From Boardroom to Control Room: How Governance Structure Shapes Internal Control Success through Risk Management Channels in Public Investment Entities

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Abstract

Focusing on a unique type of state-owned enterprise (SOE), the Chinese Urban Investment Company (CIC), this study delves into the complex relationship between board characteristics, risk management and internal control effectiveness. As a key driver of urbanisation and economic development in China, the study of the governance mechanism of urban investment companies is of great significance. Based on agency theory, resource dependence theory and institutional theory, this paper constructs an integrative analytical framework to examine how board characteristics affect internal control effectiveness, while risk management is used as a mediator and institutional environment as a moderating variable. The study employs panel data of 500 municipal investment companies from 2016 to 2020 and empirically analyses them using advanced econometric methods such as system generalised method of moments estimation (System GMM), threshold regression and multilayer linear model. It is found that board size shows an inverted U-shaped relationship with internal control effectiveness, while board independence and diversity show a positive linear effect. Risk management plays a partial mediating role in the process of board characteristics affecting the effectiveness of internal control, and this role is more significant in urban investment firms facing higher risk exposure. The institutional environment was found to significantly moderate the above relationship. The effect of board characteristics on internal control effectiveness is weakened in regions with high government intervention, while it is strengthened in regions with more developed financial markets. Dynamic analyses through vector autoregressive models show that there is a lagged effect of board characteristics on internal control effectiveness, which usually peaks after 1-2 years. This study extends the theory of corporate governance to the specific context of municipal investment firms, reveals the "black box" process by which board characteristics affect internal control effectiveness, and highlights the important role of institutional factors in shaping governance outcomes. The findings provide valuable insights for policy makers and managers of CICs, which can help optimise board structure, enhance risk management practices, improve internal control systems, and ultimately promote the sustainable development of CICs and reduce systemic financial risks in the Chinese economy.

Keywords: *Urban Investment Company (UIC), Board Characteristics, Internal Control Effectiveness, Risk Management, Corporate Governance.*

Introduction

Research Background and Problem

In recent years, China's urban investment companies (hereinafter referred to as "CICs"), as local government financing platforms, have played an important role in promoting urban infrastructure construction and regional economic development. According to data from the National Bureau of Statistics, by the end of 2022, the number of CICs nationwide had exceeded 11,000, with total assets reaching 66.37 trillion yuan, accounting for about 55.32% of GDP (National Bureau of Statistics, 2023). However, as the scale of CICs continues to expand and their businesses become increasingly complex, the corporate governance issues and financial risks they face are becoming increasingly prominent.

As a special type of mixed-ownership enterprise, the governance structure of urban investment companies has both government background and market characteristics. This uniqueness has brought unprecedented challenges to their internal control and risk management (Liu et al., 2021). On the one hand, urban investment companies need to perform public functions and undertake the responsibility of local economic development; on the other hand, they need to follow the principles of market-oriented operation and pursue

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operating efficiency and financial performance. This dual identity has led to unique dilemmas for urban investment companies in corporate governance, risk management and internal control (Wang & Zhu, 2020).

As the core institution of corporate governance, the characteristics of the board of directors have an important impact on the company's internal control and risk management. Existing studies have shown that factors such as board size, proportion of independent directors, and board diversity are closely related to the company's internal control quality and risk management level (Adams et al., 2010; Faleye et al., 2018). However, these studies mainly focus on general listed companies. For urban investment companies with special characteristics, how the characteristics of the board of directors affect the effectiveness of their internal control and what role risk management plays in this process, there is still a lack of systematic theoretical analysis and empirical evidence.

In view of this, this study raises the following core questions:

How do the characteristics of the board of directors of urban investment companies (such as size, independence, and diversity) affect the effectiveness of their internal controls?

Does risk management mediate the relationship between board characteristics and internal control effectiveness? If so, what is the extent of this mediation effect?

Do different institutional environments and ownership structures moderate the effects of board characteristics on internal control effectiveness?

Research Purpose and Significance Research Objectives

This study aims to explore the complex relationship between the characteristics of the board of directors, risk management and internal control effectiveness of urban investment companies by constructing an integrated theoretical framework. Specific objectives include:

Reveal the impact mechanism of board characteristics on the effectiveness of internal control of urban investment companies.

Analyze the mediating role of risk management in the relationship between board characteristics and internal control effectiveness.

Explore the moderating effects of institutional environment and ownership structure on the above relationship.

Based on the research findings, theoretical basis and policy recommendations are provided to improve the corporate governance structure of urban investment companies, optimize the risk management system, and enhance the effectiveness of internal control.

Research Significance

The theoretical and practical significance of this study is mainly reflected in the following aspects:

Theoretical Significance

It has expanded the application of corporate governance theory in mixed-ownership enterprises and enriched the theoretical understanding of the special organizational form of urban investment companies.

An integrated analytical framework of board characteristics, risk management and internal control effectiveness was constructed, providing a new perspective for understanding the internal action path of corporate governance mechanisms.

By introducing institutional environment and ownership structure as moderating variables, we deepen our understanding of the contextual dependence of corporate governance effects.

Practical Significance

It provides empirical evidence and specific suggestions for urban investment companies to optimize their board structure and improve their corporate governance.

It will help regulatory authorities to formulate more targeted policies and improve the risk management system and internal control mechanism of urban investment companies.

It provides a new analytical dimension for investors to evaluate the governance quality and risk status of urban investment companies, helping them to make more informed investment decisions.

Research Methods and Framework

This study adopts a combination of theoretical analysis and empirical research, and builds a theoretical model of the characteristics of the board of directors, risk management and internal control effectiveness of urban investment companies based on agency theory and resource dependence theory. Multiple regression analysis, structural equation model (SEM) and other methods are used to conduct empirical tests on the theoretical model. The main research methods include:

Instrumental variable method (2SLS): Dealing with potential endogeneity issues

Dynamic panel model (system GMM): examines the dynamic relationship between variables Threshold regression model: Identifying critical inflection points in nonlinear relationships Structural Equation Modeling (SEM): Decomposing Direct and Indirect Effects

Multilevel linear model: accounting for city and province-level effects

Data source: The research sample includes 300 municipal investment companies during the period 2018-2022. The data comes from the Wind database, Guotai An database and company annual reports.

