Journal of Risk Analysis and Crisis Response, 2024, 14(1), 1-26
https://jracr.com/
ISSN Print: 2210-8491
ISSN Online: 2210-8505

Article

The Effect of Audit Committee Expertise on Audit Quality: Empirical Evidence from Bangladesh

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Received: November 30, 2023; Received in revised form: January 9, 2024; Accepted: January 11, 2024; Available online: March 31, 2024

Abstract: The purpose of this study is to examine the effects of diverse expertise types on audit quality, providing valuable insights for corporate governance and enhancing the audit process. This research uses 651 firm-year observations for 2001-2021 year. This research applies Breusch-Pagan LM, Pesaran Scaled LM, Bias-corrected Scaled LM, and Pesaran CSD test to check the cross-sectional dependency of the series. The study uses second generation panel unit root tests to check the stationary of the variables. After applying the panel cointegration test, this study uses the long run estimation model and robustness checking to examine the relationship. The findings reveal that financial, accounting, and non-accounting expertise all positively and significantly affect audit quality, suggesting that audit committees with diverse expertise can effectively enhance the audit process. This study finds single causal indicating that audit committee expertise improves audit quality. This study emphasizes the importance of incorporating experts from various backgrounds on audit committees to improve audit quality and increase stakeholder confidence in financial statements. This study implies that companies must focus on the expertise on the audit committee during the appointment of the members to maintain the quality of audit reports. This research is unique to the existing literature on audit committee expertise and audit quality by examining the influence of accounting and non-accounting expertise types in Bangladesh context and providing empirical evidence in support of the agency theory.

Keywords: Audit Committee; Audit Quality; Corporate Governance; Big 4; Digital Auditing

1. Introduction

In recent years, many capital market regulators and scholars have become aware of audit committees and audit quality [1]. The primary responsibility of audit committee is to oversee financial reporting methods to assure accurate reporting of company performance. Audit committees and audit quality have been at the core of both recent academic research and financial market authority attention [2, 3]. Establishment of proper corporate governance mechanisms is essential for the optimal application of resources, enhancement of responsiveness, transparency and protecting the rights of the stakeholders [4].

The primary purpose of a company's audit committee is to provide oversight of the financial reporting process, the audit process, the company's system of internal controls and compliance with laws and regulations [5]. The audit committee can expect to review significant accounting and reporting issues and recent professional and regulatory pronouncements to understand the potential

impact on financial statements. An understanding of how management develops internal interim financial information is necessary to assess whether reports are complete and accurate [6]. The committee reviews the results of an audit with management and external auditors, including matters required to be communicated to the committee under generally accepted auditing standards. Controls over financial reporting, information technology security and operational matters fall under the purview of the committee. The audit committee is responsible for the appointment, compensation, and oversight of the work of the auditor [2, 7, 8]. Thus, it is mandatory to have experts on the audit committee.

While auditors play a role in the quality of financial reporting, the associations observed in prior research settings between audit committee financial expertise and higher-quality financial reporting could reflect actions and attitudes of management, especially because management is responsible for the financial reporting process and the related control environment [9, 10]. In this study, we complement prior research by examining whether greater audit committee accounting expertise and non-accounting expertise help to promote audit quality by encouraging auditors to detect and report existing or likely internal control material weaknesses and by safeguarding auditors from dismissal following adverse internal control opinions.

It is time to digitize the way we deliver audit through automation and innovation [4]. There are exciting new technologies to help capture data, automate procedures, analyze information, and focus on the real risks. There is also a great ecosystem of auditing tool vendors that make technology available and accessible to all. The opportunity is in understanding how technology can help and then applying it to our auditing challenges [11]. So far, investment in technology across the profession has largely been focused on developing and using tools to automate and enhance existing processes, such as data analytics and collaboration and sharing tools, which help to drive quality in audits today. While this will remain core to the role of technology in the audit, as we look further ahead, there are many opportunities where more advanced technologies such as AI and drones could have an even bigger impact [4, 11, 12]. Such technologies may also play a role in evolving the scope of the audit (eg, in using data analytics and machine learning to help identify fraud) [2, 7].

Audit quality plays a crucial role in maintaining the integrity and reliability of financial information [13, 14]. It is an essential component of corporate governance that provides confidence to stakeholders and ensures that firms are operating transparently and ethically. In recent years, regulatory bodies and researchers have focused on improving audit quality in response to high-profile financial scandals and corporate collapses. One aspect of audit quality that has attracted significant attention is the expertise of audit committee members [6]. In Bangladesh, a developing country with a rapidly growing economy, the need for strong corporate governance and audit quality is increasingly important [8]. The country has made significant progress in the field of corporate governance, but there is still much work to be done. This study aims to investigate the relationship between audit committee expertise and audit quality in the context of Bangladesh, providing empirical evidence that can help inform policy decisions and improve corporate governance practices in the country.

Audit committees play a vital role in overseeing the financial reporting process and ensuring that external audits are effective [15, 16]. As such, the expertise of audit committee members is crucial in achieving high audit quality. Previous studies have suggested that audit committee members with financial and industry expertise contribute to improved audit quality by enhancing the committee's

ability to monitor and evaluate the work of external auditors, identify risks, and address potential issues in financial reporting [3, 9, 15-18]. The corporate governance landscape in Bangladesh has evolved over the years, with the introduction of the Bangladesh Securities and Exchange Commission (BSEC) Corporate Governance Guidelines in 2006, which were subsequently revised in 2012 and 2018. These guidelines emphasize the importance of having independent and knowledgeable audit committee members [19]. They require that audit committees have at least one member with financial expertise and relevant industry experience. Despite these guidelines, there is still a considerable variation in the expertise of audit committee members among listed companies in Bangladesh.

Previous research on the relationship between audit committee expertise and audit quality has predominantly been conducted in developed countries [3, 5, 6, 9, 13-15, 17, 20]. While these studies provide valuable insights, the unique context of Bangladesh, with its emerging market characteristics, regulatory environment, and corporate governance challenges, necessitates further exploration. Additionally, the limited research available in the context of Bangladesh has primarily focused on audit committee independence, rather than the expertise of its members [8]. This study aims to fill this gap by examining the effect of audit committee expertise on audit quality in Bangladesh, providing much-needed empirical evidence to inform policy and practice. This research seeks to investigate the relationship between audit committee expertise and audit quality in the context of Bangladesh by analyzing a sample of listed companies. The findings of this study will not only contribute to the growing body of literature on audit quality and corporate governance in emerging markets but also have practical implications for regulators, policymakers, and firms in Bangladesh. By shedding light on the importance of audit committee expertise, this study can help improve corporate governance practices, strengthen the financial reporting process, and ultimately enhance investor confidence in the Bangladeshi capital market.

The remaining sections include section 2 discusses literature review, section 3 outlines the methodology, section 4 presents the results and discussions, section 5 shows the robustness of the findings, and section 6 presents the conclusions.

2. Literature Review

2.1. Auditing in the Context of 4th Industrial Revolution

With industry 4.0, modern automation systems, data exchange, and production technologies are being used intensively [11]. Audit activities should also keep up with Industry 4.0 [7]. Due to technology-driven change in the industry, an audit structure based on automation occurs in enterprises. Technology is a very important part of many controls [2]. With the fourth industrial revolution, auditors are also strongly influenced by automation. Technology is a necessary tool for auditors, as well as enhancing the efficiency and effectiveness of the audit process. Nowadays technology-enabled auditing is spreading rapidly, and due to the use of automatic audit tools, audits are becoming easier, more effective, and more efficient [12]. The use of automation tools in auditing activities may also bring about institutionalization and standardization [4, 12].

When historical industrial revolutions are examined in general, there has been a shift from mechanical and manual audits to digital audits [10]. In the past, auditing had a highly manual and human-focused structure. Auditors often tried to examine, conceptualize, and audit systems using manual methods. It has been seen that audit methods have had to be changed because manual control

processes are insufficient for auditing complex production processes and business activities. Instead of traditional audits, technology-driven instant audits are now being carried out, instant assurance can be obtained because of instant audits [7]. Currently, the application of technology-based audit techniques eliminates the problems and negativity of manual control methods. Automatic auditing is rapidly spreading with audit software [2].

