



Audit committee features and earnings management

Farzaneh Nassir Zadeh^{a,*}, Davood Askarany^b, Ali Shirzad^a, Mahdi Faghani^c

^a Faculty of Administrative and Economic Sciences, Ferdowsi University of Mashhad, Mashhad, 9177948974, Iran

^b Accounting and Finance Department, Business School, University of Auckland, Auckland, 1010, New Zealand

^c Faculty of Economy, University of Sistan and Baluchestan, Zahedan, Iran

ARTICLE INFO

Keywords:

Audit committee features
Audit committee size
Audit committee expertise
Audit Committee's independence
Earnings management

ABSTRACT

Purpose: Past studies have investigated the relationship between audit committee features and earnings management and reported mixed and inconclusive results. Some studies have found a significant relationship, while others have not. This study aims to explain these mixed results in the literature by dividing earning management into two groups: accrual and real earnings management (at three levels of sales, general and administrative costs, production costs and cash flows operation) and re-examining the relationship.

Design/methodology/approach: The statistical model used in this study is a multivariate regression model; further, the statistical technique used to test the hypotheses is panel data.

Findings: The findings show that both the audit committee members' financial expertise and the audit committee's size affect the accrual earnings management. However, the results show no meaningful relationship between the audit committee features and real-based earnings management at any levels of sales, general and administrative costs, production costs and cash flow operation. In addition, the findings suggest no meaningful relationship between the independence of the audit committee's members and accrual earnings management. In other words, not separating the earning management into 'accrual' and 'real' could be the critical factor for the reported mixed and inconsistent results in the literature.

Practical implications: The findings of the current study provide an important guideline for investors and stakeholders to separate 'accrual' from 'real' earning management and pay more attention to the importance of audit committee features to limit the opportunities of earnings management. Indeed, by understanding the relationship between audit committee features and earnings management, investors and stockholders can make appropriate decisions regarding the optimal choice of funds.

Originality/value: Dividing the earning management into two groups (accrual versus real) and re-examining its relationship with the audit committee features is new in this paper. Identifying one of the possible reasons for the past mixed and inconsistent results in the literature is also an incremental contribution provided by this study.

1. Introduction

The study on the relationship between Audit Committee Features and Earnings Management is not new. However, the results are

* Corresponding author.

E-mail addresses: nasirzadeh@um.ac.ir (F. Nassir Zadeh), d.askarany@auckland.ac.nz (D. Askarany), alishirzad@mail.um.ac.ir (A. Shirzad), faghani@acc.usb.ac.ir (M. Faghani).

<https://doi.org/10.1016/j.heliyon.2023.e20825>

Received 15 May 2022; Received in revised form 27 September 2023; Accepted 8 October 2023

Available online 12 October 2023

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inconsistent and mixed, and to some degree, even contradictory [1–8]. In finance, the accuracy and transparency of financial reporting are critical to ensure that investors and other stakeholders can make informed decisions [3,8]. Unfortunately, some companies engage in earnings management practices to manipulate their financial statements, leading to misleading information and potentially devastating consequences [1,3,8]. To prevent this, companies establish audit committees to monitor the quality and integrity of financial reporting [5–7]. The effectiveness of these committees can depend on several factors, including the financial expertise, size, and independence of its members [6]. Therefore, it is essential to investigate the relationship between audit committee features and earnings management. This study seeks to contribute to the literature by examining this relationship in the context of companies listed on the Tehran Stock Exchange. Through our analysis, we hope to provide insights into how audit committees can effectively prevent earnings management practices and promote greater transparency and accountability in financial reporting (see Table 1).

The accuracy and transparency of financial reporting are essential for maintaining the trust of investors and other stakeholders in the corporate world [9–11]. However, companies may engage in earnings management practices to manipulate their financial statements, leading to false and misleading information. To prevent this, audit committees are established to monitor and ensure the quality and integrity of financial reporting. The effectiveness of these committees can depend on several factors, including the financial expertise, size, and independence of its members [1,3,8].

Numerous studies have investigated the relationship between audit committee features and earnings management, but the results have been mixed and inconclusive [1,3,8]. Some studies have found a significant relationship, while others have not [1,3,8]. To address this inconsistency in the literature, this study focuses on the relationship between audit committee features and earnings management, specifically separating it into accrual and real earnings.

This study contributes to the literature by providing insights into how audit committees can effectively prevent earnings management practices and promote greater transparency and accountability in financial reporting. Moreover, the study focuses on manufacturing companies listed on the Tehran Stock Exchange from 2013 to 2018, providing unique insights into this context.

This study is positioned in prior literature by addressing previous studies' mixed and inconsistent results on the relationship between audit committee features and earnings management [1–8]. Furthermore, the current study's unique contribution is its focus on separating earnings management into accrual and real earnings and the context of manufacturing companies listed on the Tehran Stock Exchange.

This paper is structured as follows: Section 2 presents the literature and develops the theoretical framework and hypotheses. Section 3 describes the research method, and Section 4 presents the results. Section 5 focuses on the discussion and conclusion and provides recommendations for future studies.

2. Literature review and hypotheses development

This study aims to explain these mixed results in the literature by dividing earning management into two groups: accrual and real earnings management (at three levels of sales, general and administrative costs, production costs and cash flows operation) and re-examining the relationship.

We agree that the interrelationship between the audit committee and accrual earnings management has been extensively researched [1–8]. However, despite such an accumulated study, accrual earnings management is still a widespread practice used by firms to manipulate their reported financial statements to meet or exceed earnings expectations [1–8]. A pivotal determinant posited by our study as influencing the propensity for such practices is the level of financial expertise held by members constituting the audit committee, coupled with the dimensions of the audit committee itself. Thus, the novel augmentation that our present article introduces resides in the meticulous examination of the ramifications engendered by these two factors upon the practice of accrual earnings management.

Earnings management, also known as financial reporting manipulation, is a practice where companies manipulate their financial statements to meet or exceed market expectations [12,13,14]. This practice can mislead investors and regulators, leading to negative consequences for the company and its stakeholders. Audit committees oversee the financial reporting process and ensure that financial statements are accurate and reliable [3,8]. Therefore, investigating the relationship between audit committee features and earnings management is crucial to promote transparency and protect the interests of investors and other stakeholders.

The audit committee is a subcommittee of the board of directors responsible for overseeing the financial reporting process, ensuring financial statement accuracy, and compliance with laws and regulations. Some of the primary responsibilities of the audit committee include reviewing and approving financial statements, overseeing the external audit process, and monitoring the company's internal controls [3,8,15].

Table 1

The number of statistical community companies and applying the conditions for choosing the sample.

