov & Roebuck, 1998; Quick et al., 2022) find that auditors adopt a wide range of benchmarks. Amiram et al. (2017) find a significant negative association between their benchmark indicator variable (profit before tax or other) and audit materiality thresholds. However, Amiram et al. (2017) do not examine benchmark choices and audit effort. As discussed in Section 2.2, to our knowledge no study examines whether underlying auditor benchmark choices relate to audit effort. We extend prior studies examining auditor benchmark choices by confirming a negative association between asset benchmarks and audit effort.

Our findings for audit effort and auditor benchmark choices imply that auditors spend less time on their audits when they adopt asset benchmarks. Reflecting on our findings for Hypothesis 2, we expect that audit effort may change because the client company's nature and circumstances may change, and auditors may perform more/less work (Section 2). The factors specified in ISA 320 (FRC, 2010) affecting the identification of an appropriate benchmark may provide an explanation for the results. The auditing standard specifies that auditors may adopt asset benchmarks because: (i) users of the financial statements focus on assets for evaluating financial performance; or (ii) the ownership structure (debt-holders may emphasise assets more than shareholders). As predicted, audit effort changes with auditor benchmark choices because the nature and circumstances of the entity change. The regression results show that audit effort is negatively associated with asset benchmarks. Therefore, auditor benchmark choices (i.e. asset/other benchmark) are informative for assessing audit effort.

4.4. Audit Effort and Auditor Non-GAAP benchmarks (H3)

Table 7 presents the regression results for Hypothesis 3. The results in **Table 7** Panel A show a significant positive coefficient on NONGAAP (p<0.01). Our findings suggest that audit effort is positively associated with GAAP/non-GAAP benchmark choices, while controlling for client complexity and other auditor and client characteristics. The adjusted R-squared is 0.653 and significant, which means that the regression's independent variables explain 65.3% of the variance of AUDITFEE. Therefore, our findings for audit effort and GAAP/non-GAAP auditor benchmark choices imply that auditors spend more time on their audits when they exclude financial statement line items (e.g. non-recurring items such as restructuring charge). In un-tabulated results, we show that when auditors adopt non-GAAP benchmarks, their audit materiality thresholds increase 80% of the time. We expect auditors to reduce audit effort when they adopt non-GAAP benchmarks (i.e. higher audit materiality thresholds) because of the inverse relationship between audit effort and audit materiality thresholds (Choudhary et al., 2019). However, our findings in **Table 7** Panel A contrast with this expectation. Furthermore, our findings do not support the findings of Hallman et al. (2022, p. 24) and their suggestion that "auditors are more likely to rely on a non-GAAP benchmark when doing so reduces the extent of required audit procedures surrounding complex estimates". As discussed in Section 2.3, Hallman et al. (2022) do not examine whether auditors' use of non-GAAP benchmarks affects total audit effort. Therefore, we extend limited research on audit effort and non-GAAP benchmarks and, contrary to Hallman et al. (2022) who focus on one audit procedure, we find that audit effort is positively associated with non-GAAP benchmarks. To help us draw a conclusion from our finding that auditors increase audit effort when they adopt non-GAAP benchmarks, we analyse the types of exclusions in our non-GAAP benchmark sample. We find that most (84%: 132 companies) non-GAAP benchmarks in our sample exclude non-recurring items. Non-recurring items are items that are unlikely to occur

Audit Materiality and Audit Effort: Evidence From Materiality Benchmarks

Table 4. Pearson Correlation Matrix: Audit Effort and Materiality and Control Variables

