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Explaining the Pattern for Measuring Companies' Environmental Uncertainty and Its Effect on the Volatility of the Qualitative Characteristics of Companies' Financial Information

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ABSTRACT

Environmental uncertainty refers to the unpredictability and complexity of factors surrounding the organization that can impact the firm's operations, strategy and results. Firms must deal with these uncertainties in order to make informed decisions and adapt effectively to changing circumstances. The main objective of this research is to explain a model for measuring corporate environmental uncertainty from the perspective of theoretical foundations and experimental research. To this end, the statistical method of principal component analysis is used to select a suitable criterion for each component of environmental uncertainty from several criteria and, in a next step, the degree of environmental uncertainty of each company is measured by weighting each component. Then, the effect of this variable on the volatility of the qualitative characteristics of the companies' financial information is tested. For this purpose, the data of 131 companies from 2012 to 2021 were analyzed and a multivariate regression analysis was used to test the research hypotheses. The results obtained show that environmental uncertainty affects the volatility of qualitative characteristics of companies' financial information, such as relevance and understandability. Environmental uncertainty poses challenges to any company in terms of lack of information and speed of information and limits its room for maneuver. Therefore, it is difficult to reconcile the relevance of financial information with the degree of environmental uncertainty in order to improve business performance. Furthermore, there is no significant relationship between environmental uncertainty and the volatility of reliability and comparability of financial information/

Keywords: environmental uncertainty, qualitative characteristics of financial information, fluctuating relevance, fluctuating reliability, fluctuating comparability, fluctuating comprehensibility.

1. Introduction

Today, the most important commodity that plays an essential role in the allocation of economic resources is financial information. This information is a useful guide for economic decisions according to the needs of users. In the case of any economic decision that is made in a business unit of an economic enterprise, if we ignore the environmental conditions governing that enterprise, then we should expect an error to occur in that decision (Valizadeh et al., 2021). Correct economic decisions optimize the allocation of resources. That is, a correct economic decision, while maintaining effectiveness, allows us to obtain the maximum yield from a source in the least amount of time. Therefore, ignoring an important factor called the environment can lead to a waste of resources (Sadidi & Ebrahimidardeh, 2011). One of the most prominent features of any economic environment is environmental uncertainty. The concept of environmental uncertainty is concerned with the amount of variability or instability that environmental activities bring into operations, such as the unpredictability of customer reactions, goods and service suppliers, company competitors, and legislative groups that make the possibilities intended ineffective due to constant changes (Drago, 1998). In general, environmental uncertainties can be defined as the conditions imposed by the environment that are: 1) unpredictable; 2) create opportunities and threats for the company; and 3) vary (Milliken, 1987).

Some economic events and other events presented in financial reports face uncertainty. The Financial Accounting Standards Board (FASB) claims that if the information is provided in a way that can be compared to another business unit (or the activities of a business unit over several periods), the usefulness of the information will increase (Hendriksen et al., 2006). Sohn (2016) states that if accounting systems are similar between the two companies, their output, namely accounting figures such as profit and book value, will be similar in the same economic events. But since the accounting system is a relatively closed system, that is, it affects both the environment and is affected by the environment (Dastgir & Saeedi, 2017), environmental fluctuations may affect the data and information published by business units. Managers use their authority to neutralize the effect of these fluctuations and publish reports according to their goals. In the interaction between the financial reporting process and the environment outside the organization, and in order to achieve specific organizational goals or personal interests, managers may select specific accounting methods for financial reporting, thereby reporting parts of financial statements according to their goals (Sadidi & Ebrahimi Dhard, 2011) and therefore causing fluctuations in the quality of financial information. With this end in mind, this study aims to first find a pattern for measuring the environmental uncertainty of corporations and then test its effect on the fluctuation of corporate financial information.

2. Literature Review

2.1 Theoretical Fundamentals and Background

In accounting, uncertainty has significantly influenced investors' decision-making theories. Uncertainty in the economic environment has led to economic decisions that are often accompanied by risk in the sense that the results will not be in line with expectations. Accepting this feature of the economic environment and the fact that the acquisition of valuable information can reduce these uncertainties has affected all information resources. Financial reporting as a source of information can reduce environmental uncertainty by submitting beneficial reports (Mehrani et al., 2014). In this regard, according to signaling theory, companies provide signals to investors and other stakeholders, usually related to the qualitative characteristics of financial information. These signals can include disclosing a variety of financial and non-financial information. Increasing environmental uncertainty can lead to an increased need for companies to send signals that can show that they have made successful and efficient decisions in the face of uncertain conditions. Therefore, if an ineffective signal is issued, the high costs will be imported to the shareholder without reducing the effects of information asymmetry (Mohammadian et al., 2021).

According to information asymmetry theory and signaling theory, companies can transfer signals from their activities to the outside world by disclosing information and reducing information asymmetry between companies and shareholders (Pan et al., 2020). Akerlof (1970) believes that managers have more private information and are maleficians. Therefore, companies can send a signal to users by

disclosing information to help them gain reliability and understanding.

Spence (2002) presented the theory of signaling as a mechanism of information exchange. According to this theory, strong firms can separate themselves from weak firms by sending signals. As a result, the independent balance, or information balance, is created, and the undesirable effects of information asymmetry (i.e., increased risk and expected returns) are reduced. In fact, by providing a positive signal by the management of the firm, the shareholder, despite the lack of knowledge of the company's cash flow, will be more secure about the value of the company due to the company's distinction from a bad company and will be exposed to less risk. Subsequently, despite the high information asymmetry, his expected return will decrease, the price of stocks will increase, and consequently, his wealth will increase. Spence emphasizes that, based on what is stated in the theory of signaling, the signal has information value if it has a positive correlation with the shareholder's understanding of the cash flow and the value of the company. In other words, the signaling firm will incur a lot of costs to obtain that signal, and firms with low cash flow and low value cannot imitate this signal (Spence, 2002).

