Does Failure Tolerance of the Board of Directors Affect Investment Efficiency?

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Abstract: Based on the perspective of failure tolerance, this paper measures the board's failure tolerance by whether the company's performance failing to meet the board's expectations leads to the mandatory replacement of managers. On this basis, the paper selects data from A-share listed companies in China from 2010 to 2022 to study the impact of board failure tolerance on corporate investment efficiency. The research finds that board failure tolerance can significantly improve corporate investment efficiency, both inhibiting over-investment and alleviating under-investment.

Keywords: Agency Conflict, Executive Team Stability, Failure Tolerance Theory

1.   Introduction

China's economy has maintained rapid growth for a long time, but the goals of economic development have undergone qualitative changes. The report of the 19th National Congress of the Communist Party of China proposed a shift from a "high-speed growth stage" to a "high-quality development stage." Enterprises are the micro-foundation of economic development, and their efficient development is crucial for promoting high-quality economic development. For micro-enterprises, investment is the foundation for enhancing corporate value, and investment decision-making is the core of the three major financial decisions. Investment efficiency plays an important role in corporate development. Only highly efficient investments can enable companies to maintain a competitive advantage in fierce market competition and achieve sustainable development. However, high investment does not necessarily mean high efficiency. There is a contradictory phenomenon in China of high investment but low efficiency, with listed companies exhibiting inefficiencies in the form of over-investment or under-investment. According to the CSMAR database statistics, about 61% of companies exhibit under-investment, and about 39% exhibit over-investment. This indicates that there are inefficient investment behaviors among China's listed companies, with under-investment being more prevalent than over-investment. Both over-investment and under-investment deviate from ideal investment states, causing numerous problems for business operations and leading to increased risks of stock price crashes [1] and damage to corporate value [2].

In the modern corporate structure characterized by the separation of ownership and management, the control of the business is no longer in the hands of shareholders but is delegated to experienced senior managers. As investment is a critical way for a company to create value, the decision-making power for investments largely lies with senior managers. Managers, in pursuit of their own interests, may often sacrifice the interests of stakeholders such as shareholders and creditors when making

investment decisions, thereby negatively impacting corporate investment efficiency. Therefore, it is particularly important to motivate senior managers to improve corporate investment efficiency. Existing literature mainly explores the impact of board governance [3] and management incentives [4] on corporate investment efficiency from an internal perspective based on agency theory and optimal contract theory. However, the inherent riskiness, long-term nature, and unpredictability of corporate investments make performance measurement difficult, thus limiting the motivational effectiveness of standard performance-based compensation mechanisms.

Given the limitations of traditional standard performance-based compensation mechanisms in motivating managers to make investment decisions, Manso [5] proposed the failure tolerance theory oriented towards innovation incentives. This theory points out that compensation mechanisms strictly linked to performance can lead managers to pursue short-term performance, resulting in myopic behaviors. It further suggests establishing a new type of incentive mechanism: tolerating early failures of managers and rewarding success. The failure tolerance theory provides a new theoretical perspective to mitigate the conflicts of interest between shareholders and corporate managers. Thus, can the board's introduction of a failure tolerance incentive mechanism motivate managers' investment behavior, leading them to make investment decisions with a greater focus on the company's long-term value and maximizing shareholder wealth?

The academic contributions of this paper mainly lie in the innovation of the measurement method of board failure tolerance. This paper reviews the measurement methods of board failure tolerance and finds that existing literature mainly measures it from the perspective of performance decline, using the sensitivity of managerial forced turnover to short-term performance changes [6, 7] and the stickiness of executive compensation [8]. This paper starts from whether managerial forced turnover occurs when the board's expectations are not met, providing a new measurement method for board failure tolerance and enriching the failure tolerance theory.

2. Research Hypothesis

The failure tolerance theory proposes that an incentive mechanism should be established to tolerate early failures and reward long-term successes [5]. A failure-tolerant board is characterized by "emphasizing rewards and light punishments" and "rewarding excellence without penalizing failure" [9], which alleviates managers' short-sighted behaviors, enhances their adventurous spirit and risk-taking ability, reduces agency costs, and thereby improves corporate investment efficiency.

