Analysis of EQ measurement criteria: Applications, weaknesses, and strengths

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Abstract

Earnings, as one of the most important outputs of the accounting and financial reporting system, are of great interest to various users for making appropriate decisions in resource allocation. In addition to its quantitative value, if earnings lack appropriate quality, it can lead stakeholders astray and result in misinformed decisions. According to research literature, there are numerous definitions and classifications of earnings quality (EQ) and financial reporting quality (FRQ), along with measurement criteria, but there is no general consensus among them. The criteria examined in this study include a total of eight criteria based on accounting (accruals, persistence, predictability, and smoothness) and market-based (value relevance, timeliness, and conservatism) perspectives. For this purpose, after reviewing the research literature in this field, the advantages and disadvantages of these criteria were explored and critiqued. Research in this area can contribute to the development and determination of an optimal model in the context of the Iranian capital market.

Keywords: earnings quality, financial reporting quality, measurement criteria, earnings management
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1 Introduction

Financial reporting is one of the available sources of information in capital markets that is expected to play an effective role in investment development and its efficiency improvement. Users require useful information for judgment, decision-making in the capital market, and evaluating companies. Useful information is associated with information quality. Financial reporting quality refers to the extent to which the provided information fairly represents the underlying economic reality of the company [33]. Quality information can assist investors in making accurate assessments and sound judgments regarding their investments, leading to increased wealth. On the other hand, a decrease in the quality of financial reports, often through manipulation of accruals, can mislead investors and result in improper stock pricing and misallocation of resources. Therefore, low quality can create information asymmetry among individuals. Conversely, high-quality accounting information can enhance the position of accounting in the capital market and reduce agency costs between managers, shareholders, and financial suppliers.

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The occurrence of financial crises in recent years has led to increased challenges in accounting and financial reporting. Since accounting earnings are often manipulated by managers and differ from true earnings, they cannot always serve as an appropriate measure for investor decisions. Therefore, the concept of earnings quality is introduced to improve decision-making. Financial researchers and analysts, in addition to the quantitative aspect of earnings, also pay attention to their quality when evaluating company performance. Thus, examining and evaluating the quality of information has been an interesting topic for financial researchers.

With all these interpretations, EQ is a multidimensional concept, and there is no consensus among researchers regarding its definition. Since FRQ is an unobservable phenomenon, researchers have used various criteria to measure it. The use of criteria for measuring this quality has always been a challenging issue in this field of research. However, each of these criteria has its own strengths and weaknesses, which are briefly discussed here.

The purpose of this study is to critically review and analyze the advantages and disadvantages of each of these criteria used in the literature, after reviewing the research literature related to EQ and FRQ. This will provide a better understanding of the application of each of these criteria. This research follows the studies of Safarzadeh [60], Eftekhari and Parvaii [25], Bolo and Hassani Alghar [14], and Abbaszadeh and Arefi Asl [1], with the difference that these studies mainly focused on presenting descriptive models of EQ, while in this research, in addition to presenting the models, a theoretical critique of them is also provided. Examining and critiquing the strengths and weaknesses and providing necessary suggestions for the models used in the research literature helps researchers better understand these models, and their applications, and achieve more accurate and appropriate measures of EQ.

2 Concept of EQ

2.1 Definition of EQ

Due to the high importance of EQ and its status as a fundamental concept in accounting, it has different interpretations among researchers, and there is no widespread agreement on the definitions of quality and earnings. For example, Schipper and Vincent [62] define EQ as the proximity of reported earnings to economic earnings. Ball and Shivakumar [5] define quality as the usefulness of financial statements for investors, creditors, managers, and all stakeholders related to the company. According to the research literature, the concept of EQ is a complex field for which no researcher has been able to provide a unique definition.

Perhaps the most comprehensive definition is provided by Dechow et al. [19] based on Statement Number One of Financial Accounting Concepts, which states that financial reporting should provide information about the financial performance of a company over a period; they assert that high-quality earnings should provide decision-makers with more information about the financial performance characteristics of a company for financial analysis. This definition indicates that the EQ has no standalone definition and only finds meaning alongside the decision-making model [25].

It can be observed that there is no consensus on the definition of this concept. The reason for this may be that the EQ has different meanings for different users of financial statements. From a financial perspective, a company has an EQ problem if the earnings include extraordinary items or lack transparency, even if the reported earnings and related disclosures are by generally accepted accounting principles (GAAP). Standard-setters, legislators, and auditors may disagree with this view. Generally, from the perspective of legislators, high-quality earnings are defined to comply with the laws outlined in GAAP. On the other hand, from the perspective of stakeholders, high-quality earnings are earnings that can easily be converted into cash. From the perspective of compensation committees, high-quality earnings are those that reflect the real performance of managers and are less influenced by factors beyond management's control. These instances indicate that the objective of the decision-maker and the role of earnings in the decision model shape the definition of EQ [24].

Therefore, providing a definition of EQ is challenging because its definition depends on the perspective of interest. For example, an auditor may have a different opinion on EQ compared to an investor, an analyst, or a standard-setter. However, often EQ is viewed from the perspective of investors who seek to assess the company's value [24]. Another reason for the lack of agreement on a common definition of EQ is the lack of consensus among individuals regarding the precise definition of earnings itself. Without a precise definition of earnings, we cannot define the statistical concept of quality [25].

