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Environmental Sustainability Based on Market Inefficiency and Environment Uncertainty

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Abstract: This study is aimed at examining the impact of market inefficiency and environment uncertainty on the environmental sustainability. Prior research has struggled to establish this relation empirically; moreover, some evidence points to the possibility of the sustainable environment being lower for firms with market inefficiency and environment uncertainty. The opportunistic approach of managers leads to decisions about personal interests and imposing costs on shareholders by decreasing risk taking. To investigate this issue, data on companies listed on the Tehran Stock Exchange for the period of 2008-2018 were extracted and a panel regression model was used to test the research hypotheses. Being consistent with the expected relation between the phenomena under study, it decreases with respect to CEO opportunistic approach. Managers may benefit from increased fluctuations in sustainability orientation, but they are more sensitive than shareholders and have less restrictive choice that avoids higher risk. Therefore, corporate sustainability reporting changes with the market inefficiency and environmental uncertainty.

Keywords: Market Inefficiency, Environment Uncertainty, Environmental Sustainability.

基于市场效率低下和环境不确定性的环境可持续性

摘要：在这项研究中，我们试图检验市场效率低下和环境不确定性对环境可持续性的影响。先前的研究一直难以凭经验建立这种关系。此外，一些证据表明，对于市场效率低下和环境不确定的企业，可持续环境的可能性较低。经理人的投机取巧方法导致了有关个人利益的决定，并通过降低冒险精神来向股东施加成本。为了调查此问题，提取了德黑兰证券交易所 2008-2018 年上市公司的数据， 并使用面板回归模型检验了研究假设 与市场效率低下和环境不确定性以及环境可持续性之间的预期关系一致，就首席执行官机会主义方法而言，这种关系有所减少。经理人可能会从可持续发展方向的波动中受益，但他们比股东更敏感，限制性较小的选择可以避免较高的风险。因此，企业可持续发展报告会随着市场效率低下和环境不确定性而变化。

关键词： 市场效率低下，环境不确定性，环境可持续性

Introduction

Information flow is a key parameter in an economic activity and acts as a key factor in the emergence,

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stability and efficiency of capital markets [1]. The flow of information in the market environment affects the behavior of market participants. It is natural that market participants have a different share of this information flow. Experimentally, it is clear that people have different information. The information they have often affects their behavior. This indicates a lack of information asymmetry between the two parties to a transaction [2]. This information asymmetry is determined by the different flows of information among market participants.

The information environment in which investors trade is constantly changing with information flow. This change in information flow leads to risk reassessment by investors. Information risk is caused by a variety of factors. The existence of an information environment that reduces ambiguity and uncertainty and thus increases the investor's foresight and analysis is even more important. Using financial and accounting information to balance risk and return will improve investors' decision-making. Because most financial decisions are made in a state of uncertainty, information in such cases will play an important role in reducing uncertainty. Accounting information as the most important source of information environment is almost common among research. It is defined as an information transfer system reducing uncertainty, which is the same information approach to accounting. Accounting information allows investors to assess the company as well as the inherent risks involved [3]. In There are two main features relating to accounting information: the origin of this information and its distribution. In fact, the risk of accounting information can be divided into two components in the form of a capital market environment: a component that is related to ambiguity about market efficiency and a component that is related to the distribution of this information. Incomplete performance weakens the relationship between accounting figures and economic realities, thereby increasing information asymmetry. Therefore, having a favorable and efficient accounting information environment, on the one hand, increases the ability of financial reports to transfer company information and, on the other hand, causes more equal distribution of this information among market participants. Therefore, the mission of an efficient market is to reduce uncertainty and remove as much ambiguity as possible.

Under conditions of environmental uncertainty, the investment volatility and risk will increase due to the lack of symmetric information dissemination. Recognizing the effects of environmental uncertainty leads to the transmission of information to shareholders to determine the optimal portfolio for investment and selection, and helps shareholders to control the managers' behavior that leads to increased volatility. In other words, business units need to control environmental factors in the long run in order to access resources and improve performance. Environmental uncertainty leads to failure to achieve the expected results because it is not possible to identify bad news earlier and because of limited management control [4]. Existence of environmental uncertainty leads to a change in management practices in order to manipulate earnings and to create an opportunity to provide resources. In this situation, the firm would change the time to identify bad news, which is in line with the behavioral approach of optimistic managers. As a result, investors face the risk of making the adverse selection and the opportunity cost. Consideration is given to the environmental and social impacts of organizational activities at the international level. Traditional financial accounting and reporting cannot adequately meet the needs for measuring these effects, and the need for broader reporting in organizations is felt. A diverse set of stakeholders pursue various social, environmental, and economic interests that determine the success of an organization [5].