In addition, according to the signaling theory, capable managers are not only reluctant to vaguely and complexly state their desirable performance but also publish financial reports in order to inform investors and financial analysts of their optimal performance and abilities. They make it more readable and understandable (Hasan, 2017). On the other hand, the theory of managerial ambiguity states that less capable managers are more motivated to reduce the transparency of the information environment and conceal their poor performance. In this way, they can reduce the adverse reaction of the capital market. One of the ways to reduce the transparency of the information environment to hide the bad news about the company is to provide complicated and less readable financial reports (Safari Gerayli & Rezaei Pitenoei, 2018).

Research on the consequences of environmental uncertainty has suggested that increasing environmental uncertainty has a significant impact on the volatility of the qualitative characteristics of financial information. Qiu et al. (2023) conducted a study on the impact of political uncertainty on the readability of financial statements in the Chinese stock market and showed that the financial statements were less readable when political uncertainty was greater. This was because companies may need to hide real accounting information to avoid political costs. There was also a negative relationship between political uncertainty and the readability of financial statements for companies without political communication and weaker supervision.

Maranjory (2024) examined the role of competitiveness in the product market in relation to environmental uncertainty and research and development (R&D) investment, and the results showed that there was a negative and meaningful relationship between environmental uncertainty and R&D investment in the Tehran Stock Exchange. Competition in the product market also strengthened the negative relationship between environmental uncertainty and R&D investment.

By examining the impact of environmental uncertainty on the relevance of financial and non-financial information and the performance of top industrial companies in Portugal, Pires and Alves (2022) found that the organizational environment of large industrial companies operating in Portugal had medium uncertainty. This was mainly due to intense competition and high demands for social and environmental responsibility. In conditions of higher environmental uncertainty, more emphasis was placed on non-financial information for decision-making, especially non-financial information related to employees and customers and the evaluation of suppliers. Pires and Alves also did not find a significant relationship between environmental uncertainty and company performance.

Dhole et al. (2021) found that there was a negative relationship between environmental uncertainty and the qualitative characteristic of comparability. This relationship was more negative for companies with weaker accrual quality and higher profit volatility. Therefore, with the weakening of comparability, it became difficult for investors and analysts to estimate the company's value, which potentially led to a decrease in liquidity and a nonoptimized allocation of capital and had a negative effect on the decisions of individuals and companies.

By examining the relationship between market uncertainty and changes in the trading volume around earnings announcements, Choi (2019) showed that

market uncertainty affects the trading volume around earnings announcements. When market conditions are unstable, investors have difficulty predicting future cash flows, and their beliefs become more fragmented. In periods of high uncertainty, earnings announcements provide valuable information to investors in predicting future cash flows, but investors' interpretations of earnings announcements are also different. Under market uncertainty, the increase in trading volume is greater for firms with more information and for larger firms.

Lim et al. (2018) investigated the impact of business strategies on the readability of the financial statements of companies in Australia during the years 1997–2009. They believe that concerns about the complexity of disclosures have forced regulators to initiate projects to improve the readability of annual financial reports. Since business strategy basically determines the product and market scope, technology, and organizational structure of a company, it affects the complexity of operations, environmental uncertainty, and information asymmetry. Consequently, the business strategy determines the level, context, and complexity of disclosure. Lim et al. also found that the financial reports of companies with an aggressive investment strategy are less readable than those of companies with a defensive strategy.

By using the approaches of time-varying parameter stochastic volatility (TVP-SV) and partial least squares (PLS) models and comparing them with the ordinary least squares (OLS) method, Tarighi et al. (2018) investigated the impact of uncertainty in macroeconomic indicators on the returns of the Tehran Stock Exchange. They found that, based on the TVP model, in different time intervals, variables with different intensities (different parameters) affect stock returns. This reflects the fact that stock return forecasting should be done at short-term intervals, and long-term forecasts cannot be considered in stock investment. Also, based on the PLS model, it was concluded that the variables of economic growth and oil price have affected the efficiency of the Tehran Stock Exchange more than other variables. Therefore, economic growth and oil price variables were entered into the TVP-SV model. According to the results, the TVP model is more efficient than the OLS model. In addition, the TVP-SV model, after the breakup of stock returns, had the highest impact on stock returns and economic growth during the period.

Al-Mawali and Lam (2016) investigated the relationship between customers' accounting information and companies' performance in light of the moderating role of environmental uncertainty. Their results showed that the use of customer accounting information significantly affected organizational performance, and environmental uncertainty had a moderating effect on the relationship between customer accounting information and organizational performance. According to this relationship, in companies with low levels of environmental uncertainty, there was a positive and strong relationship between the usefulness of accounting information and organizational performance.

Cormier et al. (2013) conducted a study titled "The incidence of earnings management on information asymmetry in an uncertain environment: Some Canadian evidence during 2000 to 2004." Their results showed that a complex and dynamic environment weakens the relationship between optional accruals and information asymmetry. In particular, the positive relationship between earnings management and information asymmetry is weakened for firms that invest heavily in R&D and those that face high sales volatility. This issue presents difficulties for investors in evaluating earnings management in an uncertain environment. Cormier et al.'s results also showed that corporate governance is associated with lower earnings management, indicating that the board of directors plays a supervisory role. Moreover, corporate governance may limit earnings management in a country like Canada, where ownership is highly concentrated.

Ghosh and Olsen (2009) investigated the relationship between environmental uncertainty and managers' use of optional accruals during the years 1986–2000. Their findings showed that when environmental uncertainty is high, the number of optional accruals is also higher. This implies that managers use accruals as leverage against the potential effects of reported earnings in an uncertain environment. Also, for firms operating in high-uncertainty environments, the difference between the variance of unmanaged profits and reported profits is significantly greater. They also found that for companies in environments with a lot of uncertainty, the positive relationship between the number of optional accruals and the lower volatility of reported profits compared to unmanaged profits is much

stronger. In general, when firms operate under high environmental uncertainty, managers use accrual accounting to reduce volatility in reported earnings.