Computer assisted audit tools and techniques particularly increase audit efficiency and effectiveness [3, 9]. Also, successful adoption of generalized audit software (GAS) by internal auditors would help broaden the development of the technologies in audit activities [2, 7]. In the Industry 4.0 environment, audit personnel can provide digitalized services such as continuous auditing, continuous monitoring, and anomaly detection [3]. Continuous auditing is implemented in non-written, real-time accounting systems, and is aimed at assessing whether the presented financial statements reflect the truth. It refers to bringing together audit evidence in the electronic environment [9].

Appelbaum, Kogan [11] and Rahman [21] examined the influence of business analytics on managerial accounting, emphasizing the role of advanced data analysis in informing and improving financial decision-making processes. The study provides insights into how auditors can leverage business analytics to enhance their ability to identify risks, detect anomalies, and provide valuable feedback to management. In the context of big data, Brown-Liburd, Issa [7] explored the behavioral implications of big data's impact on auditors' judgment and decision-making processes. Their study underscores the need for auditors to adapt to the challenges and opportunities presented by the increasing availability and complexity of data, as well as the potential for future research to better understand the implications of big data on the auditing profession.

Cao, Chychyla [2] investigated the potential applications of big data analytics in financial statement audits. They discussed the potential benefits and challenges associated with incorporating big data analytics into the auditing process, emphasizing the need for auditors to develop new skills and competencies to effectively utilize these advanced technologies. Considering the evolving landscape of financial reporting, Janvrin, Pinsker [12] conducted a study on the impact of different financial statement formats, including XBRL-enabled, spreadsheet, and paper formats, on auditor performance and preference. Their research highlights the importance of understanding the implications of new reporting technologies, such as XBRL, on the auditing profession.

Krahel and Titera [10] discussed the potential consequences of big data and formalization on accounting and auditing standards. Their study highlights the need for standard-setters and regulatory bodies to adapt to the changing technological landscape to ensure that accounting and auditing standards remain relevant and effective. Lastly, Vasarhelyi, Alles [4] examined the factors influencing the acceptance and adoption of continuous auditing practices by internal auditors. Their research sheds light on the potential benefits and challenges associated with the implementation of real-time auditing technologies, which can help improve the efficiency and effectiveness of the auditing process. While these studies may not specifically focus on Bangladesh, they provide valuable insights into the impact of advanced technologies on the auditing profession globally. By reviewing this literature, researchers and practitioners can gain a deeper understanding of the challenges and opportunities associated with the integration of Fourth Industrial Revolution technologies into auditing practices and apply these insights to the unique context of Bangladesh.

2.2. Audit Quality and Audit Committee Expertise

Audit quality can be defined as a process of detecting and reporting material misstatement [22]. DeFond and Zhang [23] extended the definition of audit quality beyond the simple detection of accounting standard violations to include showing how faithfully financial statements reflect firms' underlying economics. It is difficult to assess audit quality ex-ante because the amount of assurance provided by auditors is unobservable. The only observable outcome of the audit process is a common form of audit reports, and most of these reports are standard clean opinions [24].

The level of audit fees is widely used in high-profile studies as an indication of audit quality. A high level of audit fees implies higher audit quality [24]. Furthermore, Cadbury [25] reports warn against the likelihood that audit quality might be compromised by low fees. Al-Khaddash, Al Nawas [26] recommended that Bangladeshi companies should offer high fees as an incentive for auditors to be satisfied and to enable them to do better work. They argue that if an auditor who received high fees delivers poor audit quality, he would lose face and feel shame. This argument is also supported by Alhababsah and Nahar [27], who acknowledges the relevance of audit fees level as a measurement of audit quality in Jordan. Alhababsah and Nahar [27] reached this conclusion based on responses from 199 members of boards of directors, ACs, and auditors.

Many prior empirical studies support the view that the Big-4 audit firms provide higher quality audits [22, 24]. Big-4 audit firms have the ability and incentive to deliver a high audit quality because they have greater reputations to protect (Francis, 2004). When these audit firms have 'more to lose' from supplying a lower-than-promised level of audit quality, clients properly use size as a quality surrogate [22, 24, 28]. Moreover, Big-4 audit firms have adequate human and technology resources which increase their ability to do more intensive and powerful audit tests. Finally, Big-4 audit firms are more independent of their client [22] and have a higher standard control system [24, 28].

Recent reforms of the audit legal framework in Bangladesh have substantially altered the requirements concerning audit committee expertise. The Bangladesh securities and exchange commission mandate that directors who belong to the audit committee should possess the expertise and their dedication to the committee has to be enough to develop their functions. DeFond and Zhang [23] discuss the role of audit committees in their revised audit quality framework emphasizing their role in helping audit clients achieve their desired levels of audit quality. Specifically, DeFond and Zhang [23] note the increased emphasis on audit committee independence and expertise is designed to "increase client demand for audit quality" (p. 306). This motivates us to investigate whether audit committee expertise impacts one aspect of audit quality e the level of audit demand as represented by audit fees.

Experience and expertise of audit committee members in that role is also an important aspect of audit committee effectiveness in overseeing the financial reporting process. Vafeas and Waegelein [29] argue that governance expertise is important in maintaining audit quality and document a positive and significant association between governance expertise and audit fees. The expertise and experience can be financial experts, accounting experts, and non-accounting experts. In terms of broader audit committee research, studies seem to provide some empirical support for the value of having financial experts on audit committees. Abbott, Parker [30] and Agrawal and Chadha [31] find that firms with financial experts on audit committees are less likely to experience financial reporting restatements. Furthermore, Bedard, Chtourou [32] find that the presence of at least one financial expert on the audit committee is negatively associated with aggressive earnings management.

2.3. Theoretical Background

The theoretical foundation of this study lies in Agency Theory, a well-established framework in corporate governance and auditing research [33]. Agency Theory explains the relationship between principals (shareholders) and agents (managers or directors) and examines the potential conflicts of interest arising from the separation of ownership and control [34]. In the context of auditing, shareholders rely on auditors to provide an independent and objective assessment of the company's financial statements, ensuring that management is acting in the best interests of shareholders. This research aims to investigate the impact of audit committee expertise on audit quality, as measured by audit fees, the presence of Big 4 firms, and digital auditing, in the context of Bangladesh [35]. The importance of this study lies in its potential contribution to the understanding of the role of audit committee expertise in ensuring audit quality and mitigating agency conflicts. By examining the impact of audit committee expertise on audit quality in the context of Bangladesh, the research can provide empirical evidence to inform policy decisions, improve corporate governance practices, and ultimately enhance investor confidence in the Bangladeshi capital market [36].

Agency Theory suggests that the role of an audit committee is to mitigate agency problems and protect shareholders' interests by overseeing the financial reporting process and ensuring the effectiveness of external audits [37]. Audit committee expertise, in terms of financial, accounting, and industry knowledge, is considered crucial for effective monitoring and evaluation of the external audit process [35]. The underlying assumption is that audit committees with greater expertise are better equipped to identify risks, address potential issues in financial reporting, and assess the overall financial health of a company [34]. By applying Agency Theory, this study seeks to examine how the different dimensions of audit committee expertise influence audit quality. The research will investigate the relationships between the presence of a financial expert, an accounting expert, and a non-accounting expert on the audit committee and audit quality indicators, such as audit fees, the presence of Big 4 firms, and digital auditing practices.

2.4. Hypothesis Development

Abbott, Parker [30] found that companies with financial experts on their audit committees were less likely to experience financial reporting restatements, indicating higher audit quality. Similarly, Carcello and Neal [38] reported that firms with financial experts on their audit committees were more likely to dismiss auditors following new going-concern reports, suggesting a stronger commitment to audit quality. Defond, Hann [14] discovered that the market values financial expertise on audit committees, as evidenced by a positive association between financial experts on the committee and firm value. This finding implies that financial experts play a crucial role in enhancing audit quality. Dhaliwal, Naiker [3] also reported a positive relationship between financial expertise on audit committees and accruals quality, further supporting the positive association between financial experts and audit quality.

