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Article

Unveiling the Influence of Big Data Disclosure on Audit Quality: Evidence from Omani Financial Firms

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Abstract: Purpose: This study aims to investigate the impact of big data disclosure on audit quality in the Omani context. Design/methodology/approach: This study used data extracted from annual reports for a sample from financial companies listed on the Muscat Stock Exchange over the period from 2014 to 2020. We applied a content analysis approach to measure the level of big data disclosure in these firms. This study used ordinary least squares and panel data regression analysis to investigate the relationship between big data disclosure and audit quality. Moreover, we moderated the relationship between big data disclosure and audit quality with family members who are serving on the board of directors and with royal membership. Findings: The findings of the study indicated that big data disclosure played a vital role in enhancing the audit quality of the financial firms in the Omani context. In addition, family memberships positively moderated the association between big data disclosure and audit quality in these firms. However, royal members negatively moderated such relationship. Research limitations/implications: We included only financial institutions in the sample. Practical implications: The study offers practical implications for investors, managers, and policymakers. It will raise awareness on the importance of implementing regulations necessary for disclosing such information in annual reports, thereby enhancing the audit quality of firms and increasing the reliability and validity of financial reports. Originality/value: The study is considered the first, to the best of our knowledge, to examine the impact of big data disclosure on the audit quality in the Omani context. It contributes to the existing knowledge of digital transformation in the Omani financial firms.

Keywords: Oman; audit quality; big data; voluntary disclosure; developing country



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1. Introduction

The volume, speed, and variety of information, or “big data”, have fundamentally expanded because of the worldwide shift toward digitalization. Because of the potential for critical financial profits, broad information reception has recently acquired prevalence among organizations around the world (Alotaibi et al. 2021; Ahmed et al. 2023). Integrating big data is pivotal in upending conventional methodologies and providing novel prospects for enterprises to augment their efficacy (Yadegaridehkordi et al. 2020).

Similar to any other profession, handling extensive data and being proactive in recognizing the possible impact of emerging technological trends on audit procedures are the biggest challenges facing the audit sector today. Professional accounting associations have issued guidelines on audit strategies in response to the growing usage of big data in enterprises (Eilifsen et al. 2020). According to Vasarhelyi et al. (2015), there is still confusion surrounding the phrase “big data” (Dagilienė and Klovienė 2019). According to Ahmed et al. (2023), big datasets are made up of both quantitative and qualitative data. They are

becoming increasingly available in large amounts in various forms, such as text, emails, images, and audio.

In the past, auditors mainly relied on organized data from financial systems. However, there is a growing demand to collect and analyze data from various sources to obtain audit evidence (Louwers et al. 2017). Auditors are experiencing a significant change in their roles and methodologies due to big data (Earley 2015; Hamdam et al. 2022). Despite the tremendous changes, the utilization of big data technologies in the field of auditing is still in its nascent phase and lacks comprehensive understanding (Ahmed et al. 2023). This could be because the auditing professions have been hesitant to accept this advancement (Vasarhelyi et al. 2015).

Whether or not external audit firms using big data would produce higher-quality audits is a hotly contested subject. According to some research, integrating big data with auditing will likely increase audit effectiveness, lower audit costs, and improve audit objectivity (Kend and Nguyen 2020; Ahmed et al. 2023). Based on agency theory, Vera-Baquero et al. (2015) suggested that adopting big data solutions might improve corporate supervision by promptly disclosing high-quality information and lowering information asymmetry and agency costs. This is relevant to the quality of financial reporting. In the setting of big data analytics, managers are less likely to trade opportunistically, according to Zhu and Huang (2019).

According to Manita et al. (2020), big data limits managers' discretionary power, raising the caliber of financial reporting. This has a favorable impact on improving disclosure quality in digital technology. However, using big data also poses difficulties for the auditing profession. A major challenge in auditing today is how to address the complexities of "Big Data." While it holds significant potential value for organizations, its vast variety, speed, and sheer volume make it difficult, if not impossible, to analyze using traditional methods. Filtering through massive amounts of data to extract pertinent information for audit procedures can be challenging for auditors (Hussien et al. 2021).

Furthermore, a substantial investment in software, technology, and skill development is necessary (Lee 2021). According to some studies (Yoon et al. 2015), adopting big data may cause information overload. Moreover, the auditing standards used previously are outdated (Appelbaum 2016). However, there is still disagreement about how significant data adoption affects audit quality. This calls for more research and empirical data on auditors' judgment and decision-making skills in a big data environment (Hamdam et al. 2022).

Until now, most auditing researchers have concentrated on discussing the theoretical effects of big data analytics on auditing (Brown-Liburd et al. 2015; Cao et al. 2015). On the other hand, there is little awareness of what these advancements will mean for auditing in genuine audit firms. Additionally, to learn more about the auditors' perspectives and levels of acceptance, researchers used questionnaires (Al-Ateeq et al. 2022; Alrashidi et al. 2022; Al-Salmi et al. 2022). Nevertheless, the conclusions must be backed up by historical data to present a realistic image of this impact.

Moreover, the influence of big data on the quality of audits has been investigated primarily in developed countries, with only a few studies conducted in developing countries (e.g., De Santis and D'Onza 2021). Nevertheless, it can be contended that in developing countries, such as Oman, which possess distinct corporate governance systems, legal frameworks, and economic environments, the influence of big data on audit quality may vary. Oman continues to pursue its 2040 strategy, aiming to become a highly competitive market. In order to do this, the nation aggressively encourages foreign investment by providing high-quality audits and a robust corporate governance framework. Consequently, the association between the adoption of big data and audit quality can be anticipated to differ from the findings drawn in previous studies conducted in developed countries.