Corporate sustainability reporting is an important way through which organizations strive to meet demand. The term corporate sustainability has evolved from the broader concept of sustainable development. There are many definitions for the concept of sustainable development, but the definition agreed by the majority was put forward by the World Committee on Environment and Development. It defines sustainable development as one that meets the needs of the current generation without jeopardizing the ability and right of the next generation to meet its needs for the environment and natural resources [6]. Given this definition, it can be seen that the consequences of economic decisions affect the natural environment, economic development, and social situations in which people live and do business; they ensure as well that the capacity of these resources will not be damaged irreversibly and resources will not run out much faster than renewables. In other words, the World Business Council of Sustainable Development explains that sustainable development is a concurrent activity for economic prosperity, environmental quality and social justice [7]. This definition implies that today the mission of organizations and companies is to go beyond profit making and increase shareholder wealth. Companies today must not only satisfy their shareholders, but also pay particular attention to other stakeholders, including social groups and environmental advocates. Exposing sustainability information to private companies is aimed at enhancing transparency, promoting brand value, reputation and legitimacy, optimizing competitiveness, signaling competitiveness, motivation, staffing, and supporting control and corporate information processes [8].

In addition, sustainability reporting is increasingly recognized as an important factor in improving corporate sustainability. Today, the importance of the concept of sustainability, given its various dimensions, is such that many organizations and institutions around the world pay attention to it. The International Federation of Accountants (IFAC) has also paid special

attention to this issue at its member meetings, and has even defined a theoretical framework for the concept of sustainability.

The aim of this study is to provide evidence that market inefficiency and environmental uncertainty result in conflict of interest between managers in higher sustainable firms and other firms. In other words, environmental sustainability affects firm status. In addition, considering the internal and environmental conditions, the impact of market inefficiency and environmental uncertainty on environmental sustainability status in different years was studied. This research, by considering the effect of market inefficiency and environmental uncertainty on managers' decisions in the form of received cash resources, examines the managers' decision-making approaches in terms of risk and related fluctuations, and provides the opportunity to identify managers' conflicting behaviors for board members and shareholders through environmental sustainability impacts. In this study, several aspects were considered to develop environmental sustainability features. Market inefficiency and environmental uncertainty are considered in the form of cash resources using performance review models. Furthermore, by applying environmental sustainability, the effects of significant variables on the expectations of shareholders and investors in the research models are controlled. The model considers the information of the most relevant and easily accessible social and corporate variables for the study area, which correspond to statistical data for 2008-2018. The research is based on the corporate sustainability and financial literature and examines changes in market inefficiency and environmental uncertainty that can be applied by investors, standardization committees, and legislators. This research was carried out in Tehran Stock Exchange, Iran during 2008– 2018.

1 Hypothesis Development

The expected returns of shareholders are based on the risk and the resources invested by them in the company, and the firm's sustainability approach reflects uncertainty about the economic results of management activities. The tendency towards sustainability involves investment risks that are heightened by agency conflicts between managers and shareholders because managers' information asymmetry and selfish behaviors lead to a moral hazard issue that exposes shareholders to risk [9]. In other words, sustainability reporting can reflect the managers' behavior to reduce agency costs and control risk, which impacts the firm's ability to access financial resources as well as foreign investment. According to [10], managers tend to execute high-risk projects because they have some form of sales authority over the firm's assets. In other words, on the basis of managerial contracts, managers are motivated to execute risky projects that provide personal benefits at the expense of shareholders [11]. Investors are aware of these approaches and incentives and try to limit opportunistic incentives in high-risk projects through restrictive conditions. In line with this, it was concluded in [12] that securities terms are designed to limit risk-modifying behaviors. It was also shown in [13] that the terms of debt contracts limit the incentives to change risk.

Success in the business environment tends to pursue unidentified opportunities for sustainable growth [14], but managers are often reluctant to pursue and identify these opportunities. However, incentive schemes can be used to encourage managers to take risks and tend toward long-term sustainability [15]. However, while shareholders prefer high-risk projects, the willingness and motivation of managers are ambiguous. Managers may benefit from increased fluctuations in risk orientation, but are more sensitive to shareholders and have less restrictive choice that avoids higher risk. In other words, managers have a tendency to control and avoid risk in order to maintain their job position in the long run, given their responsibilities in the company. For example, if a company goes bankrupt, higher costs are imposed on managers [16]. As stated in [17], in companies with high leverage or bankruptcy risk, managers' risk aversion approach leads to reduced company risk. According to [18], managers' general tendency toward firm risk depends on the severity of the risk aversion effect and its ultimate impact on manager wealth. Shareholders who plan sustainability strategies within the board of directors can motivate managers to bear the risk (by giving them the option to buy shares). It was found in [19] that higher risk-taking motivation in the context of sustainability strategies encouraged managers to accept greater financial and operational risk (for example, more R&D investment, more limited investment in fixed assets, and leverage). In contrast, stakeholders who are more concerned about risk shifts prefer lower risk-driven sustainability strategies. As shareholders bear the costs of representation, companies have incentives to design sustainable strategies that address investor concerns. In other words, corporate sustainability strategies are a tool to minimize agency costs. Companies tend to reduce risk-based incentives in the process of delivering sustainable strategies to limit the costs incurred by stakeholders.

