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# THE EFFECT OF ERM ON RELATION BETWEEN MANAGERIAL ABILITY AND INVESTMENT EFFICIENCY

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*ABSTRACT*

*This study investigates how COSO ERMI (Enterprise Risk Management Index) influence on managerial ability and investment efficiency relation. Variables include managerial ability as independent variable that measure by the methodology developed in Demerjian et al. (2012) to estimate managerial ability, and over- or under-investment as dependent variables that measured by Gan (2015) and Biddle et al. (2009). Also ERMI are measured by Gordon et al (2009). The sample includes 106 companies listed in Tehran Stock Exchange (TSE) for a period of 2007 to 2016. Panel data based fixed effect regression showed that ERMI collectively have effect on relation between managerial ability and capital investment efficiency and inefficiency. But the study shows that interactive effect between aggregate ERMI and managerial ability cannot influence on relation between managerial ability and investment efficiency and inefficiency.*

***Keywords***: *Managerial Ability, Investment Efficiency, Over Investment, Under Investment, ERMI.*

## INTRODUCTION

Investment is one of the most important corporate activities, with the objective to maximize firm value (Gan, 2015). Inferior investment decisions harm shareholder wealth because they not only waste significant resources, but also result in negative impacts in the long run. In addition, inferior investments can lead to unexpected consequences. Managements who have the ability of efficiently managing a firm should make efficient capital investments because capital investments are the inputs supporting revenue growth.

Stein (2003) argues that investment decision making and implementation signal managerial ability. In other hand, enterprise risk management can increase the management ability to select and implement high quality investments in running a firm. Considering that firms pay a higher compensation premium to attract and retain higher management ability (Custodio et al., 2013), it is of great interest to study whether enterprise risk management (ERM) along with managerial ability brings the benefit of improving investment efficiency or not.

The findings from this study enable organizations to better understand the status of their ERM implementation and assist them in identifying areas of improvement with regards to the processes within each ERM elements. It also contributes to the literature on the importance of good management and governance within ERM framework in organizations.

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## Theoretical Background

Three key constructs in this analysis are investment efficiency, management ability and enterprise risk management. The following we discussed on these factors.

### Investment Efficiency

We conceptually define a firm as investing efficiently if it undertakes projects with positive net present value (NPV) under the scenario of no market frictions such as adverse selection or agency costs (Gordon et al., 2009). Thus, under-investment includes rejecting investment opportunities that would have positive NPV in the absence of adverse selection. Correspondingly, over-investment is defined as investing in projects with negative NPV. Investment is necessary to promote firms' growth. Typical capital investments, such as capital expenditures and R&D are expected to support the growth of sales and technology so that firms can maintain their competitive advantage (Gan, 2015). Capital investments are central to the value creation and value maximization of firms (Copeland et al., 1994). Hence, a CEO's ability to make investment decisions may be significantly influenced by his/her efficiency of operating the firm. The higher ability to foresee and estimate the future payoffs from the new assets and research inputs, the more efficient investment decisions would be made (Goodman et al., 2013).

### Management Ability

This study adopts the methodology developed in Demerjian et al. (2012) to defines and estimate managerial ability. Based on the assumption that more able managers generate higher revenue from a given level of resources, Demerjian et al. (2012) construct a direct measure of managerial ability based DEA method to capture a CEO's efficiency in managing the firm and producing revenue. This measure indicates a CEO's managerial ability to produce more revenue while consuming fewer resources than his/her peers in the same industry. Such efficiency refers to the capability of value creation, value management, and value enhancement in corporate management, a capability that can ensure companies' productivity and create value for shareholders.

### Enterprise Risk Management (ERM)

Facing a great deal of daily environmental changes, we are exposed to new opportunities as well as threats (Choi et al., 2015). In this rapidly changing world, risks exist in all aspects of our lives, which can be viewed as threats in general. By adopting a systematic and consistent approach (or process) to managing all of the risks confronting an organization, ERM is presumed to lower a firm's overall risk of failure and thus increase the investment efficiency, the performance and, in turn, the value of the organization. The presumed link between risk management and an organization's performance value is clearly noted in the following definition of ERM provided by the Casualty Actuarial Society Committee on Enterprise Risk Management (2003, p. 8. As stated choi et al. 2015):

> ERM is the discipline by which an organization in an industry assesses, controls, exploits, finances, and monitors risks from all sources for the purpose of increasing the organization's short-and long term value to its stakeholders.