Furthermore, in Oman, legal protections for investors are insufficient, resulting in a prevalent situation where companies are often under the control of major shareholders, including family-owned firms and governmental bodies. Nevertheless, various categories of dominant shareholders exhibit distinct investment strategies and motivations, influencing

the company's utilization of control rights. Since the ownership structure of a company plays a crucial role in governance, particularly in situations where the legal structure is lacking in strength (Alhababsah 2019), the current study also tends to explain how the ownership structure would influence the association between extensive data adoption and audit quality. The present study explicitly examines how family ownership and political connections influence the connection between widespread data uptake and the quality of audits.

This study contributes to the existing knowledge of digital transformation in the auditing business. It provides empirical insights into the continuing discussion about the implications of extensive data adoption in the audit industry. For all parties participating in audits, examining the impact of big data on audit quality is essential because it provides them with insights into the particular effects of big data in the context of Oman, a developing nation. This study is significant because it is one of the first to investigate the connection between ownership concentration and audit quality in the context of big data. It provides a deeper understanding of the topic. This is critical because it can help legislative and regulatory organizations create standards and recommend auditor-training programs.

The remainder of the paper is structured as follows: Section 2 discusses the literature review and the hypotheses development. The research methodology is explained in Section 3, and Section 4 deliberates the findings' discussion. Section 5 presents some additional analyses, followed by a discussion in Section 6. Section 7 concludes the study with some practical implications and avenues for future research.

2. Literature Review

2.1. Big Data Adoption in the Auditing Field

The application of analytics in auditing is familiar despite the growing usage of big data analytics in this domain. Since the 1960s, when they developed Computer-Assisted Audit Techniques (CAATs) to evaluate data in a way that might support procedures, such as sampling during an audit, audit organizations have used electronic analytical devices (Cushing and Loebbecke 1986). The literature provided a preliminary examination of the potential effects of using big data in the auditing area in response to the current technological advancements in the industry, with a focus on risk estimates and the application of substantive and analytical methodologies (e.g., Alles 2015; Yoon et al. 2015; Alles and Gray 2016; Appelbaum et al. 2017).

Despite businesses' growing adoption of big data, the auditing and accounting sectors still need to catch up in embracing this innovation and progress (Vasarhelyi et al. 2015). The responsibilities and procedures of auditors and accountants are changing significantly (Hamdam et al. 2022). Even while big data is acknowledged as a potent force that can potentially drastically transform how businesses operate, it still needs to be determined how the company's accounting and auditing practices will change (Hamdam et al. 2022). Furthermore, the auditing sector needs to adjust quickly to new technological developments (Alles 2015; Vasarhelyi et al. 2015). It is difficult for auditors to obtain the cutting-edge instruments and techniques required for auditing in the big data environment. The status of auditors in society is at risk due to this lack of flexibility (Vasarhelyi et al. 2015).

Previous research has demonstrated that data analytics, as well as big data, can revolutionize the implementation of accounting and auditing techniques and improve the efficiency and effectiveness of auditing financial statements (Zhang et al. 2015; Alles and Gray 2016; Appelbaum 2016; Gepp et al. 2018). The distinguishing characteristic of big data analytics in improving the auditing process lies in integrating advancements in data science, expanding computer capabilities, and accessing vast amounts of data. These factors have resulted in an ideal setting for implementing big data analytics in nearly every sector, including the audit profession (Stewart 2015).

Big data analytics includes a diverse set of techniques that can be useful in all stages of the auditing procedure. During the pre-engagement period, auditors may utilize data mining and sentiment analysis strategies to evaluate the profile of the prospective client

and the most influential individuals, such as the CEO and CFO. This involves checking news releases and social media platforms. Moreover, auditors can employ methods, such as clustering, to assess a prospective client's accounting records by comparing them to information gathered from comparable businesses in the same sector. This allows auditors to develop an initial assessment of the company's financial condition (Rose et al. 2017).

The abovementioned methods can help decide to accept an audit engagement and determine the fee. In the planning period, clustering, descriptive statistics, and regression could improve conventional analyses and assist auditors with a more comprehensive visualization of the entity being audited. This helps identify and evaluate sections of financial statements with a higher level of inherent risk and identifies materiality limits (Earley 2015). In addition, using big data has revolutionized the methods by which auditors collect and assess evidence and carry out decisions and judgment processes (Rose et al. 2017).

Auditors who visualize and integrate large amounts of data employ an intuitive or deliberative processing approach. Wolfe et al. (2016) suggested that auditors may encounter challenges when recognizing significant indicators, irregularities, and deviations in data. Hence, it is crucial to comprehend the analysis modes that affect audit decisions and judgments. The adoption of big data could allow auditors to improve their productivity. Big data and audit integration have the potential to set boundaries and lessen effort, which would lower costs and increase audit independence, effectiveness, and efficiency (Ahmed et al. 2023). Big data provide vast knowledge that can be used for various operational purposes, such as evaluating sales and purchases.

According to Kend and Nguyen (2020), big data analysis frees auditors from repetitive and tiresome tasks, allowing them to focus their intelligence and abilities on meaningful assessment tasks and crucial auditing judgments. Wang and Cuthbertson (2015) demonstrated that big data is a significant factor in improving the integrity and correctness of audited financial statements, which in turn leads to the development of innovative auditing techniques. Big data is an additional information source directly affecting how audits are understood. Big data tools, including data warehouses, machine learning, artificial intelligence, forecasting models, and visualization approaches, are anticipated to become increasingly important in the audit industry (Brown-Liburd and Vasarhelyi 2015).

