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The Impact of Market Inefficiency and Environmental Uncert`ainty on CEO Risk-Taking Incentives

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Abstract

This study investigates the effect of market inefficiency and environmental uncertainty on CEO risk taking. Prior research, however, have struggled to establish this relation empirically; moreover, some evidence points to the possibility that the CEO risk appetite is lower for firms active in inefficient markets. The opportunistic approach of managers leads to decisions about personal interests and imposing costs on shareholders by decreasing risk taking. In order to investigate the issue, data on companies listed in Tehran Stock Exchange, from 2008 to 2018, were extracted and a panel regression model was used to test the research hypotheses. Consistent with expected relation between market inefficiency, environmental uncertainty and CEO risk taking, the managers' risk taking decreases with respect to market inefficiency and environmental uncertainty. Managers may benefit from increased fluctuations in risk orientation, but are more sensitive than shareholders and have less restrictive choice that avoids higher risk.

Keywords: Market inefficiency, Environment uncertainty, CEO risk taking.

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Introduction

Top executives play a key role in business operations and value creation. The shareholders and the board of directors are responsible for identifying poorly performing managers and, if necessary, replacing them, to avoid the potential for severe losses and imposing agency costs (Bushman et al., 2010). The key issue here is how the board of directors or shareholders can evaluate the performance of senior executives, especially when the board of directors decides whether to terminate the job. The impossibility of objectively observing the activities and capabilities of managers leads to the use of performance-based contractual criteria, including accounting gains and share returns (Smith and Watts, 1992) to evaluate managers' performance and to describe the events that lead to change in managers (Brickley, 2003). In this regard, Bushman et al. (2010) stated that managers' ability to influence firm performance and uncertainty in terms of current and future cash flows. Accounting gains mainly emphasize the cash effects of managerial decisions and ignore the risk-based effects. Failure to include risk in managers' performance appraisal models can lead to deviations from estimated profit effects (Easton and Monahan, 2005).

The information environment in which investors trade is constantly changing with the dissemination of information. This change in information flow leads to a reassessment of risk by investors. Information risk is due to various factors. What is more important is the existence of an information environment that reduces ambiguity and uncertainty, thereby enhancing investor ability of forecasting and analysis. Using financial and accounting information to balance risk and return leads to improved investor decision making. Because most financial decisions are made in uncertainty, and information in such cases will play an important role in reducing uncertainty. Accounting information is the most important source of information environment, and is defined as a system of information transfer and reducing uncertainty; this is the information approach to accounting (Armstrong et al, 2011). Market efficiency enables investors to evaluate the company as well as the inherent risks involved.

Managers' decisions affect both the operating results of the company in the form of current and future cash flows and the uncertainty about the company's performance. Based on the cash flows earned, it can be stated that a capable manager plans to increase the value of the company and reduce the risk imposed on shareholders. Finally, as managers are responsible for controlling and mitigating risk, increasing company risk signals to the market that managers' decisions are not efficient and those cash flows will not grow. The expected return on investors is a function of the risk imposed on them and the cost of capital represents the risk that is passed on to shareholders as a result of manager's decisions (Philippon, 2006). Under environmental uncertainty due to lack of symmetric information dissemination, fluctuations and investment risk increase (Hsu, Novoselov, and Wang, 2017). Understanding the effects of environmental uncertainty leads to the transmission of information to shareholders in order to determine the optimal portfolio of investment and selection and helps shareholders control the behaviors of managers that lead to escalation.

The inefficiency of the capital market leads to a shift in management's approach to manipulating profits to create an opportunistic resource. In case of inefficiency of the capital market, managers change the timing of bad news identification, which is in line with the behavioral approach of optimistic managers. As a result, investors face the risk of adverse selection and opportunity cost. This research emphasizes on limiting agency costs by limiting managers' optimistic actions. In this study, emphasis is placed on risk taking of managers based on environmental conditions. In contrast to previous researches, this study attempts on identifying a manager's incentives to take risk and the factors affecting it. Investigating the effects of market inefficiency and environment uncertainty on a manager's risk taking can help clarify and complement previous studies and provide evidence that manager risk taking can influence investors' interest.

In this study, the reflection of the attribute of market inefficiency and environmental uncertainty on CEO risk appetite have been examined. The study is based on the corporate accounting and financial literature and examines changes in manager behavioral that can be applied to investors, managers, standardization committees, and legislators.

Hypothesis development

Market inefficiency and the CEO risk taking

Improving market efficiency reduces investors' incentives to search for private information by reducing the expected benefits of acquiring private information

(Diamond and Verrecchia, 1991; Verrecchia, 2001). Diamond and Verrecchia (1991) found 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. Brown and Hillegiest (2007) have shown that 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, so 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 (Levitt, 1998).