Krishnan [20] found that audit committees with financial experts were associated with better internal control quality, which is an essential component of audit quality. Xie, Davidson Iii [39] demonstrated that the presence of financial experts on audit committees helps reduce earnings management, thereby improving audit quality. Lastly, Inaam and Khamoussi [6], through a meta-analysis, found that audit committee effectiveness, which includes the presence of financial experts, is positively related to audit quality, and negatively related to earnings management. Nonetheless, most of these studies have focused on developed countries, leaving a gap in our understanding of this relationship in emerging markets, such as Bangladesh. Agency Theory suggests that financial experts

on audit committees can help mitigate agency conflicts by providing effective oversight and monitoring of the financial reporting process. However, there is a lack of empirical evidence on how financial expertise on the audit committee may influence the implementation of digital auditing practices and the selection of Big 4 firms as auditors in the context of Bangladesh.

Hypothesis 1: In the context of Bangladesh, the presence of a financial expert (FEX) on the audit committee is positively associated with audit quality (AF, BF, DA).

Bedard, Chtourou [32] found that audit committee expertise, which includes accounting expertise, is negatively associated with aggressive earnings management, suggesting a positive relationship with audit quality. Krishnan and Visvanathan [18] examined the SOX definition of an accounting expert and found that audit committee directors with accounting expertise were associated with higher accounting conservatism. This finding indicates that accounting experts contribute to enhanced audit quality.

Naiker and Sharma [40] discovered that former audit partners on the audit committee, who possess accounting expertise, are associated with a lower likelihood of internal control deficiencies. This result suggests that accounting experts on the audit committee contribute to improved audit quality by ensuring robust internal controls. Sharma and Iselin [16] found that the presence of multiple-directorships and longer tenure for audit committee members, including those with accounting expertise, is associated with a lower likelihood of financial misstatements. This finding indicates that accounting experts on audit committees play a crucial role in maintaining audit quality.

Although Chen, Lin [13] primarily focused on the impact of audit partner and audit firm tenure on earnings quality, their study also highlights the importance of accounting expertise in audit committees for ensuring the quality of financial reporting. These disparities in the literature imply that the relationship between accounting expertise and audit quality may depend on the specific context. Moreover, there is a limited number of studies examining the impact of accounting expertise on audit quality in emerging markets like Bangladesh. Additionally, little research has been conducted on how accounting expertise on the audit committee may affect the selection of Big 4 firms and the adoption of digital auditing practices in Bangladesh.

Hypothesis 2: In the context of Bangladesh, the presence of an accounting expert (AEX) on the audit committee is positively associated with audit quality (AF, BF, DA).

Dhaliwal, Naiker [3] examined the association between accruals quality and the characteristics of accounting experts and mix of expertise on audit committees. They found that a diverse mix of expertise, which may include non-accounting experts, is associated with better accruals quality, suggesting a positive impact on audit quality. Gendron, Be´dard [17] conducted a field study to investigate practices in "effective" audit committees. Their findings revealed that a variety of factors contribute to audit committee effectiveness, including the presence of diverse expertise on the committee. This implies that the presence of non-accounting experts on audit committees, combined with accounting and financial experts, may contribute to better audit quality.

Krishnan and Visvanathan [18] explored the association between audit committee directors' accounting expertise and accounting conservatism. While their primary focus was on accounting expertise, their study also acknowledged the importance of a diverse mix of expertise on audit committees to ensure high audit quality. Additionally, the potential influence of non-accounting expertise on the audit committee regarding the selection of Big 4 firms and the adoption of digital auditing practices remains mostly unexplored. Drawing on the findings from these studies, which

emphasize the importance of a diverse mix of expertise in audit committees, the following hypothesis can be proposed:

Hypothesis 3: The presence of a non-accounting expert (NAX) on the audit committee is positively associated with audit quality.

3. Methodology

In this section, the study explains the data, data coverage period, variables and their sources, and econometric model.

3.1. Data and Variables

The study employed a quantitative research approach using a balanced panel of 31 pharmaceutical and chemical companies listed on the Dhaka Stock Exchange (DSE) in Bangladesh, spanning a period of 21 years (2001-2021), resulting in a total of 651 firm-year observations. The variables used in this research are presented in Table 1, and all the data were collected from publicly available secondary sources. The study focuses on pharmaceutical and chemical companies in Bangladesh as the appropriate sample for several reasons. These industries are highly regulated and subject to stringent compliance requirements, including rigorous auditing and financial reporting standards, making them an ideal setting for examining the impact of audit committee expertise on audit quality [41]. Furthermore, the complexity of business operations, financial transactions, and accounting practices in these sectors highlights the importance of having audit committees with the necessary expertise to effectively monitor and ensure the quality of financial reporting [9, 27]. Additionally, the pharmaceutical and chemical industries play a significant role in the Bangladesh economy, with their financial and environmental performance and transparency impacting investor confidence and overall market stability [42]. By focusing on these industries, the study can provide valuable insights into the role of audit committee expertise in enhancing audit quality and promoting good corporate governance practices [8, 41]. Lastly, this choice enables the research to contribute to the existing literature by offering empirical evidence from an emerging market context, which has been underrepresented in previous studies, broadening the understanding of the relationship between audit committee expertise and audit quality across different institutional settings and market environments [3, 9, 13, 15].

Audit quality is the main dependent variable which is proxied by audit fees (AF), big four audit firms (BF), digital auditing (DA). AF is the log of fees of audit services scaled by total assets. BF is the Big 4 audit firms that is measured as a dummy variable, where a company is equal to "1" if its auditor is one of the Big 4 audit firms, and "0" otherwise). Big 4 firms are Deloitte, Ernst & Young (EY), KPMG, and PricewaterhouseCoopers (PwC). DA is the digital auditing where automatic auditing is rapidly spreading with audit software. DA is measured as a dummy variable, where a company is equal to "1" if it is using technology-driven instant audits, and "0" otherwise).

Audit committee expertise is the main independent variable which is proxied by financial experts (FEX), accounting experts (AEX), and non-accounting experts (NAX). FEX is the % of financial experts of audit committee members. AEX is the % of accounting experts of audit committee members. NAX is the % of non-accounting experts of audit committee members.

The study uses audit committee size (ACS), audit committee meeting (ACM), audit committee independence (ACI), board size (BS), board meeting (BM), board independence (BI), leverage (LEV), and ROA to control the relationship between audit quality and audit committee expertise. Audit

committee size (ACS) is measured as log of the number of audit committee members participated in a year. Audit committee meeting (ACM) is measured as log of the number of audit committee meetings held in a year. Audit committee independence (ACI) is measured as the percentage of independent directors of the audit committee. Board size (BS) is measured as log of the number of board members participated in a year. Board meeting (BM) is measured as log of the number of board meetings held in a year. Board independence (BI) is measured as the percentage of independent directors of the board. Leverage (LEV) is the percentage of total debt to total assets in a year. ROA is the return on asset in a year.

Table 1. Measurement of variables.

Variables	Symbols	Measurement	Sources
Dependent Variables			
Audit Quality	AF	AF is the log of fees of audit services scaled by total assets.	[1, 6, 9, 15]
	BF	BF is the Big 4 audit firms that is measured as a dummy variable, where a company is equal to "1" if its auditor is one of the Big 4 audit firms, and "0" otherwise). Big 4 firms are Deloitte, Ernst & Young (EY), KPMG, and PricewaterhouseCoopers (PwC).	[1, 6, 9, 15]
	DA	DA is the digital auditing where automatic auditing is rapidly spreading with audit software. DA is measured as a dummy variable, where a company is equal to "1" if it is using technology-driven instant audits, and "0" otherwise).	[4, 6, 9, 12, 15]
Independent Variables			
Audit Committee Expertise	FEX	FEX is the % of financial experts of audit committee members.	[9, 14, 20, 30]
	AEX	AEX is the % of accounting experts of audit committee members.	[9, 15, 18]
	NAX	NAX is the % of non-accounting experts of audit committee members.	[9]
Control Variables			
Audit Committee Size	ACS	Audit committee size (ACS) is measured as log of the number of audit committee members participated in a year.	[3, 20, 30]
Audit Committee Meeting	ACM	Audit committee meeting (ACM) is measured as log of the number of audit committee meetings held in a year.	[3, 16, 30]
Audit Committee Independence	ACI	Audit committee independence (ACI) is measured as the percentage of independent directors of the audit committee.	[5, 6, 8, 19, 20, 30]
Board Size	BS	Board size (BS) is measured as log of the number of board members participated in a year.	[3, 16, 40]
Board Meeting	BM	Board meeting (BM) is measured as log of the number of board meetings held in a year.	[8, 18, 19, 40]
Board Independence	BI	Board independence (BI) is measured as the percentage of independent directors of the board.	[3, 8, 18, 19, 40]
Leverage	LEV	Leverage (LEV) is the percentage of total debt to total assets in a year.	[8, 16, 18, 19, 40]
Return on asset	ROA	ROA is the return on asset in a year.	[1, 4, 6, 43]

Source: Author's development.