Greater risks usually indicate greater losses. If potential risks are not managed effectively, they can reduce a firm's abilities to achieve its overall objective and decrease the shareholders' value.

### Literature Review

Review of literature shows three issues that have been analyzed separately such as investment efficiency, management ability and enterprise risk management. In example, studies in

investment efficiency has seen in Barootian, 2017, Sagafi et al. 2012, Forogi and Sakiani, 2016. Gan, 2015.

Bae et al. (2017) hypothesize and find that auditor characteristics that proxy for an auditor's knowledge and resources are associated with higher client investment efficiency, after controlling for the auditor's effect on financial reporting quality. They find that this auditor effect is more pronounced for clients who have a higher demand for information as measured by client size, industry competition, and client complexity. The effect is also more pronounced for clients of longer-tenured auditors. Overall, the results suggest that auditors may be one component to the management information environment and, as such, appear to influence capital investment behavior.

Laux and Ray (2017) in their research entitled "the Effects of Accounting Conservatism on Investment Efficiency and Innovation" they find when incentive contracts are endogenous, however, more conservative accounting (i) always reduces overinvestment incentives (and does not create underinvestment incentives), (ii) leads to stronger, not weaker, managerial incentives to search for innovative projects, and (iii) increases firm value.

Lai and liu (2017) in a study titled "Management characteristics and corporate investment efficiency" find that firms with better and more reputable Top Management Teams (TMTs) are negatively related to investment inefficiency caused by over- and underinvestment. Furthermore, they find that TMT characteristics complement the positive effect of financial reporting quality on investment efficiency. Findings suggest that better TMT characteristics can mitigate investment distortions caused by over- and underinvestment.

Management ability also examined in works of Park et al. 2016, Koester et al. 2016. Chen et al. 2015 and so on.

Park et al. (2016) investigate the incremental effects of managerial ability on tax avoidance. Their study find that there is a negative relationship between tax avoidance and firm value. In addition, they document a statistically meaningful negative relation between managerial ability and tax avoidance. The results also suggest that high managerial ability mitigates the negative relationship between tax avoidance and firm value. These findings suggest that managerial ability influences the tax avoidance behavior of the firm. Also Koester et al. (2016) investigate whether executives with superior ability to efficiently manage corporate resources engage in greater tax avoidance. Results show that moving from the lower to upper quartile of managerial ability is associated with a 3.15 (2.50) percent reduction in a firm's one-year (five-year) cash effective tax rate (ETR).

Research on Enterprise Risk Management (ERM) also shows that scholars who have studied on this issue as Lukianchuk, 2015 Nair et al. 2014 McShane, et al, 2011, Thomya and Saenchaiyathon 2015, Hoseini et al. 2014.

Ping and Muthuveloo (2015) examined the implementation of Enterprise Risk Management (ERM) on firm performance of Public Listed Companies (PLCs) on main market in Bursa Malaysia based on COSO (2004) ERM Integrated Framework. Based on the analysis, implementation of ERM was found to have significant influence on firm performance.

## *Hypotheses and Research Design*

Considering theoretical foundations, we proposed and examined following hypothesis:

**Hypothesis***: COSO ERM Index influence on relation between managerial ability and investment efficiency.*

### Dataset description

In order to test if the ERM implementation along with managerial ability increases investment efficiency, we focused our attention on a sample of 106 Iranian listed companies, operating in different industries (non-financial) in Tehran Stock Exchange (TSE).

The Tehran Stock Exchange (TSE) opened in February 1967, with only six companies listed during its first year of trading. The TSE is now the largest market in the Middle East in terms of the number of stockholders, variation of industry and profitability. From the year 2000, the Iranian Accounting Standards (IAS) were officially published and became compulsory for listed companies in Stock Exchanges in Iran. In addition, it is necessary to comply with International Financial Reporting Standards (IFRS), simultaneously.

Our sample belong to period from 2006 to 2016, getting a strongly balanced panel of 1060 observations (106 x 10 years). The final sample is decided by applying conditions such as the followings: 1) corporations whose financial statements have been presented to the TSE for the research period, 2) because in pooled financial statements, negative items are neutralized by positive items, data have been selected for non-pooled statements. To meet these conditions, 106 firms qualified for testing in the final sample that analyzed by E-views 9 software.