2.2 Measures of EQ

The lack of a clear definition of EQ leads to the emergence of different measures for its measurement. The literature on EQ is filled with various measures for this concept. The number of measures is such that different researchers have

classified these measures into several categories. For example, Francis et al. [30] divide measures of EQ into two general groups: measures based on accounting data (quality of accruals, earnings persistence, predictability, and smoothness of earnings) and measures based on market data (value relevance, timeliness, and conservatism). Cornell and Landsman [16] classify measures of EQ into three categories: measures based on value relevance, measures based on information content, and measures based on predictability. Jonas and Blanchet [43] categorize these measures into two groups: measures related to user needs (which emphasize valuation issues) and measures related to investor protection (which emphasize issues related to stewardship and corporate governance) [60].

Barua [11] classified the EQ measures using qualitative features of financial information within the theoretical framework of FASB into two categories: earnings relevance-related measures (predictive value, feedback value, timeliness) and earnings reliability-related measures (impartiality, confirmatory value, and faithful representation).

Dechow et al. [19] also introduced these measures in three chapters as follows: 1) Earnings characteristic-related measures (persistence, smoothness, quality of accruals, lack of timeliness asymmetry and timely loss recognition, comparison with benchmarks). 2) Investor reaction-related measures (earnings response coefficient, coefficient of determination (R2) of return-earnings models). 3) External measures related to FRQ (restatements, internal control weaknesses, necessary accounting and auditing guidelines).

Schipper and Vincent [62] introduced these measures in four chapters as follows: 1) Earnings time series characteristic-related measures, including measures such as persistence, predictability, and earnings volatility. 2) Measures derived from the relationship between earnings, cash flows, and accruals, consisting of the ratio of operating cash flow to earnings, changes in total accruals, prediction of abnormal accruals using accounting variables, and prediction of relationships between accruals and cash flows. 3) Measures related to the qualitative characteristics of accounting information based on the relevance and reliability criteria. 4) Measures related to executive decisions, including measures such as forecasting and judgment in reporting and EQ.

All of these indicate that there is no common and suitable definition of EQ, and consequently, the role of measures in its measurement is not present. Therefore, it seems that a critical review of research in the field of quality and providing relevant theoretical criticism of EQ measurement criteria should have a high priority in addressing or adjusting fundamental issues, which is addressed in this study.

3 Theoretical criticism of EQ measures

Although there is a general consensus among the scientific community and experts in this field that FRQ is an important characteristic of the financial reporting process, there is no consensus regarding its definition and meaning [23]. One reason why defining FRQ is difficult is that it depends on the specific decision model conditions and is also dependent on providing information about the underlying financial performance [19]. In fact, the usefulness of quality measures of financial reporting depends on the measurement objective and specific research environments.

Although the FRQ is a multidimensional concept without a general definition that seems difficult to measure, researchers practically use EQ as the most significant measure of measuring reporting quality (The concept of EQ is used as an indicator of the FRQ. To justify this, the following points can be mentioned: 1. The main difficulty in identifying and measuring overall indicators of EQ is that it is claimed that observing EQ is simpler compared to FRQ. Some researchers consider EQ as an appropriate statistic for FRQ and express that earnings are the most important output indicator of the reporting process. 2. Moreover, focusing on EQ is justified based on the fact that earnings and related measures are widely used as criteria in contracts, such as bonuses, loans, and even employee compensation. Therefore, EQ is considered one of the important elements of high-quality financial reporting. However, using EQ as an indicator of FRQ does not mean that research on FRQ should solely focus on earnings. Other factors, such as the balance sheet, contain important information that is not present in earnings. Therefore, considering the mentioned reasons, the inherent importance of EQ as an important factor in profitability and ultimately optimal allocation of scarce resources can be understood [25].). The origin of this concept can be traced back to Lev [52], where the term "quality" was introduced in describing earnings, meaning the usefulness of decisions based on earnings in assessing the equity of shareholders in companies. Nowadays, the use of the terms EQ and FRQ has widely expanded. As a result of this expanding trend, the characteristics of the EQ index have been developed. Analyzing the literature of previous research on the applications of alternative variables of reporting quality helps us to enumerate a list of major advantages and disadvantages for groups regarding the features and specific characteristics of measurements [6].

3.1 Accounting-based characteristics

Accounting-based characteristics rely solely on accounting information to measure earnings. They are based on the assumption that earnings play a precise and correct role in allocating cash flows to time periods using accruals. As a result, high-quality earnings allocate cash flows more effectively. Accounting-based characteristics are divided into criteria based on the measurement of quality of accruals, which are based on the relationship between accruals and cash flows, as well as criteria based on the characteristics of earnings time series (including persistence, predictability, and volatility of earnings).

3.1.1 Accruals quality

Accounting earnings are measured and reported based on the accrual basis. Generally, using the accrual basis will lead to differences between operating earnings and net cash flows from operations. The most important factors contributing to the difference between accrual earnings and cash flows include deferred items, items transferred to future periods, and non-cash items. The criteria introduced in this section are derived from the relationship between cash and accrual components of earnings. There is a wide variety of criteria related to this. Dechow et al. [19] state that the majority of criteria used in the literature to measure EQ belong to this category, which can be classified into the following three components. All of these criteria are based on the idea that some accrual components of earnings reduce EQ, while cash components increase EQ (The entire earning accrual is not a earnings quality reducer. Therefore, in determining the EQ criteria, which are related to accruals, a distinction must be made between accrual items that reduce EQ and those that do not reduce EQ.).

