

**The Influence of Board Human Capital and Social  
Capital on the Core Competitiveness  
of Chinese Firms: An Empirical Study of the  
Automotive Industry**

by

He Qian  
(21010287)



Presented to the  
FACULTY OF ECONOMICS AND BUSINESS  
in Fulfillment of the Requirement for the Degree of

**DOCTOR OF PHILOSOPHY**  
(Accounting)

**2026**

**UNIVERSITI MALAYSIA SARAWAK**

## **DECLARATION**

I hereby declare that the work presented in this thesis was conducted in full compliance with the regulations of Universiti Malaysia Sarawak (UNIMAS). Except where proper acknowledgment is given, this work is solely the effort of the author. This thesis has not been accepted for the award of any other degree and is not being **concurrently** submitted for any other academic qualification.

Signature \_\_\_\_\_

Student Name: He Qian

Matric No: 21010287

Date: 13 April 2026

**Faculty of Economics and Business**

Universiti Malaysia Sarawak (UNIMAS)

## ACKNOWLEDGMENT

I extend my heartfelt gratitude to the individuals and institutions whose support and contributions have been integral to the completion of this doctoral thesis in Management at Universiti Malaysia Sarawak (UNIMAS).

First and foremost, I am deeply indebted to my advisor, Associate Professor Dr. Salawati binti Sahari, whose dedication and guidance were invaluable throughout this journey. Long before the official commencement of my thesis, Associate Professor Dr. Salawati generously imparted essential methods and techniques in academic writing, consistently encouraging me to broaden my reading and build a strong foundation of knowledge. Her patient revisions and insightful feedback at every stage of my writing were instrumental in refining my research. I am profoundly grateful for her selfless support.

I would also like to express my sincere appreciation to my second supervisor, Associate Professor Michael anak Tinggi, for his invaluable insights, encouragement, and scholarly contributions that significantly enhanced this thesis. His constructive critique and guidance were vital to shaping my work and ensuring its rigor.

Furthermore, I am grateful to my classmates and roommates, whose assistance in data collection and information sourcing proved essential to this project. Their camaraderie and support in both academic and personal aspects of my life have been a source of strength.

To my parents, who have nurtured me with unwavering love and high expectations, I owe a debt of gratitude that words cannot fully express. Their steadfast belief in my potential and their encouragement has been foundational to my achievements.

Finally, I acknowledge the authors and scholars whose work I have cited. Without the knowledge and perspectives shared through their research, this thesis would have been far more challenging to complete. I humbly recognize that, as a researcher, I still have much to learn, and I sincerely welcome any feedback or suggestions for improvement

would like to take this opportunity to those who have contributed directly or indirectly to this guidebook.

My sincere gratitude to the Centre for Graduate Studies, for the advice and support given during my period of study in Universiti Malaysia Sarawak.

Finally, I would like to thank the management of the Universiti Malaysia Sarawak for making it possible for me to complete my study here in Sarawak.

Thank you all.

***The Influence of Board Human Capital and Social Capital on the Core Competitiveness of Chinese Firms: An Empirical Study of the Automotive Industry***

**ABSTRACT**

As a cornerstone of China's manufacturing and technological innovation driver, the Chinese automotive industry is pivotal to transitioning to high-end manufacturing and an innovation-oriented economy. Despite significant scale growth, it faces challenges like insufficient independent core technologies amid intensified competition, industrial transformation and dual carbon goals, making core competitiveness enhancement critical. Existing board governance research focuses on short-term financial outcomes, isolates board human and social capital, and overlooks executive incentives' moderating role in emerging markets, which are gaps this study addresses. This study employs a balanced panel dataset comprising 3,923 firm-year observations from 173 A-share listed automotive companies in China, covering the period from 2018 to 2023. After eliminating anomalous data retrieved from the Guotaian database, the analysis investigates the influence of board human capital and board social capital on corporate core competitiveness, while further exploring the moderating role of executive incentive mechanisms in these relationships. Specifically, the objectives are to test: i) To examine the positive impact of human capital on corporate core competitiveness; ii) To examine the positive impact of social impact on corporate core competitiveness; iii) To examine the moderating effect of board compensation on the relationship between human capital and corporate core competitiveness; and iv) To examine the moderating effect of board compensation on the relationship between social capital and corporate core competitiveness. Utilizing STATA 17, descriptive statistics, Pearson correlation analysis, Hausman tests, fixed-effects regression, interaction analyses, and robustness checks excluding data from the COVID-19 period are employed. The key findings indicate that the proportions of female directors and independent directors, their financial backgrounds, and their service in other companies significantly enhance core competitiveness, while overseas experience plays a relatively minor role; management shareholding chiefly amplifies the effects of education and director ownership, independence, financial expertise, and international perspective; all

results remain robust after pandemic exclusions. From a theoretical standpoint, this study further refines the explanatory framework of the Upper Echelons Theory by incorporating incentive mechanisms. Practically, it offers empirical guidance for optimizing board composition and tailoring incentive schemes in the Chinese automotive sector. Future research should validate our framework in other industries or cross-country settings and explore the mediating and dynamic mechanisms through which board capital delivers value.

**Keywords:** Board capital, Human capital, Social capital, Core competitiveness.

***Pengaruh Modal Manusia dan Modal Soslih Lembaga Pengarah terhadap  
Daya Saing Teras Firma-firma China: Satu Kajian Empirik ke atas  
Industri Automotif***

***ABSTRAK***

*Sebagai tunggalan industri pembuatan China dan pemacu inovasi teknologi, industri automotif China memainkan peranan krusial dalam peralihan ke industri pembuatan berperingkat tinggi dan ekonomi berorientasikan inovasi. Walaupun pencapaian pertumbuhan skala yang signifikan, industri ini menghadapi cabaran seperti kekurangan teknologi teras bebas tanggungjawab di tengah persaingan yang semakin ketat, transformasi industri dan matlamat dua karbon, menjadikan peningkatan daya saing teras sebagai perkara kritikal. Penyelidikan tadbir urus lembaga pengarah sedia ada memfokuskan pada hasil kewangan jangka pendek, mengasingkan modal insan dan modal sosial lembaga pengarah, serta mengabaikan peranan penyederhanaan insentif eksekutif di pasaran sedang berkembang—yang merupakan jurang penyelidikan yang akan ditangani oleh kajian ini. Kajian ini menggunakan set data panel seimbang yang terdiri daripada 3,923 pemerhatian firma-tahun daripada 173 syarikat automotif tersenarai A-share di China, meliputi tempoh dari 2018 hingga 2023. Selepas menapis data yang tidak munasabah daripada pangkalan data Guotaian, analisis ini dijalankan untuk menilai kesan modal insan dan modal sosial lembaga pengarah terhadap daya saing teras korporat, serta meneliti peranan moderasi mekanisme insentif eksekutif dalam hubungan tersebut. Secara khusus, objektif kajian ini merangkumi: i) Untuk mengkaji kesan positif modal insan terhadap daya saing teras korporat; ii) Untuk mengkaji kesan positif modal sosial terhadap daya saing teras korporat; iii) Untuk mengkaji kesan penyederhanaan pampasan lembaga pengarah terhadap hubungan antara modal insan dan daya saing teras korporat; dan iv) Untuk mengkaji kesan penyederhanaan pampasan lembaga pengarah terhadap hubungan antara modal sosial dan daya saing teras korporat. Melalui perisian STATA 17, kajian ini melibatkan statistik deskriptif, korelasi Pearson, ujian Hausman, regresi kesan tetap, analisis interaksi, serta ujian keteguhan dengan pengecualian data semasa pandemik COVID-19. Penemuan utama menunjukkan bahawa peratusan pengarah wanita dan pengarah bebas, latar belakang kewangan, serta pengalaman menjadi*

*pengarah di syarikat lain meningkatkan daya saing teras secara signifikan, manakala latar belakang luar negara menunjukkan kesan yang lebih lemah. Pegangan saham oleh pengurusan memainkan peranan penting dalam mengukuhkan kesan pendidikan, pemilikan pengarah, kebebasan, kepakaran kewangan, dan perspektif antarabangsa. Semua keputusan kekal mantap selepas pengecualian data pandemik. Dari sudut teori, kajian ini memperluas kebolegunaan teori pergantungan sumber dalam konteks pasaran baru muncul di China dan memperhalusi rangka kerja teori agensi melalui integrasi mekanisme insentif. Dari sudut praktikal, ia menyediakan panduan empirikal untuk mengoptimumkan komposisi lembaga dan menyesuaikan skim insentif dalam sektor automotif China. Kajian masa depan dicadangkan untuk mengesahkan kerangka ini dalam industri lain atau konteks rentas negara, serta meneroka mekanisme perantaraan dan dinamik yang melalui modal lembaga memberikan nilai kepada firma.*

**Kata Kunci:** Modal lembaga, Modal insan, Modal sosial, Daya saing teras.

## TABLE OF CONTENTS

DECLARATION .....	i
ACKNOWLEDGMENT .....	ii
ABSTRACT .....	iii
<i>ABSTRAK</i> .....	v
TABLE OF CONTENTS .....	vii
LIST OF TABLES .....	x
LIST OF FIGURES .....	xii
<b>CHAPTER 1: INTRODUCTION .....</b>	<b>1</b>
1.1 Introduction .....	1
1.2 Study Background .....	2
1.3 Problem Statement .....	6
1.4 Research Questions .....	7
1.5 Research Objectives .....	8
1.6 Purpose of Study .....	8
1.7 Significance of Study .....	9
1.7.1 Theoretical contribution .....	9
1.7.2 Practical contribution .....	10
1.8 Research Scope .....	11
1.9 Structure of Thesis .....	13
<b>CHAPTER 2: LITERATURE REVIEW .....</b>	<b>15</b>
2.1 Introduction .....	15
2.2 Concept and Definition of Enterprise Core Competitiveness .....	15
2.2.1 Definition and Evolution .....	15
2.2.2 Relationship and Distinction between Core Competitiveness and Core Competencies .....	17
2.2.3 Theoretical Evolution and Research Frontiers of Core Competitiveness .....	19
2.3 Executive-related concepts .....	20
2.3.1 Executive .....	20
2.3.2 Executive Compensation .....	21
2.4 The Relationship Between Control variables and Core Competitiveness .....	22
2.5 Research Gap .....	24
2.6 Research Framework .....	25
2.7 Research theory .....	29
2.8 Hypotheses Development .....	37
2.9 Conclusion .....	39

<b>CHAPTER 3: METHODOLOGY .....</b>	<b>41</b>
3.1 Introduction .....	41
3.2 Research Design .....	42
3.3 Sample Selection and Data Sources .....	43
3.3.1 Population and Sample Definition .....	43
3.3.2 Secondary Data .....	43
3.3.3 Data Pre-Processing .....	45
3.4 Instrument Development and Variable Measurement .....	45
3.4.1 Board Capital Indices .....	45
3.4.2 Firm Core Competitiveness .....	46
3.5 Variable Measurement .....	46
3.5.1 Dependent Variables .....	47
3.5.2 Independent Variables .....	49
3.5.3 Moderating Variables .....	52
3.5.4 Control Variables .....	52
3.5.5 Operational Definitions of Core Concepts .....	55
3.6 Research Estimation Model .....	57
3.7 Data Analysis .....	63
3.7.1 Descriptive Statistics .....	64
3.7.2 Date Standardization Processing .....	65
3.7.3 Correlation Statistics .....	65
3.7.4 KMO Test and Bartlett's Test of Sphericity .....	67
3.7.5 Principal Component Analysis .....	68
3.7.6 Panel Data Regression Analysis .....	70
3.7.7 Robustness Analysis .....	72
3.8 Three-Stage Quantitative Paradigm .....	74
3.9 Conclusion .....	75
<b>CHAPTER 4: RESULTS AND DISCUSSIONS .....</b>	<b>77</b>
4.1 Introduction .....	77
4.2 Corporate Core Competencies under Principal Component Analysis .....	78
4.2.1 Descriptive Statistics .....	78
4.2.2 Correlation Analysis .....	80
4.2.3 KMO Test and Bartlett's Test of Sphericity .....	82
4.2.4 Factor extraction .....	83
4.2.5 Factor Naming and Explanation .....	85
4.2.6 Calculation of Factor Scores .....	86
4.2.7 Descriptive analysis for core competencies measurement .....	87
4.3 An Empirical Analysis of Board Capital and Corporate Core Competitiveness .....	89
4.3.1 Descriptive Analysis .....	89
4.3.2 Correlation Analysis of Main Variables .....	93
4.3.3 Hausman Test .....	107
4.3.4 Fixed-Effects Regression Analysis of Board Human Capital on Corporate Core Competitiveness .....	110

4.3.5	Fixed-Effects Regression Analysis of Board Social Capital on Corporate Core Competitiveness .....	115
4.3.6	Analysis of the Executive Compensation Impact on the Relationship between Board Human Capital and Corporate Core Competitiveness .....	121
4.3.7	Analysis of the Executive Compensation Impact on the Relationship between Board Social Capital and Corporate Core Competitiveness .....	127
4.3.8	Robustness Test .....	132
4.4	Discussion .....	140
4.4.1	The Positive Impact of Board Human Capital on Core Competitiveness .....	140
4.4.2	The Positive Impact of Board Social Capital on Core Competitiveness .....	145
4.4.3	The Moderating Role of Compensation Incentives in Human Capital and Enterprises' Core Competitiveness .....	150
4.4.4	The Moderating Role of Compensation Incentives In Social Capital and Enterprises' Core Competitiveness .....	158
4.5	Conclusion .....	165

**CHAPTER 5: CONCLUSION AND RECOMMENDATIONS .....166**

5.1	Introduction .....	166
5.2	Summary of Findings .....	167
5.3	Theoretical Contributions .....	171
5.3.1	Expansion of Corporate Governance Theory .....	171
5.3.2	Deepening of Compensation Incentive Theory .....	172
5.4	Practical Contributions .....	172
5.4.1	Guidance for Board Composition Optimization .....	172
5.4.2	Reference for Compensation Incentive Design .....	173
5.4.3	Support for Strategic Adaptation .....	173
5.5	Methodological Contributions .....	174
5.6	Research Limitations and Future Prospects .....	174
5.6.1	Research Limitations .....	174
5.6.2	Research Prospects .....	176
5.7	Conclusion .....	177

**REFERENCES ..... 178**

## LIST OF TABLES

Table 1.1: Quick View .....	12
Table 2.1: Comparison of Core Competencies and Core Competitiveness Dimensions .....	18
Table 3.1: Financial Dimension Indicators and Codes Table .....	48
Table 3.2: Variables measurements .....	54
Table 3.3: Concepts and Measurement Indicators .....	55
Table 3.4: Descriptions for Equation 3.1 .....	57
Table 3.5: Descriptions for Equation 3.2 .....	58
Table 3.6: Descriptions for Equation 3.3 .....	60
Table 3.7: Descriptions for Equation 3.4 .....	62
Table 3.8: Comparison of Dimensionality Reduction Methods: Evaluation Dimensions .....	69
Table 3.9: PCA Implementation Steps .....	70
Table 3.10: Research Method Stages and Theoretical Mapping .....	74
Table 4.1: Descriptive analysis .....	78
Table 4.2: Correlation coefficient matrix .....	80
Table 4.3: Bartlett's test of sphericity and KMO test .....	82
Table 4.4: Principal Component Factors .....	83
Table 4.5: Orthogonal Matrix .....	85
Table 4.6: Descriptive Statistics of Main Research Variables .....	89
Table 4.7: Correlation Statistics of the Research Variables .....	93
Table 4.8: Correlation Matrix .....	107
Table 4.9: The Impact of Human Capital on Enterprise Core Competitiveness .....	111
Table 4.10: The Impact of Social Capital on Enterprise Core Competitiveness .....	115

Table 4.11: Moderating Effect of Management Shareholding Ratio on the Relationship between Board Human Capital and Corporate Core Competitiveness .....	122
Table 4.12: Moderating Effect of Management Shareholding Ratio on the Relationship between Board Social Capital and Corporate Core Competitiveness .....	128
Table 4.13: The Impact of Human Capital on the Core Competitiveness of Enterprises Excluding the Impact of the COVID-19 Pandemic .....	132
Table 4.14: The Impact of Social Capital on the Core Competitiveness of Enterprises Excluding the Impact of the COVID-19 Pandemic .....	134
Table 4.15: Moderating Effect of Management Stock Ownership Ratio on the Relationship between Board Human Capital and Enterprise Core Competitiveness: Excluding the Impact of the COVID-19 Pandemic .....	135
Table 4.16: Moderating Effect of Management Stock Ownership Ratio on the Relationship between Board Social Capital and Enterprise Core Competitiveness: Excluding the Impact of the COVID-19 Pandemic .....	137

## LIST OF FIGURES

Figure 1.1: China GDP and Per Capita GDP (2018-2023).....	3
Figure 1.2: Automobile Industry Production (2018-2023).....	4
Figure 1.3: Automobile Industry Sales (2018-2023).....	5
Figure 1.4: Vehicle Production (2018-2023).....	5
Figure 2.1: Research Framework.....	29
Figure 4.1 : Scree Plot.....	85

CHAPTER 1:  
**INTRODUCTION**

## **1.1 Introduction**

---

This chapter begins by establishing the research context and clarifying the purpose of the dissertation. It initially introduces the background and rationale for examining the influence of board capital and executive incentive mechanisms on corporate core competitiveness. Subsequently, it defines the central research problems and outlines the corresponding research questions that guide the study. The chapter further specifies the research objectives, encompassing both theoretical advancements and practical implications, and highlights the academic and managerial relevance of the topic. In addition, the chapter delineates the scope of the research by defining the sample framework, key variables, and methodological approach. Lastly, it provides a structured overview of the organization of the entire dissertation.

The structure of this chapter is organized as follows. Section 1.1 presents an introduction that clarifies the purpose of the chapter and positions the study within the broader discourse on corporate governance and organizational competitiveness. Section 1.2 provides the study background by examining relevant macroeconomic developments and industry-specific dynamics that underscore the relevance of board human and social capital, while also identifying existing gaps in the literature. Section 1.3 defines the research problem, outlining the central issues and knowledge deficiencies that the dissertation intends to address. Section 1.4 formulates the principal research questions that frame both the empirical investigation and theoretical exploration. Section 1.5 states the research objectives, including the aims related to hypothesis testing and conceptual model construction. Section 1.6 elaborates on the significance of the study, emphasizing its theoretical contributions to corporate governance and resource-based perspectives, as well as its practical implications for policymaking and managerial practice. Section 1.7

delineates the research scope by specifying the temporal, geographical, and industrial coverage of the sample, along with the limitations of the selected variables and methodological approach. Finally, Section 1.8 outlines the structure of the dissertation by summarizing the content and academic purpose of each of the five chapters.

## **1.2 Study Background**

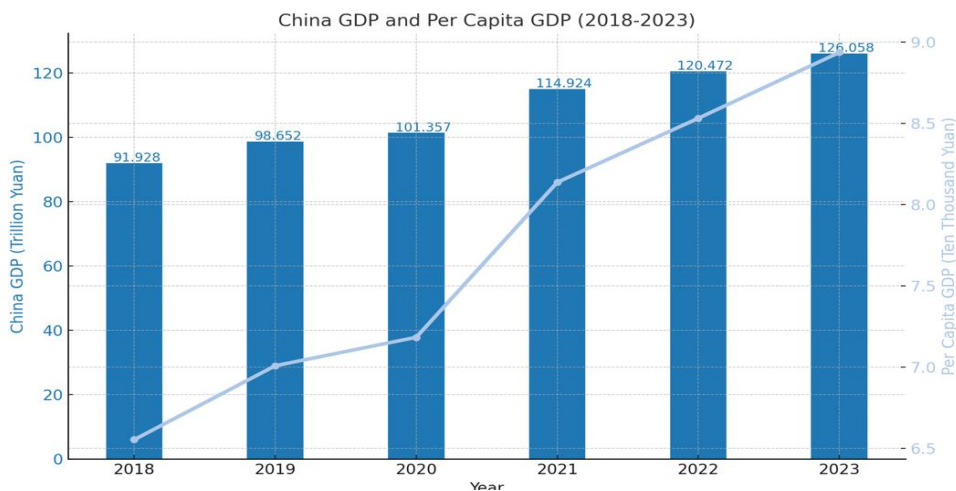
---

In recent years, China's economy has undergone rapid and sustained development, with gross domestic product (GDP) consistently maintaining a relatively high growth rate (Zhao, 2017). Over the four decades since the implementation of reform and opening-up policies, China has successfully established one of the most comprehensive and independent industrial systems globally. During this period, the scale of the national economy has expanded to approximately 34 times that of 1978, marking an extraordinary achievement in modern economic history (Lin, 2014). At present, China ranks as the world's second-largest economy, with its industrial output exceeding that of all other nations. The country has accomplished within several decades what historically took Western industrialized economies over two centuries, representing a significant economic transformation.

The manufacturing sector has played a fundamental role in this process, serving as the cornerstone of China's real economy and functioning as a primary engine of national economic growth. It has contributed to sustaining medium-to-high-speed development, promoting industrial upgrading, and advancing towards higher value-added production. Additionally, the sector remains central to independent innovation and technological progress. Within this broader industrial framework, the automotive industry occupies a strategic position and is regarded as a key driver of China's transition to high-end manufacturing. It exemplifies a sector at the forefront of global industrial and technological revolutions and plays a critical role in facilitating the integration of industrialization and digital technologies (Zhao et al., 2017). Furthermore, it is instrumental in advancing China's ambition to become a leading modern manufacturing power and an innovation-oriented economy.

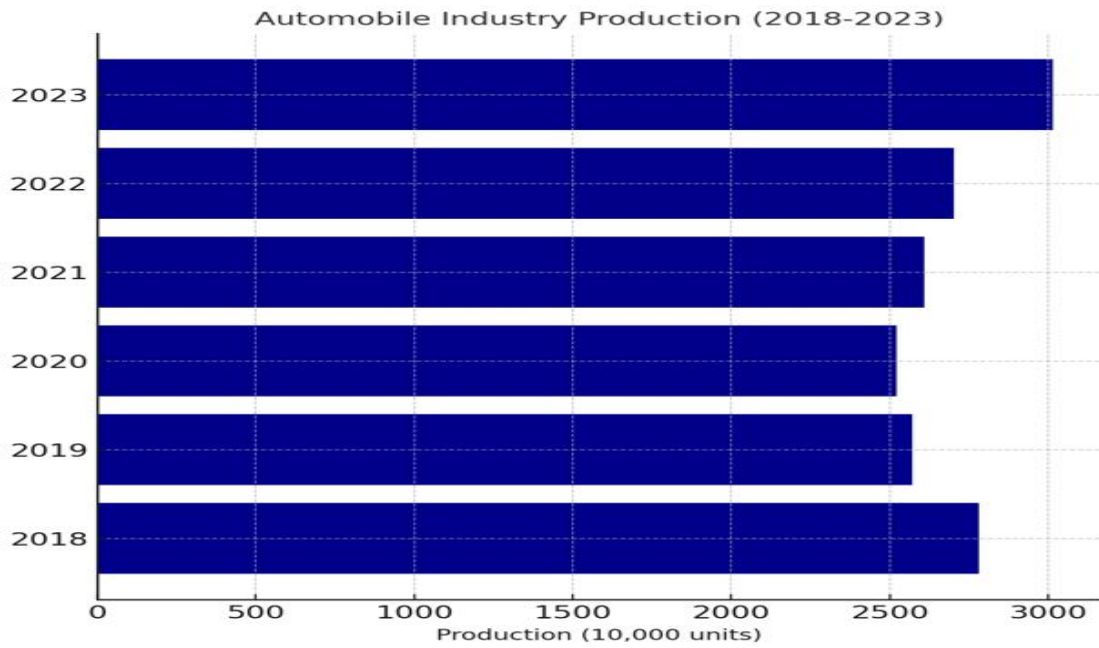
China's Medium- and Long-Term Development Plan for the Automotive Industry emphasizes the sector's pivotal role in driving the new wave of technological change and industrial transformation. As a sector often described as the "industry of industries," the automotive field possesses a history of over 200 years and is characterized by its intensive use of labor, technology, and capital. Its expansive value chain also stimulates the development of numerous related industries.

**Figure 1.1: China GDP and Per Capita GDP (2018-2023)**



In 2022, China's total GDP reached 121,020.7 billion yuan, representing a year-on-year increase of 3.0 percent. The value added by the primary industry was 8,834.5 billion yuan, increasing by 4.1 percent; the secondary industry contributed 48,316.4 billion yuan, with a growth rate of 3.8 percent; and the tertiary industry reached 63,869.8 billion yuan, up by 2.3 percent. By the end of the same year, the number of civilian motor vehicles in operation totaled 319.03 million units, including 7.19 million three-wheeled vehicles and low-speed trucks. This figure marked an increase of 17.52 million units compared to the previous year. The total number of privately owned vehicles stood at 278.73 million, an increase of 16.27

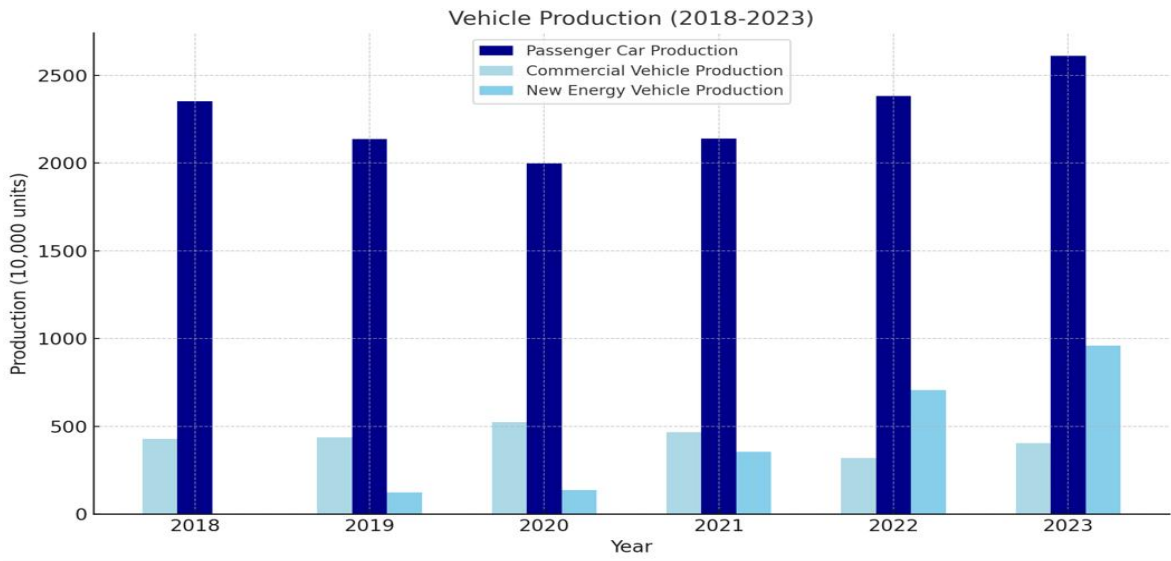
million units, while civilian passenger car ownership reached 177.4 million units, up by 10.03 million. Among these, privately owned passenger vehicles accounted for 166.85



**Figure 1.2: Automobile Industry Production (2018-2023)**

million, reflecting an annual increase of 9.54 million units (People's Daily Online).

**Figure 1.3: Automobile Industry Sales (2018-2023)**



**Figure 1.4: Vehicle Production (2018-2023)**

Despite the remarkable scale growth achieved by China's automotive industry, it still faces structural weaknesses that hinder competitiveness. Low levels of autonomy in key components and core technologies, insufficient layout of high-end vehicle models, and limited brand influence in global markets leave the industry in a relatively vulnerable position within the global value chain (McKinsey and Company, 2022). Meanwhile, China's dual carbon goals of peaking carbon emissions before 2030 and achieving carbon neutrality before 2060, coupled with the accelerated development of intelligent and connected vehicles, are profoundly reshaping market dynamics. Growing consumer demand for high-performance, highly reliable new energy vehicles and intelligent models places higher requirements on corporate governance structures and the effectiveness of strategic decision-making.

From the perspective of human capital theory, board human capital as a critical strategic resource of enterprises should theoretically drive the improvement of core competitiveness through paths such as optimizing strategic decisions and promoting innovative development. However, existing research in this field still has obvious theoretical gaps. First, most studies analyze board human capital and social capital in isolation, failing to explore how their interaction jointly shapes enterprises' long-term competitive advantages. There is a particular lack of research targeting emerging markets

like China with unique institutional environments and market dynamics. Second, existing studies mostly focus on the impact of board human capital on short-term financial performance such as return on assets and earnings per share, while paying insufficient attention to core competitiveness. As a multidimensional construct, it encompasses profitability, technological innovation, growth capacity and operational efficiency. This leads to an incomplete understanding of its long-term strategic value. Third, the internal mechanisms through which specific dimensions of board human capital such as gender diversity, educational level and independence influence enterprises' core competitiveness have not been fully explored. Existing research conclusions are fragmented and lack systematic validation in technology-intensive industries like automotive manufacturing. Fourth, few studies take executive incentive mechanisms as boundary conditions, ignoring the moderating role of compensation structures in the effectiveness of board human capital. This limits the practical guiding significance of research conclusions for the optimization of corporate governance. These research gaps highlight the necessity of this study to systematically examine the relationship between board human capital and corporate core competitiveness in China's automotive industry.