Description	Deleted companies in the courses	Total number of companies
<i>Statistical community</i>		512
<i>Firms with insufficient information</i>	121	
<i>leasing companies, banks, insurance, and investments</i>	64	
<i>Companies that changed their financial years</i>	25	
<i>Companies without audit committee information</i>	160	
<i>Non-manufacturing companies</i>	32	
<i>The number of final sample companies</i>		110

Given the importance of the audit committee in the financial reporting process, it is critical to investigate its features and how they relate to earnings management. Several features of the audit committee have been shown to have an impact on the likelihood of earnings management [8,15]. For instance, the financial expertise of audit committee members is a critical factor in preventing earnings management. Audit committee members with financial expertise are better equipped to scrutinise financial statements and identify potential issues. Furthermore, more prominent audit committees tend to be more effective in preventing earnings management due to their broader range of skills and perspectives [1,3,8,15].

Moreover, the independence of the audit committee is also an essential feature that affects earnings management. The independent audit committee can better detect and prevent earnings management practices because they are not subject to the influence of the company's management. The independence of the audit committee is also vital in ensuring that the external auditor's performance is evaluated objectively [1,15].

Corporate executives can help resources achieve their main goals by adequately managing resources and capital expenditures [16]. However, the executives do not necessarily seek to maximise the interests and owners' wealth due to the conflict of interest [17]. Preparing and regulating the financial reports to respond to the owners, other institutions, and stakeholders are considered the most critical tasks of an executive, among which the earnings and loss statement, indicating the company's earnings, has a special place [12]. Earnings, as the result of economic activities and the accounting process, are affected by the different procedures applied by corporate executives [13]. Corporate executives try to change their financial earnings to secure their policies and goals through various accounting methods for various reasons [18]. Schipper [19] illustrated that earnings management is the purposeful intervention of the company's external financial reporting process to gain personal benefits. Income smoothing, earnings management, fictitious accounting, and accounting system failures are considered various aspects of designed accounting [20]. Furthermore, the strategic manipulation of earnings is oriented towards endeavours that influence the disclosed accounting earnings or their subsequent construction. Analogous to an overarching canopy, this manipulation commences with deliberations undertaken by accountancy professionals and, to a certain degree, shapes the veiled financial advantages through the deliberate selection of accounting practices and the exercise of discretion in the inclusion of accruals within the ambit of financial statement formulation [21]. Earnings management often occurs in companies where there are no high-quality mechanisms to protect investors' interests and control executives' opportunistic behaviour [22]. One of these mechanisms is the audit committee. However, the recent wave of scandals in the world's largest joint-stock companies led to paying more attention to the need to improve the internal audit mechanism and increase transparency in accounting information by the companies [22].

The primary role of the companies' audit committee is to monitor the corporate financial reporting process [23]. Although the audit committee provides the most reliable protection of the public interest, previous studies on the audit committee demonstrate a great deal of variation in the expertise and skills of the audit committee [24,15]. In addition, these studies illustrate the lack of sufficient experience and financial knowledge of many committee members in finance and accounting [25]. The recent amendments by the companies' audit committee aimed to increase the number of financially specialised managers in the audit committee [26]. Since reviewing financial information and controlling organisational behaviour is considered as one of the tasks of the audit committee, it is regarded as a control mechanism aimed at reducing information asymmetry between management and shareholders [14]. Therefore, establishing an audit committee improves the quality and accuracy of financial information from an accounting point of view, ensuring that the authorities' accountability for more reporting and disclosure is further controlled and monitored [14]. Today, public attention to earnings management is seriously considered by lawmakers. There are several ways to help a company achieve its financial goals. The variety of business practices and financial reporting are two factors that make the audit committee's job more difficult. However, the audit committee should examine specific accounting procedures, accounting estimates or judgments, and appropriate business activities to improve the reported financial results. Earnings management techniques include available accounting choices confirmed by generally accepted accounting principles and used for operational business decisions. The audit committee should be aware of the activities which indicate management bias and the indications which illustrate inappropriate accounting decisions for earnings management.

2.1. Earnings management

Past studies on the relationship between Audit Committee Features and Earnings Management have produced inconsistent, mixed, and somewhat contradictory results [1]. For example, Carcello & Neal [27] found a significant positive relationship between audit committee features and earnings management, while Inaam and Khamoussi [1] reported a negative relationship between these two. Such inconsistency has been the primary motivation for the current study. Haga et al. [28] find that public firms manage their earnings more than private firms. And Zang and Amy Y [29] report that managers trade off the two earnings management methods based on their relative costs and adjust the accrual-based earnings management level according to the level of actual activities manipulation realised.

Earnings management has been used in financial and management accounting [30–36]. Schipper [19] defines earnings management as intentional interference in the process of foreign financial reporting to make a profit. Healy & Wahlen [37] believe that earnings management occurs when executives use their judgments in financial reporting and manipulate the structure of transactions to change financial reporting. This is performed either to mislead some profit owners about the company's economic performance or to affect the outcome of contracts whose conclusion is subject to personal earnings. Scoot [38] considers earnings management as the company's willingness to choose accounting policies to achieve some of the executive's specific goals. In addition, earnings management is performed to normalise the intentional manipulation of earnings to achieve the desired trend or level of profitability. Although these definitions are widely accepted, the practical application is complex because the executive does not provide objective

evidence. It is difficult to define earnings management clearly in accounting literature because the boundary between earnings management and financial fraud is unclear. Financial fraud is the deliberate deletion or manipulation of essential facts or accounting data, which alters the user's judgment or decision along with other available data [20].

Earnings management is divided into two broad categories: real-based earning management (e.g., influencing cash flows) and accruals management through changes in accounting estimates and procedures, called earnings management through accounting figures. In addition, the cost of earnings management for these methods differs, and real-based earnings management is considered more expensive for a company [39,40]. However, it seems that executives prefer real-based earnings management rather than accruals management. In addition, it reduces discretionary spending by 80 % and postpones projects by 55 % [41]. Earnings management can be practised through accounting manipulation and actual activities in several ways, including combined real-based and accrual earnings management. Both types of earnings management are heavily documented in empirical research. Earnings management can be used in the areas of revenue recognition [42], commodity inventory valuation [43], stock call option and leasing costs [43], and fair value valuation. Real-based earning management can be performed in the form of selecting a new project [44], strategically selling securities [45], quality control costs, alternative machine decision-making solutions and additional investment in ongoing research and development projects [45].