From the perspective of personal costs and benefits, managers consider the potential returns and personal costs when making investment decisions. New investments require managers to invest more time and effort and bear higher risks. When managers incur high personal costs from new investments and the returns are uncertain, they tend to abandon some projects with positive net present values [10], resulting in under-investment. However, a failure-tolerant board provides managers with protection from failure and rewards for investment success [5], reducing the personal costs of investment and providing the necessary incentives. This motivates managers to pursue new investments and make high-quality investment decisions based on the goal of maximizing the company's long-term value, thus alleviating the problem of under-investment caused by concerns over personal costs and subsequently improving corporate investment efficiency.

From the perspective of job security for managers, a failure-tolerant board does not replace managers due to short-term performance not meeting expectations, ensuring job security for managers. This security makes managers more likely to make high-quality investment decisions based on the company's long-term value. On one hand, when managers expect a short tenure, they may avoid investing in high-risk new projects due to concerns about job and income security, leading to a tendency to maintain previous investment projects [11] and resulting in under-investment. On the other hand, when managers expect a short tenure, they have a strong motivation to engage in self-

serving investments that sacrifice long-term shareholder interests [12], leading to over-investment. A failure-tolerant board provides managers with the expectation or promise of a longer tenure [8], allowing managers to enjoy the delayed returns from investments during their term. Therefore, managers will consider the company's long-term value when making investment decisions, alleviating under-investment and over-investment issues, and thereby enhancing corporate investment efficiency.

From the perspective of executive team stability, if the board cannot tolerate short-term performance not meeting expectations and replaces managers, it will exacerbate managerial short-sighted behaviors [13], reduce the quality of internal control [14], and lead to inefficient investment problems. Conversely, if the board provides high tolerance and does not replace managers due to short-term performance not meeting expectations, the executive team can maintain high stability. On one hand, a stable executive team is a guarantee for making high-quality investment decisions. A stable executive team can reduce the likelihood of conflicts among team members [15], leading to more coordinated and efficient communication, thus making decisions that are more beneficial for the company's development. On the other hand, a highly stable executive team is more focused on the company's long-term development. When the team is very stable, the interests of team members align with the company's long-term value, allowing them to enjoy the long-term benefits from investments. Executives will have the willingness and motivation to focus on the company's future development, considering long-term returns in their investment decisions, reducing agency costs [16], and suppressing inefficient investment behaviors.

In summary, based on the failure tolerance theory, board failure tolerance reduces the personal costs of managers' new investments to a certain extent, ensures job security for managers, and improves the stability of the executive team. This allows managers to make high-quality investment decisions from the perspective of the overall interests of the company, thereby improving investment efficiency. Based on the above analysis, the first research hypothesis of this paper is proposed:

Hypothesis H1: Board failure tolerance can significantly improve corporate investment efficiency.

3. Research Design

3.1. Sample Selection and Data Sources

This paper selects A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2010 to 2022 as the initial research sample. The original sample was processed as follows: (1) excluding financial and insurance companies; (2) excluding ST, *ST, and PT companies; (3) excluding companies with missing data. To eliminate the potential impact of extreme values, all continuous variables were winsorized at the 1st and 99th percentiles. The data used in this paper are all sourced from the CSMAR database.

3.2. Variable Design

3.2.1. Dependent Variable: Investment Efficiency

The dependent variable in this paper is corporate investment efficiency. Referring to Richardson's residual measurement model [17], the deviation between a company's actual investment and the predicted optimal investment level is used to measure inefficient investment. The specific model (1) is as follows:

$$Inv_{i,t} = \alpha_0 + \alpha_1 Growth_{i,t-1} + \alpha_2 Lev_{i,t-1} + \alpha_3 Cash_{i,t-1} + \alpha_4 Age_{i,t-1} + \alpha_5 Size_{i,t-1} + \alpha_6 Return_{i,t-1}$$

$$+\alpha_7 Inv_{i,t-1} + \sum Industry/Year + \varepsilon_{i,t-1} \qquad (1)$$

where *Inv* represents investment expenditure; *Growth* is the growth rate of operating revenue; *Lev* is the asset-liability ratio; *Cash* is the ratio of cash and cash equivalents to total assets; *Age* is the natural logarithm of the observation year minus the listing year; *Size* is the natural logarithm of total assets; *Return* is the stock return.

The residuals obtained from the regression of the above Richardson model are used to measure investment efficiency (*Inveff*). The absolute value of the residual indicates the level of investment inefficiency: the larger the absolute value, the lower the investment efficiency. A positive residual indicates over-investment (*Overinv*); a negative residual indicates under-investment (*Underinv*), measured by the absolute value of the residual.