### **1.3 Problem Statement**

---

In the contemporary landscape of global economic restructuring and accelerated technological convergence, the sustained competitive advantage of an enterprise increasingly converges upon the strategic configuration of its board leadership. While theoretical frameworks suggest that core competitiveness derives from the dynamic integration of strategic resources and organizational capabilities (Teece, 2018), empirical evidence from the Chinese automotive sector reveals a profound structural deficit in this regard. Despite China's status as the preeminent global automotive market, the indigenous industry exhibits a persistent vulnerability in autonomous innovation. Statistical analysis indicates that the average research and development (R and D) intensity among domestic original equipment manufacturers (OEMs) remains localized below the 5% threshold, significantly trailing the 8% to 10% investment standards maintained by established global leaders in the New Energy Vehicle (NEV) and autonomous driving domains (CAAM, 2024; Zhu et al., 2023).

This competitiveness deficit is intrinsically linked to the suboptimal utilization of board capital. Although board human capital, encompassing advanced academic qualifications and gender diversity, is theoretically positioned to enhance cognitive depth, its actual translation into strategic precision is frequently obstructed by institutional inertia. Furthermore, the role of board social capital, remains contentious within the Chinese context. While these networks offer potential access to critical external knowledge and institutional legitimacy (Kor and Sundaramurthy, 2009), they concurrently introduce complexities regarding resource coordination and agency conflicts. In the absence of robust incentive alignment, such as equity compensation, directors may lack the motivation to actively mobilize their private social capital for the collective benefit of the firm (Li and Wang, 2023; Hambrick and Wowak, 2024).

The urgency of this issue is exacerbated by the rapid market penetration of NEVs, which reached approximately 25% in 2022 and continues to oscillate amid shifting global trade regulations (International Energy Agency, 2022). The failure to synchronize board-level governance with radical technological disruption poses an existential threat to organizational adaptability. Consequently, there is an imperative need to ascertain the boundary conditions under which board human and social capital can be activated to bridge the current innovation gap. This study addresses this critical void by examining the interplay between board capital configurations and core competitiveness, with a specific focus on the moderating influence of compensation incentives within the Chinese automotive paradigm.

## **1.4 Research Questions**

---

This study proposes that board capital, defined as the aggregate human and social resources embedded within a firm's board of directors, serves as a key driver of core competitiveness. (Jian Xinhua et al., 2019). To address the critical governance gaps in China's automotive sector, this study investigates the following research questions:

- Does human capital have a positive impact on corporate core competitiveness?
- Does social capital have a positive impact on corporate core competitiveness?

- Does board compensation moderate the relationship between human capital and corporate core competitiveness?

- Does board compensation moderate the relationship between social capital and corporate core competitiveness?

## **1.5 Research Objectives**

---

This study investigates how the components of board capital, specifically board human capital and board social capital, influence the core competitiveness of listed firms in China's automotive sector, and how executive compensation incentives moderate these effects. The specific objectives are as follows:

- To examine the positive impact of human capital on corporate core competitiveness.

- To examine the positive impact of social capital on corporate core competitiveness.

- To examine the moderating effect of board compensation on the relationship between human capital and corporate core competitiveness.

- To examine the moderating effect of board compensation on the relationship between social capital and corporate core competitiveness.

## **1.6 Purpose of Study**

---

This study investigates how board capital, which encompasses both human and social capital, influences the core competitiveness of listed companies in the Chinese automotive industry. It further examines the moderating effect of executive compensation incentives on this relationship. In the context of global competition, the transition to new energy vehicles, and rapid technological innovations such as autonomous driving, this research identifies the driving effects of board human capital (including age, educational attainment, gender diversity, and independence) on core competitiveness and elucidates the critical functions of board social capital (specifically regarding overseas experience,

financial backgrounds, and interlocking directorates) in resource acquisition and strategic coordination. Based on upper echelons theory, the analysis verifies whether incentive mechanisms, such as executive stock ownership, effectively catalyze the transformation of directors' professional expertise and external network resources into strategic outputs, thereby amplifying the positive impact of board capital on firm competitiveness. Through an empirical analysis of balanced panel data from 173 A-share Chinese automotive enterprises between 2018 and 2023, this study fills the research gap regarding the nexus between board governance and long-term core competitiveness, providing empirical evidence and managerial implications for the optimization of corporate governance and strategic adaptation during industry transformation.

## **1.7 Significance of Study**

---

### **1.7.1 Theoretical contribution**

This study provides three main theoretical contributions to the research fields of corporate governance, Upper Echelons Theory, and compensation incentive mechanisms.

First, existing studies have primarily concentrated on structural characteristics of the board, such as independence, gender diversity, and board size, and their influence on short-term financial performance (Hillman and Dalziel, 2003). However, empirical research remains limited regarding the extent to which board human capital, encompassing director age, educational attainment, gender diversity, and independence, as well as board social capital, including financial sector experience, overseas professional or educational exposure, and interlocking directorships, contribute to long-term core competitiveness in environments marked by globalization and high technological intensity (Peng, Sun, Pinkham and Chen, 2022). By utilizing panel data from China's automotive industry, this study expands corporate governance theory by illustrating how board capital strengthens core competitiveness through optimizing strategic decision-making processes, fostering innovation capabilities, and integrating critical resources.

Second, this study incorporates compensation incentives as a moderating variable to systematically examine their effect on the relationship between board capital and

corporate core competitiveness. Drawing upon Upper Echelons Theory, a well-designed compensation structure can significantly motivate directors to fulfil their responsibilities (Jensen and Meckling, 1976). While existing research has predominantly focused on mature markets, this study addresses the empirical gap in the context of China's automotive industry.

Third, the automotive industry's strong dependence on technological progress and regulatory frameworks renders it a representative case for applying Upper Echelons Theory. Xu and Zhang (2023) suggest Upper Echelons Theory is particularly applicable in industries characterized by intense global competition and rapid technological change. Through empirical evidence, this study validates the relevance of Upper Echelons Theory to the mechanisms of board capital in the context of Chinese automotive enterprises, thereby extending its theoretical applicability in a localized setting.

### **1.7.2 Practical contribution**

The practical significance of this study is reflected in three major dimensions. First, the study provides valuable managerial implications for Chinese automotive enterprises seeking to strengthen their core competitiveness under the dual pressures of globalization and accelerated technological transformation. Recent studies indicate that China's automotive sector is confronted with fierce market competition and rapid innovation, particularly in areas such as new energy vehicles and autonomous driving technologies. These challenges require firms to continuously enhance their innovation capabilities, resource integration efficiency, and responsiveness to market dynamics (Zhang and Liu, 2023). Through empirical investigation of listed automotive companies in China, this research underscores the pivotal role of board human capital and social capital in promoting core competitiveness. The findings offer evidence-based recommendations for optimizing board composition, acquiring critical external resources, and formulating effective strategies to enhance innovation outcomes.

Second, this research contributes practical insights into the design of board-level compensation incentive mechanisms. As a fundamental instrument of corporate governance, compensation incentives have been shown to significantly influence director motivation and engagement (Jensen and Meckling, 1976). According to Li and Wang

(2023), appropriately structured short-term cash incentives and long-term equity-based rewards can effectively encourage board members to apply their human and social capital in ways that promote firm-level value creation. The empirical results of this study affirm these assertions, indicating that performance-linked compensation systems play a central role in enhancing board effectiveness, particularly in strategic decision-making and resource coordination.

Third, this study informs strategic responses to the evolving policy environment and innovation-driven transformation in the automotive industry. With increasing global emphasis on low-carbon development and the rapid expansion of the new energy vehicle sector, automotive firms are undergoing a critical phase of structural transformation (International Energy Agency, 2022). Despite a relatively modest rate of national GDP growth, the steady rise in China's vehicle production and sales reflects substantial market resilience and future potential (National Bureau of Statistics of China, 2024). Empirical findings from technology-intensive industries suggest that board members with specialized technical knowledge and extensive external networks can effectively assist firms in complying with environmental policy mandates, such as dual-carbon objectives, and navigating complex international regulations. These capabilities further enhance organizational adaptability, promote technological innovation, and support expansion into global markets.

## **1.8 Research Scope**

---

This study encompasses multiple key dimensions of board capital, specifically human capital and social capital, to comprehensively examine their impact on corporate core competitiveness. This study focuses on publicly listed companies in China's Shanghai and Shenzhen stock markets, ensuring that the factors influencing core competitiveness possess a degree of representativeness. After several rounds of careful consideration, the study ultimately selects automotive companies listed in China from 2018 to 2023 as its research subjects. The research sample consists of 173 companies within the automotive industry listed on China's A-share market (A-shares, which refer to ordinary shares issued by companies registered in China and traded in RMB) over a six-year observation period. Given the robust development of the Chinese automotive industry in the past six years, a

six-year examination period from 2018 to 2023 is particularly conducive to accurate data collection and analysis. By considering the characteristics of executives in these 173 publicly listed automotive firms and excluding ST companies and those with incomplete data, this study will yield 3923 valid data points.

The study selects various indicators related to board capital characteristics, including whether the chairman also serves as director age, educational attainment, gender and independence diversity, and financial background, overseas training, and directors serving on other companies. It also incorporates financial indicators related to corporate core competitiveness, such as return on net assets, return on total assets, research and development expense ratio, shareholder equity growth rate, total asset growth rate, debt-to-asset ratio, and inventory turnover ratio. Analytical tools employed in this research include principal component analysis, panel data analysis, multiple regression, grouped regression analysis, and econometric software (Stata 17.0). Finally, empirical testing is conducted on the research questions posed in this study. In economics, Stata is utilized to forecast economic indicators and to understand the effects of various economic policies, assisting policymakers and businesses in making informed decisions based on predictive models.

**Table 1.1: Quick View**

Research Objective	Research Hypothesis	Independent / Moderating Variable	Dependent Variable	Estimation Method
Table 1.1 continued				
Examine the positive impact of board human capital on corporate core competitiveness	H1: Board human capital → ↑ Core competitiveness	Board human capital (HC): <ul style="list-style-type: none"> <li>• Age</li> <li>• Education level</li> <li>• female directors%</li> <li>• independent directors%</li> </ul>	Composite Core Competitiveness Index (CCI) extracted by PCA	Two-way fixed-effects panel regression (Eq 3.1)
Examine the positive impact of board social capital	H2: Board social capital → ↑ Core competitiveness	Board social capital (SC):	CCI	Two-way fixed-effects panel

on corporate core competitiveness			<ul style="list-style-type: none"> <li>• Overseas background</li> <li>• Financial background</li> <li>• Directors serving on other companies</li> </ul>		regression (Eq 3.2)
Test whether executive compensation moderates the HC–competitiveness link	H3: Management shareholding positively moderates H1	Moderator: Management shareholding ratio (MSR)		CCI	Fixed-effects panel regression with interaction terms (Eq 3.3)
Test whether executive compensation moderates the SC–competitiveness link	H4: Management shareholding positively moderates H2	Moderator: MSR		CCI	Fixed-effects panel regression with interaction terms (Eq 3.4)

## 1.9 Structure of Thesis

This dissertation is organized into five chapters as follows:

Chapter 1: Introduction. Clearly articulates the research background, defines the study’s scope, formulates the core research questions and objectives, and assesses the academic and practical significance. It also outlines the research approach and overall framework.

Chapter 2: This section defines the core concepts of board capital and corporate core competitiveness, and systematically reviews recent developments in Upper Echelons Theory. It identifies the existing gaps in the literature, establishes the theoretical foundation for this study, and formulates the corresponding research hypotheses.

Chapter 3: Based on the theoretical framework in Chapter 2 and the research questions in Chapter 1, design a quantitative indicator system for measuring core

competitiveness in Chinese automotive firms, explain the rationale and methods for selecting these indicators, and provide detailed information on data sources and sample selection criteria.

Chapter 4: Using relevant data from 2018 to 2023, first apply principal component analysis to empirically assess the core competitiveness of Chinese automotive firms and identify its key indicators; next use fixed-effects regression to analyse the impact of board human capital and social capital on corporate core competitiveness; finally introduce board compensation as a moderating variable to measure its effect on the relationship between board human capital, social capital, and corporate core competitiveness.

Chapter 5: This section summarizes the empirical findings and theoretical contributions of the study, provides governance recommendations concerning board composition and compensation structure, acknowledges the limitations related to sample representativeness and potential confounding variables, and outlines possible directions for extending the research framework to other industry contexts.

CHAPTER 2:

# LITERATURE REVIEW

## **2.1 Introduction**

---

To further explore the relationship between board governance and the core competitiveness of automotive companies, this chapter systematically elaborates on and summarizes relevant research on corporate core competitiveness and board capital. It identifies theoretical support and provides foundational literature to back this study. The chapter comprehensively examines theories related to the research topic, numerous literature reviews, and empirical findings from previous studies. Relevant theories are introduced to support the conceptual framework of this study, with all theoretical bases for the variables in this paper derived from this chapter. Based on these theories and past research findings, hypotheses are formulated. This chapter forms a crucial part of the thesis as it helps establish the foundation for the research.

## **2.2 Concept and Definition of Enterprise Core Competitiveness**

---

As a unique capability system accumulated during prolonged corporate development, enterprise core competitiveness integrates heterogeneous elements such as technological innovation, organizational governance, and market foresight. Endowed with the characteristics of value relevance, rarity, inimitability, and non-substitutability, this system enables firms to build enduring competitive advantages and continuously create excess economic value in the marketplace (Prahalad & Hamel, 1990).

### **2.2.1 Definition and Evolution**

Corporate core competitiveness refers to an enterprise's ability, within a specific market environment, to utilize its unique and inimitable resources, capabilities, and

organizational mechanisms to achieve value creation in products, services, and business models through continuous innovation and dynamic adjustment. It enables the firm to consistently outperform its primary competitors in terms of market performance (Adner, 2017). This concept encompasses four essential characteristics. The first is sustainability, which emphasizes the firm's long-term evolutionary capacity and the ability to move beyond short-term performance constraints. The second is dynamic adaptability, which reflects the need to promptly reconfigure resource allocation and operational processes in response to external environmental changes. The third is differentiation, achieved through unique value propositions and operating models that secure relative competitive advantages. The fourth is value-creation orientation, where market feedback and economic returns serve as the core evaluation criteria, and path dependence or market entry barriers help establish competitive moats that are difficult to replicate (Li and Liu, 2021).

Since the 1980s, the theory of core competitiveness has undergone continuous refinement and expansion. Initial research primarily focused on firms' internal resources and capabilities. As the business environment became increasingly complex, scholarly attention gradually shifted to external factors. Adner (2017) introduced the ecosystem perspective, emphasizing the critical role of industrial network structures and interorganizational collaboration in shaping competitiveness. In the context of digital transformation, Li and Liu (2021) demonstrated that data analytics capabilities and platform construction capabilities have become key drivers of new competitive advantages. Responding to global sustainability imperatives, Chen and Zhang (2022) incorporated green innovation and low-carbon management systems into the assessment of competitiveness, thereby extending the environmental dimension of the theory. Vandermerwe and Rada (1988) advanced the concept of service-based competitiveness, proposing that innovation in value-added service models offers new strategic paths for enhancing customer value.

Collectively, these studies enrich the connotation of core competitiveness from multiple perspectives and promote the integration of theoretical development with practical application.

### **2.2.2 Relationship and Distinction between Core Competitiveness and Core Competencies**

The concepts of core competencies and core competitiveness both fall within the theoretical domain of firm capabilities, yet they differ substantially in terms of conceptual meaning, theoretical foundation, and practical orientation. The theory of core competencies was first introduced by Prahalad and Hamel in 1990, who defined it from the perspective of capability accumulation. Core competencies refer to a firm's internal strengths rooted in proprietary technologies, organizational routines, and accumulated knowledge. These competencies are understood as unique combinations of skills that result from long-term investment in research and development, continuous organizational learning, and experiential accumulation (Teece, 2020). Representative examples include Canon's advanced optical lens-grinding techniques and Toyota's lean production system, both of which illustrate how specific technological and managerial capabilities form the foundation for competitive advantage at the operational level.

In comparison, the theory of core competitiveness builds upon the integration of the resource-based view (Barney, 1991) and the market performance perspective (Porter, 1985). It places stronger emphasis on the process through which internal capabilities are transformed into value within competitive market environments. According to Barney's VRIO framework, core competitiveness is characterized by four essential attributes: value, rarity, inimitability, and organizational embeddedness. Porter's competitive strategy perspective further highlights that the essence of core competitiveness lies in achieving sustainable differentiation through strategic positioning and the integration of the value chain (Wernerfelt, 2022). For instance, Apple's strategic integration of design excellence, hardware–software coordination, and brand communication in the smartphone industry has created a competitive position that is both resilient and difficult to replicate. This integrated system reflects a comprehensive realization of core competitiveness in practice.

The distinctions between core competencies and core competitiveness can be systematically delineated across several dimensions. In terms of theoretical foundation, core competencies emphasize the internal development and accumulation of firm-specific capabilities, while core competitiveness incorporates both internal resources and external market performance, focusing on strategic alignment with external conditions (Wernerfelt,

2022). Regarding the focus of analysis, core competencies pertain to technological capabilities, organizational processes, and knowledge assets internal to the firm, whereas core competitiveness is evaluated through external outcomes such as market share, growth rate, and profitability. Concerning dynamic characteristics, core competencies are relatively stable and require prolonged periods of accumulation, whereas core competitiveness is adaptive in nature and must be continuously reconfigured in response to changing market dynamics and competitive pressures (Asamoah, E., and Nkrumah, K., 2020).

Based on the work of Prahalad and Hamel (1990), Barney (1991), and Porter (1985), comparisons are as below:

**Table 2.1: Comparison of Core Competencies and Core Competitiveness Dimensions**

<b>Dimension</b>	<b>Core Competencies</b>	<b>Core Competitiveness</b>
Theoretical origin	Capability-accumulation perspective (Prahalad and Hamel, 1990)	Resource-based view (Barney, 1991) and market-performance perspective (Porter, 1985)
Focus	Cultivation and optimization of internal technologies, processes, and proprietary knowledge	Construction and maintenance of external competitive advantages such as market share, profitability, and brand influence
Dynamic characteristic	Relatively stable; requires long-term accumulation and sedimentation	Emphasizes dynamic adaptation; must be continuously updated with changing market conditions

Core competencies and core competitiveness also share a close internal logic. Core competencies are the foundational building blocks of competitive advantage, providing the technological and knowledge reserves for building core competitiveness; Core competitiveness, in turn, represents the higher-order transformation of core competencies in strategic practice by closely aligning internal strengths with market demand and competitive dynamics, thereby externalizing firm advantages into sustainable market-winning capabilities (Li et al., 2021). This relationship establishes a complete capability evolution path from the possession of specific capabilities to their effective deployment,

and ultimately to achieving success in market competition. For example, Huawei's long-term investment in communications research and development has resulted in the accumulation of 5G patents and chip-design capabilities, representing core competencies. Through the implementation of a global strategy and the establishment of ecosystem partnerships, these competencies have been transformed into a leading position in the global communications equipment market. This case clearly illustrates the transformation mechanism and the synergy between core competencies and core competitiveness (Zhu et al., 2023).

### **2.2.3 Theoretical Evolution and Research Frontiers of Core Competitiveness**

Since its inception, the theory of enterprise core competitiveness has continued to develop in the global academic community, with distinct evolutionary trajectories and research emphases at different historical stages.

International research on core competitiveness began earlier. Prahalad and Hamel (1990) were the first to introduce the concept, defining it as a firm's cumulative knowledge, particularly its ability to coordinate diverse production skills and integrate multiple streams of technology. This conceptualization laid the foundation for the development of resource-based and capability-based theoretical perspectives. Subsequently, Barney (1991), drawing on the Resource-Based View, proposed the VRIO framework, emphasizing that core competitiveness must possess value, rarity, inimitability, and organizational support, thus providing an analytical tool for assessing competitiveness (Barney, 1991). Teece et al. (1997) then advanced Dynamic Capabilities theory, extending core competitiveness to include a firm's ability to integrate, build, and reconfigure internal and external resources in response to rapidly changing environments (Teece et al., 1997). In recent years, against the backdrop of digital transformation, Adner (2017) adopted an ecosystem perspective to highlight the pivotal role of industrial ecosystem networks and external collaborations in shaping competitiveness (Adner, 2017); Li and Liu (2021) confirmed that data-analytics and platform-building capabilities have become core elements for firms to secure new competitive advantages (Li and Liu, 2021).

Research on enterprise core competitiveness in China began in the mid to late 1990s, with initial efforts primarily centered on theoretical introduction and clarification of

core concepts. Wang Bing'an and colleagues (1999) were among the earliest scholars to systematically introduce the theory of core competitiveness. By integrating the operational context of Chinese enterprises, they defined core competitiveness as a set of unique capabilities that enable firms to maintain sustainable competitive advantages. Subsequently, academic attention gradually shifted toward localization and practical application. Wei Jiang (2003) proposed a knowledge-based framework for understanding core competitiveness, emphasizing the importance of tacit knowledge and organizational learning in its development. Lan Hailin (2007) associated core competitiveness with dynamic strategic alignment, exploring the mechanisms through which firms can develop competitiveness in rapidly changing environments.

In recent years, under the dual influence of the digital economy and carbon reduction strategies, domestic research has made notable advances. Chen Jin and colleagues identified the capability to construct open innovation ecosystems as a critical dimension of core competitiveness for firms operating on digital platforms. Jin Bei (2023) highlighted that green technological innovation and low-carbon operational models are fundamentally transforming the nature of core competitiveness in traditional manufacturing enterprises.

Compared with international research, domestic studies exhibit differences in theoretical underpinnings, thematic focus, and temporal evolution. These distinctions will be systematically summarized in the subsequent section.

## **2.3 Executive-related concepts**

---

### **2.3.1 Executive**

Under Within the framework of modern corporate governance, the executive management team serves as the central force in the implementation of corporate strategy and the creation of organizational value. Acting under the authority of the board of directors, executives are nominated and appointed in accordance with the company's articles of association. Through formal delegation mechanisms, they are entrusted with the

responsibility of managing corporate resources on behalf of shareholders (Chen and Wang, 2022). Accordingly, executives derive their managerial authority from the board and exert significant influence over strategic planning, resource deployment, and daily operational decisions. Common executive positions include Chief Executive Officer, Chief Financial Officer, and Chief Operating Officer, along with other key managerial roles such as General Manager, Deputy General Manager, and Board Secretary (Zhang, Liu, and Brown, 2023).

According to Article 217 of the Company Law of the People's Republic of China, executives are defined to include the general manager, deputy general manager, financial officer, board secretary of listed companies, and other personnel specified in the articles of association. This statutory definition highlights the critical role executives play in ensuring the survival, stability, and long-term development of the enterprise. It further emphasizes that executives bear primary responsibility for driving innovation investment and achieving organizational performance outcomes (Company Law of the People's Republic of China, 2022 Amendment).

This study focuses on managerial personnel authorized by the board of directors, specifically those individuals capable of influencing the firm's core competitiveness. Under this framework, executives whose official titles include General Manager, Chief Executive Officer, or President are categorized as core executives and collectively referred to as chief executive-level managers. Other executive personnel who do not hold these titles are classified as non-core executives. This categorization facilitates a more precise analysis of the differential contributions made by distinct levels of executive leadership to strategy implementation, risk management, and innovation outcomes. Moreover, this classification serves as the foundation for subsequent empirical analysis conducted in this study.

### **2.3.2 Executive Compensation**

Executive compensation refers to the complete set of rewards formally granted to senior managers through contractual arrangements. It includes both monetary incentives and non-monetary benefits. Such compensation structures are intended to reflect executives demonstrated abilities and effort, thereby meeting their material expectations

while also reinforcing their psychological commitment to the firm (Gómez-Mejía et al., 2020). In general, executive compensation can be categorized into two main types. The first type, referred to as narrow compensation, consists of direct cash payments, such as base salary, performance bonuses, and allowances. These are typically disbursed in monetary form or easily convertible equivalents. The second type, known as broad compensation, encompasses non-cash benefits, including paid leave, exclusive executive services, and comprehensive insurance or protection plans (Brick, Palmon, and Wald, 2021).

Equity-based incentives are widely regarded as a primary mechanism for aligning the interests of executives with those of shareholders over the long term. Through instruments such as stock options, restricted shares, or performance shares, executives become residual claimants, participating in gains while also internalizing potential losses. This alignment fosters stronger stewardship behavior, reduces agency costs, and encourages innovative behavior aimed at maximizing long-term shareholder value. In the context of China's A-share market, publicly listed companies predominantly utilize stock options and restricted shares as their principal forms of equity incentives (Zhao, Chen, and Gao, 2023).

In this study, executive compensation is operationalized using the managerial ownership ratio, defined as the proportion of total outstanding shares held by all executive team members. This variable serves as a key moderating factor in the analysis.

## **2.4 The Relationship Between Control variables and Core Competitiveness**

---

In analysing the relationship between board capital and corporate core competitiveness, it is necessary to incorporate appropriate control variables to ensure model accuracy and to mitigate the influence of potential confounding factors. This study includes firm size, measured by total assets, financial leverage, and the presence of CEO duality, defined as the condition in which the Chief Executive Officer simultaneously holds the position of board chairperson. These control variables are selected based on

established empirical evidence, which consistently highlights their relevance in influencing the strategic capabilities and competitiveness of firms.

Firm size is widely regarded as a fundamental determinant of both innovative capacity and market position. Larger firms typically possess greater resources, enabling them to support research and development investment and coordinate across the supply chain, thereby enhancing their core competitiveness (Wang and Huang, 2023). For example, Wang and Huang (2023) use panel data from Chinese manufacturing firms to show a significant positive relationship between total assets and innovation output, with the size effect being especially pronounced in R&D-intensive companies.

Capital structure directly influences a firm's risk-bearing capacity and cost of resources, which in turn affects its ability to sustain and develop core competencies (Chen and Zhao, 2024). Both excessively high and excessively low debt levels can hamper a firm's agility in pursuing technological innovation and market opportunities. Chen and Zhao (2024) find in a sample of Chinese private listed companies that moderate leverage incentivizes management to achieve higher operational efficiency with manageable financial risk, whereas leverage above 60% tends to suppress the firm's core capabilities.

When the CEO also holds the position of board chairman, decision-making authority becomes highly centralized. While this can improve the efficiency of strategic execution, it may also weaken board oversight, thereby affecting governance quality and core competitiveness (Park and Lee, 2022). Park and Lee (2022) report that, among Asian publicly listed firms, CEO duality helps companies quickly adjust strategy during periods of high market volatility and enhances short-term competitive performance; however, over the long term, insufficient oversight under duality can impede the sustainable growth of core capabilities.

By incorporating these control variables, the study effectively mitigates potential confounding effects arising from heterogeneity in firm size, capital structure, and governance configuration. This approach enhances the internal validity of the estimated relationship between board capital and corporate core competitiveness and ensures greater external comparability of the empirical results.

## 2.5 Research Gap

---

Based on the literature review mentioned earlier, there are still gaps in the existing research on the relationship between board capital and corporate core competitiveness.

From the review of research on corporate core competitiveness, it is evident that studies in this area began in the 1990s, making it a relatively new field of study. Although both domestic and international scholars have made significant progress and achieved some results, several gaps and unresolved issues remain. First, in qualitative research, the definition of corporate core competitiveness is not yet unified, leading to various subjective interpretations of the concept. As a result, many studies define factors affecting core competitiveness based on their subjective understanding (Bai Lu, 2009) and then proceed to evaluate these factors and propose policy recommendations. Second, in quantitative research, the establishment of corporate core competitiveness indicator systems lacks scientific rigor (Wang Yucui, 2005). The scope of the indicators is too narrow, failing to comprehensively reflect a company's operational status. Lastly, the models used to evaluate corporate core competitiveness are still not sufficiently refined. There is a lack of innovation in the methods employed, and quantitative analysis of the relationships between factors affecting corporate core competitiveness remains limited (Wang Xiaoxia, 2007). Additionally, empirical studies are insufficient, and there are relatively few studies using STATA for modelling. This study draws on Deng Danhua's (2012) work on measuring corporate core competitiveness in high-tech enterprises, as well as the theoretical and methodological framework provided by Chinese management scholar Jin Bei (2021) on competitiveness assessment. Furthermore, this study is tailored to the characteristics of automotive enterprises, selecting multiple secondary indicators that reflect corporate core competitiveness. These indicators are analysed through principal component analysis to produce a more scientifically sound comprehensive core competitiveness value index.