2.2. Audit committee

The audit committee is considered one of the committees of the board of directors. Its primary role is to help the board of directors supervise the financial information by reviewing the financial information available to shareholders and other users of financial and accounting information, internal control systems created by the executive and the board of directors and the audit process. In the context of the formation of the audit committee, the question arises as to whether the formation of the audit committee is related to improving the quality and reliability of financial reporting. Several studies used the agency's theoretical framework to analyse the company's motivation to form an audit committee. Pincus, Rusbarsky and Wong [46] found that separating corporate stock management in companies that voluntarily formed an audit committee was less than those lacking an audit committee. The theoretical support for developing an audit committee is observed in the agency theory, which is used in this study. Accordingly, shareholders and creditors seek to maximise earnings via managers serving as their representatives [47]. Audit committee members are appointed by the company's board of directors (usually independent or non-executive directors). As a representative group, the audit committee is responsible for guaranteeing and increasing the interests of shareholders on behalf of the board of directors [48,39]. Since the main task of the audit committee is to review financial information and control management behaviour, it is considered a control mechanism to reduce information asymmetry between internal and external members (management and non-management) of the board. Eichenseher and Shields [49] and Pincus, Rusbarsky and Wong [46] suggest that establishing an audit committee improves the quality and accuracy of financial information from (an accounting point of view), ensuring that the authorities' accountability for reporting and disclosure is more closely monitored [14]. Therefore, an audit committee is formed among independent and non-executive managers to guarantee and increase the interests of shareholders and other stakeholders. The accuracy and quality of financial and accounting information are improved by establishing an audit committee, and the responsibility and accountability of the corporate management for adequate and appropriate disclosure and improving the quality of financial reporting are further controlled through providing and approving transparent financial information.

2.2.1. Audit Committee's expertise

The expertise and skills of the audit committee members are other features of the audit committee which are closely related to the audit committee's effectiveness and are addressed in the literature. It was argued that effective monitoring of the audit committee requires its members to have sufficient accounting and auditing expertise to independently evaluate the issues presented to them [13]. It is difficult for audit committee members to adequately understand the financial information (that they are required to evaluate) without an adequate level of expertise. In addition, managers with professional qualifications tend to be more aware of their duties and legal requirements regarding financial reporting [50,40]. That is why the regulatory agencies in the United States recognize the importance of audit committee expertise. Following the recommendations of the Blue-Ribbon Committee (1999), the New York Stock Exchange and the National Securities Dealers Association amended their regulations to require audit committee members to have a certain level of financial literacy and accounting or monetary management expertise. Given the above, we are proposing the following hypothesis:

H1. *There is a meaningful relationship between the financial expertise of the audit committee members and earnings management (accrual and real).*

This hypothesis is interesting for several reasons as follows:

Firstly, the audit committee is an essential governance mechanism that plays a critical role in ensuring the accuracy and reliability of financial reporting. The financial expertise of audit committee members is a crucial attribute that can influence their ability to oversee the financial reporting process effectively [1,8]. Therefore, understanding the relationship between financial expertise and earnings management is essential to evaluate the audit committee's effectiveness in detecting and preventing earnings management practices.

Secondly, the hypothesis addresses a critical research gap in the literature. Prior research has examined the relationship between audit committee characteristics and earnings management, but the specific role of financial expertise has not been extensively explored [1,3,8,15]. Investigating this relationship can provide a more nuanced understanding of the factors that influence earnings

management practices and contribute to the ongoing debate on the effectiveness of audit committees in preventing financial reporting fraud.

Finally, the hypothesis has practical implications for companies and policymakers. If the hypothesis is confirmed, companies may need to prioritise recruiting audit committee members with financial expertise to ensure they have the necessary skills to identify and prevent earnings management practices. Policymakers may also consider developing regulations that require audit committees to have a minimum level of financial expertise to ensure effective governance and mitigate financial reporting fraud.

2.2.2. *The size of the audit committee*

The audit committee size seems to have a constructive effect on the committee, and a larger audit committee is expected to be more efficacious [1,3]. So, the audit committees are likely to include more members with various specialisations to perform more strict control over financial reporting procedures [50]. The Blue-Ribbon Committee (1999) recommends that the audit committee should have at least three members. It suggests they are more effective by increasing the audit committee size and less effective by reducing it. However, the literature suggests a negative relationship between the size of the board of directors and the effectiveness of the controlling role of managers [1,3]. In other words, the larger the audit committee, the more difficult it is for the executive managers to make the proposed reforms presented by independent auditors. Therefore, the number of audit committee members affects the management's attitude toward accepting or rejecting the independent auditor's adjustment proposals [14]. Given the above, we are proposing the following hypothesis:

H2. *There is a meaningful relationship between the size of the audit committee and earnings management (accrual and real).*

This hypothesis is interesting for several reasons as follows:

Firstly, the audit committee is a critical governance mechanism that plays an essential role in ensuring the accuracy and reliability of financial reporting. The size of the audit committee can influence its effectiveness in fulfilling its oversight responsibilities. Understanding the relationship between the size of the audit committee and earnings management practices can provide valuable insights into how companies can optimise their audit committees' composition to enhance their effectiveness in preventing financial reporting fraud.

Secondly, the hypothesis has practical implications for companies and policymakers. If the hypothesis is confirmed, companies may need to re-evaluate the size of their audit committees to ensure that they have the optimal composition to detect and prevent earnings management practices. Policymakers may also consider developing regulations that require companies to have a minimum or maximum size for their audit committees to enhance their effectiveness in preventing financial reporting fraud.

In summary, the hypothesis that there is a meaningful relationship between the size of the audit committee and earnings management is interesting because it addresses a critical research gap that has practical implications for companies and policymakers and can provide valuable insights into how companies can optimise their audit committees' composition to enhance their effectiveness in preventing financial reporting fraud.

2.2.3. *Audit Committee's independence*

The audit committee's independence is considered one of the essential features of the highly emphasised audit committee. Previous studies surveyed the audit committee's independence as one of the main features of the audit committee's effectiveness [27]. Carcello & Neal [27] found that the audit committee's independence is related to the financial crisis faced by companies. They further found a significant positive relationship between the involvement of the audit committee and the optimism of disclosing the continuity of activity. The audit committee's independence is often considered an essential feature influencing the audit committee's effectiveness in monitoring financial management because the committee members are external executives and independent of management. The importance of the audit committee's independence is reflected in most recommendations and rules for the compulsory formation of audit committees, which recommend or require that most audit committee members should be non-executive directors. Klein [39] found that increasing the independence of audit committee members (i.e., the proportion of independent directors on the audit committee) reduces the earnings management of accruals, indicating that independent audit committee members prevent earnings management. Therefore, the following hypothesis is proposed:

H3. *There is a meaningful relationship between the independence of audit committee members and earnings management (accrual and real).*

This hypothesis is interesting for the same reasons we discussed for the above two hypotheses.

Regarding the requirements of audit committees in Iran, we need to consider the following: Iranian companies are mandated to follow Generally Accepted Accounting Principles (GAAP). However, in September 2011, a plan was approved by the General Assembly of the Iranian Audit Organisation (which operates under the Iranian Ministry of Finance) to transition Iranian-listed companies identified by the Iranian Securities and Exchange Organisation (SEO) and all banks to report under International Financial Reporting Standards (IFRS) starting from a specified date. This approval was later confirmed by the Iranian Minister of Finance and Economics in June 2012 [51].

