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Financial Reporting Quality: A Review of Its Applications and Measurements

Abdulrahman Alomair
Accounting Department, Business School, King Faisal University, Al-Ahsa, Saudi Arabia

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ABSTRACT

This study extensively examines various proxies used to capture financial reporting quality (FRQ), a critical factor in ensuring transparency in financial markets and maintaining robust corporate governance. Via conducting a comprehensive review of popular proxies from previous literature, the study emphasises the importance of FRQ in fostering investor confidence, supporting effective decision-making and enhancing overall financial market efficiency. The research systematically compares several models used to calculate discretionary accruals, a widely recognised proxy for earnings management. In doing so, it identifies the modified Jones model, developed by Dechow et al. (1995), and the performance-matched model, introduced by Kothari et al. (2005), as two of the most effective proxies for measuring FRQ. Furthermore, the study suggests that the performance-controlled model should be re-tested to ensure its theoretical consistency with the modified Jones model, potentially improving its applicability in future empirical research. Ultimately, this study contributes to the ongoing development of robust methodologies for accurately assessing FRQ and enhancing financial reporting standards.

KEYWORDS
Accruals model, corporate governance, discretionary accruals, earnings management, earnings persistence, market efficiency

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1. Introduction

Financial reporting is key for conveying reliable financial data to external users. Financial reporting quality (FRQ) directly influences the reliability and value of corporate financial statements, which are critical for decision-making by investors and regulators. Despite its importance, the definition of FRQ remains debated (Ball *et al.*, 2003). Various proxies have been proposed, but no consensus on the best method exists, as all have limitations. Recent studies have explored the link between earnings management and FRQ in different economic contexts (e.g. Beuselinck *et al.*, 2019).

Gaynor *et al.* (2016) define high-quality financial reports as complete, neutral, error-free and offering predictive or confirmatory information. This aligns with International Accounting Standards Board's (IASB) (2010) characteristics of relevance and faithful representation. Adopting this definition, this study reviews FRQ measurement models to identify suitable proxies. A greater understanding of their strengths and limitations could help improve FRQ measurement, enhance transparency and monitor FRQ more effectively. Therefore, this study aims to contribute to the literature by proposing a robust FRQ measurement framework.

This study applies agency theory to FRQ. This theory suggests a conflict between managers (agents) and shareholders (principals) due to the separation of ownership and control. Managers may manipulate earnings or selectively disclose information to further personal goals. High-quality financial reporting mitigates these agency problems by providing transparent, unbiased information (Healy and Wahlen, 1999). However, assessing FRQ is difficult due to its multidimensional nature and the lack of a standardised definition. Informed by agency theory, this study aims to address the following key research questions:

What are commonly used proxies for measuring FRQ in empirical research?

Which methods provide the most valid and reliable assessment of FRQ based on a review of the prior literature?

Via analysing popular FRQ measurement models through the lens of agency theory, this study seeks to advance the conceptual understanding of this important accounting construct and clarify the best practices for future empirical examination of FRQ.

2. Financial Reporting Quality Measurements

Various methods are used to assess FRQ, each offering a different perspective (Gaynor *et al.*, 2016). These approaches include voluntary disclosure levels, timely loss recognition and earnings persistence. For example, Botosan and Plumlee (2002) used voluntary disclosure, while Bushman and Williams (2015) focused on early loss recognition. The accrual quality method developed by Dechow and Dichev (2002) assesses short-term accruals against cash flows. Earnings persistence is another measure used to gauge FRQ (Dechow *et al.*, 2010). The multifaceted nature of FRQ means its assessment is often decision specific (Dechow *et al.*, 2010). The current study organises FRQ measures into two categories, as follows: market-based and accounting-based.

2.1. Market-based Measures:

Market-based measures essentially rely on market data, such as share price and returns, and financial statements data to assess the quality of financial reports (Francis *et al.*, 2004). Market-based estimation focuses on the association between share prices or returns and accounting earnings (Bushman and Williams, 2015; Francis *et al.*, 2004). Two commonly used market-based measures of FRQ are value relevance and timely loss recognition (Dechow *et al.*, 2010).

2.1.1. Value Relevance

The value relevance of accounting information refers to the ability of financial statements to evaluate information affecting a company's value (Lang *et al.*, 2006). It is measured by examining the relationship between accounting information and stock market values or returns (Nicolò *et al.*, 2024). Barth and McClure (2023) linked value relevance to valuation and accounting theories. Common measurements include the explanatory power of earnings–returns

Corresponding Author: Abdulrahman Alomair 00966554844599, aamalomair@kfu.edu.sa

regression and the earnings response coefficient (Nicolò *et al.*, 2024). Easton and Harris's (1991) return model and Ohlson's (1995) modified price model are widely used to detect value relevance, relying on variables such as the market value of equity, book value of equity and earnings per share.