Although many scholars, both domestically and internationally, have explored the impact of board capital on corporate performance, most of the existing research primarily examines the influence of executives on organizations through the lens of demographic or psychological characteristics. However, there is a noticeable lack of focus on specific leadership dimensions of executives, particularly regarding their impact on corporate core

competitiveness. While recent studies have investigated the broader effects of leadership on innovation, the specific outcomes of this influence on corporate core competitiveness, from the perspective of board capital, remain under-researched. To address this gap, the present study draws on Upper Echelon Theory and employs a multiple linear regression method to investigate this relationship in depth.

Finally, the impact of board capital on corporate performance within the context of Chinese culture has not been sufficiently explored. Few studies have comprehensively examined the moderating factors of executive compensation. Treating board capital as a single variable is another gap in the literature. Most existing studies investigate the relationship between board capital and corporate core competitiveness from a singular perspective, typically focusing on either human capital or social capital of the board. Few studies have integrated both dimensions to explore how they jointly contribute to enhancing corporate core competitiveness. Moreover, while recent studies have examined the differential impacts of entrepreneurial leadership on firms, very few have considered executive compensation as a moderating variable. This study aims to address this gap by conducting a comprehensive analysis within the specific context of enhancing corporate core competitiveness, with a focus on integrating board capital and executive compensation as key variables.

## **2.6 Research Framework**

---

Figure 2.1 presents the theoretical framework of this study. The framework aims to systematically examine the impact of board capital on the core competitiveness of Chinese automotive manufacturing firms. This study takes the Upper Echelons Theory (UET) as its sole and fundamental theoretical basis. Proposed by Hambrick and Mason in 1984, the core view of UET is that the demographic characteristics, cognitive abilities and value orientations of top management teams influence corporate strategic choices directly. The board of directors, as the core decision-making body of enterprises, is part of the top management team. These characteristics ultimately affect corporate performance. UET provides a critical theoretical perspective for this study. It enables the explanation of how board member characteristics, specifically reflected in board capital, influence the formulation and implementation of corporate strategies. These influences further act on the

core competitiveness of Chinese automotive manufacturing firms. Based on UET, this study defines board capital as two core dimensions. These dimensions are board human capital (HC) and board social capital (SC). Meanwhile, executive compensation is introduced as a moderating variable. It is used to explore the regulatory role in the relationship between board capital and corporate core competitiveness. The theoretical logic of this variable also originates from UET.

In this framework, board human capital and board social capital serve as independent variables (IV). Both exert direct impacts on the dependent variable (DV), which is corporate core competitiveness. The theoretical basis for this variable setting comes entirely from the core views of UET. Specifically, UET emphasizes that personal characteristics of top decision-makers are important antecedents of corporate strategic behaviors and performance. Board members are the top decision-makers in this study. Board human capital is a concentrated reflection of the personal characteristics of board members. It is measured by four indicators. The four indicators include the average age of board members, their educational attainment, the proportion of female directors and the proportion of independent directors. These indicators are not randomly selected. They are highly consistent with the core views of UET. They directly reflect the board's cognitive abilities, value orientations, risk preferences and governance capabilities. All these factors further affect the scientificity and effectiveness of strategic decision-making and resource allocation within enterprises (Wang, Tan, and Zhou, 2022). For example, from the perspective of UET, directors with higher educational attainment often have stronger abilities to absorb new technologies and market information. They can formulate more forward-looking technological innovation strategies. The proportion of independent directors is an important characteristic of board structure. It reflects the independence of the board's cognitive judgments. It helps avoid group decision-making biases and improve governance quality. These effects further promote the improvement of corporate core competitiveness indirectly.

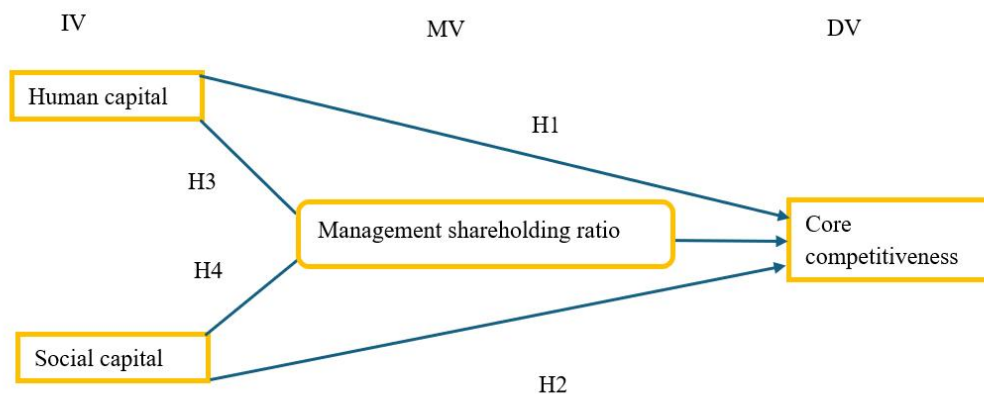
Consistent with the logical extension of UET, board social capital is measured through directors' overseas educational experience, prior employment in the financial sector and cross-enterprise tenure experience. UET holds that the life experience and social background of top decision-makers shape their cognitive frameworks and information

acquisition channels. These characteristics of directors reflect their broader cognitive horizons. They also reflect their richer industry insights and more diverse external information networks. These characteristics enable directors to break through the cognitive limitations of internal organizational boundaries. Directors can obtain more comprehensive and valuable market information, technological resources and institutional support. This helps enterprises formulate more adaptive strategies in the fiercely competitive automotive manufacturing industry. It also helps enterprises improve core competitiveness (Chen and Zhang, 2023). The market environment of China's automotive manufacturing industry is dynamically changing and resource-constrained. In this environment, the role of board social capital is particularly prominent. Under the guidance of UET, a clear explanation can be made. The social experience and external connections of board members are not irrelevant to corporate operations. They are important extensions of their cognitive abilities and decision-making capabilities. These extensions ultimately act on the core competitiveness of enterprises.

As shown in Figure 2.1, Paths H1 and H2 represent the direct effects of board human capital and board social capital on core competitiveness respectively. The theoretical logic of these two paths is fully supported by UET. Board capital is a comprehensive reflection of the characteristics of board members. It affects strategic decision-making and resource allocation directly. These effects then act on corporate core competitiveness. Paths H3 and H4 reflect the moderating role of executive compensation in the above two groups of relationships. This moderating mechanism also relies on the theoretical support of UET. UET holds that incentive mechanisms for top decision-makers can adjust the relationship between their personal characteristics and strategic behaviors. A reasonably designed compensation mechanism can align the interests of board members with those of enterprises. This alignment strengthens the strategic participation and performance effectiveness of directors. It motivates directors to give full play to their cognitive advantages and characteristic strengths in strategic decision-making and resource allocation. These advantages are reflected in board human capital and social capital. They ultimately amplify the impact of their human capital and social capital on corporate performance (Li, Luo, and Lin, 2023). For example, a more generous compensation system is more likely to motivate directors with high educational attainment or rich industry experience. It encourages them to actively put their professional insights into the

enterprise’s technological innovation and global expansion strategies. This is a specific manifestation of the relationship between incentive mechanisms, decision-maker characteristics and corporate performance proposed by UET.

In general, the theoretical framework constructed in this study is entirely based on UET. UET not only provides a clear theoretical basis for the definition, dimension division and measurement indicators of board capital. It also clarifies the theoretical logic of the direct impact of board capital on corporate core competitiveness. It further clarifies the theoretical logic of the moderating effect of executive compensation. This framework effectively solves the problem of insufficient explanation of the role of supporting theories in the original framework. It elaborates on how UET supports the entire research design. It clarifies the theoretical connections between various variables. It makes the theoretical basis of the study more solid and persuasive. Through the construction of this conceptual model, this study aims to provide theoretical enlightenment. It further enriches the application of UET in the field of corporate governance of Chinese automotive manufacturing firms. It also aims to provide empirical basis for improving corporate governance practices in China’s manufacturing sector, especially in the automotive industry.



**Figure 2.1: Research Framework**

## **2.7 Research theory**

---

Upper Echelons Theory, also known as the High-Level Echelons Theory or simply the Upper Theory, focuses on the executives and top management teams within an organization. In practice, decision-making teams composed of senior managers significantly influence a company's behaviour, strategic choices, and operational performance. The relationship between executives and the firm's strategic decisions constitutes the core research domain of Upper Echelons Theory. Since its introduction, this theory has provided a more macro and scientific perspective for research in the fields of finance, accounting, corporate governance, and leadership (Hambrick and Mason, 1984).

According to this theory, an organization reflects its top management team; the experiences, values, and personalities of executives shape the strategic choices they make. Therefore, understanding the characteristics and dynamics of the top management team is crucial for analysing how strategic decisions are formed and executed (Carpenter et al., 2004). Over the years, Upper Echelons Theory has made significant contributions to revealing how leadership influences corporate governance practices and drives firm performance (Bekos and Chari, 2023).

Hambrick and Mason formally introduced the theory in 1984 in the *Academy of Management Review*, incorporating the concept of bounded rationality into executive research. They proposed two core propositions: first, under the same organizational environment and strategic information, different executives will make different strategic choices and interpret information differently; second, these differences stem from executives past experiences, values, cognition, and personal characteristics (Hambrick and Mason, 1984). The fundamental assumption is that no single executive, nor the entire top management team, can fully comprehend all aspects of the organization and its external environment, which makes observable demographic characteristics important proxies for measuring executives' cognition and values (Hambrick, 2007).

On this basis, Hambrick and Mason further proposed that: (1) examining the top management team is more effective than focusing on individual executives; and (2)

demographic characteristics can serve as reliable indicators of executives' cognitive frameworks and values (Hambrick and Mason, 1984). In recent years, systematic reviews and empirical research have continuously refined its framework and methodological innovations and have validated the significant impact of managerial characteristics on corporate strategic decisions in various contexts (Achbah, 2024).

In research involving Upper Echelons Theory, variables such as executives' cognition, values, and demographic characteristics are observed to predict and explain corporate behaviour and strategic choices. Psychological factors are important yet difficult to measure directly, since executives are often reluctant or unable to report their true cognitive frames (Miller, Kets de Vries, and Toulouse, 1982). To address this, Hambrick and Mason (1984) proposed using observable demographic and background characteristics of top management as proxies for cognition and values. Indeed, even before their seminal work, consumer-psychology research had relied on demographics to infer preferences and decision rules (Frank and Greenberg, 1979).

From a practical perspective, demographic characteristics are generally more objective and accessible than psychological variables, and they have been widely validated as reliable measures for studying executives and predicting corporate behaviour (Finkelstein, Hambrick, and Cannella, 2009; Bekos and Chari, 2023). Observable attributes such as functional background, prior work experience, educational attainment, socioeconomic origin, financial incentives, and group composition serve as key indicators of underlying managerial traits. These characteristics exert direct influence on strategic decision-making processes and, consequently, affect overall firm performance.

Executive age has been linked to corporate growth (Child, 1974; Hart and Mellons, 1970) and innovation (Li and Li, 2015). Older executives may exhibit lower physical energy and greater risk aversion, showing increased commitment to the status quo and prioritizing financial security near retirement (Carlsson and Karlsson, 1970; Stevens, Beyer, and Trice, 1978). Recent work confirms that age diversity within top teams can both hinder radical innovation and foster incremental improvements, depending on contextual factors (Nguyen, Hussinger, and Kleindienst, 2023).

Functional background constitutes a critical dimension in understanding executive decision-making behavior, as domain-specific expertise fundamentally influences cognitive orientation and problem-solving strategies. Traditional frameworks typically differentiate between open-systems functions, such as marketing and research and development, which emphasize external adaptability and innovation, and productivity-focused functions, such as production and finance, which prioritize efficiency and internal optimization (Katz and Kahn, 1966; Hambrick and Mason, 1984). More recent empirical studies have advanced this classification by emphasizing the value of cross-functional experience. Executives who have served across diverse operational domains are more likely to develop strategic ambidexterity, enabling them to simultaneously pursue exploratory innovation and exploitative efficiency in dynamic environments (Gupta, Smith, and Shalley, 2022).

Serving as directors in other companies provides executives with access to broader strategic insights and diverse operational experiences. Prolonged tenure within a single firm may constrain cognitive flexibility and reduce sensitivity to external change, whereas exposure to multiple organizational contexts through external directorships can enhance adaptability and facilitate strategic transformation (Helmich and Brown, 1972; Zuzul and Tripsas, 2021).

Educational attainment represents a foundational factor shaping executives' cognitive styles, value systems, and decision-making approaches. Prior research has demonstrated a significant association between education level and innovation performance, suggesting that advanced academic training fosters analytical reasoning and openness to novel ideas (Li and Li, 2015). Moreover, educational attainment serves as a critical screening mechanism in executive recruitment processes, influencing both selection outcomes and organizational fit (Pfeffer, 1981a). Recent empirical studies have further confirmed that managers with formal business education tend to implement more effective risk management practices, thereby enhancing organizational resilience (Garcia-Granero, Hurtado-Torres, and Martinez-Lopez, 2022).

Socioeconomic origin also contributes to shaping executives' strategic preferences. Individuals from entrepreneurial or upper-class backgrounds are more inclined to pursue aggressive expansion and innovation-oriented strategies, a tendency that is often reinforced

by cultural capital and access to elite networks (Hambrick and Mason, 1984; Judge and Cable, 2020).

Financial status is closely linked to executives' incentive structures, including equity-based rewards, performance bonuses, and other forms of compensation. These financial arrangements not only reflect managerial priorities but also shape their risk-taking behavior and strategic focus (Hambrick and Mason, 1984; Hamori and Koyuncu, 2021).

Team composition, particularly in terms of heterogeneity, plays a critical role in group decision-making processes. While early studies warned of the dangers of homogeneity and groupthink (Janis, 1972), subsequent research has demonstrated that demographic and cognitive diversity within executive teams enhances decision quality by incorporating multiple perspectives and reducing cognitive biases (House and Kerr, 1976; Nguyen et al., 2023).

In contrast to earlier research that predominantly centered on the Chief Executive Officer, contemporary applications of Upper Echelons Theory emphasize the collective influence of the entire top management team in shaping organizational strategy and performance. Within this framework, the authority of the CEO is recognized as one of several determinants contributing to strategic outcomes (Finkelstein and Hambrick, 2022; Hambrick and Mason, 1984).

Since Hambrick and Mason introduced Upper Echelons Theory in 1984, three major extensions have been proposed: the inclusion of managerial discretion as a moderator (Hambrick and Finkelstein, 1987), the addition of executive job demands as another boundary condition (Hambrick, Finkelstein, and Mooney, 2005), and the introduction of top-management-team behavioural integration as a contingency factor (Ling and Veiga, 2006). Current research confirms that demographic characteristics of the top management team exert significant effects on various dimensions of corporate behaviour and performance, yet the precise mechanisms through which executives shape a firm's core competencies remain insufficiently resolved.

Although Upper Echelons Theory has played a pivotal role in the study of organizational behavior and strategic management, several core mechanisms underlying the theory remain insufficiently clarified. Hambrick and his colleagues have identified several promising directions for future theoretical advancement. First, the cognitive interpretation mechanisms of executives, particularly the extent to which heterogeneous backgrounds and personal preferences influence information processing, remain largely unexplored. This cognitive dimension of executive behavior has yet to be examined through systematic empirical analysis (Hambrick 2007). Second, issues related to reverse causality and endogeneity require further investigation. It remains unclear whether executive values primarily originate from individual attributes or are significantly shaped by prior organizational environments and board-level influences (Finkelstein and Boyd 1998). Third, while the theory emphasizes individual-level determinants of strategic behavior, the influence of broader cultural systems at both the national and organizational levels on the formation of executive values has been insufficiently addressed. This omission limits the applicability of the theory across different cultural contexts (House et al. 2004). Finally, the interaction between executive characteristics and compensation structures constitutes another underexamined moderating mechanism. For example, how age affects the sensitivity of executives to financial incentives and how such interactions influence strategic decision-making have not been adequately explored in existing literature (Balkin and Gomez-Mejia 1990; Hambrick and Fukutomi 1991).

This discussion not only reveals critical limitations in the current application of Upper Echelons Theory but also outlines potential directions for future empirical research with significant theoretical and managerial implications.

Based on the content of Upper Echelons Theory, it is evident that the executive team holds a significant role in the study of corporate behaviour and performance. The influence of the executive team can be measured and observed in the following aspects: Research on the impact of executive teams on corporate performance has yielded varied results. For example, He Yuanqiong et al. examined Chinese manufacturing companies listed before 2002 with over three years of experience and stable operations. They found an inverted U-shaped relationship between the size of the executive team and corporate performance (He Yuanqiong and Chen Yun, 2009). Sun Haifa et al., using a sample of 132

listed textile companies and 145 listed information technology companies in China, discovered that executive team size and average tenure were positively correlated with short-term corporate performance, while the average education level was positively correlated with long-term performance (Sun Haifa, Yao Zhenhua, Yan Maosheng, 2006). Similarly, Wang Xueli et al. studied 105 listed companies in China's information technology sector from 2004 to 2010 and examined the impact of different executive functional backgrounds on dynamic and diverse corporate performance. Their research revealed that executive teams with "production-oriented" functional backgrounds positively influenced short- and long-term performance, innovation performance, and international performance (Wang Xueli, Ma Lin, Wang Yanli, 2013). In addition, several other factors related to executive teams have been found to affect corporate performance, including team heterogeneity (Yao Bingshu, Ma Lin, Wang Xueli, Li Bingxiang, 2015) and communication frequency (Yao Zhenhua and Sun Haifa, 2011). Social capital within the executive team can also impact merger and acquisition (MandA) performance, with embedded financial networks promoting MandA performance, while social capital embedded in alumni networks inhibits it. Social capital embedded in government networks promotes MandA performance (Qi Jipeng and He Xiaoming, 2015). Both structurally embedded social capital (direct ties) and relationally embedded social capital (indirect ties) can improve management and innovation performance, though the effect of the former is stronger (Moran, 2005). Executive tenure and the social capital of founders help companies better manage strategic changes (Fischer and Pollock, 2004). The characteristics of individual executives and compensation systems also significantly affect corporate performance. Research by Shi Yongshuan et al. indicates that both internal and external compensation gaps within the executive team exhibit an inverted U-shaped relationship with future company performance. Smaller compensation gaps can reduce dissatisfaction and enhance cohesion, thus improving work quality and corporate performance (Shi Yongshuan and Yang Hongfen, 2013). Furthermore, emotional conflicts within executive teams are negatively correlated with company growth performance (Lei Hongsheng and Chen Zhongwei, 2008). Despite variations in results depending on the industry and research focus, it is evident that executive teams significantly impact corporate performance. However, most studies have focused on the direct relationship between executives and corporate performance, neglecting the important decision-making processes

in between. This study will examine how executive teams influence corporate core competencies by considering these intermediate decision-making processes.

The impact of executive teams on corporate strategy is multifaceted. Through their influence, authority, and roles, executives make strategic decisions that result in varying strategic outcomes across companies. Research shows that executive team characteristics affect both strategic change and post-change value creation (Yang Lin and Rui Mingjie, 2010). The internal succession of followers within the executive team is negatively correlated with strategic change, while team restructuring partially mediates this relationship. Additionally, the succession of internal competitors or external leaders is positively correlated with strategic change (Liu Xinmin, Wang Lei, Wu Shijian, 2013). The breadth of board human capital is positively related to strategic change, while the depth of human capital is negatively related (Ren Shanghua, 2011). Variables such as executive age, gender, career heterogeneity, executive power, and professional background also impact entrepreneurial strategy in different ways (Wei Xuhua, Liu Yongmei, Yue Liuqing, 2015). External mergers and acquisitions (M and A) enable companies to expand rapidly, acquire necessary resources, and achieve leapfrog development, making M A one of the most important corporate strategic actions (Lee and Lieberman, 2010). Previous studies have found that the average age and tenure of executive teams are negatively correlated with the likelihood and patterns of M&A activity, while the proportion of males in the executive team is positively correlated with M&A patterns and likelihood (Yang Lin and Yang Qian, 2012). Additionally, the education level of executives, which reflects their cognitive processes, influences a company's global strategic positioning (Carpenter and Fredrichson, 2001) and impacts its diversification strategy.

In the field of accounting, the impact of executives and executive teams on earnings management has become an important research topic. Previous studies have shown that the monetary compensation and on-the-job consumption levels of founding executive teams have a significant inverted U-shaped relationship with the level of real earnings management, while the equity holdings of founding executive teams are positively correlated with earnings management (Liu Xinmin, Zhang Ying, Wang Lei, 2014). Executives also manipulate earnings information based on the upper and lower limits set by their monetary compensation packages. Differences in education and gender between

the chairman and the CEO have been found to trigger earnings management behaviours, while differences in their tenure tend to suppress such behaviours (He Weifeng, 2015).

The psychological cognition, values, proportion of founders, degree of managerial ownership dispersion, whether the founder also serves as CEO, average age of the executive team, education levels, and the proportion of team members with output-oriented backgrounds all influence the research and development (R&D) decisions of a company (Zhu Weiyi, 2015). Executives, particularly founders, have a profound impact on corporate strategy and culture through their values, culture, and mindset (He, 2008). Founders have been shown to improve corporate performance and secure greater external support (He, 2008). Additionally, research indicates that the interaction between the proportion of executive stock ownership and ownership dispersion enhances corporate R&D investment (Liu Xinmin, Wang Lei, Kang Wanglin, 2014), although the age of executives is negatively correlated with R&D investment (Li Jianjun, Li Danmeng, 2015). Older executives tend to be more risk-averse, favoring conservative projects with lower risk efficiency (Han Jing, Han Zhihong, Yang Xiaoxing, 2014).

Research has also demonstrated that executive teams significantly influence accounting conservatism. In state-owned enterprises, the relationship between accounting conservatism and inefficient investment is significantly affected by the average age, tenure heterogeneity, and educational attainment heterogeneity of the executive team (Han Jing, Chen Zhihong, Yang Xiaoxing, 2014). The greater the vertical differences in education and tenure between the executive team and the chairman, the stronger the accounting conservatism (Liu Yongli, 2014).

In summary, research on Upper Echelons Theory has encompassed various aspects such as corporate performance, strategy, earnings management, decision-making, and accounting conservatism, underscoring its significance. This study selects Upper Echelons Theory as its foundational framework for several reasons. Upper Echelons Theory offers several benefits as a theoretical foundation: (1) It provides scholars with a powerful framework for explaining corporate strategy and behaviour; (2) In practice, it can help managers avoid common pitfalls when selecting or assembling executive teams; (3) It enables strategists or competitors to anticipate a rival's next move and develop countermeasures, gaining a competitive edge in a highly contested market. The study of

Upper Echelons Theory is not just an academic pursuit; understanding the cognitive biases and errors that executives may encounter can also significantly improve management efficiency and quality in real-world practice. In this research, the starting point is the inspiration provided by Upper Echelons Theory and the practical demands of management. The endpoint is corporate core competency, with executive compensation and interactive effects examined in between. This study aims to address certain blind spots within Upper Echelons Theory, potentially offering a theoretical innovation. In the empirical research section, this study draws on the Upper Echelons Theory to explore how external environments and external forces influence a firm's internal leadership and organizational conditions, thereby expanding the research scope of the Upper Echelons Theory.

Upper Echelons Theory provides a macro-level perspective for this study by emphasizing the personal characteristics of board members. Drawing on a review of domestic and international literature, this study concretizes this high-level theory into a multidimensional model illustrating the impact of board governance on corporate core competitiveness: board human capital (director age, education level, proportion of female directors, proportion of independent directors) and board social capital (overseas experience, financial background, director concurrently holds positions at other companies) serve as operational indicators of these upper-echelon characteristics. In this way, the broad propositions of Upper Echelons Theory are validated and applied at the level of board governance practice through a specific indicator system and empirical modelling.

## **2.8 Hypotheses Development**

---

Board human capital refers to the aggregate professional knowledge, skills, and experience possessed by board members (Becker, 1964; Singh and Ahmad, 2023). Upper Echelons Theory posits that these attributes serve as proxies for directors' cognitive frames and value orientations, thereby influencing strategic decision-making (Hambrick and Mason, 1984; Chen and Zhao, 2024). Upper Echelons Theory emphasizes that board human capital helps attract external resources and legitimacy (Pfeffer and Salancik, 1978; Li, Wang and Chen, 2024). Upper Echelons Theory suggests that human capital can mitigate managerial myopia and reduce agency costs (Jensen and Meckling, 1976; Kumar and Lee, 2023). In this study, board human capital is measured through four observable characteristics: average age, proportion of highly educated directors, proportion of female

directors, and proportion of independent directors. On this basis, the research hypotheses are presented as follows:

H1: Board human capital is positively related to corporate core competitiveness

Upper Echelons Theory posits that observable characteristics such as overseas education, financial background, and industry experience function as proxies for directors' cognitive frameworks and strategic preferences, thereby shaping the quality of board-level strategic decision-making (Hambrick and Mason, 1984). Upper Echelons Theory emphasizes that through their external networks, directors secure external resources and legitimacy, reducing environmental uncertainty and enhancing the firm's competitive advantage (Pfeffer and Salancik, 1978). Upper Echelons Theory suggests that when directors' interests are closely aligned with those of the firm, they are more proactive in leveraging social capital to secure external resources and curb managerial short-termism, thereby improving the firm's long-term competitiveness (Jensen and Meckling, 1976). In this study, board social capital is measured using the proportion of directors with overseas educational attainment, financial background, and industry experience. On this basis, the research hypotheses are presented as follows:

H2: Board social capital is positively related to corporate core competitiveness

Recent research indicates that the level of executive compensation, by reinforcing economic incentives, can significantly moderate the impact of board human capital on corporate core competitiveness. Upper Echelons Theory posits that appropriate compensation incentives better align directors' interests with those of shareholders, mitigating information asymmetry and managerial short-termism, and motivating directors to leverage their expertise and experience to drive innovation and long-term value creation (Jensen and Murphy, 1990; Zhang et al., 2022). Upper Echelons Theory suggests that a high level of executive compensation enhances directors' authority and legitimacy within corporate governance, enabling them to more autonomously deploy their human capital for strategic adjustments and resource integration, thereby strengthening the firm's market responsiveness and resource-allocation efficiency (Pfeffer and Salancik, 1978; Li et al., 2021). In this study, executive compensation is measured by one indicator, the ownership stake of board members. On this basis, the research hypotheses are presented as follows:

H3: Executive compensation positively moderates the relationship between board human capital and corporate core competitiveness

Recent studies indicate that the level of executive compensation can significantly moderate the impact of board social capital on corporate core competitiveness by reinforcing economic incentives. Upper Echelons Theory posits that when directors receive higher compensation incentives, their personal interests become more closely aligned with those of the firm, motivating them to more actively leverage their external networks to

secure policy support, cross-industry collaborations, and financing opportunities, while curbing managerial short-termism, thereby enhancing the firm's long-term competitiveness (Jensen and Meckling, 1976; Zhao and Liu, 2020). Upper Echelons Theory suggests that high levels of executive compensation increase directors' authority and legitimacy within the governance structure, enabling them to more autonomously utilize social capital for strategic alliances and resource integration, further strengthening the firm's market responsiveness and resource-allocation efficiency (Pfeffer and Salancik, 1978; Chen and Zhang, 2023). Additionally, a well-designed compensation system encourages executives to proactively maintain and expand their external networks, creating more strategic opportunities for the company and further boosting its competitiveness. In this study, the moderating role of executive compensation is operationalized using board ownership stake. On this basis, the research hypotheses are presented as follows:

H4: Executive compensation positively moderates the relationship between board social capital and corporate core competitiveness

## **2.9 Conclusion**

---

This chapter systematically reviewed and integrated the theoretical foundations and empirical advancements concerning corporate core competitiveness and board capital. It provided conceptual clarity by distinguishing between core competencies and core competitiveness, emphasizing that while the former denotes internal resource accumulation, the latter reflects the strategic transformation of these resources into sustained competitive advantages under dynamic market conditions (Teece et al., 1997).

The chapter highlighted the multidimensional nature of corporate competitiveness and its evolving manifestations in the digital and sustainability-driven era (Chen and Zhang, 2023). Furthermore, the chapter introduced board capital as a dual-dimensional construct encompassing board human capital and board social capital. Board human capital, reflected in director age, educational attainment, gender diversity, and board independence, shapes firms' strategic cognition, innovation orientation, and governance quality (Tan and Zhou, 2022). Board social capital, including overseas education, financial experience, and industry expertise, enhances external resource acquisition and strategic adaptability, particularly in contexts characterized by rapid technological change and policy uncertainty (Zhang and Wang, 2023).

The literature review revealed that, although prior studies have examined board capital's influence on firm performance, they often overlook its specific impact on corporate core competitiveness. Existing studies are also fragmented, treating human and social capital as isolated dimensions and failing to consider their interactive or synergistic effects (Liu et al., 2023). Moreover, empirical research has rarely incorporated moderating factors such as executive compensation, which plays a critical role in aligning board incentives and fostering effective utilization of board capital (Li, Luo and Lin, 2023).