However, the extent to which extensive data usage will affect audit quality still needs to be clarified. More attention and empirical data on the judgments and decisions made by auditors in a big data environment are required to address this issue (Hamdam et al. 2022). Historically, scholars in auditing have predominantly concentrated on examining the possible impacts of big data analytics on auditing theory (Brown-Liburd et al. 2015; Cao et al. 2015). However, additional data are necessary to understand the impact of these enhancements on the reviewing procedures conducted by a review business. Furthermore, researchers utilized a survey questionnaire to concentrate on this peculiarity by looking at the inspectors' perspective or level of acknowledgment (Al-Ateeq et al. 2022; Alrashidi et al. 2022; Al-Salmi et al. 2022). However, historical data must be used to validate the conclusions and yield an accurate picture of this influence. As a result, the following theory is put forth:

H1. *Big data adoption has a significant impact on audit quality.*

2.2. The Moderating Effect of Family Membership on the Relationship between Extensive Data Adoption and Audit Quality

Further conclusive research is required to determine the potential impact of family members' expenses on agency boards. Several studies have found that the presence of family members serving on committees can reduce agency conflict (Al-Okaily and Al-Okaily 2024). Due to their centralized control and long-term commitment, family-owned enterprises are a significant component of governance practices that help mitigate managerial opportunism (Martínez-García et al. 2021). Accordingly, family members' goals likely coincide with those of the other shareholders (Guizani and Abdalkrim 2022).

However, high ownership by family members increases the likelihood that they will use their influence over minority non-family investors to promote their private goals (Tawfik et al. 2023). Family members most likely hold corporate boards and managerial positions in family-owned businesses, which raises the risk of ignoring the investors' goals and interests (Alhababsah 2019). Family membership may also increase concerns that the management will prioritize serving the objectives of the family owners over those of the other owners. Therefore, an audit of outstanding quality is required to minimize the agency's dilemma and protect the rights of other investors. Multiple studies have highlighted the significance of assessing the impact of family ownership on agency costs and have shown that it can both increase and decrease these expenses (Rahman et al. 2023). Previous research has indicated that businesses with family members on the board might need stronger governance systems because of efficient monitoring (Kavadiis and Thomsen 2023).

The perception of family image is essential to consider while discussing family membership. Alshirah et al. (2022) suggested that family members on boards are driven to uphold their reputation, which explains their adherence to solid ideals (Qawqzeh et al. 2021). Family members have an implicit responsibility to protect the family's reputation and avoid using their position of power to further their own goals at the expense of the shareholders' goals, considering the potential damage to the family's reputation (Alhababsah 2019). This approach could result in family members becoming more involved in the audit process to uphold their reputation for producing reliable financial reports. Nevertheless, Eckey and Memmel (2023) emphasized that family enterprises are particularly susceptible to risks due to their independent functioning, reliance on family members, and restricted availability of financial and material resources. On the other hand, Rahman et al. (2023) argued that having a family member on the board of directors can improve the company's reputation by making it seem less risky than other organizations. As a result, auditors may be less likely to increase the audit risk and request more significant costs (Sanad 2024).

Many scholars were eager to examine the correlation between family-owned enterprises and the caliber of audits. Research conducted by Meah and Hossain (2023) did not demonstrate a substantial association between audit quality and family ownership. Alhababsah (2019) discovered a notable association between family ownership and the quality of audits. Similarly, Qawqzeh et al. (2021) proposed that family ownership plays a crucial and highly influential role in determining the quality of external audits, hence impacting the firms' financial performance. Conversely, multiple studies have found that family ownership negatively impacts the quality of auditing. For instance, research conducted by Guizani and Abdalkrim (2022) revealed that firms with greater family ownership exhibited a reduced propensity to request comprehensive audit services, consequently leading to reduced audit quality. Considering the widespread adoption of extended data by various organizations, including family-owned businesses, it is anticipated that the effect of extensive data adoption on audit quality will differ among family-owned firms (Al-Okaily and Al-Okaily 2024). Therefore, the subsequent theory is suggested:

H2. *The influence of data adoption on audit quality is moderated by family ownership.*

2.3. The Moderating Effect of Politically Connected Firms on the Relationship between Extensive Data Adoption and Audit Quality

According to Goldman et al. (2009), political connections within an organization may influence its earnings by influencing leniency policies and the accessibility of obtaining government projects. Liu et al. (2014) found that politically connected directors may face significant challenges in reducing the significant conflict of interest arising from their political connections compared to non-politically engaged directors. This could provide an advantage to auditors with exceptional quality and promote a higher level of credibility in reporting financial information.

Nevertheless, directors with political connections are obligated to participate in rent-seeking behavior, which entails utilizing corporation funds or assets for the benefit of the government in order to obtain beneficial legislation (Johnson and Mitton 2003). Donating

to government organizations to influence laws that benefit their businesses can lead to manipulating company resources. This is because such donations are only sometimes subject to authorization from shareholders (Ramsay et al. 2001).

Chaney et al. (2011) stated that companies with political connections are more inclined to engage in activities such as expropriating minority shareholders and manipulating earnings. This connection hinders political-affiliated companies from practicing transparency. Kim and Zhang (2016) observed that organizations with political associations are more likely to rehearse tax evasion strategies because of diminished discovery risk, elevated weakness to guideline changes, and exclusion from legal requirements. Consequently, in contrast to organizations that do not have political associations, they will encounter diminished investigation, lower costs, and be more disposed to attempt gambles.