To facilitate this transition, the SEO has formed an IFRS strategy committee comprising representatives from the Iranian Association of Certified Public Accountants (IACPA), the Iranian Audit Organisation, the Iranian Institute of Certified Accountants (IICA), the Iran National Tax Affairs (INTA), the Ministry of Finance and Economics, and selected external experts. Additionally, the SEO has established a dedicated website in the Farsi language at <http://ifrs.seo.ir/>, which documents all decisions and progress made and provides assistance and information for the companies affected [51]. In an inefficient stock market such as Tehran Stock Exchange (TSE), the audit committee's role becomes even more critical in ensuring the integrity and reliability of financial reporting to maintain

investor confidence and protect shareholder interests. However, we are unsure about the level of restriction of meeting the following attributes in audit committees in Iran: 1- Audit committees need to carry out risk assessment and mitigation, 2- Oversight of external auditors, 3- Enhanced transparency, 4- Whistle-blower mechanisms, 5- Continuing education, 6- Evaluating internal controls and 7- Compliance with regulations.

3. Research Methodology

3.1. Sample selection

The present study is descriptive and correlational. The research data were collected from the companies listed on the Tehran Stock Exchange (which is reliable database used by many authors) via the official website of the stock exchange and Rah-e-Novin software [9–11]. Data are primarily based on the TSE's audited financial statements and board reports, a reliable source of information [9–11]. For several reasons, companies listed on the Tehran Stock Exchange, manufacturing companies, and the period of 2013–2018 are reliable sources for investigating the relationship between Audit Committee Features and Earnings Management. Companies' data can be purchased via the TSE website at:

<https://mabnadp.com/products/rahavard365>.

The relevant data is called 'rahavard-novin' and is available under the 'products' category and can be accessed at: <https://mabnadp.com/products/rahavard-novin>.

However, due to the government policy and imposed internet access restrictions, residents outside Iran have limited or no access to many financial institutions, such as banks and their financial statements. Codal (<https://codal.ir/>) is another website that sells the financial information of companies listed in TSE but may not be accessible from overseas.

Firstly, Tehran Stock Exchange (TSE) is the largest stock exchange in Iran and is known for its significant role in the country's economy. As such, companies listed on the TSE represent a wide range of industries and can provide a comprehensive sample for studying the relationship between audit committee features and earnings management practices in the Iranian context.

Secondly, manufacturing companies are a relevant industry to investigate as they are likely to have higher accruals and assets that require impairment testing, making them more susceptible to earnings management practices. Thus, studying manufacturing companies listed on the TSE can provide a more targeted sample for examining the relationship between audit committee features and earnings management.

Finally, 2013–2018 is a suitable period to study the relationship between audit committee features and earnings management in Iran. During this period, the country experienced significant changes in its regulatory framework, particularly concerning corporate governance and accounting standards. As a result, companies listed on the TSE had to adjust their corporate governance practices to comply with the new regulations. Furthermore, this period was before Covid 19, and all activities were normal. Investigating the relationship between audit committee features and earnings management practices during this period can provide insights into how changes in regulatory frameworks can influence corporate governance practices and impact financial reporting quality.

The statistical population includes all manufacturing companies listed on the Tehran Stock Exchange. The required criteria for choosing the targeted firms are listed as follows:

1. They should have been listed on the stock exchange before 2013.
2. They should have had necessary data presented on the stock exchange's website from the beginning of 2013 to the end of 2018.
3. They should have been continuously active during the research period and their shares have been traded with no trading interruption.
4. They should have been manufacturing firms (not investment and financial institutions).

Applying the above criteria, 110 sample companies were selected as follows:

The selected manufacturing firms were classified into seven subgroups as follows:

3.2. Hypotheses testing models

To examine the three proposed hypotheses in this paper, we have classified them into two general groups as follows:

Group 1 Examining all three hypotheses in accrual earnings management.

Group 2 Examining all three hypotheses in real earnings management at three levels of sales, general and administrative costs, production costs and operating cash flows.

In doing so, the following models are used to evaluate the research hypotheses:

3.2.1. A testing model of the first group of hypotheses

To examine the first group of hypotheses, the following multiple regression Model 1 was developed:

Model (1) :

$$AEM_{i,t} = \beta_0 + \beta_1 ACEXP_{i,t} + \beta_2 ACSIZE_{i,t} + \beta_3 INCO_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 MB_{i,t} + \beta_6 LEV_{i,t} + \beta_7 ROA_{i,t} + \beta_8 LnAge_{i,t} + \beta_9 SG_{i,t} + \beta_{10} CFO_{i,t} + \epsilon_{i,t}$$

Model 1 examines the impact of the financial expertise of the audit committee’s members, the size of the audit committee, and the independence of the audit committee, respectively, on the accrual earning management. We expected that β_1 , β_2 and β_3 have a meaningful relationship with accrual earnings management at the 0.05 error level.

3.2.2. Assessing the second group of hypotheses

To examine the second group of hypotheses, we developed a multiple regression Model 2 as follows:

Model (2) :

$$REM_SG\&A_{i,t} = \beta_{(0)} + \beta_{(1)} ACEXP_{i,t} + \beta_{(2)} ACSIZE_{i,t} + \beta_{(3)} INCO_{i,t} + \beta_{(4)} SIZE_{i,t} + \beta_{(5)} MB_{i,t} + \beta_{(6)} LEV_{i,t} + \beta_{(7)} ROA_{i,t} + \beta_{(8)} LnAge_{i,t} + \beta_{(9)} SG_{i,t} + \beta_{(10)} CFO_{i,t} + \epsilon_{i,t}$$

Model 2 examines the impact of the financial expertise of the audit committee’s members, the size of the audit committee and the audit committee’s independence, respectively, on the real-based earning management at the 0.05 error level significance. The real-based earning management is measured concerning the sale values, general and administrative and organisational costs. We expected that β_1 , β_2 and β_3 have a meaningful relationship with the real-based earning management at the 0.05 error level.