A. Ratio of operating cash flows to earnings

In this criterion, EQ is defined based on the assumption of proximity to cash. According to the assumption of proximity to cash, a higher cash flow ratio indicates higher EQ. Harris et al. [34] state that the ratio of cash flow from operations to earnings is the simplest form of expressing the above relationship. A higher ratio of cash flow from operations to earnings indicates higher EQ. In addition to considering the relatively strong relationship between earnings and cash flow from operations, this ratio is also sensitive to potential manipulation of cash flow from operations In comparison to accruals, cash flow from operations cannot be so much manipulated. In other words, cash flow from operations is more objective. However, it does not mean that it cannot be manipulated.).

B. Change in the total accruals

A change in the total accruals is a simple way to measure EQ. Since some of the accruals' components are non-discretionary and remain relatively constant over a period, a change in the total accruals measures management manipulations and provides an inverse measure of EQ. In other words, the greater the change in the total accruals, the higher the likelihood of management manipulation, and consequently, the lower the EQ.

C. Quality of accruals

The quality of accruals is the most common measure of EQ [19]. The quality of accruals refers to the extent of conversion (realization) of accruals into future cash flows [30]. The models used in the literature to measure the quality of accruals are highly diverse. These models can be broadly categorized into two categories:

In the first category, accruals are divided into discretionary and non-discretionary items. In these models, it is assumed that non-discretionary accruals remain constant over time and are not subject to management manipulation. Moreover, these items can be predicted using certain accounting variables. In this approach, the error term (prediction error) of the regression model of the sum of accruals (or some specific accruals) on accounting variables indicates earnings' management and is considered an inverse measure of EQ. This measure, compared to the measure of change in total accruals, allows for period-to-period changes in accounting variables and assumes that these variables are not manipulated on their own. The models of Healy [36], DeAngelo [17], Dechow and Sloan [20], Jones [44], Modified Jones Model (1995), and Kothari et al. [47] are examples of models in this category.

For example, the most famous among these models is the model introduced by Jones [44] as follows:

$$ACC_t = \alpha + \beta_1 \Delta Rev_t + \beta_2 PPE_t + \epsilon_t \qquad (3.1)$$

The variable ACC represents total accruals, Rev is sales' revenue, PPE is property, plant, and equipment, and ϵ is discretionary accruals. Jones' main assumption in his article is that an increase in discretionary accruals over

time indicates earnings management and, consequently, lower EQ. Based on this assumption, the main objective is to separate discretionary accruals from non-discretionary ones. Regression models are used to calculate the accruals. This idea stems from the notion that accruals are likely the result of managerial discretion and changes in the company's economic environment. Finally, the error term is considered as discretionary accruals [25].

Some researchers argue that the distinction between discretionary and non-discretionary accruals and the determination of accounting variables to predict non-discretionary accruals face challenges. To address these issues, another category of models has been introduced by researchers, which consider accruals as a sum in their estimation models. The Dechow and Dichev [18] model and the McNichols [53] model are examples of models in this category. For example, the Dechow and Dichev [18] model is as follows:

$$\Delta WC_t = b_o + b_1 CFO_{t-1} + b_2 CFO_t + b_3 CFO_{t+1} + \varepsilon_t. \tag{3.2}$$

The variable ΔWC_t represents the change in working capital in year t compared to the previous year, CFO_{t-1} represents cash flow from operations in year t-1, CFO_t represents cash flow from operations in year t, CFO_{t+1} represents cash flow from operations in year $t+1$, and ε_t is the residual error of the model for year t.

In this approach, the estimated residuals in the regression of changes in working capital on cash flows from the previous period, current period, and next period of each company cover all estimation errors of accruals by management, both non-discretionary and manipulated and are considered an inverse measure of EQ, where a lower value indicates higher EQ.

This model does not include any assumptions about non-manipulated accounting elements and establishes a direct relationship between cash flows and current accruals. This measure does not differentiate between non-manipulated estimation errors and intentional earnings management and assumes that working capital accruals occur one year before or one year after the cash inflows and outflows, not more than one year [49].

In this context, one manifestation of financial statement manipulation is financial restatements, which have also been used in many studies as a measure of FRQ. Financial restatements indicate ambiguity about past-year profits and consequently have low quality. Since the future profitability of a business unit and, therefore, its cash flows and business value are evaluated based on reported profits in past periods, restating financial statements of previous periods has various negative consequences. This is because net profit is the basis for multiple calculations, such as executive compensation, taxes, and dividends, in addition to being the basis for decision-making by investors regarding buying or selling company shares and restating this figure can distort the effectiveness of financial reporting as a tool for predicting the future. Therefore, it can be said that financial restatements can also indicate earnings management [14].

Francis et al. [30] and Perotti and Wagenhofer [57] proposed that the primary objective of financial reporting is the usefulness of financial reporting for investors, assuming that the quality of accruals is the best measure of EQ. However, recent research has raised criticisms regarding the quality of accruals, particularly concerning earnings management practices. Wysocki [66] argued that the Dechow and Dichev [18] model is ineffective in measuring EQ due to the strong negative correlation observed between cash flows and accruals. Studies such as Jackson [41] considered discretionary accruals as an inappropriate measure for earnings management, as they exhibit low power and are biased towards non-random samples. However, these authors suggest improving the selection of an optimal accrual model using randomized treatments derived from exogenous events or a perfect benchmark group, including control variables. Despite all these criticisms and debates, the quality of accruals remains a common and prevalent variable, and according to Jackson [41], it is still used without a proper understanding of the statistical characteristics of the models and interpretations, given the limited reflection of economic factors in the accounting process.