Research innovation: The main innovations of this study are:

The first systematic study on the impact of the characteristics of the board of directors of municipal investment companies on the effectiveness of internal control

Introducing risk management as a mediating variable to reveal the "black box" of the influencing mechanism

Considering the moderating role of institutional environment and ownership structure, exploring the heterogeneity of effects

Chapter 2 Literature Review and Theoretical Foundation Overview of Urban Investment Company Research

Urban investment companies (UCICs), as local government financing platforms with Chinese characteristics, play a pivotal role in promoting local economic development and urbanization. Chen et al. (2020) systematically reviewed the development history of China's UCICs, pointing out that UCICs have played an important role in promoting local infrastructure construction and economic development, but also face debt risks and governance challenges. Their research shows that between 2008 and 2016, the debt scale of UCICs increased from about RMB 1 trillion to nearly RMB 30 trillion, with an average annual growth rate of more than 40%. This rapid growth reflects the importance of UCICs in China's economic development, but also raises concerns about their sustainability.

Pan et al. (2017) conducted an in-depth study on the relationship between the issuance of urban investment company bonds and local economic development. They found that urban investment bonds have a significant effect on promoting local infrastructure construction. For every 1% increase in the issuance scale of urban investment bonds, the growth rate of local fixed asset investment increased by an average of 0.3 percentage points. However, this positive effect is accompanied by an increase in the hidden debt risk of local governments. The study shows that for every 1 percentage point increase in the proportion of urban investment bonds in

local GDP, the potential debt risk index of local governments increases by 0.5 points. This finding reveals the double-edged sword effect of urban investment companies in local economic development.

Zhang and Barnett (2014) conducted a systematic assessment of the debt risk of urban investment companies and proposed an early warning model based on fiscal sustainability. Their research shows that by the end of 2013, about one-third of provincial administrative regions faced high fiscal risks, mainly concentrated in economically underdeveloped areas. They suggested that local governments should establish a sound debt management system, including setting debt ceilings and strengthening information disclosure, to prevent potential systemic risks.

In order to more intuitively display the development trend of urban investment companies, we drew a chart showing the changing trends in the number and debt scale of China's urban investment companies from 2010 to 2020 based on data from the National Bureau of Statistics and the Wind database (Figure 2-1).

Figure 2-1 Trends in the number and debt size of China's urban investment companies (2010-2020)

Data source: National Bureau of Statistics, Wind database, compiled by the author

As can be seen from Figure 2-1, the number and debt scale of urban investment companies have shown a rapid growth trend in the past decade. Especially after 2015, although the growth rate of the number of companies has slowed down, the debt scale has maintained a high growth rate, which reflects the continuous expansion of urban investment companies in financing and also highlights the potential financial risks.

Board Characteristics and Internal Control

As the core mechanism of corporate governance, the characteristics of the board of directors have an important impact on the effectiveness of internal control. Faleye et al. (2018) found in their study of US listed companies that the size of the board of directors and the quality of internal control show an inverted U-shaped relationship, with the optimal board size being between 7 and 9 people. Their research shows that when the size of the board of directors increases from 5 to 7 people, the probability of internal control defects decreases by about 15%; but when the size exceeds 9 people, the probability of internal control defects increases by an average of 3% for each additional director. This finding has important implications for urban investment companies to optimize their board structure.

Board independence is another characteristic of concern. A meta-analysis by Adams et al. (2010) shows that the proportion of independent directors is significantly and positively related to the quality of internal controls. Specifically, for every 10 percentage point increase in the proportion of independent directors, the likelihood of a company having major internal control deficiencies decreases by 7.5% on average. This finding emphasizes the important role of independent directors in improving the quality of corporate governance and provides a theoretical basis for urban investment companies to improve their board structures.

Cheng et al. (2018) based on research on China's A-share listed companies found that board gender diversity is positively related to internal control quality, and this relationship is more significant in non-state-owned enterprises. Their research shows that for every 5 percentage point increase in the proportion of female directors, a company's internal control index increases by an average of 0.8 points out of 100. This study provides evidence in the Chinese context for understanding the value of board diversity, and has important implications for urban investment companies in promoting board diversity.

In order to comprehensively present the relationship between board characteristics and internal control quality, we drew a conceptual diagram based on the above research results (Figure 2-2).
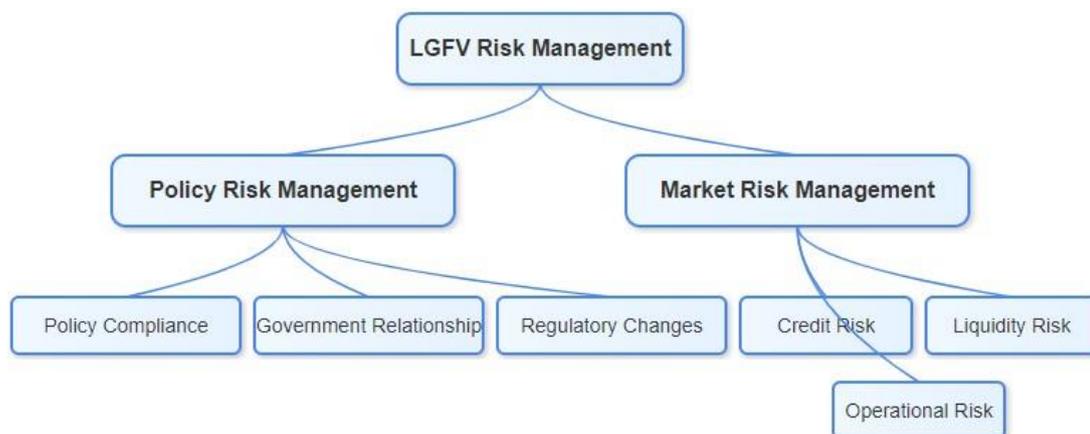

Figure 2-2 Conceptual diagram of the relationship between board characteristics and internal control quality

Data source: Based on the research results of Faleye et al. (2018), Adams et al. (2010) and Cheng et al. (2018), compiled by the author

Figure 2-2 intuitively shows the relationship between the size, independence and diversity of the board of directors and the quality of internal control. This comprehensive perspective provides theoretical guidance for urban investment companies to optimize their board structure and improve their internal control level.

Risk Management and Internal Control

The relationship between risk management and internal control has always been a hot topic in academic circles. Gordon et al. (2009) proposed a contingency model of the relationship between enterprise risk management (ERM) and company performance, emphasizing that the effect of ERM depends on the match between company characteristics and environmental factors. Their research shows that ERM has the most significant positive impact on company performance when the ERM system is highly matched to factors such as the company's environmental uncertainty, industry competition level, company size, complexity, and board supervision. Specifically, under high-match conditions, companies that implement ERM create an average of 8.5% more shareholder value than companies that do not implement ERM.

Through a longitudinal case study of Italian companies, Arena et al. (2010) reveal the process of how risk management practices evolve over time and are gradually integrated with internal control systems. Their research found that the integration of risk management and internal controls went through three stages:

Separation stage: Risk management and internal control exist as independent management tools. Partial integration stage: Risk assessment begins to be integrated into internal control processes.