However, the value relevance approach has limitations. For example, Lang *et al.* (2006) argued that value relevance is limited to focusing on the relationship between accounting information and stock market values or returns rather than comprehensively measuring the quality of financial reporting. Another study by Barth and McClure (2023) highlighted several obstacles to employing value relevance. This approach requires the accounting value reported in financial reports to align with the fair value in share prices and returns; furthermore, some managers cannot handle discretion in accounting figures (Barth and McClure, 2023). Other studies, such as those of Watts (2001) and Nicolò *et al.* (2024), have noted that the value relevance approach does not always reflect the actual information in financial reports.

2.1.2. Timely Loss Recognition

Timely loss recognition refers to the faster reflection of bad news in earnings compared with good news (Khalifa *et al.*, 2024). It is an important FRQ measure (Gaynor *et al.*, 2016) based on conditional conservatism, whereby companies promptly recognise losses (Duong *et al.*, 2018). This method leads to higher FRQ, as noted by Brown *et al.* (2006), who argued that stronger legal institutions enforce timely loss recognition and prevent opportunistic gain recognition. Basu's (1997) model, which is widely used in conservatism literature, measures the relationship between earnings timeliness and stock returns. However, critics such as Dechow *et al.* (2010) have suggested that bad news recognition may result in less persistence of negative earnings changes.

2.2. Accounting-based Measures:

Accounting-based measures depend on accounting information from financial statement data, such as cash flow and earnings, to detect FRQ (Francis *et al.*, 2004). This type of measure is constructed using accounting information only, ignoring capital market data. Such measures commonly used in the literature are earnings persistence predictability and earnings management as proxies for FRQ.

2.2.1. Earnings Persistence and Predictability

Earnings persistence refers to the sustainability of earnings over time (Francis *et al.*, 2004). Penman (2013) defined it as a company's ability to generate recurring earnings. Highly persistent earnings indicate high-quality earnings (Perotti and Wagenhofer, 2014), while less persistent earnings are considered lower quality. Persistent earnings help analysts make better performance predictions (Scott, 2015). A common method utilised to measure persistence is through the regression coefficient of current earnings on lagged earnings (Dechow *et al.*, 2010).

Although earnings persistence provides a useful concept in analysing earnings and is a good measure for equity valuation, some argue that it is largely affected by the accounting policies applied (Scott, 2015). In addition to Scott (2015), Dechow *et al.* (2010) have also expressed concerns about measuring earnings persistence, believing this measurement to be less reliable – it may be useful in the short term but not in the long term. Dechow *et al.* (2010) reported that short-term accrual components are less persistent than long-term components, which means the measurement is more appropriate for short-term operating assets than for financial assets.

Earnings predictability is defined as the ability of past and current earnings to forecast future earnings (Khuong *et al.*, 2022). A higher quality of earnings predictability means a higher ability to predict future earnings, whereas a lower quality of earnings predictability is viewed as a lesser ability to predict future earnings (Khuong *et al.*, 2022). Dechow *et al.* (2010) observed that a high quality of earnings predictability indicates a strong association between a company's earnings series; that persistence in earnings plays a substantial role in predicting earnings. Earnings predictability is measured using the square root of the error variance from the earnings persistence (Francis *et al.*, 2004).

2.2.2. Earnings Management

Earnings management is the manipulation of financial information to alter a company's reported financial position (Alghamdi, 2012). Walker (2013) defined it as the use of managerial discretion over accounting choices and real decisions to influence how economic events are reflected in earnings. Healy and Wahlen (1999) described earnings management as the use of judgement to mislead stakeholders or influence contractual outcomes dependent on reported numbers.

Several studies consider earnings management a primary concern for financial information quality. Curbing earnings management has drawn significant attention from global regulatory reforms (Smith, 2003).

A company may manipulate its earnings based on its motivation (Aljifri, 2007). Accrual accounting is considered the most common practice utilised in earnings management because it gives managers a great deal of discretion in manipulating the timing of earnings (and/or) expenditures that can be linked to opportunistic management behaviour (Healy and Wahlen, 1999). Accruals are the time lag between the timing of cash flows and the accounting recognition of a transaction (Ronen, 2008). For example, some companies try to increase their income to raise their stock prices to meet analysts' predictions, whereas others try to decrease their income to avoid the costs of regulation. Thus, discretionary accruals play a significant role in earnings manipulation.