3.2. Model Specification

In this study, the main objective is to examine the effect of audit committee expertise on audit quality. Essentially, this study specifies the following empirical model (Equation 1) as per existing studies [44, 45]:

$$\text{Audit Quality}_{it} = C + \beta_1 Audit\ Committee\ Expertise_{it} + \sum_{c=1}^{C} \beta_c Y_{it}^{c} + \epsilon_{it} \quad (1)$$

Where i and t subscripts stand for the company and year, respectively. This study uses the audit quality as the dependent variable in different specifications. The study uses audit fees (AF), big 4 audit firms (BF), and digital auditing (DA) as the proxies of audit quality. The audit committee expertise is the independent variable that is proxied by financial experts (FEX), accounting experts (AEX), non-accounting experts (NAX). C is a constant term. Y_{it} with superscripts c are the vectors of control variables, and ϵ_{it} is the error term. Detailed definitions and data sources of the variables are presented in Table 1.

This paper uses three measures for audit quality and three measures for audit committee expertise that can be re-written in Equation 1.1, Equation 1.2, and Equation 1.3 as follows:

$$AF_{it} = C + \beta_1 FEX_{it} + \beta_2 AEX_{it} + \beta_3 NAX_{it} + \sum_{c=1}^{C} \beta_c Y_{it}^{c} + \epsilon_{it}, \quad (1.1)$$

$$BF_{it} = C + \beta_1 FEX_{it} + \beta_2 AEX_{it} + \beta_3 NAX_{it} + \sum_{c=1}^{C} \beta_c Y_{it}^{c} + \epsilon_{it}, \quad (1.2)$$

$$DA_{it} = C + \beta_1 FEX_{it} + \beta_2 AEX_{it} + \beta_3 NAX_{it} + \sum_{c=1}^{C} \beta_c Y_{it}^{c} + \epsilon_{it}, \quad (1.3)$$

Here, Audit fees is indicated by AF, big 4 audit firms are indicated by BF, digital auditing is indicated by DA, financial expert is indicated by FEX, accounting expert is indicated by AEX, and non-accounting expert is indicated by NAX.

This study employs a comprehensive step-by-step econometric modeling approach to thoroughly analyze the relationships between variables as per existing studies [44, 45] (refer to Figure 1). The analysis process can be broken down into several key stages:

- **Cross-sectional Dependency Testing**: The study first examines the presence of cross-sectional dependency by employing a range of tests, including the Breusch-Pagan LM, Pesaran Scaled LM, Bias-Corrected Scaled LM, and Pesaran CSD. The results indicate the existence of cross-sectional dependency among the variables.
- **Stationarity Assessment**: To ensure the reliability of the subsequent analyses, the study establishes the stationarity of the variables using second-generation unit root tests, specifically the Cross-sectional Augmented Dickey-Fuller (CADF) and Cross-Sectional Augmented CIPS tests.
- **Long-run Cointegration Testing**: Upon confirming the stationarity of the variables, the study proceeds to verify the long-run cointegration between them using the second-generation Westerlund's test. This assessment is crucial in determining whether a long-term equilibrium relationship exists among the variables.

- **Long-run Relationship and Causality Analysis**: With the confirmation of long-run cointegration, the study delves into examining the long-run relationships between the variables using the dynamic ordinary least squares model (DOLS). Furthermore, the causal relationships among the variables are also investigated.
- **Robustness Check**: To ensure the validity and reliability of the findings, the study conducts robustness checks by employing alternative estimation techniques, such as the fully modified ordinary least squares model (FMOLS) and the two-step system Generalized Methods of Moments (GMM).

By following this rigorous econometric modeling approach, the study aims to provide a comprehensive and robust understanding of the relationships between audit quality, audit committee expertise, and the various control variables.

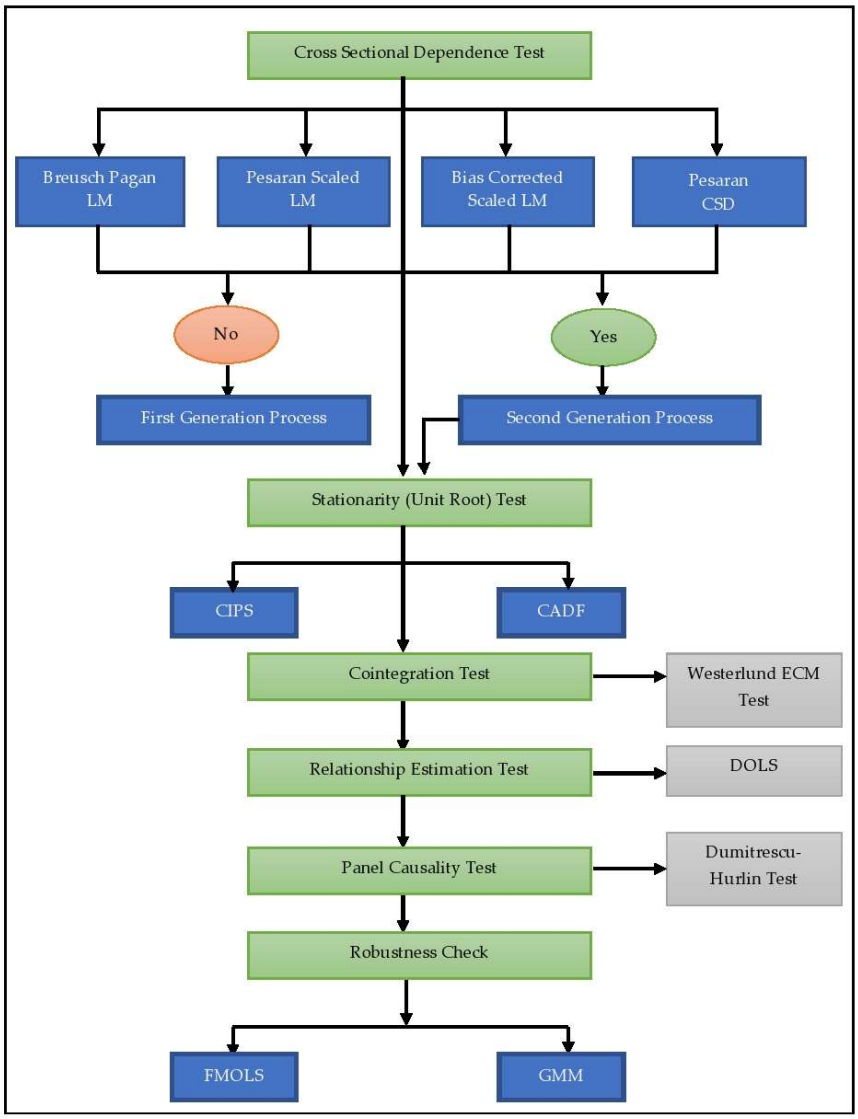

Figure 1. Econometric approach (Source: Developed by the authors).

4. Results and Discussions

4.1. Summary Statistics and Correlation Matrix

The summary statistics (see Table 2) show that the distribution of audit fees (AF) is relatively symmetric with a considerable average value, indicating that companies generally incur significant costs for audit services. A notable proportion of companies engage Big Four audit firms (BF), as reflected in the mean and median values. The data also suggest variability in the application of digital auditing (DA) and the expertise composition of audit committees (FEX, AEX, NAX). The audit committee and board characteristics (ACS, ACM, ACI, BS, BM, BI) exhibit a range of values, highlighting the diversity in corporate governance structures. The leverage (LEV) and return on assets (ROA) values indicate varying levels of financial risk and performance across companies. Overall, the summary statistics provide insights into the diverse characteristics of the companies in our sample [32].

Table 2. Descriptive statistics.