The benefits of risk taking managers frameworks are well known and include better performance and efficiency, greater access to financing, lower cost of capital, and a more favorable treatment of all stakeholders. Equally, market inefficiency can increase risks by affecting the quality of firm assets and causing financial volatility, and are often associated with lack of transparency. The failure and distress conditions of many firms have reignited the debate over the market inefficiency frameworks of these institutions and their impact on performance and risk-taking activities.

Overall, evidence suggests that market inefficiency is more likely to affect greater risk propensity. 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 risk taking. It would therefore be reasonable to assume that enhanced market inefficiency change the decision-making processes and negatively affect the CEO risk taking.

Hypothesis 1: Market inefficiency has a significant impact on CEO risk taking.

Environmental uncertainty and CEO risk taking

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. (Huchzermeier and Loch, 2001). In uncertain environments, decisions must be made quickly and the ability to identify issues in a timely manner plays an important role (Hambrick

and Cruzier, 1985). In this regard, Chen and Zhang (2014) in their research showed 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 clear.

An entity modifies an investment in order 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 in order to maintain investment risk at a certain level and monitor the results of managers' decisions over different periods of time, thereby It reduces the likelihood of costs being missed due to missed opportunities and optimism of managers (Shyti, 2013).

CEOs' opportunistic are believed to be due to weak oversight, in which case managers provide opportunities for surplus cash and over-investment. Deciding how to use the surplus cash leads to a potential conflict of interest between managers and shareholders. Based on the strategic perspective, managers look at the optimal use of cash from a variety of aspects, including how they are distributed to shareholders, the amount of internal expenses spent on the organization's operations, how it determines reserves, and other issues that sometimes lead to the accumulation of surplus cash (Harford, Mansi, & Maxwell, 2008). In line with this, environmental uncertainty is effective on risk taking behavior. Surplus resources can allow to managers to use the surplus cash for their own interests (Jensen and Meckling, 1976) or to obtain the profits through cash accumulation (Amess, Banerji and Lampousis, 2015) and change the risk taking of CEO.

Hypothesis 2: Environmental uncertainty has a significant impact on CEO risk taking.

Research method

Sample selection

This research is based on firms listed on the Tehran stock exchanges in Iran. We begin with an initial sample of 4,983 firm-year observations from 2008–2018. The Rahavard 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 information asymmetry 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**

Dependent variable measure

Drawing on prior research, the CEO risk taking (*CEO*) has been measured based on Balsam, Gu, and Mao (2018) that, managers compensation sensitivity is used to measure managers 'risk taking, which is equal to the logarithm of one plus ratio of the percentage change of managers' compensation to the company's stock value. Managers' compensation information can be extracted from the accompanying notes of the financial statements and from the sales, administrative and organizational expenses sections. A company's stock value can be extracted from the Rahavard Novin software or by multiplying the number of shares (in the accompanying notes of the financial statements and from the equity section) the the closing price of the share at the end of fiscal year. A CEO's risk willingness to take risks (*CEO*) has been used as dependent variables to test both H1 and H2.

Independent variables measure

Our independent variables represent market inefficiency and environment uncertainty. Market inefficiency (*IMPERFECT*[1]) could be measured through

[1]. Market inefficiency

the ratio of the number of shares traded during the year to the average number of stocks issued at the beginning and end of the period, according to research by Emhof, Seavey, and Smith (2017). A measure of environmental uncertainty (*EU*) has also been used to calculate the environmental uncertainty proxy which is used as the independent variable to test H_2. To measure environmental uncertainty (EU2), the standard deviation of sales revenue changes over a 3-year period has been used, and the sales information was extracted from the profit and loss statements. Sales information can be extracted from the Rahavard Novin software or accompanying notes of financial statements on the Codal[3] site. The use of standard deviations to measure environmental uncertainty has been used by researchers such as Dichev and Tang (2009).

Models

Regression specification for testing H_1 and H_2

To investigate the CEO risk taking based on environmental uncertainty and market inefficiency, the following regression is run, to examine the linear impact of environmental uncertainty and market inefficiency on the CEO risk taking.

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

Where *CEO* is a measure of the CEO risk taking. *IMPERFECT* and *EU* 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*[4] is the ratio of the book value of equity to the market value of equity at the fiscal year end. *ROA*[5] is the income before extraordinary items scaled by lagged total assets. *LEV*[6] 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 three past

2. Environmental uncertainty

3. Www.codal.ir

4. Book value to market value

5. Return of asset

6. Leverage

years. *STDOCF* is the standard deviation of operating cash flow over the three past years. *INST*[7] is the percentage of shareholding by institutional investors and *MGO*[8] shows the percentage of stock ownership by the management. Finally, regression analysis control for the industry and year effect.