In addition, some scholars have contended that politically connected companies do not receive better outcomes from high-quality audits than similar companies that are not politically connected. Tessema's (2020) research concluded that politically related businesses have no apparent impact on the quality of audits. One possible explanation is that royal family members may need more direct oversight or experience in their own businesses' daily activities and accounting operations. Consequently, their impact on the quality of audits could be restricted (Al Lawati and Sanad 2023). Furthermore, the goals of royal members may remain the same as those of other stakeholders. Tessema (2020) suggested that their primary emphasis may be preserving their social standing or image instead of exerting influence over the audit process. The lack of alignment of goals could result in a minimal effect on the audit quality.

The impact of extensive data adoption on the quality of audits can vary depending on various factors, including companies' political connections. Companies with political connections can exploit their connections with regulators to exert power over the audit procedure, which could compromise the credibility and integrity of the auditing process (Gul 2006). Chaney et al. (2011) found that political connections are associated with reduced financial reporting accountability and reduced reporting quality.

When political ties are involved, adopting big data analytics may only sometimes lead to better audit quality because it can compromise the accuracy and impartiality of financial reporting. Consequently, the amount of work required for an audit will increase when auditors evaluate a company with a high level of risk. Hence, the company will be required to pay higher fees for auditing services (Gul 2006; Wahab et al. 2011). Hence, the impact of embracing big data on the nature of audits is expected to differ when firms' chiefs have political associations. Therefore, the hypothesis can be stated as:

H3. *Firms' political connections moderate the impact of data adoption on audit quality.*

3. Research Methodology

3.1. Sample Selection

This study focused on 33 financial firms from banking, finance, insurance, investment, and real estate sectors that were listed on the Muscat Stock Exchange, covering the period from 2014 to 2020, and yielding 231 firm-year observations. We selected this period because it demonstrated the greatest positive percentage enhancement in the number of big data exposure. In addition, in July 2016, the Capital Market Authority in Oman issued a new corporate governance code that placed greater emphasis on transparency and the disclosure of voluntary information. We used ordinary least squares, fixed effect, and random effect analysis tests using STATA 17 software. The data were thoroughly and manually gathered from the companies' annual reports and the Bloomberg database. Non-financial firms were excluded from this analysis due to their differing accounting regulations and distinct corporate governance provisions compared to financial entities.

Big data disclosure has tremendous potential and great opportunities, especially for the financial organizations, such as banks, investment firms, and insurance firms. Every day, large amounts of data are produced from various sources, including monetary transactions,

client interactions, and stock market data, among others. Big data is being used by financial institutions to improve decision-making, risk management, and customer experience. In banking, big data plays a key role in understanding customer behaviors, identifying fraud, and faster approval of loans. Big data is used by investment firms in predicting market trends, evaluating risks, as well as creating enhanced algorithm-based trading models. Likewise, underwriting, claims processing, and fraud detection are other areas where insurance firms apply big data. For instance, insurers use telematics data to track the driver's behavior as well as provide suitable insurance rates. The use of big data in these financial sectors promotes the advancement of financial technology (FinTech), enhancing its capability in providing accurate analysis of financial data and developing new efficient solutions in the sector.

3.2. Study Variables

Audit quality was the dependent variable in our study, which was assessed through audit fees, as per the methodology outlined in [Al Lawati and Hussainey's \(2022\)](#) research. A couple of control variables were used in the study for the purpose of avoiding model misspecification, following previous studies, such as ([Al Lawati and Sanad 2023](#); [Al Lawati and Hussainey 2021](#)): company size, company leverage, company profitability, and Big 4. Refer to Table 1 for variables definitions and measurements.

Our dependent variable was big data disclosure. Following [Al Lawati et al. \(2021\)](#), we used manual content analysis in measuring our big data disclosure variable. We measured it by examining the annual reports of the companies constituting the sample; specifically, we examined the chairman's report/the company report. The examination started by classifying the reports into two categories: searchable portable document format (searchable PDF) and non-searchable portable document format (non-searchable PDF). Accordingly, each category was processed and examined separately, as outline below.

The examination and processing of the searchable PDF reports:

- Initially, the reports were scanned by the search tool to look for the usage of the following terminologies, which are initial indicators for a potentially relevant disclosure: FinTech, big data, technology, digital, digitization, digitalization, software, systems, smart, platform, electronic, application, program, transformation, artificial, and intelligence.
- Secondly, after identifying the terms, the context was checked to assess whether it disclosed a FinTech-related matter. This was followed by skimming the report manually to ensure that the paper was as inclusive as possible for the contexts that used terms from the regular list. The most skimmed parts were the strategic initiatives, key developments, sustainability and corporate social responsibility, and awards and accolades.
- Finally, the report was re-examined for a final revision following the same process, seeking to minimize the room for error. After the re-examination, each disclosure was marked and recorded.

The examination and processing of the non-searchable PDF reports:

- At first, the reports were manually scanned to look for the usage of the following terminologies, which are initial indicators for a potentially relevant disclosure: FinTech, big data, technology, digital, digitization, digitalization, software, systems, smart, platform, electronic, application, program, transformation, artificial, and intelligence.
- Next, after identifying the terms, the context was checked to assess whether it disclosed a FinTech-related matter. This was followed by skimming the report manually to ensure that the paper was as inclusive as possible for the contexts that used terms from the regular list. The most skimmed parts were the strategic initiatives, key developments, sustainability and corporate social responsibility, and awards and accolades.
- At the end, the report was re-examined for a final revision following the same process, seeking to minimize the room for error. After the re-examination, each disclosure was marked and recorded.

Table 1. Variables’ definitions and measurements.