In their research on the nature of the reliability of accounting information, Maines and Wahlen (2006) stated that the degree of uncertainty in future cash flows affects the reliability of accounting information. This is because more risk and uncertainty in future cash flows can harm the faithful representation and verifiability of measured values and accounting structures. In this regard, financial statements identify and disclose information in order to inform users about the level of uncertainty in future cash flows. In this way, potential sources of "unreliability" are revealed.

2.2 Hypotheses Development

An essential outcome of environmental uncertainty is the need to closely monitor accounting outcomes. One notable trend in accounting during the twentieth century was the adoption of a practical approach to decision-making. Standardization of accounting practices institutions have also focused their efforts on standardization to ensure the provision of valuable information for decision-making purposes. Perhaps if there was no uncertainty, the useful approach to the decision would never be so influential on accounting policy. Therefore, accounting in its current form has chosen a goal as the main goal, and it is useful in making decisions (Mehrani et al., 2015). Information is useful for deciding when it is relevant. According to the perspective based on the usefulness of information for decision-making, if we cannot provide relevant financial statements theoretically, we can at least provide more beneficial financial statements on the basis of the historical cost principle (Scott, 2012). Therefore, if the information has a number of desirable features, such as being relevant, reliable, and timely, it can inform investors and be useful in forming their predictions of future events (Mehrani et al., 2015). Cormier et al. (2013) believe that in a high-uncertainty environment, managers intend to increase profit prediction for investors through manipulation and smoothing. This is because less volatile profits increase the prediction of future financial information, which causes information asymmetry. But due to the management effort to provide reliable information, information asymmetry is less than its normal condition (Marfo & Hasani Alghar, 2015). Therefore, it is expected that, in terms of environmental uncertainty, the relevance and reliability of the company's financial information will be affected.

Another quality feature of the company's financial information is comparability. FASB considers comparability the quality of information that enables users to identify the similarities or differences between the two categories of economic phenomena (Hendriksen et al., 2016). De Franco et al. (2011) also see financial statements as economic events using accounting figures and state that a company's financial statements are a function of economic events. When two companies have comparable accounting systems, they report similar financial reports for one set of economic events. Now, if companies report the same accounting figures for the same economic events and different accounting figures for different economic events, we will see comparable financial statements (Zalaghi et al., 2016). As a result, by changing the economic environment of the company, the ability to compare companies will be affected.

Financial reports are provided to meet the needs of different users with different knowledge of the reporting unit's activities. However, the important point is that information will be useful for decisions if it is easy for users to understand. The understandability feature makes information easily understandable for users. This means that the explanations of financial and other information should be written in a simple language and provided in a way that can be easily understandable to users (Conceptual Framework of Iranian financial reporting). The US Securities and Exchange Commission has also made efforts to publish more readable and understandable reports and is constantly trying to make corporate reports more readily read (Firtel, 1999). Bloomfield (2002) states that poor-performing companies are forced to publish long financial reports. Li (2008) also states that the annual reports of companies that are less profitable are longer and more complex than those of other companies. These findings show that managers are opportunistically reducing the readability of financial reports to hide unfavorable environmental news from investors. Therefore, it is expected that environmental reports will be reduced in terms of environmental uncertainty and adverse environmental news. Considering the effect of environmental uncertainty of companies on the qualitative characteristics of financial information, the following hypotheses are proposed:

- **Hypothesis one**: Increasing environmental uncertainty leads to the volatility of the relevance of corporate financial information.
- **Hypothesis two**: Increasing environmental uncertainty leads to volatility in the reliability of corporate financial information.
- **Hypothesis three**: Increasing environmental uncertainty leads to volatility of the comparability of a company's financial information.
- **Hypothesis four**: Increasing environmental uncertainty leads to volatility of the understandability of a company's financial information.

3. Methodology

This research is deductive in terms of reasoning method and applied research in terms of purpose, and in terms of method and nature, it is a descriptive type with emphasis on correlational relationships. According to the method of data collection, which uses historical and real information, this research is classified as causal-comparative or post hoc. On the other hand, it determines the relationship between different variables using regression analysis. To carry out this research, the companies admitted to the Tehran Stock Exchange were considered the statistical population, and the systematic elimination sampling method was used to select the sample. The sample companies were studied during the years 2013–2014, and 131 companies that qualified for the research were selected. The information needed to measure the variables and test the research hypotheses was generally extracted from the Rahavard Novin software, and in cases where the required information was not available, financial audits and other published reports on the websites of the companies, Codal, and Securities and Exchange Organization were used. After gathering the data, the Excel software was used for data analysis. The final analysis was performed with the aid of multivariate regression analysis and Eviews software.

The statistical analysis of this research was conducted in two stages. First, in order to design a model to measure companies' environmental uncertainty, the statistical method of principal component analysis (PCA) was performed on environmental uncertainty criteria. In this way, the component with the highest value (eigenvalue) was selected, and any criterion that had the highest correlation with the selected component was considered the criterion for calculating that component (Chang et al., 2002). After calculating the components of environmental uncertainty, we obtained the weight of each component with the help of the above statistical analysis (PCA), and with the sum of the product of the weight of each component in the calculated component, the environmental uncertainty was obtained according to equation 1:

$$EU = \sum_{1}^{8} W_{it} X_{it} \qquad (1)$$

in which W_{it} stands for the weight of each component, and X_{it} denotes the components of environmental uncertainty.