In the above regression, the coefficient to test the role of market inefficiency and environmental uncertainty in CEO risk taking 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 research hypotheses, possibility of CEO risk taking decreases with increasing market inefficiency and environmental uncertainty.

Results

Descriptive analysis

Table 2 presents descriptive statistics for our sample. It summarizes the descriptive statistics for the market inefficiency and environmental uncertainty and other control variables used in multivariate regression analyses. The average CEO risk taking is 0.001, indicating the low risk taking of managers. 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 *EU* 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 (Xu, Wang, and Han, 2012).

[7]. Institutional ownership

[8]. Managerial ownership

Table 2. Descriptive statistics

Variable	N	Mean	Median	Min	Max	Std
CEO	1309	0.001	0.000	0.000	0.038	0.002
IMPERFECT	1309	0.440	0.174	0.010	0.995	0.216
EU	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

Correlation analysis

Table 3 reports the correlation coefficients between CEO risk taking 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 CEO risk taking of firms changed to the decrease in market inefficiency and environmental uncertainty.

Table 3. Correlations

Variable	BTM	CEO	IMPERFECT	INST	LEV	LOSS	MGT	ROA	SIZE	STDOCF	STDRET	EU
BTM		0.025	-0.035	0.210	-0.023	-0.012	0.119	-0.048	0.158	-0.037	-0.003	0.037
CEO	0.025		-0.036	0.010	0.032	-0.032	0.055	-0.029	0.078	-0.048	-0.004	-0.076
IMPERFECT	-0.035	-0.03		0.033	0.041	0.071	0.015	-0.03	-0.01	-0.027	-0.016	0.006

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INST	0.210	0.010	0.033		-0.003	0.046	0.409	-0.025	0.017	-0.077	-0.045	-0.013
LEV	-0.023	0.032	0.041	-0.003		0.195	-0.017	-0.105	-0.089	-0.085	-0.067	0.132
LOSS	-0.012	-0.032	0.071	0.046	0.195		0.019	-0.324	0.036	-0.021	0.021	0.061
MGT	0.119	0.055	0.015	0.609	-0.017	0.019		0.017	0.046	-0.110	-0.017	-0.036
ROA	-0.048	-0.029	-0.038	-0.025	-0.105	-0.324	0.017		-0.230	0.100	-0.035	0.025
SIZE	0.158	0.078	-0.016	0.017	-0.089	0.036	0.046	-0.230		-0.155	0.041	-0.112
STDOCF	-0.037	-0.048	-0.027	-0.077	-0.085	-0.021	-0.110	0.100	-0.155		-0.001	0.145
STDRET	-0.003	-0.004	-0.016	-0.045	-0.067	0.021	-0.017	-0.035	0.041	-0.001		0.041
EU	0.037	-0.076	0.006	-0.013	0.132	0.061	-0.036	0.025	-0.112	0.145	0.041	

This table contains pairwise Pearson correlation coefficients among important variables.

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 (Bhuiyan and Hooks, 2019) affecting CEO risk taking.

Table 4 presents the multivariate regression analysis for H1 and H2. Column 1 and 2 present the findings for H_1 and H_2 where CEO risk taking is the dependent variable, market inefficiency and environmental uncertainty are independent variables, respectively. I use two different measures for independent variables, *IMPERFECT* and *EU*. Initially, baseline regression ran to test the impact of *IMPERFECT* on CEO risk taking. Columns 1 present the baseline regression. The results show that *IMPERFECT* has a negative association with the measure of CEO risk taking indicating that firms active in inefficient market have lower CEO risk taking compared to firms which active in efficient market. The coefficient of *IMPERFECT* (coefficient = -0.0006, t-statistics = -1.780) shows a negative association with the CEO risk taking. The result is statistically significant at the 10% level. The coefficients and the statistical significance of the findings support H1.

In columns 2, include several and firm-specific control variables and test the impact of *EU* on CEO risk taking. Column 2 presents the findings for H_2. In other words, presents the test of the effect of environmental uncertainty on CEO risk taking and whether this association varies when there is a different level of environmental uncertainty. The results indicate that firms which active in unstable environments (*EU*) have lower CEO risk taking (coefficient = -0.006; t-statistics = -2.308) and the coefficients are statistically significant at the 5% level. Thus, H_2 is supported. In column 3, we can see the merged multivariate regression analysis. It confirm the H_2 result (coefficient = -0.006; t-statistics = -3.814) and, H_1 is significant (coefficient = -0.007; t-statistics = -1.758) indicating that environmental uncertainty decrease the CEO risk taking.