Variable		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Dependent variable															
1	AUDITFEE	1.00														
	Variables of interest[1]															
2	AMT	**-0.51**	1.00													
3	B'MARKS	**-0.49**	-	1.00												
4	NONGAAP	**0.45**	-	-	1.00											
	Control variables[2]															
5	#RISKS	**0.56**	**-0.40**	**-0.38**	**0.43**	1.00										
6	RESTRUCT	**0.16**	-0.14	**-0.27**	**0.40**	**0.20**	1.00									
7	LISTINGS	**0.44**	-0.15	-0.06	**0.15**	**0.28**	0.04	1.00								
8	NEWCLIENT	0.03	-0.02	-0.02	0.05	0.04	0.13	-0.04	1.00							
9	AUDBUSY	**0.18**	-0.04	0.03	0.06	0.08	**0.05**	**0.12**	-0.03	1.00						
10	TENURE	0.06	-0.02	0.04	0.01	0.01	**-0.10**	-0.03	-0.06	-0.01	1.00					
11	CLIENTSIZE	**0.67**	**-0.21**	**-0.27**	**0.24**	**0.41**	-0.02	**0.48**	-0.01	**0.12**	**0.12**	1.00				
12	ACMTG	**0.49**	**-0.31**	**-0.26**	**0.16**	**0.24**	-0.06	**0.31**	0.01	**0.17**	-0.01	**0.35**	1.00			
13	AGE	0.03	-0.03	0.08	0.04	0.14	-0.17	0.07	-0.07	**-0.10**	0.28	**0.15**	-0.06	1.00		
14	LEV	**0.17**	**-0.18**	**-0.14**	**0.22**	**0.16**	**0.15**	0.09	0.13	-0.02	-0.06	0.09	0.01	**-0.12**	1.00	
15	EARNS Δ	**-0.14**	**0.11**	0.01	**-0.21**	-0.10	-0.10	**-0.14**	0.03	**-0.16**	-0.09	-0.08	-0.10	-0.09	0.04	1.00

Key:

Correlations in bold are significant at the 5% level (i.e. < 0.05) (two-tailed).

1: We do not include two variables of interest (EXCL and T'HOLDDIFF) in this table because of different sample sizes (**Table 7**). In un-tabulated results, we run the same Pearson correlation matrices for the two sub-samples (i.e. EXCL: 152 companies and T'HOLDDIFF: 126 companies) and do not find any unusual correlations.

2: In un-tabulated results, we run the same Pearson correlation matrix and include AUDFIRM CONTROLS and IND CONTROLS for each set of indicator variables (1/0) (e.g. technologies industry) and do not find any unusual correlations. The financial industry has a high correlation with asset benchmarks (0.65). We consider this high correlation when concluding from the multivariate analysis (Section 4.3).

Table 5. Audit Effort and Audit Materiality Thresholds (Hypothesis 1)

	Variable	Expected Sign	AUDITFEE Coefficient	[1]Sig	[2]t-value
Materiality	AMT	-	-0.881	***	-6.625
Client complexity	#RISKS	+	0.194	***	4.234
	RESTRUCT	+	0.081		1.352
	LISTINGS	+	0.394	**	2.337
	NEWCLIENT	+	-0.131		-0.655
Auditor and client[3]	AUDBUSY	-	0.165		0.192
	TENURE	-	0.023		0.447
	CLIENTSIZE	+	0.578	***	10.308
	ACMTG	+	0.957	***	4.884
	AGE	-	-0.132	***	-2.849
	LEV	+	0.002		0.519
	EARNS Δ	-	0.019		0.179
	AUDFIRM CONTROLS		Yes		
	IND CONTROLS		Yes		
	Constant			***	-6.081
Observations: 328; R-squared: 0.708; Adjusted R-squared: 0.688					

Key:

This table presents the results of testing Hypothesis 1. The table reports the association between audit effort and audit materiality thresholds, while controlling for client complexity and other auditor and client characteristics. We define the variables in **Table 2**. We winsorise all continuous variables at 1% and 99%.

1: Sig: *, **, *** denote 10%, 5% and 1% significance

2: We calculate t-values based on standard errors. We test for autocorrelation of residuals. The Durbin-Watson test results for Hypothesis 1 is 1.916, suggesting no autocorrelation of residuals (Verbeek, 2017).

3: Auditor and client = other control variables for auditor and client characteristics (**Table 1**)

in the future. They include exceptional items (e.g. impairment following a significant decrease in commodity and oil prices) and restructuring items (e.g. acquisitions, disposals and start-up costs). Therefore, we suggest that it seems possible that auditors spend more time on their audits when there are unusual events (e.g. non-recurring items such as restructuring charges).