4. Model and Research Variables

4.1 Research Model

In order to test the hypotheses of the research, the regression model of equation 2, adapted from Bayar and Ceylan (2017) and Magerakis and Habib (2022), was used:

$$FCH_{it} = \alpha + \beta_1 EU_{it} + \beta_2 Size_{it} + \beta_3 Age_{it} + \varepsilon_{it} \qquad (2)$$

in which FCH_{it} represents volatility in the qualitative characteristics of financial information, EU_{it} denotes environmental uncertainty, $Size_{it}$ represents the size of the firm, and Age_{it} denotes the age of the firm. Moreover, β_1 represents the fact that an increase in environmental uncertainty leads to an increase in volatility of the qualitative characteristics of companies' financial information.

4.2 Research Variables

Dependent variables: In this study, the volatility of the qualitative characteristics of the company's financial information includes relevance, reliability, comparability, and understandability.

Relevance: In this study, the Ohlson (1995) model was used to calculate the relevance. The ability of this pattern to predict the value of the company in Iran has been examined and verified (Mahmoudabadi, 2006). The Ohlson model is shown below:

$$MV_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2 E_{it} + \mathcal{E}_{it} \qquad (3)$$

in which MV_{it} is the market value of each share, BV_{it} is the book value of each share, and E_{it} is the reported accounting profit of each share.

Reliability: To calculate the reliance capability, the measurement method described by Bandyopadhyay et al. (2010) was used. In this method, the following equation is first used, and R^2 is calculated for each company.

$$E_{t+1} = \alpha_0 + \alpha_1 \ cfo_t + \alpha_2 \ E_t + \mathcal{E} \quad (4)$$

in which E_{t+1} represents profits before the extraordinary items of the following year, cfo_t denotes this year's operational cash flow, and E_t represents this year's profit. Then, with the help of the following equation, R^2 is calculated for each company:

$$E_{t+1} = \alpha_0 + \alpha_1 \ cfo_t + \mathcal{E} \quad (5)$$

The difference between R^2 in (4) and (5) is the index of information reliability. This amount shows how much this year's profit can affect the forecast for next year. In fact, it offers the ability to rely on profitability in predicting the following year's profit (Bandyopadhyay et al., 2010).

Comparability: The accounting comparability between two companies *i* and *j* was estimated through the regression model provided by De Franco et al. (2011) for each company-year and using Time-Series Data of a four-year period (16 seasons):

$$Earnings_{it} = \alpha_i + \boldsymbol{\beta}_i \ Return_{it} + \boldsymbol{\varepsilon}_{it} \quad (6)$$

where *Earnings* and *Return* represent, respectively, the quarterly net profit divided by the stock's market value at the beginning of the period and the quarterly stock return of the company.

The predicted coefficients of the above equation are $\hat{\alpha}_i$ and $\hat{\beta}_i$ as a measure for the accounting function of company *i*, and $\hat{\alpha}_j$ and $\hat{\beta}_j$ as a measure for the accounting function of company *j* (estimated with the help of net profit and stock return of company *j*). To estimate the difference between the accounting functions of two companies *i* and *j* in each year through the following equations, the profits of company *i* was predicted separately, once using the accounting function of *i* company and once using the accounting function of company *j* but with the *i* company's own return (the same economic event) for the same time period as the time period of equations (7):

$$E(Earnings)_{iit} = \hat{\alpha}_i + \hat{\beta}_i \ Return_{it}, \quad E(Earnings)_{ijt} = \hat{\alpha}_j + \hat{\beta}_j \ Return_{it}. \quad (7)$$

Based on the above equation, $E(Earnings)_{iit}$ is the expected profit of company *i* in period *t* according to the accounting function of company *i*. $E(Earnings)_{ijt}$ is the expected profit of company *i* in period *t* according to the accounting function of company *j*. After calculating the above values, the average difference in the expected profit values represents the difference in the accounting functions of the two companies. Therefore, its symmetry shows the degree of similarity and comparability between two companies, as described in relation (8):

$$CompAcct_{ijt} = -1/16 \times \sum_{t-15}^{t} \left| E(Earnings)_{iit} - E(Earnings)_{ijt} \right| \quad (8)$$

where $CompAcct$ is the ability to compare financial statements between two companies *i* and *j* in year *t*. In a similar way, this measure was calculated for each year and for each pair of *i* companies with *j* companies in the same industry. High values of $\boldsymbol{CompAcct_{ijt}}$ reflect greater accounting comparability. In other words, the closer these values are to zero, the greater the comparability of accounting.

Understandability: To calculate the readability of financial reports, the Gunning fog index (1952) was used. To use the formula and perform its steps, the selected text must have at least 100 words (Gunning, 1952).

$$\text{Readability} = 0.4 \times \left[\frac{\text{number of words}}{\text{number of sentences}} + (100 \times \frac{\text{number of difficult or three word syllables}}{\text{number of words}}) \right] \quad (9)$$

The obtained number indicates the degree of difficulty of a text.

The volatility of each of the qualitative characteristics of the company's financial information was calculated based on the percentage of their annual changes.

Independent variables:

The environmental uncertainty obtained from the proposed research model is an independent variable. In order to design a model to measure the environmental uncertainty of companies, the components of environmental uncertainty were determined first.

Based on research records and with the aim of extracting quantitative criteria, six main components, including customers, competition, supply of raw materials, business cost, political environment, and economic environment, were selected. In the second step, different criteria were determined by which each of the components of environmental uncertainty was calculated. In the third step, in order to choose a suitable criterion for each component, the PCA statistical method was used. In this regard, the component that had the highest value (eigenvalue) was selected, and any criterion that had the highest correlation with the selected component was considered the criterion for calculating that component. It should be noted that the raw material supply component had only one criterion for calculation, and the analysis of this step was not done for it. In the fourth step, we obtained the weight of each component of environmental uncertainty using the PCA statistical analysis, and with the sum product of the weight of each component in the calculated component, environmental uncertainty was obtained according to equation 1. The components and criteria of each component of environmental uncertainty are introduced as follows:

The first component included the customer component, and three criteria were considered for its calculation: 1) the coefficient of variation in sales; 2) the variability of earnings per share of the company; and 3) the number of different groups of customers in the market.

