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Earnings quality measures and stock return volatility in South Africa

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Abstract

This paper examined the association between various measures of earnings quality and stock return volatility of Johannesburg Stock Exchange (JSE)-listed companies for 10 years from 2009 to 2018. The measures of earnings quality considered were accrual quality, conservatism, earnings persistence, predictability and smoothness. The stock return volatility was measured with idiosyncratic volatility. Multilevel linear regression found that accrual quality and earnings persistence are negatively related to idiosyncratic volatility. Firms with a high value of accrual quality and those with more persistent earnings exhibited a decrease in stock return volatility. Furthermore, it was found that the earnings smoothness positively influenced the idiosyncratic volatility, suggesting that firms with less smooth earnings display an increase in stock return volatility. The conservatism and earnings predictability have no significant effect on stock return volatility. The mixed results of this study supported the noise and information perspective to explain the stock return volatility of JSE-listed companies.

Keywords: Earnings, Earnings quality, Risk, Idiosyncratic volatility, JSE-listed companies

JEL Classification: G1, M41

Introduction

The stock return volatility of a company is affected by idiosyncratic and market risks [35, 44]. These two types of risks form part of the risks related to an investment. The idiosyncratic risk is related to a firm's characteristics and can be eliminated by diversifying the investment portfolio of assets. In contrast, systematic risk is not diversifiable and is related to market factors. Therefore, market risk is expensive, and investors who choose this type of risk should be rewarded through a higher return on their investments, whereas idiosyncratic risk is unpredictable. This notion derives from the capital asset pricing model, which illustrates the relationship between risk and return of an asset [2, 47].

Investors only considered a systematic risk in their investment decisions in the past, although the idiosyncratic risk is the most predominant in explaining stock return [18]. Campbell et al. [6] reported that the stock return in the US market increased between 1962 and 1997. However, the authors found that the increase was not attributable to market risk but idiosyncratic risk. Since the publication of these findings, the idiosyncratic risk has received considerable attention in accounting and finance research. Several studies have investigated the reasons for the upward trend in idiosyncratic volatility. Possible causes include the increase in market competition, increase in leverage, a firm's age and size, and the financial reporting quality [6, 34, 41, 51].

Irvine and Pontiff [34] showed that market competition is one of the reasons for the increase in idiosyncratic volatility. When a firm operates in a highly competitive environment, its profitability decreases because consumers become less loyal to a specific product. Another explanation provided by Pastor and Veronesi [46], Bali et al. [2] and Campbell et al. [6] suggested that the rise in leverage and the age and size of a firm can justify

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trends in idiosyncratic volatility. Furthermore, Rajgopal and Venkatachalam [51] reported that the increase in idiosyncratic volatility in the US context was related to the deterioration of earning quality; in fact, the earnings numbers they used did not convey accurate firm-specific information. Domingues et al. [18] reached a similar finding from UK stock market data.

Many previous studies focused on market factors and a firm's specific characteristics to explain stock return volatility. Few studies that examined the association between financial reports and the volatility of stock return mainly used a single measure of earnings quality, although several measures can be used to assess the quality of firm reported earnings [8, 18, 51]. Each measure of earnings quality is unique and captures a specific aspect of a firm's reported earnings. Therefore, each measure of earnings quality could influence the stock return volatility differently. The studies mentioned above were conducted in developed markets where the capital market behaves differently from those in developing countries such as South Africa (SA). Stock return volatility in each country is influenced by factors such as political risk, the policies that govern the stock market and the institutional settings [4]. The reasons that explain stock return volatility in one country cannot be applied to another country since each country has specific rules governing its capital market's functioning. Previous studies reported mixed results. Some studies found that a decline in earnings quality is associated with an increase in stock return volatility [8, 18, 50]. These studies favour the noise perspective, which stipules that "worsening earnings quality causes noisy earnings" [51]. Other studies reported that impaired earnings quality is related to the decrease in stock return volatility; these studies are in favour of the information perspective, which infers that a firm's specific information about reported earnings is embedded into the stock price [19, 31, 43]. In South Africa, the effect of accounting quality on the firm's stock return volatility has received little attention.

This study investigated the relationship between the various ways earnings quality is measured and a company's stock return volatility. The study assessed whether financial reporting quality (mainly reported earnings) is associated with a company's stock return volatility, especially in SA. The study examined the effect of accrual quality, conservatism (conditional and unconditional conservatism), earnings persistence, predictability and smoothness on the stock return volatility of JSE-listed companies.

This issue is essential for several reasons. Firstly, a part of a firm's return is based on its private information contained in the financial reports (particularly earnings reports). Secondly, such investigation is vital to inform investors of factors that can cause or increase the risk/return associated with their investments. This is also important to policymakers as they are interested in finding out the origin of the volatility of a stock to formulate policies that will ensure the stability of the capital market and the economy. Lastly, high-quality financial reports reduce uncertainty and improve the efficiency of the capital market [35, 43, 59]. Thus, understanding the association between earnings quality measures and firm-specific return volatility will contribute to the efficient allocation of resources and the well-functioning of the capital market.

To investigate the relation between various measures of earnings quality and the company's stock return volatility, hypotheses were formulated. Multivariate analyses were used to analyse 800 firms' year observations gathered from 80 non-financial JSE-listed companies, for a 10-year period, from 2009 to 2018. Specifically, the multivariate analyses notably the multilevel linear regression (MLR) were applied to test the hypotheses of the study.

It was found that three out of the five earnings quality measures considered influence the volatility of stock return. Specifically, accrual quality and earnings persistence were found to be negatively associated with the stock return volatility. It was also found that earnings smoothness is positive and significantly associated with the stock return volatility. The findings further revealed that the conservatism and earnings predictability have no significant effect on the volatility of stock.

These findings imply that, in the SA context, earnings quality is one of the reasons that explains the volatility of stock. In fact, it was found that, when earnings quality is measured by accrual quality and earnings smoothness, poor earnings quality is associated with the decrease in stock return volatility; this finding is consistent with the information hypothesis, which infers that firm's specific information about reported earnings is imbedded into the stock price [19, 39]. It was also found that, when the earnings quality is measured by earnings persistence, a poor-earnings quality leads to an increase in stock return volatility; this finding is in accordance with the noise hypothesis which conjectures that "worsening earnings quality causes noisy earnings" [51]. The results obtained in this study provide mixed evidence which support both the noise and information hypotheses in explaining the stock return volatility. The information hypothesis is also endorsed by Morch et al. [43], Durnev et al. [19] and Hutton et al. [31] who reported that information about reported earnings is incorporated into the stock prices. In contrast, Rajgopal and Venkatachalam [50], Chen et al. [8] and Domingues et al. [18] are in support of the noise hypothesis. Specifically, Rajgopal and Venkatachalam [50] and Domingues et al. [18] used the US and UK samples, respectively, and found that the upward trend in idiosyncratic volatility is related to poor earnings quality, measured by accrual quality.