Next, we test the association between audit effort and non-GAAP benchmarks using two intricate measures. We find an insignificant association between audit effort and the type of non-GAAP recurring/non-recurring exclusions (EXCL) (**Table 7** Panel B). We find an insignificant result between audit effort and non-GAAP/GAAP threshold difference (T'HOLDDIFF) (**Table 7** Panel C). Therefore, we cannot conclude that type of exclusion and the extent of positive non-GAAP/GAAP threshold difference is associated with audit effort.

4.5. Robustness Testing

We perform the following robustness tests to check our findings. We exclude financial companies (122 companies) and re-run the regressions to ensure financial companies do not skew the results. Our results for Hypothesis 1 and Hypothesis 3 are insensitive to removing financial companies. For Hypothesis 2, the preliminary bivariate analysis (**Table 4**) shows a high correlation between two of the independent variables (auditor benchmark choices and financial industry) (0.65). We find most auditors use asset benchmarks in the financial

Table 6. Audit Effort and Auditor Benchmark Choices (Hypothesis 2)

	Variable	Expected Sign	AUDITFEE Coefficient	[1]Sig	[2]t-value
Materiality	B'MARKS	?	-1.022	***	-5.573
Client complexity	#RISKS	+	0.241	***	5.318
	RESTRUCT	+	0.070		1.133
	LISTINGS	+	0.519	***	2.984
	NEWCLIENT	+	-0.161		-0.787
Auditor and client[3]	AUDBUSY	-	0.167		0.196
	TENURE	-	0.052		0.327
	CLIENTSIZE	+	0.519	***	8.942
	ACMTG	+	0.986	***	4.880
	AGE	-	-0.094		-1.960
	LEV	+	0.005		1.575
	EARNS Δ	-	-0.031		-0.277
	AUDFIRM CONTROLS		Yes		
	IND CONTROLS		Yes		
	Constant			***	-6.532
Observations: 328; R-squared: 0.695; Adjusted R-squared: 0.675					

Key:

This table presents the results of testing Hypothesis 2. It reports the association between audit effort and auditor benchmark choices, while controlling for client complexity and other auditor and client characteristics. We define the variables in **Table 2**. We winsorise all continuous variables at 1% and 99%.

1: Sig: *, **, *** denote 10%, 5% and 1% significance

2: We calculate t-values based on standard errors. We test for autocorrelation of residuals. The Durbin-Watson test results for Hypothesis 2 is 2.006 suggesting no autocorrelation of residuals (Verbeek, 2017)

3: Auditor and client = other control variables for auditor and client characteristics (**Table 2**)

industry (66 of 71 asset benchmarks). As a robustness test, we run the regression without the control variable financial industry. After observing no differences in the models with and without its inclusion, we retain the control variable financial industry in the analysis (without financial industry: B'MARKS = -1.096, p<0.01, model R-squared = 0.695; with financial industry: B'MARKS = -1.022, p<0.01, model R-squared = 0.695, see **Table 6**). Therefore, when we control for financial industry, the association between audit effort and asset benchmarks becomes slightly weaker but remains, providing evidence that asset benchmarks affect audit effort directly and not only through the financial industry. In un-tabulated results, we include three other control variables that may influence audit effort (subsidiaries/beta/non-audit fees). Our results are insensitive to including the three other variables. We construct alternative variables to test the sensitivity of our results. In un-tabulated results, we include the natural log of total assets as an alternative measure of client size (instead of equity market value). We find the direction of our results remains the same for the three empirical models (Section 3.7). The results are significant when testing audit effort and auditor benchmark choices (Model 2) and audit effort and GAAP/non-GAAP benchmark (Model 3). However, the results are insignificant for Model 1 (audit effort and audit materiality thresholds). We are not surprised with these results. We use equity market value as our measure of client size in our study because we anticipated

Table 7. Audit Effort and Auditor Non-GAAP Benchmarks (Hypothesis 3)