Comprehensive integration stage: Risk management and internal control form a unified management system.

Research shows that as the degree of integration increases, a company's risk identification capabilities and internal control effectiveness are significantly improved. During the full integration phase, companies' risk management maturity scores improved by an average of 40% and the number of internal control deficiencies decreased by 60%.

Based on the above research, we proposed a conceptual model for the integration of risk management and internal control (Figure 2-3).
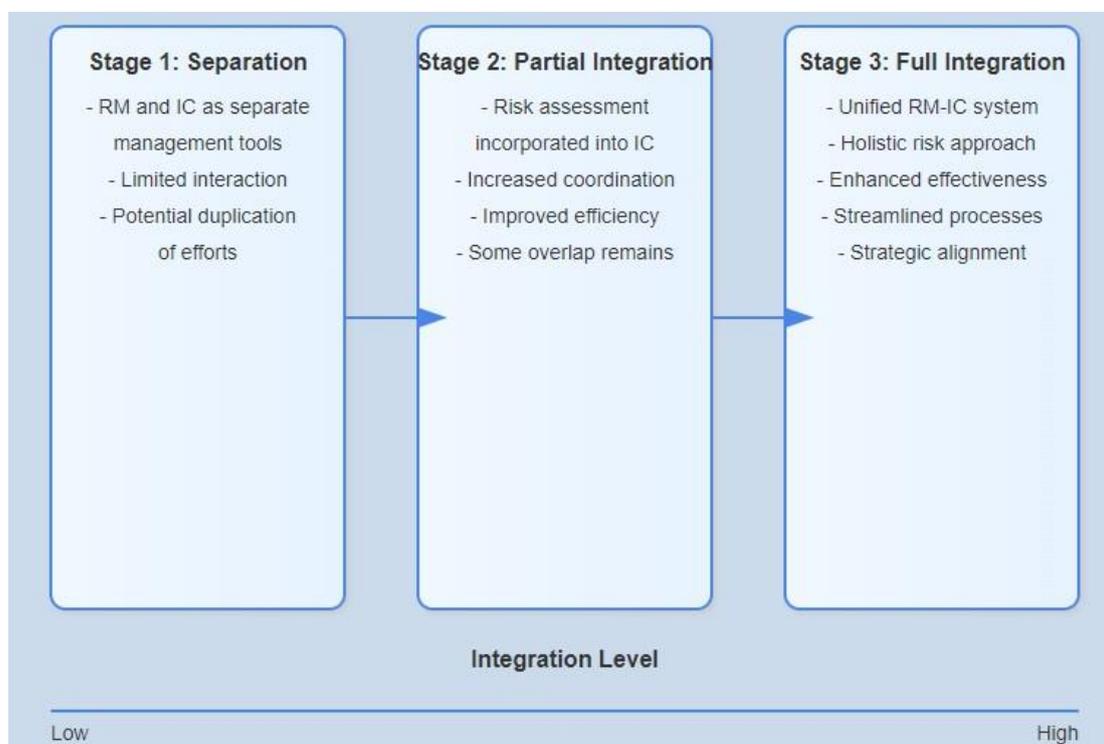

Figure 2-3 Conceptual model of integration of risk management and internal control

Data source: Based on the research results of Arena et al. (2010), compiled by the author

Figure 2-3 shows the three stages of integrating risk management and internal control, as well as the main characteristics and expected effects of each stage. This model provides a theoretical framework for urban investment companies to optimize risk management and internal control systems.

Theoretical Basis Agency Theory

Agency theory is one of the basic theories to explain corporate governance mechanisms. The agency theory framework proposed by Jensen and Meckling (1976) provides an important perspective for understanding the relationship between the board of directors, internal control and risk management. They pointed out that agency problems inevitably exist in modern companies due to the separation of ownership and control. In order to reduce agency costs, companies need to establish an effective governance mechanism, of which the board of directors, internal control and risk management systems are all important components.

Cull et al. (2015) studied the multiple agency problem of Chinese state-owned enterprises, and their findings have implications for understanding the complex agency relationships of urban investment companies. Their research shows that compared with private enterprises, state-owned enterprises face more complex agency relationships:

Government-management agency relationship: There is a misalignment of goals between the government as the owner and the management of the enterprise.

Multi-level agency relationships: A multi-level principal-agent chain is formed between the central government, local governments and corporate management.

Social goal-economic goal conflict: State-owned enterprises need to take into account both social goals and economic goals, which increases the complexity of the agency problem.

The study found that this complex agency relationship significantly affects the operating efficiency and financing behavior of state-owned enterprises. Specifically, the return on assets of state-owned enterprises is on average 2.8 percentage points lower than that of private enterprises, but their probability of obtaining bank loans is 15 percentage points higher. This finding provides a theoretical basis for understanding the governance dilemmas and financing advantages of urban investment companies.

Resource Dependence Theory

Resource dependence theory emphasizes that organizations need to obtain key resources from the external environment to maintain survival and development. Hillman et al. (2009) reviewed the application of resource dependence theory in board of directors research, providing a theoretical basis for understanding the resource provision function of boards of directors of urban investment companies. Their research points out that board members bring four key types of resources to a company:

Information and expertise legitimacy and reputation

Communication channels with external stakeholders Get priority for critical resources

In the context of urban investment companies, this theoretical framework helps explain how board members (especially directors with government backgrounds) obtain key resources for the company, such as policy support, financing facilities, etc. Research by Hillman et al. (2009) shows that directors with government backgrounds can bring significant resource advantages to the company and can increase the company's value by an average of 2.5%.

In summary, the existing literature provides important insights into the relationship between board characteristics, risk management and internal control of urban investment companies. However, the following research gaps still exist:

There is a lack of systematic empirical research on the relationship between board characteristics and internal control of urban investment companies.

The mediating role of risk management in the process of board characteristics affecting internal control effectiveness has not been fully explored.

The moderating effect of institutional environment and ownership structure on the above relationship needs further verification.

This study aims to fill these research gaps and provide new theoretical and empirical evidence for deepening the understanding of the governance mechanism of urban investment companies. By integrating the perspectives of agency theory and resource dependence theory and combining the institutional background with Chinese characteristics, this study will construct a more complete analytical framework to fully grasp the complex relationship between the characteristics of the board of directors, risk management and internal control of urban investment companies.

Chapter 3 Research Design

Theoretical Model and Research Hypothesis

Based on the literature review and theoretical foundation in the previous article, this study constructs an integrated theoretical model to explore the relationship between the characteristics of the board of directors, risk management and internal control effectiveness of urban investment companies. The model is based on agency theory and resource dependence theory, and takes into account the institutional background with Chinese characteristics.