The study contributes to the knowledge by elucidating whether the quality of a firm's reported earnings (measured by various properties of earnings) explains the volatility of stock return of the JSE-listed companies. This information may be useful to investors and other users of accounting information in identifying the causes of the volatility of stock return and whether the volatility of stock return can be predicted using factors that affect accounting information in SA. This in turn will lead to an efficient allocation of resources in the economy.

This paper is organised as follows: "Literature review" section is a literature review of the concept of earnings quality and stock return volatility. "Hypotheses development" section develops the hypothesis of the study. "Methods" section describes the methods used to measure the variables used in the study, the sample and data, and the statistical analysis. "Empirical results and discussion" section presents results and discussion. The conclusion is presented in "Conclusions" section.

Literature review

Earnings quality

Financial reporting provides useful accounting information to capital markets for business decision-making [48]. Financial reports are read widely by managers, investors, analysts, regulators and standards setters. The earnings figure in the financial statement summarises accounting information [24], whereas the earnings quality is used to make economic decisions. High-quality earning is characterised by providing an accurate measure of a company's operations. It is sustainable and predicts future earnings reliably. It is unmanaged and offers valuable information to the users [24].

Low earnings quality originates from the earnings management, errors in accounting rules and or information asymmetry between the stakeholders [3, 13]. Low earnings quality increases information risk and leads to inefficient resource allocation.

Earnings quality is a multidimensional concept, and several measures, including accrual quality, conservatism, timeliness, value relevance, earnings persistence, predictability and smoothness, have been developed to measure it [23]. No specific guidelines on the choice of earnings measures are enforced, but it is advisable to use various measures since each standard of earnings quality illustrates a particular aspect of a firm's reported earnings [13, 28].

Stock return volatility

Volatility is defined in terms of an investment approach in the context of this paper. The "US Securities Exchange Commission" [56] described volatility as a sudden change in stock price either at an individual firm or the market level. Volatility represents the up-and-down fluctuation of stock prices or returns. Volatility patterns may assist market participants in managing risks or assessing the degree of risk associated with an investment.

Risk prevents the prediction of capital market behaviour and influences the price of a security [54]. The security price is determined by the capital asset pricing model (CAPM) initiated by Sharpe [54]. The model illustrates the relationship between risk and returns on investment. Investment is subject to systematic and idiosyncratic risks. Systematic risk is associated with the market, whereas idiosyncratic risk is related to firm-specific risks. The CAPM assumes that investors are exposed to a firm's total risk and hold a well-diversified portfolio. Therefore, investors are rewarded (through higher return) for only systematic risk, whereas idiosyncratic risk can be eliminated through portfolio diversification [57]. The CAPM assumes that idiosyncratic risk is not essential since it is diversified. However, this assumption is misleading for investors who prefer to keep a non-diversified portfolio [18]. The finding of Campbell et al. [6] contradicts the "no importance of idiosyncratic risk". It provided empirical evidence that the stock return volatility of firms in the USA has increased due to idiosyncratic risk and not market risk.

Prior research on earnings quality and stock return volatility

Following the report by Campbell et al. [6] that idiosyncratic risk was associated with the firm stock return volatility, several other studies attempted to explain the reasons for the rise of idiosyncratic risk or its association with earnings quality [18, 51, 59].

US data from the Zack database was used to investigate the association between the quality of financial reports and idiosyncratic volatility [51]. Using accrual quality as a proxy for financial reporting quality, the study found that the deterioration of earnings quality is one of the reasons for increasing idiosyncratic volatility. Using a sample of firms listed in the London stock exchange, Domingues et al. [18] also found that high idiosyncratic volatility is associated with poor earnings quality, measured by accrual quality. Xiao et al. [59] used Chinese data to investigate the relation between a firm's specific return variation proxy by idiosyncratic volatility and price informativeness proxy by institutional holding. The study identified sophisticated trading (firm fundamental value) and unsophisticated trading (noise trading) as two driving forces for the stock market. Sophisticated trading occurs when the market is efficient due to high-quality information about a firm. Unsophisticated trading is characterised by a weak information environment and where the market participants are less or incorrectly informed about the firm's value. Xiao et al. [59] showed that the relation between firm-specific return variation and stock price is negative in cases where the stock prices are primarily driven by sophisticated trading and unsophisticated trading. This finding is different from that of Lee and Liu [37], who found that the relation between firm-specific return variation and stock price is negative in cases where the stock prices are primarily driven by unsophisticated trading.

Further, the U-shaped association is observed where the stock prices are driven by sophisticated trading. The U-shape implies that the relation first decreases and then increases. Xiao et al. [59] also reported a negative association between idiosyncratic volatility and institutional holding. In contrast, Xu and Malkiel [60] reported that an increase in idiosyncratic volatility is due to institutional holding.

The main reason for income smoothing is risk reduction [27]. Markarian and Albornoz [42] verified this assertion when investigating the relationship between income smoothing and idiosyncratic volatility. The study focused on smoothness that originates from the discretionary actions of managers. A positive association was found between income smoothing and idiosyncratic volatility. The study showed that smoothness affects stock return volatility; managers smooth earnings to reduce risk and secure their jobs.

The association between stock return and idiosyncratic risk based on the data from 38 countries was reported by Visaltanacholi and Pukthuanthong [57]. The authors used the CAPM to measure the idiosyncratic risk and investigate whether idiosyncratic risk should be priced in the market. The results show that only two countries out of the 38 presented a positive association between idiosyncratic risk and stock return, implying that idiosyncratic risk influences the stock returns. The study concluded that idiosyncratic risk is not priced. Since only two countries favoured the impact of idiosyncratic risk in the CAPM, it does not explain stock return volatility. However, it is recognised that the CAPM is not a complete measure of risk since a large portion of stock return variation is unexplained by the CAPM [52] (Batram, 2011).

The unexplained CAPM portion of a firm's specific return volatility is explicable by "the existence of either private information or else occasionally frenzy unrelated to concrete information" [52]. Several studies [11, 19, 43] provide empirical evidence to explain private information. Other studies by Lee and Liu [37], Kelly [35], and Gassen et al. [26] favour the noise explanation.