Many studies (see Carrera *et al.*, 2017; Dou *et al.*, 2018) use earnings management and the level of discretionary accruals as proxies to measure FRQ. Carrera *et al.* (2017) and Walker (2013) emphasised that earnings management indicates poor FRQ, in which the relationship between earnings management and FRQ is adverse. Measuring earnings management relies on the level of discretionary accruals in a company; minimising the level of discretionary accruals leads to higher FRQ (Walker, 2013). More recent research (e.g. Dou *et al.*, 2018) has expanded on the role of discretionary accruals in emerging markets, offering further validation of the accrual models discussed in earlier studies (Dechow *et al.*, 1995; Kothari *et al.*, 2005). Table 1 provides a summary of the key FRQ measurement approaches discussed in this paper to help the reader understand the relative merits and limitations of each model.

Table 1: Comparison of selected financial report quality (FRQ) measurement methods.

Model	Theoretical Rationale	Data Required	Key Strengths	Key Limitations
Value Relevance	Links accounting Information to equity market values	Stock prices Accounting data	Directly assesses FRQ's impact on investor decision usefulness	Requires efficient markets Ignores instances where prices diverge from fundamentals
Timely Loss Recognition	Conditional conservatism – biases managers towards timely bad news	Earnings Stock Returns	Objective measure of bias in earnings Reduced agency costs	Does not consider all factors driving conditional conservatism
Earnings Persistence	Sustainable earnings over time indicate higher-quality reports	Earnings over multiple periods	Intuitive measure of consistency and predictability	Influenced by accounting choices Short-term focus
Discretionary Accruals	Accruals model control for non-discretionary accruals	Financial statement accounts	Direct assessment of earnings management bias	Imprecise accruals decompositions Proxy error issues

In the exploration of the value relevance model in the literature, it is essential to consider the theoretical underpinnings linking

accounting information to equity market values. This model is premised on the idea that financial statements convey pertinent information that reflects a firm's value, a concept that has been extensively discussed in seminal work (Ohlson, 1995). Empirical studies have operationalised this model using stock prices and accounting data as key inputs, as demonstrated via influential research by Ball and Brown (1968). The direct assessment of FRQ and its subsequent impact on investor decision-making are among the model's key strengths, as validated by Nicolò *et al.* (2024). However, the model's limitations are notable, particularly its reliance on efficient market assumptions and its disregard when prices diverge from fundamental values (Shleifer and Vishny, 1997).

The timely loss recognition model highlights the concept of conditional conservatism and managerial bias towards the prompt acknowledgement of unfavourable news (Dutta *et al.*, 2024). The requisite data for this model extends beyond earnings to include stock returns and other financial measures, which have been effectively used in previous studies, such as those of Zhong and Li (2017). The model's objective nature and implications for reduced agency costs are its fortitudes (Watts, 2003). Nonetheless, it does not encompass all factors influencing conditional conservatism, and there are concerns regarding proxy errors (Watts, 2003).

When discussing earnings persistence, it is paramount to consider the sustainability of earnings over time as a reflection of higher-quality financial reports, a topic thoroughly examined in the literature (Dechow and Schrand, 2010). The need for longitudinal earnings data underscores the model's capacity to measure consistency and predictability, which Sloan (1996) found to be particularly valuable. However, this model is not without caveats, as it could be subject to manipulation through accounting choices; moreover, there is a possibility that managers may focus too narrowly on short-term earnings (Cable and Jackson, 2008).

Discretionary accruals are scrutinised via models designed to differentiate between discretionary and non-discretionary elements to detect earnings management (Jones, 1991). These models rely heavily on detailed financial statement account analyses (DeFond and Jiambalvo, 1994). Their primary strength lies in their direct assessment of earnings management bias, an effectiveness evidenced by the work of Dechow *et al.* (1995). However, the imprecision of accrual decomposition and the potential for proxy errors present significant limitations to this approach (McNichols, 2002).

In conclusion, each model offers insights into the link between accounting information and market values. Their effectiveness depends on an understanding of their theoretical bases, data needs, and strengths and weaknesses. The literature provides evidence and critiques that inform the development of these models and their application in research.

3. Models for Capturing Earnings Management

Earnings management is a key measure for determining FRQ (Dechow *et al.*, 2010). Perotti and Wagenhofer (2014) evaluated eight FRQ measures in United States non-financial firms and found that accrual measurements are the most useful for detecting earnings quality. DeFond and Zhang (2014) also found earnings management to be a primary FRQ measure due to its strong link to audit quality, consistent with Jones's (1991) findings that it is widely used to assess FRQ.