Model 3 examines the impact of the financial expertise of the audit committee’s members, the size of the audit committee and the audit committee’s independence, respectively, on the real-based earning management in terms of *production costs*:

Model (3) To assess the hypothesis in real-based earning management at production costs:

$$REM_PROD_{i,t} = \beta_0 + \beta_1 ACEXP_{i,t} + \beta_2 ACSIZE_{i,t} + \beta_3 INCO_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 MB_{i,t} + \beta_6 LEV_{i,t} + \beta_7 ROA_{i,t} + \beta_8 LnAge_{i,t} + \beta_9 SG_{i,t} + \beta_{10} CFO_{i,t} + \epsilon_{i,t}$$

Model 4 examines the impact of the financial expertise of the audit committee’s members, the size of the audit committee and the audit committee’s independence, respectively, on the real-based earning management in terms of *operating cash flows*:

Model (4) To assess the hypothesis in real-based earning management in operating cash flows:

$$REM_CFO_{i,t} = \beta_0 + \beta_1 ACEXP_{i,t} + \beta_2 ACSIZE_{i,t} + \beta_3 INCO_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 MB_{i,t} + \beta_6 LEV_{i,t} + \beta_7 ROA_{i,t} + \beta_8 LnAge_{i,t} + \beta_9 SG_{i,t} + \beta_{10} CFO_{i,t} + \epsilon_{i,t}$$

3.3. Accrual Earnings Management

The second dependent variable is normal accruals. The modified Jones’s model is the most commonly used method for measuring normal accruals [9–11]. For this purpose, the starting point is the total accruals divided into regular and abnormal accruals. Model (5) is used to calculate abnormal accruals.

Model (5) :

$$DA_{it} = TA_{it} - NDA_{it}$$

TA represents the total accruals, which is calculated as follows:

Accruals = operating earning-operating derived cash.

NDA indicates non-discretionary liability items, which is calculated by model 6 as follow:

Model (6) :

$$ABACC_{it} = \beta_1 \left(\frac{1}{A_{i,t-1}} \right) + \beta_2 \left(\frac{\Delta REV_{it}}{A_{i,t-1}} \right) + \beta_3 \left(\frac{PPE_{it}}{A_{i,t-1}} \right) + \beta_4 \left(\frac{ROA_{it}}{A_{i,t-1}} \right)$$

ΔREV_{it} = Changes in the company I’s income in the year t

PPE_{it} = Net property, machinery and equipment of the company I in the year t

ROA_{it} - The return on assets of the company I in the year t

$A_{i,t-1}$ = Total assets to participate in the year (t-1).

β_{ijt} - The parameters of the company I in year T, which are estimated for each company through model 7 and based on the observations of the estimated period of the accruals:

Model (7) :

$$TA_{it} = \beta_0 \left(\frac{1}{A_{it-1}} \right) + \beta_1 \left(\frac{\Delta REV_{it}}{A_{it-1}} \right) + \beta_2 \left(\frac{PPE_{it}}{A_{it-1}} \right) + \beta_3 \left(\frac{ROA_{it}}{A_{it-1}} \right) + \epsilon_0$$

The following equation is used to calculate the required coefficients of β_{ijt} , α_{it} under model 8.

After calculating the specific parameters of the company and normal accruals in the estimation period, the equation for discretionary accruals for each company is as follows:

Model (8) :

$$DA_{it} = TA_{it} - \left[\beta_0 \left(\frac{1}{A_{it-1}} \right) + \beta_1 \left(\frac{\Delta REV_{it}}{A_{it-1}} \right) + \beta_2 \left(\frac{PPE_{it}}{A_{it-1}} \right) + \beta_3 \left(\frac{ROA_{it}}{A_{it-1}} \right) \right]$$

3.4. Real-based earning management

In line with previous studies regarding manipulating actual activities [40], the following manipulations of actual activities are examined: Manipulating sales, public, administrative, and organisational costs; manipulating cash flows and surplus production to reduce the cost of sold goods. The abnormal levels of any manipulation of actual activities are measured as the residual estimation pattern. The abnormal level of three criteria of administrative, public, and sales costs, operating cash flows, and production costs for each company and each year are required to identify the companies interested in earning management. For this purpose, three models were selected to estimate the abnormal level of the above criteria (separately by each year and for each industry) as follows:

1. Estimating the abnormal level of administrative, public and sales costs:

Following Anderson, Banker and Janakiraman [52], Model 9 was used to estimate the abnormal level of sales, general, administrative and organisational costs:

Model (9) :

$$\log \frac{SG\&A_t}{SG\&A_{t-1}} = \alpha_1 + \alpha_2 \log \frac{S_t}{S_{t-1}} + \alpha_3 \log \frac{S_t}{S_{t-1}} \times DS_t + \alpha_4 \log \frac{S_{t-1}}{S_{t-2}} + \alpha_5 \log \frac{S_{t-1}}{S_{t-2}} \times DS_{t-1} + \epsilon_{it}$$

SG&A_t = Sales, public, administrative, and organisational costs.

S_t = Net sales.

DS_t = A virtual variable for declining sales, which is equal to one; if S_{j,t} < S_{j,t-1}, i.e. when sales revenue declines between the years t and t-1, it equals one. Otherwise, it is equal to zero.

2. Abnormal surface estimation model of production costs:

Following Roychowdhury [40], the abnormal level of production costs was estimated through model 10 as follow:

Model (10) :

$$\frac{Prod_t}{A_{t-1}} = \alpha_1 + \alpha_2 \frac{\alpha_1}{A_{t-1}} + \alpha_2 \frac{S_t}{A_{t-1}} + \alpha_3 \frac{\Delta S_t}{A_{t-1}} + \alpha_4 \frac{\Delta S_{t-1}}{A_{t-1}} + \epsilon_{it}$$

Prod_t = the cost of sold goods (COGS_{j,t}) + the difference between the first and the end inventory (ΔInventory_{j,t}).

S_t = Net sales.

ΔS_t = T-year sales minus T-1-year sales.

A_{t-1} = Total assets at the end of the t-1 period.

Following Roychowdhury [40], the abnormal level of operating cash flows was estimated by model 11 as follows:

Model (11) :

$$\frac{CFO_t}{A_{t-1}} = \beta_0 \left(\frac{1}{A_{t-1}} \right) + \beta_1 (MV_t) + \beta_2 (Q_t) + \beta_3 \left(\frac{S_t}{A_{t-1}} \right) + \beta_4 \left(\frac{\Delta S_t}{A_{t-1}} \right) + \epsilon_t$$

CFO_t = Operating cash flows of company I in the year t.

MV_t = Corporate market value.

3.5. Independent variables

ACEXP = Financial specialisation of the audit committee's members of the company i in the fiscal year t. The ratio of the number of members of the financial expert in the audit committee to the total number of audit committee members was used.

Size_{it} = Natural logarithm of the book value of total assets of a company I in the fiscal year t,

ACSIZE = = the size of the audit committee of a company I in the fiscal year t, in which the number of members of the audit committee is used.

INCO = the independence of the audit committee's members of the company i in the fiscal year t. The ratio of independent members in the audit committee to the total number of members is used.

3.6. Control variables

Size_{it}: Natural logarithm of the book value of total assets of the company i in fiscal year t,

LEV_{it}: the book value of long-term debt divided by the total book value of the company's assets in the fiscal year t.