Morch et al. [43] argued that a firm's private information can explain stock return variation. The price informativeness parameter (R^2) was suggested to assume that firm-specific information as opposed to market information is reflected in the stock price. A lower R^2means that the stock return is explained by firm-specific information, whereas a high R^2 is interpreted as a return driven by the market-wide information. The study demonstrated that there is an inverse relationship between earnings quality and R^2—measures market synchronicity derived from asset pricing regression. The inverse relationship implies that transparency in the financial report leads to capitalisation of accounting information into the stock price. A low R^2 suggests that earnings quality is high, and a firm's specific information is incorporated into the stock price. High-quality earnings exist in countries with strong protection of property rights, making earnings valuable information to the capital market [43]. Transparent accounting information leads to an increase in stock return synchronicity and greater incorporation of firm-specific information into the stock price [11]. The latter study demonstrated that firms disclose relevant information timely to the market in a transparent environment. This information may predict a firm's future events and prevent any surprises in the market. There will be little or no information to add to the stock price, increasing synchronicity stock returns. Durnev et al. [19] showed that the current stock return could predict future earnings in firms with lower R^2 values. The authors argued that information contained in the stock price is driven by firm-specific details and showed a high correlation between the stock price and future earnings. The variation in the stock return is linked to a firm's specific information.

Kelly [35] re-analysed the suggestion that R^2 is inversely related to price informativeness or information efficiency by examining the influence of a firm's private information on idiosyncratic volatility. The author was interested in stock price reactions when new information enters the capital market. It was shown that days with further details increase idiosyncratic volatility. On the other hand, only 30% of new information reaches the market in a year. Firm-specific information and unrelated information (noise) impact idiosyncratic volatility. A firm's private information explains only 14% of return. There is the contention that R^2 is not a good measure of "information efficiency" [35] (Li et al. 2014). Furthermore, Gassen et al. [26] established that price informativeness is not a good measure when stocks are illiquid. The authors claimed, *ceteris paribus*, that when the firm value changes due to the market-wide information, the return of illiquid stock does not correlate with the market since illiquidity remains unchanged when the stock price changes.

Similarly, Skaife et al. (2006) asserted that low R^2 does not necessarily imply that a firm's private information is impounded into the stock price. The authors argued that if Morch et al. [43] interpreted low R^2 as a "return that reflects more specific firm information", they would have expected a low value R^2 related to the price that provides more information about the firm's future earnings. Skaife et al. (2006) indicated no significant link between the R^2 value, price and future earnings. Further, Lee and Liu [37] showed that the association between firm-specific return variation and idiosyncratic volatility is negative or U-Shaped. This suggests that private information and noise trading can explain firm-specific return volatility.

Some studies reported that earnings quality (firm-specific information) does not explain the stock return variation [9, 14, 21, 58]. These studies maintain that the variation in stock return is due to the risk related to the market and not to idiosyncratic risk. DeLong et al. [14] contend that the variation in stock price can be explained by factors unrelated to a firm's specific information, such as the market-wide noise trader risk. Similarly, Fernandes and Ferreira [21] claimed that in a market with considerable analysts' coverage, stock price variation is explained by market-level information rather than firm-level information. Wang et al. [58] showed that stock return volatility is due to market factors by demonstrating that the general information environment influences the return on a stock. The authors showed that when a particular firm provides earnings information to the market, investors consider this information but do not use it to make decisions; instead, they wait for other firms to display their earnings information. The investors update their beliefs about a firm's information and consider the overall (general) market information when all the firms present their earnings. Stock return is affected by signals in the market and not by a specific firm's knowledge since the latter is incorporated in the market. Reduced stock return variation occurs when the "general information environment improves".

The influence of systematic risk on stock market volatility was investigated in South Africa [9]. The study also analysed the effect of the financial crisis on the relationship between market risk and stock market volatility. The author acknowledged the importance of market factors in determining a company's performance and revealed that the systematic risk stemming from the macroeconomic environment explained the stock market's volatility. Chinzara [9] also found that a financial crisis strengthens the association between the two variables since the stock return volatility increases.

In summary, studies on earnings quality and stock return volatility provided mixed results. These results are attributed to many factors, including a firm's fundamental value and noise trading that influence a firm's stock return [59, 60]. Earning quality is also influenced by the speed and diffusion of new information in the capital market [61], market risk and industry factors [9, 58]. Few studies have examined the relationship between the different measures of earnings quality and stock return volatility in South Africa, where little information is available about the association between earnings quality and a firm's stock return variation.

Hypotheses development

The lack of a disclosure policy and transparency in financial reports increases information asymmetry about a firm's performance and stock price volatility [51]. Anything that increases information risk also increases the volatility of a stock price [20, 45]. Information risk is either information asymmetry or poor earnings quality [20, 38]. The expectation is that any earnings quality measure directly linked to information risk increases the volatility of stock return and vice versa. This study examined five measures of earnings quality, including accrual quality, conservatism, earnings persistence, predictability and smoothness and their associations with stock return volatility. The relation between each measure of earnings quality (accrual quality, conservatism, earnings persistence, predictability and smoothness and their associations with stock return volatility) is explained in the next section to formulate the study's hypotheses.

As a measure of earnings quality, accrual quality is a component of earnings, apart from cash flow [7]. Accrual quality is directly related to information risk since earnings manipulation is done through the accrual process [23]. Accrual is considered subjective and subject to the manager's judgment and estimation [7]. The firm's reported earnings will be distorted if these estimations are incorrect. It is expected that accrual quality would be positively associated with stock return volatility. Conservatism is described as the understatement of reported earnings due to the possibility of unfavourable circumstances [53]. Since conservatism is conditional to the occurrence of an uncertain event, one would expect more conservatism earnings to increase information risk and hence the volatility of stock returns.

Persistent earnings are sustainable and reduce the uncertainty about a firm's reported earnings [13]. Therefore, earnings persistence is related to information risk, eventually reducing information risk. Lipe [40] described predictability as "the ability of past earnings to predict future earnings". Francis [23] and Dichev and Tang [16] pointed out that more predictable earnings reduce forecasting errors and allow financial analysts to determine the value of a firm more accurately. If predictable earnings improve earnings quality, earnings predictability is indirectly related to information risk. More predictable earnings lead to a reduction of information risk.

Earnings smoothness is an alteration in reported earnings by a manager to avoid the variation in reported earnings. Tucker and Zarowin [55] postulated that earnings smoothness reduces earnings volatility. A decrease in earnings volatility is only possible if a manager's alteration of reported earnings is not done opportunistically. Therefore, it was stated that earnings smoothness decreases earnings quality since managers take action to gain the capital market's advantage [38]. The latter further asserted that smoothness is a form of earnings management, indicating poor earnings quality. It is challenging to discern earnings smoothness derived from correctly applying accounting rules, which emanates from improper accounting. Therefore, one would expect earnings smoothness to influence information risk directly. Firms with smoother earnings would be exposed to higher information risk than those with less smooth earnings. Based on the above discussion, the following hypotheses were formulated.