### Model and variables

We investigate whether high managerial ability along with ERM Index is able to improve capital investment efficiency when firms are more vulnerable to agency problems, i.e., to decrease (increase) investment when it has a tendency of over-investing (under-investing). We add ERM Index in Gan (2015) model, then estimate the following OLS regression Model (1) to test ERM Index effect on the association between managerial ability and capital investment levels (or abnormal investment levels).

**Model (1)**

$$INVTi,t+1\ (or\ AB\_INVTi,t+1) = \beta 0 + \beta 1\ MgrlAbilityi,t + \beta 2\ \text{ERM} + \beta 3\ \text{ERM}i,t * MgrlAbilityi,t + \beta 4SIZEi,t + \beta 5\ MTOBi,t + \beta 6\ LOSSi,t + \beta 7SALE_{VOLi},t + \beta 8INVT_{VOLi},t + \beta 9CFO_{SALEi},t + \beta 10CFO_{VOLi},t + \beta 11SLACKi,t + \beta 12DIVi,t + \beta 13ZSCOREi,t + \beta 14TANGIBILITY\text{i,t} + \beta 15KSTRUCTUREi,t + ei,t+1$$

where INVT= INVT_TOT, the level of total investment, equaling to the sum of capital expenditure, and acquisition expenditure less cash receipts from the sale of property, plant, and equipment, AB_INVT = AB_TOT, the abnormal level of total capital investment, peroxided by the residuals from the regression of a firm's total investment on lagged sales growth, $MgrlAbility$: managerial ability measure according to Demerjian et al. (2012). SIZE = natural log of total assets; MTOB = the ratio of the market value of total assets to book value of total assets; LOSS = an indicator variable equal to 1 if net income before extraordinary items is negative, and 0 otherwise; SALE_VOL = standard deviation of the sales scaled by average total assets over previous five years; INVT_VOL = standard deviation of investment over previous five years; CFO_SALE = operating cash flows divided by sales; CFO_VOL = standard deviation of the cash flow from operations scaled by average total assets over previous five years; SLACK = the

ratio of cash to PPE; DIV = an indicator variable equal to 1 if the firm paid dividends, and 0 otherwise; ZSCORE = 0.033*earnings before extraordinary item/total assets + sales/total assets + 0.014*retained earnings/total assets + 0.012*(working capital/total assets) + 0.006*(market value of common stock/total liabilities); TANGIBILITY = PPE divided by total assets; KSTRUCTURE = long-term debt divided by the sum of long-term debt and the market value of equity.

The following we describe that how construct three key measure including: investment efficiency, management ability and enterprise risk management.

### *Investment Efficiency*

In addition to the actual level of capital investment (INVT= INVT_TOT, the level of total capital investment), we also calculate the abnormal level of total capital investment AB_INVT = AB_TOT. We use the following Model (2) to estimate the abnormal capital investment.

$$INVEST_{i,t+1} = \beta 0 + \beta 1\ \Delta SALE\ growth_{i,t} + e_{i,t+1} \qquad \text{Eq. (1)}$$

The residuals from this regression are considered as the abnormal total capital investment.

### *Management Ability*

Demerjian et al. (2012) use data envelopment analysis (DEA) to estimate firm efficiency within industries, comparing the sales generated by each firm conditional on the following inputs used by the firm: Cost of Goods Sold, Selling and Administrative Expenses, Net PP&E, Net Operating Leases, Net Research and Development, Purchased Goodwill, and Other Intangible Assets. Demerjian et al. (2012) use DEA to solve the following optimization problem:

$$max_v \theta = \frac{Sales}{v_1 CoGS + v_2 SG\&A + v_3 PPE + v_4 OPsLease + v_5 R\&D + v_6 Goodwill + v_7 OtherIntan} \qquad \text{Eq. (2)}$$