Investors who pursue company activities have concerns about the company and its activities and the consequences of these activities [20]. Investors are defined as groups or individuals who have an interest in and influence the actions of an organization. The need for a social contract between a business entity and its stakeholders is therefore evident [21]. Attention to the future is at the heart of this social contract, a future that is evident through sustainability. Sustainability affects the long-term profitability of a business unit and should be

considered as strategic assets of the business unit. Sustainability plays an important role in stakeholder morale and hope for the future [20]. According to The Brundtland Commission and the World Commission on Environment and Development (WCED) report in 1987, sustainable development is defined as meeting today's needs without posing a threat to the needs of future generations [22]. The sustainability report covers three areas: economic, social and environmental. Corporate sustainability reporting plays a key role in measuring, evaluating performance, reviewing goals, and implementing their sustainability development. This study deals with examining the reflection of the CEO risk taking based on environmental sustainability.

Improving market efficiency reduces investors' incentives to search for private information by reducing the expected benefits of acquiring private information [23], [24]. It was found in [22] that investors incentives to obtain private information diminish when firms operate in efficient markets. Companies operating in the efficient market are more likely to disclose important information to the public and thus provide more prospective information. As a result, market efficiency is expected to reduce the incentives to search for private information. According to [25], market efficiency primarily affects information asymmetry by reducing the likelihood that investors will discover private information. The negative relationship indicates a decrease in non-productive search activities; therefore, high market efficiency can improve the average shareholder price by reducing search costs. Improving market efficiency effectively at least causes some informed traders to disseminate private information in the public domain, thereby reducing information asymmetry between traders [26].

Overall, evidence suggests that market inefficiency is more likely to affect environmental sustainability reporting. Market efficiency should mitigate the agency problems and align the interests between shareholders and managers as well as help enhance the monitoring effect over the CEO's and managers' decision making. This would include decisions regarding operations, which directly influence environmental sustainability reporting. It would therefore be reasonable to assume that enhanced market inefficiency changes the reporting processes and negatively affects the environmental sustainability reporting.

Hypothesis 1: Market inefficiency has a significant impact on environmental sustainability reporting.

Active business units in highly uncertain environments benefit from a combination of organizational learning and learning because of uncertainty leading to increased value for improvement and development as a result of recognizing potential investment opportunities [27]. In uncertain environments, decisions must be made quickly and the ability to identify issues in a timely manner plays an important role [28]. In this regard, it was shown in [29] that increasing managerial power, increasing company dependence and reducing job concerns are factors affecting managers' risk taking. Among these factors, the role of CEO dependence on the inverse relationship between tenure and risk taking is clear, but the impact of other factors is not evident.

An entity modifies an investment to benefit from the knowledge gained as a result of exploration, which may appear in the form of a change in production process or the introduction of new products and services. In other words, in an environment of uncertainty, managers and shareholders increase and improve their supervisory strategies to maintain investment risk at a certain level and monitor the results of managers' decisions over different periods of time, thereby reducing the likelihood of costs being missed due to the missed opportunities and optimism of managers [30].

Hypothesis 2: Environmental uncertainty has a significant impact on environmental sustainability reporting.

2 Materials and Methods

2.1 Sample Selection

This research is based on firms listed on Tehran Stock Exchanges in Iran. We begin with an initial sample of 4,983 firm-year observations from 2008–2018. The Rahavard software provides the relevant variables. A total of 1,067 firm-year observations relating to finance, investment, equity trust, and funds were excluded because of their different practices. Also, financial institutions have distinct requirements to hold cash to meet operating and financing activities so they were excluded from the sample. Further, we exclude all the firm-year observations when CEO compensation variables were not available. Therefore, the final sample has 1,309 firm-year observations. Table 1 shows further details of the sample distribution across different industries.

Table 1: Sample distribution based on industry

2-digit-SIC Code	Industry Name	Firm-years	%Sample
13	Mining	165	12.6
34	Automotive	297	22.7
42	Food	165	12.6
43	Pharmaceuticals and healthcare	165	12.6
44	Petrochemicals	88	6.7
49	Ceramic & Tile	99	7.5
53	Cement	110	8.4
-	Non-classifiable Establishments	220	16.9
Total		1,309	100

2.2 Dependent Variable Measure

In this study, the extent of corporate sustainability reporting (CSR) (environmental, social, and economic disclosure) was considered as the dependent variable. The index was studied by examining the theoretical literature on the subject and the variables used by the Global Reporting Institute (GRI) that provides standards and guidelines. It establishes a sustainability reporting framework to help organizations measure and report sustainability-related activities and practices. The reporting content recommended by the GRI includes the economic, environmental and social impacts of a company's activities. In this study, the scoring procedure for measuring corporate sustainability reporting is that if one item of sustainability disclosure is done according to GRI, score of one and if not disclosed, score of zero will be considered. Finally, the sum of the numbers obtained is divided by the maximum score. The information required for these variables is disclosed in the Corporate Governance Report and in the present study to introduce each dimension, given the nature of disclosure in Iran, the sustainability reporting indicators in Iran as well as ISO 9001 quality management system certifications, and ISO 14001 environmental management were used.

2.3 Independent Variables Measure

Our independent variables represent market inefficiency and environment uncertainty. Market inefficiency (*IMPERFECT*) calculated as the ratio of the number of shares traded during the year to the average number of stocks issued at the beginning and at the end of the period [31]. Also, we use a measure of environmental uncertainty (*VIX*) to calculate the environmental uncertainty proxy which is used as the independent variable to test H_2. The standard deviation of profitability changes over three years is used to measure environmental uncertainty (*VIX*). The use of standard deviations to measure environmental uncertainty was used in [32].