H_{1a}: Accrual quality is positively related to stock return volatility.

H_{1b}: Conservatism is positively related to stock return volatility.

H_{1c}: Earnings persistence is negatively related to stock return volatility.

H_{1d}: Earnings predictability is negatively related to stock return volatility.

H_{1e}: Earnings smoothness is positively related to stock return volatility.

Methods

Measurements of the study's variables, sample and data collection, and statistics are explained next.

Variables measurement

The variables for this study are classified into three categories: dependent, independent and control.

Measurement of the dependent variables

The dependent variable is the company's stock return volatility. The company's stock return volatility is measured by idiosyncratic volatility since it explains the central portion of stock return variation related to a firm's specific information [42, 50]. The idiosyncratic volatility is considered a good measure of its stock return volatility since it can be used in a better or inferior environment [61]. Cohen [10] and Wang et al. [58] showed that idiosyncratic volatility could be measured with the standard capital asset pricing model (CAPM) as in Eq. (1).

$$R_{i,t} = \alpha + \beta Rm_t + \mu_{i,t} \tag{1}$$

where $R_{i,t}$ is the monthly return for firm i in the month t; Rm_t is the market return for the month t. The value weight market return is used as market return [35, 58]. The idiosyncratic volatility (IDIO) for the stock i is the variance of the error term ($IDIO = \sigma^2(\mu_{i,t})$). Equation (1) is estimated each year and for each firm in the sample using the monthly market and return data. The analysis is conducted with the natural logarithm of IDIO.

Measuring the independent variables

The independent variables consist of five measures of earnings quality, including accrual quality, conservatism earnings persistence, predictability and smoothness.

Accrual quality Accrual quality is estimated using the modified Dechow and Dichev [12] model widely used to measure accrual quality [13] (Shi and Zhou 2012). The model estimates the accrual quality in terms of the accrual and cash flow components of earnings, variation in sale and property plant and equipment, as in Eq. (2).

$$\begin{aligned} \Delta WC_{i,t} = &\beta_0 + \beta_1 CFO_{i,t-1} + \beta_2 CFO_{i,t} \\ &+ \beta_3 CFO_{i,t+1} + \beta_4 \Delta SALES_{i,t} \\ &+ \beta_5 PPE_{i,t} + \mu_t \end{aligned} \tag{2}$$

where ΔWC_t is the change in the working capital in the year t; CFO_t is the cash flow from the operation in the year t; $\Delta SALES_t$ is the change in sales in year t; PPE_t is the property, plant and equipment in year t; μ the prediction error; i, t the firm and year, respectively, and β is obtained from the regression model. All variables are scaled by total assets at the beginning of year t. AQ is computed as the standard deviation of the residual, calculated over 5 years ($AQ_{i,t} = \sigma(\mu)_{i,t}$).

Conservatism Two types of conservatisms are distinguished, including conditional and unconditional conservatism. The Basu [5] model is used to measure conditional conservatism (CONSER1) due to its popularity [58]. The Basu [5] model is provided in Eq. (3).

$$EPS_{i,t}/P_{i,t-1} = \alpha_0 + \alpha_1 D + \beta_0 R_{i,t} + \beta_1 DR_{i,t} + \mu_{i,t} \tag{3}$$

where $EPS_{i,t}$ is the earnings per share of firm i in the period t; D the indicator variable which is equal to 1 if $R_{i,t}$ is negative ($R_{i,t} < 0$) and 0 otherwise; $R_{i,t}$ is the stock return of firm i in the period t. From Eq. (3), CONSER1 is estimated with the formula: $(\beta_0 + \beta_1)/\beta_0$.

The unconditional conservatism (CONSER 2) is measured using the book-to-market ratio, computed as a company's book value divided by its market value [49].

Persistence and predictability Persistence and predictability are time-series measures of earnings. Earnings persistence (PERSIST) is measured as the slope coefficient obtained from the regression of current earnings on past earnings [13], as in Eq. (4).

$$Earnings_{i,t} = \beta_0 + \beta_1 Earnings_{i,t-1} + \mu_{i,t} \tag{4}$$

Earnings predictability (PREDICT) is measured as the error variance from the earnings persistence model [23, 48] as in Eq. (5).

$$PREDICT_{i,t} = \sqrt{\sigma^2}(\mu_{i,t}) \tag{5}$$

Smoothness Earnings smoothness (SMOOTH) is estimated as the standard deviation of operating income divided by the standard deviation of cash flow from operations [38, 48] as in Eq. (6).

$$SMOOTH_{i,t} = \sigma OI_{i,t} / \sigma CFO_{i,t} \tag{6}$$

The standard deviation is calculated for each firm over a rolling five-year window. A high value of SMOOTH, indicates less earnings smoothness, and a low value implies smoother earnings.

Measurement of the control variables

The control variables for the stock return volatility include the firm's size, leverage, growth (book to market), cash flow volatility, operating performance and stock return performance. These variables may lead to an increase or decrease in the stock return volatility [18, 31, 51, 58]. Therefore, these variables were included in the regression model in this study. The firm's size was measured as the natural logarithm of total assets. Leverage was calculated as the ratio of the total debts to total assets. Growth was computed as the market value of equity divided by the book value of equity. Cash flow volatility was calculated over a rolling five-year window as the cash flow variance from operation scaled by total assets. Before extraordinary items were scaled by total assets, earnings were used to measure the operating performance. Lastly, the annual buy and hold returns measured stock return performance.

Sample and data

The sample included all non-financial companies listed in the JSE during 2009–2018. As in related studies [18], the financial companies were unnamed as they are a part of well-regulated industries. Furthermore, their accounting rules differ from that of other sectors, and the assessment of their earnings quality is likely to differ from that of different sectors. The final sample included companies that satisfied the following criteria: (1) availability of financial statements for the sample period with relevant information for measuring the variables, (2) the company had data for the past 5 consecutive years from the beginning of the sample period since the computation of accrual quality is based on the standard deviation of residual calculated over a 5-year rolling period [17]. After eliminating all companies with missing information, the final sample consisted of 800 observations obtained from 80 companies. The final sample represented 36% of the initial sample.

The IRESS Research Domain database extracted the companies' annual financial statements. The annual financial statements were analysed to retrieve relevant data to compute the study's variables. SPSS software version 27 was employed to analyse the MLR model's data. MLR is a more powerful estimating technique for analysing panel data than traditional estimating models such as ordinary least squares [22]. MLR addresses the shortcomings of conventional estimating methods and offers more benefits, such as greater flexibility in analysing panel data; it handles data well, using the maximum likelihood and restricted maximum likelihood estimations [25].