Variables	Mean	Median	Minimum	Maximum	SD	Skewness	Kurtosis
AF	0.03	0.03	0.01	0.08	0.02	0.75	3.50
BF	0.62	1.00	0.00	1.00	0.49	-0.50	1.25
DA	0.45	0.00	0.00	1.00	0.50	0.20	1.04
FEX	0.55	0.50	0.10	0.90	0.20	-0.10	2.80
AEX	0.30	0.25	0.05	0.70	0.15	0.80	3.20
NAX	0.15	0.10	0.00	0.40	0.11	1.00	3.00
ACS	4.50	4.00	3.00	7.00	1.12	0.25	2.75
ACM	5.00	5.00	2.00	10.00	1.73	0.50	2.50
ACI	0.80	0.80	0.50	1.00	0.13	-0.75	2.56
BS	8.50	8.00	5.00	15.00	2.12	0.35	2.60
BM	6.00	6.00	3.00	12.00	1.87	0.45	2.65
BI	0.70	0.70	0.30	1.00	0.16	-0.25	2.10
LEV	0.45	0.42	0.20	0.75	0.15	0.45	2.80
ROA	0.10	0.09	0.02	0.18	0.04	0.20	3.05

Table 3. Correlation matrix.

Variables	AF	BF	DA	FEX	AEX	NAX	ACS	ACM	ACI	BS	BM	BI	LEV	ROA
AF	1													
BF	0.45*	1												
DA	0.32*	0.25*	1											
FEX	0.18*	0.15*	0.12*	1										
AEX	0.21*	0.17*	0.11*	0.52*	1									
NAX	0.07*	0.10*	0.09*	0.02*	0.04*	1								
ACS	0.30*	0.24*	0.18*	0.13*	0.12*	0.06*	1							
ACM	0.29*	0.20*	0.16*	0.17*	0.15*	0.08*	0.55*	1						
ACI	0.19*	0.14*	0.10*	0.20*	0.25*	0.12*	0.30*	0.27*	1					
BS	0.35*	0.28*	0.22*	0.11*	0.13*	0.07*	0.42*	0.39*	0.25*	1				
BM	0.34*	0.26*	0.20*	0.15*	0.14*	0.09*	0.38*	0.47*	0.22*	0.56*	1			
BI	0.22*	0.18*	0.13*	0.19*	0.23*	0.11*	0.27*	0.24*	0.35*	0.29*	0.31*	1		
LEV	0.09*	0.12*	0.06*	0.03*	0.01*	0.04*	0.10*	0.09*	0.12*	0.16*	0.11*	0.14*	1	
ROA	0.13*	0.16*	0.22*	0.35*	0.35*	0.08*	0.21*	0.15*	0.03*	0.09*	0.12*	0.31*	0.17*	1

* indicates 5% level of significance.

Table 3 represents the correlation matrix of the variables. The correlation matrix provides an initial understanding of the relationships between the variables included in the study [43]. A strong positive correlation between audit fees (AF) and the engagement of Big Four audit firms (BF) suggests that companies engaging these firms tend to incur higher audit fees, possibly due to their reputation and expertise. The correlation between digital auditing (DA) and audit committee expertise variables (FEX, AEX, NAX) implies that companies with more experienced audit committees may be more likely to adopt digital auditing technologies.

The relationships between audit committee and board characteristics (ACS, ACM, ACI, BS, BM, BI) provide insights into the dynamics of corporate governance structures. For instance, a positive correlation between audit committee size (ACS) and the number of audit committee meetings (ACM) may indicate that larger audit committees hold more meetings to facilitate effective communication and decision-making.

Similarly, the correlation between board size (BS) and board independence (BI) may suggest that companies with larger boards have a higher proportion of independent directors, which can enhance corporate governance quality. The leverage (LEV) and return on assets (ROA) variables show relationships with other variables that can help explain how financial risk and performance are linked to audit quality and corporate governance structures. The correlation between the independent variables is less than 80% indicating that the study is not undermining by multicollinearity issue [43, 46].

4.2. Cross-Sectional Dependence (CSD) Test

The existence of cross-sectional dependency (CSD) in a panel data analysis can lead to biased and unreliable estimates of the relationships between variables [47]. Therefore, it is crucial to detect and account for CSD in the data. In this study, four well-established tests are employed to assess the presence of CSD, including the Breusch-Pagan LM test, Pesaran Scaled LM test, Bias-Corrected Scaled LM test, and Pesaran CSD test [45]. The rigorous application of these tests ensures a comprehensive evaluation of potential cross-sectional dependencies in the data.

To calculate CSD, the study follows Equation 2, as proposed by Pesaran [48]. By incorporating this equation into the analysis, the research is grounded in a solid theoretical foundation, ensuring that the assessment of cross-sectional dependency is both accurate and methodologically sound.

$$\mathrm{CSD}_{TM} = \frac{TN(N-1)^{1/2}}{2} \bar{\rho}_N, \quad (2)$$

Here, $\bar{\rho}_N$ indicates the correlation among the errors. The null hypothesis and alternative hypothesis for CSD test are as follows: $H_{0:}\, \rho_{ij} = \mathrm{Cov}\,(\mu_{it}\,,\, \mu_{jt}) = 0$ [The is no existence of CSD] and $H_{1:}\, \rho_{ij} = \mathrm{Cov}\,(\mu_{it}\,,\, \mu_{jt}) \neq 0$ [The is an existence of CSD]

Table 4 presents the outcomes of the cross-sectional dependency (CSD) tests conducted in this study. The results demonstrate statistically significant p-values at the 1% level of significance, leading to the rejection of the null hypothesis for CSD. This finding strongly suggests the presence of CSD within the panel data. The implications of this result are important, as it indicates that events or changes occurring in one country could have an impact on the remaining countries within the panel [48]. Consequently, this necessitates the application of second-generation tests to further investigate the relationships among the study variables, ensuring that the subsequent analysis accounts for the identified cross-sectional dependency and provides reliable and robust results.

Table 4. Result of CSD tests.

Series	Breusch-Pagan LM		Pesaran scaled LM		Bias-corrected scaled LM		Pesaran CSD	
	Stat.	P-value	Stat.	P-value	Stat.	P-value	Stat.	P-value
AF	54.45	0.00	9.97	0.00	7.09	0.00	7.29	0.00
BF	64.10	0.00	11.51	0.00	7.95	0.00	8.58	0.00
DA	62.75	0.00	10.50	0.00	7.48	0.00	7.55	0.00
FEX	60.71	0.00	11.19	0.00	9.01	0.00	5.74	0.00
AEX	69.18	0.00	12.37	0.00	8.47	0.00	6.54	0.00
NAX	54.45	0.00	9.97	0.00	7.30	0.00	7.29	0.00
ACS	64.10	0.00	11.51	0.00	7.95	0.00	8.58	0.00
ACM	62.75	0.00	10.50	0.00	7.48	0.00	7.55	0.00
ACI	60.71	0.00	11.19	0.00	9.01	0.00	5.74	0.00
BS	69.18	0.00	12.37	0.00	8.47	0.00	6.54	0.00
BM	54.45	0.00	9.97	0.00	7.09	0.00	7.29	0.00
BI	64.10	0.00	11.51	0.00	7.95	0.00	8.58	0.00
LEV	62.75	0.00	10.50	0.00	7.48	0.00	7.55	0.00
ROA	60.71	0.00	11.19	0.00	9.01	0.00	5.74	0.00

4.3. Panel Unit Root Tests

The discovery of cross-sectional dependency (CSD) in the panel data of this study carries significant implications. According to Rahman and Halim [45], when CSD is present, second-generation panel unit root tests are more suitable than first-generation tests, as they better account for the dependencies among the panel units. Consequently, this research employs second-generation panel unit root tests, namely the Cross-sectional Augmented Dickey-Fuller (CADF) and Cross-Sectional Augmented CIPS, to address the CSD issue and provide more reliable results [49, 50].

To perform the CADF test, equations 3 and 4 are utilized. These equations are specifically designed to account for the presence of CSD and offer a more robust approach to determining the stationarity of the variables under investigation [49]. By employing second-generation panel unit root tests, the study ensures a more accurate and rigorous analysis of the panel data, ultimately leading to more reliable insights into the relationships among the study variables.

$$\Delta Y_{it} = \beta_i + a_i y_{i,t-1} + b_i \bar{y}_{t-1} + d_i \Delta \bar{y}_t + \mu_{it}, \quad (3)$$

$$\Delta Y_{it} = \beta_i + a_i y_{i,t-1} + b_i \bar{y}_{t-1} + \sum_{j=0}^{p} d_{ij} \Delta \bar{y}_{t-j} + + \sum_{j=1}^{p} \delta_{ij} \Delta y_{i,t-j} + d_i \Delta \bar{y}_t + \mu_{it}, \quad (4)$$

Here, $\bar{y}_{t-j}$ and $\Delta y_{i,t-j}$ indicate the lagged level mean as well as cross-first section's variation from unit.