In regards to the control variables, I find that large firms *SIZE* (coefficient = 0.009, -0.002 and -0.012; t-statistics = -0.924, -2.079 and -1.246), have lower CEO risk taking and firms with more managerial ownership (coefficient = 0.002, 0.015 and 0.002; t-statistics = 2.186, 3.220 and 2.122) show a positive association and book to market value (coefficient = -0.002, -0.008 and -0.015; t-statistics = -0.910, -0.341 and -0.642) show a negative association with CEO risk taking. Also, *INST* shows a negative association (coefficient = -0.001, -0.012 and -0.006; t-statistics = -1.455, -3.468 and -1.381) which indicates that firms with a higher institutional ownership expect low CEO risk taking. Firms with inappropriate performance (*LOSS*) also show a negative association with a CEO risk taking which indicates the inappropriate performance of firms caused low CEO risk taking within the 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 approach ranges from 12.2% to 36.6%.

Table 4 Regression Result

VARIABLES	**IMPERFECT**	**EU**	**ALL**
IMPERFECT	-0.006* (-1.780)		-0.006*** (-3.814)
EU		-0.006** (-2.308)	-0.007* (-1.758)
INST	-0.001 (-1.455)	-0.012*** (-3.468)	-0.006 (-1.381)
LEV	-0.009 (-0.560)	-0.002 (-0.089)	-0.007 (-0.459)
LOSS	-0.001 (-1.107)	-0.004*** (-2.789)	-0.002 (-1.079)
MGT	0.002** (2.186)	0.015*** (3.220)	0.002** (2.122)
ROA	-0.001 (-1.347)	-0.003 (-1.299)	-0.014 (-1.202)
SIZE	-0.009 (-0.924)	-0.002** (-2.079)	-0.012 (-1.246)
STDOCF	-0.001 (-0.492)	-0.004 (-0.133)	-0.008 (-0.334)
STDRET	0.001 (0.714)	-0.007 (-0.418)	0.016 (0.911)
BTM	-0.002 (-0.910)	-0.008 (-0.341)	-0.015 (-0.642)
Intercept	0.001*** (2.959)	0.008*** (6.639)	0.002 (1.233)
Observations	**1,309**	**1,309**	**1,309**
Adj R-square	0.122	0.366	0.122
F-statistic	2.223 (0.000)	6.914 (0.000)	2.221 (0.000)
***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. (t-statistics in parentheses).			

Conclusion

This study examines and investigates CEO risk taking based on market inefficiency and environmental uncertainty. The first hypothesis of the study is that market inefficiency has a significant effect on CEO risk taking. The results show that market inefficiency has led to negative changes in risk taking behavior such that under inefficient market, managers incapable to use of resources and as a result, we can see CEO turnover decrease. The results of this hypothesis are consistent with those of Cziraki and Xu (2014). Capital market risk leads managers to value risky projects differently than do 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. Risk-taking incentives generated by executive performance are designed to decrease managerial risk aversion, it is not surprising that these risk-taking incentives have been abundantly documented to change based on market position.

The results of the second hypothesis are similar to those of Ferris, Javakhadze, and Rajkovic (2019). Environmental uncertainty is used as a signaling factor and external mechanism with regard to different circumstances and environments to influence manager decisions. In order to development of inappropriate investing behaviors in environmental uncertainty position, increase negative information transmission and decrease CEO risk taking. The results show that the high risk-taking of managers leads to negative changes in performance so that under managerial opportunism it is not possible to adjust the performance as a result of management behavior. The environment in which managers operate is constantly changing as interest fluctuates. This change in interests leads to a reassessment of risk by managers. Environmental uncertainty results in negative news prices. In other words, companies reduce their risk-taking in order to control and protect prices as well as reduce the risk of information asymmetry for investors and implement approaches that protect the interests of investors.

Investors are more likely to invest in firms that have information transparency or seem to have information transparency. Success in the business environment does not require the pursuit of opportunities that are not identified (March, 1991), but managers are often reluctant to pursue and identify these opportunities. However, incentive schemes can be used to encourage managers to take risks (Armstrong and Vashishtha, 2012). 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 than 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 long-term job, given their responsibilities in the company.

According to the findings of the study, boards of directors should pay more attention to managers' risk-taking approach, because if the proper investment procedures are not implemented as a result of managers' risk-taking, 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 CEO's behavioral factors because there may be opportunities to improve performance, reduce risk, or delay the negative consequences of the investment.

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