Before analysing the data, several tests were performed to ensure that the assumptions of linear regression were met. These tests included normality, multicollinearity, heteroscedasticity and autocorrelation. The results of these tests are provided in Appendix 1 and discussed below.

Normality test

The normality was checked using the histogram of standardised residual of the dependent variables and the P–P plot of standardised residual against the predicted values as advised by Field [22]. As illustrated in Fig. 1a of "Normality test" section in Appendix 1, the histogram has a bell shape and is symmetrically distributed around the mean. The points in the P–P plot in Fig. 1b of "Normality test" section in Appendix 1 are close to the diagonal line. Therefore, Fig. 1a and Fig. 1b of "Normality test" section in Appendix 1 show that data are normally distributed for the regression with the dependent variable idiosyncratic volatility.

Multicollinearity test

To test for multicollinearity in the independent variables, the variance inflation factor (VIF) test was used in this study as advised by Field [22]. VIF values obtained are provided in "Multicollinearity test" section in Appendix 1. "Multicollinearity test" section in Appendix 1 shows that all VIF values are below 10; therefore, multicollinearity is not a problem in the regression analysis in this study. This is further substantiated by the correlation results obtained in "Descriptive statistics and correlation analysis" section, where it is found that none of the correlation coefficients between the independent and control variables is above 0.80; this indicates that there is no multicollinearity problem [29].

Heteroscedasticity test

All variables of the study were winsorized to the 1st and 99th percentile to control for outliers.

After winsorizing, the Glejser test was performed to test the heteroscedasticity. The results are displayed in "Heteroscedasticity test" section in Appendix 1. There is no heteroskedasticity problem as the p values are above 0.05.

Autocorrelation test

The Durbin–Watson (DW) test was used to check for autocorrelation in the data. The regression with the dependent variable stock return volatility produced a DW values between 1.29 and 1.950. The DW values were below 2, indicating a serial autocorrelation problem. To address this problem, the MLR [22] was used to analyse the data. The MLR controls the serial correlation in the data or does not require the assumption of no autocorrelation to be met [22, 32].

Descriptive statistics and correlation analysis

The descriptive statistic on the main variables of the study is provided in Appendix 2. The Pearson correlation matrix among the stock return volatility, measures of earnings quality and control variables is provided in Appendix 4. As shown in Appendix 4, IDIO is negatively correlated with AQ ($r=-0.138$), persistence ($r=-0.173$), predictability ($r=-0.140$), size ($r=-0.073$), leverage ($r=-0.063$), OPF ($r=-0.352$) and SRP ($r=-0.228$); all are significant except for leverage. In addition, IDIO displays a positive correlation with conservatism 1 ($r=0.015$), conservatism 2 ($r=0.176$), smoothness ($r=0.098$), BTM ($r=0.174$) and CFV ($r=0.095$); all are significant except for conservatism 1.

Empirical results and discussion

The regressions in Eq. (7) were estimated to test the association between the stock return volatility and earnings quality measure. The stock return volatility is the dependent variable measured by idiosyncratic volatility. The earnings quality measures, including accrual quality, conservatism, persistence, predictability and smoothness, are the independent variables; they are the primary variables of interest. The control variables are the size, leverage, growth, cash flow volatility, operating performance and stock return volatility.

$$\begin{aligned} SRV_{i,t+1} =& \beta_0 + \beta_1 EQP_{i,t} + \beta_2 Size_{i,t} \\ &+ \beta_3 Leverage_{i,t} + \beta_4 BTM_{i,t} \\ &+ \beta_5 CFV_{i,t} + \beta_6 OPF \\ &+ \beta_7 SRP_{i,t} + \mu_{i,t} \end{aligned} \quad (7)$$

where *SRV* is the stock return volatility, measured by idiosyncratic volatility; *EQP* is either accrual quality, conservatism, earnings persistence, earnings predictability, or earnings smoothness; *SRV* is the stock return volatility; *BTM* is growth; *CFV* is cash flow volatility; *OPF* is operating performance; *SRP* is the stock return performance. i and t are the firm i at period t, respectively; β is the regression coefficients; μ is the error term.

Equation (7) is used to test the hypotheses H_{1a} to H_{1e} developed in "Hypotheses development" section; these hypotheses estimate earnings quality measures' effect on stock return volatility. Equation (7) is calculated using MLR, and the results are shown in Table 1.

Results for testing H_{1a}

The first column of Table 1 presents the results of hypothesis $H_{1a,}$ which tests the effect of accrual quality (AQ) on a company's stock return volatility (SRV). Column 1 of Table 1 shows that AQ has a coefficient of − 3.1804 (t-statistic = −4.9269), which is statistically significant. This suggests that there is an indirect association between AQ and SRV. An increase in AQ will lead to a decrease in SRV. When AQ increases (a high value of AQ), earnings are of lower quality; therefore, the result suggests that for the JSE-listed companies, the decline in earnings quality measured by AQ is associated with a decrease in idiosyncratic volatility (IDIO).

Similarly, an increase in earnings quality leads to a rise in IDIO. This result is contradictory to the result by Rajgopal and Venkatachalam [51]. They found that a decline in earnings quality (measured by accrual quality) is associated with a rise in idiosyncratic volatility. This contradictory result emphasises that earnings quality results obtained in one country cannot be generalised for others due to differences in capital markets. However, our results are in agreement with those of Hutton et al. [31], Durnev et al. [19] and Morch et al. [43]. These authors argued that a high stock return volatility at the firm level captures more information about a firm embedded in the stock prices.