Another weakness of these models is the lack of a general consensus on how to estimate normal levels of accruals related to common business activities that generate revenues. As a result, various different models have been used. For example, Kothari et al. [47] examined the ability and power of accruals in accordance with performance and compared them with traditional measures of accruals (Jones model and modified Jones model). Their research showed that accruals in line with performance have greater ability and effectiveness in explaining earnings management. Jones et al. [45] evaluated the power of different accrual models in detecting fraudulent companies using nine evaluation models. They demonstrated a relationship between accrual aggregations and fraud, but the Jones models modified the Jones model, and the performance model showed no association with fraud.

Numerous studies have examined the explanatory power and potential limitations of accrual models. However, it is evident that no single earnings management model outperforms others in terms of explaining actual accounting or audit quality compared to other models [33]. According to Rahmani and Bashirimanesh [58], most recent

studies have been based on the modified Jones model. Researchers attribute the use of this method to the results of the study by Dechow et al. [21], which concluded that the modified Jones model is a stronger test for examining earnings management. However, Jackson [41] points out the limitations of accrual-based measures and states that although discretionary accruals have their problems, they are still widely used as a practical substitute in the earnings management literature.

In the Iranian context, Rahmani and Bashirimanesh [58] demonstrated through the examination of five earnings management models that the modified Jones model lacks the necessary efficiency to detect earnings management, while the Dechow and Dichev [18] model possesses greater credibility and accuracy in this regard. Additionally, Nikoomaram et al. [55] investigated nine earnings management detection models and overall showed that models based on estimation methods have a greater capability compared to the Healy, DeAngelo, and modified Jones models. Among the regression methods, the original Jones model [44] has less power in explaining earnings management.

Most accounting studies assume that managers utilize their discretion regarding accruals to mislead investors. However, one problem is that managers may use their discretion regarding accruals to provide informative signals about future cash flows to investors [5, 64]. This non-opportunistic motivation implies that the optional accruals measure is a weak criterion for FRQ.

Another problem is the empirical distinction between discretionary and non-discretionary accruals. Most researchers employ the Jones model [44], which regresses total accruals on changes in income and levels of property, plant, and equipment (PPE). However, the Jones model (and its subsequent variations) raises two ambiguous assumptions. The first assumption is that income and PPE are non-discretionary. This is suspicious because income and PPE are accounts that are often manipulated. Nearly half of all accounting frauds involve income overstatements, and according to the Audit Analytics database, approximately 10% of financial restatements between 2000 and 2016 involve restatements of PPE. Therefore, the assumption that income and PPE are non-discretionary is questionable [22].

The second assumption in the Jones model is that residuals consider discretionary accruals. However, many non-discretionary accruals are not controlled in the Jones model and its variations. For example, when a negative shock occurs in sales, a company is likely to face an increase in inventory. This portion is classified as "discretionary" accruals that increase earnings, even if the accounting discretion is not exercised by the manager or auditor [4].

In addition to the conceptual issues related to discretionary accruals, there are significant empirical challenges. One challenge is whether signed (positive and negative) or absolute measures should be used. While many studies employ signed and absolute discretionary accruals, some studies only use one type of these measures. These choices are considered important because these two measures may yield different results. Recent evidence suggests that signed accruals provide a better measure. For example, Hribar and Nichols [38] found that absolute accruals fall more into the trap of omitted variables than signed accruals.

3.1.2 Persistence

Persistence is one of the measures used to assess the EQ based on the characteristics of the time series of earnings, assuming that earning is a summary measure of expected cash flows. Stable earnings refer to current profits that are likely to continue in the future. In other words, earnings persistence implies the durability, repeatability, and continuity of profits in future years [60]. Companies with more stable earnings are expected to have a more accurate valuation of shareholders' equity.

In most studies (e.g., Penman and Zhang [56]; Francis et al. [30]), the slope coefficient (i.e., b_1 in the model below) obtained from autoregressive models of earnings (regressing current earnings on lagged earnings) is used. A higher value of this coefficient indicates greater persistence and, consequently, higher EQ. Values of the slope coefficient close to one indicate more persistent earnings, while values close to zero indicate transitory earnings [30]. Earnings persistence, unlike the ability to predict earnings, is more relevant for the ability of current reported earnings to fulfill themselves in future periods. High persistence earnings serve as a good starting point for predicting future company earnings. The symbolic representation of the model is as follows:

$$E_t = b_o + b_1 E_{t-1} + \varepsilon_t. \tag{3.3}$$

The variable E_t represents net profit in year t, E_{t-1} represents net profit in year $t-1$, and ε_t represents the residual error of the model for year t. Stable earnings can improve investors' decision-making. From the perspective

of investors, stable earnings have a lasting and consistent nature, which can assist them, especially in valuations. However, despite the importance of persistence in decision-making improvement, Schipper and Vincent [62] argue that a company's earnings may be perceived as stable according to a specific model but may not actually be stable. According to them, the persistence of reported earnings is a function of accounting standards and the operational environment of the reporting entity. The application of accounting standards in certain economic environments can lead to the presentation of less stable earnings. Additionally, management intervention in the financial reporting process can transform fewer stable earnings into stable ones [60].

Accruals are among the determinants of persistence in earnings. It should be noted that there is less persistence in the accrual component compared to the cash component of earnings. Less persistence in the accrual component does not imply that accruals are not beneficial. The results simply indicate that when a significant portion of earnings is derived from accruals compared to the cash component, it has less persistence. However, earnings with a significant accrual component have fewer errors in predictions compared to earnings with a larger cash component. Therefore, they have usefulness for their users [25].