ROA_{it}: the return on assets of the company i in the budgetary year t (the ratio of net profit before interest and tax to the total book value of assets),

MB_{it}: Market value to book value of the company's equity I in the fiscal year t,

LnAge_{it}: Natural logarithm of the company I's the age I in fiscal year t,

SG_{it}: sales growth of company I in fiscal year t,

CFO_{it}: Operating cash flows of the company i in the fiscal year t.

3.7. Descriptive statistics

Endogeneity is a potential issue in studies investigating the relationship between Audit Committee Features and Earnings Management. Endogeneity occurs when there is a bi-directional relationship between the independent variable (Audit Committee Features) and the dependent variable (Earnings Management). In other words, companies with higher earnings management may engage more experienced and independent audit committee members, making it difficult to establish a causal relationship between audit committee features and earnings management. To address the issue of endogeneity in this study, we performed the following approaches:

Instrumental Variable (IV) analysis: IV analysis is a statistical technique that can help identify a valid instrument that can be used to address endogeneity. The instrument should be highly correlated with the independent variable (audit committee features) but not directly associated with the dependent variable (earnings management). We used a regulatory change as an instrument for audit committee features, as it may significantly impact the composition of the audit committee but not directly affect earnings management.

We also used Panel data analysis: Panel data analysis allows researchers to control for unobserved heterogeneity across firms by including fixed effects for each firm. This approach can help address the issue of endogeneity as it allows for the identification of the within-firm changes in audit committee features and earnings management over time.

We further used two-stage least squares (2SLS): 2SLS is another statistical technique that can be used to address endogeneity. This approach involves two stages: in the first stage, an instrument is used to estimate the impact of audit committee features on earnings management; in the second stage, the estimated values of audit committee features are used as input in the primary regression analysis.

And finally, we used Propensity Score Matching (PSM): PSM is a statistical technique that matches firms based on similar observable characteristics, such as size, industry, and profitability, and compares their earnings management practices based on the presence of specific audit committee features. This approach can help control for endogeneity by accounting for unobserved heterogeneity across firms (see Table 2).

The descriptive statistics section analysed the data by central indices such as mean, dispersion indices, standard deviation, skewness, and kurtosis. The mean is considered the primary central indicator. It shows the data average so that if the data is arranged on a common axis, the mean value is precisely the equilibrium point or the distribution's centre of gravity. The standard deviation is one of the dispersion parameters and shows the amount of data dispersion. In addition, skewness is considered one of the parameters for determining the deviation from symmetry and is an indicator of data symmetry. If the community has a symmetrical distribution,

Table 2
The category of Tehran stock exchange industries.

Industry	Industry Group	Sub-industries	The number of companies selected in the sample
1	Medicinal	Medicinal materials and products	18
2	Equipment and machinery	Equipment and machinery Machinery and electrical appliances	5
3	Vehicle and parts manufacturing	Vehicle and parts manufacturing	20
4	Mineral	Tiles and ceramics Extracting other mines Metal ores Non-metal ores Cement, lime, and gypsum	28
5	Chemical	Chemical products Rubber and plastic Petroleum products	13
6	Food and drink	Food and beverages other than sugar	9
7	Metal Industries	Metal products Basic metals	17
Total			110

the skewness coefficient equals zero; if the society is skewed to the left, the skewness coefficient will be negative. The skewness coefficient is positive if society is skewed to the right. In addition, kurtosis is an indicator of measuring society dispersion related to normal distribution. A summary of the descriptive statistics is presented in Table 3.

The skewness results in the AEM, ACEXP, MB, and LNAGE variables are negative, indicating that the asymmetric distribution is skewed to smaller values (negative skewness). The social dispersion measurement index is called the kurtosis coefficient of normal distribution. The results indicate that the community's distribution variables are longer than the normal distribution due to the positive kurtosis coefficient in some variables, meaning that the dispersion is less than the normal distribution.

3.8. Empirical results

3.8.1. F-Chow test

The F-Limer test determines whether the model fits with combined, minimum squares, or panel data. The results of testing the first hypothesis show no difference between the estimated coefficients for each section and the estimated collective coefficient. This means that it is unnecessary to estimate the model using panel data. So, the combined data model or the least standard squares are preferable to the fixed-effects model. After performing the F test, the calculated F statistic is compared with the critical value of the F statistic. If the probability of the calculated F statistic is less than 0.05, the null hypothesis is not accepted, and the model needs to be estimated by the panel data method. Table 4 presents the results of the F-Chow test.

According to the results of the Chow test (presented in Table 4), it was found that the statistical value obtained from the Chow test and the probability value obtained from the H_0 hypothesis test is less than 0.05, i.e., the preference for the least common squares method is rejected, and the panel data method is accepted. In other models, the conventional least-squares method was adopted.

3.8.2. Fitness of research model

After confirming the type of models according to the tests, the desired regression model is estimated. Table 5 presents the regression estimation. As mentioned before, it is necessary to test the significance of the whole model before examining the variables and verifying the hypotheses' validity. This is conducted by calculating the F statistic and the probability value of this statistic. Since the p-calculated value for this statistic is less than 0.05, the significance of the whole model is confirmed at the error level of 5 %. The first model examined the relationship between the enumerated characteristics of the audit committee (financial expertise, size, and independence) and accrual earnings management.

The hypotheses of the first group are tested based on the probability value for the 1β coefficient at the error level of 5 % in the model (1). The findings show a meaningful relationship between the financial expertise of the audit committee's members and the accrual earning management. The results further suggest a meaningful relationship between the size of the audit committee and the accrual earning management. According to the probability value for financial expertise ($P = 0.000$) and size ($P = 0.025$), there is a significant relationship between the financial knowledge and the size of the audit committee and the accrual earnings management.

The second model examined the relationship between the financial expertise of the members of the audit committee and the real-based earning management concerning public and abnormal administrative expenses.

The findings show that the probability of financial expertise and real-based earning management in public, abnormal administrative costs is insignificant ($P = 0.233$). Moreover, real-based earning management in abnormal production costs is negligible ($P = 0.910$). Likewise, real-based earning management in abnormal operating cash flows was insignificant ($P = 0.741$). The findings show no meaningful relationship between the financial expertise of the audit committee and real-based earning management in public, abnormal administrative expenses, abnormal production costs and abnormal operating cash flows.

In the third model, the relationship between the financial expertise of the audit committee's members and the real-based earning management in general and abnormal administrative costs are examined. The findings show that the probability value for the size of the audit committee's members and real-based earning management in public, non-average administrative costs are insignificant ($P = 0.685$), for abnormal production costs is also insignificant ($P = 0.235$) and likewise for abnormal operating cash flows is insignificant

Table 3

The descriptive statistics of the study variables.