Earnings management has always been a major concern in corporate regulatory reform (Smith, 2003). In addition, the importance of reported earnings is directly related to a company's value; thus, earnings management represents a significant tool that any top management uses to align with the earnings expectations of their companies. Further, earnings management is considered an important topic in developing and emerging markets. Several studies have found that the level of earnings management is higher in developing countries than in developed countries. Enomoto *et al.* (2015) concluded that developing countries show less investor protection and higher levels of aggressive earnings management than developed countries, attributing these findings to the concentration of ownership and the weak legal enforcement in developing countries. In addition, Enomoto *et al.* (2015) and Beuselinck *et al.* (2019) emphasised that the level of earnings management increases remarkably in an environment with weak legal enforcement.

Abdul Rahman and Haneem Mohamed Ali (2006) claimed that managers may increase their wealth by taking advantage of agency problems to conspire against owners. Habbash (2010) considered that managers are more likely to practice earnings management by managing accruals because this approach is less obvious and more difficult to detect. From an institutional theory perspective, Li *et al.* (2011) noted that the enactment of laws and regulations by governments may create constraints for companies and that these formal constraints can motivate managers to manipulate earnings. They suggested using earnings management to measure FRQ, consistent with the commonly accepted indicator of earnings measurement discussed in prior literature (Li *et al.*, 2011).

Earnings management measurement is challenging in many studies because earnings management is difficult to detect (Alghamdi, 2012; Habbash, 2010). Therefore, the process of earnings management detection must involve a fully integrated study in which it is treated as a phenomenon. Many research works have found multiple ways to measure earnings management using statistical methods. However, manipulating accruals is the preferred instrument for earnings management and does not manipulate cash earnings due to difficulty in doing so (Schipper, 1989). Therefore, most research focuses on the proportion of earnings that are not managed (accruals) to measure companies' earnings management. Based on various accrual measurement studies, the level of discretionary accruals is the most accepted approach used in the accounting literature for measuring earnings management. Many studies (see DeAngelo, 1986; Healy, 1985; Jones, 1991) favour the discretionary accruals approach because it can detect and measure levels of discretionary accruals that are not directly observable.

Numerous studies have used discretionary accruals as a proxy for FRQ (Carrera *et al.*, 2017; Li *et al.*, 2008). Previous research works have built various models to detect and measure the level of discretionary accruals utilising different statistical analysis methods. These include the DeAngelo (1986) model, the Healy (1985) model, the Jones (1991) model, the modified Jones model (Dechow *et al.*, 1995), the industry model (Dechow *et al.*, 1995), the performance-matched model (Kothari *et al.*, 2005), the Dechow and Dichev (2002) approach and discretionary estimation errors (Francis *et al.*, 2005). The current study focuses on Jones's (1991) model, the modified Jones model (Dechow *et al.*, 1995), the performance-matched model (Kothari *et al.*, 2005), Dechow and Dichev's (2002) approach and discretionary estimation errors (Francis *et al.*, 2005). These models were selected based on the work of Dechow *et al.*' (2010), who found that they are the most common accrual models employed to estimate the level of discretionary accruals. This section summarises each accrual model independently in order to choose the most effective and appropriate model for this study.

3.1. The Jones (1991) Model:

Jones (1991) proposed that this model controls for both discretionary and non-discretionary accruals in a company's economic position.

The Jones (1991) model assumes the accrual model is that working capital accruals and depreciation expenses are a function of revenue growth and property, plant and equipment (PPE). This model is used as a proxy for earnings management, has been employed widely in various studies to detect earnings management and is considered more powerful than previous models, including those of Healy (1985) and DeAngelo (1986).

However, the Jones (1991) model has been critiqued by later studies (see Bernard and Skinner, 1996; Francis *et al.*, 2005). Researchers have noted that it does not properly measure earnings management. Bernard and Skinner (1996) find that the Jones model imprecisely estimates the level of discretionary accruals because the estimated coefficients of the model are inaccurate. In addition to Bernard and Skinner (1996), Aljifri (2007) claims that the Jones model does not consider the manipulation of revenue over time and that it assumes that all revenues over a period are non-discretionary, which may generate a biased model. The Jones (1991) model assumes that managers do not exercise discretion over revenue; however, they can manipulate discretionary accruals (Habbash, 2010). Another study by Dechow *et al.* (2010) found that the explanatory power of the Jones model is low as it explains less than 10% of the variation in accruals. Dechow *et al.* (2010) explain that this low explanatory power is due to managers' control over accruals.