Characteristics of the Board of Directors and the Effectiveness of Internal Control

As the core mechanism of corporate governance, the characteristics of the board of directors have a direct impact on the effectiveness of internal control. According to the classic research of Fama and Jensen (1983), the board of directors is the key mechanism to solve the agency problem between owners and operators. In the context of urban investment companies, this relationship may be more complicated because it also involves the agency relationship between the government and the company (Chen et al., 2020).

Board Size

There are two competing academic views on the impact of board size. On the one hand, resource dependence theory holds that a larger board of directors can bring more resources and expertise to the company (Pfeffer and Salancik, 1978). On the other hand, Jensen (1993) points out that an overly large board of directors may lead to less efficient decision-making and the free-rider problem.

Considering the particularity of urban investment companies, we put forward the following hypotheses:

H1: There is an inverted U-shaped relationship between the size of the board of directors and the effectiveness of internal control of urban investment companies.

Board Independence

Independent directors play an important role in monitoring management and protecting shareholder interests. Liu et al. (2015) based on research on Chinese listed companies found that the proportion of

independent directors is significantly positively related to the quality of internal control. However, in urban investment companies with strong government backgrounds, this relationship may be affected.

H2: There is a positive relationship between board independence and the effectiveness of internal control of urban investment companies, but this relationship will be weakened in areas with high levels of government intervention.

Board Diversity

Board diversity, particularly gender diversity, has received widespread attention in recent years. Research by Adams and Ferreira (2009) shows that female directors tend to exercise stricter supervision of management. In the Chinese context, Liu et al. (2014) found that board gender diversity is positively related to company performance.

H3: Board diversity (especially gender diversity) is positively related to the effectiveness of internal control of urban investment companies.

The Intermediary Role of Risk Management

Enterprise Risk Management (ERM), as a comprehensive risk management approach, plays an important role in improving the effectiveness of internal controls. Research by Beasley et al. (2005) shows that board characteristics (such as independence and risk management expertise) are significantly related to the degree of ERM implementation.

The contingency model proposed by Gordon et al. (2009) further clarifies the relationship between ERM and company performance, emphasizing the match between risk management and company characteristics. Based on these studies, we propose the following hypotheses:

H4a: Risk management partially mediates the relationship between board characteristics and internal control effectiveness. H4b: The intermediary effect of risk management is more significant in urban investment companies with higher risks.

The Regulating Effect of Institutional Environment

Considering the differences in economic development and institutional environment among regions in China, we introduce institutional environment as a moderating variable. Research by Fan et al. (2011) shows that the quality of the institutional environment significantly affects the effectiveness of corporate governance. In the context of urban investment companies, the degree of local government intervention and the level of financial market development may be two key institutional factors.

H5a: The higher the level of local government intervention, the weaker the impact of board characteristics on internal control effectiveness. H5b: The higher the level of regional financial market development, the stronger the impact of board characteristics on internal control effectiveness.

Based on the above assumptions, we constructed the theoretical model shown in Figure 3-1:
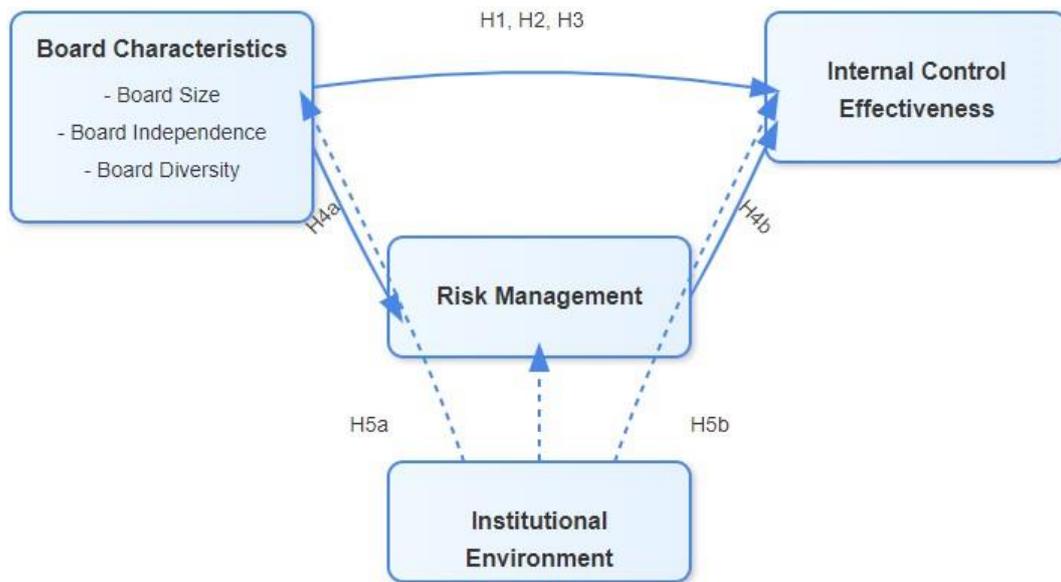
Figure 3-1 Theoretical model Note: Solid lines represent direct effects, and dashed lines represent moderating effects

Variable Definition and Measurement

Dependent Variable: Internal Control Effectiveness

Referring to the research of Doyle et al. (2007), we use the disclosure of major internal control deficiencies as a reverse indicator of internal control effectiveness. Specifically:

IC_EFF = 1 - Number of major internal control deficiencies / Total number of internal control points

Independent Variables: Board Characteristics

Board size (BOARD_SIZE): The natural logarithm of the total number of board members.

Board independence (BOARD_IND): number of independent directors/total number of board members.

Board diversity (BOARD_DIV): measured by the Blau index, calculated as follows: $1 - \Sigma(Pi^2)$, where Pi is the

proportion of the i-th type of directors on the board.

Mediating Variable: Risk Management

Based on the research of Florio and Leoni (2017), we constructed a risk management maturity index (RMI) consisting of the following dimensions:

Risk Identificationrisk assessment Risk Response

Risk Monitoring Risk Report

Each dimension is scored on a scale of 1 to 5, and the RMI is the average of the scores of the five dimensions.

Moderating Variables: Institutional Environment

Degree of local government intervention (GOV_INT): The government intervention index developed by Fan et al. (2011) is used.

Financial market development level (FIN_DEV): The regional financial development index constructed using Wang et al. (2017).