Results for testing H_{1b}

Columns 2 and 3 of Table 1 display the results of hypothesis H_{1b}, which is concerned with the effect of conservatism (CONSER1 and CONSER2) on stock return volatility. Column 2 of Table 1 shows that the estimated coefficient and t-statistic for CONSER 1 are − 0.0199

Table 1 Regression analysis of stock return volatility on various measures of earnings quality and control variables

	Column 1		Column 2		Column 3		Column 4		Column 5		Column 6	
	Estimate	*t*-statistic	Estimate	*t*-statistic	Estimate	*t*-statistic	Estimate	*t*-statistic	Estimate	*t*-statistic	Estimate	*t*-statistic
Intercept	−3.4258***	−9.9404	−4.0368***	−12.303	−3.9973***	−12.07	−4.08939***	−12.523	−4.0211***	−12.239	−4.2874***	−13.285
SIZE	−0.0867***	−4.3583	−0.0481***	−2.525	−0.0491***	−2.574	−0.04114**	−2.161	−0.0474***	−2.491	−0.0527***	−2.827
LEVERAGE	−0.3874**	−2.3044	−0.4913***	−2.852	−0.5136***	−2.973	−0.40651***	−2.345	−0.4585***	−2.616	−0.3684**	−2.166
BTM	0.0039	0.8415	0.0026	0.546	0.011	1.031	0.003426	0.706	0.0021	0.451	0.0019	0.412
CFV	3.5188***	4.1925	1.8413**	2.187	1.9054**	2.26	1.532473*	1.817	1.8270**	2.169	3.5918***	4.189
OPF	−2.6486***	−7.7654	−3.3896***	−9.87	−3.4313***	−9.901	−3.22625***	−9.329	−3.3146***	−9.471	−2.8278***	−8.342
SRP	−0.3352***	−4.0428	−0.2760***	−3.229	−0.2841***	−3.318	−0.27244***	−3.215	−0.2773***	−3.248	−0.3659***	−4.401
AQ	−3.1804***	−4.9268										
CONSER1			−0.0199	−0.729								
CONSER2					−0.01	−0.908						
PERSIST							−0.18156***	−3.157				
PREDICT									−0.1257	−1.137		
SMOOTH											0.0984***	3.583

SIZE is defined as the natural logarithm of total assets. LEVERAGE is estimated as total debts divided by total assets. BTM is the growth computed as market to book value ratio. CFV is the cash flow volatility computed as the variance of cash flow from operations scaled by total assets, calculated over rolling 5-year window. OPF is the operating performance calculated as the earnings before extraordinary item scaled by total assets. SRP is the stock return performance defined as the annual buy and hold return

AQ is the accrual quality computed as the standard deviation of residual obtained using the modified Dechow and Dechev [12] model, the regression of change in working capital on cash flow from operation year $t-1$, t and $t+1$, sales and properties, plants and equipment. CONSER 1 is the conditional conservatism, estimated using the Basu [5] model; CONSER 2 is the unconditional conservatism computed as the book value of the firm divided by its market value. PERSIST is the earnings persistence estimated as the slope coefficient obtained from the regression of current earnings on previous earnings. PREDICT is the earnings predictability measured as the square root error variance from the earnings persistence models; the detailed description of these models is provided in "Measuring the independent variables". SMOOTH is the earnings smoothness calculated as the ratio of the standard deviation of operating income divided by cash flow from operation

***, ** and *Significance at 1%, 5% and 10% level, respectively and − 0.729, respectively. The results are statistically insignificant, implying that CONSER 1 is not related to the stock return volatility. Conditional conservatism is concerned with the time of recognition of losses and gains in reported earnings [53]; therefore, the above findings imply that a manager's decision to anticipate losses and defer the recognition of revenues does not affect the volatility of stock return.

Concerning CONSER 2, Table 1, and column 3 also displays statistically insignificant results, suggesting that unconditional conservatism does not influence stock return volatility. The unconditional conservatism that describes the understatement of the value of certain assets and the overstatement of the importance of certain liabilities [13, 53] has no impact on stock return volatility. These findings may be ascribed to the controversy about whether unconditional conservatism impacts the decision usefulness of reported earnings [13]. Nevertheless, these findings agree with those of Armstrong et al. [1], who proposed that unconditional conservatism does not provide timely information to outside directors about unfavourable events in reported earnings. If unconditional conservatism practice is not informative at the time of recognition of adverse events in earnings, it is possible that it will not impact stock volatility. Therefore, the overall results for conservatism are inconsistent with H_{1b}.

Results for testing H_{1c}

The hypothesis H_{1c} predicts the effect of earnings persistence on stock return volatility. The results are displayed in column 4 of Table 1 showing that earnings persistence is negatively associated with the stock return volatility with a coefficient of − 0.18156 and a *t*-statistic of − 3.157. The association is statistically significant, meaning that an increase in earnings persistence would lead to a decline in stock return volatility. This result also suggests that the greater persistent earnings will lead to less volatility in the stock return of the JSE-listed companies. These results corroborate the work by Pastor and Veronesi [46], Easley et al. [20], Rajgopal and Venkatachalam [50] and Chen et al. [8]. They argued that an increase in stock return volatility at the firm level is related to the noise in stock price. A poor earnings quality increases information risk, leading to less informative stock price and high idiosyncratic volatility. The result supports H_{1c}.

Results for testing H_{1d}

The relationship between earnings predictability and stock return volatility is tested in hypothesis H_{1d}. The results in Table 1, column 5, indicate that predictability has a coefficient (*t*-statistic) of − 0.12571 (− 1.137). The association is not statistically significant, suggesting that earnings predictability is unrelated to stock return volatility. The stock volatility for the JSE-listed companies cannot be attributed to the earnings predictability. The result does not support hypothesis H_{1d}. Francis et al. [23] argued that although highly predictable earnings decrease the uncertainty about reported earnings, earnings predictability only decreases information risk if it does not provide false information to investors about the firm's performance. Inaccurate information may come from the managers' exercise of discretion and judgement in the accounting processes at their advantage but at the disadvantage of investors by not providing accurate information about their companies' operational activities. Therefore, it can be concluded that, despite earnings predictability being a desirable attribute of earnings for analysts, the above result suggests that it does not impact stock volatility. This may be due to the difficulty in accurately predicting reported earnings since such prediction is affected by management's involvement in the accounting process. It is difficult to discern the predictable revenues derived from the correct application of the accounting rules from those that emanate from improper application.

Results for testing H_{1e}

The hypothesis H_{1e} tests the association between stock return volatility and earnings smoothness. Table 1 Column 6 shows that the coefficient and *t*-statistic for the smoothness are 0.0984 and 3.583, respectively. This result suggests that earnings smoothness is positively related to stock return volatility. An increase in smoothness leads to an increase in stock return volatility. A high value of smoothness indicates less smooth earnings. Furthermore, this result implies that less smooth earnings increase stock return volatility and vice versa. Leuz et al. [38] and Dechow et al. [13] reported that earnings smoothness is a form of earnings management and smoother earnings lead to a decrease in earnings quality. Following these authors and using smoothness as a measure of earnings quality, the results suggest that low earnings quality is associated with a decline in stock return volatility. Therefore, Hutton et al. [31] support the finding, who reported that poor earnings quality is related to decreasing stock return volatility.