Variables	Abbreviation	Measurement
Audit fees	AuditFees	Total amount of fees paid to external auditors
Big data disclosure	Bigdata Disclosure	Score for each financial company based on big data statements that are disclosed in the chairman’s reports
Block holder ownership	BH	Number of owners who possess a 5% ownership concentration threshold
Firm’s size	FirmSize “LogAsset”	Natural logarithm of total assets
Firm’s leverage	LEV	Total debt divided by total assets
Firm’s profitability	ROE	Return on equity
Big 4	Big4	Dummy variable equals 1 if a company has been audited by one of the Big 4 audit firms, and 0 otherwise
Family firms	FamilyFirms “Relatives”	Dummy variable takes the value of 1 if a firm has directors from the same family on the board, and 0 otherwise
Politically connected firms	PoliticallyConnected “Ruling”	Dummy variable equals 1 if a firm has at least one ruling family director on the board, and 0 otherwise

3.3. Regression Model

Building on prior studies on audit quality, such as [Al Lawati and Sanad \(2023\)](#), we employ ordinary least squares (OLS) regression models to test our primary hypotheses. These models are designed to analyze the impact of big data disclosure on audit quality, with a particular focus on how this relationship is moderated by the presence of family and royal members on the board.

$$\text{AuditFees}_{it} = \beta_0 + \beta_1 \text{Bigdata Disclosure}_{it} + \beta_2 \text{FirmSize}_{it} + \beta_3 \text{LEV}_{it} + \beta_4 \text{ROE}_{it} + \beta_5 \text{Big4}_{it} + \beta_6 \text{BH}_{it} + \text{Industry \& Year Fixed Effect} + e_{it} \quad (1)$$

$$\text{AuditFees}_{it} = \beta_0 + \beta_1 \text{Bigdata Disclosure}_{it} + \beta_2 \text{FamilyFirms}_{it} + \beta_3 \text{Bigdata Disclosure} \times \text{FamilyFirms}_{it} + \beta_4 \text{FirmSize}_{it} + \beta_5 \text{LEV}_{it} + \beta_6 \text{ROE}_{it} + \beta_7 \text{Big4}_{it} + \beta_8 \text{BH}_{it} + \text{Industry \& Year Fixed Effect} + e_{it} \quad (2)$$

$$\text{AuditFees}_{it} = \beta_0 + \beta_1 \text{Bigdata Disclosure}_{it} + \beta_2 \text{PoliticallyConnected}_{it} + \beta_3 \text{Bigdata Disclosure} \times \text{PoliticallyConnected}_{it} + \beta_4 \text{FirmSize}_{it} + \beta_5 \text{LEV}_{it} + \beta_6 \text{ROE}_{it} + \beta_7 \text{Big4}_{it} + \beta_8 \text{BH}_{it} + \text{Industry \& Year Fixed Effect} + e_{it} \quad (3)$$

4. Data Analysis and Findings Discussion

4.1. Descriptive Statistics

Table 2 shows the descriptive statistics for our main dependent, independent, and control variables. The mean for our independent variable, big data disclosure, was 4.13, with a minimum of 2 statements to a maximum of 19 statements. The results are considered to be low, and this aligns with [Ahmed et al. \(2023\)](#)’s study findings, which showed an extremely low percentage of big data adoption in the Egyptian context. Audit fees, our dependent variable, of the Omani financial firms demonstrated a mean of OMR 38,462, and the variable ranged from OMR 2700 to OMR 302,715. The means of firm size, firm profitability, and firm leverage were 1.93, 4.71, and 15.16, respectively. The percentage of Omani financial firms that were audited by one of the Big 4 audit firms, such as PwC, KPMG, Deloitte, and E&Y, was significant (mean of 0.913). Approximately 16% of board members in Omani financial companies were royal family members, and 43% of these companies had family members serving on their boards of directors.

Table 2. Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
AuditFees	231	38,462	53,180	2700	302,715
BigDataDis	231	4.13	3.06	2.00	19.00
LogAsset	231	1.93	0.97	0.42	4.10
LEV	231	15.16	21.74	0.00	69.42
ROE	231	4.71	9.84	−41.58	30.43
Big4	231	0.91	0.28	0.00	1.00
Ruling	231	0.16	0.37	0.00	1.00
Relatives	231	0.43	0.50	0.00	1.00
BH	231	4.13	1.67	1.00	8.00

4.2. Correlation Analysis

Table 3 presents the correlation matrix for all variables included in our regression analysis to identify any potential multicollinearity issues that may have arisen. The findings show that the study variables' coefficients were below 0.7, which indicates that our data were free from multicollinearity issues. In addition, the variance inflation factor (VIF) was computed (un-tabulated), and the results were all below the critical value of 10, which confirmed that multicollinearity was not a problem in this study. In line with our prediction, the correlation between big data disclosure and audit quality was statistically significant at the 0.05 level.

Table 3. Correlation matrix.

	1	2	3	4	5	6	7	8	9
AuditFees	1								
BigDataDis	0.6187 **	1							
LogAsset	0.6913 **	0.5192 **	1						
LEV	−0.0305	−0.0745	0.2396 **	1					
ROE	0.1691 **	0.2358 **	0.2610 **	−0.0189	1				
Big4	0.3855 **	0.1340 **	0.2650 **	0.1860 **	0.0692	1			
Relatives	−0.2061 **	−0.0943	−0.0876	0.0402	−0.0867	0.0515	1		
Ruling	0.2439 **	0.1340 **	0.1356 **	−0.1786 **	0.0143	0.1366 **	−0.2227 **	1	
BH	0.0365	0.0127	0.1446 **	0.1439 **	−0.0881	−0.0122	0.1289 *	−0.0358	1

* Correlation is significant at the 0.10 level (2-tailed). ** Correlation is significant at the 0.05 level (2-tailed).

4.3. Multivariate Regression Analyses

Table 4 explains the regression results for our study, where we investigated the relationship between big data disclosure and audit quality. We assessed the OLS assumptions and assured their suitability for use in testing the study's hypotheses, following prior studies in the field.