To address the aforementioned research gaps, this study develops an integrated analytical framework based on the Upper Echelons Theory. It posits that board human and social capital exert significant influence on corporate core competitiveness and that this relationship is moderated by executive compensation, as measured by board ownership stake (Murphy, 2019). This conceptual model is expected to contribute to the literature by offering a comprehensive view of how board characteristics, under appropriate incentive structures, enhance firms' capacity for sustained value creation.

The chapter also identified relevant control variables, including firm size, financial leverage, and CEO duality, to ensure robustness in subsequent empirical analyses (Chen and Zhao, 2024). In sum, this literature review lays the theoretical groundwork for the empirical investigation in the following chapters, providing both academic and practical justification for examining the interplay between board governance and firm-level competitiveness within the context of China' s automotive industry.

CHAPTER 3:  
**METHODOLOGY**

### **3.1 Introduction**

---

The primary objective of this methodological framework is to establish a rigorous empirical bridge between board-level capital configurations and the resultant firm-level competitiveness. Consistent with the theoretical postulations delineated in Chapter 2, the research design adopts a quantitative post-positivist approach to systematically evaluate the causal mechanisms involving board human capital, social capital, and corporate governance efficacy. This section elucidates the transition from theoretical abstraction to empirical validation; furthermore, it justifies the selection of the Chinese automotive industry as a salient context for the systematic investigation of strategic disruptions and organizational resilience. The integration of longitudinal data and econometric modeling ensures that the multidimensional nature of board characteristics is captured with statistical precision, thereby facilitating a robust assessment of the proposed hypotheses.

The structure of this chapter is as follows: 3.1 Introduction: presents the chapter's objectives, structure, and overall approach. 3.2 Research Design: describes the quantitative empirical framework, hypothesis logic, and model types. 3.3 Sample Selection and Data Sources: defines the population and sample, details primary and secondary data sources, and explains data preprocessing. 3.4 Instrument Development and Variable Construction: explains the selection and construction of board capital and core competitiveness measures. 3.5 Variable Measurement: specifies how dependent, independent, moderator, and control variables are quantified. 3.6 Estimation Models: provides the mathematical specification of the fixed-effects panel regression and variable definitions. 3.7 Data Analysis: covers descriptive statistics, correlation analysis, principal component analysis, panel regression, and robustness checks. 3.8 Three-Stage Quantitative Paradigm: summarizes the sequential process of hypothesis formulation, model estimation, and robustness testing to guarantee

the reliability and validity of the results. 3.9 Conclusion, providing a summary of this chapter.

## **3.2 Research Design**

---

It systematically examines how board capital influences corporate core competitiveness within the context of high-powered compensation mechanisms. The empirical investigation is based on balanced panel data from 173 A-share listed automobile manufacturers and parts suppliers located in Shanghai and Shenzhen, covering the period from 2018 to 2023, comprising a total of 3923 firm-year observations.

To evaluate corporate core competitiveness, a comprehensive measurement system is developed comprising eight indicators categorized into five dimensions, namely profitability, technological innovation, growth potential, solvency, and operational efficiency. The construction of this evaluation framework draws upon the variance-weighted method introduced by Fang Mingming in 2006, the composite core competitiveness index proposed by Deng Danhua in 2013, and the assessment model established by Jin Wen in 2021. Principal component analysis is subsequently applied to extract the first principal component, referred to as Y, which is adopted as the composite score representing the level of core competitiveness for each firm.

In the empirical analysis, firm size, financial leverage, and CEO duality are included as control variables. Board human capital and board social capital serve as the key independent variables. To test the research hypotheses, fixed-effects panel regression models and multiple linear regression analyses are employed, aiming to determine the extent to which board capital affects corporate core competitiveness under varying governance conditions.

### **3.3 Sample Selection and Data Sources**

---

#### **3.3.1 Population and Sample Definition**

The population comprises all A-share automobile assemblers and component manufacturers continuously listed on the Shanghai or Shenzhen Stock Exchanges between 1 January 2018 and 31 December 2023. Company identifiers were first extracted from the China Stock Market and Accounting Research (CSMAR) database and cross-checked against disclosures on [cninfo.com.cn](http://cninfo.com.cn) and the two exchanges to create the sampling frame. A purposive census was then conducted: a firm was retained only if it (i) is a mainland China incorporated limited-liability company; (ii) remained listed for the entire six-year window; and (iii) released externally audited annual reports every year.

This procedure yielded 173 firms and 3,923 balanced firm-year observations, ensuring both industry homogeneity and data completeness (Sekaran and Bougie, 2022).

#### **3.3.2 Secondary Data**

The data used in this study was all secondary data. The first data were manually extracted from the PDF versions of company annual reports and include board-level variables such as the average age of directors, the proportion of directors holding master's or doctoral degrees, the percentage of female directors, the proportion of independent directors, the proportion of directors with overseas backgrounds, the proportion with financial services experience, and whether directors hold concurrent external directorships. In addition, information regarding the cash remuneration of the top three highest-paid executives was collected.

Next data were obtained from the China Stock Market and Accounting Research (CSMAR) database and cover financial statement and market-related indicators, including total assets, sales revenue, research and development expenditure, total liabilities, and inventory levels. It is important to note that the present research employs secondary data, which are defined by Sekaran and Bougie (2012) as data collected by authorized external institutions rather than directly gathered by the researcher.

The dataset used in this study takes the form of panel data, which consists of repeated observations of multiple cross-sectional units over several time periods. As discussed by Baltagi (2005) and Gujarati (2009), panel data offer several methodological advantages in quantitative research. First, they enable the control of unobserved individual heterogeneity, thereby enhancing model accuracy. Second, panel data provides more informative variation, reduce multicollinearity among variables, increase the degrees of freedom, and improve estimation efficiency. Third, by integrating time-series and cross-sectional dimensions, panel data helps to address the issue of omitted variable bias. Fourth, they allow for a more effective examination of dynamic changes over time. Fifth, panel data facilitate the detection and estimation of effects that are otherwise difficult to identify through pure time-series or cross-sectional data. Sixth, they support the construction of more complex behavioral models. Seventh, by increasing the number of observations, panel data reduce the aggregation bias that may arise at the individual level. These advantages make panel data a robust and valuable tool for examining variable relationships in studies involving complex and dynamic processes.

Given the relatively large sample size and the exclusion of firms with incomplete data, this study adopts purposive sampling as the sampling technique. The selected sample spans a six-year period from 2018 to 2023. Purposive sampling is a type of non-probability sampling that relies on the researcher's judgment in selecting representative samples. As explained by Black (2010), researchers can utilize informed judgment to identify suitable observations, thereby enhancing efficiency and reducing research costs.

All data related to the dependent variables, moderating variables, control variables, and independent variables for the specified period were collected from the official website of the China Securities Exchange, using publicly disclosed annual reports of listed companies. Although the dataset does not cover the full operational history of each sampled firm, the selected six-year timeframe provides a sufficiently comprehensive and reliable basis for empirical analysis. Moreover, the timeframe from 2018 to 2023 represents a recent and relevant period, which enhances the applicability of the research findings to current economic and corporate governance contexts.

Based on the purposive sampling strategy, this study selects 173 automotive firms listed on the China Securities Exchange as the final research sample. All empirical

analyses are conducted using STATA 17 software, and multiple econometric testing methods are applied to ensure the robustness and validity of the results.

### **3.3.3 Data Pre-Processing**

After retrieving the raw data from the China Stock Market and Accounting Research (CSMAR) database and performing batch extraction using Python scripts, the dataset was cleaned and pre-processed in Microsoft Excel 2021. This process included field alignment and the identification of missing values. Subsequently, the cleaned dataset was imported into Stata 17.0 for further processing. The procedures conducted in Stata included the standardization of measurement units and the application of natural logarithmic transformation to continuous variables, the conversion of categorical variables into binary dummy variables, the generation of descriptive statistics, and the implementation of outlier diagnostics.

## **3.4 Instrument Development and Variable Measurement**

---

### **3.4.1 Board Capital Indices**

Board human capital is assessed using four key indicators, including the average age of directors, the proportion of board members holding master's or doctoral degrees, the percentage of female directors, and the proportion of independent directors. The theoretical foundation for this construct is grounded in the Upper Echelons Theory and the Resource-Based View. These perspectives emphasize that the knowledge and skills possessed by directors constitute strategic resources that are valuable, rare, inimitable, and non-substitutable, thereby aligning with the VRIN framework proposed by Barney (1991). Such resources are considered essential for enhancing firms' internal capabilities and sustaining long-term competitive advantages.

Board social capital is measured through three dimensions: the proportion of directors with overseas educational or professional experience, the proportion of directors with a background in financial services, and whether directors concurrently hold board positions in other companies. This construct is supported by the theoretical lens of Upper

Echelons Theory, which posits that organizations rely on external linkages to secure access to critical resources and reduce environmental uncertainty. According to Pfeffer and Salancik (1978), such external connections enhance the firm's ability to acquire strategic information, build legitimacy, and coordinate with key stakeholders in the external environment.

### **3.4.2 Firm Core Competitiveness**

Drawing In alignment with established quantitative evaluation approaches, this study develops a corporate core competitiveness measurement system grounded in the variance-weighted method proposed by Fang (2006), the composite index structure outlined by Deng (2013), and the indicator selection principles recommended by Jin (2021). These foundations are further refined by incorporating recent methodological advancements in principal component analysis (PCA) as demonstrated in the empirical work of Zhang et al. (2023). The resulting framework comprises five key dimensions and eight financial indicators. The profitability dimension is evaluated using net profit margin and cost-to-profit margin (NPM, CPM); technological innovation is measured by the R&D capitalization ratio; growth is captured through equity growth rate and total asset growth rate; solvency is reflected in the current ratio and quick ratio; and operating efficiency is assessed via the inventory turnover ratio. This multidimensional construct is theoretically justified and aligned with the financial characteristics of the automotive manufacturing sector, thereby offering a reliable foundation for subsequent principal component extraction and empirical estimation.

### **3.5 Variable Measurement**

---

Operationalization is a way to confine abstract concepts of a thing to be able to get measured in a real number (Sekaran and Bougie, 2012). Operationalization is conducted by seeing behavioural dimensions, aspects, and nature that are symbolized with the concept and then be translated into observable and measurable elements and thus can develop an index measure of the concept. Operational definition and variable measurements in this research are presented as follows.

### 3.5.1 Dependent Variables

The dependent variable in this study is corporate core competitiveness, which represents the focal outcome influenced by the explanatory variables. Given the complex and multidimensional nature of competitiveness, recent literature increasingly critiques the use of single financial proxies such as return on assets (ROA), earnings per share (EPS), or R&D intensity due to the risk of measurement bias and construct incompleteness (Zhang et al., 2023). To overcome these limitations, this study adopts a composite index approach grounded in both theoretical foundations and empirical validity, thereby ensuring the construct's conceptual richness and statistical rigor.

Building on prior contributions by Fang (2006), Deng (2013), and Jin (2021), the measurement system integrates three complementary perspectives: (1) the variance-weighted evaluation method, which objectively assigns indicator weights; (2) the composite competitiveness index framework, which synthesizes diverse dimensions into a unified construct; and (3) an enterprise competitiveness model emphasizing logical coherence, empirical relevance, and data availability. Additionally, the structure of the indicator set aligns with global benchmarking systems, including the World Economic Forum's Global Competitiveness Framework (2023), IMD's World Competitiveness Yearbook (2024), and the evaluation practices of the China Business Journal (2024).

Empirical insights further support the selection of financial indicators used in this study. For example, current ratio and net profit margin have been shown to significantly influence profitability in Southeast Asian automotive firms between 2018 and 2022. Inventory turnover has been linked to capital efficiency, while R&D intensity has emerged as a leading indicator of technological innovation in global manufacturing sectors. These findings suggest that core competitiveness manifests through a firm's dynamic financial structure and resource deployment patterns (Li et al., 2024; European Automobile Manufacturers' Association, 2022).

Drawing from these theoretical and empirical insights, the present study constructs a five-dimensional indicator system comprising eight financial metrics to capture the underlying structure of firm-level competitiveness in the automotive sector. These are summarized in Table 3.1.

**Table 3.1: Financial Dimension Indicators and Codes Table**

<b>Dimension</b>	<b>Indicator</b>	<b>Rationale</b>
Profitability	1. Net Profit Margin (NPM)	Captures the firm's ability to convert sales into bottom-line earnings; positively linked to future profit growth
	2. Cost-to-Income Ratio (CIR)	Gauges cost control; a lower ratio signals higher operating leverage
Technological Innovation	3. R&D Intensity (RDS)	R&D expenditure ÷ revenue; reflects commitment to innovation and product differentiation, a proven source of competitive advantage in the sector
Growth	4. Shareholders' Equity Growth Rate (SEGR)	Indicates value creation for owners and capital-raising capacity
	5. Total Asset Growth Rate (TAGR)	Measures the pace of resource accumulation and scale expansion
Solvency	6. Current Ratio (CR)	Assesses short-term debt-servicing capacity
	7. Quick Ratio (QR)	A stricter liquidity gauge that excludes inventory
Operating Efficiency	8. Inventory Turnover Ratio (ITR)	Higher turnover denotes better inventory management and is positively associated with capital intensity

These indicators collectively form a multi-faceted portrait of enterprise competitiveness. Profitability and growth dimensions assess value generation and development potential; R&D intensity reflects innovation capacity; solvency captures short-term financial stability; and operating efficiency reflects the firm's ability to respond to resource allocation challenges.

To derive a unified measure from this multidimensional structure, principal component analysis (PCA) is employed. Prior to PCA application, all raw data are standardized to eliminate scale discrepancies. The Kaiser-Meyer-Olkin (KMO) measure

and Bartlett's test of sphericity are used to assess the suitability of factor extraction. Components with eigenvalues greater than 1 are retained, and the first principal component is interpreted as the composite core competitiveness index, denoted as Y. This approach enables maximum retention of relevant information while minimizing redundancy across indicators.

Compared to alternatives such as exploratory factor analysis or PLS-PM, PCA offers higher objectivity in weighting, better transparency in interpretation, and stronger robustness in large-sample financial research (Shi and Guo, 2024). Thus, the derived variable Y serves as a reliable and theoretically grounded proxy for firm-level core competitiveness in the Chinese automotive industry context.

### **3.5.2 Independent Variables**

In this study, the independent variables are categorized into two dimensions: board human capital and board social capital. This classification aligns with the conceptual framework and the theoretical foundations of upper echelons theory, which highlight the strategic importance of directors' personal attributes and external linkages in shaping firm competitiveness.

Board human capital (HC) reflects the internal competencies embedded in directors' personal characteristics, such as age, educational attainment, gender diversity, and independence.

Age is a key indicator of human capital within board capital. Research has shown that older directors tend to have a stronger sense of career and financial security and are more willing to invest in research and development (Barker III, V. L., and Mueller, G. C., 2002). Additionally, related studies by Lee P. M. and O'Neill H. M. (2003) indicate that as directors age, they tend to favor more stable development strategies. Following these studies, this paper calculates the age of the board members. In this research, age is treated as a critical factor influencing individual performance. This is because age is an inherent characteristic that is closely linked to a person's ability to perform. Age impacts a person's capacity in decision-making processes, particularly their ability to make correct decisions. It also affects intellectual capability, as well as psychological and emotional maturity.

Based on Hurlock's (2012) research on maturity levels, this study adopts the age of board members as the measure for the age variable. Specifically, the age variable is measured as follows:

Age = Age of board members

Educational attainment indicates an individual's level of knowledge and skill foundation (Hambrick and Mason, 1984) and is an important indicator of human capital. Education serves as a crucial means of acquiring knowledge. Drawing on Zhou Jian et al. (2012), this study categorizes board members into six levels based on their highest educational attainment: postdoctoral, doctoral, master's, bachelor's, associate degree, and secondary school or below. Values of 6, 5, 4, 3, 2, and 1 are sequentially assigned to these respective levels. The board's depth of knowledge is then measured by the education level of its members.

Education = Educational levels

Studies suggest that female leadership impacts others by encouraging employees to voluntarily unleash their potential and achieve excellence within an organization (Dong Fangfang, 2008). Lv Ying (2014) emphasized that female leadership refers to the ability of women to use their unique personality and style to influence others and organizational situations effectively. Tong Zhaoying (2004) also described female leadership as encompassing sensitivity, ambition, organizational ability, and the capacity to create environments. Thus, this study analyses the proportion of female directors as a key factor.

Percentage of female directors = Number of female directors / Total number of board members\*100%

Research has shown that independent directors play a crucial role in companies. Jiao Yuehua and Sun Yuan (2021) explored the role of scholar-type independent directors in corporate innovation and found that they contribute significantly by offering consultation, promoting research and development (R&D) investment, and improving innovation efficiency in listed companies. Moreover, technical independent directors, compared to non-technical ones, are more effective in enhancing R&D inputs and outputs. Chen Xichan (2024) discovered a significant negative correlation between the proportion

of professional independent directors and corporate cash holdings, indicating that independent directors with financial, legal, or economic expertise tend to favour investments over cash retention.

Percentage of independent directors = Number of independent directors / Total number of board members\*100%

As China accelerates its globalization strategy, many overseas returnees are contributing to the talent pool, especially in corporate innovation. These highly skilled individuals, who have received education and training abroad, bring fresh perspectives and cutting-edge knowledge, providing companies with innovative thinking. The presence of overseas talent strengthens corporate governance and enhances a company's global competitiveness. According to Liu Bai et al. (2014) and Xie bobao et al. (2003), the proportion of board members with overseas backgrounds is used to measure this aspect of board capital. In this study, directors with overseas backgrounds are coded as 1, while those without are coded as 0.

Board social capital (SC) denotes the external linkages and relational resources that directors bring into the firm through their over sea background, financial background, Directors serving on other companies.

Ovesea Back = directors with overseas backgrounds

Chain directors refer to those who hold board positions in multiple companies, creating links between the firm they represent and external companies. This study categorizes board members based on whether they hold multiple board positions. Directors with such roles are coded as 1, while those without are coded as 0. Chain directors establish direct connections between the companies where they serve.

Directors serving on other companies = Director concurrently holds positions at other companies

Board members who currently or previously worked in financial institutions bring valuable financial resources to the company, representing a key aspect of the company's relational capital. Based on the studies by Jermias and Gani (2014) and Chen Yue et al.

(2015), this study measures financial background by the proportion of board members with experience in financial institutions. Directors who have worked in banks, insurance companies, securities firms, fund management companies, or investment management companies are considered to have financial experience.

FinBack = Directors with financial backgrounds

### **3.5.3 Moderating Variables**

Taussings and Baker (1925) found that there was correlation between entrepreneur compensation and firm performance. For a company, long-term development considerations often lead to granting senior executives corresponding stock options each year. This practice tightly aligns the personal interests of executives with those of the company, thus enhancing the bond between them and motivating executives to work diligently for the firm. It also helps prevent talent loss at the executive level, ultimately increasing company value and enhancing competitiveness. Wang Hao and Huang Xiaoling (2023) found that long-term compensation gaps among executives positively influence firm performance. The primary goal of long-term incentives is equity-based compensation, which aims to maximize shareholder value by ensuring that the management team acts selflessly in the interest of the company, thereby improving competitiveness. Therefore, the management's shareholding ratio is chosen as a key measure of equity incentives.

Management shareholding ratio = Number of shares held by management / Total shares\*100%

### **3.5.4 Control Variables**

One of the control variables in this study is firm size. Firm size is a consistently included factor when determining corporate performance. It reflects the total assets a company holds to support its business operations (Dong and Liu, 2015). There are several methods to measure firm size, including using the natural logarithm of total assets or the natural logarithm of the number of employees. Larger firms may possess more production resources and a greater number of internal managers to enhance efficiency and effectiveness in achieving business performance. Previous research by Blease et al. (2010)

also used the number of employees to measure firm size. However, in this study, firm size is determined by taking the logarithmic value of the company's total assets held for business operations. This method has been employed by researchers such as Michaely (2012), and Abed et al. (2012). The formula for calculating firm size is as follows:

$$\text{Firmsize} = \text{Log of Total Assets}$$

Debt financing carries a unique governance effect. While it may prompt management to invest in high-risk, high-return projects, it can also lead to actions such as control contests and leveraged buyouts, which increase agency costs. Therefore, in China, debt financing has been observed to have a negative governance effect (Lu Jin, 2024). As a result, controlling the impact of the debt-to-asset ratio on company growth is essential.

$$\text{Assetliabilityratio} = \text{Liabilities} / \text{Total Assets}$$

In the context of corporate governance, the divergence of interests between the board of directors and the executive management facilitates mutual oversight and accountability. The separation of the roles of Chief Executive Officer (CEO) and Chairman of the Board is widely regarded as a mechanism that strengthens board independence and mitigates the risk of managerial opportunism. Nevertheless, in certain firms, it remains common for the CEO to simultaneously serve as Chairman, a governance arrangement often referred to as CEO duality. This structure may undermine the effectiveness of independent oversight by the board and compromise the balance and long-term orientation of corporate strategy. Therefore, it is essential to control for the potential disruptive effect of CEO duality on firm growth potential.

To capture the structural characteristics of CEO duality, a dummy variable is constructed. A value of 1 is assigned when the CEO concurrently holds the position of Chairman, and a value of 0 is assigned when the two roles are held by separate individuals. This variable is incorporated into the model as a control variable to account for the degree of managerial power concentration and its possible influence on the assessment of corporate core competitiveness, thereby enhancing the explanatory power and robustness of the empirical model.

IsDuality = Number of CEO serving as Chairman or Vice Chairman / Total number of board members

**Table 3.2: Variables measurements**

Variable type	Variable	Analyzing indicators	Variable definition or description
Dependent Variable	Enterprise core competence	Enterprise Core Competitiveness Composite Value Index	After factor analysis to get the comprehensive value index of enterprise core competitiveness
		(a person's) Age	age of board members
Independent Variable	human capital	Educational attainment	1 for Secondary School; 2 for college; 3 for bachelor's degree 4 for master's degree; 5 for doctoral degree; 6 for post-doctoral degree
		Distinguishing between the sexes	Percentage of female boards
		independent director	Percentage of independent boards
	social capital	Overseas Background	directors with overseas backgrounds are coded as 1, while those without are coded as 0.
		Financial background	directors with financial backgrounds are coded as 1, while those without are coded as 0.
		Directors serving on other companies	1 for a director's part-time employment or previous employment in an occupation of a different nature, 0 otherwise
moderator variable	remunerations	shareholding	Management's shareholding

	Remuneration of personnel	Total remuneration of the top three highest paid executives per annum
Table 3.2 continued		
	Company size	Total assets of the enterprise
		Natural logarithms of total assets
		Corporate gearing
		Total liabilities/assets
control variable	financial position	
		1= The CEO is a member of the board of directors
	bilaterality	0=The CEO is not a member of the board of directors

### 3.5.5 Operational Definitions of Core Concepts

In alignment with the variable measurement logic outlined earlier, operational definitions for key concepts are explicitly delineated below. All definitions comply with the academic paradigm of abstract concept, observable indicators, quantification method and are tailored to the rigor of empirical testing:

**Table 3.3: Concepts and Measurement Indicators**

Concept	Operational Definition	Measurement Indicators & Quantification
Board Human Capital	The cumulative stock of knowledge, skills, experience, and structural attributes of board members that are convertible into organizational value, operationalized through quantifiable demographic and governance characteristics	1. Age: Average age of all board members; 2. Degree Level: Coded by educational attainment (secondary school or below = 1, technical college = 2, bachelor's degree = 3, master's degree = 4, doctoral degree = 5, postdoctoral training = 6), computed as the mean educational level of the board; 3. Percentage of Women Directors: $(\text{Number of female directors} \div \text{Total board size}) \times 100\%$ ;

Table 3.3 continued

Board Social Capital	Board members' capability to access critical resources, information, and institutional legitimacy via external ties, manifested in their cross-border experiences and interorganizational network connections	4. Percentage of Independent Directors: $(\text{Number of independent directors} \div \text{Total board size}) \times 100\%$
Corporate Core Competitiveness	An enterprise's comprehensive competitive advantage derived from integrating internal and external resources, encompassing profitability, technological innovation, growth potential, solvency, and operational efficiency, measured by a composite financial indicator index	<p>1. Overseas Background: Dummy variable (1 = director possesses overseas educational or professional experience; 0 = otherwise);</p> <p>2. Financial Background: Dummy variable (1 = director has prior employment in financial institutions, including banks, securities firms, or investment entities; 0 = otherwise);</p> <p>3. Interlocking Directorships: Dummy variable (1 = director holds concurrent directorships in other companies; 0 = otherwise)</p> <p>Composite Competitiveness Index (CCI) extracted through Principal Component Analysis (PCA), constructed using 8 financial metrics:</p> <p>1. Profitability: Net Profit Margin (NPM), Cost-to-Income Ratio (CIR);</p> <p>2. Technological Innovation: R&amp;D Intensity (<math>\text{RDS} = \text{R\&amp;D expenditure} \div \text{Operating revenue}</math>);</p> <p>3. Growth Potential: Shareholders' Equity Growth Rate (SEGR), Total Asset Growth Rate (TAGR);</p> <p>4. Solvency: Current Ratio (CR), Quick Ratio (QR);</p> <p>5. Operational Efficiency: Inventory Turnover Ratio (ITR)</p>
Moderating Variable: Management Shareholding Ratio	An indicator reflecting the intensity of equity-based incentives, capturing the degree of interest alignment between management and shareholders	$(\text{Number of shares held by the executive team} \div \text{Total outstanding shares of the firm}) \times 100\%$
Control Variables	External confounding factors that may affect corporate core competitiveness, which are controlled in empirical models to ensure the validity and robustness of results	<p>1. Firm Size: Natural logarithm of the firm's total assets;</p> <p>2. Asset-Liability Ratio: <math>(\text{Total liabilities of the firm} \div \text{Total assets of the firm}) \times 100\%</math>;</p> <p>3. CEO Duality: Dummy variable (1 = CEO concurrently serves as board chairperson; 0 = otherwise)</p>

### 3.6 Research Estimation Model

This study employs panel data multiple regression analysis to examine the impact of independent variables, consisting of board human capital and board social capital, on the dependent variable of corporate core competitiveness. Several control variables related to firm size and financial condition are also included in the analysis. Additionally, executive compensation and shareholding ratio are introduced as moderating variables and incorporated into the model. The following regression equations are used in this study to test the hypotheses.

To test hypothesis H1 regarding the impact of board human capital on corporate core competitiveness, the following baseline regression model is constructed:

$$\text{ECCOMPETITIVENESS} = a + \beta_1 \text{ Age} + \beta_2 \text{ Education} + \beta_3 \text{ Percentageoffemaledirectors} + \beta_4 \text{ Percentageofindependentdirectors} + \beta_5 \text{ Firmsize} + \beta_6 \text{ Assetliabilityratio} + \beta_7 \text{ IsDuality} + \varepsilon$$

Equation 3.1

This equation is a fixed-effects regression model designed to estimate the linear relationship proposed in Hypothesis H1 between board human capital and corporate core competitiveness (ECCOMPETITIVENESS). The meanings of the symbols are as follows:

**Table 3.4: Descriptions for Equation 3.1**

Symbol / Variable	Description	Interpretation
ECCOMPETITIVENESS	Dependent variable — the firm's core-competitiveness score	A composite index generated via PCA / factor analysis; a higher value indicates stronger competitiveness.
a	Intercept (constant term)	The theoretical baseline value of core competitiveness when all explanatory variables equal zero.
$\beta_1$ Age	Average age of directors	$\beta_1$ shows the expected change in competitiveness when the average age rises by one year (holding other factors constant).
$\beta_2$ Education	Proportion of directors with postgraduate degrees	$\beta_2$ indicates the expected change when the share of highly educated directors increases by one percentage point.
$\beta_3$ Percentageoffemaledirectors	Percentage of female directors	$\beta_3$ captures the marginal impact of greater gender diversity on competitiveness.

Table 3.4 continued

$\beta_4$ Percentage of independent directors	Percentage of independent directors	$\beta_4$ reflects how stronger oversight and governance affect competitiveness.
$\beta_5$ Firm size	Firm size (e.g., ln Total Assets)	$\beta_5$ measures the change in competitiveness when firm size expands by one (log) unit.
$\beta_6$ Asset liability ratio	Asset-liability ratio (leverage)	$\beta_6$ captures the positive or negative effect of leverage on competitiveness.
$\beta_7$ IsDuality	CEO duality dummy (1 = CEO is also board chair; 0 = otherwise)	$\beta_7$ estimates the net effect of a dual role on competitiveness.
$\varepsilon$	Error term	Encompasses all random factors not explicitly included in the model; assumed to have zero meaning and constant variance.