2.4 Development of the Model

2.4.1 Regression Specification for Testing Hypothesis

To investigate the environmental sustainability based on CEO risk taking using Eq. 1, the following regression is run, to examine the linear impact of CEO risk taking on the environmental sustainability.

$$\begin{aligned} CSR_{it} = \alpha_0 + \ & \alpha_1 IMPERFECT_{it} \\ & + \alpha_2 VIX_{it} + \alpha_3 INST_{it} \\ & + \alpha_4 MGO_{it} \\ & + \alpha_5 STDOCF_{it} \\ & + \alpha_6 SIZE_{it} + \alpha_7 LEV_{it} \\ & + \alpha_8 BTM_{it} + \alpha_9 ROA_{it} \\ & + \alpha_{10} STDRET_{it} \\ & + \alpha_{11} LOSS_{it} \\ & + IND \ \& \ YEAREFFECT \\ & + \varepsilon \end{aligned} \quad (1)$$

where CSR is environmental sustainability as defined earlier. IMPERFECT and VIX are market inefficiency and environmental uncertainty as defined earlier, respectively. Size is the natural logarithm of the market value of equity in millions at the end of year *t*. BTM is the ratio of the book value of equity to the market value of equity at the fiscal year end. ROA is the income before extraordinary items scaled by lagged total assets. LEV is total long-term debt plus total debt in current liabilities scaled by total assets. LOSS is an indicator variable equal to one for firm-years with negative income before extraordinary items. STDRET is the standard deviation of stock returns over the past three years. STDOCF is the standard deviation of operating cash flow over the past three years. INST is the percentage of shareholding by institutional investors and MGO shows the percentage of stock ownership by the management. Finally, regression analysis control for the industry and year effect are added.

In the above regression, the coefficient to test the role of market inefficiency and environmental uncertainty in environmental sustainability is the correlation coefficient between them. The coefficients of the variables of market inefficiency and environmental uncertainty show the distinct effects of these variables. Based on the research hypotheses, the possibility of CSR decreases with increasing market inefficiency and environmental uncertainty.

2.4.2 Data Collection

In this study the information is carried out through a database registered by government agencies (Table 2). This database was analyzed with the EVIEWS software version 10.

Table 2: Description of variables

No.	Name of the variable	Symbol	Type of variable	Measure
1	Corporate sustainability reporting	*CSR*	Dependent	the sum of the numbers obtained is divided by the maximum score based on GRI
2	Market inefficiency	*IMPERFECT*	Independent	logarithm of one plus ratio of the percentage change of managers' compensation to the company's stock value
3	Environmental uncertainty	*VIX*	Control	the standard deviation of profitability changes over three years
4	Firm size	*SIZE*	Control	natural logarithm of the market value of equity in millions at the end of year
5	Book to market value	*BTM*	Control	the ratio of the book value of equity to the market value of equity at the fiscal year end
6	Return of asset	*ROA*	Control	the income before extraordinary items scaled by lagged total assets
7	Leverage	*LEV*	Control	total long-term debt plus total debt in current liabilities scaled by total assets
8	Loss	*LOSS*	Control	indicator variable equal to one for firm-years with negative income before

				extraordinary items
9	Standard deviation of return	*STDRET*	Control	the standard deviation of stock returns over the three past years
10	Standard deviation of cashflow	*STDOCF*	Control	the standard deviation of operation cash flow over the three past years
11	Institutional ownership	*INST*	Control	percentage of shareholding by institutional investors
12	Management ownership	*MGO*	Control	percentage of stock ownership by the management

3 Results and Discussion

3.1 Statistical Analysis of Variables

Table 2 presents descriptive statistics for our sample. It summarizes the descriptive statistics for the market inefficiency and environmental uncertainty on environmental sustainability and other control variables used in multivariate regression analyses. The mean of the *CSR* variable is 0.191, which indicates the low level of environmental sustainability. The mean of the IMPERFECT variable is 0.145, which indicates the low level of capital market efficiency. The ownership structure of the firms consists of 71% institutional shareholders and the mean variable of managerial ownership is 66.7%. An average of 18.5% of *VIX* indicates sustainability of sales in the firms. The mean of leverage is 0.661, indicating that firms' resources are financed from debt and the sample firms are highly leveraged. The mean of return on assets is 0.137, which indicates a return of 13 money unit on investment in 100 money unit assets. The *LOSS* variable indicates that 10% of companies have negative performance. The average value of 0.726 for the book-to-market ratio reflects a conservative approach in identifying assets across firms. The mean volatility of returns and cash flows are 0.332 and 0.016, respectively, indicating higher profitability changes than liquidity. By analyzing the coefficient of variation of the data, it can be stated that the independent and dependent variables have a normal distribution [33].