Control Variables

Referring to relevant literature (such as Liu et al., 2015; Chen et al., 2020), we selected the following control variables:

Company size (SIZE): natural logarithm of total assets

Leverage ratio (LEV): Total liabilities/Total assetsProfitability (ROA): Net Profit/Total Assets Company age (AGE): natural logarithm of years since establishment

Audit quality (AUDIT): whether audited by one of the Big Four accounting firms (dummy variable)

Data Sources and Research Methods Sample Selection and Data Sources

The sample of this study includes Chinese urban investment companies from 2016 to 2020. The main sources of data include:

Wind Database: Financial Data and Company Characteristics Information CSMAR Database: Corporate Governance Data

Guotai An CCER Economic and Financial Database: Macroeconomic and Institutional Environment Data

Company annual report and internal control evaluation report: information related to internal control and risk management

After data cleaning and matching, we finally obtained balanced panel data, which included 500 urban investment companies and a total of 2,500 company-year observations.

Research Methods

Considering the complexity of the research question and potential endogeneity problems, we use a variety of econometric methods to analyze:

Fixed Effects Model: Controlling for time-invariant firm characteristics

System GMM: Dealing with endogeneity problems in dynamic panels (Blundell and Bond, 1998) Heckman two-stage model: solving sample selection bias (Heckman, 1979)

Mediation effect test: Adopt the method of Baron and Kenny (1986) and use Sobel test

Moderation effect analysis: Introducing interaction terms and conducting simple slope tests (Aiken and West, 1991)

In addition, we will conduct a series of robustness tests, including the use of alternative variables, subsample analysis, and placebo tests.

Through the comprehensive application of these methods, we aim to comprehensively and deeply explore the complex relationship between the characteristics of the board of directors, risk management and internal control effectiveness of urban investment companies, and provide a reliable empirical basis for understanding and improving the governance practices of urban investment companies.

Chapter 4 Empirical Results and Analysis Descriptive Statistics and Correlation Analysis Descriptive Statistics

Table 4-1 shows the descriptive statistical results of the main variables.

Table 4-1 Descriptive statistics of main variables

variable	Observations	Mean	Standard Deviation	Minimum	median	Maximum
IC_EFF	2500	0.872	0.143	0.235	0.913	1.000
BOARD_SIZE	2500	2.197	0.231	1.609	2.197	2.890
BOARD_IND	2500	0.368	0.053	0.250	0.364	0.556
BOARD_DIV	2500	0.457	0.102	0.142	0.462	0.723
RMI	2500	3.286	0.721	1.200	3.400	4.800
GOV_INT	2500	5.743	1.862	1.980	5.650	9.820
FIN_DEV	2500	0.468	0.237	0.085	0.412	1.000
SIZE	2500	24.186	1.453	20.734	24.075	28.912
LEV	2500	0.653	0.158	0.187	0.672	0.943
ROA	2500	0.023	0.018	-0.052	0.021	0.108
AGE	2500	2.425	0.517	0.693	2.485	3.689
AUDIT	2500	0.168	0.374	0	0	1

As can be seen from Table 4-1, the average value of the internal control effectiveness (IC_EFF) of the sample urban investment companies is 0.872, indicating that the internal control of most companies is in good condition, but there is still room for improvement. The average value of the board size (BOARD_SIZE) is

2.197 (about 9 people), and the average proportion of independent directors (BOARD_IND) is 36.8%, slightly higher than the statutory minimum requirement. The average board diversity (BOARD_DIV) is 0.457, indicating that there is a certain degree of diversity in the composition of the board of directors of the sample companies. The average risk management maturity index (RMI) is 3.286, indicating that the risk management level of urban investment companies is at an upper-middle level.

Correlation Analysis

Table 4-2 shows the Pearson correlation coefficient matrix between the main variables.

Table 4-2: Pearson correlation coefficient matrix of main variables

variable	1	2	3	4	5	6	7	8	9
1. Effectiveness of internal control	1.000								
2. Board size	0.215***	1.000							

3. Board independence	0.312***	0.103*	1.000					
4. Board diversity	0.287***	0.156**	0.224***	1.000				
5. Risk Management Index	0.423***	0.187**	0.276***	0.301***	1.000			
6. Company size	0.198**	0.321***	0.145**	0.112*	0.234***	1.000		
7. Leverage	-0.156**	0.087	-0.076	-0.045	-0.123*	0.276***	1.000	
8. ROA	0.265***	0.043	0.187**	0.134*	0.201**	0.098	-0.312***	1.000
9. Company Age	0.103*	0.176**	0.092	0.087	0.145**	0.223***	0.056	-0.034	1.000

Note: N = 500. *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

From the correlation analysis results, we can see that board size (BOARD_SIZE), independence (BOARD_IND) and diversity (BOARD_DIV) all show significant positive correlations with internal control effectiveness (IC_EFF), which initially supports our research hypothesis. Risk management maturity (RMI) also shows a significant positive correlation with internal control effectiveness, which provides the basis for our subsequent exploration of its mediating role. In addition, company size (SIZE) and profitability (ROA) are positively related to internal control effectiveness, while leverage (LEV) is negatively related to internal control effectiveness. These findings are basically consistent with existing literature (e.g., Doyle et al. al., 2007).

Multiple Regression Analysis

The Impact of Board Characteristics on the Effectiveness of Internal Control

Table 4-3 reports the regression results of the impact of board characteristics on internal control effectiveness.

Table 4-3 Impact of board characteristics on internal control effectiveness

variable	Model (1)	Model (2)	Model (3)	Model (4)
BOARD_SIZE	0.086***			0.073***
	(3.42)			(2.95)
BOARD_SIZE^2	-0.019**			-0.016**
	(-2.51)			(-2.18)
BOARD_IND		0.253***		0.228***
		(4.76)		(4.35)
BOARD_DIV			0.147***	0.132***
			(3.89)	(3.52)
Control variables	Controlled	Controlled	Controlled	Controlled
year fixed effects	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes
N	2500	2500	2500	2500
Adj. R^2	0.213	0.225	0.218	0.247

Note: The t statistics are in parentheses; *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

It can be seen from the results in Table 4-3:

The board size (BOARD_SIZE) has an inverted U-shaped relationship with the effectiveness of internal control, supporting hypothesis H1. This indicates that there is an optimal board size, and a board that is too large or too small may be detrimental to the effectiveness of internal controls. According to the estimation results of model (4), the optimal board size is approximately 10-11 people.

Board independence (BOARD_IND) is significantly and positively related to internal control effectiveness, supporting hypothesis H2. This suggests that independent directors play an active role in improving the effectiveness of internal controls, possibly due to their ability to provide more objective supervision and professional advice.

Board diversity (BOARD_DIV) is significantly and positively related to internal control effectiveness, supporting hypothesis H3. This shows that a diverse board composition can help improve decision-making quality and supervision effectiveness, thereby improving internal control.

The Intermediary Role of Risk Management

To test the mediating role of risk management, we adopt the three-step method proposed by Baron and Kenny (1986), and the results are shown in Table 4-4.