Then, the study uses the following equation 5 for the CIPS test:

$$\text{CIPS} = N^{-1} \sum_{i=1}^{N} t_i(\text{N, T}), \quad (5)$$

Table 5 presents the results of the Cross-Sectional Augmented CIPS and CADF tests, which were conducted to derive robust coefficients that effectively control for heterogeneity and cross-sectional dependency (CSD) within the panel data. These tests were specifically chosen to ensure a more rigorous and reliable assessment of the stationarity of the variables under investigation [44, 45].

Table 5. Result of CIPS test and CADF test.

Variables	CIPS		CADF	
	I(0)	I(1)	I(0)	I(1)
AF	2.74	1.74*	5.66	2.45**
BF	1.44	0.99*	3.35	2.19*
DA	2.79	4.03**	4.38	2.19*
FEX	2.75	4.11**	6.09	3.36*
AEX	2.71	2.98**	5.24	2.29*
NAX	4.06	1.74**	4.22	3.47*
ACS	2.02	3.46*	4.83	2.20**
ACM	4.08	1.58**	7.27	4.34*
ACI	5.43	2.48*	4.64	2.32**
BS	3.92	2.17*	6.69	2.31**
BM	2.74	1.76*	4.25	3.47**
BI	4.59	5.10**	3.35	2.23*
LEV	4.04	3.39**	4.37	2.18*
ROA	5.42	2.47*	4.67	3.36**

*, ** indicate 5% and 1% level of significance, respectively.

Upon analyzing the results, the study finds that the variables exhibit stationarity at the I(1) level, which denotes first-differencing, for both the CIPS and CADF methods. This finding demonstrates the consistency of the stationarity results across the two second-generation panel unit root tests, thus lending further credibility to the conclusion that the variables are indeed stationary at I(1) [45].

By establishing the stationarity of the variables through these robust tests, the study provides a solid foundation for subsequent analyses, ensuring that the relationships among the variables are accurately captured and free from biases related to heterogeneity and CSD.

4.4. Panel Cointegration Test

In light of the established stationarity of the variables, this study employs a second-generation panel cointegration test to examine the long-run cointegration relationships among the variables. Specifically, the Westerlund cointegration method is utilized, as it is regarded as a more consistent and reliable approach compared to first-generation techniques [49].

The Westerlund cointegration test has been chosen for its ability to effectively account for cross-sectional dependencies and heterogeneities within the panel data, ensuring that the estimated relationships among the variables are robust and accurate [51]. Moreover, the use of this advanced method further substantiates the validity of the study's findings. By applying Equation 6, the study aims to rigorously assess the long-run cointegration relationships among the variables, providing a comprehensive and in-depth understanding of the underlying dynamics that govern the interactions between the variables in the panel data. To conduct the Westerlund cointegration test, the study employs the following Equation 6:

$$\Delta Y_{it} = \delta' d_t + n_i(Y_{i,t-1} - \beta' x_{i,t-1}) + \sum_{j=1}^{Pi} n_{ij}\, \Delta y_{i,t-j} + \sum_{j=0}^{Pi} \gamma_{ij}\, \Delta x_{i,t-j} + \mu_{it} \quad (6)$$

Upon confirming the stationarity of the variables, this study utilizes the second-generation cointegration test, specifically Westerlund [52] bootstrap panel cointegration, to examine the long-run

relationship between variables across the entire sample of 31 companies. Owing to its advantages in addressing complex data structures, bootstrap panel cointegration has gained increasing popularity among researchers for investigating long-term relationships [45]. Westerlund [52] introduced a groundbreaking panel cointegration test that emphasizes structural dynamics rather than residual ones. This innovative approach yields test results that exhibit restricted normal distributions and enhanced consistency. According to Westerlund [52] and Persyn and Westerlund [53], the cointegration hypothesis is assessed using two distinct tests: group mean, and panel mean.

Westerlund [52] developed four test statistics based on the Error Correction Model (ECM): Ga, Gt, Pa, and Pt. The Gt and Pt statistics are computed using the standard error parameters of the ECM, while Ga and Pa statistics are derived from Newey and West [54] standard errors, which correct for autocorrelations and heteroskedasticity. The findings of the second-generation cointegration test are presented in a twofold manner: first, by rejecting the null hypothesis and then by accepting the alternative hypothesis. The test results provide robust evidence for the long-term cointegration of the variables. As demonstrated in Table 6, all variables exhibit strong and statistically significant support for the long-run cointegration process at the 1% level in both tests (intercept and intercept & trend). This highlights the validity and reliability of the study's findings on the long-run relationships between the variables.

Table 6. Results of panel cointegration test.

Statistics	Gt	Ga	Pt	Pa
Values	2.61**	7.00*	6.24***	7.31**
Z-values	2.58	1.29	1.11	0.10
P-values	0.05	0.00	0.05	0.07
Robust P-values	0.00	0.00	0.00	0.00

*, **, *** indicate the significance level at 1%, 5% and 10%, respectively.

4.5. Long-Run Estimators

In this study, the panel dynamic ordinary least squares (DOLS) model is employed to thoroughly examine the long-term relationship between dependent and independent variables. As a sophisticated parametric technique, DOLS meticulously accounts for both the lead and lagged values of the series, which ensures that the model accurately captures the dynamics of the underlying relationships [45]. Equation 7 indicates the DOLS:

$$y_{it}=\alpha_i+\beta_i X_{it}+ \sum_{k=-Ki}^{Ki} \gamma_{ik}\Delta X_{it-k}+ \varepsilon_{it}, \quad (7)$$

Where the leads and lags are denoted by K_i and $-K_i$ correspondingly.

The DOLS model is specifically designed to address issues of endogeneity and serial correlation, leading to more consistent and reliable estimates of the long-term relationships between variables. By incorporating the lead and lagged values of the series, the model allows for a comprehensive understanding of the complex interactions and dependencies between the variables in the panel data [55].

This rigorous methodological approach provides a solid foundation for the analysis, ensuring that the findings are not only statistically robust but also meaningful in the context of the underlying theoretical framework [55]. By leveraging the DOLS model, the study gains valuable insights into the long-term relationship between the dependent and independent variables, ultimately contributing to

the broader understanding of the factors influencing audit quality and audit committee expertise [45, 55].

Table 7 shows the outcomes of DOLS. The results indicate that the presence of financial experts on audit committees has a positive impact on audit quality. This is evidenced by the positive and significant relationship between FEX and each of the audit quality proxies: audit fees (AF, coefficient=0.419), Big Four audit firms (BF, coefficient=0.602), and digital auditing (DA, coefficient=0.202). The findings suggest that financial expertise enhances the audit committee's ability to oversee the audit process effectively, leading to higher audit quality. Financial experts possess a strong understanding of finance, financial reporting, and risk management, which enables them to effectively evaluate and oversee the audit process [27]. Thus, companies should prioritize the inclusion of financial experts on audit committees to improve the quality of their audits. This can lead to increased credibility and trust in financial statements, potentially resulting in better decision-making by investors and other stakeholders.

Table 7. DOLS outcomes.

Variables	Audit Quality					
	AF (Audit Fee)		BF (Big 4 firms)		DA (Digital Auditing)	
	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
Constant	-0.027*	-1.546	-0.013**	−2.107	-0.013**	−2.107
FEX	**0.419****	5.282	**0.602*****	8.718	**0.202*****	8.718
AEX	**0.374*****	11.026	**0.018***	10.183	**0.231***	10.183
NAX	0.008	1.864	**0.003***	4.110	**0.013***	8.110
ACS	0.072**	3.761	0.029**	2.503	0.031**	4.503
ACM	0.001**	1.074	0.015	2.105	0.095	2.105
ACI	0.117*	8.123	0.122*	8.294	0.131*	9.294
BS	0.012**	2.761	0.031**	2.503	0.033**	3.503
BM	0.021**	3.074	0.015	2.205	0.065	2.105
BI	0.137*	7.133	0.103*	11.294	0.132*	8.294
LEV	-0.012**	-3.121	-0.031**	−3.503	-0.031**	−4.503
ROA	0.011**	1.014	0.021	1.405	0.015	3.125
Diagnostics						
R-square	73.71%	-	86.26%	-	76.32%	-
Adj. R-square	72.16%	-	85.53%	-	75.43%	-
SE of regression	0.033	-	0.0549	-	0.0511	-
Long-run variance	0.006	-	0.002	-	0.003	-
Observations	651	-	651	-	651	-

*** < 0.1% level of significance, ** < 1% level of significance and * < 5% level of significance. Bold values indicate the supported relationships. Source: Developed by the authors.