To test Hypothesis H2 regarding the impact of board social capital on corporate core competitiveness, the following baseline regression model is constructed:

$$\begin{aligned} \text{ECCOMPETITIVENESS} = & a + \beta_1 \text{OveSeaBack} + \beta_2 \\ & \text{FinBack} + \beta_3 \text{Directorservingonothercompanies} + \beta_4 \text{FirmSize} \\ & + \beta_5 \text{Assetliabilityratio} + \beta_6 \text{IsDuality} + \varepsilon \end{aligned} \quad \text{Equation 3.2}$$

This equation is a fixed-effects regression model designed to estimate the linear relationship proposed in Hypothesis H2 between board social capital and corporate core competitiveness (ECCOMPETITIVENESS). The meanings of the symbols are as follows:

Table 3.5: Descriptions for Equation 3.2

Symbol	Variable name	Definition	Expected effect
ECCOMPETITIVENESS	Core-competitiveness score	Composite index extracted via PCA / factor analysis; the higher the value, the stronger the competitiveness	Dependent variable
a	Intercept	Baseline level of competitiveness when all explanatory variables equal zero	Constant

Table 3.5 continued

$\beta_1$ OverseaBack	Directors with overseas background	Whether there are directors with overseas study or work experience	$\beta_1 > 0$ would mean international exposure enhances competitiveness
$\beta_2$ FinBack	Directors with financial background	Whether there are directors with experience in banks, securities, investment, etc.	$\beta_2 > 0$ indicates financial expertise improves resource-allocation efficiency
$\beta_3$ Directorsservingonothercompanies	Directors serving in other companies	Whether there are directors who serve as directors of other listed companies	$\beta_3 > 0$ suggests network ties bring in external resources and information
$\beta_4$ Firmsize	Firm size (log of total assets)	Control for scale effects	A positive (negative) $\beta_4$ reflects “large-firm advantage” (“size burden”)
$\beta_5$ Assetliabilityratio	Asset–liability ratio (leverage)	Control of financial leverage	Sign of $\beta_5$ shows whether leverage aids or hinders competitiveness
$\beta_6$ IsDuality	CEO duality dummy	1 if the CEO is also board chair; 0 otherwise	$\beta_6 > 0$ implies concentrated power boosts efficiency; $\beta_6 < 0$ implies the opposite
$\varepsilon$	Error term	Captures random factors not explicitly modelled; assumed to have zero meaning and constant variance	Random disturbance

To test Hypothesis H3 regarding whether board compensation moderates the relationship between board human capital and corporate core competitiveness, the following baseline regression model is constructed:

$$\begin{aligned}
\text{ECCOMPETITIVENESS} = & a + \beta_1 \text{ Age} + \beta_2 \text{ Education} + \beta_3 \\
& \text{Percentageoffemaledirectors} + \beta_4 \text{ Percentageofindependentdirectors} + \\
& \beta_5 \text{ Managementshareholdingratio} + \beta_6 (\text{Age} \times \\
& \text{Managementshareholdingratio}) + \beta_7 (\text{Education} \times \\
& \text{Managementshareholdingratio}) + \beta_8 (\text{Percentageoffemaledirectors} \times \\
& \text{Managementshareholdingratio}) + \beta_9 (\text{Percentageofindependentdirectors} \\
& \times \text{Managementshareholdingratio}) + \beta_{10} \text{ Firmsize} + \\
& \beta_{11} \text{ Assetliabilityratio} + \beta_{12} \text{ IsDuality} + \varepsilon
\end{aligned}
\tag{Equation 3.3}$$

This equation is a fixed-effects regression model designed to estimate the interaction effects proposed in Hypothesis H3, which examines whether board compensation moderates the relationship between board human capital and corporate core competitiveness (ECCOMPETITIVENESS). The meanings of the symbols are as follows:

**Table 3.6: Descriptions for Equation 3.3**

Symbol	Variable	Meaning
ECCOMPETITIVENESS	Core-competitiveness score	PCA / factor-analysis composite; higher values = stronger competitiveness
a	Intercept	Baseline competitiveness when all regressors equal zero
$\beta_1$ Age	Average director age	Main effect: expected change in competitiveness when average age rises by one year (other variables remain constant)
$\beta_2$ Education	Sharing directors with postgraduate degrees	Main effect of educational attainment
$\beta_3$ Percentageoffemaledirectors	Percentage of female directors	Main effect of gender diversity
$\beta_4$ Percentageofindependentdirectors	Percentage of independent directors	Main effect of monitoring strength
$\beta_5$ Managementshareholdingratio	Log cash pay of the three highest-paid executives	Main effect of executive-pay intensity

Table 3.6 continued

$\beta_6$ (Age $\times$ Managementshareholdingratio)	Interaction between Age and Managementshareholdingratio	Does pay amplify or dampen the age effect?
$\beta_7$ (Education $\times$ Managementshareholdingratio)	Interaction between education and Managementshareholdingratio	Does pay strengthen the value of higher education?
$\beta_8$ (Percentageoffemaledirectors $\times$ Managementshareholdingratio)	Interaction between Percentage of female directors and Managementshareholdingratio	Does pay alter the competitiveness premium of gender diversity?
$\beta_9$ (Percentageofindependentdirectors $\times$ Managementshareholdingratio)	Interaction between Percentage of independent directors and Managementshareholdingratio	Complementarity or substitution between pay intensity and board monitoring
$\beta_{10}$ Firmsize	Firm size (ln Total Assets)	Control for scale effects
$\beta_{11}$ Assetliabilityratio	Asset–liability ratio (leverage)	Control of financial structure
$\beta_{12}$ IsDuality	CEO duality dummy (1 = CEO is also board chair)	Control for power concentration
$\varepsilon$	Error term	Unmodelled random influences; assumed IID with zero mean and constant variance

$$\begin{aligned}
\text{ECCOMPETITIVENESS} = & a + \beta_1 \text{OveseaBack} + \beta_2 \text{FinBack} + \beta_3 \\
& \text{Director\_ListCO} + \beta_4 \text{Managementshareholdingratio} + \beta_5 (\text{OveseaBack} \times \\
& \text{Managementshareholdingratio}) + \beta_6 (\text{FinBack} \times \\
& \text{Managementshareholdingratio}) + \beta_7 (\text{Directorservingonothercompanies} \\
& \times \text{Managementshareholdingratio}) + \beta_8 \text{Firmsize} + \beta_9 \text{Assetliabilityratio} + \\
& \beta_{10} \text{IsDuality} + \varepsilon
\end{aligned}
\tag{Equation 3.4}$$

This equation is a fixed-effects regression model designed to estimate the interaction effects proposed in Hypothesis H4, which examines whether board compensation moderates the relationship between board social capital and corporate core competitiveness (ECCOMPETITIVENESS). The meanings of the symbols are as follows:

**Table 3.7: Descriptions for Equation 3.4**

Symbol	Variable	Meaning
ECCOMPETITIVENESS	Core-competitiveness score	PCA / factor-analysis composite; higher values indicate stronger competitiveness
a	Intercept	Baseline level of competitiveness when all explanatory variables are set to zero
$\beta_1$ OveseaBack	Whether there are directors with overseas study or work experience	Main effect of international exposure on competitiveness
$\beta_2$ FinBack	Whether there are directors with experience in banks, securities, investment, etc.	Main effect of financial expertise on competitiveness
$\beta_3$ Directorsservingonothercompa nies	Whether there are directors who serve as directors of other listed companies	Main effect of external network and interlocking directorships
$\beta_4$ Managementshareholdingratio	Log cash pay of the three highest-paid executives	Main effect of executive-pay intensity
$\beta_5$ (OveseaBack $\times$ Managementshareholdingratio)	Interaction between OveseaBack and Managementshareholdingratio	Does compensation moderate the effect of overseas experience?

Table 3.7 continued

---

$\beta_6$ (FinBack $\times$ Managementshareholdingratio)	Interaction between FinBack and Managementshareholdingratio	Does pay influence the value of financial background?
$\beta_7$ (Directorsservingonothercompanies $\times$ Managementshareholdingratio)	Interaction between Directorsservingonothercompanies and Managementshareholdingratio	Does compensation affect the contribution of interlocking directorships?
$\beta_8$ Firmsize	Firm size (log of total assets)	Control for firm scale
$\beta_9$ Assetliabilityratio	Asset–liability ratio (leverage)	Control of financial structure and risk profile
$\beta_{10}$ IsDuality	CEO duality dummy (1 = CEO is also board chair)	Control for power centralization
$\varepsilon$	Error term	Unobserved random effects; assumed to be IID with zero meaning and constant variance

---

Model assumptions : Explanatory variables are uncorrelated with  $\varepsilon$  (no endogeneity).  $\varepsilon$  is IID with zero mean and constant variance; heteroskedasticity, if detected, should be addressed with robust standard errors. No severe multicollinearity among regressors (checked via VIF).

### 3.7 Data Analysis

---

The analysis of research data in this study is conducted with several statistical tools. Initial analysis is conducted in the form of descriptive statistics to obtain general description of research data. Further analysis will be the main analysis using panel data regression that required several steps to find the best estimation for the best result. The final analysis will cover sensitivity analysis to build strong and robust research empirical evidence that confirm the capacity and the validity of the research.

### 3.7.1 Descriptive Statistics

Descriptive statistics is a statistical tool used to present quantitative descriptions of a research object in a manageable form without drawing analytical inferences or general conclusions (Holcomb, 2016; Field, 2022). This tool enables researchers to organize and simplify large amounts of data in a meaningful way, allowing complex datasets to be understood briefly. Each descriptive statistic distils extensive information into a concise summary, making it easier to interpret data and facilitating comparisons across different data sets (Kotronoulas et al., 2023).

Typically, descriptive statistics involve univariate analysis, focusing on examining one variable at a time across multiple cases. This approach helps capture the fundamental characteristics of the data, which are essential for understanding patterns and trends within a single variable (Holcomb, 2016). According to Holcomb (2016), there are three primary characteristics of a variable that descriptive statistics aim to examine:

a. **Data Distribution:** This is represented by frequency distribution, which displays how often each value or category of the variable occurs, giving insight into the overall structure of the data (Field, 2022).

b. **Central Tendency:** Central tendency is represented by the mean, median, and mode, which are measures that identify the center or typical value within a dataset. These metrics provide a summary of where most data points cluster, allowing researchers to understand the "average" or "typical" observation (Holcomb, 2016).

c. **Data Dispersion:** Data dispersion is represented by measures such as standard deviation, which indicate the extent to which data points vary around the central tendency. This helps in understanding the spread or variability within the dataset, showing whether the data are closely grouped or widely dispersed (Ahmed, 2025).

In sum, descriptive statistics provide a powerful means of summarizing and interpreting complex datasets, enabling researchers to identify patterns, trends and relationships within the data, and offering a foundation for further analytical processes (Kotronoulas et al., 2023; Ahmed, 2025).

### **3.7.2 Data Standardization Processing**

Normality testing is performed to assess whether the dataset conforms to the properties of a Gaussian distribution, which serves as a critical foundational assumption underpinning the validity of numerous parametric estimation techniques, including linear regression, maximum likelihood estimation, and analysis of variance. The standard approach involves formulating a null hypothesis stating that the residuals follow a normal distribution and testing it against an alternative hypothesis. This process facilitates the selection of appropriate estimation methods and reduces the risk of bias in parameter inference. Commonly employed tests include the Shapiro–Wilk test, the Kolmogorov–Smirnov test, and the Anderson–Darling test. According to recent Monte Carlo simulation studies, the Shapiro–Wilk and D’Agostino–Pearson tests have demonstrated relatively higher statistical power across a variety of symmetric and asymmetric distributional conditions.

Rejection of the null hypothesis at a specified significance level indicates potential violations of the normality assumption, suggesting that standard parametric methods may produce biased or inefficient estimates. Nevertheless, the Central Limit Theorem posits that with sufficiently large sample sizes, the sampling distribution of means and regression coefficients will approximate normality, even when the underlying data deviate slightly from a normal distribution.

Prior to conducting factor analysis, whether exploration or confirmatory, all raw indicators must be standardized into normal variates with a mean of zero and a standard deviation of one. This standardization process, known as z-score normalization, ensures uniformity of measurement scales across variables. It also enhances comparability, improves the stability of factor loadings, and facilitates more accurate interpretation of component scores.

### **3.7.3 Correlation Statistics**

Correlation analysis constitutes a fundamental statistical technique employed to assess the strength and direction of associations between two or more variables. Within empirical research, it is frequently utilized to determine the presence of inter-variable

relationships and to evaluate the extent to which variations in one variable correspond with changes in another (Schober et al., 2018; Field, 2022). It is essential to recognize that correlation does not imply causation; rather, it reflects statistical association. This characteristic renders correlation analysis particularly useful in exploratory research or preliminary stages of empirical inquiry, where the objective is to identify potential patterns that warrant more rigorous investigation (Emamjomeh et al., 2023).

The Pearson correlation coefficient, denoted as  $r$ , is the most widely applied metric in such analyses. This coefficient measures the degree of linear association between two continuous variables and ranges from -1 to +1. A coefficient close to +1 indicates a strong positive relationship, wherein both variables tend to increase concurrently. Conversely, a value near -1 suggests a strong negative relationship, where one variable increases as the other decreases. Coefficients near zero indicate an absence of meaningful linear association.

It is important to note that Pearson's  $r$  is limited to detecting linear relationships. In cases where the association between variables is monotonic but not linear, alternative techniques such as Spearman's rank correlation are more appropriate (Field, 2022).

Interpretation of correlation coefficients should consider both the sample size and the corresponding p-values. Larger sample sizes generally yield more reliable estimates, while the p-value provides a measure of the statistical significance of the observed relationship. A commonly accepted threshold for significance is  $p < 0.05$  (Bonett and Wright, 2022). However, statistical significance should not be equated with causal inference.

Despite its utility, correlation analysis is subject to several limitations. It does not permit causal conclusions, is sensitive to the influence of outliers which may distort the magnitude or direction of relationships and is vulnerable to the effects of confounding variables that may induce spurious associations (Emamjomeh et al., 2023).

Considering these constraints, it is imperative that researchers interpret correlation results with caution. Where feasible, findings should be substantiated through complementary analytical methods, including regression models with appropriate control

variables or experimental designs, to enhance the validity and robustness of the conclusions drawn.

### **3.7.4 KMO Test and Bartlett's Test of Sphericity**

Before conducting factor analysis, it is necessary to confirm that the data matrix exhibits sufficient common variance and statistically significant inter-item correlations. Two widely accepted diagnostic tools for this purpose are the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity, both of which provide empirical justification for proceeding with factor extraction.

The KMO measure evaluates the proportion of shared variance among variables relative to their total variance, producing values between 0 and 1. Higher KMO values indicate a stronger underlying structure among variables, thereby supporting the use of factor analysis. Specifically, values above 0.80 are considered highly satisfactory, values between 0.70 and 0.79 are regarded as moderate, values from 0.60 to 0.69 as mediocre, and those between 0.50 and 0.59 as marginally acceptable. Values below 0.50 suggest that the dataset is unsuitable for factor analysis. In empirical research, a KMO value exceeding 0.50 is typically recognized as the minimum threshold for continuing with the analysis.

Bartlett's Test of Sphericity assesses whether the observed correlation matrix significantly diverges from an identity matrix, indicating the presence of meaningful correlations among variables. If the test yields a p-value lower than the predetermined significance level (commonly 0.05), the null hypothesis of sphericity is rejected. This outcome affirms that the correlations are not random and thus substantiates the appropriateness of applying factor analysis.

In conclusion, the KMO measure and Bartlett's test serve as critical preliminary evaluations, ensuring that the selected variables exhibit sufficient statistical coherence to justify the extraction of latent factors.

### 3.7.5 Principal Component Analysis

Principal Component Analysis (PCA) is one of the most widely used dimensionality reduction algorithms (Jolliffe and Cadima, 2016). The main idea of PCA is to map n-dimensional features onto k dimensions, where these k dimensions are new orthogonal features, also known as principal components, constructed from the original n-dimensional features. PCA works by sequentially finding a set of mutually orthogonal coordinate axes in the original space, where the selection of new coordinate axes is closely related to the data itself (Abdi and Williams, 2010). The first new coordinate axis is chosen in the direction of the greatest variance in the original data, and the second axis is selected from the plane orthogonal to the first axis where the variance is maximized. The third axis is selected from the plane orthogonal to both the first and second axes, and so on, resulting in n such coordinate axes. In this way, it is found that the majority of the variance is contained within the first k coordinate axes, whereas the remaining axes account for nearly zero variance. Therefore, the remaining axes can be ignored, with the first k axes that contain most of the variance retained. Essentially, this means keeping the feature dimensions that contain most of the variance and discarding those that contribute almost zero variance, thus achieving dimensionality reduction of the data features (Jolliffe and Cadima, 2016). In this study, PCA will be used to calculate the core competitiveness of automotive industry companies, which will then be treated as the dependent variable for further analysis.

To compress eight highly- correlated financial and operating indicators into a single, information-rich Core-Competitiveness Index (CCI), the study must satisfy three simultaneous criteria: maximum information retention, statistical soundness, and economic interpretability. After a comprehensive evaluation of commonly used dimensionality reduction techniques, including Exploratory Factor Analysis (EFA), Partial Least Squares Path Modelling (PLS-PM), Independent Component Analysis (ICA), as well as non-linear methods such as t-SNE and deep autoencoders, Principal Component Analysis (PCA) was identified as the most suitable method based on three key considerations. First, PCA ensures orthogonality, as each principal component (PC) is uncorrelated with others, thereby eliminating multicollinearity when these components are subsequently used in interaction-intensive panel regression models. Second, PCA offers full transparency, with linear loadings clearly disclosed and traceable to variables commonly examined in prior

research on China’s automotive industry (Fang, 2006; Deng, 2013). In contrast, approaches such as kernel PCA, ICA, and manifold learning methods often operate as “black boxes,” which do not meet academic and regulatory standards for interpretability and disclosure. Finally, empirical evidence supports the superiority of PCA. A 2024 benchmark study comparing 15 dimensionality reduction techniques in the context of credit rating prediction demonstrated that PCA outperformed alternatives in both explanatory power and forecast accuracy (Chi, Zeng, and Ma, 2024).

Hence, PCA provides the best balance between information compression, orthogonality, interpretability and sample suitability.

**Table 3.8: Comparison of Dimensionality Reduction Methods: Evaluation Dimensions**

<b>Evaluation Dimension</b>	<b>PCA</b>	<b>Alternative: EFA</b>	<b>Alternative: PLS-PM</b>	<b>Alternative: t-SNE / Auto-encoder</b>
Orthogonality	Components are orthogonal by design	Factors may be correlated	Latent scores partially correlated	Loadings cannot be meaningfully quantified
Sample efficiency	Stable with $\approx 4$ k observations	Similar requirements	Must estimate Y and X simultaneously $\rightarrow$ lower efficiency	Usually needs $> 10$ k samples for stability
Interpretability and transparency	Loadings can be given clear economic meanings	Still interpretable after rotation	Prediction-oriented; interpretation difficult	“Black-box” models—hard to disclose or justify
Information retention	$PC_1$ alone explains $\geq 70\%$ of variance	Variance spread across several factors	Needs extra metrics to assess explained variance	Does not report variance shares

Evidence in literature	Most widely validated in credit-rating and competitiveness studies	Fewer recent empirical applications	Favored in marketing-oriented modelling	Geared toward visualization, not quantitative inference
------------------------	--	-------------------------------------	---	---

**Table 3.9: PCA Implementation Steps**

Step	Key Operation
1. z-standardization	$(x_{ij}-x_j)/s_j \Rightarrow$ mean 0, variance 1
2. KMO and Bartlett tests	Acceptance: $KMO > 0.70$ ; $\chi^2(p) < 0.001$
3. Eigenvalues and scree plot	Kaiser rule $\lambda > 1$ ; “elbow” in scree plot
4. Principal-component loadings	Inspect magnitude of factor loadings
5. Construction of CCI	Weight by loadings: $CCI_{it} = \sum w_k Z_{kit}$
6. Reliability test	Cronbach’s $\alpha > 0.80$ ; bootstrap $\alpha$
7. Robustness check	Re-run PCA after randomly holding out 20 % of data

### 3.7.6 Panel Data Regression Analysis

Panel data, also referred to as longitudinal or cross-sectional time-series data, consist of repeated observations on the same entities over multiple time periods (Baltagi, 2021). By tracking the same firm or individual across time, researchers are able to control for unobserved, time-invariant factors such as managerial style or corporate culture, thereby addressing individual heterogeneity (Wooldridge, 2022). Furthermore, the structure of panel data naturally supports the analysis of variables across multiple levels, offering a robust foundation for multilevel or hierarchical modeling (Cameron and Trivedi, 2005).

Panel data regression is thus considered an extension of conventional multiple regression models. Estimation, hypothesis testing, and diagnostic procedures are adapted to account for the dual dimensions of cross-sectional units (N) and time periods (T). Common approaches include fixed effects, random effects, and mixed effects models, supplemented by robustness checks for heteroskedasticity, consistency, and endogeneity (Gujarati and Porter, 2009; Hsiao, 2014).

The fixed effects model assumes that differences across entities are captured in varying intercepts due to individual-specific characteristics (Gujarati, 2009). In contrast, the random effects model treats these intercepts as constant, sampled from a common mean, with individual variations absorbed into the error term (Gujarati, 2009).

The selection between these models depends on both theoretical and empirical considerations. When the number of time periods is relatively large and the number of cross-sectional units is small, the results from fixed and random effects models tend to converge. Under such circumstances, fixed effects are often preferred due to ease of estimation. Conversely, when the cross-sectional dimension is substantially larger than the time dimension, the estimates may differ significantly. If the cross-sectional units are randomly drawn, the random effects model is appropriate. Otherwise, fixed effects should be employed.

In instances where the cross-sectional error component is correlated with the independent variables, estimates from the random effects model may be biased, while those from the fixed effects model remain consistent. If the assumptions underlying the random effects model hold and the cross-sectional size is large, the random effects model offers more efficient estimates.

To determine the most appropriate model in empirical analysis, the Hausman test is employed. The null hypothesis posits no systematic difference in coefficients between the two models, whereas the alternative suggests significant differences. A p-value below 0.05 leads to the rejection of the null hypothesis, indicating that the fixed effects model is more suitable. If the p-value exceeds this threshold, the random effects model is preferred.

To assess the explanatory power of the regression model, the coefficient of determination ( $R^2$ ) is used. This statistic quantifies the proportion of variance in the dependent variable explained by the independent variables and is a standard indicator of model fit (Gujarati, 2009). Values of  $R^2$  range from 0 to 1, with higher values indicating stronger predictive power.

The F-statistic is applied to evaluate the joint significance of all independent variables (Gujarati and Porter, 2009; Wooldridge, 2022). If the significance level is less than the alpha threshold (typically 0.05), the null hypothesis is rejected, confirming the model's suitability for further analysis. If the significance level exceeds the threshold, the model is considered statistically insignificant.

Additionally, the test is conducted to examine whether each independent variable individually influences the dependent variable. A significance level lower than the alpha value (such as 0.01, 0.05, or 0.10) indicates that the variable has a significant effect. Conversely, a significance level above the threshold suggests that the variable does not exert a statistically meaningful influence.

In summary, the combined use of fixed and random effects models, supported by the Hausman test and supplemented with diagnostic procedures, ensures the methodological rigor, accuracy, and reliability of panel data regression analysis in this study.

### **3.7.7 Robustness Analysis**

In empirical research, ensuring the robustness and reliability of analytical results is a fundamental requirement for advancing academic knowledge. To achieve this objective, researchers typically employ rigorous analytical procedures along with supplementary tests under varying scenarios (Plümper and Neumayer, 2017). These procedures, collectively referred to as robustness checks, serve as essential tools for verifying the consistency and generalizability of research findings, thereby enhancing the overall quality of the study (Kreinovich, Sriboonchitta, and Huynh, 2017).

In the present study, robust testing involves conducting further analyses of the independent variables to examine their effects on the dependent variable across different contextual conditions. Specifically, the exclusion of samples from the COVID-19 period is deemed both necessary and beneficial. Given the extensive disruptions caused by the pandemic to global economic activity and corporate operations, data from this period present a distinct empirical environment. By excluding such data, the analysis focuses on a more stable context, which facilitates a more accurate assessment of the study's core findings and reinforces their credibility.

The exclusion of pandemic-period data contributes scientific value in three critical aspects. First, between 2020 and 2022, firms encountered substantial supply chain disruptions, market demand volatility, and severe cash flow constraints. These external shocks compelled corporate decision-makers to reprioritize risk management, cost efficiency, and sustainability initiatives (Ivanov and Dolgui, 2020; EY, 2023). Removing these observations allows the analysis to concentrate on standard operating conditions, thereby validating the robustness of the model in non-crisis environments.

Second, if the estimated coefficients remain stable across pandemic and non-pandemic subsamples, this indicates that the model retains explanatory power under varying temporal conditions. Such stability enhances the external validity and generalizability of the empirical results (Plümper and Neumayer, 2017; Kreinovich et al., 2017).

Third, the pandemic period triggered observable shifts in firms' financial leverage, investment timing, and risk appetite. Existing studies suggest that many enterprises adopted conservative financial strategies, such as hoarding cash and reducing exposure to high-risk investments (Yang, Bao, and Chen, 2024). Conducting regression analysis after excluding pandemic-era data provides a more precise understanding of the causal mechanisms in typical operating environments and offers empirical support for policy formulation aimed at crisis management and future shock preparedness (Assibi, 2022; Ivanov and Dolgui, 2020).

In summary, excluding pandemic-period samples enhances the robustness of empirical results and provides valuable insights for managers and policymakers seeking to develop resilience against external disruptions.

### 3.8 Three-Stage Quantitative Paradigm

---

This study develops an integrated analytical framework and further introduces a dynamic-capability lens to explain why firms generate heterogeneous performance outcomes when (re)configuring and leveraging resources against the backdrop of the globalization of the automotive industry (Barney, 1991; Pfeffer & Salancik, 1978; Tsou & Kim, 2024).

The Resource-Based View (RBV) emphasizes that the firm’s ability to maintain a sustainable competitive advantage primarily depends on the possession and deployment of internal resources that are valuable, rare, inimitable, and non-substitutable. In contrast, Upper Echelons Theory asserts that organizations must establish formal governance mechanisms, particularly the board of directors, within external networks to acquire essential resources and legitimacy. By integrating these two perspectives, a comprehensive understanding emerges regarding the role of board capital in enhancing corporate core competitiveness. Specifically, board human capital, which encompasses the directors’ knowledge and skills, and board social capital, which reflects their external affiliations and reputational assets, serve not only as direct sources of strategic resources but also as mechanisms for integrating internal and external capabilities. These two dimensions jointly contribute to the firm's ability to construct and sustain long-term competitive advantages.

**Table 3.10: Research Method Stages and Theoretical Mapping**

---

Stage	Key steps	Theoretical mapping	Expected outcome
-------	-----------	---------------------	------------------

---

Stage ① – Metric construction and PCA extraction	Using the variance-weighted method (Fang, 2006), Deng’s core-competence composite index (Deng, 2013) and Jin’s evaluation framework (Jin, 2021), eight operative indicators are selected under five dimensions—profitability, innovation, growth, solvency and efficiency. Principal-component analysis (PCA) then extracts the first principal component Y as the firm’s core-competence score.	RBV – resource heterogeneity	An unbiased, comprehensive and dynamic measure of competitiveness
Stage ② – Baseline effects test	Controlling for firm size, asset-liability ratio, and CEO duality, this study employs a fixed-effects panel regression model to examine the impact of board human capital and board social capital, respectively, as independent variables on the dependent variable Y.	RDT – external resource acquisition	BHC and BSC are both expected to enhance core competitiveness
Stage ③ – Moderation effects test	The executive incentive proxy variable, represented by the management shareholding ratio, is used to construct interaction terms to examine the joint effect of board capital and incentive mechanisms on corporate core competitiveness.	Upper Echelons Theory – incentive contracts	Under high-incentive conditions, the marginal contribution of BHC/BSC should become more pronounced

### 3.9 Conclusion

This chapter systematically presents the methodological framework adopted to examine the impact of board capital, encompassing both human and social dimensions, on the core competitiveness of automotive manufacturing enterprises in China.

The research sample consists of 173 A-share listed automotive manufacturing firms, resulting in a balanced panel dataset comprising 3923 firm-year observations from 2018 to 2023. Board-related variables were manually extracted from publicly disclosed annual reports, while financial and market data were obtained from authoritative databases including Wind and the China Stock Market and Accounting Research database. All data processing, transformation, and regression analyses were conducted using STATA version 17.

Independent variables representing board human capital and board social capital were developed based on the Upper Echelons Theory and supported by prior empirical studies. The dependent variable, corporate core competitiveness, was measured using a composite index generated through Principal Component Analysis. This index integrates five key dimensions: profitability, innovation, growth, solvency, and operational efficiency. The construction of this index follows established methodological standards outlined in previous literature including Fang, Deng, and Zhang.