The efficiency measure generated by the DEA estimation is attributable to both the firm and the manager. The efficiency measure that DEA produces, θ, takes a value between zero and one. Observations with a value of one are the most efficient. Observations with efficiency measures less than one fall below the frontier (Demerjian et al., 2013). For example, a more able manager will be better able to predict trends, regardless of the size of the firm, while a manager in a larger firm will, on average, be better able to negotiate terms with suppliers, regardless of his or her quality. Demerjian et al. (2012) therefore modify the DEA-generated firm efficiency measure by purging it of key firm-specific characteristics expected to aid or hinder management's efforts, including firm size, market share, positive free cash flow, and firm age, which aid management, and complex multi-segment and international operations, which challenge management. Because the efficiency measure that DEA produces, θ, takes a value between zero and one, they estimate the following Tobit regression model (see Demerjian et al. 2013):

$$\begin{aligned} firm\ efficiency \\ &= \beta_0 + \beta_1 Ln(Total\ Assets) + \beta_2\ Market\ Share + \beta_3 Positive\ FreeCash\ Flow \\ &+ \beta_4 Ln(Age) + \beta_5 BusinessSegmentConcentration \\ &+ \beta_6 \text{ForeignCurrency Indicator} + \text{Year Indicators} + \varepsilon \end{aligned}$$

Eq. (3)

The residual from the estimation is the MA-Score, which we attribute to the management team and which we rely on as our main measure of managerial ability.

### *Enterprise Risk Management Index (ERMI)*

We adopt and revised a model developed by Gordon et al. (2009) an ERM Index (ERMI) for measuring a firm's ERM used in Eq. (1). The Index is based on COSO's four objectives of ERM. In other words, Gordon et al. (2009) developed an index of the effectiveness of an organization's ERM based on its ability to achieve its objectives relative to strategy, operations, reporting, and compliance. The basic goal of the ERMI is to combine the achievement of the above four objectives into one metric. The ERMI is then constructed by summing up all four indicators for the above four objectives, as Eq. (4) shows

$$ERMI = strategy + operation + reporting + compliance \qquad \text{Eq. (4)}$$

Each indicator is standardized among the sample of 106 ERM firms before being combined in Eq. (4). The definition and related data for each indicator are explained below.

**Strategy**. Strategy refers to the way a firm positions itself in the market place relative to its competition. When executing its strategy, a firm tries to develop a competitive advantage over participants in the same industry (Porter, 2008). This competitive advantage should lower a firm's overall risk of failure, and thus increase a firm's performance and value.

All firms in the same industry compete for the sales opportunities in the same market. Thus, more sales by firm i relative to the industry's average sales means firm i is outperforming its average competitors. Hence one measure of whether or not a firm has a successful strategy is the number of standard deviations its sales deviates from the industry sales, as shown below:

$$strategy = \frac{salesi - \mu sales}{\sigma sales} \qquad \text{Eq. (5)}$$

Where Salesi = Sales of firm i, $\mu$Sales = average industry sales, and $\boldsymbol{\sigma}$Sales = standard deviation of sales of all firms in the same industry.

**Operations**. Operations (i.e., operating efficiency or productivity) can be measured as the input–output relation within the process of a firm's operations (Banker et al., 2005). More output for a given level of input or less input for a given level of output means better operating efficiency. Higher operating efficiency should lower a firm's overall risk of failure, and thus increase its performance and value. Thus, the turnover of assets, defined as sales divided by total assets, is one measure of operating efficiency (Kiymaz, 2006). This measure is shown below:

$$Operation = (sales) \,/\, (total\ assets) \qquad \text{Eq.(6)}$$

**Reporting**. The reporting concept is easiest to discuss in terms of reporting reliability. Illegal earnings management, financial restatements, and financial fraud all provide evidence of poor financial reporting quality (Cohen et al., 2004). Poor financial reporting should increase a firm's overall risk of failure, and thus decrease it performance and value.

The absolute value of Non- Discretionary Accrual has also been used to measure poor financial reporting quality (Johnson et al., 2002). Thus, a measure of a firm's reporting reliability used in

this study is the relative proportion of the absolute value of Discretionary Accruals divided by the sum of the absolute value of Discretionary and Non- Discretionary accruals. Absolute values are used because both Discretionary Accrual and Non- Discretionary Accruals could be negative. Thus, their relative strengths are better measured by using their absolute values.
The Non- Discretionary Accrual are estimated using Jones (1991) accruals estimation model. In this model, Discretionary Accrual are estimated as a function of the change in revenue and the level of property, plant and equipment. These variables control for changes in accruals that are due to changes in the firm's economic condition. Total assets at the beginning of the year are used as the deflator for all variables in the model. The Non- Discretionary Accruals are estimated from equation (7) below:

$$TA_{ijt}/A_{ijt-1} = a_{jt}\left[1/A_{ijt-1}\right] + \beta_{1jt}\left[\Delta REV_{ijt}/A_{ijt-1}\right] + \beta_{2jt}\left[PPE_{ijt}/A_{ijt-1}\right] + e_{ijt} \qquad \text{Eq. (7)}$$

where, TAijt = total accruals for firm i in industry j, Aijt_1 = total assets for firm i in industry j, ΔREVijt = change in net revenues for firm i in industry j, PPEijt = gross property plant and equipment for firm i in industry j, and eijt = error term for firm i in industry j. Total accruals are defined as income before extraordinary items minus operating cash flows. Industry-specific estimates are obtained from the coefficients in the ordinary least squares Eq. (7). The variable for Non- Discretionary Accrual is the error term from the regression model shown in Eq. (7). The variable Discretionary Accrual is defined as Total Accruals minus Non- Discretionary Accrual. Reporting is then measured as the following:

$$reporting = \frac{|\,\textbf{Discretionary Accrual}\,|}{|\,\textbf{Discretionary Accrual}\,| + |\textbf{Non}-\textbf{Discretionary Accrual}|} \qquad \text{Eq. (8)}$$

**Compliance**. Increased compliance with applicable laws and regulations should lower a firm's overall risk of failure, and thus increase it performance and value. O'keefe et al. (1994) found compliance with Generally Accepted Auditing Standards (GAAS) increases with audit fees. Thus, the first Johnson measure of compliance used in the study reported in this paper is the proportion of auditor's fees to total assets. Auditor's fees are paid mainly for the services derived from auditing financial statements, certification, examining individual and consolidated accounts, due-diligence reviews, agreed-upon procedures (e.g., confirming compliance with specific contractual agreements), and tax compliance and consultancy. The data for auditor's fees (Auditor Fees) are collected from proxy statements and scaled by total assets.

$$Compliance = \frac{Auditor\ Fees}{Total\ Assets} \qquad \text{Eq. (9)}$$

The ERM Index (ERMI) is derived from the sum of the indicators discussed above.

## EMPIRICAL RESULTS

For analyzing panel data, we first elect the suitable method. Result in table (1) in two dependent show that based Eviews 9 software, in one hand preference is by Panel method and other hand is by Fixed effect method.

**Table 1 : F Limer and Huasman Test Result**

| Panel A. dependent variable: invest | | | | |
|---|---|---|---|---|
| result | Prob. | statist | test | model |
| Panel method accept | 0.0000 | 11.431885 | F limer | 1 |
| Fixed effect method accept | 0.0029 | 31.466035 | *hausman* | 1 |

| Panel B. dependent variable: Ab- invest | | | | |
|---|---|---|---|---|
| result | Prob. | statist | test | model |
| Panel method accept | 0.0000 | 11.554104 | F limer | 1 |
| Fixed effect method accept | 0.0440 | 31.935328 | *hausman* | 1 |

## Result of Testing Model

The results from testing the hypothesis are shown in panel A and B, table (2). As stated earlier, the dependent variable for testing this hypothesis is total investment and ab-investment.

**Table 2: result of testing model**

| abbreviation | Variable | Panel A. dependent variable: invest | | | Panel B. Dependent variable: ab-invest | | |
|---|---|---|---|---|---|---|---|
| | | Prob. | t-Statistic | Coefficient | Prob. | t-Statistic | Coefficient |
| MgrlAbility | Managerial ability | 0.1130 | -1.586801 | -35564.80 | 0.1215 | -1.550134 | -34770.03 |
| ERMI | COSO ERM Index | 0.0390 | 2.067700 | 5499.872 | 0.0317 | 2.151895 | -18344.18 |
| Mgrlability *ERMI | Combination of Managerial Ability and ERMI | 0.1562 | 1.419344 | 15174.91 | 0.2309 | 1.198954 | 12854.21 |
| R2 | R-squared | 0.624082 | | | 0.623988 | | |
| Adjusted-R2 | Adjusted R-squared | 0.566432 | | | 0.566323 | | |
| DW | Durbin-Watson stat | 1.632301 | | | 1.632412 | | |
| F | F-statistic | 10.82530 | | | 10.82096 | | |
| Prob F | Prob (F-Statistic) | 0.000000 | | | 0.000000 | | |