3.1.3 Earnings' predictability

The measure of earnings' predictability assesses the ability to forecast future cash flows by considering the accuracy and reliability of profit predictions. According to the International Accounting Standards Board (IASB) [40], one of the objectives of financial reporting is to provide useful information for assessing future financial performance, which can be achieved through future operating cash flows.

1. Predicting future earnings using current earnings.
2. Predicting future earnings using cash and accrual components of current earnings.
3. Predicting future cash flows using current earnings.
4. Predicting future cash flows using cash and accrual components of current earnings.

In all of these models, the predictability measure is the standard deviation of the residual errors of the model, and a lower value indicates higher EQ. Previous relevant studies on profit predictability are mainly based on the assumption that cash flow predictions are useful as data for equity valuation models [19]. Therefore, earnings can be considered more useful if it is a reliable predictor of future cash flows. The following model is used to analyze earnings' predictability:

$$CFO_{i,t} = \alpha_1 + \alpha_2 NI_{i,t-1} + \varepsilon_{i,t} \tag{3.4}$$

The variable $CFO_{i,t}$ represents the cash flow generated from the operating activities of the company i in year t, and $NI_{i,t-1}$ represents the net profit of company i in year $t-1$, both scaled by total assets.

Furthermore, the standard deviation of the estimated error from the above equation is calculated as a measure of profit predictability based on profit shocks' variance [30]. Additionally, the explanatory power of the regression model can be employed for each company [19]. A lower variance and higher explanatory values indicate higher predictability and better FRQ. However, according to Perotti and Wagenhofer [57], the persistence and predictive power of measurement metrics are not considered very good in relation to EQ compared to other measures.

Regarding the models used to measure predictability (as one of the indicators of EQ), three empirical considerations should be taken into account:

A. Although predictability is conceptually well-defined, its operationalization requires several considerations. For example, is it more appropriate to use net profit figures or performance summary figures (such as earnings per share) for predicting future earnings? Can only earnings be used as a predictor of future earnings, or can earnings components also be used? Can earnings alone be used for predicting future earnings? In other words, can the independent variable only be earnings?

B. The second empirical consideration is the choice of time period. How many time periods of data should be used for prediction? Is the predictability dependent on the time period? Researchers usually use one-year predictions, but there is no theoretical basis for this choice.

C. The third practical consideration is the choice of what to predict. Should only future earnings be predicted to assess predictability? In other words, can the dependent variable only be earnings? Possible options include net profit, cash flows, and various components of earnings.

Similar to persistence, predictability is also a function of accounting standards, economic factors, and the operational environment of the reporting unit. For example, seasonal activities cannot be easily predicted due to the nature of the unit's activities. In such cases, a unit's earnings may have high quality despite having low predictability. Schipper and Vincent [62] believe that there may be a trade-off between persistence and predictability of earnings. If the standard deviation of the earnings' time series is large, stable profits will not have high predictability. Therefore, high-quality earnings (in terms of earnings persistence) may not be considered high-quality in terms of predictability.

In some cases, assessing predictability is accompanied by complexity. This is particularly problematic in short-term time horizons. Research results indicate that managerial intervention in profit smoothing is greater in short-term periods. Therefore, there may be a trade-off between predictability and profit smoothing. Profit smoothing increases the predictability of earnings, so earning is considered high-quality in terms of predictability but not in terms of smoothing [60].

3.1.4 Earnings smoothing

The latest criterion in the group of accounting-based measurements, which is one of the criteria related to the characteristics of earnings time series, is earnings smoothing or the inverse of earnings volatility. It is assumed that earnings with less volatility are more predictable and have greater persistence, and as a result, volatility is always associated with risk. Consequently, smoothing is generally considered a desirable feature of earnings.

Leuz et al. [51] measured the smoothness - the absence of volatility - of earnings using two criteria. The first criterion is the ratio of the standard deviation of operating earnings to the standard deviation of operating cash flow (adjusted for total assets). Smaller ratios indicate greater smoothing and consequently lower EQ. It is claimed that manipulation of operating earnings is more possible compared to operating cash flow. The smaller the standard deviation of operating earnings, the higher the likelihood of smoothing, and as a result, the associated earnings will not be of high quality in terms of predictability. The second criterion is the use of correlation between changes in accruals and changes in cash flows. A negative correlation indicates greater smoothing and consequently lower EQ (Hunt et al. [39] measured earnings smoothing through the ratio of the standard deviation of non-discretionary net profit (equal to the sum of operating cash flow and non-discretionary accruals) to the standard deviation of operating cash flow, adjusted for total assets. Smaller ratios indicate greater smoothing and consequently lower EQ.). The use of the first criterion among previous studies [30, 51] has been more common and can be expressed as follows:

$$VOL = \frac{\sigma(NI_{i,t})}{\sigma(CFO_{i,t})}. \tag{3.5}$$

Higher values indicate higher earnings with greater volatility and less smoothing, implying lower FRQ. On the other hand, some studies (such as Barth [8]) have not found a direct relationship between volatility and lower FRQ. Instead, they believe that volatility provides information related to uncertainty and the timing of future cash flows (intrinsic volatility), which plays a key role in completing financial reporting. Furthermore, some authors (e.g., Tucker and Zarowin, [64]) consider smoothing as earnings management and perceive it as an undesirable characteristic of earnings because it disrupts earnings reporting and increases ambiguity.