- **Coefficient of variation in sales**: This measure was calculated from the five-year average of the sales amount in the form of equation 10 (Ghosh & Olsen, 2009):

$$cv(z_i) = \frac{\sqrt{\sum_{k=1}^{5} \frac{(z_i - \bar{z})^2}{5}}}{\bar{z}} \qquad (10)$$

where $\bar{z}$ is the average amount of sales over the past five years, and z_i is the sales amount during the current year.

- **Variability of earnings per share of the company**: This measure is obtained from the percentage changes in profit per share at the beginning and end of each year (Ghosh & Olsen, 2009).
- **The number of different customer groups in the market**: This measure was obtained through the volatility of the number of customers of the company's products, and the data about them was extracted from the explanatory notes of the company's operating income (Duncan, 1972).

The second component included the competition component, and four criteria were considered for its calculation: 1) fierce competition in the industry; 2) Herfindahl-Hirschman Index (HHI); 3) Lerner index; and 4) adjusted Lerner index.

- **Competition intensity in industry**: This criterion was obtained through the volatility of the total number of companies in the industry (Arieftiara et al., 2017).
- **HHI**: This measure was calculated from the sum of the second power of the market share of all companies active in the industry in the form of equation 11:

$$HHI = \sum_{i=1}^{K} S_i^2 \qquad (11)$$

where K is the number of companies active in the market, and S_i is the market share of the i-th company, which is obtained from the following equation:

$S_i = \frac{X_j}{\sum_{l=1}^{n} X_j}$ in which X_j represents the sales of company j, and l represents the type of industry.

- **Lerner's Index**: This measure was estimated in terms of operating profit divided by sales in the form of equation 12:

$$LI = (Sale - Cogs - SG\&A) / Sale \qquad (12)$$

in which *Sale* represents the amount of sales, *Cogs* denotes the cost of sold goods, and *SG&A* refers to sales, administrative, and general expenses.

- **Adjusted Lerner index**: This measure was obtained from equation 13:

$$LI_{IA} = LI_i - \sum_{i=1}^{N} \omega_i LI_i \qquad (13)$$

in which LI_{IA} is the adjusted Lerner index based on the industry, LI_i is the Lerner index of company i, and ω_i is the ratio of company i's sales to the industry's total sales.

The third component included the raw material supply component, and a criterion called the material cost volatility was considered for its calculation. This criterion was obtained through the annual percentage change in the cost of raw materials consumed (Paulraj & Chen, 2007).

The fourth component included the business cost component, and five criteria were considered for its calculation: 1) Labor cost volatility; 2) material cost volatility; 3) shipping cost volatility; 4) communication cost volatility; and 5) water, electricity, and gas cost volatility. Each of these measures was calculated based on the percentage of

their annual changes, and the data related to them were extracted from the explanatory notes to cost of operating income and sales, administrative, and general expenses (Ward et al., 1995).

The fifth component included the political environment component, and three criteria were considered for its calculation: 1) the government's attitude towards foreign investment; 2) the state of the country's balance of payments (B.O.P.); and 3) the stability of the political system in the country.

- **The government's attitude towards foreign investment**: This criterion was calculated through the annual percentage change of the amount of foreign investment in Iran, and its amount was extracted from the UNCTAD annual report (Badri et al., 2000).
- **B.O.P**: This measure was calculated through the annual percentage change of the country's B.O.P, and its amount was extracted from the economic statistics of the Central Bank of the Islamic Republic of Iran website (Badri et al., 2000).
- **The stability of the political system in the country**: This criterion was calculated through the annual percentage change of the country's political stability index, and its amount was measured based on the Kaufman political stability index published by the World Bank (Shahabadi & Behari, 2013).

The sixth component included the economic environment component, and three criteria were considered for its calculation: 1) exchange rate volatility; 2) gross domestic product (GDP) volatility; and 3) inflation rate volatility. Each of these criteria was calculated based on the percentage of their annual changes, and their amounts were extracted from the economic statistics section of the website of the Central Bank of the Islamic Republic of Iran. An increase in each of the above measures indicates an increase in environmental uncertainty, except for the Herfindahl-Hirschman, Lerner, and adjusted Lerner indices, whose decrease indicates an increase in environmental uncertainty. Therefore, in order to homogenize the criteria, the inverse of Herfindahl-Hirschman, Lerner, and adjusted Lerner indices have been used.

Control variables

These variables included company size and company age. How to calculate each of them is as follows:

Firm size: This variable was obtained through the logarithm of the market value of the company's shareholders' equity (Ghosh & Olsen, 2009).

Firm age: This variable was calculated from the logarithm of the number of years the company has been listed on the stock exchange (Magerakis & Habib, 2022).

4.3. Measuring Companies' Environmental Uncertainty

The environmental uncertainty of companies consists of six main components, including customers, competition, supply of raw materials, business cost, political environment, and economic environment. It can be seen that, except for the component of supply of raw materials, other components can be calculated using different criteria. In order to choose a suitable criterion for each component, we used the PCA statistical method, as shown in Table 1.

According to Table 1, for customer uncertainty, there is only one component with an eigenvalue above one, which is equal to 1.084, and the correlation level of each of the criteria (including coefficient of variation in sales, variability of earnings per share, and number of customer groups) with the first component is 0.694, 0.350, and 0.693. It can be seen that the measure of the coefficient of variation in sales has the highest correlation with the first component compared to other measures. Therefore, the coefficient of variation in sales is chosen as a measure of customer uncertainty.

Table 1 also depicts that for the uncertainty of competition, there are two components with an eigenvalue above one; the highest eigenvalue is related to the first component and is equal to 1.084, and the correlation level of each of the criteria (including the intensity of competition in the industry, Herfindahl-Hirschman index, Lerner index, and adjusted Lerner index) with the first component is -0.134, 0.726, 0.424, and 0.599, respectively. It can be seen that the Herfindahl-Hirschman index has the highest correlation with the first component compared to other criteria. Therefore, the HHI is chosen as a measure of competitive uncertainty.