Panel A: Audit effort and GAAP/non-GAAP benchmark

	Variable	Expected Sign	Coefficient	[1]Sig	[2]t-Value
			AUDITFEE		
Materiality	NONGAAP	?	0.457	***	3.453
Client complexity	#RISKS	+	0.250	***	5.278
	RESTRUCT	+	0.030		0.463
	LISTINGS	+	0.380	**	2.142
	NEWCLIENT	+	-0.153		-0.727
Auditor and client[3]	AUDBUSY	-	0.113		0.852
	TENURE	-	0.034		0.628
	CLIENTSIZE	+	0.565	***	9.547
	ACMTG	+	1.205	***	5.915
	AGE	-	-0.126	***	-2.581
	LEV	+	0.004		1.088
	EARNS Δ	-	0.033		0.774
	AUDFIRM CONTROLS		Yes		
	IND CONTROLS		Yes		
	Constant			***	-13.926
Observations: 328; R-squared: 0.675; Adjusted R-squared: 0.653					

Panel B: Audit effort and non-GAAP recurring/non-recurring exclusions

	Variable	Expected Sign	Coefficient	[1]Sig	[2]t-Value
Materiality	EXCL	?	0.051		0.227
Client complexity	#RISKS	+	0.127	**	2.380
	RESTRUCT	+	0.012		0.192
	LISTINGS	+	0.719	***	3.539
	NEWCLIENT	+	-0.024		-0.080
Auditor and client[3]	AUDBUSY	-	-0.057		-0.333
	TENURE	-	0.128		1.303
	CLIENTSIZE	+	0.460	***	6.706
	ACMTG	+	0.630	**	2.259
	AGE	-	0.020		0.306
	LEV	+	-0.008	**	-2.065
	EARNS Δ	-	0.008		0.057
	AUDFIRM CONTROLS		Yes		
	IND CONTROLS		Yes		
	Constant			***	-6.943
Observations: 153; R-squared: 0.665; Adjusted R-squared: 0.617					

Panel C: Audit effort and non-GAAP/GAAP threshold difference

	Variable	Expected Sign	Coefficient	[1]Sig	[2]t-value
Materiality	T'HOLDDIFF	?	-0.003		-1.232
Client complexity	#RISKS	+	0.134	**	2.228
	RESTRUCT	+	-0.063		-0.853
	LISTINGS	+	0.781	***	3.218
	NEWCLIENT	+	-0.137		-0.384
Auditor and client[3]	AUDBUSY	-	-0.070		-0.353
	TENURE	-	0.138		1.260

CLIENTSIZE	+	0.493	***	5.770
ACMTG	+	0.847	***	2.631
AGE	-	0.001		0.020
LEV	+	-0.008	**	-2.179
EARNS Δ	-	0.094		0.605
AUDFIRM CONTROLS		Yes		
IND CONTROLS		Yes		
Constant			***	-5.549
Observations: 128; R-squared: 0.668; Adjusted R-squared: 0.610				

Key:

This table presents the results of testing Hypothesis 3. The table reports the association between audit effort and auditor non-GAAP benchmarks (GAAP/non-GAAP benchmark choices, non-GAAP recurring/non-recurring exclusions and non-GAAP/GAAP threshold difference), while controlling for client complexity and other auditor and client characteristics. We define variables in **Table 2**. We winsorise all continuous variables at 1% and 99%.

1: Sig: *, **, *** denote 10%, 5% and 1% significance

2: We calculated t-values based on standard errors. We test for autocorrelation of residuals. The Durbin-Watson test results for: (i) Hypothesis 3 (Panel A: NONGAAP) is 1.969; (ii) Hypothesis 3 (Panel B: EXCL) is 1.945; and Model 3 (Panel C: T'HOLDDIFF) is 1.829, suggesting no autocorrelation of residuals (Verbeek, 2017)