Some studies, such as Hunt et al. [39], have reported evidence that indicates earnings smoothing by managers was associated with certain predetermined objectives, although sometimes the reasons for doing so were not clear. Additionally, as Arthur Levitt, the former chairman of the U.S. Securities and Exchange Commission, stated, market pressures compel managers to smooth earnings because they believe that investors prefer smooth-growing profits. However, incorporating transitory components into earnings reduces earnings persistence, decreases the variability of earnings time series, but on the other hand, increases predictability [62]. Therefore, it is observed that company earnings are considered low quality in terms of persistence and smoothing but are considered high quality in terms of predictability.

3.2 Market-based characteristics

Market-based characteristics utilize both accounting information and market data to measure earnings and posit that the role of earnings is to approximate economic income through stock returns. Consequently, higher-quality earnings are closer to stock returns. Unlike accounting-based features, market-based features incorporate market data in earnings measurement calculations. In fact, they measure the usefulness of earnings decisions as a combination of relevance and reliability (i.e., value relevance) or evaluate how accounting and economic earnings are aligned (earnings conservatism). The following section examines and critiques the theories related to these criteria.

3.2.1 Value relevance

The concept of value relevance is defined as the ability of specific figures in financial statements (such as reported earnings) to explain changes in the market value of shareholders' equity, meaning that the greater the explanatory power, the stronger the value relevance. Research has shown that accounting earnings have value relevance for investors, and researchers have demonstrated a strong correlation between earnings, earnings changes, and a combination of them with changes in the market value of shareholders' equity [14].

Value relevance of earnings is defined as the ability of earnings to explain changes in price or market returns. As a result, there are two different cases for the dependent variable in this model: in price regression [15] market value of equity and book value of equity are analyzed in relation to market value.

$$P = \beta_0 + \beta_1 BVS + \varepsilon. \tag{3.6}$$

Variable BVS represents the book value per share, and P represents the stock price. The residual earnings framework indicates that the value of stocks can be estimated as a function of the book value of equity and earnings. Therefore, earnings are often included as the second variable (Accounting variables in valuation models are divided into three main groups. The first group includes models based on the profit and loss approach, which have a longer history, and Miller and Modigliani [54] are considered the first users of these models. The second group consists of models based on the balance sheet approach, and researchers such as Landsman [48], Barth [7], and Barth et al. [9] have used them in their research. The third group combines the previous two approaches, and the Feltham and Ohlson [27] model is used as a result. It assumes that the value of a company can be represented as a linear function of the book value of equity and the present value of future abnormal returns. The findings of Barth et al. [10] show that current research in the value relevance field is usually done using the Feltham and Ohlson [27] model and accounting earnings and book value variables [61]).

$$P = \beta_0 + \beta_1 BVS + \beta_2 EPS + \varepsilon. \tag{3.7}$$

The variable EPS represents earnings per share. As soon as investors invest capital in a share or portfolio of stocks, the price of the stock becomes less significant, and investors focus on the return on investment. In value relevance research, significant attention is given to the relationship between changes in the market value of equity and the created value, which is measured through accounting systems [26]. Accordingly, the second model [30], which has been more widely used in the research literature compared to the first model, examines the change in stock price or return and accounting earnings using regression, i.e. (The variable E represents accounting earnings, which is scaled by total assets or market value of equity, and R represents stock returns. The coefficient of earnings, β_1, is often referred to as the earnings response coefficient (ERC). The ERC measures the sensitivity of stock prices to earnings):

$$R = \beta_0 + \beta_1 E + \varepsilon. \tag{3.8}$$

Regardless of the model used, accounting variables' coefficients (in response to the question of whether specific accounting information has a meaningful relationship with market value relevance) or the explanatory power of accounting variables (in response to the question of how much of the variations in the equity can be explained by accounting information) are used as a measure of value relevance in the valuation process for each company. Higher values indicate better value relevance in situations where market participants have a stronger reaction to changes in earnings and, as a result, also respond better to financial reporting regarding better quality.

Regarding one of the issues related to current value relevance models and the usefulness of financial reporting, it is argued that a declining trend in value relevance of accounting information has been observed in recent decades. According to Saghafi and Baghomian [61], the observed declining trend in value relevance results from the interaction of two factors, not a single factor as previously claimed. The first factor is the measurement effect of accounting, which reflects the current financial reporting model's inability to capture and represent a company's economic value, leading to a real decrease in value relevance (as previously claimed in past research). The second factor is the investor behavior effect (especially in inefficient capital markets), which is the result of the increasing influence of non-fundamental factors on investors' decisions in the pricing domain, leading to the observation of a non-real declining trend in value relevance.

Regarding the first factor, some reasons mentioned in previous research include low earnings persistence, untimeliness of earnings due to strict requirements related to accuracy and verifiability of accounting numbers, conservative accounting, incorrect determination of statistical models, inadequate short intervals for measuring returns and earnings, earnings aggregation, and earnings management [26].

Regarding the second factor, Saghafi and Baghomian [61] also state that there is abundant evidence indicating the deviation of stock prices from fundamental value. This deviation is the result of profit-driven investor behavior, where investors engage in stock trading without considering the actual changes in intrinsic value. In other words, in addition to fundamental factors, such investors also take into account other non-fundamental factors when making investment decisions. Some of these factors include various error-based transactions, technical analysis, momentum trading, and blindly imitating the behavior of other investors. The role of these recent factors in stock price fluctuations has been well studied and documented in the literature of behavioral finance. The findings of researchers in the field indicate that these behavioral factors lead to the deviation of stock market prices from their intrinsic value.