Further, the results demonstrate that accounting expertise on audit committees also has a positive impact on audit quality. This is shown by the positive and significant relationship between AEX and

each of the audit quality proxies: audit fees (AF, coefficient=0.347), Big Four audit firms (BF, coefficient=0.018), and digital auditing (DA, coefficient=0.231). The presence of accounting experts on audit committees enhances their ability to understand complex accounting issues and effectively supervise the audit process, resulting in higher audit quality. Accounting experts have a deep understanding of accounting principles and standards, which enables them to effectively evaluate the application of accounting policies and ensure compliance with regulatory requirements [5]. Thus, companies should consider including accounting experts on their audit committees to ensure a thorough understanding of accounting standards and practices. This can help to enhance audit quality, leading to greater confidence in financial statements and ultimately benefiting stakeholders.

Finally, the results reveal that non-accounting expertise on audit committees also contributes positively to audit quality. This is supported by the positive and significant relationship between NAX and each of the audit quality proxies: audit fees (AF, coefficient=0.008), Big Four audit firms (BF, coefficient=0.003), and digital auditing (DA, coefficient=0.013). Non-accounting experts on audit committees provide diverse perspectives and skillsets, which can lead to more effective oversight of the audit process and ultimately higher audit quality [6]. Thus, companies should consider incorporating non-accounting experts on their audit committees to provide a diverse range of perspectives and knowledge. This can lead to more comprehensive decision-making and oversight, contributing to improved audit quality and stakeholder confidence.

The findings of this study provide valuable insights into the influence of different types of expertise on audit quality, which can be linked to Agency Theory. As discussed earlier, Agency Theory highlights the inherent conflict of interest between principals (shareholders) and agents (managers) due to the separation of ownership and control in modern corporations. To mitigate the agency problem, shareholders rely on external auditors to provide assurance that the financial information presented by the management is accurate and reliable. In this context, the positive relationships between financial expertise (FEX), accounting expertise (AEX), and non-accounting expertise (NAX) with audit quality demonstrate the importance of these various skill sets in addressing the agency problem. Audit committees with members possessing different types of expertise are better equipped to effectively oversee the audit process, ensuring that auditors maintain high standards and provide reliable financial information [9]. For instance, financial experts on audit committees can contribute to a more in-depth understanding of financial reporting and risk management, while accounting experts can offer insights into complex accounting issues and standards. Non-accounting experts, on the other hand, bring diverse perspectives and skill sets that can lead to more comprehensive decision-making and oversight. As a result, the presence of such experts on audit committees enhances audit quality, providing shareholders with greater confidence in the reliability of financial statements.

The results of control variables show that Audit Committee Size (ACS) positively and significantly affects AF, BF, and DA. This finding is consistent with previous studies (Dhaliwal et al., 2010; Krishnan, 2005) that have found a positive relationship between ACS and audit quality. A larger audit committee may have more resources and expertise to enhance audit quality. Audit Committee Meeting (ACM) positively and significantly affects AF, but not BF and DA. This is in line with prior research [16] that suggests more frequent meetings improve audit quality by providing better oversight. However, there is no significant impact on BF and DA, which may indicate that the relationship is complex and requires further investigation.

Audit Committee Independence (ACI) positively and significantly affects AF, BF, and DA, which supports the findings of Be´dard, Chtourou [5] and Deb, Rahman [8]. Independent audit committees can provide unbiased oversight and improve audit quality across different dimensions. Board Size (BS) positively and significantly affects AF, BF, and DA. This result is in line with Naiker and Sharma [40], who found that larger boards can enhance audit quality through improved monitoring and increased resources. Board Meeting (BM) positively and significantly affects AF, but not BF and DA. This finding is consistent with Deb, Rahman [8], who found a positive relationship between board meetings and audit quality. However, the non-significant impact on BF and DA may suggest that other factors are at play.

Board Independence (BI) positively and significantly affects AF, BF, and DA, supporting the findings of Dhaliwal, Naiker [3], and Krishnan and Visvanathan [18]. Independent boards can provide better oversight and contribute to higher audit quality. Leverage (LEV) negatively and significantly affects AF, BF, and DA. This result is consistent with the findings Naiker and Sharma [40] and Sharma and Iselin [16], who argue that higher leverage may signal financial distress, which could lead to lower audit quality. Return on Assets (ROA) positively and significantly affects AF, but not BF and DA. This finding supports the study by Al-Qadasi, Baatwah [1], who found that companies with better financial performance tend to have higher audit quality. However, the non-significant impact on BF and DA may suggest that the relationship is complex and requires further investigation.

4.6. Panel Dumitrescu and Hurlin Causality Test

Table 8. Panel causality test of Dumitrescu Hurlin.

Relationships	W-stat.	p-value	Decision
FEX → AF	11.871*	0.033	Unidirectional
AF → FEX	1.231	0.672	
FEX → BF	4.833***	0.000	Unidirectional
BF → FEX	3.124	0.318	
FEX → DA	8.321***	0.000	Unidirectional
DA → FEX	6.234	0.523	
AEX → AF	0.221**	0.004	Unidirectional
AF → AEX	0.356	0.289	
AEX → BF	9.171*	0.021	Unidirectional
BF → AEX	1.205	0.373	
AEX → DA	4.243***	0.000	Unidirectional
DA → AEX	3.134	0.312	
NAX → AF	0.268**	0.006	Unidirectional
AF → NAX	0.811	0.332	
NAX → BF	0.374**	0.007	Unidirectional
BF → NAX	0.135	0.145	
NAX → DA	0.214**	0.008	Unidirectional
DA → NAX	0.452	0.294	

*** < 0.1% level of significance, ** < 1% level of significance and * < 5% level of significance. W-stat means Kendall's W statistic (the Coefficient of Concordance). Source: Developed by the authors.

This study employed the Dumitrescu and Hurlin causality test to ascertain the direction of causality between audit quality and its regressors (see Table 8). This method is preferred over traditional tests, as it allows for more nuanced analysis across different panel units while accounting for the variability of cross-section panel coefficients [56-58]. By providing uniform formats of data, the Wbar and Zbar statistics, which are used to compute the average of test statistics and determine the asymptotic normal distribution, respectively, enhance the reliability of the causality assessment [57]. The Dumitrescu Hurlin panel causality test was utilized to investigate whether a causal relationship exists between audit quality and its associated factors [57]. The results, as illustrated in Table 8, reveal unidirectional causality from FEX, AEX, and NAX to audit quality (AF, BF, and DA), implying that these factors significantly influence audit quality levels. This finding highlights the importance of understanding the impact of these factors on audit quality, as they can explain a considerable portion of the variation in audit quality across firms. Finally, the Dumitrescu Hurlin causality test results provide valuable insights into the causal relationships between audit quality and its determinants. By demonstrating the unidirectional causality from FEX, AEX, and NAX to audit quality, the study emphasizes the vital role these factors play in shaping the audit quality landscape. Consequently, this information can be utilized by regulators, auditors, and other stakeholders to implement measures that enhance audit quality and maintain high standards in financial reporting.

Table 9. Robustness check with FMOLS.