The empirical strategy applies fixed-effects panel regression models to account for time-invariant unobserved heterogeneity across firms. The selection of the fixed-effects estimator was validated using the Hausman specification test. Control variables such as firm size, debt ratio, and CEO duality were included to mitigate the risk of omitted variable bias. In addition, to examine the moderating role of executive incentives, interaction terms between board capital and management shareholding ratios were introduced based on Upper Echelons Theory.

To further test the consistency and robustness of the results, the study conducted several robustness checks. These included alternative model specifications and subsample analyses that excluded data from the COVID-19 pandemic period. These procedures enhance the generalizability and reliability of the empirical findings, especially under conditions of economic disruption and strategic uncertainty.

In conclusion, this chapter provides a rigorous and transparent methodological foundation for investigating the relationship between board capital and corporate core competitiveness. The research design comprises three stages, namely variable construction, model estimation, and robustness validation. This approach ensures internal consistency and supports the broader applicability of the findings in governance research across dynamic industrial contexts.

CHAPTER 4:

# RESULTS AND DISCUSSIONS

## 4.1 Introduction

---

This chapter presents the comprehensive statistical outcomes derived from the systematic testing of the hypothesized relationships between board attributes and core competitiveness. The analysis commences with a descriptive evaluation of the sample characteristics, providing the foundational context for the subsequent correlation and multiple regression analyses. Through the application of rigorous diagnostic tests to address potential endogeneity and multicollinearity, the empirical results offer a granular examination of the mechanisms through which academic diversity and external network linkages function as strategic assets within the Chinese automotive paradigm. The subsequent sections transition from fundamental statistical observations to advanced

moderation analyses, specifically scrutinizing the capacity of compensation incentives to activate latent board resources for value creation.

This chapter presents the empirical analysis of the study. Section 4.2 provides a detailed explanation of the descriptive analysis and correlation analysis of corporate core competencies, followed by the implementation of the KMO and Bartlett’s tests, factor extraction, factor naming, score calculation, and the final aggregation of competence scores. Based on these measures, Section 4.3 conducts empirical examinations of the effects of board human capital, social capital, and moderating variables on corporate core competitiveness. This includes descriptive statistics and correlation analysis of key variables, the Hausman test to determine the appropriate panel model, and fixed-effects panel regression estimations, followed by robustness checks. Section 4.4 offers a conclusive discussion, providing an in-depth analysis of the impact of each measurement factor on corporate core competitiveness, thus laying the foundation for the final conclusions of the dissertation. Finally, Section 4.5 summarizes the contents of the chapter.

## **4.2 Corporate Core Competencies under Principal Component Analysis**

### **4.2.1 Descriptive Statistics**

To provide an overview of the characteristics of the selected variables, this study conducted a statistical analysis using the descriptive analysis method mentioned in Section 3.7.1 of Chapter 3. The results are presented in Table 4.1. This analysis helps to understand the central tendency and dispersion of the sample, providing preliminary insights for subsequent regression analysis.

**Table 4.1: Descriptive analysis**

<b>Variable</b>	<b>Mean</b>	<b>Std. dev.</b>	<b>Min</b>	<b>Max</b>
Operating Net Profit Margin	-0.03	1.17	-28.41	0.44
Research and Development Expense	0.06	0.04	0.00	5.52
Cost to Expense Pro fit Margin	0.05	0.26	-3.63	0.78
Total Asset Growth Rate	0.12	0.31	-0.67	5.59
Sustainable Growth Rate	0.03	0.17	-1.69	2.34
Owner ’s Equity Growth Rate	0.11	0.34	-1.69	3.48
Current Ratio	2.03	1.71	0.39	19.25

---

The Operating Net Profit Margin has a mean value of -0.03 and a standard deviation of 1.17, with a minimum of -28.41 and a maximum of 0.44. These figures indicate that some firms experienced substantial losses during the observation period. The overall profitability exhibits considerable volatility, suggesting that the automotive sector was subject to operational pressures and external uncertainties.

The Research and Development Expense has an average of 0.06, with a standard deviation of 0.24. The minimum value is 0, and the maximum reaches 5.52. This reflects that most firms allocated a relatively small proportion of resources to innovation activities, while a few exhibited significantly higher R&D intensities, potentially indicating a strategic focus on technological advancement.

The Cost to Expense Profit Margin has a mean of 0.05 and a standard deviation of 0.26, ranging from -3.63 to 0.78. This wide variation suggests significant differences in cost control and operational efficiency among the sampled firms.

In terms of growth indicators, the Total Asset Growth Rate averages 0.12, with a standard deviation of 0.31. Although most firms experienced positive asset growth, the presence of negative values implies that some firms faced contraction, possibly due to restructuring or market constraints. The Sustainable Growth Rate has a mean of 0.03 and a standard deviation of 0.17, with values spanning from -1.69 to 2.34. These results indicate that certain firms were unable to maintain stable financial growth, highlighting potential vulnerabilities in their capital structure.

The Owners' Equity Growth Rate presents a mean value of 0.11 and a standard deviation of 0.34, with a maximum of 3.48. This suggests considerable variation in capital accumulation capabilities, where some firms demonstrated robust equity enhancement, potentially through retained earnings or financing activities.

Regarding liquidity, the Current Ratio averages 2.03 with a standard deviation of 1.71, ranging from 0.39 to 19.25. The Quick Ratio has a mean of 1.61 and a standard deviation of 1.55, with a minimum of 0.29 and a maximum of 17.26. On average, firms maintained a healthy level of short-term solvency. However, the presence of extremely

high values in some cases may imply inefficient allocation of liquid assets or suboptimal capital management practices.

In summary, the descriptive statistics reveal substantial heterogeneity among Chinese automotive manufacturers in terms of profitability, growth, and liquidity. These findings reflect the diverse strategic positions and operational conditions across firms, thereby laying a necessary foundation for the empirical investigations in the following sections.

#### 4.2.2 Correlation Analysis

Correlation To further examine the relationships among the selected variables, this study applied the correlation analysis method introduced in Section 3.7.3 of Chapter 3. The correlation analysis provides a preliminary assessment of the strength and direction of linear associations between variables, which is essential for understanding potential multicollinearity and for informing the subsequent construction of econometric models. The results are presented in Table 4.2.

This analytical step offers valuable empirical support for model specification by identifying variables that are significantly associated with the composite index of corporate core competitiveness. Variables exhibiting strong and statistically significant correlations may be retained for regression analysis, while those with weak or inconsistent relationships may be reconsidered. Additionally, the detection of high correlations among independent variables serves as an early warning of multicollinearity risks, which may influence the stability and interpretability of parameter estimates in the panel regression models. Section 4.2.2 plays a critical role in ensuring the empirical consistency and robustness of the subsequent analytical process.

**Table 4.2: Correlation coefficient matrix**

<b>Oper ating Net Profit Marg in</b>	<b>Research and Developm ent Expense</b>	<b>Cost to Expense Profit Margin</b>	<b>Total Asset Growt h Rate</b>	<b>Sustain able Growth Rate</b>	<b>Owners' Equity Growth Rate</b>	<b>Current Ratio</b>	<b>Quick Ratio</b>
--	--	--	---	---	---	--------------------------	------------------------

---

Operating Net Profit Margin	1	0.15*	0.99*	0.41*	0.68*	0.51*	0.56*	0.56*
Research and Development Expense	-0.57*	1	0.13*	-0.01	-0.07*	0.01	0.19*	0.18*
Cost to Expense Profit Margin	0.77*	-0.36*	1	0.41*	0.68*	0.51*	0.56*	0.55*
Total Asset Growth Rate	0.11*	-0.08*	0.23*	1	0.45*	0.67*	0.13*	0.12*
Sustainable Growth Rate	0.45*	-0.41*	0.65*	0.22*	1	0.56*	0.15*	0.18*
Owners' Equity Growth Rate	0.25*	-0.21*	0.36*	0.58*	0.33*	1	0.22*	0.22*
Current Ratio	0.10*	-0.04	0.32*	0.07*	0.09*	0.17*	1	0.95*
Quick Ratio	0.09*	-0.03	0.31*	0.07*	0.09*	0.16*	0.99*	1

---

The correlations between Sustainable Growth Rate and Cost-to-Expense Profit Margin and Operating Net Profit Margin are 0.65 and 0.45, respectively, indicating that higher profitability enables firms to achieve greater internally driven growth potential.

Total Asset Growth Rate and Owners' Equity Growth Rate also show a significant positive correlation, suggesting that asset expansion and equity accumulation proceed in tandem, consistent with the basic logic of financial leverage.

Research and Development Expense is moderately negatively correlated with both Operating Net Profit Margin and Sustainable Growth Rate. This may reflect the short-term drag of increased R&D spending on profit margins and self-financed growth, though it does not preclude a positive long-term contribution to competitiveness; lagged variables or interaction terms should therefore be introduced in regression models.

### 4.2.3 KMO Test and Bartlett's Test of Sphericity

Before To evaluate the suitability of the dataset for factor extraction, this study conducted the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity, following the statistical procedures outlined in Section 3.7.4 of Chapter 3. The results are presented in Table 4.3. These tests are essential for assessing the adequacy of sampling and the overall significance of the correlation matrix, thereby justifying the application of principal component analysis in the next stage of empirical research.

The KMO value provides an index of the proportion of variance among variables that might be common variance, while Bartlett's test examines whether the correlation matrix is significantly different from the identity matrix. A high KMO value and a statistically significant Bartlett's test result indicate that the dataset is appropriate for factor analysis. This step serves as a methodological foundation for extracting the underlying dimensions of corporate core competitiveness.

**Table 4.3: Bartlett's test of sphericity and KMO test**

Kaiser-Meyer-Olkin metric of sampling adequacy		0.573
Bartlett's Sphericity Test	Chi-square	4940.156
	degrees of freedom	28
	p-value	0

Based on the results of the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Sphericity Test, the following analysis and conclusions can be drawn:

In this study, all eight indicators representing corporate core competitiveness for 173 automotive firms from 2018 to 2023 were standardized to have a mean of 0 and a standard deviation of 1. Subsequently, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity were applied to 732 firm-year observations to assess the data's suitability for factor analysis. As shown in Table 4.3, the KMO value is 0.573, and Bartlett's test yields a chi-square statistic of 4940.156 with 28 degrees of freedom ( $p < 0.001$ ). Although the KMO value falls within a relatively low range, it still exceeds the commonly accepted threshold of 0.50. The highly significant result from Bartlett's test indicates that the null hypothesis of sphericity can be rejected. Collectively, these results

confirm that the dataset meets the minimum criteria for conducting principal component analysis.

#### 4.2.4 Factor extraction

To identify the underlying structure among the observed variables, this study conducted a factor extraction procedure based on the method described in Section 3.7.5 of Chapter 3. This step aims to reduce the dimensionality of the dataset while retaining the maximum amount of variance, thereby facilitating the construction of a comprehensive measure of corporate core competitiveness. The results are presented in Table 4.4.

By applying principal component analysis with Varimax rotation, several orthogonal factors were extracted from the standardized indicators. The eigenvalues and cumulative variance explained were used to determine the number of retained components. This analysis provides empirical support for categorizing the indicators into meaningful latent dimensions, which serve as the basis for constructing the composite competitiveness index and conducting subsequent regression analysis.

**Table 4.4: Principal Component Factors**

Factor	Eigenvalue	Difference	Proportion	Cumulative
1	3.137	1.281	0.392	0.392
Table 4.4 continued				
2	1.856	0.551	0.232	0.624
3	1.305	0.645	0.163	0.787
4	0.66	0.138	0.0825	0.87
5	0.523	0.127	0.0653	0.935
6	0.396	0.283	0.0495	0.985
7	0.113	0.104	0.0142	0.999
8	0.00957	.	0.0012	1
Variable	1	2	3	Uniqueness
Operating Net Profit Margin	0.749	-0.331	-0.345	0.21

Research and Development Expense	-0.572	0.368	0.298	0.448
Cost to Expense Profit Margin	0.869	-0.0928	-0.178	0.204
Total Asset Growth Rate	0.42	-0.0947	0.795	0.182
Sustainable Growth Rate	0.711	-0.296	-0.0748	0.401
Owners' Equity Growth Rate	0.591	-0.0725	0.644	0.23
Current Ratio	0.485	0.864	-0.0833	0.0124
Quick Ratio	0.476	0.869	-0.0787	0.0122

Table 4:4 shows that three principal components meet this criterion, jointly explaining 78.7 % of the total variance, thereby balancing dimensionality reduction with information preservation.

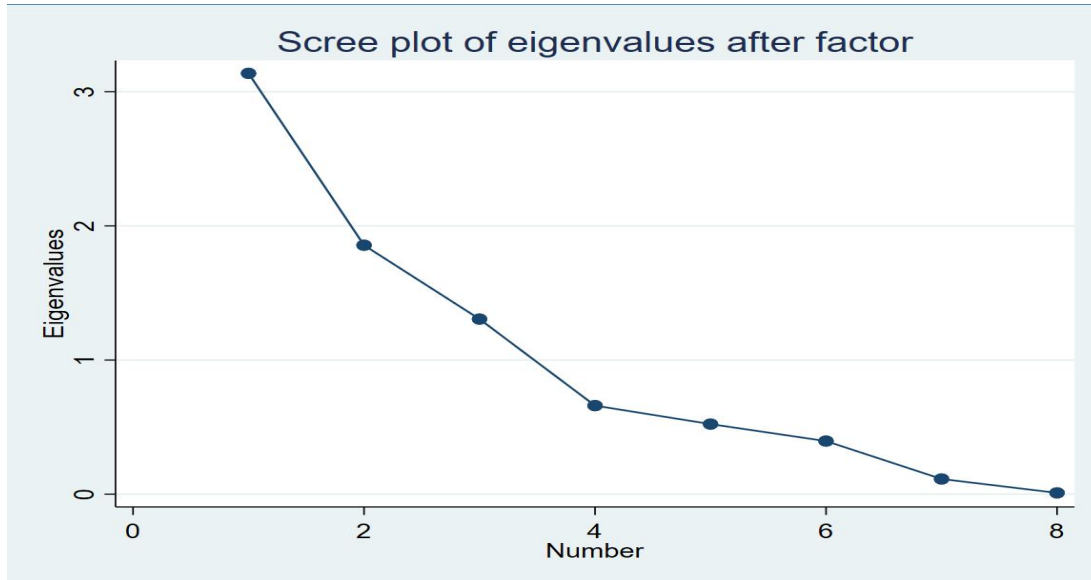
An examination of the extracted components reveals several distinct dimensions of enterprise competitiveness. The first principal component, which exhibits the highest eigenvalue ( $\lambda_1 = 3.137$ ), demonstrates strong loadings on profitability indicators, specifically Operating Net Profit Margin and Cost-to-Expense Profit Margin. This finding suggests that profitability serves as the most significant dimension influencing corporate competitiveness. The second principal component is primarily associated with the Current Ratio and Quick Ratio, thereby reflecting a firm's short-term solvency and liquidity capacity. The third component shows strong correlations with the Total Asset Growth Rate and Owners' Equity Growth Rate, which together represent the organization's potential for long-term development and capital accumulation. Components with eigenvalues below one were considered to offer limited explanatory power and are thus excluded from further analysis.

Based on the three extracted principal components, a preliminary evaluation model was formulated as follows:

$$y = 39.2\%/78.7\% * f_1 + 23.2\%/78.7\% * f_2 + 16.3\%/78.7\% * f_3 \quad \text{Equation 4.1}$$

(Y represents the comprehensive value index of core competitiveness).

Figure 4.1 illustrates the Scree Plot of the factor analysis, showing the eigenvalues associated with each component in descending order to determine the optimal number of factors to be retained for the study.



**Figure 4.1 : Scree Plot**

#### 4.2.5 Factor Naming and Explanation

To obtain independent and interpretable components, an orthogonal Varimax rotation was applied to the principal component loading matrix using Stata 17. This rotation method maximizes the variance of squared loadings across factors, allowing each extracted factor to exhibit high loadings on a limited number of variables while maintaining low loadings on others. Such a transformation facilitates the approximation of a simple structure, thereby enhancing the clarity of conceptual interpretation and improving the discriminant validity of the extracted components.

**Table 4.5: Orthogonal Matrix**

	<b>component</b>	<b>factors</b>	<b>3</b>	<b>factors</b>
<b>Variable</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Uniqueness</b>
Operating Net Profit Margin	0.8867	0.0425	0.0414	0.21

Research and Development Expense	-0.7396	0.0691	-0.012	0.448
Cost to Expense Profit Margin	0.8142	0.2914	0.2185	0.204
Total Asset Growth Rate	0.0385	0.0117	0.9033	0.182
Sustainable Growth Rate	0.7265	0.0319	0.2643	0.401
Owners' Equity Growth Rate	0.2314	0.1167	0.8381	0.23
Current Ratio	0.0704	0.9903	0.0457	0.0124
Quick Ratio	0.0598	0.991	0.0458	0.0122

Table 4.5 presents the rotated loadings for the three retained components:

Factor 1 (Profitability) loads strongly on Operating Net Profit Margin (0.8867) and Cost-to-Expense Profit Margin (0.8142), underscoring that cost control and margin expansion are the primary drivers of competitive advantage in automotive firms.

Factor 2 (Short-term Solvency) shows near-perfect loadings on Current Ratio (0.9903) and Quick Ratio (0.9910), reflecting firms' liquidity cushions and ability to meet immediate obligations.

Factor 3 (Growth Potential) correlates highly with Total Asset Growth Rate (0.9033) and Owners' Equity Growth Rate (0.8381), indicating long-term capacity for asset expansion and equity accumulation.

Uniqueness measures (all  $\leq 0.45$ ) confirm that these three factors capture the vast majority of shared variance. Assigning names aligned with theoretical constructs ensures that each factor is both statistically robust and conceptually meaningful.

#### 4.2.6 Calculation of Factor Scores

After completing the economic interpretation of the common factors, it is necessary to calculate the factor scores for each sample to quantitatively measure the factors. These

scores represent each sample's relative position in different factors and provide a quantitative basis for further analysis of corporate core competitiveness. In this study, the factor score coefficient matrix was derived through orthogonal Varimax rotation using Stata 17.0 software. Based on this coefficient matrix and the standardized values of the original variables, the corresponding factor score equations were formulated to represent each principal component. These equations provide the basis for calculating factor scores and subsequently constructing the composite index of corporate core competitiveness.

$$F1 = 0.8867 * \text{Operating Net Profit Margin} - 0.7396 * \text{Research and Development Expense} + 0.8142 * \text{Cost to Expense Profit Margin} + 0.0385 * \text{Total Asset Growth Rate} + 0.7265 * \text{Sustainable Growth Rate} + 0.2314 * \text{Owners Equity Growth Rate} + 0.0704 * \text{Current Ratio} + 0.0598 * \text{Quick Ratio} \quad \text{Equation 4.2}$$

$$F2 = 0.0425 * \text{Operating Net Profit Margin} + 0.0691 * \text{Research and Development Expense} + 0.2914 * \text{Cost to Expense Profit Margin} + 0.0117 * \text{Total Asset Growth Rate} + 0.0319 * \text{Sustainable Growth Rate} + 0.1167 * \text{Owners Equity Growth Rate} + 0.9903 * \text{Current Ratio} + 0.9910 * \text{Quick Ratio} \quad \text{Equation 4.3}$$

$$F3 = 0.210 * \text{Operating Net Profit Margin} + 0.448 * \text{Research and Development Expense} + 0.204 * \text{Cost to Expense Profit Margin} + 0.182 * \text{Total Asset Growth Rate} + 0.401 * \text{Sustainable Growth Rate} + 0.230 * \text{Owners Equity Growth Rate} + 0.0124 * \text{Current Ratio} + 0.0122 * \text{Quick Ratio} \quad \text{Equation 4.4}$$

By substituting the above three formulas into the comprehensive core competitiveness evaluation model mentioned earlier, the comprehensive core competitiveness index (Y) for Chinese automobile enterprises can be obtained.

#### **4.2.7 Descriptive analysis for core competencies measurement**

The study identified three orthogonal factors that together explain 78.7% of the total variance. This result was obtained through a four-stage analytical procedure

comprising correlation screening, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, Bartlett's test of sphericity, principal component extraction, and Varimax rotation. These extracted factors demonstrate both statistical robustness and conceptual consistency with the fundamental dimensions of corporate competitiveness. Accordingly, they establish a structured foundation for subsequent empirical validation and support strategic analytical positioning within the broader research framework.

**Profitability.** The first extracted factor is primarily characterized by high loadings on Operating Net Profit Margin and Cost-to-Expense Profit Margin. It demonstrates statistically significant positive correlations with both the Sustainable Growth Rate ( $r = 0.45$ ) and the Total Asset Growth Rate ( $r = 0.41$ ). This factor has an eigenvalue of  $\lambda_1 = 3.137$ , accounting for 39.2% of the total variance explained. It reflects a firm's capability to enhance profitability through effective cost management and margin optimization, thereby contributing to its sustained competitive advantage. High profitability not only reflects superior resource allocation and operational efficiency but also underpins both short-term survival and long-term reinvestment capacity (Li, H. J., Wang, X. Y., and Zhao, L. 2022).

**Short-Term Solvency.** The second factor is characterized between Current Ratio and Quick Ratio, carries an eigenvalue of  $\lambda_2 = 1.856$  (23.2 % of explained variance). It reflects the liquidity buffer that enables firms to meet maturing obligations and maintain operating continuity. In the capital-intensive, innovation-driven automotive sector, robust short-term solvency is essential for withstanding market shocks, ensuring project progression, and stabilizing the supply chain (She, J., Zhang, Q., and Li, M. 2017).

**Long-Term Growth Capacity.** The third factor is dominated by Total Asset Growth Rate and Owners' Equity Growth Rate ( $r = 0.58$ ), has an eigenvalue of  $\lambda_3 = 1.305$  (16.3 % of explained variance). It embodies firms' strategic asset expansion and equity accumulation, signalling strong financing and investment capabilities. Against the backdrop of industrial upgrading and the shift to new-energy vehicles, this dimension determines whether enterprises can seize emerging opportunities and sustain competitive advantage over the long run.

Collectively, the three identified dimensions, namely profitability, solvency, and growth capacity, construct a coherent and analytically rigorous model for assessing the

core competencies of China’s automotive enterprises. This framework, derived through systematic variable screening and factor interpretation, provides a robust quantitative and conceptual basis for subsequent panel regression analyses, strategic benchmarking, and evaluations of dynamic capabilities. Beyond contributing to the theoretical advancement of competitiveness research within the automotive sector, it also offers practical implications by enabling corporate decision-makers to conduct informed performance assessments and formulate effective strategic responses.

### 4.3 An Empirical Analysis of Board Capital and Corporate Core Competitiveness

The study draws on annual-report data from 173 A-share companies listed on the Shanghai and Shenzhen Stock Exchanges over the 2018 – 2023 period, employing descriptive statistics, correlation analysis, the Hausman test, and stability test to ensure both the scientific rigor of the results and the appropriateness of the model.

#### 4.3.1 Descriptive Analysis

In this study, a total of 3,923 firm-year observations from 173 A-share automotive firms during the period 2018 to 2023 are analysed to capture the characteristics of both governance-related and financial variables. Table 4.6 reports the number of observations (N), mean, median, standard deviation (SD), minimum, maximum, and range for corporate core competitiveness and firm-level indicators.

**Table 4.6: Descriptive Statistics of Main Research Variables**

Variable	N	Mean	Median	SD	Min	Max	Range
Core Competitiveness	3,923	0.023	-0.158	0.605	-0.791	3.527	4.318
Age	3,923	48.76	49	7.85	26	76	50
Degree level	3,923	3.575	4	0.941	2	7	5
Percentage of women directors	3,923	0.146	0.125	0.126	0	0.6	0.6

Percentage of independent directors	3,923	0.383	0.364	0.078	0.214	0.714	0.5
OverSeaBackground	3,923	0.901	1	0.298	0	1	1
Financial Background	3,923	0.515	1	0.5	0	1	1
Directors serving on other companies	3,923	0.219	0	0.414	0	1	1
Management shareholding ratio	3,923	0.081	0.012	0.136	0	0.832	0.832
Ln Total assets	3,923	22.54	22.248	1.517	19.875	27.621	7.747
Asset liability ratio	3,923	0.432	0.429	0.178	0.058	0.947	0.889
Is Duality	3,923	0.054	0	0.226	0	1	1

The descriptive statistics derived from 3,923 firm-year observations form the empirical foundation of this study. The relatively large sample size enhances the reliability of statistical inference, mitigates the impact of outliers, and increases the robustness of model estimation. As emphasized by Hair et al. (2019), sample sizes above 2,000 are generally regarded as sufficient for complex multivariate analyses, including principal component analysis and panel regressions.

The core competitiveness index exhibits a mean of 0.023 and a median of  $-0.158$ , with a standard deviation of 0.605 and a range from  $-0.791$  to 3.527. The positive skewness and relatively high dispersion suggest the presence of a small number of firms with exceptionally strong competitiveness, while the majority remain closer to the lower end of the distribution. This pattern is consistent with the resource-based view, which holds that sustainable competitive advantages are rare and unequally distributed across firms (Barney, 1991).

The average age of board members is approximately 48.76 years, with a standard deviation of 7.85 and a range between 26 and 76 years. This wide age span reflects a mix of generational perspectives in strategic decision-making. Prior studies (Hambrick and Mason, 1984) have noted that age diversity may introduce heterogeneous cognitive frames, which can enrich strategic deliberation but may also complicate consensus-building.

The educational attainment of directors, coded from 2 (associate degree) to 7 (doctoral degree), yields a mean score of 3.575 and a median of 4.000. The relatively high median suggests that most directors possess at least a bachelor's or master's degree, aligning with evidence that educational qualifications enhance directors' cognitive capabilities and strategic vision (Kor and Sundaramurthy, 2009). Higher educational diversity also correlates with innovation performance, especially in knowledge-intensive industries such as automotive manufacturing.

The percentage of female director averages 14.6%, with a maximum of 60% and a minimum of 0%, indicating that some boards are entirely male while others have achieved considerable gender diversity. This wide variation reflects the uneven progress in gender inclusion, a finding aligned with past research that observes slow but increasing representation of women in Chinese corporate boards (Liu et al., 2014). Gender diversity has been linked to enhanced monitoring and ethical standards (Adams and Ferreira, 2009), although its influence on firm performance remains context dependent.

The proportion of independent directors has a mean of 38.3%, clustered around the median of 36.4%, with a narrow standard deviation (7.8%) and a range from 21.4% to 71.4%. This concentration suggests a regulatory-conformant pattern across firms, likely influenced by corporate governance codes in China that mandate a minimum of one-third independent directors (CSRC, 2002). Independent directors are expected to enhance board objectivity and protect minority shareholders, although the actual effectiveness may depend on their professional background and engagement level.

With respect to international exposure, the percentage of directors with overseas experience is notably high, averaging 90.1% and exhibiting a median of 100%. This indicates that most boards include at least one director with international educational or professional background, potentially strengthening global strategic alignment and cross-border innovation. Research by Oxelheim and Randøy (2003) confirms that internationalized boards can facilitate internationalization strategies and improve firm legitimacy in global markets.

The percentage of directors with a financial background averages 51.5%, with a median of 100% and a standard deviation of 50%. This bimodal distribution indicates that

some firms prioritize financial expertise in their governance structure, while others exhibit minimal emphasis. Prior studies suggest that financial expertise improves board oversight of capital allocation and risk management (Defond et al., 2005), which is especially critical in capital-intensive sectors such as automotive manufacturing.

In terms of relational capital, the proportion of directors concurrently serving on other company boards averages 21.9%, with a median of 0% and a standard deviation of 41.4%. The skewed distribution implies that while most firms have low levels of interlocking directorships, a subset leverages extensive external networks. According to social capital theory (Nahapiet and Ghoshal, 1998), interlocks may provide access to external resources and strategic partnerships but may also raise concerns regarding over embeddedness and groupthink.

The management shareholding ratio has a mean of 8.1% but a median of only 1.2%, with a standard deviation of 13.6%. This indicates that although most firms grant limited equity to managers, some have adopted substantial ownership-based incentive schemes. This variability supports the incentive alignment hypothesis, which posits that equity ownership mitigates agency costs by aligning managerial interests with those of shareholders (Fama and Jensen, 1983).

Regarding firm size, the natural logarithm of total assets ranges from 19.875 to 27.621, with a mean of 22.540 and standard deviation of 1.517. This reflects substantial heterogeneity in firm scale across the sample. Firm size has been found to influence both governance structure and innovation capability, with larger firms typically exhibiting more formalized governance mechanisms (Peng et al., 2007).

The asset-liability ratio, a proxy for financial leverage, averages 43.2%, with considerable dispersion (SD = 17.8%). The range from 5.8% to 94.7% suggests diverse capital structures, with some firms operating under conservative financial policies, while others employ aggressive leverage. High leverage may increase financial risk but also signal managerial confidence and efficient capital utilization (Modigliani and Miller, 1963).