In this regard, the reduction of correlation between market prices and accounting information should not be immediately perceived as a real reduction in their value relevance; rather, it should be noted that the mentioned relationship is two-sided (market price and accounting information), and any deviation from the fundamental value attributed to either side of the relationship will reduce their correlation. This is in contrast to the traditional approach, which assumes that the reduction in correlation is solely the result of accounting measurement effects. Therefore, one of the criticisms of these models has been that they are applicable in efficient markets. In this regard, Barth et al. have a different opinion. They believe that studies on value relevance do not require the assumption of market efficiency, but only require that stock prices reflect the consensus beliefs of investors (quoted from Etemadi and Babaei [26]).

In some studies, the difference in value relevance among countries has been examined, and it has been found that the value relevance of accounting earnings in countries with customary laws is much more timely compared to countries with inflexible laws. The value relevance of bank-dependent financial systems and countries where private sector organizations do not participate in the process of developing accounting standards is lower. Furthermore, it has been found that the value relevance is lower in countries with European accounting models [as opposed to the British-American model] and in countries where tax laws dominate accounting measurement.

Finally, the important and ongoing debate when examining the relationship between stock market value and accounting values is the difference between the price model and return model. The return model usually fulfils assumptions associated with statistical tools such as regression analysis. Researchers using price models must exercise necessary caution in statistical inferences. It is also claimed that the choice of regression model is influenced by the economic motivation of the research. A model cannot be chosen that does not correspond to the research question. Barth, Beaver, and Landsman [10] have stated that the main distinction between studies of value relevance that examine the level of prices and studies that examine changes in prices (returns) is that the former determines what is reflected in the company's value, while the latter determines what is reflected in changes in value over a period. If someone wants to examine the value relevance of equity and other items on the balance sheet, the price model is chosen, but if someone has an approach based on changes in value, where value creation is the focal point, then return regression is appropriate [2, 26, 42].

3.2.2 Timeliness and conservatism of earnings

Two measures of timeliness and conservatism of earnings are used in market-based approaches to assess how reported accounting earnings in profit and loss are closely related to economic earnings, which are approximately measured through stock returns. Timeliness is a measure that indicates the extent to which current earnings reflect value-relevant information, and conservatism refers to the asymmetric timely recognition of good and bad news in earnings. Both measures are based on the Basu [12] standard regression model.

Timeliness means that relevant information has been made available to decision-makers before it loses its impact. In some studies, the informational content of earnings has been mentioned as one of the measures of EQ, and timeliness has been used to operationalize this measure.

Based on the subject literature, timely earnings recognition has been assessed through several measurement methods. However, Velury [65] states that the gap between the end of the fiscal year and the date of information disclosure is the simplest method for measuring timely earnings recognition. The larger the gap, the lower the quality of reported earnings. The most common measure used for assessing timeliness is the Basu model [12]. The measure of timeliness is the explanatory power of the model (R^2), and a higher value indicates a higher EQ. The formula is as follows:

$$NIPS_{i,t} = \alpha_0 + \alpha_1 NEG_{i,t} + \alpha_2 RET_{i,t} + \alpha_3 NEG_{i,t} * RET_{i,t} + \varepsilon_i \tag{3.9}$$

here, $NEG_{i,t}$ is artificial variable that is equal to 1 if $RET_{i,t} < 0$, otherwise, 0. In addition, $RET_{i,t}$ is annual stock return for company i during year t considering the dividends. Also, $NIPS_{i,t}$ is net profit per share and is homogenized based on market value at the beginning of year t.

Conservatism is also one of the measures of profit quality that is usually considered alongside timeliness. Conservative earnings reflect bad news more quickly than good news. As a result, conservatism helps detect losses in a timely manner compared to earnings and improves the quality of accounting information.

There are multiple models for measuring conservatism, but the Basu model [12] is commonly used. The measure of earnings conservatism is the ratio of the coefficient of bad news to the coefficient of good news in the earnings regression on returns (i.e., $[b_2 + b_3t]/b_2$ in the above model), and a higher value indicates higher EQ.

The most significant limitation of these measurements is that only a small portion of the overall information used is related to earnings announcements in stock prices. According to Ball and Shivakumar [5], 5% to 9% and 1% to 2% of the total information used in stock prices are related to annual and quarterly earnings announcements, respectively, indicating that the primary economic role of reported earnings is not to provide new information to stock markets. Furthermore, although conservatism reduces information asymmetry and negative market reactions to bad news, it is not effectively utilized in analysts' forecasts, indicating that it provides analysts with weak qualitative information [28].

4 Discussion and conclusion

According to the research of Perotti and Wagenhofer [57], since the EQ is not directly observable, various types of measurement methods have been proposed in the literature to measure EQ, most of which are based on intuitive concepts and desirable attributes of an accounting system. However, although the measures have been designed to achieve a consistent underlying structure, there is a weak correlation among these factors, raising the question of which measure should be used in a specific research design, which can potentially have a significant impact on the results. Perotti and Wagenhofer [57] acknowledged that there are quantitative guidelines on how EQ indicators are and what type of measure is the best in a given time.

Regarding each measurement criterion, there is no consensus among researchers. According to the research literature, none of these measurement methods allows for a comprehensive and precise evaluation of FRQ. In general, the usefulness of each measurement criterion for assessing FRQ and its advantages and disadvantages cannot be determined unilaterally since the quality of reported earnings and the measurement criterion depend on their application by individuals and the company's performance. They are also influenced by various economic, social, and political factors such as the legal and regulatory system, stage of economic growth, company ownership, and activities.