3.2. The Modified Jones Model (Dechow *et al.*, 1995):

Many studies have considered the arguable assumption of the Jones (1991) model and claimed that their studies reduce potential errors (about the assumption that managers do not exercise discretion over revenue) in the model (Ronen, 2008). Dechow *et al.* (1995) addressed the limitations of the Jones (1991) model (built on the assumption of non-discretionary revenue that leads to discretionary accruals being calculated incorrectly). While Jones (1991) defined the accruals process as a function of revenue growth and PPE, the modified Jones model (Dechow *et al.*, 1995) is an adjusted form of the original model. It excludes growth in credit sales in the years identified as manipulation years. Dechow *et al.*'s (1995) modification has made the model more capable of detecting revenue manipulations when managers exercise discretion over it. According to Dechow *et al.* (1995), the modified Jones model 'is designed to eliminate the conjectured tendency of the Jones model to measure discretionary accruals with error when discretion is exercised over revenues' (p. 199). Dechow *et al.* (2010) pointed out that this modification increases the explanatory power of the Jones model.

The modified Jones model (1995) is calculated using the following steps:

Step (1): Consistent with Jones's (1991) work, total accruals are computed using the following equation:

TA_{it} = [Change Current Assets – Change Cash] – [Change Current Liabilities] – Depreciation and Amortisation Expense, (1)

where:

TA_{it} = total accruals for company i in year t.

Step (2): Non-discretionary accruals can be calculated by the following equation (after estimating the firm-specific parameters α_{1i}, α_{2i} and α_{3i} as described below):

$$NDA_{it} / A_{it-1} = \alpha_{1i} (1/A_{it-1}) + \alpha_{2i} [(\Delta REV_{it} - \Delta REC_{it}) / A_{it-1}] + \alpha_{3i} (PPE_{it} / A_{it-1}), \quad (2)$$

However, multiplying the previous equation by (A_{it-1}) makes it easier to use.

$$NDA_{it} = \alpha_{1i} + \alpha_{2i} (\Delta REV_{it} - \Delta REC_{it}) + \alpha_{3i} (PPE_{it}) \quad (3)$$

where:

NDA_{it} = non-discretionary accruals for firm i in year t

A_{it-1} = total assets for firm i in year t-1

ΔREV_{it} = difference between revenues for firm i in year *t* and revenues in year *t – 1*

ΔREC_{it} = difference between net receivables for firm i in year *t* and net receivables in year *t -1*

PPE_{it} = total PPE for firm i at the end of year t

Total accruals are used to estimate the firm-specific parameters α_{1i}, α_{2i} and α_{3i} using the following equation, with data from an independent estimation period prior to the main analysis period:

$$TA_{it} / A_{it-1} = \alpha_{1i} (1/A_{it-1}) + \alpha_{2i} [(\Delta REV_{it} - \Delta REC_{it}) / A_{it-1}] + \alpha_{3i} (PPEit / A_{it-1}) + \varepsilon_{it}, \quad (4)$$

where:

α_{1i}, α_{2i} and α_{3i} are firm-specific parameters and are estimated using at least 10 years of historical financial data for each variable of the sample companies*

ε_{it} = residuals of the model for firm i at the end of year t

Step (3): After the total accruals in Step (1) and the non-discretionary accruals in Step (2) are defined, discretionary accruals can be computed using the following equation:

$$DA_{it} = TA_{it} - NDA_{it}, \quad (5)$$

where:

DA_{it} = discretionary accruals for firm i in year t.

The modified Jones model (1995) has gained wide support in accounting literature, which considers this version to be the most powerful for detecting earnings management; this is because it focuses on detecting cases of revenue manipulations, while other models do not (Aljifri, 2007). However, the modified Jones model was criticised by Kothari *et al.* (2005), who argued that the Jones (1991) and modified Jones models might not accurately capture discretionary accruals because of their failure to consider company performance. Recent studies (e.g. Carrera *et al.*, 2017; Kayed and Meqbel, 2024) have continued to validate the modified Jones model while also acknowledging its limitations in detecting earnings manipulation in certain contexts.

3.3. The Dechow and Dichev (2002) Approach:

Subsequently, Dechow and Dichev (2002) developed a novel model to measure earnings management; their approach assumes that the accruals model is the association between current-period working capital accruals and operating cash flows from different time periods. McNichols (2002) discussed various models that measure accruals quality and found that Dechow and Dichev's (2002) approach captures a significant factor of earnings quality, which is based on the relationship between accruals and cash flows.