The control variables in Table 1 (columns 1 to 6) show that size is negatively related to the stock return volatility; this implies that the stock return volatility is low for big companies and high for small companies. Large companies are stable, more efficient and competitive in the market. This leads to risk diversification [1] and a less volatile stock return. Leverage is also negatively related to the stock return volatility in Table 1. When leverage increases, stock return volatility decreases; this suggests that highly leveraged companies have lower stock return volatility than less leveraged ones. This idea is contrary to the belief that companies with high financial leverage are exposed to high risk and may display high stock volatility [15, 31].

Nonetheless, this result aligns with Harris and Raviv [30], who demonstrated that leverage plays an essential role in the efficient management of a company. The authors argued that managers utilise the resources efficiently to ensure that the company can repay its debts in high leveraged companies. The timely and consistent repayment of debt shows cash flow stability, whereas any default in repayment indicates signs of future bankruptcy. Therefore, the companies with a high level of leverage are more profitable and display less stock return volatility.

The remaining control variables are given in Table 1 (columns 1 to 6), growth (BTM) is not statistically significant with SRV, the cash flow volatility (CFV) has a positive impact on SRV, and the operating performance (OPF) and stock return performance (SRP) are negatively related to SRV. These results imply that companies with high levels of risk from operations have high stock return volatility. Furthermore, the companies with a strong performance have high stock returns due to an increase in share prices, which leads to a decrease in stock return volatility.

Conclusions

This study provided evidence of the association between various measures of earnings quality and the stock return volatility, measured by idiosyncratic volatility. Specifically, the study revealed that the accrual quality and earnings persistence are negatively associated with idiosyncratic volatility. Earnings smoothness is positively related to idiosyncratic volatility. The findings further revealed that conservatism and earnings predictability significantly affect idiosyncratic volatility. These findings imply that the volatility of stock return in the SA context is probably due to earnings quality. The results suggest that, when the earnings quality is measured by the accrual quality and earnings smoothness, a poor earnings quality is associated with the decrease in stock return volatility; this is consistent with the information perspective, which infers that firm's specific information about reported earnings is impounded into the stock price [19] (Li et al. 2014). The findings also imply that when the earnings quality is measured by earnings persistence, poor earnings quality increases stock return volatility. This agrees with the noise hypothesis, which conjectures that "worsening earnings quality causes noisy earnings" [51]. The results obtained in this study provided mixed evidence, which supports both the noise and information perspective in explaining the stock return volatility of JSE-listed companies.

Appendix 1: Test results for normality, multicollinearity and heteroscedasticity

Normality test

See Fig. 1.

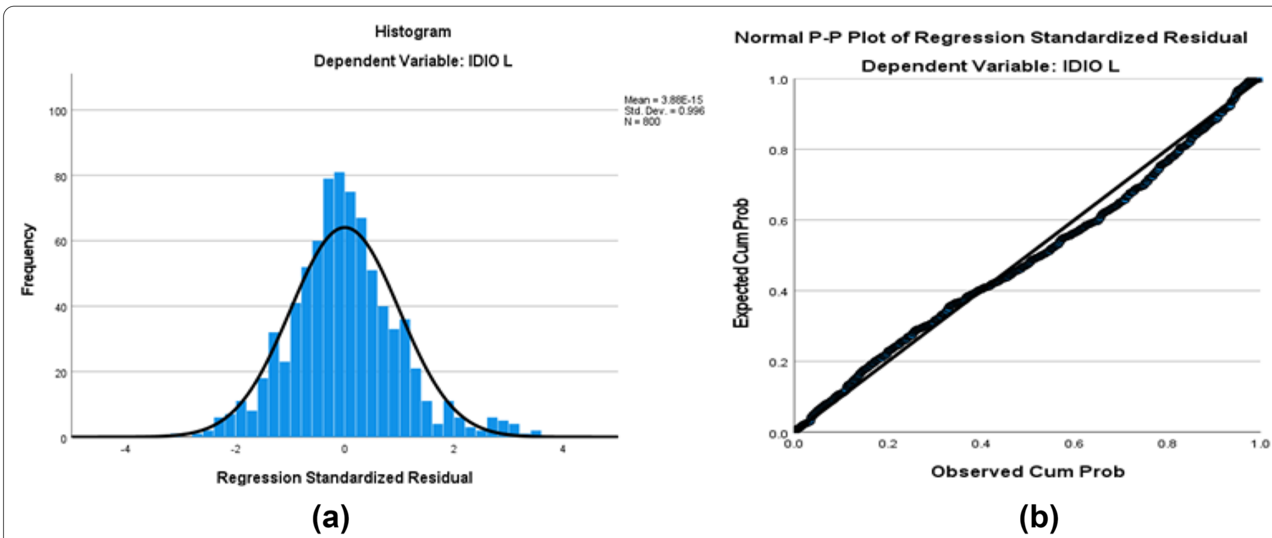

Fig. 1 **a** Histogram and **b** P–P plot for idiosyncratic volatility

Multicollinearity test

	VIF values
Variables	Stock return volatility (IDIO)
AQ	1.325
CONSER1	1.015
CONSER2	6.363
PERSIST	1.077
PREDICT	1.093
SMOOTH	1.06

Heteroscedasticity test

	p value
AQ	0.67
CONSER1	0.23
CONSER2	0.432
PERSIT	0.797
PREDICT	0.881
SMOOTH	0.508

Sample description and variables definition: The sample consists of 800 observations gathered from 80 companies from the period 2009–2018.

IDIO is idiosyncratic volatility measured as the variance of the error term obtained from the standard CAPM model; The standard CAPM is estimated using the monthly return data.

AQ is the accrual quality computed as the standard deviation of residual obtained using the modified Dechow and Dechev [12] model, the regression of change in working capital on cash flow from operation year $t-1$, t and $t+1$, sales and properties, plants and equipment. CONSERV 1 is the conditional conservatism, estimated using the Basu [5] model; CONSER 2 is the unconditional conservatism computed as the book value of the firm divided by its market value. PERSIST is the earnings persistence estimated as the slope coefficient obtained from the regression of current earnings on previous earnings. PREDICT is the earnings predictability measured as the square root error variance from the earnings persistence models; the detailed description of these models is provided in "Multicollinearity test" section. SMOOTH is the earnings smoothness calculated as the ratio of the standard deviation of operating income divided by cash flow from operation. SIZE is defined as the natural logarithm

Appendix 2: Descriptive statistics on stock return volatility, earnings quality properties, and control variables

Variables	N	Minimum	Maximum	Mean	Std. Deviation
IDIO	800	0.0004	0.0665	0.0089	0.0126
AQ	800	0.0015	0.2752	0.0725	0.0563
CONSER 1	800	− 12.9193	17.3568	0.0742	1.6805
CONSER 2	800	− 4.0823	47.0705	6.7436	7.2312
PERSIST	800	− 1.3282	2.6840	0.5814	0.5782
PREDICT	800	0.000038	0.9998	0.3746	0.3020
SMOOTH	800	0.0283	6.7816	1.27150	1.1915
SIZE	800	10.39	19.9	15.6269	1.8898
LEVERAGE	800	0.01	1.23	0.4995	0.1946
BTM	800	0.01	35.4	6.8044	7.3605
CFV	800	0.0085	0.2225	0.0543	0.0393
OPF	800	− 0.31	0.59	0.1104	0.1029
SRP	800	− 1.76	1.26	0.0297	0.4005
Valid N (listwise)	800				

of total assets. LEVERAGE is estimated as total debts divided by total assets. BTM is the growth computed as market to book value ratio. CFV is the cash flow volatility computed as the variance of cash flow from operations scaled by total assets, calculated over rolling 5-year window. OPF is the operating performance calculated as the earnings before extraordinary item scaled by total assets. SRP is the stock return performance defined as the annual buy and hold return.