Based on Table 1, for business cost uncertainty, there are three components with a specific value above one. The highest specific value is related to the first component and is equal to 1.169, and the correlation

level of each of the criteria (including Labor cost volatility, material cost volatility, shipping cost volatility, volatility of communication costs, and volatility of water, gas, and electricity costs) with the first component is 0.650, 0.604, -0.048, 0.566, and 0.244, respectively. It can be seen that the labor cost volatility criterion has the highest correlation with the first component compared to other criteria. Therefore, Labor cost volatility is chosen as a measure of business cost uncertainty.

Table 1: Choosing the appropriate criteria for each component

Main components	The amount of variance explained by each component							Components Matrix			
	Component	Initial Phase of Analysis			Extraction Phase of Analysis			Components Criteria	Correlation of Each Measure with Component		
		Eigenvalues	% of Variance	Cumulative %	Eigenvalues	% of Variance	Cumulative %		1	2	3
Customers	1	1.084	36.123	36.123	1.084	36.123	36.123	coefficient of variation in sales	0.694		
	2	0.989	32.977	36.101				Variability of earnings per share	0.350		
	3	0.927	30.899	100				Number of customer groups	0.693		
Competition	1	1.084	27.097	27.097	1.084	27.097	27.097	Competition intensity in industry	-0.134	0.950	
	2	1.006	25.152	52.248	1.006	25.152	52.248	HHI	0.726	-0.120	
	3	0.992	24.805	77.053				Lerner index	0.424	0.200	
	4	0.918	22.947	100				Adjusted Lerner Index	0.599	0.220	
Business Cost	1	1.169	23.379	23.379	1.169	23.379	23.379	Labor cost volatility	0.650	-0.230	-0.020
	2	1.013	20.266	43.645	1.013	20.266	43.645	Material cost volatility	0.604	0.270	0.060
	3	1.005	20.092	63.737	1.005	20.092	63.737	Shipping cost volatility	-0.048	0.630	0.730
	4	0.919	18.383	82.120				Volatility of communications costs	0.566	0.310	-0.260
	5	0.894	17.880	100				Volatility in the cost of water, electricity, and gas	0.244	-0.630	0.630
Political	1	1.404	46.790	46.790	1.404	46.790	46.790	Foreign investment	-0.751		
	2	0.868	28.926	75.716				B.O.P	0.659		
	3	0.729	24.284	100				Political stability of the country	0.637		
Economic	1	1.912	63.723	63.723	1.912	63.723	63.723	Exchange rate volatility	0.969		
	2	0.974	32.479	96.202				Volatility of GDP	-0.279		
	3	0.114	3.798	100				Inflation rate volatility	0.946		

Source: Researcher's findings

According to Table 1, for political uncertainty, there is a component with a specific value above one, which is equal to 1.404, and the correlation level of each of the criteria (including the government's attitude towards foreign investment, the country's B.O.P., and the country's political stability index) with the first component is -0.751, 0.659, and 0.637, respectively. It can be seen that the country's B.O.P. volatility measure has the highest correlation with the first component compared to other measures. Therefore, the volatility of the country's B.O.P. is chosen as a measure of political uncertainty.

Another point illustrated in Table 1 is that for economic uncertainty, there is a component with a

specific value above one, which is equal to 1.912, and the correlation level of each of the criteria (including exchange rate volatility, GDP volatility, and inflation rate volatility) with the first component is respectively 0.969, -0.279, and 0.946. It can be seen that the exchange rate volatility measure has the highest correlation with the first component compared to other measures. Therefore, exchange rate volatility is chosen as a measure of economic uncertainty.

With the help of the PCA analysis, we calculated the importance or weight of each of the components again. According to Table 2, we see that there are three components with an eigenvalue above one, and the highest eigenvalue is related to the first component, which is equal to 1.596. The correlation level of each criterion (including customers, competition, supply of raw materials, business cost, political environment, and economic environment) with the first component is 0.784, 0.086, 0.761, 0.616, 0.118, and 0.035, respectively. Since the sum of the squares of each criterion ($(0.784)^2 + (0.086)^2 + (0.761)^2 + (0.616)^2 + (0.118)^2 + (0.035)^2$) is equal to the eigenvalue of that component (1.596); therefore, the importance or weight of each component in the calculation of uncertainty is obtained by dividing the square of each criterion by the eigenvalue. Hence, equation 8 is used to calculate companies' environmental uncertainty.

Environmental uncertainty= (0.3852× customers) + (0.0046×competition) + (0.3629+ supply of raw materials) + (0.2378× business cost) + (0.0087×political) + (0.00008×economic) (14)

Table 2: Determining the weight of each component

Variable	The amount of variance explained by each component							Components Matrix			
	Components	Initial Phase of Analysis			Extraction Phase of Analysis			Components Criteria	Correlation of Each Measure with Component		
		Eigenvalues	% of Variance	Cumulative %	Eigenvalues	% of Variance	Cumulative %		1	2	3
Environmental Uncertainty	1	1.596	26.598	26.598	1.596	26.598	26.598	coefficient of variation in sales (customers)	0.784	0.103	0.004
	2	1.282	21.369	47.966	1.282	21.369	47.966	HHI (competition)	0.086	-0.024	0.992
	3	1.001	16.691	64.658	1.001	16.691	64.658	Supply of raw materials	0.761	0.180	-0.081
	4	0.793	13.215	77.873				Labor Cost Volatility (Business Cost)	0.616	-0.248	-0.024
	5	0.755	12.584	90.457				B.O.P. volatility (political)	0.118	-0.757	-0.091
	6	0.573	9.543	100				Exchange rate volatility (economic)	0.035	0.777	-0.048

Source: Researcher's findings

5. Results

Descriptive statistics for research variables are presented in Table 3. The mean of the dependent variables relevance volatility, reliability volatility, comparability volatility, and understandability volatility is equal to -27.856, 289.157, 2.160, and 0.705, respectively. This shows most of the observations regarding these variables have been focused around the mentioned points, and the variable reliability volatility had the highest volatility compared to other variables. The mean of the variable environmental uncertainty indicates that among the companies admitted to the Tehran Stock Exchange, the average level of environmental uncertainty was equal to 0.389. On the other hand, the investigation of the level of dispersion of the research variables shows that among the research variables, the volatility of stock returns had the highest level of dispersion.