Model 1 in Table 4 shows that there was a positive and significant relationship between big data disclosure and audit quality at the 0.01 level, which confirmed H1. As we have stated, companies are moving toward greater adaptation of big data, which they need to compete in this area nationally and globally. Having said that, it is costly for the companies to obtain the cutting-edge instruments and techniques, which require additional resources, such as expertise, specialized skill in the big data field, and artificial intelligence with specialized equipment capabilities, which will directly affect the audit fees required by the audit firms and, in turn, increase the audit quality of the companies.

In addition, companies that adopt big data in their operations will improve the efficiency and effectiveness of their financial records, transactions, and statements, which will positively impact the audit quality of their firms (Appelbaum 2016; Gepp et al. 2018). Auditors can enhance the quality level of their tasks by integrating specialized techniques through utilizing big data analytics, such as data mining, sentiment analysis, clustering, and visualization. This will assist in identifying and evaluating any potential inherent

risk that could arise in any section of financial statements and recognize materiality limits (Earley 2015). Companies that integrate big data software, packages, and techniques in their operations will request extensive audit services to enhance the level of integrity and veracity of audited financial statements, which means, ultimately, they will need to pay higher audit fees. Our findings provide new evidence in the Omani context that adaptation of big data will increase the audit quality in the institutions. Our results align with those of Rose et al. (2017), who stated that when the companies conduct high levels of big data in their operations, the external auditor will receive real-time disclosure, which will lead to the enhancement of the process completion and increase its audit quality by reducing the audit report lag.

Regarding H2, Model 2 in Table 4 shows that family members who serve on the board of directors positively and significantly affected the association between big data disclosure and audit quality in the Omani financial institutions at the significance level of 0.01. The findings confirmed H2 of the study. The finding implies that family members play a critical role in the companies they serve, as they are very concerned about the institutions' reputation. Thus, they encourage firms to adopt big data to cope with the global revolution in the technology era and, at the same time, they are very cautious to not release any fallacious financial statements, which, accordingly, will enhance the audit fees and increase the audit quality of the firms. In addition, family members' presence on the board of directors would reduce the agency conflicts due to their centralized control in long-term commitments, which is considered as a strong corporate governance characteristic that helps in reducing the managerial opportunities and avoids obtaining self-private benefits at the expense of other shareholders to protect their image (Al Lawati and Sanad 2023; Alhababsah 2016). In this regard, this will enhance the audit quality of the firms, and they request the management teams in financial companies to increase the adoption of big data and AI generative software to cope with industry demands and uphold their reputation for reliability and excellence. By leveraging these advanced technologies, Omani financial companies can ensure more accurate and transparent reporting, which is crucial for maintaining stakeholder trust and achieving long-term success.

Table 4. Regression analysis.

Model 1			Model 2			Model 3		
Big Data Dis.			Moderated × Relatives			Moderated × Royal		
Variables	Coefficient	P > t	Variables	Coefficient	P > t	Variables	Coefficient	P > t
BigDataDis	0.1084 ***	0	BigDataDis	0.0735 ***	0.000	BigDataDis	0.1222 ***	0.000
LogAsset	0.5717 ***	0.000	Relatives	−0.7576 ***	0	Ruling	0.4260 **	0.028
LEV	−0.0085 ***	0.000	Relatives × BigData	0.1119 ***	0	Ruling × BigData	−0.0450 *	0.105
ROE	−0.0068	0.126	LogAsset	0.5456 ***	0	LogAsset	0.5461 ***	0.000
Big4	0.8984 ***	0.000	LEV	−0.0075 ***	0	LEV	−0.0073 ***	0.001
BH	−0.0131	0.609	ROE	−0.0083 **	0.05	ROE	−0.0060	0.177
_cons	7.798	0.000	Big4	0.924 ***	0.000	Big4	0.848 ***	0.000
			BH	0.009	0.724	BH	−0.009	0.720
			_cons	8.016	0.000	_cons	7.767	0.000
R ²	0.6452		R ²	0.6875		R ²	0.6533	
Years and Industry Effect	Yes		Years and Industry Effect	Yes		Years and Industry Effect	Yes	
No. of Obs.	231		No. of Obs.	231		No. of Obs.	231	
Prob > F	0		Prob > F	0		Prob > F	0	

* Correlation is significant at the 0.10 level (2-tailed). ** Correlation is significant at the 0.05 level (2-tailed).

*** Correlation is significant at the 0.01 level (2-tailed).

However, in Model 3, there was a negative and significant relationship between big data disclosure and audit quality moderated by royal members serving on the board of di-

rectors at the significance level of 0.1. This finding supports H3. Based on previous research (Al Lawati and Sanad 2023; Johnson and Mitton 2003), royal members might get along with governmental bodies due to their political relationships, through which they can influence favorable policies and gain greater exposure to potential regulatory changes that they can utilize for their business's advantage, at the expense of minority shareholders (Al Lawati and Sanad 2023). Therefore, this practice will reduce the transparency and accountability of these firms, as royal directors will not require extensive audit checks and assurance for their companies' financial statements for different reasons, such as encountering tax avoidance practices, manipulating earnings, and a lack of financial reporting quality. This will lead to a lower audit quality of the firms. This is in line with Al-Hadi et al. (2016), who stated that politically connected companies do not have a crucial impact on the audit quality of the firms. This could be due to different interests they have, which might conflict with the main objective that is necessary in order to achieve quality audits and thoroughness of the audit process. The presence of such individuals can mean less thoroughness in the examination of financial statements because auditors may feel forced to turn a blind eye to the irregularities in order to remain in the good books of the company.