The variable representing CEO duality, which identifies whether the Chief Executive Officer concurrently holds the position of board chair, exhibits a mean of 5.4

percent and a median of zero. This relatively low proportion suggests that most firms comply with corporate governance guidelines advocating the separation of these two roles. Such separation is generally regarded as a mechanism to improve board independence and enhance the effectiveness of managerial oversight by preventing excessive concentration of authority. However, empirical findings regarding the impact of CEO duality on firm performance remain inconclusive, with outcomes varying across different ownership structures and industry settings (Rechner and Dalton, 1991).

In summary, the sample exhibits substantial variation across director demographics, educational attainment, governance structures, compensation policies, and financial conditions. These patterns not only reflect the complexity and heterogeneity of board composition and firm characteristics in the Chinese automotive industry but also provide a rich empirical foundation for subsequent regression analysis.

### 4.3.2 Correlation Analysis of Main Variables

To assess the suitability of variables for subsequent panel data regression analysis, correlation analysis was conducted to examine the strength and direction of linear associations among all variables included in the empirical model. This method facilitates the identification of statistically significant relationships and enables the quantification of the degree of association through correlation coefficients. The analysis distinguishes between positive and negative correlations, thereby offering preliminary evidence on potential interdependencies. Moreover, the results serve as an important diagnostic step, providing a statistical basis for evaluating multicollinearity and informing the specification of regression models in the following sections.

**Table 4.7: Correlation Statistics of the Research Variables**

Research Variables	Core Competitiveness	Age	Degree level	Percentage of women directors	Percentage of independent directors	Over sea Background	Financial Background
--------------------	----------------------	-----	--------------	-------------------------------	-------------------------------------	---------------------	----------------------

Dependent Variable (DV)	Core Competitiveness	1						
	Age	-0.033**	1					
	Degree level	0.059**	-0.038*	1				
	Percentage of women directors	0.253**	-0.032*	-0.006	1			
Independent Variable (IV)	Percentage of independent directors	0.156**	-0.006	-0.047**	0.049***	1		
	Over sea Background	0.078**	0.012	-0.017	-0.125***	-0.063***	1	
	Financial Background	0.099**	-0.063**	-0.082**	0.046***	0.029*	-0.183***	1
Independent Variable (IV)	Directors serving on other companies	0.125**	-0.035*	0.042**	-0.126***	-0.071***	0.154***	0.414**
Moderator Variable (MV)	Management shareholding ratio	0.199**	-0.008	-0.044**	0.086***	0.231***	-0.252***	-0.018

Table 4.7 continued

Control Variable (CV)	Ln Total assets	-0.426**	0.145**	0.106**	-0.303***	-0.041***	0.182***	-0.147**
-----------------------	-----------------	----------	---------	---------	-----------	-----------	----------	----------

	Asset liability ratio	-0.683** *	0.050**	0.050** *	-0.213***	-0.095***	0.088***	-0.032* *
	Is Duality	0.037**	0.213**	-0.017	0.069***	0.079***	-0.012	0.013
	Directors serving on other companies	Management shareholding ratio	Ln Total assets	Asset liability ratio	Is Duality			
Independent Variable (IV)	Directors serving on other companies	1						
Moderator Variable (MV)	Management shareholding ratio	-0.061** *	1					
	Ln Total assets	0.648** *	-0.262**	1				
Control Variable (CV)	Asset liability ratio	0.279** *	-0.158**	0.594** *	1			
	Is Duality	-0.024	0.130**	-0.079** *	-0.037**	1		

This study analyses the correlations between corporate core competitiveness and variables such as corporate governance structure, executive characteristics, and financial indicators using Pearson correlation coefficients.

#### 4.3.2.1 Independent Variable

Board member age is commonly viewed as a proxy for managerial experience, cognitive maturity, and risk tolerance. However, the empirical findings of this study reveal

a statistically significant yet modest negative correlation with corporate core competitiveness ( $\rho = -0.033$ ,  $p < 0.01$ ), indicating that an increase in average board age may slightly diminish a firm's competitive capacity. Although older directors often bring industry expertise, regulatory knowledge, and strategic stability (Hambrick and Mason, 1984), excessive reliance on age-related experience may lead to strategic conservatism and resistance to innovation. These tendencies can restrict a firm's responsiveness in rapidly evolving industries, such as automotive manufacturing. This result aligns with upper echelons theory, which posits that executive demographics shape strategic decisions through bounded rationality and cognitive framing. Older board members may favor stability and capital preservation over innovation, weakening core capabilities like technological leadership and adaptability (Kor and Sundaramurthy, 2009). Empirical evidence supports this view. Li and Tang (2010) found that younger executives are more inclined toward exploratory innovation, while Nielsen and Huse (2010) emphasized that age diversity enhances strategic debate and adaptability, particularly when combined with other forms of diversity. Although the effect size is relatively small, age remains an important factor in board composition. A generationally balanced board composition includes both older and younger directors. Older members contribute accumulated managerial experience and institutional knowledge. Younger directors provide innovative thinking and fresh strategic perspectives. The integration of these complementary attributes can enhance strategic renewal. This balance also supports the long-term sustainability of corporate competitiveness.

The educational attainment of board members serves as a key indicator of human capital quality and plays a critical role in corporate governance. The empirical results of this study indicate a statistically significant positive correlation between board education level and corporate core competitiveness ( $\rho = 0.059$ ,  $p < 0.001$ ). This finding suggests that directors with higher educational attainment are more likely to enhance a firm's capabilities in innovation, strategic judgment, and resource allocation. Highly educated directors tend to possess stronger analytical abilities and broader knowledge bases, enabling them to assess complex business environments and contribute more effectively to strategic decision-making (Kor and Sundaramurthy, 2009). In sectors characterized by high technological intensity and policy uncertainty, such as the automotive industry, these directors are particularly valuable in facilitating informed and forward-looking planning.

Moreover, a high level of formal education may allow directors to engage with emerging technologies, understand advanced management frameworks, and strengthen the firm's absorptive capacity for external knowledge and innovation. This finding is consistent with the fundamental proposition of the resource-based view, which asserts that resources possessing value, rarity, and inimitability, particularly advanced forms of intellectual capital, constitute the basis for achieving and sustaining long-term competitive advantage (Barney, 1991). Additionally, such directors are more likely to have access to high-level networks and possess a stronger awareness of global economic and regulatory trends, thereby improving the firm's ability to secure external resources. Previous empirical studies further validate the importance of education in board effectiveness. Wincent et al. (2010) found that directors with higher educational attainment are more inclined to support high-risk, high-return innovation projects. Similarly, Dalziel et al. (2011) demonstrated that education enhances board members' effectiveness in both financial oversight and strategic monitoring. In summary, a higher average educational attainment among board members contributes positively to a firm's knowledge-based competitiveness. Firms are therefore encouraged to incorporate educational quality and diversity into board composition strategies to improve governance effectiveness and reinforce their ability to compete in dynamic markets.

Gender diversity on corporate boards has become an important dimension of governance research, with increasing attention directed toward its influence on firm-level performance and strategic outcomes. The empirical findings of this study reveal a statistically significant positive correlation between the percentage of women directors and corporate core competitiveness ( $\rho = 0.253$ ,  $p < 0.001$ ). This result suggests that greater female representation on boards is associated with enhanced strategic capacity and innovation effectiveness. Women directors often contribute diverse perspectives, ethical sensitivity, and collaborative leadership styles, which can enrich board deliberations and decision-making processes. Such cognitive and behavioral diversity may facilitate the generation of innovative ideas and reduce groupthink, particularly in traditionally male-dominated sectors such as the automotive industry. Adams and Ferreira (2009) found that gender-diverse boards are more likely to engage in active monitoring and offer independent viewpoints, thus strengthening governance effectiveness. In the context of Chinese corporate governance, where female participation in leadership remains limited, even

modest improvements in gender diversity can yield significant strategic benefits. Female board members may enhance the firm's reputation for inclusiveness and social responsibility, which in turn may improve stakeholder relations and external legitimacy. Moreover, prior research has demonstrated that gender-diverse boards tend to place greater emphasis on long-term strategic investments, risk management, and corporate social responsibility—factors closely aligned with sustained competitive advantage (Post and Byron, 2015). It is also important to consider that gender diversity may influence board dynamics through indirect mechanisms, such as enhancing communication efficiency or challenging dominant power structures. Bear et al. (2010) argue that the presence of women on boards increases the range of stakeholder-oriented perspectives considered during strategic planning, which can be particularly valuable in environments that demand continuous adaptation and innovation. While gender diversity alone does not determine competitiveness, the evidence suggests that it contributes to board effectiveness and the strategic renewal of firms. Therefore, firms aiming to improve their core competitiveness may benefit from institutionalizing diversity as part of board selection and governance practices.

Independent directors play a central role in strengthening corporate governance through their impartiality, oversight function, and ability to challenge management decisions. The empirical results of this study reveal a statistically significant positive correlation between the percentage of independent directors and corporate core competitiveness ( $\rho = 0.156$ ,  $p < 0.001$ ). This suggests that independent board members contribute positively to a firm's ability to build and sustain core capabilities. Independent directors, by definition, are not part of the company's internal management and thus bring an external, objective perspective to board deliberations. Their presence is associated with more rigorous monitoring, reduction of agency problems, and the enhancement of board accountability (Fama and Jensen, 1983). In emerging markets such as China, where ownership concentration and insider control are prevalent, the role of independent directors becomes particularly vital in balancing stakeholder interests and ensuring transparency. From a strategic standpoint, independent directors may foster more disciplined evaluation of investment opportunities, innovation strategies, and long-term growth plans. Their external expertise and broader professional experience contribute to improving decision quality, reducing managerial entrenchment, and promoting dynamic capabilities essential

to competitiveness (Hillman and Dalziel, 2003). Furthermore, a diversified pool of independent directors can enhance board cognitive resources, enabling firms to respond more effectively to environmental uncertainty and technological disruption. Empirical evidence also supports these theoretical perspectives. For example, Peng (2004) found that Chinese firms with a higher proportion of independent directors were more likely to engage in reform-driven innovation and adopt market-oriented strategies. Similarly, Chhaochharia and Grinstein (2009) documented a positive association between independent director presence and firm value in firms with high agency risks. However, the mere presence of independent directors is not sufficient. The actual effectiveness of independent directors is determined by their professional qualifications, the extent of their active engagement, and the degree of their substantive independence, rather than merely their formal status. Therefore, to maximize the governance value of independent directors, firms must ensure that their selection process emphasizes expertise, strategic insight, and commitment to objective oversight. In conclusion, a higher proportion of independent directors contributes meaningfully to a firm's governance quality and strategic decision-making, thereby enhancing corporate core competitiveness. As such, fostering a well-structured, professionally competent, and genuinely independent board should be considered a critical component of competitive strategy.

The international exposure of board members, typically measured by overseas education or work experience, is considered a vital dimension of board human capital. In this study, the proportion of directors with an overseas background shows a statistically significant, though relatively weak, positive correlation with corporate core competitiveness ( $\rho = 0.078$ ,  $p < 0.001$ ). This suggests that international experience may contribute positively, albeit modestly, to a firm's strategic capabilities and long-term competitive positioning. Directors with overseas backgrounds are more likely to possess global perspectives, cross-cultural communication skills, and familiarity with international management practices. These traits enable firms to adopt advanced governance models, better navigate global markets, and benchmark themselves against international standards. According to Carpenter et al. (2001), international experience enhances a board's ability to assess foreign investment opportunities, implement globally oriented innovation strategies, and respond to competitive dynamics in international environments. Moreover, such directors may also serve as conduits for transferring institutional knowledge, technologies,

and global best practices, which are particularly relevant in the high-tech and innovation-driven automotive sector. Their presence on board may facilitate organizational learning and strengthen absorptive capacity, which Cohen and Levinthal (1990) identified as a critical factor in sustaining innovation-based competitiveness. In the context of China's institutional transition and global integration, directors with international experience may also provide access to foreign networks, partnerships, and capital markets, further enhancing firm-level strategic flexibility. Oxelheim and Randøy (2003) found that firms with foreign or internationally experienced board members exhibited stronger financial performance and greater internationalization. However, the relatively low correlation coefficient suggests that the strategic value of overseas experience is not automatic. It may be contingent on how well such knowledge is integrated into firm-specific contexts and whether the firm has the internal mechanisms to absorb and apply externally acquired insights. Without alignment between global knowledge and local execution, the effectiveness of internationally experienced directors may be diluted. In conclusion, while the contribution of directors with overseas backgrounds to core competitiveness is statistically significant, its impact is relatively modest. Firms are advised to treat overseas experience not as a symbolic credential but as a substantive strategic asset, ensuring its relevance through effective board integration and knowledge transfer mechanisms.

Financial expertise among board members is widely recognized as a critical component of board human capital, particularly in environments characterized by complex capital structures, intensive resource allocation, and high levels of strategic uncertainty. In the current analysis, the proportion of directors with a financial background exhibits a statistically significant and positive correlation with corporate core competitiveness ( $\rho = 0.099$ ,  $p < 0.001$ ). Although the magnitude of this correlation is modest, it nonetheless indicates that financial knowledge at the board level may enhance the firm's ability to make more efficient strategic decisions. Directors with prior experience in financial institutions or with financial training are generally better equipped to evaluate investment opportunities, manage financial risks, and monitor resource utilization. Their presence can facilitate improved capital budgeting, cost control, and return on investment assessments, all of which are fundamental to sustaining competitive advantage. As noted by Hillman and Dalziel (2003), financial expertise strengthens board monitoring functions and contributes to higher-quality strategic oversight. Moreover, the presence of financial professionals may

reduce agency problems by increasing transparency and accountability in financial reporting and internal control systems. Boards with financial expertise are more likely to challenge managerial decisions, interpret financial performance data rigorously, and ensure alignment between strategic initiatives and financial capacity. These capabilities are particularly vital in innovation-driven industries such as automotive manufacturing, where firms must balance technological investment with financial discipline. The positive relationship also resonates with findings in prior empirical literature. For instance, García-Sánchez et al. (2017) reported that boards with higher financial literacy significantly enhance firm performance and are more effective in allocating R&D expenditure. Similarly, Krishnan (2005) found that the presence of audit committee members with financial expertise is associated with stronger internal controls and lower risk exposure, indirectly supporting core competitiveness. However, it is important to recognize that financial background alone does not guarantee strategic success. If overrepresented, financial professionals on boards may also promote risk-averse behavior, which could hinder innovation and long-term value creation. Therefore, the contribution of financial expertise must be balanced with other forms of capital, including technical, international, and industry-specific knowledge, to achieve a synergistic effect on competitiveness. In summary, directors with financial backgrounds contribute positively to the development and maintenance of core competitiveness by enhancing financial governance, resource allocation efficiency, and strategic monitoring. Their inclusion should be considered a key dimension of board capital when designing optimal governance structures.

The presence of directors concurrently serving on boards of other companies represents an important aspect of board-level social capital, particularly through their external connectivity and inter-organizational ties. The correlation analysis indicates a statistically significant positive relationship between this variable and corporate core competitiveness ( $\rho = 0.125$ ,  $p < 0.001$ ). This finding suggests that external directorships may positively contribute to enhancing firms' competitive strength. Directors with multiple board affiliations are likely to possess broader strategic insights, richer knowledge of industry trends, and access to external information channels. These attributes, grounded in the resource dependence theory (Pfeffer and Salancik, 1978), enable organizations to obtain critical resources, institutional legitimacy, and strategic advice from beyond firm boundaries. In industries characterized by regulatory complexity and technological

uncertainty, such as the automotive sector, this form of social capital enhances a firm's capacity for adaptation and innovation. Furthermore, the existence of external board memberships facilitates inter-firm knowledge diffusion and the adoption of best practices. As argued by Nahapiet and Ghoshal (1998), relational and cognitive dimensions of social capital embedded in external networks allow firms to acquire and apply external resources more effectively, thereby strengthening internal capabilities. Directors' affiliations with other firms may also create reputational advantages and facilitate informal coordination with key stakeholders, which can be particularly valuable in economies with less transparent institutional frameworks. This result is consistent with earlier empirical studies. Carpenter and Westphal (2001) emphasized that directors with outside board experience contribute to a broader range of strategic alternatives and greater board engagement in strategic planning. Similarly, studies conducted in emerging markets such as China have found that interlocking directors positively influence firm value by expanding external legitimacy and access to critical resources (Lai and Tam, 2017). However, it is also important to acknowledge potential downsides. A high level of board interlock may lead to director overextension, reduced monitoring effectiveness, and potential conflicts of interest. These issues may offset the advantages of external ties if not properly managed. Thus, it is essential for firms to adopt governance mechanisms that ensure the effectiveness of interlocking directors while preventing the dilution of oversight responsibilities. In summary, directors who hold positions in other companies can enhance the strategic value of the board by contributing external knowledge and relational assets, thereby improving the firm's core competitiveness. Optimal board composition should therefore consider both internal capabilities and the extent of beneficial external linkages.

#### **4.3.2.2 Moderator Variable**

The management shareholding ratio reflects the extent to which senior executives possess equity stakes in the firms they govern. This variable is widely regarded as a critical mechanism for aligning the interests of management with those of shareholders, thereby mitigating agency problems (Jensen and Meckling, 1976). In the present study, a statistically significant and moderately strong positive correlation was observed between the management shareholding ratio and core competitiveness ( $\rho = 0.199$ ,  $p < 0.001$ ). This finding suggests that firms with higher levels of managerial ownership tend to exhibit

enhanced core competitive capabilities. This relationship can be interpreted through the lens of incentive alignment theory. When executives hold a substantial portion of equity, they become more invested in the firm's long-term value creation. Such alignment not only curbs opportunistic behavior but also fosters a greater commitment to strategic objectives, including technological innovation, operational excellence, and organizational transformation (Morck, Shleifer, and Vishny, 1988). In the context of the automotive industry, which demands sustained investment in research and development as well as rapid responsiveness to evolving market demands, such commitment can be instrumental in cultivating and maintaining competitive advantage. Furthermore, the positive correlation aligns with existing empirical evidence. Studies have demonstrated that executive ownership positively influences innovation outputs, firm value, and the efficient allocation of resources (Chen, Guo, and Mande, 2003). Higher ownership stakes may also reduce information asymmetry and increase executives' willingness to take calculated strategic risks, thereby contributing to the development of unique, inimitable capabilities that underpin core competitiveness (Hill and Snell, 1988). However, it is essential to consider potential non-linear effects. Excessive ownership concentration may entrench management, leading to reduced board oversight and resistance to necessary change (Fahlenbrach, 2009). Therefore, while a moderate level of managerial ownership appears to be beneficial, firms should carefully design ownership structures to avoid potential governance inefficiencies. In conclusion, the management shareholding ratio plays a vital role in shaping corporate strategic behavior. The observed positive relationship with core competitiveness underscores the importance of equity-based incentives in fostering long-term commitment and innovation-driven growth, particularly in industries that are knowledge-intensive and capital-demanding.

#### **4.3.2.3 Control Variable**

The logarithm of total assets (Ln Total Assets) serves as a widely accepted proxy for firm size and resource endowment. It reflects the firm's capacity to mobilize capital, scale operations, and invest in strategic initiatives. However, the correlation analysis in this study reveals a statistically significant negative relationship between firm size and core competitiveness ( $\rho = -0.426$ ,  $p < 0.001$ ), indicating that as firm size increases, the level of core competitiveness tends to decline. This inverse association may be attributed to several

structural and strategic dynamics. Although larger firms typically possess more financial and physical resources, they are also more likely to experience bureaucratic inertia, coordination inefficiencies, and slower decision-making processes. These disadvantages can hinder their ability to swiftly respond to market shifts, adopt emerging technologies, and sustain innovation—factors that are critical for maintaining a competitive edge in rapidly evolving industries such as automotive manufacturing (Penrose, 1959). From the perspective of organizational theory, firm size often correlates with increased complexity and reduced strategic flexibility. Larger firms may encounter internal resistance to change, especially when existing routines and structures are deeply embedded. This rigidity can obstruct transformative initiatives and dampen the firm's capacity for proactive innovation, ultimately diminishing its core competitiveness (Hannan and Freeman, 1984). Moreover, in large firms, the dispersion of responsibilities and diluted accountability may weaken the implementation of innovative strategies, despite the availability of resources. Empirical literature supports this interpretation. For instance, Chen and Hambrick (1995) demonstrated that small and mid-sized firms exhibit greater entrepreneurial orientation and are more likely to invest in radical innovations. Conversely, large firms often prioritize risk aversion, cost control, and incremental improvements, which may be insufficient for sustaining competitiveness in technology-driven sectors. The observed negative correlation is also consistent with the resource-based view, which emphasizes that possessing resources is not sufficient; the firm must also effectively deploy and integrate these resources to achieve sustained competitive advantage (Barney, 1991). Nevertheless, the relationship between firm size and competitiveness may be context dependent. In regulated or capital-intensive sectors, scale can offer cost advantages and bargaining power. However, in innovation-intensive industries, agility and adaptability are more decisive. Therefore, while the negative correlation observed in this study is notable, it highlights the need for large firms to avoid complacency and actively cultivate innovation capability, organizational flexibility, and strategic renewal mechanisms. In summary, although larger firms hold greater resource pools, the inefficiencies associated with scale may suppress their core competitive strength. To counteract these limitations, firms should optimize internal structures, decentralize decision-making where appropriate, and invest in dynamic capabilities that can translate scale into sustained performance.

The asset-liability ratio, also known as the leverage ratio, measures the proportion of a firm's total assets financed by liabilities. It serves as an indicator of the firm's financial structure and risk exposure. The results of the correlation analysis in this study demonstrate a strong and statistically significant negative relationship between the asset-liability ratio and corporate core competitiveness ( $\rho = -0.683$ ,  $p < 0.001$ ). This suggests that firms with higher leverage tend to exhibit weaker core competitiveness. This inverse relationship may be attributed to several interrelated mechanisms. High leverage levels impose substantial interest payment obligations, thereby reducing the firm's available internal funds for research and development (R&D), technological innovation, and long-term strategic investments. Financial constraints arising from debt obligations can hinder the firm's ability to respond proactively to market changes and engage in continuous capability upgrading. This is particularly critical in industries such as automotive manufacturing, where innovation cycles are short and technological advancements are rapidly evolving. From a strategic perspective, firms with high debt ratios are often compelled to prioritize short-term financial stability over long-term value creation. The necessity to meet debt covenants and avoid default may restrict managerial discretion in pursuing exploratory innovation and other non-immediate-return activities. In this context, financial leverage acts as a constraint on the development of dynamic capabilities, such as learning, adaptation, and technological absorption, which are essential components of core competitiveness (Teece, Pisano, and Shuen, 1997). Furthermore, high leverage may adversely affect stakeholder perceptions, including those of suppliers, customers, and investors. Firms burdened with excessive debt are often perceived as financially vulnerable, which can erode stakeholder confidence and weaken strategic partnerships. This reputational effect may further undermine the firm's ability to access external resources and collaborate in value-creating networks—an increasingly vital aspect of competitiveness in complex global value chains. Empirical evidence also supports this finding. For example, Aghion et al. (2004) showed that firms with moderate levels of leverage tend to exhibit better innovation outcomes, while excessive leverage suppresses R&D expenditure and innovation success. Similarly, Opler and Titman (1994) found that highly leveraged firms are more likely to suffer operational and strategic setbacks during periods of industry distress. In conclusion, although moderate leverage can be beneficial for improving capital efficiency and tax advantages, excessive debt levels significantly

inhibit a firm's capacity to invest in innovation and strategic renewal. To enhance core competitiveness, firms should maintain a prudent capital structure that balances financial flexibility with strategic agility, especially in sectors characterized by high innovation intensity and technological dynamism.

The variable *Is Duality* reflects whether the same individual concurrently holds the positions of chief executive officer and board chair. This form of leadership structure suggests a centralization of authority and strategic control. Based on the correlation analysis results, a statistically significant yet relatively weak positive relationship is observed between this variable and corporate core competitiveness ( $\rho = 0.037, p < 0.05$ ). This indicates that the presence of dual leadership may be marginally associated with improvements in firms' competitive capabilities; however, the effect size remains limited. From a theoretical standpoint, the implications of dual leadership have been widely debated. The stewardship theory argues that consolidating executive and oversight roles under a single leader can enhance leadership coherence, reduce coordination barriers, and expedite strategic decision-making. In sectors characterized by rapid change and competitive intensity, such as the automotive industry, this centralized governance may help firms respond more effectively to market dynamics and implement innovation strategies more efficiently. In contrast, Upper Echelons Theory raises significant concerns regarding potential governance risks. The concentration of authority may weaken the board's ability to provide independent oversight and increase the likelihood of managerial entrenchment. This, in turn, could reduce transparency, compromise accountability, and hinder long-term strategic development. The weak correlation identified in this study may result from the offsetting effects of the potential benefits and drawbacks of dual leadership. Previous empirical findings are also inconclusive. Some studies suggest that duality may be advantageous in specific contexts that demand quick strategic alignment, particularly in state-influenced or hierarchically structured firms. Others emphasize that separating the roles of CEO and board chair enhances governance quality by ensuring checks and balances. In the context of the Chinese automotive industry, where organizational and institutional conditions vary substantially, the observed weak positive correlation may reflect these context-specific dynamics. In conclusion, although dual leadership may offer limited benefits in terms of strategic efficiency, its broader implications for board independence and governance integrity warrant cautious evaluation. The findings suggest

that duality is not a dominant determinant of core competitiveness. Firms are advised to assess their internal governance mechanisms and external institutional environments when determining their executive structure, ensuring that leadership configurations align with both strategic objectives and accountability standards.

### 4.3.3 Hausman Test

In The Hausman test was employed in this study to determine the appropriate model specification for panel data analysis. The test result yielded a Prob>chi<sup>2</sup> value of 0.0000, which is significantly lower than conventional significance thresholds (such as 0.05 or 0.01). This provides strong evidence to reject the null hypothesis that the random effects model is appropriate. The result suggests that the assumptions underlying the random effects model may be violated, particularly the assumption of no correlation between the individual-specific error term and the explanatory variables. Such a violation may result in biased and inconsistent parameter estimates under the random effects specification.

To ensure the robustness of the estimations and the validity of the inferences, the fixed effects model is adopted in subsequent empirical analyses. The fixed effects model effectively controls unobserved time-invariant heterogeneity across entities and is particularly suitable in cases where explanatory variables may be correlated with individual-specific effects. This approach enhances the reliability and explanatory power of regression results.

**Table 4.8: Correlation Matrix**

Variable	(b) Fixed Effect	(B) Random Effect	(b-B) Difference	sqrt(diag(V <sub>n</sub> -V <sub>β</sub> )) Std. Error
Age	0.0001331	0.0003328	-0.0001996	0.0004342
Degree level	0.0142314	0.0222495	0.008018	0.0045068
Percentage of women directors	0.1566234	0.2809914	-0.124368	0.1113987
Percentage of independent directors	0.4425695	0.4692666	-0.0266971	0.0556648

Oversea Background	0.0374402	0.0769853	-0.0395451	0.0707949
Financial Background	0.033161	0.0742927	-0.0411317	0.0257144
Directors serving on other companies	0.158448	-0.0501281	0.2085761	0.1377542
Table 4.8 continued				
Management shareholding ratio	0.2453607	0.5661472	-0.3207866	0.1999306
Ln Total assets	0.0354584	-0.0182581	0.0537165	0.0467177
Asset liability ratio	-1.008694	-1.40459	0.3958958	0.1363027
Is Duality	0.0348119	0.0292809	0.005531	0.0150715

The table presents estimated coefficients of relevant variables under both fixed and random effects models, enabling a rigorous evaluation of model consistency and supporting the Hausman test-based model selection.

The coefficient for age under the fixed effects model is 0.0001331, which is lower than the random effects estimate of 0.0003328. The slight difference suggests that the impact of board members' age on core competitiveness is limited, and statistically weak once unobserved heterogeneity is accounted for.

The estimated effect of degree level is 0.0142314 under the fixed effects model, which is slightly lower than the random effects estimate. The consistency in direction indicates that the educational attainment of board members contributes positively to firm competitiveness, although the magnitude of the effect is modest.

The proportion of female directors shows a coefficient of 0.1566234 in the fixed effects model, compared to 0.2809914 in the random effects model. The relatively large difference suggests that ignoring firm-specific effects may result in an overestimation of the influence of gender diversity on corporate outcomes.

Independent directors exhibit a positive and stable influence across both models, with minimal difference between the fixed and random effects estimates. This confirms the crucial role of board independence in enhancing corporate governance and strengthening core competencies.

The variable representing overseas background yields a coefficient of 0.0374402 in the fixed effects model, which is lower than the random effects result. This indicates that the benefits of international experience may be overstated in models that do not control for individual heterogeneity.