Table 3: Descriptive statistics of research variables

Variables	symbol	Mean	Median	Max	Min	S.D	Skewness	kurtosis
Relevance	Rele	-27.856	-9.570	123.268	-227.224	99.235	-0.577	2.745
Reliability	Reli	289.157	-4.110	1943.682	-93.995	635.882	1.904	5.108
Comparability	Comp	2.160	-0.527	39.765	-28.384	21.878	0.300	1.929
Understandability	Undrst	0.705	1.752	17.433	-16.257	11.151	-0.059	1.713
Environmental Uncertainty	EU	0.389	0.324	1.065	0.089	0.259	1.118	3.573
Size	Size	14.489	14.245	17.706	11.796	1.639	0.349	2.252
Age	Age	2.890	2.890	3.714	2.197	0.403	0.260	2.599

Source: Researcher's findings

The results of the data durability analysis show that the probability value of all variables is less than 5 percent and the durability of the variables is confirmed, meaning that the mean and variance of the variables over time and the covariance of the variables between different years are fixed. As a result of using these variables in the model, false regression does not occur. The variance inflation factor (VIF test) was used to check the existence or non-existence of collinearity between explanatory variables of the research, and according to Table 4, the value of the VIF statistic for all variables was less than 2, so it can be said that there is no collinearity problem between them.

In order to choose the appropriate model and determine the fixed or random effects, F-Limer test and Hausman test were used. The results of F-Limer test are rejected at a significance level of 5% for the first, second, and fourth hypotheses, and the Restricted effects (pooled) model is used for them, but the results of F-Limer test are significant for the third hypothesis, and in order to calculate the coefficients of the variables of this hypothesis, the panel model is used. The results of Hausman test for the third hypothesis showed that the significance level of this test is less than 5 percent, and for this hypothesis, the fixed effects method is used.

In this research, White's test was used to check the homogeneity of the variance of the residuals. The significance level of this test is less than 5 percent only for the first hypothesis, and the homogeneity of variance of the residuals is rejected for this hypothesis. To solve this problem, in the evaluation of the first hypothesis, instead of the ordinary least squares (OLS) method, the generalized least squares (GLS) method has been used.

Table 4- VIF test

	Environmental Uncertainty	Size	Age
Test statistics	1.155	1.158	1.093

Source: Researcher's findings

Table 5: Test of the First and Second Hypothesis

Variables	Results of First Hypothesis Test			Results of Second Hypothesis Test		
	Coefficients	t- statistic	p-value	Coefficients	t- statistic	p-value
C	141.135	5.015	0.000	326.898	1.806	0.071
Environmental Uncertainty	-33.145	-2.439	0.015	72.127	0.835	0.404
Size	-6.966	-3.782	0.000	-6.335	-0.549	0.583
Age	-19.296	-2.690	0.007	9.446	0.209	0.834
Adjusted R^2	0.32			-0.002		
F- statistic (Prob)	15.218 (0.000)			0.272 (0.846)		
D.W	2.138			2.372		

Source: Researcher's findings

Table 5 shows the results of the first and second hypotheses of the research. According to this table, the results of the Fisher's F test for the first hypothesis indicate the significance of the research model, and for the second hypothesis with a significance level of 0.846, it indicates the lack of significance of the research model. And the results of the Durbin-Watson test also show that there is no autocorrelation between the residuals. The adjusted determination coefficient for the first hypothesis is 3.2 percent. This indicates that 3.2 percent of the changes in the dependent variable (relevance volatility) are explained by the explanatory variables of the model. According to the significant level of the t statistic for the first hypothesis (0.015) and its negative coefficient (-33.145), the first hypothesis of the research is confirmed, and the increase in environmental uncertainty leads to volatility in the relevance of financial information for companies. But the significance level of the t statistic for the second hypothesis is 0.404, and the assumption of increasing environmental uncertainty that leads to volatility in the reliability of financial information for companies is rejected. Examining the effect of control variables shows that the variables of size and age have an indirect and significant relationship with the volatility in the relevance of financial information, but these variables do not have a significant relationship with the volatility in the reliability of financial information.

Table 6 shows the results of the third and fourth hypotheses of the research. According to this table, the results of the Fisher's F test for the third and fourth hypotheses indicate the significance of the research models, and the results of the Durbin-Watson test also show that there is no autocorrelation between the residuals. The results of the Durbin-Watson statistic for the initial estimation of the models showed that there was autocorrelation in the models. To fix this issue, the 1st-order autocorrelation variable, AR(1), was added to the research models. According to this table, the significance level of the t statistic for the third hypothesis is 0.084, and the assumption of increasing environmental uncertainty that leads to volatility in the comparability of financial information among companies is rejected. Also, Adjusted R squared for the fourth hypothesis is 20.7 percent. This means that 20.7 percent of the dependent variable changes (volatility in understandability) are explained by the explanatory variables of the model. According to the significance level of the t-statistic for the fourth hypothesis (0.040) and its positive coefficient (2.458), the fourth hypothesis of the research is confirmed, and the increase in environmental uncertainty leads to a volatility in the understandability of financial information for companies. Examining the effect of control variables shows that the size variable does not have a significant relationship with the volatility in the comparability of financial information, and the age variable has an indirect and significant relationship with the volatility in the comparability of financial information. Also, these control variables do not have a significant relationship with the volatility in the understandability of financial information.