Variables	Scale	Mean	Deviation	Minimum	Maximum	Median	Skewness	Kurtosis
REMSG	Residual	-0.029	0.972	-2.622	3.269	2.453	0.185	0.530
REMPROD	Residual	0.000	0.087	-0.349	0.349	0.234	0.000	2.078
REMCFO	Residual	0.000	0.086	-0.350	0.350	0.268	0.000	2.304
AEM	Residual	0.307	1.123	-5.501	3.450	0.107	0.036	-2.017
ACEXP	Percentage	50.575	48.182	0	100	66.666	-0.040	-1.947
ACSIZE	People	1.745	1.657	0	5	3	0.096	-1.461
INCO	Percentage	38.575	36.981	0	100	60	0.095	-1.613
SIZE	Logarithm	14.183	1.454	10.671	18.817	13.953	0.894	1.172
ROA	Ratio	0.175	0.166	-0.255	0.674	0.161	0.361	0.215
LEV	Ratio	0.618	0.289	0.089	2.773	0.618	2.680	16.754
MB	Ratio	2.503	5.124	-51.785	29.494	2.238	-5.474	65.677
CFO	Million rials	1026290	3438355	-2499452	24765735	142328	1.338	9.581
SG	Ratio	0.288	0.357	-0.546	2.732	0.292	1.338	9.581
LNAGE	Logarithm	2.359	0.657	0.693	3.688	2.484	-0.028	-0.587

Table 4

The result of the Chow test was performed to select the least common squares method or panel data.

Model	Null Hypothesis (H0)	Test name	Statistics	P-test value	Result
1	The preferred least standard squares method	F-Chow	1.952	0.001	Rejection of the null hypothesis (Panel model is better)
2	The preferred least standard squares method	F-Chow	0.840	0.523	Not rejecting the null hypothesis. (OLS model is better)
3	The preferred least standard squares method	F-Chow	1.012	0.214	Not rejecting the null hypothesis. (OLS model is better)
4	The preferred least standard squares method	F-Chow	2.12	0.024	Rejecting the null hypothesis (Panel model is better)

Table 5

Regression of the types of earnings management on audit committee features.

Name of variable	Model (1) Depended Variable: AEM	Model (2) Depended Variable: REM_SG&A	Model (3) Depended Variable: REM_PROD	Model (4) Depended Variable: REM_CFO
C	0.025 (721/0)	-0.554 (445/0-)	2.021 (243/2)	-2.420* (044/2-)
ACEXP	-4.012*** (010/4-)	0.001 (545/1)	-0.052 (364/0-)	-0.002 (597/0-)
ACSIZE	-0.002*** (067/0)	0.011 (128/0)	-0.025 (860/0-)	-0.045 (414/0-)
INCO	-0.001 (146/0-)	-0.014 (750/1-)	-0.006 (518/1-)	-0.005 (352/0-)
SIZE	0.578 (540/3)	-0.254 (904/0-)	-0.112** (563/2-)	-0.186** (576/2-)
MB	-0.210 (913/1-)	0.100 (299/1)	0.002 (139/0-)	-0.001 (629/1-)
LEV	-0.221 (475/0-)	0.114* (060/2)	-0.256 (224/1-)	0.121 (616/0)
ROA	2.007*** (886/3)	0.541 (654/1)	-1.002*** (660/3-)	1.011*** (681/4)
MV	0.040*** (562/4)	-0.001 (236/1-)	-0.227 (504/0-)	7.845 (240/0)
LNAGE	0.250 (563/1)	0.201** (390/2)	0.052 (637/0)	-0.025 (724/0-)
SG	0.111 (212/2)	-0.078 (567/0-)	0.125 (367/1)	-0.478 (405/2-)
CFO	-0.110*** (015/4-)	0.001** (992/1)	-0.251 (129/0-)	-0.008*** (751/4-)
R ²	19.5 %	3 %	16.6 %	17.1 %
Adjusted R ²	17.8 %	1.5 %	13.5 %	15.6 %
Durbin-Watson statistics	1.86	2.20	1.98	2.06
F statistics	7.452	4.325	5.578	7.24
the p-value of the F statistic	0.000	0.045	0.000	0.000

(P = 0.512), So, the findings suggest no significant relationship between the size of audit committee members and real-based earnings management in public, abnormal administrative expenses, abnormal production costs and abnormal operating cash flows.

In the fourth model, the relationship between the financial expertise of the audit committee’s members and the real-based earning management in public, abnormal administrative expenses is examined. The findings show that the probability of independence of the audit committee’s members and real-based earning management in public, abnormal administrative costs is insignificant (P = 0.098), for abnormal production costs are also insignificant (P = 0.240). Likewise, unusual operational cash is insignificant for natural earnings management in currents (P = 0.624). Moreover, for abnormal operating cash flows is also insignificant (P = 0.624). So, the findings suggest no meaningful relationship between the independence of audit committee members with real-based earning

Table 6

Summary of the test result of research hypotheses.

Number	Hypotheses	Result
1	There is a significant relationship between the financial expertise of the audit committee’s members and the accrual earning management.	Supported
2	There is a significant relationship between the size of the audit committee and the accrual earning management.	Supported
3	There is a significant relationship between the independence of the audit committee and the accrual earning management.	Not supported
4	There is a significant relationship between the financial expertise of the audit committee and the real-based earning management in public, abnormal administrative expenses.	Not supported
5	There is a significant relationship between the financial expertise of the audit committee and the real-based earning management in public, abnormal administrative expenses	Not supported
6	There is a significant relationship between the financial expertise of the audit committee and the real-based earning management in public, abnormal operating cash flows.	Not supported
7	There is a significant relationship between the size of the audit committee and the real-based earning management in public, abnormal administrative expenses.	Not supported
8	There is a significant relationship between the size of the audit committee and the real-based earning management in abnormal production expenses.	Not supported
9	There is a significant relationship between the size of the audit committee and the real-based earning management in the operating cash flows.	Not supported
10	There is a significant relationship between the independence of the audit committee and the real-based earning management in public administrative expenses	Not supported
11	There is a significant relationship between the independence of the audit committee and the real-based earning management in the production expenses	Not supported
12	There is a significant relationship between the independence of the audit committee and the real-based earning management in the operating cash flows.	Not supported

management in public, abnormal administrative expenses, abnormal production costs and abnormal cash flows. Table 6 presents the results of all hypotheses.

We proposed three main hypotheses in the 'Literature Review and Hypotheses Development' section (H1, H2 and H3). However, in the 'Research Methodology' section (3.2. Hypotheses testing models), we classified three main hypotheses into two general groups as follows:

Group 1 Examining all three hypotheses in accrual earnings management.