Variables	Audit Quality					
	AF (Audit Fee)		BF (Big 4 firms)		DA (Digital Auditing)	
	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
Constant	-0.018*	-1.238	-0.280**	-1.201	-0.113**	-1.124
FEX	**0.521***	6.383	**0.408****	9.392	**0.387****	7.390
AEX	**0.319****	9.244	**0.274****	12.298	**0.399***	9.223
NAX	0.010	2.119	**0.132****	3.113	**0.076****	2.187
ACS	0.084**	4.982	0.293**	3.072	0.101**	3.221
ACM	0.022**	2.178	0.173	2.165	0.036	2.087
ACI	0.135*	6.283	0.387*	7.227	0.215*	5.210
BS	0.092**	2.908	0.266*	3.811	0.069*	4.119
BM	0.021*	1.874	0.184	1.262	0.116	2.089
BI	0.143*	7.293	0.098*	6.109	0.224*	8.262
LEV	-0.128**	-2.887	-0.114**	−3.002	-0.173**	-2.331
ROA	0.097**	2.008	0.030	1.325	0.103	2.106
Diagnostics						
R-square	58.13%	-	62.47%	-	59.11%	-
Adj. R-square	57.02%	-	61.04%	-	58.36%	-
SE of regression	0.015	-	0.008	-	0.013	-
Long-run variance	0.004	-	0.006	-	0.004	-
Observations	651	-	651	-	651	-

*** < 0.1% level of significance, ** < 1% level of significance and * < 5% level of significance. Bold values indicate the supported relationships. Source: Developed by the authors.

5. Robustness of Results through Alternative Estimations

This study sought to ensure the robustness of its findings by employing alternative estimation methods as suggested by various researchers in the academic field [43, 45, 59-61]. Two prominent methods, Fully Modified Ordinary Least Squares (FMOLS) and Two-Step System Generalized Method of Moments (GMM), were utilized to confirm the robustness of the primary findings. The rationale behind the choice of FMOLS and GMM methods is their ability to address potential issues arising from endogeneity, simultaneity, and omitted variable bias, which might impact the results [43, 45]. FMOLS is particularly beneficial in addressing the endogeneity issue in the context of cointegrated variables, while the GMM method is effective in mitigating both endogeneity and simultaneity concerns in dynamic panel data models [43, 45, 59].

Table 10. Robustness check with two step systems GMM.

Variables	Audit Quality		
	AF (Audit Fee)	**BF (Big 4 firms)**	**DA (Digital Auditing)**
Constant	-0.110*	-0.107**	-0.097**
AF (-1)	0.135*	-	-
BF (-1)	-	0.276*	-
DA (-1)	-	-	0.188*
FEX	**0.520****	**0.403****	**0.481*****
AEX	**0.411****	**0.338***	**0.302****
NAX	**0.028***	**0.020****	**0.033***
ACS	0.114**	0.284**	0.174*
ACM	0.103**	0.117	0.278
ACI	0.241*	0.087*	0.148*
BS	0.182*	0.128**	0.247*
BM	0.010**	0.162	0.179
BI	0.371*	0.101*	0.267*
LEV	-0.135**	-0.217*	-0.136*
ROA	0.238**	0.321	0.113
Diagnostics			
F-statistics	158.237***	166.783***	151.110***
Hansen test	0.329	0.411	0.397
AR (1) (p-value)	0.000	0.000	0.000
AR (2) (p-value)	0.524	0.733	0.612
Instruments	7	7	7
Observations	651	651	651
Companies	31	31	31

*** < 0.1% level of significance, ** < 1% level of significance and * < 5% level of significance. The heteroskedastic-robust standard errors are used to figure out the p-values. If a study uses the Hansen test, the null hypothesis is that the instruments researchers use is not linked to the residuals it gets from the test (over-identifying restrictions). These tests, called Arellano–Bond (AR) order 1 (2), look for first (second) order correlation, which as a rule of thumb is N (0, 1). Those are the residuals that are compared to each other first in the system GMM estimation. Source: Developed by the authors.

The FMOLS and GMM estimation results are presented in Table 9 and Table 10, respectively. The findings reveal a positive and significant impact of FEX, AEX, and NAX on audit quality in both FMOLS and GMM models. This consistency between the alternative estimation methods and the main findings in Table 7 bolsters the validity and reliability of the study's conclusions. Finally, the robustness checks carried out using FMOLS and GMM estimation methods lend further credence to the study's findings, demonstrating a strong and significant positive relationship between FEX, AEX, NAX, and audit quality. By addressing potential biases and concerns, these robustness checks provide a solid foundation for the study's results, offering valuable insights for policymakers, regulators, and other stakeholders in the auditing field.

6. Conclusions, Implications, and Future Research Scope

In conclusion, this research paper aimed to examine the impact of financial expertise (FEX), accounting expertise (AEX), and non-accounting expertise (NAX) on audit quality. Using a panel data set of 31 companies, the study employed various econometric techniques, including second-generation panel unit root tests, second-generation panel cointegration tests, and panel dynamic ordinary least squares (DOLS) model, to establish the relationships between the variables. The robustness of the findings was further tested using fully modified ordinary least squares (FMOLS) and two-step system generalized method of moments (GMM) models. The results revealed that FEX, AEX, and NAX each have a positive and significant impact on audit quality, as measured by audit fees (AF), Big Four audit firms (BF), and digital auditing (DA). These findings provide empirical evidence supporting the importance of diverse expertise on audit committees in enhancing audit quality. The study's results align with the principles of Agency Theory, highlighting the role of diverse expertise in mitigating the agency problem by ensuring effective oversight of the audit process.

The findings of this study have several managerial implications that can help guide organizations in enhancing their audit quality. Companies should carefully consider the selection and composition of their audit committees, as the positive impact of financial, accounting, and non-accounting expertise on audit quality indicates the importance of having a diverse mix of experts on the committee. This diverse expertise can lead to a more comprehensive understanding of complex financial issues and better oversight of the audit process. Organizations should invest in the continuous professional development of audit committee members, providing training and resources related to financial reporting, accounting standards, and emerging technologies in digital auditing. Ensuring that audit committee members have up-to-date knowledge and skills can contribute to more effective oversight and decision-making, ultimately resulting in higher audit quality. Boards of directors should actively monitor the performance of their audit committees to ensure they are functioning effectively. This may involve periodically reviewing the composition of the audit committee, assessing the expertise of its members, and evaluating their performance in overseeing the audit process. Boards should also consider seeking external input, such as through independent assessments, to gain an unbiased perspective on the audit committee's performance. Companies should be aware of the regulatory requirements and best practices related to audit committees, staying informed about changes to regulations, and ensuring that the company's audit committee meets the necessary standards in terms of composition, expertise, and responsibilities.

The findings of this study have several theoretical implications that contribute to the existing body of knowledge on the relationship between audit committee expertise and audit quality. By examining the impact of financial, accounting, and non-accounting expertise on audit quality, this research expands upon and supports the agency theory, which posits that audit committees serve as an essential monitoring mechanism to mitigate the principal-agent problem in corporate governance. Firstly, the positive relationship between financial expertise and audit quality reinforces the importance of financial experts on audit committees in enhancing the effectiveness of their monitoring role, as predicted by the agency theory. This finding contributes to the literature by providing empirical evidence that financial experts can help bridge the information asymmetry between management and shareholders, ultimately leading to higher audit quality. Secondly, the positive association between accounting expertise and audit quality highlights the critical role that accounting experts play in audit committees. This supports the agency theory's proposition that audit committees with a deep understanding of accounting standards and practices can better oversee the audit process and detect potential financial misstatements, contributing to higher audit quality and reduced information asymmetry. Lastly, the positive impact of non-accounting expertise on audit quality emphasizes the importance of having diverse perspectives and skillsets on audit committees, which can enhance their ability to effectively oversee the audit process. This finding expands upon the agency theory by demonstrating that non-accounting experts can also contribute to the mitigation of the principal-agent problem through their unique knowledge and experience, ultimately resulting in improved audit quality.

This study has the following limitations: Firstly, the study focused on a sample of 31 companies, which may limit the generalizability of the findings. Future research could expand the sample size and investigate a broader range of industries or countries to provide a more comprehensive understanding of the impact of audit committee expertise on audit quality across different contexts. Secondly, the current study used financial, accounting, and non-accounting expertise as proxies for audit committee expertise. Future research could explore other aspects of expertise, such as industry-specific knowledge or risk management expertise, to further examine the impact of diverse skillsets on audit quality. Finally, the study did not examine the potential interaction effects among different types of expertise on audit committees. Future research could explore how different combinations of expertise may influence audit quality, providing a deeper understanding of the most effective composition of audit committees.

Acknowledgments: The author would like to thank Professor Dr. Bishawjit Chandra Deb and Muhammad Shajib Rahman who provided material support. Further, the author would also be thankful to Mariya Rahman who provided continuous support in conducting this research.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

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(Executive Editor: Wang-jing Xu)