Table 6: Test of the Third and Fourth Hypothesis

Variables	Results of Third Hypothesis Test			Results of Fourth Hypothesis Test		
	Coefficients	t- statistic	p-value	Coefficients	t- statistic	p-value
C	67.546	3.545	0.000	2.383	1.096	0.273
Environmental Uncertainty	4.623	1.727	0.084	2.458	2.058	0.040
Size	-0.998	-1.293	0.196	-0.051	-0.367	0.714
Age	-17.208	-2.195	0.028	-0.532	-1.032	0.302
A.R	0.460	17.210	0.000	-0.450	-17.483	0.000
Adjusted R^2	0.326			0.207		
F- statistic (Prob)	5.252 (0.000)			77.859 (0.000)		
D.W	1.678			2.331		

Source: Researcher's findings

6. Discussion and Conclusions

This study aims to elucidate a framework for quantifying corporate environmental uncertainty and its influence on the volatility of corporate financial data. Regarding this matter, the study aims to examine the factors that effectively measure corporate environmental uncertainty. Specifically, the study focuses on exploring the theoretical foundations of

these factors and how they collectively contribute to corporate environmental uncertainty, as well as the resulting outcomes. In this regard, using statistical analysis, the most suitable criteria for each environmental component were selected from several criteria. Then, with the weight of each component, the amount of environmental uncertainty for each company was measured, and this variable was tested with other research variables.

After evaluating the first hypothesis, it was discovered that as environmental uncertainty increases, there is a decrease in the volatility of corporate financial information. The quality characteristic of relevance declines when environmental uncertainty increases, due to its impact on the quality of accounting information and investment risk. Conversely, environmental uncertainty poses issues with the scarcity and rapidity of information for companies, restricting their range of possible activities. Matching the pertinence of financial data with the degree of environmental unpredictability in order to enhance firm performance presents difficulties. In this scenario, managers aim to enhance the predictability of profits for investors by engaging in profit manipulation and smoothing. The predictability of future financial information is enhanced by less fluctuating earnings. This results in a situation where there is a lack of equal access to information. Consequently, our findings align with the findings of Pires and Alves (2022) but not with the findings of Al-Mawali and Lam (2016).

The findings from evaluating the second hypothesis of the study indicate that there is no correlation between growing environmental uncertainty and volatility in reliability. Uncertainty in the corporate environment can lead to reduced financial data reliability. This is because it becomes challenging to accurately estimate future cash flows, evaluate assets, and realize debt. Volatility in market conditions, encompassing variations in commodity prices, interest rates, and currency rates, can impact the accurate valuation of assets and debt. The variability in this volatility introduces ambiguity in the assessment procedure, hence impacting the dependability of financial accounts. The results of our study do not align with the findings of Maines and Wahlen (2006) in relation to the second hypothesis.

Regarding the third hypothesis, it has been found that heightened environmental uncertainty does not result in higher swings in comparability capability. However, the research literature indicates that when there is a rise in environmental uncertainty, it becomes challenging for investors to accurately detect profit manipulation. Since organizations have varying profit management aims, the level of profit management is likely to differ among them. As a result, companies under similar economic conditions may report differing profits, which in turn impacts the comparability of their financial performance. Our findings are inconsistent with the results reported by Dhole et al. (2021) and Arianpoor and Esmailzadeh Asali (2023).

The findings from the fourth hypothesis test indicate that higher levels of environmental uncertainty lead to bigger variations in the ability to comprehend information. Specifically, as environmental uncertainty increases, there is a corresponding increase in the volatility of corporate understandability. The reason for this is that environmental unpredictability can heighten the imbalance of information between investors and corporations, intensifying investors' apprehensions. Given these conditions, investors will face challenges in forecasting future cash flows and assessing the long-term prospects of companies. When there is a significant level of uncertainty, the beliefs of investors become more dispersed. Given the wide range of ideas held by individuals, having access to information is very valuable when making decisions, and investors may request further information from corporations. Consequently, it is probable that corporations will enhance the comprehensibility of financial statements in order to convey more valuable information to investors, diminish information imbalances, and bolster investor confidence. These findings align with the results reported by Qiu et al. (2023).

To summarize, the study findings indicate that environmental uncertainty has an effect on the volatility of the qualitative characteristics of financial information of companies, such as relevance and comprehensibility. In light of the fact that in this research, for the first time, the environmental uncertainty of stock exchange companies was measured based on the components and criteria of each company, therefore, it is advisable for the stock exchange organization to establish an indigenous database, assess the environmental uncertainty of each company, and communicate this information to investors and users . Furthermore, investors are

advised to take environmental unpredictability into account when making investment decisions. In light of the research findings, it is crucial for company executives to recognize potential environmental risks and opportunities that may impact the company's operations and profitability. They should prioritize enhancing the adaptability of their financial planning and budgeting procedures, stay informed about market trends, strengthen communication with shareholders, enhance the company's adaptability, and make well-informed choices. Investors are also advised to pay special attention to the characteristic of understandability and readability of financial statements. Because companies increase the readability of financial statements in order to convey more useful information to investors in order to reduce information asymmetry and with the aim of increasing investor confidence.

Every study has inherent limitations, and the current study is no exception. A major constraint of the current study was the insufficient information pertaining to the specifics of several components and criteria used to assess the environmental uncertainty of enterprises, resulting in a reduction of these criteria. Given the scarcity of research on assessing the environmental uncertainty of firms and the multitude of factors that impact such uncertainty, we strongly suggest conducting research on the topic of environmental factors, such as government laws and regulations, the availability of human resources, and technological advancements. It is important to investigate how these factors affect various accounting components, such as conservatism, profit provision, and profit management.

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