3.2.2. Independent Variable: Board Failure Tolerance

Following Manso's [5] proposal of the failure tolerance theory, which advocates for tolerating early failures, scholars have begun to measure this variable. Di Junpeng et al. [18] used the average tenure of managers to measure a company's failure tolerance towards its managers. Zhu Bing et al. [6] measured a company's tolerance towards managers by examining the sensitivity of forced managerial changes to short-term performance. They argue that if managers are dismissed due to a short-term decline in corporate performance, it indicates a low level of failure tolerance.

Thus, this paper defines board failure tolerance as follows: when the board does not change managers due to actual corporate performance failing to meet expectations, the board is considered failure-tolerant [6]. Referring to the studies by Zhu Bing et al. [6] and Chen Xiude et al. [8], this paper constructs a dummy variable to measure board failure tolerance. Specifically, the sample where actual earnings per share (EPS) is lower than the analysts' forecast mean is retained. The difference between actual EPS and the analysts' forecast EPS mean is divided into high and low groups based on the annual industry median. If the difference is above the median and no forced managerial change occurs in the following year1, the board is considered failure-tolerant, assigned a value of 1. If the difference is below the median and a forced managerial change occurs in the following year, the board's failure tolerance is low, assigned a value of 0. The specific measurement method of board failure tolerance is shown in Table 1.

There are two main reasons for using analyst forecasts as the board's performance expectations: Firstly, when the board evaluates whether corporate performance has declined, merely comparing the performance difference between this year and last year cannot fully account for external factors such as market environment and industry competition. Analysts, as important information intermediaries in the capital market, analyze and publish earnings forecasts based on their professional ability and information-gathering advantages. These forecasts reflect the capital market's expectations for company performance to a certain extent, helping to alleviate the information asymmetry between investors and listed companies [19]. Therefore, comparing this year's performance with the analysts' forecast mean, rather than directly comparing the performance difference between this year and last year, incorporates market expectations and industry trends, avoiding the aforementioned incomplete considerations. Secondly, considering the optimistic bias in analyst forecasts [20], this paper categorizes the difference between corporate performance and analysts' forecast mean into high and

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[1] Managerial changes are categorized into forced changes and non-forced changes. This study considers non-forced changes in managers as voluntary changes that do not involve whether the board tolerates failure. Zhu Bing et al.'s research categorizes "dismissal," "resignation," and "personal reasons" as types of forced managerial changes, and categorizes "retirement," "end of term," "change in controlling rights," "health reasons," "improvement of corporate governance structure," "involvement in a case," and "end of agency" as types of non-forced managerial changes. However, some CEOs' voluntary resignations may also be disclosed as "personal reasons." Therefore, building on Zhu Bing et al.'s research, this study categorizes "personal reasons" as non-forced managerial changes rather than forced managerial changes.

low groups when constructing the variable. When the difference is large, it indicates that the actual corporate performance is far below the board's expected level. If the board does not enforce a managerial change at this time, it shows a certain level of failure tolerance. Conversely, when the difference is small, and the board enforces a managerial change, it indicates the absence of failure tolerance. Therefore, this paper uses analyst forecasts as the board's expectations for executive performance. If the actual corporate performance is below the analysts' forecast mean, the board will consider whether the executives have exerted maximum effort in managing the company.

Table 1: Measurement Method for Board Failure Tolerance

	Difference Above Median	Difference Below Median
Non-forced managerial change	1	-
Forced managerial change	-	0

3.2.3. Control Variables

Referring to the approach of Yan Zichun et al. [21], this paper selects firm size, asset-liability ratio, revenue growth rate, return on assets, free cash flow, listing duration, board size, proportion of independent directors, CEO duality, stock return, and ownership nature as control variables. Additionally, industry and year effects are controlled for in the analysis.

3.3. Model Construction

This paper constructs model (2) to test Hypothesis H1 and Hypothesis H2. The specific model is as follows:

$$Inveff_{i,t}(Overinv_{i,t}/Underinv_{i,t}) = \alpha_0 + \alpha_1 RR_{i,t-1} + \alpha_2 Controls + \sum Industry + \sum Year + \varepsilon \tag{2}$$

Where: $Inveff_{i,t}$ is the investment efficiency of firm i in period t ($Overinv_{i,t}$ indicates over-investment and $Underinv_{i,t}$ indicates under-investment). RR_{t-1} is the board failure tolerance of firm i in period t-1. Since the impact of board failure tolerance on corporate investment efficiency has a lagging effect, we examine the influence of board failure tolerance in period t-1 on investment efficiency in period t. *Control* represents the control variables. The model adopts a "two-way fixed effects model" to account for relevant fixed effects. *Year* and *Industry* are the year and industry fixed effects, respectively. α_0 is the intercept term. α_1 is the regression coefficient of the independent variable RR_{t-1}. α_2 is the regression coefficient of the control variables. ε is the error term.