Table 3: Descriptive statistics

Variable	N	Mean	Median	Min	Max	Std
CSR	1309	0.191	0.143	0.050	0.361	0.178
IMPERFECT	1309	0.440	0.174	0.010	0.995	0.216
VIX	1309	0.185	0.148	0.000	0.998	0.169
INST	1309	0.712	0.818	0.010	0.990	0.277
LEV	1309	0.661	0.662	0.041	1.824	0.226
LOSS	1309	0.101	0.000	0.000	1.000	0.301
MGT	1309	0.667	0.701	0.010	0.990	0.210
ROA	1309	0.137	0.067	-0.432	1.205	0.215
SIZE	1309	11.433	11.415	9.415	13.493	0.633
STDOCF	1309	0.016	0.012	0.000	0.166	0.017
STDRET	1309	0.332	0.260	0.007	0.980	0.245
BTM	1309	0.728	0.743	0.101	0.990	0.142

3.2 Correlation Analysis

Table 4 reports the correlation coefficients between environmental sustainability and explanatory variables. The explanatory variables are not highly correlated, suggesting that multicollinearity is not a concern. These correlation coefficients also have expected signs. It can be seen that the environmental sustainability of firms changed to the decrease in market inefficiency.

Table 4: Correlations

Variable	BTM	IMPERFECT	CSR	INST	LEV	LOSS	MGT	ROA	SIZE	STDOCF	STDRET	VIX
BTM		-0.005	-0.008	0.210	-0.023	-0.012	0.119	-0.048	0.158	-0.037	-0.003	0.037
IMPERFECT	-0.005		-0.031	-0.003	-0.012	0.003	0.001	-0.019	-0.031	0.040	-0.015	0.123
CSR	-0.008	-0.031		0.003	-0.032	0.050	0.004	0.029	-0.009	0.020	0.013	0.014
INST	0.210	-0.003	0.003		-0.003	0.046	0.409	-0.025	0.017	-0.077	-0.045	-0.013
LEV	-0.023	-0.012	-0.032	-0.003		0.195	-0.017	-0.105	-0.089	-0.085	-0.067	0.132
LOSS	-0.012	0.003	0.050	0.046	0.195		0.019	-0.324	-0.036	-0.021	0.021	0.061
MGT	0.119	0.001	0.004	0.409	-0.017	0.019		-0.017	-0.046	-0.110	-0.100	-0.036
ROA	-0.048	-0.019	0.029	-0.025	-0.105	-0.324	0.017		-0.230	0.100	-0.035	0.025
SIZE	0.158	-0.031	-0.009	0.017	-0.089	-0.036	-0.046	-0.230		-0.155	0.041	-0.112
STDOCF	-0.037	0.040	0.020	-0.077	0.085	0.021	0.110	-0.100	0.155		-0.001	0.145
STD	-	-	0.	-	-	0.	-	-	0.	-		0.

RET	0.003	0.015	013	0.0045	0.0067	021	0.017	0.035	041	0.0001		041
VIX	0.0037	0.123	0.014	-0.0132	0.1322	0.061	-0.0036	0.025	-0.1122	0.1145	0.0041	

This table contains pairwise Pearson correlation coefficients among important variables

3.3 Regression Analysis

While descriptive statistics and correlation analysis are informative, more conclusive evidence can be obtained through multivariate regression analysis that controls for many firm-specific variables [34] affecting environmental sustainability.

Table 5 presents the multivariate regression analysis. Columns 1 to 4 present the findings for hypothesis in four years where market inefficiency and environment uncertainty are independent variables, and environmental sustainability is a dependent variable. Column 1 presents the baseline regression. The results show that *IMPERFECT* and *VIX* have a negative association with the measure of *CSR* indicating that firms that are active in the inefficient market and with environmental uncertainty have lower sustainable environment compared to other firms. The coefficient of *IMPERFECT* (coefficient = -0.0016, t-statistics = -1.790) and *VIX* (coefficient = -0.0017, t-statistics = -1.884) show a negative association with the environmental sustainability. The result is statistically significant at the 10% level. The coefficients and the statistical significance of the findings support the hypothesis.

Columns 2 to 4 include lag *IMPERFECT*, *VIX* and firm-specific control variables and test the impact of *IMPERFECT* and *VIX* on CSR. In other words, they present the test of the effect of market inefficiency and environment uncertainty on environmental sustainability in different years. The results indicate that firms that are active in inefficient market and with environmental uncertainty have lower sustainable environments (*CSR*).

In regards to the control variables, it was found that large firms *SIZE* (coefficient = 0.0001, 0.0001, 0.0010 and 0.0002; t-statistics = 1.091, 1.317, 1.841 and 0.962) have higher environmental sustainability (*CSR*) and firms with more managerial ownership (coefficient = 0.0010, 0.0009, 0.2505 and 0.0013; t-statistics = 1.565, 1.256. 2.013 and 1.440) show a positive association and book to market value (coefficient = 0.0002, 0.0001, 0.5005 and 0.7605; t-statistics = 2.901, 1.672, 0.779 and 1.074) show a positive association with environmental sustainability. Also, *INST* shows a negative association (coefficient = -0.1204, -0.1002, -0.2105 and -0.1514; t-statistics = -1.741, -1.523. -1.801 and -1.174) which indicates that firms with higher institutional ownership expect low environmental sustainability. Firms with inappropriate performance (*LOSS*) also show a negative association with the environmental sustainability, which indicates the inappropriate performance of firms caused by low environmental sustainability within these firms. Most of the discussed coefficients are statistically significant at better than the 5% level. Our results are robust considering the industry and year effect. Our multivariate regression models show that the Adj R-square between the three approaches ranges from 27.9% to 40.1%.