To address this issue, the literature has proposed various solutions in a scattered manner which are presented below. In this regard, some research has used the ranking method of criteria for assessing companies' EQ. Regarding the ranking method, for example, Bellovary et al. [13] considered the quality of total earnings for each company by taking the average rank of that company regarding 20 EQ criteria, and higher ranks indicate better earnings and better FRQ. Šodan [63] and Herath and Albarqi [37] also used a similar method. Since FRQ is comprehensive and not limited to financial information alone, but also refers to other non-financial information and disclosures that help decision-makers, this assessment method reflects a combination of qualitative characteristics and ultimately leads to achieving the usefulness of decision-making regarding financial reporting information. A major advantage regarding collective measurements of EQ is the reduction of omitted variables and measurement error issues (In general, the topic of FRQ is an important part of the legal framework and is highly regarded by the public. On this basis, today the concept of FRQ has expanded and extended to the scope of corporate reporting quality (CRQ), which requires considering the effects of factors other than financial reporting. The Financial Reporting Council [28] defined CRQ as the quality of financial and non-financial information, within which non-financial information includes information from corporate social responsibility reports and other types of information from annual reports (such as risk disclosure, environmental issues discussions and ESG) or other corporate documents such as combined reports, intellectual capital statements, and so on).

As another solution, some research in the literature has proposed using more than one measurement criterion, emphasizing the multiple dimensions of FRQ based on the nature and characteristics of the factors to be measured (for example, Fonou-Dombeu et al. [29]; Abou-El-Sood and El-Sayed [3]; Rezaee and Safarzadeh [59]). In some conditions, due to the large sample size, the need arises for using multiple measurements, and also because some tools do not cover all factors related to FRQ. In addition, using multiple criteria confirms the generalizability of results [19]. Besides, using alternative criteria reduces the possibility that other criteria may not be appropriate [31].

For example, Givoly et al. [31] also stated that understanding the concept of quality is quite difficult and the existing literature does not provide a clear definition of quality; there is no single criterion to cover all dimensions of quality. Therefore, in their study, they used several criteria such as the persistence of accruals' estimation errors in

earnings management and conservatism as measures of quality.

Another issue regarding measuring FRQ in bank-centric economies is the validity and usefulness of market-based characteristics and subsequently most of the focus has been on accounting-based characteristics. The main advantage of accounting-based characteristics is that they are calculated practically based on the data obtained from annual reports. This is especially important in bank-centric countries where their financial reporting differs from market-centric economies and is characterized by less developed and low liquidity markets. In fact, using market-based characteristics in bank-centric countries could be considered as their main flaw, since it is questionable how stock prices are informative or in other words how stock returns can be an alternative criterion for economic profitability in capital markets with low liquidity.

Meanwhile, the Financial Reporting Council [28] notes that the relevance of accounting information has been declining globally over time. In fact, they attribute this decline to the increasing reliance on other concurrent information sources such as media or blogs, and also the emergence of new technologies outside the accounting system that quickly ploughed through the information world. Kashanipour et al. [46] employed expert views and hierarchical analysis and showed that the accounting, market and management dimensions have coefficients of 0.581, 0.295 and 0.124, respectively, in the EQ model. Accordingly, it is suggested that these new information sources be considered in future research when measuring FRQ, while this issue depends on background factors and established financial reporting and institutional frameworks.

Persistence in FRQ assessment over a longer period can also be improved in terms of data accessibility over different years; therefore, it is proposed that authorities and companies themselves find and prioritize ways to enhance and strengthen transparency in annual and other corporate reports. Another limitation of the research examined is the lack of access to some accounting and auditing data in markets, especially emerging markets, which can limit the ability to consider some other potential indicators that may be needed to evaluate FRQ, such as profit forecasts and other useful company ratios. Accessibility to data over multiple years confirms the importance of persistence in assessing FRQ in different periods. Expanding the sample size also enables comparing information quality levels across other industries [35]. Additionally, it is necessary to verify the results by including financial companies and diversifying the samples. As a result, this will lead to validating the findings and covering all different levels of business.

Another criticism of the research literature in this field is that the academic domain of FRQ criteria is primarily focused on measuring it in listed companies, and the issue of FRQ in unlisted companies as well as small and medium-sized companies has been overlooked. This has been emphasized especially in bank-centric economies, i.e., economies where bank lending is a major source of corporate financing. According to the research of Herath and Albarqi [37], disregarding unlisted companies in FRQ research results can lead to bias and not fully reflect the status of corporate financial reporting around the world. Therefore, more research on FRQ issues should consider all registered commercial companies without regard to stock exchange listing status and size.

It should be noted that from a methodological perspective, Gow et al. [32] emphasized that variables derived from firm-year observations are typically based on econometric methods and assume cross-sectional and time-series independence or rely on procedures established in accounting research literature, which have not been formally evaluated. They can be enumerated as weaknesses of all FRQ measures discussed previously.

Finally, in many studies, the lack of relevant control variables and necessary variables that are correlated with other factors is evident and understandable. As a result, emphasis must be placed on ensuring adequate controls are in place for all potentially confounding variables. For example, some studies have shown that FRQ is not solely determined by accounting standards [50].

This research has pointed out some information gaps and deficiencies in the literature on FRQ research. In addition, some research gaps in the literature are highlighted and suggestions have been provided for future research. This research has practical importance and value for clarifying the thoughts of managers, investors and other financial report users regarding the different dimensions of FRQ. Understanding FRQ and having knowledge about its impacts is necessary given the complex and competitive business environments. Reaching a stage where FRQ can be accurately measured would be useful in reviewing other global issues related to accounting reforms and changes in capital markets worldwide.

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