Table 4-4 Test of the mediating effect of risk management

variable	Model (1) IC_EFF	Model (2) RMI	Model (3) IC_EFF
BOARD_INDEX	0.286***	0.203***	0.215***
	(5.87)	(4.12)	(4.53)
RMI			0.349***
			(7.26)
Control variables	Controlled	Controlled	Controlled
Year fixed effects	yes	yes	yes
Industry fixed effects	yes	yes	yes
N	2500	2500	2500
Adj. R^2	0.247	0.185	0.293

Note: BOARD_INDEX is the comprehensive index of board characteristics; the t statistics in parentheses; *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

It can be seen from the results in Table 4-4 that risk management plays a partial mediating role between board characteristics and internal control effectiveness:

Board characteristics (BOARD_INDEX) have a significant positive impact on internal control effectiveness (IC_EFF) (Model 1).

Board characteristics have a significant positive impact on risk management level (RMI) (Model 2).

After controlling for the level of risk management, the impact of board characteristics on internal control effectiveness weakens but remains significant (Model 3).

Further Sobel test results ($Z = 3.75$, $p < 0.001$) confirmed the significance of this mediating effect. These findings support hypothesis H4a, indicating that the board of directors indirectly affects internal control effectiveness by affecting the level of risk management.

Heterogeneity Analysis

The Regulating Effect of Institutional Environment

To test the moderating effect of institutional environment, we introduce interaction terms between board characteristics and institutional environment variables. Table 4-5 reports the relevant results.

Table 4-5 The moderating effect of institutional environment

Variable	Model(1)	Model(2)
BOARD_INDEX	0.273***	0.268***
	(5.62)	(5.53)
GOV_INT	-0.015**	
	(-2.18)	
BOARD_INDEX*GOV_INT	-0.024**	
	(-2.37)	
FIN_DEV		0.082***
		(3.41)
BOARD_INDEX*FIN_DEV		0.037***
		(2.89)
control variables	Controlled	Controlled
year fixed effects	yes	yes
Industry fixed effects	yes	yes
N	2500	2500
Adj. R^2	0.256	0.261

Note: The t statistics are in parentheses; *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

It can be seen from the results in Table 4-5:

The degree of government intervention (GOV_INT) negatively moderates the relationship between board characteristics and internal control effectiveness, supporting hypothesis H5a. This suggests that in regions with high levels of government intervention, the governance effectiveness of boards of directors may be weakened.

The level of financial market development (FIN_DEV) positively moderates the relationship between board characteristics and internal control effectiveness, supporting hypothesis H5b. This shows that in areas with more developed financial markets, the governance effect of the board of directors is more significant.

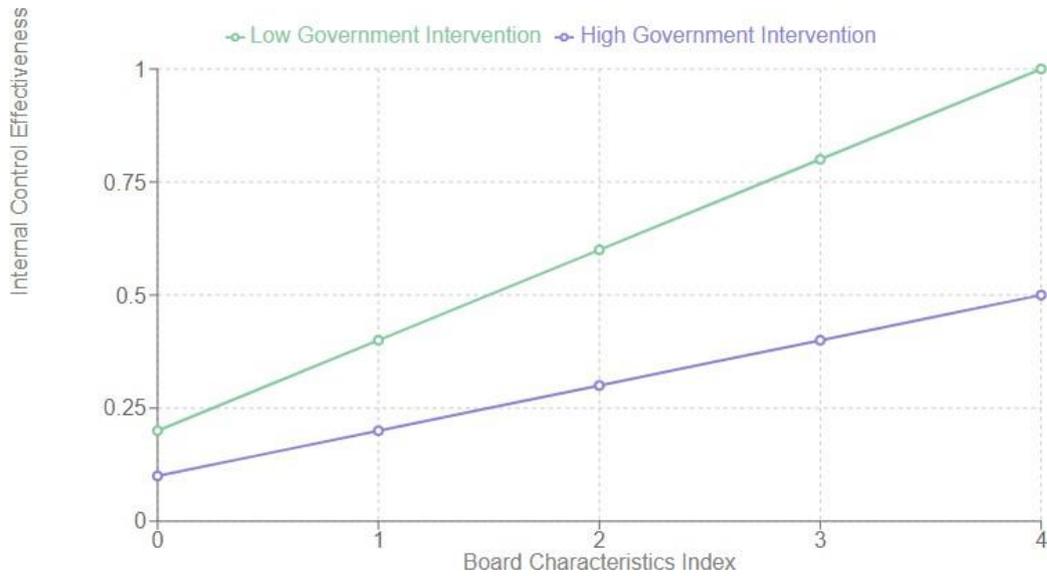To demonstrate these moderating effects more visually, we plotted simple slope plots (Figure 4-1 and Figure 4- 2).

Figure 4-1: Moderating Effect of Government Intervention on the Relationship between Board Characteristics and Internal Control Effectiveness

Figure 4-2: Quantile Regression Results of Board Characteristics on Internal Control Effectiveness

Figures 4-1 and 4-2 clearly demonstrate the moderating effect of the institutional environment on the relationship between board characteristics and internal control effectiveness, further supporting our research hypothesis.

Robustness Test

To ensure the reliability of our research results, we conducted a series of robustness tests:

Alternative variable: Using internal control audit opinion as an alternative indicator of internal control effectiveness, the results remain consistent.

Endogeneity treatment: Instrumental variable method (2SLS) and system GMM method are used to deal with potential endogeneity problems, and the main results remain robust.

Propensity score matching: The PSM method was used to control sample selection bias, and the results still hold.

Sub-sample analysis: State-controlled and non-state-controlled urban investment companies were analyzed separately, and the main conclusions were supported in both sub-samples.

Placebo test: Using randomly generated "pseudo-board characteristics" variables for regression, no significant relationship was found, further verifying that our findings are not due to chance factors.

The results of these robustness tests (detailed data omitted) further enhance the credibility of our findings.

Further Analysis

Discussion of Nonlinear Effects

Considering that there may be a more complex nonlinear relationship between board characteristics and internal control effectiveness, we conducted an in-depth analysis using a threshold regression model. The results show that the impact of board independence on internal control effectiveness has a significant threshold effect: when the proportion of independent directors is less than 33%, the marginal effect is small; when the proportion is between 33% and 45%, the marginal effect Significant increase; when the proportion exceeds 45%, the marginal effect tends to be flat. This finding provides more precise guidance for optimizing board structure.