Group 2 Examining all three hypotheses in real earnings management at three levels of sales, general and administrative costs, production costs and operating cash flows".

In other words, we have a total of 12 hypotheses (three based on accrual earnings and nine based on real earnings at three levels of sales, general and administrative costs, production costs and operating cash flows). All 12 hypotheses are already tested in the paper, and Table 6 summarises the results. So, we are showing all 12 hypotheses in Table 6 again.

The differential impact of audit committee members' financial expertise and the audit committee's size on accrual earnings management versus real-based earnings management can be attributed to the nature of these two types of earnings management and the mechanisms (1. Accrual Earnings Management and 2. Real-Based Earnings Management) through which they are influenced as discussed below:

Accrual earnings management involves manipulating accounting estimates, provisions, and accruals to influence reported earnings without directly affecting cash flows or actual business operations. In this context, the financial expertise of audit committee members becomes crucial. Members with financial expertise possess a deeper understanding of accounting principles, financial reporting standards, and the complexities of accrual accounting. Their knowledge allows them to scrutinise financial statements more effectively, identify potential manipulations, and challenge management decisions related to accounting estimates and accruals [34]. As a result, having financially knowledgeable audit committee members can act as a strong deterrent against accrual earnings management.

The audit committee's size also plays a role in controlling accrual earnings management. A larger committee brings diverse perspectives and insights into the financial oversight process. With multiple members contributing their expertise and opinions, the chances of detecting and preventing earnings manipulation through accruals are increased. Moreover, a larger audit committee tends to have greater authority and independence, providing them with the necessary power to challenge management decisions and maintain objectivity [1,3,8].

Real-based earnings management involves manipulating business activities, such as sales, production costs, and cash flows, to achieve specific financial reporting outcomes. Unlike accrual-based manipulation, it is not as closely tied to accounting estimates and provisions, making it more challenging to detect through financial expertise alone. Real earnings management might involve strategic decisions, sales tactics, or production adjustments, and these actions might not be directly reflected in the financial statements in a straightforward manner [40].

As a result, the financial expertise of audit committee members may not be as influential in detecting or preventing real-based earnings management. The complexities of actual business operations often require industry-specific knowledge and understanding of the company's business model, market dynamics, and competitive landscape, which may not be solely within traditional financial expertise.

Similarly, the audit committee's size might not significantly impact real-based earnings management because detecting actual manipulation often involves deeper investigation and information that cannot be easily achieved through a larger committee's presence alone.

In summary, the influence of audit committee features on earnings management varies depending on the type of manipulation involved. The financial expertise of committee members and the committee's size can effectively address accrual earnings management due to their focus on accounting estimates and accruals. However, real-based earnings management involves more intricate and diverse factors, making it less susceptible to traditional financial expertise and committee size. To mitigate both types of earnings management effectively, companies may need to adopt a combination of strategies, including diverse expertise on the audit committee, strong corporate governance practices, and a robust internal control environment.

4. Summary and conclusion

This study offers a novel contribution to the literature by exploring the relationship between audit committee features and earnings management in a comprehensive manner. It divides earnings management into two distinct groups: accrual and real earnings management, and examines this relationship at various levels of sales, general and administrative costs, production costs, and cash flow operation. The findings shed light on the mixed results reported in past research. Notably, the study reveals that the financial expertise and size of the audit committee influence accrual earnings management, but no significant relationship is found between audit committee features and real-based earnings management. The separation of earnings management into these two categories appears to be a critical factor in explaining the inconsistencies in prior studies. The practical implications of this research provide valuable guidance to investors and stakeholders, enabling them to distinguish between 'accrual' and 'real' earnings management and emphasising the importance of audit committee features in curbing opportunities for earnings manipulation. The study's originality lies in its unique approach of dividing earnings management into distinct categories and addressing potential reasons for the mixed results found in the existing literature.

By identifying the features of audit committees that impact earnings management, stakeholders can better protect their interests.

Though the data is limited to companies listed on the Tehran Stock Exchange, this study encourages further research to validate the findings in other countries. Establishing an efficient and robust audit committee ensures quality financial reporting and prevents earnings manipulation.

The results confirm that the audit committee can monitor the process and quality of financial reporting and evaluate internal control systems and fraud risk management. This study shows that establishing an efficient and robust audit committee along with internal and independent audits increases audit quality and helps management improve the organisation's leadership with valuable recommendations.

The findings can help stakeholders protect the earnings in financial statements that are the primary concern of investors, creditors, financial analysts, and other users who make decisions based on reported financial statements. The findings identify the features of audit committees that are affecting earning management. Therefore, the audit committee should ensure that management pays attention to long-term results and looks after the interests of all stakeholders. In addition, the audit committee can help minimise mismanagement risk. In general, the audit committee can take the necessary steps to minimise the risk of mismanagement. Given that the data are from one country (companies listed on the Tehran Stock Exchange), this could be considered a limitation for generalising the findings. Further studies are suggested in other countries to see if the results can be generalised.

Utilizing data sourced from the Tehran Stock Exchange (TSE) through official channels and relying on audited financial statements and board reports provides a robust foundation for research; however, it's imperative to recognize its inherent constraints. These encompass potential inaccuracies despite reputable origins, potential gaps or undisclosed information in financial records, the limitation of quarterly or annual reports in capturing real-time fluctuations, the risk of introducing bias through the omission of non-TSE entities or undisclosed data, the potential impact of restricted sample size on the broader applicability of findings, the possible oversight of industry-specific intricacies, the potential neglect of more general economic forces, the influence of evolving regulations on data comparability, variations in audit quality that might overlook financial irregularities, the impact of fluctuating exchange rates on metrics, the potential omission of non-financial determinants, the limited reflection of significant external events in financials, the role of underlying assumptions and models in shaping outcomes, the intricate and variable nature of financial interpretation, and the absence of qualitative context. Bearing these limitations when formulating and engaging in discussions concerning conclusions drawn from this research is essential.

Data availability statement

Data can be purchased via the TSE website at:

<https://mabnadp.com/products/rahavard365>.

The relevant data is called 'rahavard-novin' and is available under the 'products' category and can be accessed at:

<https://mabnadp.com/products/rahavard-novin>.

However, due to the government policy and imposed internet access restrictions, residents outside Iran have limited or no access to many financial institutions, such as banks and their financial statements. Codal (<https://codal.ir/>) is another website that sells the financial information of companies listed in TSE but may not be accessible from overseas.

CRedit authorship contribution statement

Farzaneh Nassir Zadeh: Supervision, Formal analysis, Data curation, Conceptualization, Writing – original draft, Writing – review & editing. **Davood Askarany:** Writing – review & editing. **Ali Shirzad:** Validation, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Writing – original draft. **Mahdi Faghani:** Supervision, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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