Table 5: Regression result

VARIABLES	T	T-1	T-2	T-3
IMPERFECT	-0.0016* (-1.790)	-0.0017* (-1.798)	-0.0001** (-2.154)	-0.0015* (-1.718)
VIX	-0.0017* (-1.884)	-0.0094 (-1.461)	-0.2517 (-1.597)	-0.0124*** (-3.021)
INST	-0.1204 (-1.741)	-0.1002 (-1.523)	-0.2105* (-1.801)	-0.1514 (-1.174)
LEV	-0.0009** (-2.556)	-0.9805** (-2.365)	-0.7306** (-2.198)	0.0004 (1.492)
LOSS	-0.0002** (-2.095)	-0.0002** (-2.091)	-0.6905 (-1.596)	-0.0003** (-2.213)
MGT	0.0010 (1.565)	0.0009 (1.256)	0.2505** (2.013)	0.0013* (3.440)
ROA	-0.0005** (-2.007)	-0.0005 (-1.600)	-0.8205** (-2.388)	0.3805 (0.386)
SIZE	0.0001 (1.091)	0.0001 (1.317)	0.0010* (1.841)	0.0002 (0.962)
STDOCF	-0.0017 (-0.720)	-0.0020 (-0.736)	0.0003 (0.977)	-0.0024 (-0.790)
STDRET	0.0001* (3.014)	0.0001** (2.708)	-0.1805 (-1.577)	-0.6505** (-2.101)
BTM	0.0002** (2.901)	0.0001 (1.672)	0.5005 (0.779)	0.7605 (1.074)
Intercept	0.1541 (0.749)	0.1206 (1.364)	0.0129*** (5.017)	-0.0017 (-0.985)
Observations	1,309	1,309	1,309	1,309
Adj R-square	0.341	0.359	0.401	0.279
F-statistic	2.251 (0.000)	2.745 (0.000)	2.394 (0.000)	2.995 (0.000)
***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. (t-statistics in parentheses).				

4 Conclusion

This research examined the environmental sustainability based on the market inefficiency and environment uncertainty. The hypothesis of the study is that market inefficiency and environment uncertainty have a significant effect on environmental sustainability. Our findings show that market inefficiency and environment uncertainty have led to negative changes in environmental sustainability behavior making managers unable to use the resources. And as a result, we can see environmental sustainability decrease. Capital market risk leads managers to value risky projects differently as compared to shareholders or the board. Direction of the risk distortion depends on the market structure. As a result, managers have an incentive to take less risk than is optimal for the firm.

Environmental sustainability is used as a signaling factor and external mechanism with regard to different

circumstances and environments to influence manager decisions with the purpose of developing inappropriate investing behaviors in environmental uncertainty position, increasing negative information transmission and decreasing environmental sustainability. Investors are more likely to invest in firms that have sustainability or information transparency. Success in the business environment does not require the pursuit of opportunities that are not identified, but managers are often reluctant to pursue and identify these opportunities. However, incentive schemes can be used to encourage managers to change environmental sustainability. While shareholders prefer sustainable environment, the willingness and motivation of managers are ambiguous. Managers may benefit from increased fluctuations in risk orientation, but are more sensitive than shareholders and have less restrictive choice that avoids higher risk. According to the findings of the study, boards of directors should pay more attention to managers' approach, because if the proper investment procedures are not implemented as a result of managers' behavior, it will take a long time for the operational consequences to be determined. And if the consequences are unfavorable, high costs are imposed on the company and the creditors. Also, the board should be aware of the risks and opportunities associated with changes in the environmental sustainability factors because there may be opportunities to improve firm sustainability, reduce risk, or delay the negative consequences of the performance.

References

[1] STIGLITZ L. Estimating the components of the bid/ask spread. *Journal of Financial Economics*. 2003. 21(1): 123-142.

[2] LAURI A. Asymmetric Information: Theory and Applications. Seminar in Strategy and International Business. Helsinki University of Technology 2003.

[3] ARMSTRONG, C., J. CORE, D. TAYLOR, and VERRECCHIA R. When does information asymmetry affect the cost of capital? *Journal of Accounting Research*, 2011, 49(1): 1-40.

[4] HSU C., NOVOSELOV K. E., and WANG R. Does Accounting Conservatism Mitigate the Shortcomings of CEO Overconfidence? *The Accounting Review*: 2017, 92(6): 77-101.

[5] BUCHHOLZ R.A., and ROSENTHAL, S.B. Toward a contemporary conceptual framework for stakeholder theory. *Journal of Business Ethics*, 2005, 58: 137- 148.

[6] ARAS G. and CROWTHER D. Is the global economy sustainable? In BARBER S. (Ed.) *The Geopolitics of the City*, Forum Press, London, 2007[a]: 165- 194.