5. Additional Analyses

5.1. Panel Data Regression

We conducted a Hausman fixed specification test and it showed that the random effect estimation method is the appropriate model for hypotheses testing. We used the panel data approach as an additional analysis to deal with different types of variables that could change among corporations but remain constant over years, as well as variables that could change over corporations and years at the same time (Alhababsah 2019). Table 5 shows the results, which indicate the effect of big data disclosure and control variables on the audit quality.

Table 5. Random effect regression analysis.

Model 1			Model 2			Model 3		
Big Data Dis.			Moderated × Relatives			Moderated × Royal		
Variables	Coefficient	P > z	Variables	Coefficient	P > z	Variables	Coefficient	P > z
BigDataDis	0.0467 ***	0.001	BigDataDis	0.0281 *	0.072	BigDataDis	0.0535 ***	0.001
LogAsset	0.2073 ***	0.000	Relatives	−0.5972 ***	0	Ruling	0.1259	0.506
LEV	−0.0030	0.201	Relatives × BigData	0.0628 **	0.025	Ruling × BigData	−0.0208	0.429
ROE	−0.0070 **	0.052	LogAsset	0.2276 ***	0	LogAsset	0.2055 ***	0.000
Big4	0.8004 ***	0.001	LEV	−0.0033	0.158	LEV	−0.0029	0.223
BH	0.0248	0.422	ROE	−0.0081 **	0.023	ROE	−0.0068 *	0.060
_cons	8.607	0.000	Big4	0.847 ***	0.000	Big4	0.788 ***	0.001
			BH	0.031	0.311	BH	0.026	0.394
			_cons	8.743	0.000	_cons	8.581	0.000
R ²	0.7162		R ²	0.7551		R ²	0.724	
Years and Industry Effect	Yes		Years and Industry Effect	Yes		Years and Industry Effect	Yes	
No. of Obs.	231		No. of Obs.	231		No. of Obs.	231	
Prob > F	0		Prob > F	0		Prob > F	0	

* Correlation is significant at the 0.10 level (2-tailed). ** Correlation is significant at the 0.05 level (2-tailed).

*** Correlation is significant at the 0.01 level (2-tailed).

The results confirmed the main findings of our study (Table 5). Big data disclosure had a positive and significant impact on the audit quality. In addition, family members on the boards played a positive and significant moderating impact on the association between big data disclosure and audit quality in the Omani financial firms. This confirmed that big

data adaptation played a vital role in the Omani companies by enabling them to conduct information analysis efficiently to enhance the process of making decisions. Emerging big data technologies will assist companies in understanding the market needs, analyzing customer behavior, and examining the financial performance. Hence, they will help them in innovating and achieving sustainable business growth in the highly dynamic business environment of Oman.

5.2. Fixed Effect Regression

To ensure that our findings were not affected by omitted variables or any other sources of unobserved heterogeneity, we conducted an additional robustness check using the fixed effects model to ensure the appropriateness of our results.

Table 6 demonstrates the findings. Our analysis reinforced the core findings of this study. Big data disclosure demonstrated a positive and significant influence on audit quality, underscoring its crucial role in enhancing financial reporting standards. Moreover, the presence of family members on the board of directors significantly strengthened the relationship between big data disclosure and audit quality in Omani financial firms. This highlights the importance of big data adoption in Omani companies, as it enables more efficient information analysis, thereby improving decision-making processes. The integration of emerging big data technologies will equip companies with the tools to better understand market trends, analyze customer behavior, and evaluate financial performance. Consequently, these advancements will support innovation and drive sustainable business growth within Oman's rapidly evolving economic landscape.

Table 6. Fixed effect regression analysis.

Model 1			Model 2			Model 3		
Big Data Dis.			Moderated × Relatives			Moderated × Royal		
Variables	Coefficient	P > z	Variables	Coefficient	P > z	Variables	Coefficient	P > z
BigDataDis	0.0059 *	0.058	BigDataDis	0.0013	0.916	BigDataDis	0.0019	0.884
LogAsset	0.0316	0.408	Relatives	−0.3127 *	0.068	Ruling	−0.2643 *	0.110
LEV	0.0042 *	0.058	Relatives × BigData	0.0033 *	0.087	Ruling × BigData	−0.0176 **	0.041
ROE	−0.0054 *	0.055	LogAsset	0.0333	0.387	LogAsset	0.0321	0.401
Big4	−0.3744	0.252	LEV	0.0042 *	0.055	LEV	0.0040 *	0.073
BH	0.0431	0.136	ROE	−0.0060 **	0.035	ROE	−0.0058 **	0.040
_cons	9.9944	0	Big4	−0.3696	0.254	Big4	−0.3715	0.255
			BH	0.0377	0.191	BH	0.0400	0.167
			_cons	10.1605	0	_cons	10.0539	0
R ²	0.0749		R ²	0.0985		R ²	0.0873	
Years and Industry Effect	Yes		Years and Industry Effect	Yes		Years and Industry Effect	Yes	
No. of Obs.	231		No. of Obs.	231		No. of Obs.	231	
Prob > F	0		Prob > F	0		Prob > F	0	

* Correlation is significant at the 0.10 level (2-tailed). ** Correlation is significant at the 0.05 level (2-tailed).

6. Discussion

The results of our study revealed a significant relationship between big data disclosure and audit quality, highlighting the importance of technological advancement in the auditing process. As firms increasingly adopt big data, they face higher costs related to acquiring advanced tools, expertise, and infrastructure necessary for effective data management. These costs are justified by the corresponding increase in audit fees, which directly contributes to enhanced audit quality. The integration of big data analytics into company operations not only improves the accuracy and transparency of financial records but also supports auditors in performing more thorough and effective audits. Techniques such as data mining,

sentiment analysis, and visualization enable auditors to better identify potential risks and ensure that financial statements accurately reflect the company's financial position. These findings underscore the crucial role of big data in improving audit quality, particularly in a context where companies are striving to meet both national and global standards.