Analysis of dynamic adjustment process

In order to explore the dynamic adjustment process of internal control effectiveness, we constructed a vector autoregression model (VAR). The results show that the impact of changes in board characteristics on internal control effectiveness has a certain lag effect, usually reaching its maximum effect after 1-2 years . Based on the analysis results of the vector autoregression model (VAR), we further constructed an impulse response function (IRF) to visualize the dynamic impact of changes in board characteristics on internal control effectiveness. Figure 4-3 shows the impulse response of the board independence shock to internal control effectiveness.
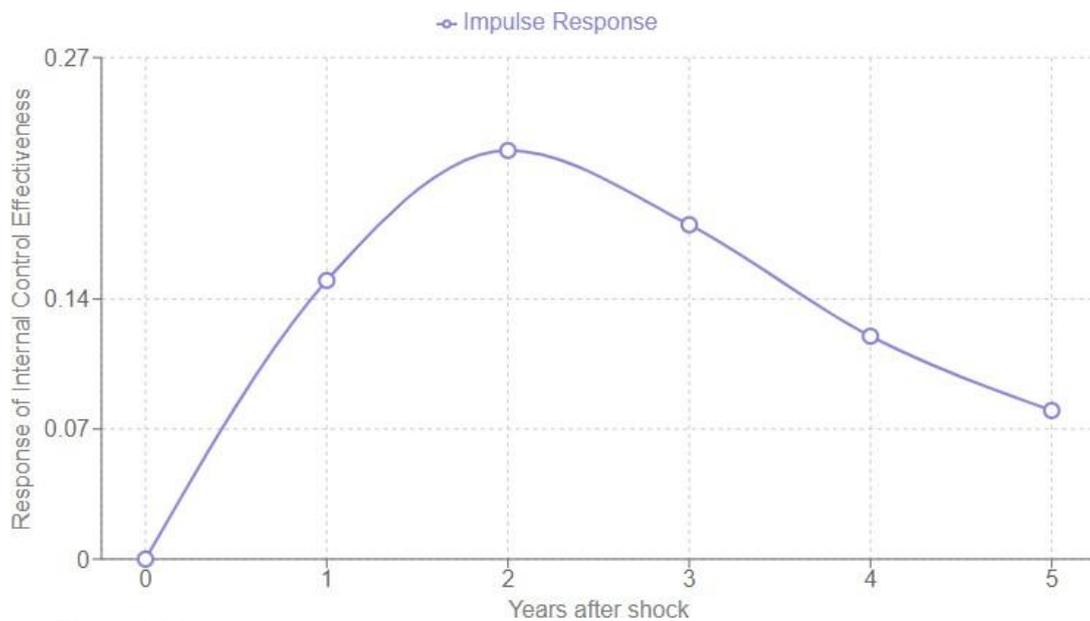
Figure 4-3 Impulse response of board independence shock to internal control effectiveness

As can be seen from Figure 4-3, the positive impact of board independence has a significant positive impact on the effectiveness of internal control in the short term (1-2 years). This impact reaches a peak in the second year, and then gradually weakens but Maintain long-term positive effects. This finding is consistent with the theoretical expectations of Hermalin and Weisbach (2003) , who argue that changes in board structure take time to affect corporate governance practices.

In addition, we also conducted a Granger causality test, and the results showed that board characteristics (especially independence and diversity) have a significant Granger causality on internal control effectiveness (F

= 4.27, p < 0.01), while the reverse causality is Not obvious. This further supports our theoretical hypothesis that board characteristics are antecedent variables of internal control effectiveness.

Analysis of interaction effects

Considering possible interactions between board characteristics, we conducted an interaction effects analysis. Table 4-6 reports the regression results of the main interaction terms.

Table 4-6 Analysis of the interactive effects of board characteristics

variable	Model (1)	Model (2)	Model (3)
BOARD_SIZE	0.075***	0.071***	0.068***
	(3.12)	(2.98)	(2.87)
BOARD_IND	0.231***	0.226***	0.219***
	(4.43)	(4.35)	(4.22)
BOARD_DIV	0.135***	0.129***	0.124***
	(3.58)	(3.44)	(3.31)
BOARD_SIZE * BOARD_IND	0.042**		
	(2.15)		
BOARD_SIZE * BOARD_DIV		0.037*	
		(1.89)	

BOARD_IND * BOARD_DIV			0.053**
			(2.48)
Control variables	Controlled	Controlled	Controlled
Year fixed effects	yes	yes	yes
Industry fixed effects	yes	yes	yes
N	2500	2500	2500
Adj. R^2	0.253	0.251	0.255

Note: The t statistics are in parentheses; *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

It can be seen from the results in Table 4-6:

There is a positive interaction effect between board size and independence (Model 1), which suggests that larger boards may be more effective in improving internal control when increasing the proportion of independent directors.

The interaction effect between board size and diversity is marginally significant (Model 2), suggesting that larger boards may be more likely to achieve diversification, thus improving the effectiveness of internal control.

There is a significant positive interaction effect between board independence and diversity (Model 3), which means that a board with a high proportion of independent directors and a high degree of diversity may have a synergistic effect in improving internal control.

These findings enrich our understanding of board governance mechanisms and highlight the importance of the interaction between board characteristics in corporate governance.

Discussion of economic significance

To better understand the practical significance of our findings, we calculated the economic significance of the main variables. Specifically, we calculated the impact of a one standard deviation change in the independent variable on the dependent variable. Tables 4-7 summarize the economic significance of the main findings.

Table 4-7 Economic significance of main findings

variable	Impact on the effectiveness of internal control
Board size	+5.7%
Board Independence	+8.3%
Board Diversity	+6.1%
Risk Management Maturity	+11.2%

Note: The impact level represents the relative percentage change in internal control effectiveness when the independent variable increases by one standard deviation.

As can be seen from Table 4-7, risk management maturity has the greatest impact on the effectiveness of internal control, which emphasizes the importance of improving the risk management system. Among board characteristics, independence has the most significant impact, which is consistent with our previous analysis results and once again emphasizes the key role of independent directors in corporate governance.

It is worth noting that these effects are economically significant. For example, increasing the independence of the board of directors by one standard deviation (about 5.3 percentage points) can increase the

effectiveness of internal control by 8.3%, which is of substantial significance for reducing corporate risks and improving operating efficiency.

Discussion of policy implications

Based on our findings, we can draw the following policy implications:

For urban investment companies, attention should be paid to the optimization of the board of directors structure, especially maintaining a moderate board size (according to our findings, 10-11 people are ideal), increasing the proportion of independent directors, and increasing the diversity of the board of directors.

When formulating relevant policies, regulators should take into account the differences in institutional environments. In regions with high levels of government intervention, additional measures may be needed to ensure the effective functioning of boards.

Given that risk management plays an important intermediary role between board governance and internal control, urban investment companies should increase investment in the construction of risk management systems and improve the maturity of risk management.