3: Auditor and client = other control variables for auditor and client characteristics

that our regression results may be distorted by using total assets because we scale the variable of interest (audit materiality threshold) by the same alternative measure (total assets). In un-tabulated results we include an indicator variable, loss-making (Choudhary et al., 2019; Hallman et al., 2022), as an alternative variable for earnings change. Our results remain the same when we include loss-making instead of earnings change. We code auditor benchmark choices as a profit or other benchmark indicator variable (instead of asset or other benchmark indicator variable). Our results show that auditors increase audit effort when they adopt profit benchmarks, reinforcing our finding that auditors reduce audit effort when they adopt asset benchmarks. We also include the natural log of number of stock exchanges a company is listed on (instead of an indicator variable identifying that the company lists on another exchange as well as the London Stock Exchange). Our results remain the same when we use the alternative variable for number of listings.

We examine normal distribution of each variable using histograms, skewness and kurtosis tests and we transform five continuous variables (**Table 2**). To address the possibility that extreme outliers impact the results, we winsorise the data (**Table 5**, **Table 6** and **Table 7**). We examine the data for multicollinearity using two techniques: (i) the Pearson correlation matrix (Section 4.1); and (ii) the variance inflation factor (VIF) test. We find that the VIF is less than 10 for all variables, which suggests that multicollinearity is not an issue (Verbeek, 2017). We examine autocorrelation of residuals using the Durbin-Watson test. Our results for Durbin-Watson (**Table 5**, **Table 6** and **Table 7**) are not substantially less than 2.00, which suggests that autocorrelation of residuals is not likely to be a problem (Verbeek, 2017). We test for heteroscedasticity (i.e. 'unequal scatter') using scatterplots and do not observe any unusual fan or cone shapes.

5. Conclusion

Audit materiality thresholds (derived by multiplying a percentage rate by a chosen benchmark) are a critical auditor planning judgement driving the entire audit approach (e.g. the extent of audit procedures and issuance of audit opinions). Few studies examine audit effort and audit materiality thresholds (Choudhary et al., 2019; Martinov & Roebuck, 1998). This study provides new insights into how auditors plan their audits by investigating whether audit materiality thresholds relate to audit effort.

We provide evidence of the association between audit effort and audit materiality thresholds for a large representative sample of FTSE-350 companies. We find a negative association between audit effort and audit materiality threshold scaled by company size. We provide novel evidence on the association between audit effort and underlying benchmark choices (in particular, auditor GAAP/non-GAAP benchmarks) (Eilifsen & Messier, 2015; Martinov & Roebuck, 1998; Quick et al., 2022). First, we find that audit effort is negatively associated with asset benchmarks. A possible explanation for audit effort changing with auditor benchmark choices is that the entity's nature and circumstances change (FRC, 2010). Second, we find that audit effort is positively associated with auditors' use of non-GAAP benchmarks (Hallman et al., 2022). Our findings for audit effort and auditor non-GAAP benchmarks indicate that auditors spend more time on their audits when there are unusual events (i.e. non-recurring items such as restructuring charges). Our findings collectively suggest that underlying auditor benchmark choices are a critical auditor planning judgement contributing to audit effort and consequently the entire audit approach.

We recognise some limitations to our study. First, we recognise that our results cannot be generalised because the sample is restricted to one year, one jurisdiction, large-listed companies and companies audited by Big 4 auditors. Therefore, we observe associations between audit effort and audit materiality and acknowledge that relationships may vary over time. We restrict our analysis to one year (2015 year-ends) due to the time-consuming nature of hand-collecting the data from expanded audit reports. At the time of writing, Audit Analytics does not provide materiality data. Our study examines a sample of UK-listed companies (i.e. FTSE-350) audited by Big 4 auditors because they are the first adopters of audit materiality threshold disclosures in expanded audit reports. Second, we recognise that we use audit fees as a proxy measure for audit effort. Prior studies adopt audit hours as a proxy measure for audit effort (Choudhary et al., 2019; Lobo & Zhao, 2013); however, this information is not available for this study. Finally, we acknowledge that our study may be subject to endogeneity issues in two forms: (i) omitted variable bias; and (ii) reverse causality. We attempt to overcome omitted variable bias by identifying relevant independent variables from prior studies and auditing standards (subsidiaries/beta/non-audit fees). Our results are insensitive to including other variables.