Dechow and Dichev (2002) calculated accrual quality using the following equation:

$$\Delta WC_t = \beta_0 + \beta_1 CFO_{t-1} + \beta_2 CFO_t + \beta_3 CFO_{t+1} + \varepsilon_t,$$

where:

ΔWC_t = [Δ Current Assets – Δ Current Liabilities] – Δcash

CFO_{t-1} = Cash flows from operations in year t−1

CFO_{t} = Cash flows from operations in year t

CFO_{t+1} = Cash flows from operations in year t+1

ε_t = residuals of model in year t

However, McNichols (2002) argued that prior models, such as those of Dechow *et al.* (1995) and Jones (1991), can also detect earnings quality based on the relationship between accruals and cash flows. In addition to McNichols (2002), Dechow *et al.* (2010) critiqued Dechow and Dichev's (2002) approach; they noted that it is unsigned, which can reduce the power of tests, and that it focuses on short-term accruals and does not address errors in long-term accruals.

3.4. The Performance-Matched Model:

Kothari *et al.*'s (2005) performance-matched model has become the focus of accounting studies (Idris *et al.*, 2018). Kothari *et al.* (2005) argued that the Jones (1991) and modified Jones models may not properly measure discretionary accruals because they do not consider company performance. They noted a significant positive relationship between discretionary accruals, calculated by the Jones or modified Jones model, and return on assets (ROA) (Kothari *et al.*, 2005).

The performance-matched model presented by Kothari *et al.* (2005) matches companies by choosing two companies from the same industry that have similar ROAs; it then calculates the difference between these two companies to generate 'performance-matched' residuals. Dechow *et al.* (2010) determined that Kothari *et al.*'s (2005) model may reduce the power of the test but can be applied when company performance is a concern. Dechow *et al.* (2010) also noted the approach 'is likely to add noise to the measure of discretionary accruals, and it is best applied when correlated performance is an important concern' (p. 359).

Similar to the modified Jones model, Kothari *et al.*'s (2005) performance-controlled approach requires using time series regression for each company to estimate the firm-specific parameters. The following steps are used in computing the performance-controlled approach:

Step (1): This step is the same as that in the modified Jones model:

Step (2): Non-discretionary accruals can be calculated using the following equation after estimating the firm-specific parameters α_{0i}, α_{1i}, α_{2i}, α_{3i} and α_{4i} as described below:

$$NDA_{it}/ A_{it-1} = \alpha_{0i} + \alpha_{1i} (1/A_{it-1}) + \alpha_{2i} [(\Delta REV_{it} - \Delta REC_{it}) / A_{it-1}] + \alpha_{3i} (PPE_{it} /A_{it-1}) + \alpha_{4i} ROA_{it.} \quad (6)$$

Total accruals are used to estimate firm-specific parameters α_{1i}, α_{2i}, α_{3i} and α_{4i} using the following equation with data from an independent estimation period prior to the main analysis period:

$$TA_{it} / A_{it-1} = \alpha_{0i} + \alpha_{1i} (1/A_{it-1}) + \alpha_{2i} [(\Delta REV_{it} - \Delta REC_{it}) / A_{it-1}] + \alpha_{3i} (PPE_{it} - A_{it-1}) + \alpha_{4i} ROA_{it} + \varepsilon_{it.} \quad (7)$$

Step (3): This step is the same as that in the modified Jones model: steps (3) and (5).

3.5. The Modified Kothari Model:

Kothari *et al.* (2005) argued that their model advances the modified Jones model by adding a firm's ROA into the equation. However, they use the intercept in their model (performance-controlled approach) even though the modified Jones model does not use this in its equation (one based on its theoretical derivation). Thus, the current study viewed it necessary to re-test Kothari *et al.*'s (2005) performance-controlled approach model in a theoretically correct way by omitting the constant, naming this 'the modified Kothari model'.