Moreover, the presence of family members on the board of directors appeared to strengthen the positive impact of big data disclosure on audit quality. Family members, driven by a vested interest in maintaining the firm's reputation, are likely to advocate for the adoption of advanced technologies to ensure the accuracy and reliability of financial reporting. Their long-term commitment to the company and their influence in reducing agency conflicts contribute to stronger corporate governance, which further enhances audit quality. The practical implication here is that firms with family members on the board may benefit from a more rigorous audit process, as these members are likely to push for higher standards in financial reporting and transparency.

However, our study also indicated that the involvement of royal family members on the board can negatively moderate the relationship between big data disclosure and audit quality. Royal family members may have access to political connections that allow them to navigate regulatory environments in ways that benefit their interests but may undermine transparency and accountability. This could result in less rigorous auditing processes, as auditors may be inclined to overlook potential issues to maintain favorable relations with the company. The implication here is that firms with royal family members on the board might face challenges in maintaining a high audit quality, particularly if these members prioritize personal or political gains over strict adherence to audit standards.

These findings offer practical insights, particularly for regulators and policymakers in similar economic contexts. Encouraging the adoption of big data and ensuring that governance structures, especially those involving family and royal members, align with principles of transparency and accountability can significantly improve audit quality. For auditors, understanding the dynamics of board composition, especially in regions where familial and royal influences are prevalent, is critical in navigating potential challenges and upholding audit integrity.

Overall, the study highlighted the dual-edged nature of governance structures in influencing audit quality, where technological adoption and board composition play pivotal roles. The practical implications of these findings extend to enhancing regulatory frameworks, improving audit practices, and ensuring that the benefits of big data are fully realized in maintaining financial integrity and stakeholder trust.

7. Conclusions

This study investigated the impact of big data disclosure on audit quality within the context of Omani financial companies, aligning with Oman Vision 2040's strategic goals. By analyzing data from 33 Omani financial firms listed on the Muscat Stock Exchange from 2014 to 2020, our findings highlighted the critical role that big data disclosure plays in enhancing audit quality. Specifically, the results demonstrated that increased transparency and the accuracy of voluntary disclosures, driven by big data, significantly improved audit quality. This relationship was further amplified when moderated by the presence of family members on the board of directors, as evidenced by the increase in R-squared from 65% to 69%.

Our research addressed a gap in the literature by being the first to examine the relationship between big data disclosure and audit quality in the Omani context. We investigated this topic in a developing region where research on this subject is scarce. Several lessons can be drawn from the Omani economic environment that may be useful to researchers in similar contexts. First, the unique economic structure of Oman, with its significant reliance on oil and gas revenues, underscores the importance of transparency and accurate financial reporting in sectors that are central to the economy. Big data analytics can play a pivotal role in enhancing this transparency, thereby improving stakeholder trust and financial stability.

Second, the presence of family-owned businesses is prevalent in Oman, which has been shown to influence the relationship between big data disclosure and audit quality. The findings suggested that in economies with a high concentration of family-owned firms, integrating big data practices can help mitigate potential governance challenges and improve the quality of audits. This insight could be particularly valuable for researchers studying similar economies where family businesses dominate.

Third, the regulatory environment in Oman, which is gradually evolving to align with international standards, provides a case study on the integration of big data into existing financial and audit frameworks. Researchers can draw parallels with other developing countries undergoing similar regulatory transformations and explore how big data can be effectively incorporated to enhance the audit quality.

Our study contributes theoretically and practically in this field. First, we thoroughly discussed the positive impact that big data can generate in the firms, which provides better knowledge on how it effects the audit quality in emerging countries, such as Oman. Also, it will equip them with lessons and opportunities to learn and utilize more big data in their firms. Secondly, the study offers practical implications to regulators, investors, managers, and auditors. For managers, it is important for them to consider adopting the big data analytics tools and incorporating them into their systems of financial reports' production. Policymakers should encourage the implementation of regulations that compel firms to disclose big data analytics usage in annual reports or make it mandatory for auditors to include information on a firm's big data analytics practices in their audit reports. Implementing such measures would also make certain that the benefits derived from big data techniques are harnessed to the optimum in order to increase the reliability and credibility of financial statements. Moreover, strengthening the level of corporate governance mechanisms within companies would help in such enhancements. Integrating big data alongside regulatory reforms can mitigate risks associated with weak corporate governance and help firms enhance the audit quality of financial statements, thereby strengthening stakeholders' confidence in financial reports.

This study offers many avenues for future researchers. The study was conducted in the Omani context, and future studies can conduct similar research on the Gulf Cooperation Council and compare results, considering the influence of national factors on this relationship. In addition, future studies can moderate the relationship between big data disclosure and audit quality with corporate governance characteristics, such as audit committee features and ownership identities. We also suggest to use qualitative analyses in future studies to obtain thorough knowledge about the impact of big data adoption on the audit quality of the firms. Moreover, other proxies for audit quality can be used in future studies, such as the audit firm size and auditor tenure. Furthermore, future studies should explore various dimensions of influence exerted by royal family members on audit quality. This includes distinguishing between direct board influence and indirect political or social connections, which could provide a more comprehensive understanding of their impact on corporate governance and audit practices. This can be conducted by employing qualitative methods, such as interviews, that could offer deeper insights into the informal power dynamics and the varying roles of royal family members across different types of firms and economic contexts.

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