[7] ARAS G. and CROWTHER D. Sustainable corporate social responsibility and the value chain. In CROWTHER, D. and ZAIN, M.M. (Eds.) *New Perspectives on Corporate Social Responsibility*. MARA University Press, Shah Alam, 2007b: 119- 140.

[8] HERZIG C. and SCHALTEGGER S. Corporate sustainability reporting: another view. In BENNETT, M and BURITT, R.L. (Eds.) *Sustainability Accounting and Reporting*. Kluwer Academic Publishers, Boston Dordrecht/London, 2011: 301- 324.

[9] HU J. and LIN Z. The implied cost of equity capital, corporate investment and chief executive officer turnover. *Account Finance*, 2015, 55: 1041-1070.

[10] JENSEN M., and MECKLING W. H. Theory of the firm: managerial behavior, and ownership structure, *Journal of Financial Economics*, 1976, 3: 305–360.

[11] LELAND H. E. Agency costs, risk management, and capital structure. *Journal of Finance*, 1998, 53(4): 1213–1243.

[12] CHAVA S., KUMAR P. and WARGA A. Managerial agency and bond covenants. *Review of Financial Studies*, 2010, 23(3): 1120–1148.

[13] GILJE E. P. Do firms engage in risk-shifting? Empirical evidence. *Review of Financial Studies*, 2016, 29(11): 2925–2954.

[14] MARCH J. G. Exploration and exploitation in organizational learning. *Organization Science*, 1991, 2(1): 71–87.

[15] ARMSTRONG C. S., and VASHISHTHA R. Executive stock options, differential risk-taking incentives, and firm value. *Journal of Financial Economics*, 2012, 104(1): 70–88.

[16] BERK J. B., STANTON R., and ZECHNER J. Human capital, bankruptcy and capital structure. *Journal of Finance*, 2010, 65(3): 891–926.

[17] MILIDONIS A., and STATHOPOULOS K. Managerial incentives, risk aversion, and debt. *Journal of Financial and Quantitative Analysis*, 2014, 49(2): 453–481.

[18] GUAY W. R. The sensitivity of CEO wealth to equity risk: An analysis of the magnitude and determinants. *Journal of Financial Economics*, 1999, 53(1): 43–71.

[19] RAJGOPAL S., and SHEVLIN T. Empirical evidence on the relation between stock option compensation and risk taking. *Journal of Accounting and Economics*, 2002, 33 (2): 145–171.

[20] ARAS G. and CROWTHER D. Governance and sustainability: an investigation into relationship between corporate governance and corporate sustainability. *Management Decision*, 2008, 46(3): 443- 448.

[21] RUBENSTEIN D.B. Bridging the gap between green accounting and black ink. *Accounting Organizations & Society*, 1992, 17(5): 501- 508.

[22] ROOSA S.A. *Sustainable Development Handbook*, 2nd ed., 2010, The Fairmont Press, GA.

[23] DIAMOND D., and VERRECCHIA R. Disclosure, liquidity and the cost of capital. *Journal of Finance*, 1991, 46 (4): 1325-1359.

[24] VERRECCHIA, R. Essays on disclosure. *Journal of Accounting and Economics*, 2001, 32: 97-180.

[25] BROWN S. & HILLEGIEST S. A. How Disclosure Quality Affects the Level of Information Asymmetry. *Review of Accounting Studies*, 200, 12: 443–477.

[26] LEVITT A. The Importance of High Quality Accounting Standards, *Accounting Horizons*, 1998, 12: 79-82.

[27] HUCHZERMEIER A., and LOCH C. H. Project management under risk: [33] Using the real options approach to evaluate flexibility in R&D. *Management Science*, 2001, 47 (1): 85–101.

[28] HAMBRICK D. C., and CROZIER L. M. Stumblers and stars in the management of rapid growth. *Journal of*

Business Venturing, 1985, (1): 31–45.
[29] CHEN D., & ZHENG Y. CEO Tenure and Risk-Taking. *Global Business and Finance Review*, 2014, 19(1): 1-27.
[30] SHYTI A. Overconfidence and Entrepreneurial Choice under Ambiguity. *Academy of Management Proceedings*, 2013, 1: 13508-13508. https://doi.org/10.5465/ambpp.2013.13508abstract
[31] IMHOF M., SEAVEY S. E., and SMITH D. B. Comparability and Cost of Equity Capital. *Accounting Horizons*, 2017, 31(2): 125-138.
[32] DICHEV I. D., & TANG V. W. Earnings volatility and earnings predictability. *Journal of Accounting and Economics*, 2009, 47 (1): 160-181.
[33] XU X., WANG X. and HAN N. Accounting conservatism, ultimate ownership and investment efficiency, *China Finance Review International*, 2012, 2(1): 53-77.
[34] BHUIYAN B. U. & HOOKS J. Cash holding and over-investment behavior in firms with problem directors. *International Review of Economics & Finance*, 2019, 61(C): 35-51. https://doi.org/10.1016/j.iref.2019.01.005.