The modified Kothari model has the same steps as the performance-controlled approach model, except that it omits the constant in Step 2. Thus, the new linear regression is as follows:

$$NDA_{it}/ A_{it-1} = \alpha_{1i} (1/A_{it-1}) + \alpha_{2i} [(\Delta REV_{it} - \Delta REC_{it}) / A_{it-1}] + \alpha_{3i} (PPE_{it} /A_{it-1}) + \alpha_{4i} ROA_{it.} \quad (8)$$

$$TA_{it} / A_{it-1} = \alpha_{1i} (1/A_{it-1}) + \alpha_{2i} [(\Delta REV_{it} - \Delta REC_{it}) / A_{it-1}] + \alpha_{3i} (PPE_{it} /A_{it-1}) + \alpha_{4i} ROA_{it} + \varepsilon_{it.} \quad (9)$$

3.6. The Francis *et al.* (2005) Model:

Francis *et al.* (2005) proposed a novel model for measuring earnings management. Their model, which some call 'discretionary estimation errors,' is based on a combination of Dechow and Dichev's (2002) and McNichols's (2002) models. Francis *et al.* (2005) used two methods. The first is consistent with that of McNichols (2002) who includes growth in revenue to reflect performance and PPE to make the model more extensive in measuring accruals. However, this method does not examine whether these adjustments lead to misclassification errors (Dechow *et al.*, 2010).

The second method decomposes the standard deviation of the residuals into company-level measures of innate and discretionary estimation errors. This helps to include managerial choices (i.e. intentional errors).

The discretionary estimation errors under Francis *et al.*'s (2005) model calculate accrual quality using the following equation:

$$AQ_{j,t} = \alpha_0 + b_1 SIZE_{j,t} + b_2\, \sigma(CFO)_{j,t} + b_3\, \sigma(Sales)_{j,t} + b_4\, OPCYC_{j,t} + b_5\, NegEarn_{j,t} + \varepsilon_{j,t},$$

where:

$AQ_{j,t}$ = accruals quality for firm j at the end of year t

$SIZE_{j,t}$ = log of total assets of firm j at the end of year t

$\sigma(CFO)_{j,t}$ = the standard deviation of cash flow from operation of firm j calculated over the past 10 years

$\sigma(Sales)_{j,t}$ = the standard deviation of sales of firm j calculated over the past 10 years

$OPCYC_{j,t}$ = the log of firm j's operating cycle, which is the average age of inventory plus the average age of receivables (in days)

$NegEarn_{j,t}$ = negative earnings are the number of years over the past 10 years, where firm j reported net income before extraordinary items < 0

ε_{it} = residuals of the model for firm i at the end of year t

Dechow et al. (2010) raised concerns about the second method. They noted that innate characteristics could also reflect estimation errors and corrections, which could consequently reduce the power of the tests. This could also lead to a bias in the proxy for discretion.

4. Overview of All Accruals Models

This study identified the most common variables relevant to FRQ based on a review of the literature. Several studies have used earnings management as an indicator of poor FRQ. Walker (2013) indicated that using the level of discretionary accruals is the most common method employed to detect earnings management, where the

relationship between the absolute level of discretionary accruals and the FRQ is inverse.

Among the different models utilised to calculate the level of discretionary accruals, many studies (e.g. Carrera *et al.* 2017; Ho *et al.*, 2015) have concluded that the modified Jones model developed by Dechow *et al.* (1995) and the performance-matched model created by Kothari *et al.* (2005), as a second place for validation, are the most common proxies for measuring FRQ.

The modified Jones model (Dechow *et al.*, 1995) is considered the most developed model and is designed to calculate discretionary accruals, which provides greater explanatory power. This model has been widely used in recent studies and has been criticised in prior studies (Carrera *et al.*, 2017). Peasnell *et al.* (2005) emphasised that the Jones (1991) and modified Jones models are the most frequently used methods to calculate accruals. Dechow *et al.* (1995) found that the modified Jones model is more powerful in detecting sales-based earnings management than the Jones (1991) model. Alghamdi (2012) noted that the modified Jones model is widely used in earnings management studies because it is considered the most powerful test for measuring earnings management in terms of robustness. This study suggests using the modified Jones model as the primary proxy for measuring FRQ.

In addition to applying the modified Jones model to estimate earnings management, this study recommends applying a robustness test as an alternative proxy for earnings management by adopting a performance-controlled model (Kothari *et al.*, 2005). The performance-matched model of Kothari *et al.* (2005) has become the focus of accounting research and is characterised by controlling for a company's prior performance (Idris *et al.*, 2018). It matches companies by choosing two companies from the same industry that have similar ROA, and then, it calculates the difference between them.

Kothari *et al.* (2005) develop a modified Jones model by adding a firm's ROA to the modified Jones equation. However, the performance-controlled approach (Kothari *et al.*, 2005) uses the intercept (constant) in its model, whereas the modified Jones model does not use the intercept in its equation. In addition to the original Kothari *et al.* (2005) model, this study suggests re-testing the performance-controlled approach model to be consistent with the modified Jones model by leaving out the constant; this model would be called the 'modified Kothari model'.