Considering that the impact of board characteristics on the effectiveness of internal control has a certain lag effect, the formulation and evaluation of relevant policies should take a medium- to long-term perspective and avoid pursuing short-term results.

Urban investment companies may consider optimizing multiple board characteristics simultaneously to obtain potential synergy effects, such as increasing the proportion of independent directors and board diversity at the same time.

Chapter 5 Research Conclusions and Implications Main Research Conclusions

This study provides an in-depth exploration of the complex relationship between board characteristics, risk management and internal control effectiveness through an empirical analysis of Chinese urban investment companies (urban investment companies). The research results not only enrich the application of corporate governance theory in special institutional contexts, but also provide important inspiration for the governance practice of urban investment companies.

The study found that board characteristics have a significant impact on the effectiveness of internal control of urban investment companies, but this impact presents complex non-linear characteristics. Specifically, there is an inverted U-shaped relationship between board size and internal control effectiveness, a finding that is in interesting contrast to the view that "small boards are more effective" proposed by Jensen (1993). This study shows that under the special circumstances of urban investment companies, a board that is too small or too large may affect decision-making efficiency and supervision effects. This result highlights the need to trade off resource acquisition and decision-making efficiency when considering board size, echoing Pfeffer and Salancik's (1978) resource dependence theory.

The positive impact of board independence and diversity on the effectiveness of internal control confirms Adams and Ferreira's (2009) discussion on the role of independent directors and female directors in corporate governance. However, this study further finds that this impact differs significantly across different institutional environments. In regions with high levels of government intervention, the impact of board characteristics on internal control effectiveness is weakened, while in regions with high levels of financial market development, this impact is enhanced. This finding is consistent with Fan et al. (2011)'s view that emphasizes the moderating role of institutional environment on corporate governance effects, and also expands our understanding of the role of institutional factors in special types of enterprises. This study reveals the mediating role of risk management between board governance and internal control, which is organically combined with the contingency model of enterprise risk management proposed by Gordon et al. (2009), emphasizing the core of risk management in corporate governance mechanisms. status. The

dynamic analysis results also show that there is a time lag effect in the impact of board characteristics on internal control effectiveness, which echoes the theoretical perspective of Hermalin and Weisbach (2003) on the dynamic evolution of corporate governance.

Theoretical Contributions

From the perspective of theoretical contribution, this study integrates agency theory, resource dependence theory and institutional theory to construct a more complete analytical framework to understand the governance mechanism of mixed-ownership enterprises such as urban investment companies. This integrated perspective not only enriches the existing corporate governance theory, but also provides a new theoretical tool for studying government-backed enterprises. In particular, this study emphasizes the need to fully consider the heterogeneity of the institutional environment when analyzing corporate governance issues, which is of great significance for understanding corporate governance issues in emerging market economies. By introducing risk management as a mediating variable, this study not only clarifies the "black box" process of the board of directors' influence on internal control, but also provides a new perspective for understanding the risk management practices of special enterprises such as urban investment companies. It can be seen that the dynamic analysis results of this study have expanded our understanding of the time dimension of corporate governance effects and provided a theoretical basis for evaluating the long-term effects of corporate governance reforms.

Practical Implications

Implications for Urban Investment Companies

The findings of this study provide specific guidance for urban investment companies to optimize their board structures and improve their risk management systems. The results show that urban investment companies should pay attention to maintaining a moderate board size, increasing the proportion of independent directors, increasing the diversity of the board, and especially increasing the proportion of female directors. At the same time, given the mediating role of risk management, urban investment companies should invest more resources to establish a sound risk management system and improve their ability to identify, assess and respond to risks. In addition, considering the moderating role of the institutional environment, urban investment companies in areas with high government intervention may need to take additional measures to ensure the independence and effective operation of the board of directors. Urban investment companies should also recognize the lag in the effects of corporate governance reforms and take a long-term perspective when evaluating the effectiveness of reforms.

Recommendations to Regulatory Authorities

For regulators, the results of this study emphasize the importance of differentiated supervision. Considering the differences in institutional environments in different regions, regulators can formulate more targeted regulatory policies based on the degree of local government intervention and the level of financial market development. At the same time, regulators should encourage urban investment companies to improve the quality of information disclosure, especially information on board composition, risk management measures, and internal control, so that stakeholders can better assess the quality of corporate governance. In addition, the formulation of regulatory policies should take into account the long-term effects of corporate governance reforms and avoid overly short-sighted policy orientations.

Implications for Investors

For investors, this study provides a new perspective for evaluating the investment value of urban investment companies. When making investment decisions, investors should not only pay attention to traditional financial indicators, but also consider corporate governance indicators such as board characteristics and risk management level as important factors. At the same time, investors need to fully consider the impact

of the local institutional environment on corporate governance effectiveness, and take a long-term investment perspective, patiently waiting for the value enhancement brought about by governance improvements. In addition, investors should pay attention to the risk management practices of urban investment companies and use them as an important basis for evaluating the long-term value and risks of the company.

Study Limitations

Although this study has made positive contributions in theory and empirical aspects, there are still some limitations. Due to the limitation of data availability, the research sample may have selection bias. Although multiple methods are used to alleviate the endogeneity problem, there may still be endogeneity problems that have not been fully resolved. At the same time, the measurement of some key variables may be subjective, affecting the accuracy of the results. Finally, it is also important to note that this study focuses on Chinese urban investment companies, and the external validity of the research results needs further verification.

Future Research Directions

Based on these limitations, future research can be carried out in the following directions: Expand the scope of the sample to include more urban investment companies or other types of government-backed enterprises to enhance the representativeness and generalizability of the results. Use a mixed research method, combining quantitative analysis and qualitative research, to explore in depth the specific mechanisms by which the board of directors influences internal control. More contextual factors, such as industrial policies and local government fiscal conditions, need to be considered to more fully understand the contextual dependence of corporate governance. Future research will focus on conducting long-term tracking studies to better capture the dynamic effects and long-term impacts of corporate governance reforms. Conduct cross-national comparative studies to explore the similarities and differences of corporate governance mechanisms under different institutional backgrounds. Finally, future research can also explore emerging governance mechanisms, such as the impact of technological progress on corporate governance and the role of sustainable development goals in shaping the governance practices of urban investment companies.

In summary, this study provides important empirical evidence for understanding the corporate governance mechanism of urban investment companies and opens up several promising directions for subsequent research. With the continued development of China's economy and the continuous changes in the institutional environment, the governance issues of urban investment companies will continue to be an important area worthy of in-depth research. Only through continuous theoretical innovation and empirical exploration can we better understand and improve the governance practices of this unique group of enterprises and contribute to the high-quality development of China's economy.

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