Appendix 3: Definition of variables

Variable symbol	Variable definition
Dependent variable	
SRV	Stock return volatility measured by idiosyncratic volatility
Independent variables	
AQ	Accrual quality computed as the standard deviation of residual obtained using the modified Dechow and Dechev [12] model
CONSER1	Conditional conservatism, estimated using the Basu [5] model
CONSER2	Unconditional conservatism computed as the book value of the firm divided by its market value
PERSIST	Earnings persistence calculated as the slope coefficient of the regression of current earnings on past earnings
PREDICT	Earnings predictability computed as the variance obtained from the earnings persistence model
SMOOTH	Earnings smoothness calculated as the ratio of standard deviation of operating income divided by cash flow from operation
Control variables	
SIZE	The size of the firm
LEVERAGE	Leverage
BTM	Firm's growth
CFV	Cash flow volatility
OPF	Operating performance
SRP	Stock return performance

Appendix 4: Correlation among stock return volatility, earnings quality properties and control variables

	IDIO	AQ	CONSER1	CONSER 2	PERSIST	PREDICT	SMOOTH	SIZE	LEVERAGE	BTM	CFV	OPF	SRP
IDIO	1	−0.138**	0.015	0.176**	−0.173**	−0.140**	0.098**	−0.073*	−0.063	0.174**	0.095**	−0.352**	−0.228**
AQ	−0.138**	1	0.003	0.043	0.045	0.075*	−0.199**	−0.443**	−0.037	0.036	0.255**	0.261**	0.119**
CONSER 1	0.015	0.003	1	0.087*	0.144**	0.111**	0.013	−0.051	0.058	0.086*	0.001	−0.043	−0.007
CONSER 2	0.176**	0.043	0.087*	1	−0.047	−0.118**	0.063	−0.208**	−0.011	0.915**	0.090*	−0.310**	−0.288**
PERSIST	−0.173**	0.045	0.144**	−0.047	1	0.664**	−0.118**	0.147**	0.180**	−0.012	−0.160**	0.101**	0.029
PREDICT	−0.140**	0.075*	0.111**	−0.118**	0.664**	1	−0.136**	0.047	0.166**	−0.099**	−0.052	0.187**	0.080*
SMOOTH	0.098**	−0.199**	0.013	0.063	−0.118**	−0.136**	1	0.086*	−0.109**	0.092**	−0.246**	−0.148**	−0.052
SIZE	−0.073*	−0.443**	−0.051	−0.208**	0.147**	0.047	0.086*	1	0.258**	−0.191**	−0.273**	−0.168**	−0.053
LEVERAGE	−0.063	−0.037	0.058	−0.011	0.180**	0.166**	−0.109**	0.258**	1	0.037	−0.077*	−0.161**	−0.020
BTM	0.174**	0.036	0.086*	0.915**	−0.012	−0.099**	0.092**	−0.191**	0.037	1	0.063	−0.293**	−0.284**
CFV	0.095**	0.255**	0.001	0.090*	−0.160**	−0.052	−0.246**	−0.273**	−0.077*	0.063	1	0.031	−0.048
OPF	−0.352**	0.261**	−0.043	−0.310**	0.101**	0.187**	−0.148**	−0.168**	−0.161**	−0.293**	0.031	1	0.264**
SRP	−0.228**	0.119**	−0.007	−0.288**	0.029	0.080*	−0.052	−0.053	−0.020	−0.284**	−0.048	0.264**	1

*Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

Sample description and variables definition: The sample consists of 800 observations gathered from 80 companies from the period 2009–2018.

IDIO is idiosyncratic volatility measured as the variance of the error term obtained from the standard CAPM model; The standard CAPM is estimated using the monthly return data.

AQ is the accrual quality computed as the standard deviation of residual obtained using the modified Dechow and Dechev [12] model, the regression of change in working capital on cash flow from operation year $t-1$, t and $t+1$, sales and properties, plants and equipment. CONSERV 1 is the conditional conservatism, estimated using the Basu [5] model; CONSER 2 is the unconditional conservatism computed as the book value of the firm divided by its market value. PERSIST is the earnings persistence estimated as the slope coefficient obtained from the regression of current earnings on previous earnings. PREDICT is the earnings predictability measured as the square root error variance from the earnings persistence models; the detailed description of these models is provided in "Variables measurement" section. SMOOTH is the earnings smoothness calculated as the ratio of the standard deviation of operating income divided by cash flow from operation. SIZE is defined as the natural logarithm of total assets. LEVERAGE is estimated as total debts divided by total assets. BTM is the growth computed as market-to-book value ratio. CFV is the cash flow volatility computed as the variance of cash flow from operations scaled by total assets, calculated over rolling 5-year window. OPF is the operating performance calculated as the earnings before extraordinary item scaled by total assets. SRP is the stock return performance defined as the annual buy and hold return.

Abbreviations
AQ: Accrual quality; BTM: Growth; CAPM: Capital asset pricing model; CFV: Cash flow volatility; CONSER1: Conditional conservatism; CONSER2: Unconditional conservatism; IDIO: Idiosyncratic volatility; JSE: Johannesburg Stock Exchange; MLR: Multilevel linear regression; OLS: Ordinary least squares; OPF: Operating performance; PERSIST: Earnings persistence; PREDICT: Earnings predictability; SMOOTH: Earnings smoothness; SRP: Stock return performance.

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Authors' contributions
The corresponding author N.C. did the data collection, conducted the experiments and written the article. The co-authors J., O.M. and B. provided guidance in the design, structure, and edition of the manuscripts; they also provided insightful comments that help improve the quality of the manuscripts. All authors read and approved the final manuscripts.

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Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
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Competing interests
The authors declare that they have no competing interests.

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