5. Conclusion

The purpose of this study was to explore the different proxies used to capture FRQ. This research concludes that earnings management is the most decisive measure of FRQ based on a review of the literature. Specifically, the level of discretionary accruals is the most common aspect employed to measure earnings management, where the relationship between the absolute level of discretionary accruals and FRQ is the inverse.

Having systematically compared different models for calculating discretionary accruals as an earnings management proxy, this study finds that the modified Jones model developed by Dechow *et al.* (1995) and the performance-matched model developed by Kothari *et al.* (2005), as a second place for validation, are proxies for measuring FRQ. Furthermore, this research suggests that the performance-controlled approach model (Kothari *et al.*, 2005) is theoretically consistent with the modified Jones model by omitting the constant (the intercept).

This study contributes to the literature by clarifying the best practice for accurately quantifying FRQ based on empirical validation and conceptual analysis of existing FRQ proxies. It is among the few research works to suggest applying the performance-controlled approach model (Kothari *et al.*, 2005) in the form of a modified Kothari model to be consistent with theory (Dechow *et al.*, 1995; Jones, 1991). Furthermore, it is among the first to suggest examining the performance-controlled approach model (Kothari *et al.*, 2005) in two ways, as follows: one as presented by Kothari *et al.* (2005, p. 174) and the other (i.e. the modified Kothari model) as consistent with the theory (Dechow *et al.*, 1995; Jones, 1991).

This study provides a theoretical and systemic comparison of different models to calculate discretionary accruals as an earnings management proxy. However, there are several points that should be considered in future research.

To begin, Kothari *et al.* (2005) argued that their model advances the modified Jones model by adding a firm's ROA into the equation. However, they used the intercept in their model (performance-controlled approach model) even though the modified Jones model does not use this in its equation (one based on its theoretical derivation). Thus, the current study argues that it is necessary to re-test the performance-controlled approach model (Kothari *et al.*, 2005), called 'the modified Kothari model', theoretically by omitting the constant.

In addition, this research noted that a number of studies (e.g. Idris *et al.*, 2018; Li *et al.*, 2008) do not calculate firm-specific parameters properly. The modified Jones model and the performance-controlled approach model of Kothari *et al.* (2005) use a time series regression of at least 10 years of historical data for each company to estimate firm-specific parameters. The parameters are detected using the B coefficients for each component in the equation and used to compute non-discretionary accruals for the main period of any study. Therefore, it is worthwhile for future studies to apply these accruals models considering the use of a time series regression of at least 10 years of historical data for each company to estimate firm-specific parameters. Future research could explore the integration of new machine-learning techniques in assessing FRQ, as suggested in recent studies (e.g. Abou-El-Sood and El-Sayed, 2022).

While this research emphasised the modified Jones model (Dechow *et al.*, 1995) and the performance-matched model (Kothari *et al.*, 2005) as effective proxies for measuring FRQ, a broader range of proxies was also evaluated to ensure the comprehensiveness of the review. Other widely used proxies discussed in the literature, such as the accrual quality method (Dechow and Dichev, 2002), earnings persistence (Francis *et al.*, 2004), value relevance (Ohlson, 1995) and timely loss recognition (Basu, 1997), were considered as part of this study's analysis. These proxies offer different perspectives on FRQ, ranging from the assessment of accruals quality to the timeliness of loss recognition and the relevance of financial information to market values.

By systematically comparing these various approaches, this study concludes that different proxies have distinct advantages depending on the context of the research. For instance, accrual-based models are commonly used in earnings management studies, while market-based models, such as value relevance and timely loss recognition, are more effective in assessing FRQ in terms of investor decision-making and market reactions. Therefore, researchers should consider the specific objectives of their studies when choosing the most appropriate proxy for FRQ.

Biography

Abdulrahman Alomair

Accounting Department, Business School, King Faisal University, Al-Ahsa 31982, Saudi Arabia, 00966554844599, aamalomair@kfu.edu.sa

Alomair holds a Ph.D. in Accounting and Finance from Victoria University, Australia, and an MS in Accounting from Fairleigh Dickinson University, USA. He is a Saudi assistant professor in the Accounting Department at King Faisal University, KSA. His research interests include corporate governance, ESG disclosure, IFRS implementation, audit quality and financial reporting. Proficient in statistical software such as Stata and SPSS, Dr Alomair has published several papers in leading journals in accounting and finance, including the *Asian Economic and Financial Review*, *Heliyon*, *Sustainability* and *Accounting and Finance*.

ORCID: 0000-0001-7493-7822

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