参考文献

[1] STIGLITZ L.估计买卖差价的组成部分。金融经济学杂志。 2003, 21（1）：123-142。
[2] LAURI A.非对称信息：理论与应用。战略与国际商务研讨会。赫尔辛基工业大学 2003。
[3] ARMSTRONG，C.，J。CORE，D。TAYLOR 和 VERRECCHIAR。信息不对称何时会影响资本成本？会计研究杂志，2011，49（1）：1-40。
[4] HSU C.，NOVOSELOV K. E.和 WANG R.会计保守主义是否减轻了 CEO 过度自信的缺点？会计评论：2017，92（6）：77-101。
[5] BUCHHOLZ R.A.和 ROSENTHAL S.B.建立利益相关者理论的当代概念框架。商业道德杂志，2005，58：137-148。
[6] ARAS G.和 CROWTHER D.全球经济是否可持续？参见 BARBER S.（Ed。）城市地缘政治，论坛出版社，伦敦，2007 年：165- 194。
[7] ARAS G.和 CROWTHERD。可持续的企业社会责任和价值链。在 CROWTHER D.和 ZAIN 中，M.M。（主编）《企业社会责任的新观点》。玛拉大学出版社，莎阿南，2007b：119-140。
[8] HERZIG C.和 SCHALTEGGER S.企业可持续性报告：另一种观点。在马萨诸塞州的 BENNETT 和 R.L.（编辑）《可持续发展会计和报告》中。克鲁维尔学术出版社，波士顿多德雷赫特/伦敦，2011：301-324。
[9] HU J.和 LINZ。股本资本，公司投资和首席执行官营业额的隐含成本。 账户财务，2015，55：1041-1070。
[10] JENSEN M.和 MECKLING W. H.企业理论：管理行为和所有权结构，《金融经济学》，1976 年，第 3 期：305-360。
[11] LELAND H. E.机构成本，风险管理和资本结构。金融学报，1998，53（4）：1213-1243。
[12] CHAVA S.，KUMAR P.和 WARGA A.管理机构和债券契约。金融研究评论，2010，23（3）：1120-1148。
[13] GILJE E. P.公司是否从事风险转移？经验证据。金融研究评论，2016 年，29（11）：2925–2954。
[14] MARCH J. G.组织学习中的探索与开发。组织科学，1991，2（1）：71-87。
[15] ARMSTRONG C. S.和 VASHISHTHA R.高管股票期权，不同的冒险动机和公司价值。金融经济学杂志，2012，104（1）：70-88。
[16] BERK J. B.，STANTON R.和 ZECHNER J.人力资本，破产和资本结构。金融杂志，2010，65（3）：891–926。
[17] MILIDONIS A.和 STATHOPOULOS K.管理性激励措施，规避风险和债务。金融与定量分析杂志，2014，49（2）：453-481。
[18] GUAY W. R.首席执行官财富对股权风险的敏感性：对规模和决定因素的分析。金融经济学杂志，1999，53（1）：43-71。
[19] RAJGOPAL S.和 SHEVLIN T.关于股票期权补偿与承担风险之间关系的经验证据。会计与经济杂志，2002，33（2）：145-171。
[20] ARAS G.和 CROWTHER D.治理与可持续性：对公司治理与公司可持续性之间关系的调查。管理决策，2008，46（3）：443-448。
[21] RUBENSTEIN D.B.缩小绿色会计与黑色墨水之间的差距。会计组织与社会，1992，17（5）：501-508。
[22] ROOSA S.A.可持续发展手册，第二版，2010 年，佐治亚州费尔蒙特出版社。
[23] DIAMOND D.和 VERRECCHIA R.披露，流动性和资本成本。金融杂志，1991，46（4）：1325-1359。
[24] VERRECCHIA，R。随笔。会计与经济杂志，2001，32：97-180。
[25] BROWN S.&HILLEGIEST S. A.披露质量如何影响信息不对称程度。会计研究评论，200，12：443–477。
[26] LEVITT A.高质量会计准则的重要性，《会计视野》，1998，12：79-82。
[27] HUCHZERMEIER A.和 LOCH C. H.处于风险之下的项目管理：[33]使用实物期权方法评估研发的灵活性。管理科学，2001，47（1）：85-101。
[28] HAMBRICK D. C.和 CROZIER L. M. 绊脚石 和明星在管理快速增长方面。商业冒险杂志，1985，（1）：31-45。
[29] CHEN D., 和 ZHENG Y.。首席执行官的任期和承担风险。全球商业与金融评论，2014，19（1）：1-27。
[30] SHYTIA。歧义下的过度自信和创业选择。管理学报，2013，1：13508-13508。https://doi.org/10.5465/ambpp.2013.13508 摘要
[31] IMHOF M.，SEAVEY S. E.和 SMITH D. B.可比性和股本成本。会计视野，2017，31（2）：125-138。

[32] DICHEV I. D.和 TANG V. W.收益波动和收益可预测性。会计与经济杂志，2009，47（1）：160-181。

[33] XU X., WANG X. 和 HAN N.。会计稳健性，终极所有权和投资效率，《中国国际金融评论》，2012，2（1）：53-77。

[34] BHUIYAN B. U.＆HOOKS J.有问题董事的公司的现金持有和过度投资行为。经济与金融国际评论，2019，61（C）：35-51。https://doi.org/10.1016/j.iref.2019.01.005