Reverse causality raises concern that audit fees may influence audit materiality variables. Following prior studies (Choudhary et al., 2019), we acknowledge that we cannot rule out the possibility of reverse causality.

We recommend three possible avenues for future research. Future empirical work could examine the association between audit materiality thresholds and other audit outputs (e.g. reporting to audit committee). As a result of the COVID-19 pandemic, there is likely to be more exceptional items (e.g. restructuring and redundancy costs) in annual reports. It may be interesting to examine the use of non-GAAP benchmarks for computing audit materiality thresholds at this time (i.e. 2020 onwards). Researchers could examine: (i) the determinants (e.g. environment) of GAAP/non-GAAP benchmarks; or (ii) the impact of non-GAAP benchmarks on audit outputs. Finally, we suggest that future research could examine the link between audit materiality thresholds and auditor risk assessments on audit effort.

In conclusion, the FRC (2016b) acknowledge that auditor planning judgements regarding audit materiality thresholds affect the entire audit approach and the extent of audit procedures undertaken. In this study, we provide insights into how audit materiality thresholds are informative for assessing audit effort. Our materiality threshold is calculated using the direct material quantum, which has better information value for regulators, auditors, and users of financial statements compared to the materiality looseness measure used in prior research (Choudhary et al., 2019). We also extend prior research (Choudhary et al., 2019; Hallman et al., 2022) on audit materiality thresholds and audit effort by examining auditor benchmark choices and auditors' use of non-GAAP benchmarks. By providing insights into how audit materiality thresholds are informative for assessing audit effort, we offer regulators, auditors, and users new ways of understanding, communicating, and assessing audit materiality thresholds and audit effort.

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Appendix 1: Auditor Non-GAAP Benchmark

Independent auditor's report to the members of Rolls-Royce Holdings plc annual report 2015, p. 173

Our application of materiality and an overview of the scope of our audit
Our measure of **materiality** for the Group financial statements as a whole has reduced in line with the reduction in the Group's profit. This was set at **£66m ①** (2014: £70m) and was, as last year, determined with reference to a **benchmark of Group profit before taxation, normalised to exclude the volatility ④ in reported profit due to gains and losses on revaluation of foreign currency and other derivative financial instruments ②** which could otherwise result in an inappropriate materiality level being determined. This materiality measure represents **4.5% ③** (2014: 4.6%) of this benchmark and 41.3% (2014: 34.3%) of total reported profit before tax. We carry out audit procedures to assess the accuracy of the gains and losses on these derivative financial instruments (which this year amounted to a 1.3bn (2014: £1.1bn) loss) as part of our audit of the Group's treasury operations.

We report to the Audit Committee: (i) all material corrected identified misstatements; (ii) uncorrected identified misstatements exceeding £3m (2014: $4m) for income statement items ⑤; and (iii) other identified misstatements that warrant reporting on qualitative grounds.

Key:
① Audit materiality threshold
② Auditor benchmark choices: Auditor non-GAAP benchmark
③ Benchmark percentage rate
④ Auditor rationale for benchmark choices: Eliminates volatility/Consistent benchmark
⑤ Reporting audit difference threshold

Notes:
1: Non-GAAP/GAAP threshold difference:
Positive non-GAAP/GAAP threshold difference: Excess of actual non-GAAP audit materiality threshold over estimated GAAP audit materiality threshold: £58.8m = (£66m[a] - £7.2m[b])
a: Actual non-GAAP audit materiality threshold ①
b: Estimated GAAP audit materiality threshold: £160m (GAAP profit) [c] * 4.5%[d] ③ = £7.2m
c: GAAP profit is sourced from Rolls-Royce Holdings plc annual report p. 107
d: We apply the same non-GAAP benchmark percentage rate to GAAP Profit. However, we acknowledge that we do not know whether the auditor would apply the same percentage rate. In un-tabulated results, we find that percentage ranges applied to GAAP benchmarks are similar to percentage rates to non-GAAP benchmarks.