4. Empirical Results

4.1. Descriptive Statistics

Table 2 reports the descriptive statistics of the main variables in this study. Among the total 9,102 samples, approximately 36.8% of the samples exhibit over-investment issues, while about 63.2% of the samples exhibit under-investment issues. The mean value for over-investment samples is 0.049, with a maximum value of 0.898. The mean value for under-investment samples is 0.031, with a maximum value of 0.271. This indicates that inefficient investment is prevalent among Chinese listed companies, with under-investment being more common and over-investment being more severe. The

mean value of the dummy variable for board failure tolerance (RR) is 0.885, indicating that 88.5%[2] of the sample firms exhibit the characteristic of board failure tolerance.

Table 2: Descriptive Statistics Results

Variables	N	mean	sd	min	P25	Median	P75	max
Inveff	9102	0.038	0.047	0	0.011	0.025	0.046	0.898
Overinv	3350	0.049	0.067	0	0.009	0.025	0.061	0.898
Underinv	5752	0.031	0.028	0	0.012	0.025	0.041	0.271
RR	9102	0.885	0.319	0	1	1	1	1

4.2. Regression Results Analysis

Table 3 reports the regression results of the impact of board failure tolerance on corporate investment efficiency. L.RR represents the one-period lagged board failure tolerance. Column (1) shows the regression results of board failure tolerance on corporate investment efficiency. It can be seen that the regression coefficient of the variable L.RR with *Inveff* is significantly negative at the 1% level, indicating that board failure tolerance can significantly suppress inefficient investment and improve investment efficiency. Columns (2) and (3) in Table 3 show that the regression coefficients of L.RR with *Overinv* are significantly negative at the 5% level, and the regression coefficients of L.RR with *Underinv* are significantly negative at the 1% level. This indicates that board failure tolerance can both inhibit over-investment and alleviate under-investment. Thus, hypothesis H1 is validated.

Table 3: Impact of Board Failure Tolerance on Investment Efficiency

	(1) *Inveff*	(2) *Overinv*	(3) *Underinv*
L.*RR*	-0.0057***	-0.0068**	-0.0051***
	(-3.798)	(-2.008)	(-4.535)
_*cons*	0.0747***	0.0707**	0.0953***
	(5.607)	(2.276)	(9.559)
Controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	9102	3350	5752
adj. R²	0.125	0.185	0.101
F	31.2982	18.6945	15.9617

Note: Values in parentheses are t-values, "***", "**", and "*" denote significance at the 1%, 5%, and 10% levels, respectively.

4.3. Endogeneity Test

The empirical tests above used the lagged independent variable by one period to mitigate reverse causality issues. However, the results may still be influenced by sample selection bias and endogeneity problems due to omitted variables. To address these concerns, this study employs two-period lagged variables, propensity score matching, and controls for firm fixed effects. The regression results are consistent with the main regression results, indicating the robustness of the conclusions.

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[2] Chen Xiude et al.'s research data shows that approximately 80% of listed companies tolerate failure, which is similar to the statistical results of this study. Hence, the definition and data collection process of this study are reasonable, and the obtained data are valid.

5. Conclusion and Implications

This paper, from the perspective of failure tolerance, measures board failure tolerance based on whether a manager is forcibly replaced when the company's performance falls short of the board's expectations. Using data from A-share listed companies in China from 2010 to 2022, this study examines the impact of board failure tolerance on corporate investment efficiency. The following conclusions are drawn: Board failure tolerance significantly improves corporate investment efficiency by both curbing over-investment and alleviating under-investment. Based on the current research findings, this paper offers the following recommendations for companies: Emphasize board governance and fully leverage the role of the board to enhance corporate investment efficiency. Companies can construct incentive mechanisms that tolerate failure to effectively boost managers' risk-taking spirit, reduce their personal costs, and ensure job security. Such fault-tolerant incentive mechanisms can motivate managers to consider the long-term interests of the company, make higher-quality investment decisions, and ultimately improve corporate investment efficiency.

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