### *Reference: result of research*

First when the dependent variable is investment the value of probability F-statistics (10.82530) indicates that at the significance level of 0.000000, the model is significant. Adjusted R2 presented in the table also indicates that approximately 56% of the dependent variable is explained by the independent variables and the control variables. Finally, according to t-test statistics of the MgrlAbility variable, which is -1.550134, at the level of prob=0.1130 there isn't a significant relationship between management ability and investment. Accordingly, for ERMI variable, the results show which t-test is 2.067700, at the level of prob=0.0390 there is a significant relationship between management ability and ERMI. The coefficient calculated for the independent variable is 5499.872 which shows that there is significant positive relationship between the investment and the ERMI, and thus the first research hypothesis is confirmed. Also, interactive combination of management ability and ERMI (Mgrlability*ERMI) shows no relationship to investment because t-test is 1.419344, at the level of prob=0.1562. In between the other control variables, size and slack only show meaningful relation to investment.

Second, in Panel B, table (2), when the dependent variable is ab-investment the value of probability F-statistics (10.82096) indicates that at the significance level of 0.000000, the model is significant. Adjusted R2 presented in the table (2) also indicates that approximately 56% of the dependent variable is explained by the independent variables and the control variables. Finally, according to t-test statistics of the MgrlAbility variable, which is -1.586801, at the level of prob=0.1215 there isn't a significant relationship between management ability and ab-

investment. Accordingly, for ERMI variable, the results show which t-test is 2.151895, at the level of prob=0.0317 there is a significant relationship between ab-investment and ERMI. The coefficient calculated for the independent variable is -18344.18 which shows that there is significant negative relationship between the ab-investment and the ERMI, and thus the first research hypothesis is confirmed. Also, interactive combination of management ability and ERMI (Mgrlability*ERMI) shows no relationship to ab-investment because t-test is 1.198954, at the level of prob=0.2309. In between the other control variables, size and slack only show meaningful relation to ab-investment.

## CONCLUSIONS

In this study, one hypothesis was proposed. For this hypothesis, we investigated role of enterprise risk management index (ERMI) on the relationship between management ability and investment efficiency. Regarding what we observe in Table (2), we can say that the relation between management ability and investment isn't significant. Also, the relation between management ability and un-investment (ab-investment) isn't significant. Gan (2015) finds that the relation between management ability and investment is significant and our result reject the Gan (2015) findings.

In other hand, our evidence about enterprise risk management index (ERMI) strongly influence on investment efficiency. Because in Table 2 Panel B, the coefficient calculated for the ERMI as independent variable is -18344.18 which shows that there is significant negative, then we conclude that ERMI decrease ab-investment. This result is match to theory that enterprise risk management index (ERMI) plays very effective role on investment efficiency. In another explanation, theory represented in this research expects that enterprise risk management index (ERMI) increase total investment. Result also, verified this hypothesis and relationship between the investment and the ERMI. Therefore, we can say that managers are likely to use enterprise risk management techniques to provide effective investment about the firms' future decision making. The result of this research is similar to those of several studies, like study of Hoseini et al. (2014).

However, the regressions indicate that overall, our inference regarding the effect interactive combination of management ability and ERMI (Mgrlability*ERMI) remains unaffected because this variable is statistically insignificant and shows no relationship to ab-investment (t-test is 1.198954, at the level of prob=0.2309).

Overall, the managers always try to bring the best performance to their companies, adopting appropriate strategies. Choosing the appropriate strategy as enterprise risk management techniques largely depends on the personals ability of the manager in analyzing the available space and selecting the best methods for leading the company. If the strategy adopted by the manager is not able to fulfill the stockholders' expectations from company's profitability, the manager will be induced to use the earning management to extend the company's profitability to the level expected by the stockholders. Accordingly, the practical implication based on research results is that firms use enterprise risk management techniques to provide effective investment about the firms' future decision making. Also, we recommend researchers use the model in other industry as banking, etc. in future studies. Also researchers can study why is no relation between management ability and investment efficiency.

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