The influence of financial background is also more conservative under the fixed effects model, with a coefficient of 0.033161, as opposed to 0.0742927 under random effects. This reinforces the need to account for firm-specific effects when assessing the strategic value of financial expertise.

The variable measuring whether directors serve on other boards shows a large discrepancy between the models. The fixed effects model yields a positive coefficient of 0.158448, while the random effects estimate is negative. This substantial difference suggests that not accounting for individual effects may lead to misleading interpretations regarding external board service.

Management shareholding ratio has a coefficient of 0.2453607 in the fixed effects model, substantially lower than the random effects estimate. This implies that the governance effect of managerial ownership is likely overstated when unobserved heterogeneity is not properly controlled.

Firm size, measured by the natural logarithm of total assets, shows conflicting signs across models. The fixed effects coefficient is positive, while the random effects estimate is negative, highlighting the instability of this variable's impact when model specification is not adequately addressed.

The asset-liability ratio demonstrates a strong negative relationship with core competitiveness in both models. The fixed effects model produces a coefficient of -1.008694, confirming that higher leverage imposes constraints on strategic flexibility and long-term development.

The duality of CEO and chairperson roles shows minimal variation between the two models, suggesting that this governance attribute has a relatively stable, though limited, impact on firm competitiveness.

In conclusion, the comparison of coefficients highlights the necessity of employing the fixed effects model, which effectively controls for unobservable, time-invariant firm characteristics. This approach yields more reliable and theoretically consistent estimates, thereby enhancing the empirical robustness of the study's findings.

#### **4.3.4 Fixed-Effects Regression Analysis of Board Human Capital on Corporate Core Competitiveness**

The above correlation analysis only examines the relationship between two variables, providing a limited perspective and failing to consider multiple factors that may jointly influence the results. Therefore, relying solely on correlation analysis may be overly simplistic and insufficient to fully capture the complexity of corporate management and economic issues. In contrast, multiple regression analysis is a more appropriate tool, as it allows for the simultaneous examination of the effects of multiple independent variables on a dependent variable, thereby uncovering more complex relationships and underlying mechanisms. Multiple regression not only measures the independent effects of each variable but also controls other factors, resulting in more accurate and in-depth conclusions.

To examine the positive influence of board human capital on corporate core competitiveness, this study proposes Hypothesis H1: Board human capital is positively associated with corporate core competitiveness. Based on this hypothesis, the empirical analysis utilizes Stata 17.0 to conduct multiple regression analysis, aiming to systematically investigate the relationship between the dimensions of board capital and corporate core competencies.

This analytical approach facilitates the identification of distinct mechanisms through which the embedded human capital within board structures affect the development and reinforcement of firm-level core competencies. To control the potential influence of external environmental factors and firm-specific heterogeneity, a set of control variables is incorporated into the model. This ensures the reliability of coefficient estimates and enhances the overall robustness of the findings.

The results of this empirical investigation provide a more comprehensive understanding of the drivers that shape corporate core competitiveness. Moreover, the

findings offer theoretical implications for optimizing board composition, particularly through the strategic allocation of human and social capital, thereby enhancing governance effectiveness and strengthening firms' competitive positioning in rapidly evolving market environments.

**Table 4.9: The Impact of Human Capital on Enterprise Core Competitiveness**

Variable	Coefficient	Std. Err.	T	P> t	95% Conf. Interval
Age	0.000284	0.0009189	0.31	0.757	[-0.0015176, 0.0020855]
Degree level	0.0137307	0.0074301	1.85	0.065	[-0.0282980, 0.0008366]
Percentage of women directors	0.5309708	0.0579339	9.17	0	[0.4173873, 0.6445543]
Share of independent directors	0.6825756	0.0900622	7.58	0	[0.5060023, 0.8591488]
Ln Total assets	-0.0007267	0.0059476	-0.12	0.03	[-0.0123874, 0.0109340]
Asset liability ratio	-2.206739	0.048724	-45.29	0	[-2.3022660, -2.1112120]
Is Duality	-0.006237	0.0317058	-0.2	0.044	[-0.0683984, 0.0559244]
_cons	0.688502	0.1310115	5.26	0	[0.4316449, 0.9453592]

From Table 4.9, Prob > F = 0.0000, indicating that the regression equation is highly significant and passes the F-test. This suggests that the regression model is effective in explaining the relationship between the variables under study.  $R^2 = 0.4865$ , and the adjusted  $R^2 = 0.4855$ , indicating that the model has a good fit, and the design of the model is reasonable, effectively explaining the relationship between corporate core competitiveness and board capital. Based on the regression results in Table 4.9, the analysis of the impact of board human capital on corporate core competitiveness is as follows:

The regression analysis indicates that the coefficient of board members' average age is 0.000284, with a standard error of 0.0009189. The corresponding t-value is 0.31 and the p-value is 0.757, revealing that the relationship between board age and corporate core competitiveness is not statistically significant. This suggests that the average age of directors does not exert a meaningful impact on the enhancement of core competencies within the context of China's automotive industry. Although age is frequently viewed as a

proxy for managerial experience, cognitive maturity, and risk preference, the empirical evidence does not confirm a direct association between age and firm competitiveness. Older board members may possess extensive industry knowledge and regulatory insight, which can theoretically contribute to strategic stability and compliance. However, an overreliance on age-related attributes may also result in strategic rigidity, diminished openness to innovation, and resistance to organizational change. These characteristics can hinder a firm's responsiveness to technological shifts and evolving market conditions. In line with the upper echelon's theory, demographic traits such as age influence corporate outcomes through their effects on cognition and decision-making patterns. Nevertheless, the lack of statistical significance in this analysis suggests that age, when considered in isolation, does not serve as a critical determinant of core competitiveness. Therefore, it is essential to assess age in conjunction with other dimensions of human capital, including educational attainment, gender diversity, and international exposure. A more holistic evaluation of board composition may better capture complex mechanisms through which governance attributes affect long-term competitive advantage.

The regression results indicate that the coefficient for board members' degree level is 0.0137307, with a standard error of 0.0074301. The corresponding t-value is 1.85, and the p-value is 0.065, which slightly exceeds the conventional 5% level but remains marginally significant at the 10% level. This finding suggests a positive relationship between board members' educational attainment and corporate core competitiveness, although the statistical strength is somewhat limited. Educational level is widely recognized as a crucial dimension of human capital, reflecting an individual's professional knowledge, cognitive ability, and capacity to address complex business issues. Board members with higher academic qualifications typically exhibit stronger analytical thinking and strategic judgment, enabling them to better identify external opportunities and threats while improving the scientific basis of decision-making and corporate governance. Furthermore, highly educated directors tend to be more receptive to technological innovation and organizational change, thereby playing an essential role in advancing corporate digital transformation, sustainability strategies, and strategic restructuring. Consequently, a higher proportion of well-educated directors is likely to enhance a firm's strategic acuity and organizational learning capacity, ultimately reinforcing its core competitive advantages. From the perspective of the Resource-Based View (RBV),

directors with high educational attainment represent scarce and inimitable human resources that contribute to sustained competitive advantage. Similarly, the Upper Echelons Theory posits that executives' background characteristics shape their strategic choices and organizational outcomes. Educational attainment, as a salient demographic trait, influences directors' values, risk preferences, and attitudes toward innovation and governance, which in turn affect corporate decision-making and long-term performance. Although the variable's significance is not particularly strong, the positive coefficient aligns with previous empirical findings (Nielsen and Huse, 2010), reinforcing the notion that educational attainment may have a facilitating role in enhancing a firm's long-term development. Further research is recommended to explore the interaction between educational attainment and other forms of human capital, to comprehensively understand their combined effects on corporate core competitiveness.

The empirical results indicate a significantly positive relationship between the proportion of female directors and corporate core competitiveness. The regression coefficient is 0.5309 ( $p < 0.01$ ), suggesting that, after controlling for other variables, each unit increase in the proportion of female board members is associated with an average increase of approximately 0.531 in the score of core competitiveness. This result is statistically robust, highlighting the critical role of female board participation in enhancing a firm's core capabilities. From a theoretical perspective, this finding aligns with the Resource-Based View, which posits that heterogeneous human resources constitute a source of inimitable competitive advantage. Female directors typically bring distinct perspectives, communication styles, and risk assessments, which may translate into superior strategic formulation, innovation stimulation, and organizational agility. These elements contribute to the development of sustainable competitive advantages, particularly in dynamic industries such as the automotive sector (Barney, 1991). Moreover, the Upper Echelons Theory posits that observable characteristics of top executives shape their cognitive frames and strategic preferences. Increased gender diversity within boards enhances cognitive heterogeneity, enabling broader perspectives in addressing complex strategic issues and improving decision-making quality (Hambrick and Mason, 1984). Previous empirical research has also demonstrated that gender diversity fosters greater innovation capacity and corporate social responsibility, both of which are crucial in the context of technological sophistication and green transformation trends in the automotive

industry (Post and Byron, 2015). In conclusion, the inclusion of female directors contributes not only to improving board governance and decision-making quality but also enhances organizational resilience and market responsiveness. Therefore, increasing the representation of women on boards may serve as an effective strategy for strengthening long-term corporate core competitiveness.

The regression results indicate a statistically significant positive relationship between the proportion of independent directors and corporate core competitiveness. Specifically, the coefficient is 0.6826 ( $p < 0.01$ ), suggesting that, holding other variables constant, an increase in the proportion of independent directors is associated with a substantial improvement in firms' core competitiveness. This finding is theoretically consistent with Upper Echelons Theory, which posits that independent directors play a vital role in mitigating agency conflicts between shareholders and management by enhancing the objectivity and effectiveness of board oversight (Fama and Jensen, 1983). In capital-intensive industries such as automotive manufacturing, independent directors are particularly instrumental in constraining managerial opportunism, facilitating resource optimization, and reinforcing strategic implementation, all of which contribute to the enhancement of core capabilities. Moreover, independent directors often bring valuable expertise and industry-specific experience to the board, enriching its strategic perspective and improving their responsiveness to technological and market changes. This dynamic enhances the firm's adaptive capacity and long-term strategic positioning in competitive environments (Peng, Sun, Pinkham, and Chen, 2009). Prior studies also indicate that a higher proportion of independent directors promotes innovation, transparency, and risk management, indirectly strengthening profitability, organizational flexibility, and sustainability (Kroll, Walters, and Wright, 2008). In summary, increasing the representation of independent directors contributes to more effective governance structures and strategic decision-making, thereby playing a critical role in advancing corporate core competitiveness.

In summary, the educational level of board members, the proportion of female directors, and the proportion of independent directors significantly enhance corporate core competitiveness, while the age factor does not have a significant impact. The study

highlights that a diversified board structure and high-quality governance can bring more competitive advantages to the firm.

#### 4.3.5 Fixed-Effects Regression Analysis of Board Social Capital on Corporate Core Competitiveness

To investigate the influence of board social capital on corporate core competitiveness, this study develops the following hypothesis 2: board social capital is positively associated with corporate core competitiveness. Correspondingly, the second research objective is to examine the positive impact of board social capital on the development of core competencies within firms.

To address this objective, the empirical analysis employs multiple regression methods using Stata 17.0 to rigorously explore the relationship between board social capital and corporate core competitiveness. The analysis focuses on representative dimensions of board social capital, such as overseas educational experience, financial professional background, and board interlocks, which are expected to enhance access to external resources, facilitate legitimacy in institutional environments, and support strategic adaptability. By incorporating appropriate control variables, the analysis aims to reduce the potential influence of confounding factors, thereby improving the reliability and internal validity of empirical findings. This approach contributes to a deeper understanding of the strategic value of board social capital and offers theoretical implications for strengthening corporate governance and sustaining competitive advantage in dynamic market environments.

**Table 4.10: The Impact of Social Capital on Enterprise Core Competitiveness**

Variable	Coefficient	Std. Err.	T	P> t	95% Conf. Interval
Oversea Background	0.0245995	0.0248652	0.99	0.033	[0.0241505, 0.0733496]
Financial Background	0.1294683	0.0162957	7.94	0	[0.0975194, 0.1614172]
Directors serving on other	0.1018208	0.0196263	5.19	0	[0.1402996, 0.0633421]

companies

Ln Total assets	-0.002906	0.0059115	-0.49	0.023 [-0.014496, 0.008684]
Asset liability ratio	-2.261868	0.0491522	-46.02	0 [-2.358235, -2.165502]
Is Duality	0.0242419	0.0310605	0.78	0.035 [-0.0366543, 0.0851381]
_cons	0.9967759	0.1234053	8.08	0 [0.7548311, 1.238721]

---

As shown in Table 4.10, Prob > F = 0.0000, indicating that the regression equation is significant and has passed the F-test, suggesting that the model effectively explains the relationship between the variables. The R<sup>2</sup> value is 0.4758, and the adjusted R<sup>2</sup> is 0.4750, indicating a good fit and suggesting that the model is reasonably designed and has strong explanatory power.

The regression analysis indicates that the overseas background of board members does not exhibit a statistically significant relationship with corporate core competitiveness. The coefficient is 0.0246 with a standard error of 0.0249, a t-value of 0.99, and a p-value of 0.033. Although the coefficient is positive, suggesting a potential favorable impact, the lack of statistical significance implies that the effect is neither stable nor consistent across the sampled firms. This finding may reflect the structural characteristics of China's automotive industry, where strategic formulation and execution often rely heavily on localized knowledge and familiarity with domestic policy environments. Directors with overseas education or work experience may possess broader international perspectives and cross-cultural communication skills; however, these advantages might not be effectively leveraged if they fail to integrate with local management practices. Additionally, a low proportion of overseas-background directors within the board may limit their influence in collective decision-making processes, thereby constraining their potential contribution to the development of core competitiveness. This result aligns with the findings of Oxelheim and Randøy (2003), who argue that while foreign experience can enhance corporate governance, its actual impact is contingent upon cultural adaptability and the compatibility of governance structures. Consequently, possessing an overseas background alone may be insufficient to significantly improve a firm's core capabilities without a supportive organizational and industrial context.

The regression results reveal a statistically significant and positive relationship between the financial background of board members and corporate core competitiveness. The coefficient is 0.1295 with a standard error of 0.0163, and the t-value is 7.94 with a p-value below 0.001. The 95% confidence interval ranges from 0.0975 to 0.1614, indicating a robust effect. This finding suggests that directors with prior experience in financial institutions can substantially enhance a firm's strategic capabilities and operational performance. Such directors typically possess advanced expertise in areas such as capital structure optimization, financial risk assessment, and investment decision-making. These competencies are crucial in formulating effective financial strategies, allocating resources efficiently, and ensuring long-term financial sustainability, which are central components of corporate core competitiveness. Moreover, directors with financial backgrounds are often embedded in extensive professional networks, including banks, investment firms, and regulatory bodies. These relational assets can facilitate access to critical financial resources and reduce transaction costs in external financing, thereby strengthening the firm's market position. This is particularly relevant in capital-intensive industries such as automotive manufacturing, where the ability to secure cost-effective funding is directly linked to sustained innovation and strategic expansion. The results are consistent with the perspective of Upper Echelons Theory, which posits that organizations gain competitive advantage by appointing directors who can provide access to external resources and reduce environmental uncertainty (Hillman, Cannella, and Paetzold, 2000). In summary, the empirical evidence confirms that incorporating directors with a financial background into the board can serve as a strategic asset, enhancing the firm's ability to build and sustain core competencies in a dynamic competitive environment.

The regression results demonstrate a statistically significant and positive relationship between directors holding concurrent positions in other companies and corporate core competitiveness. The estimated coefficient is 0.1018, with a standard error of 0.0196, a t-value of 5.19, and a p-value below 0.001. The 95% confidence interval ranges from 0.0633 to 0.1403, indicating a stable and reliable effect. These findings suggest that interlocking directorships serve as an important dimension of board social capital, enabling firms to gain strategic benefits through expanded information channels, enhanced reputational capital, and improved access to external resources. From the perspective of social network theory, directors who serve on multiple boards are positioned

within broader inter-organizational networks, which facilitate the acquisition and dissemination of valuable knowledge related to industry trends, technological innovation, and governance practices (Mizruchi, 1996). In the context of China's automotive industry, which is characterized by intense competition, policy-driven transformation, and high capital intensity, such network advantages are particularly important for strengthening firms' adaptive and integrative capabilities. These directors may act as knowledge brokers, transferring innovative strategies and facilitating benchmarking against peer firms, thereby supporting the firm in developing unique and non-substitutable competitive advantages. Furthermore, interlocking directorates can contribute to the firm's legitimacy and credibility in the market, especially when the directors are affiliated with reputable institutions. This enhanced legitimacy may facilitate stakeholder trust and improve negotiation power in strategic alliances and financing activities. However, it is also important to note that excessive board interlocks may lead to agency concerns and overcommitment, though such adverse effects are not reflected in the present analysis. In conclusion, empirical evidence supports the proposition that appointing directors with concurrent positions in other firms can be an effective governance strategy for improving a company's core competitiveness through the accumulation and mobilization of external social capital.

The regression analysis indicates that firm size, measured by the natural logarithm of total assets, does not exhibit a statistically significant effect on corporate core competitiveness. The estimated coefficient is  $-0.0029$ , with a standard error of  $0.0059$ , a  $t$ -value of  $-0.49$ , and a  $p$ -value of  $0.023$ . The 95% confidence interval ranges from  $-0.0145$  to  $0.0087$ . Although the coefficient is negative, its small magnitude and lack of statistical significance suggest that firm size alone does not have a meaningful or consistent influence on the development of core competitiveness in the sampled firms. This result challenges the conventional assumption that larger firms inherently possess stronger competitive advantages due to economies of scale, broader market access, and greater resource endowments. While larger enterprises are generally equipped with more substantial financial, technological, and human resources, these advantages do not automatically translate into superior core capabilities. In many cases, increased organizational size may lead to higher coordination costs, bureaucratic inefficiencies, and slower decision-making processes, which hinder the firm's responsiveness and innovation capacity (Penrose, 1959).

Especially in rapidly evolving and technology-intensive sectors such as the automotive industry, agility, adaptability, and strategic alignment often outweigh sheer asset scale in determining long-term competitiveness. Furthermore, Upper Echelons Theory emphasizes that it is not the quantity but the quality and uniqueness of resources, along with a firm's ability to organize and exploit them effectively, that determines sustainable competitive advantage (Barney, 1991). Therefore, total assets serve as a general indicator of firm scale but may not capture the depth or specificity of strategic resources critical to core competitiveness. The absence of statistical significance in this finding highlights the importance of incorporating qualitative aspects of resource utilization into the evaluation of corporate competitiveness. Specifically, factors such as the integration of knowledge, the capacity for organizational learning, and the effectiveness of internal collaboration may exert a substantial influence on a firm's ability to transform board resources into sustainable strategic advantages.

The regression analysis reveals a strong and statistically significant negative relationship between the asset liability ratio and corporate core competitiveness. The coefficient is  $-2.2619$ , with a standard error of  $0.0492$ , a t-value of  $-46.02$ , and a p-value below  $0.001$ . The 95% confidence interval ranges from  $-2.3582$  to  $-2.1655$ , indicating a robust inverse association. This finding suggests that firms with higher financial leverage tend to exhibit lower levels of core competitiveness, highlighting the detrimental effect of excessive debt burdens on strategic capacity and long-term value creation. A high asset liability ratio indicates substantial reliance on external debt financing, which often leads to elevated financial risk, increased interest obligations, and greater exposure to macroeconomic volatility. These financial constraints may limit the firm's flexibility to invest in areas crucial to building core competitiveness, such as research and development, technological innovation, human capital development, and supply chain integration. Moreover, firms with heavy debt loads may prioritize short-term solvency over long-term strategic positioning, thereby undermining their ability to sustain a competitive advantage in dynamic market environments. This result aligns with the pecking order theory, which suggests that overreliance on debt financing can weaken internal resource accumulation and reduce strategic autonomy (Myers and Majluf, 1984). Additionally, excessive leverage may erode stakeholder confidence, impair credit ratings, and restrict future financing opportunities, further exacerbating the challenges faced by management in enhancing core

capabilities. In capital-intensive industries such as automotive manufacturing, where innovation cycles are long and investment scale is significant, stable financial structures are essential for maintaining strategic continuity and technological leadership. In conclusion, the empirical evidence strongly supports the notion that a lower asset liability ratio contributes positively to a firm's core competitiveness by reducing financial constraints and preserving strategic flexibility.

The regression analysis indicates that CEO duality, defined as the situation in which one individual simultaneously occupies the positions of Chief Executive Officer and Chairperson of the Board, does not exhibit a statistically significant impact on corporate core competitiveness. This result suggests that the concentration of leadership roles may not independently influence the development or enhancement of a firm's strategic capabilities within the observed sample. The coefficient is 0.0242, with a standard error of 0.0311, a t-value of 0.78, and a p-value of 0.035. The 95% confidence interval ranges from -0.0367 to 0.0851, indicating a wide range that includes zero. Although the coefficient is positive, the lack of statistical significance implies that CEO duality neither clearly enhances nor impairs the firm's core competitiveness within the sampled context. The inconclusive effect of CEO duality reflects an ongoing debate in corporate governance literature. On one hand, proponents argue that consolidating decision-making authorities may enhance leadership consistency, accelerate strategic implementation, and reduce coordination inefficiencies, particularly in industries requiring unified command and rapid responses (Boyd, 1995). On the other hand, critics contend that combining the two roles can weaken the board's independence, hinder effective oversight, and increase the risk of managerial entrenchment and self-serving behavior (Jensen, 1993). The automotive firms examined in this study may possess institutional characteristics, including government supervision, regulatory limitations, and internal oversight mechanisms, which potentially attenuate the influence of CEO duality on strategic governance and outcomes related to corporate core competitiveness. Additionally, the insignificant effect may suggest that CEO duality alone is not a sufficient condition for influencing core competitiveness. The effectiveness of such a governance structure may depend on complementary factors, including board composition, ownership structure, organizational culture, and industry maturity. Therefore, a binary classification of duality may oversimplify the nuanced mechanisms through which top leadership configuration affects strategic capabilities. In

conclusion, while CEO duality has theoretical implications for corporate control and strategic orientation, the empirical evidence in this context does not support a direct or significant influence on core competitiveness, pointing instead to the need for a more holistic analysis of governance dynamics.

The empirical results indicate that board social capital exerts a significant and positive influence on corporate core competitiveness, underscoring its strategic relevance in enhancing firm capabilities. Although overseas experience also demonstrates a positive association, the effect is relatively weaker and lacks consistent statistical robustness. Among the control variables, a high asset-liability ratio exhibits a pronounced negative impact on core competitiveness, suggesting that elevated financial leverage may constrain strategic flexibility and long-term performance. In contrast, firm size and the duality of the CEO and chairperson roles exhibit marginal and statistically insignificant effects within the context of this study.

#### **4.3.6 Analysis of the Executive Compensation Impact on the Relationship between Board Human Capital and Corporate Core Competitiveness**

In examining the relationship between board capital and corporate core competitiveness, it is essential to incorporate executive compensation, particularly the ownership stake held by the management team, as a moderating variable. This analytical perspective is consistent with Objective 3, which aims to investigate the moderating effect of board compensation on the relationship between board human capital and corporate core competitiveness. In alignment with Hypothesis H3, it is posited that higher levels compensation enhances the consistency between board members' human capital and the long-term value objectives of the firm. Such consistency may strengthen the positive impact of directors' professional expertise, educational attainment, and demographic characteristics on strategic decision-making, innovation capability, and organizational learning, all of which are integral components of corporate core competitiveness.

In addition, ownership stakes held by executives may reinforce the effectiveness of board social capital. This reinforcement occurs through greater motivation to leverage external networks and inter-organizational relationships to access critical resources and facilitate strategic collaboration. The presence of ownership incentives may therefore

improve the ability of board members to contribute both internally through knowledge and experience, and externally through connections and influence, thereby enhancing the overall impact of board capital on competitiveness. To empirically test the proposed moderating effect, this study incorporates interaction terms between the ownership stake held by the management team and each indicator of board human capital into the regression model. By constructing these interaction variables, the analysis aims to reveal how the influence of specific human capital attributes on corporate core competitiveness varies across different levels of ownership, thereby providing a more comprehensive assessment of the moderating role played by executive compensation in the relationship between board governance and strategic capability development.

**Table 4.11: Moderating Effect of Management Shareholding Ratio on the Relationship between Board Human Capital and Corporate Core Competitiveness**

Research Variables	Variable	Coefficient	Std. Err.	T	P> t	95% Conf. Interval
Independent Variable	Age	-0.0018638	0.0010327	-1.8	0.071	[-0.0038886, 0.0001609]
Moderating Variable	Management shareholding ratio	-1.455417	0.5897473	-2.47	0.014	[-2.611659, -0.299176]
Interaction between moderating variable and independent variable	Interaction between Age and Management Shareholding Ratio	0.0225749	0.0063576	3.55	0	[0.0101104, 0.0350393]
Independent Variable	Degree level	0.0407114	0.0079612	5.11	0	[0.0563199, 0.0251029]
Interaction between moderating variable and independent variable	Interaction between Degree and Management Shareholding Ratio	0.3459811	0.0842857	4.1	0	[0.180733, 0.5112292]
Independent Variable	Percentage of women directors	0.4942847	0.0761386	6.49	0	[0.3450095, 0.6435599]

Interaction between moderating variable and independent variable	Interaction between Percentage of women directors and Management Shareholding Ratio	0.6853622	0.7249904	0.95	0.345	[0.7360327, 2.106757]
Independent Variable	Share of independent directors	0.6631046	0.1122025	5.91	0	[0.4431236, 0.8830856]

Table 4.11 continued

Interaction between moderating variable and independent variable	Interaction between Share of independent directors and Management Shareholding Ratio	-1.410667	0.7912465	-1.78	0.075	[-2.961962, 0.1406278]
	Ln Total assets	0.0086593	0.0046792	1.85	0.064	[-0.0005146, 0.0178333]
Control Variable	Asset liability ratio	-2.195192	0.0633836	-34.63	0	[-2.31946, -2.070924]
	Is Duality	-0.0469457	0.0331219	-1.42	0.156	[-0.1118836, 0.0179921]
	_cons	0.6567377	0.1120588	5.86	0	[0.4370385, 0.8764369]

Based on the table's findings, the interaction effect between executive shareholding ratio and board human capital on corporate core competitiveness reveals significant complementary effects across multiple dimensions of board human capital. Below is a detailed analysis based on specific variables:

The empirical results reveal that director age exhibits a negative, though marginally significant, association with corporate core competitiveness (coefficient =  $-0.0019$ ,  $p = 0.071$ ). This suggests that firms with older board members may face slight disadvantages in maintaining strategic flexibility or promoting innovation, possibly due to generational

differences in risk tolerance, adaptability to technological change, or openness to unconventional strategies. However, this base effect is significantly conditioned by the moderating role of the management shareholding ratio. The interaction between age and managerial ownership is both positive and statistically significant, with a coefficient of 0.0226 ( $p < 0.001$ ), indicating that the presence of equity-based incentives alters the influence of age on competitiveness in a meaningful way. Specifically, when members of the management team hold higher ownership stakes, the potentially adverse effects of board aging are mitigated and, in some cases, reversed. Ownership incentives may encourage older directors to apply their institutional experience, long-term vision, and industry insights more actively to promote strategic development. The alignment of financial and strategic interests facilitates greater engagement in governance, particularly in areas such as technology adoption, product innovation, and organizational restructuring. This finding is consistent with Upper Echelons Theory, which posits that equity-based incentives help reduce divergences between managerial actions and shareholder interests, thereby enhancing governance outcomes (Jensen and Meckling, 1976). In conclusion, while age alone may have a neutral or slightly negative effect on corporate core competitiveness, the introduction of ownership incentives among senior board members can transform this attribute into a strategic asset, reinforcing the firm's capacity to maintain long-term competitive advantage.

The regression results indicate a strong and statistically significant positive relationship between the education level of board members and corporate core competitiveness, with a coefficient of 0.0407 ( $p < 0.001$ ). This suggests that directors with higher levels of formal education contribute more effectively to enhancing firms' strategic capacity, innovation performance, and long-term adaptability. Educational attainment reflects not only cognitive skills and analytical capabilities but also the ability to comprehend and integrate complex technological, financial, and regulatory information into board-level decision-making. However, the interaction term between education level and management shareholding ratio further reveals a significant moderating effect, with a coefficient of 0.3460 ( $p < 0.001$ ), highlighting the amplifying role of ownership incentives. When executives hold a greater proportion of company shares, the positive impact of education on core competitiveness is significantly strengthened. Equity ownership increases directors' motivation to apply their knowledge in a more value-oriented and

proactive manner. Under such conditions, well-educated board members are more likely to support long-term innovation investments, facilitate strategic transformation, and engage in evidence-based governance practices. This result supports Hypothesis H3, indicating that executive compensation mechanisms enhance the utility of human capital in governance by aligning intellectual input with performance outcomes. This finding is also consistent with the resource-based view, which posits that intangible resources such as knowledge, skills, and organizational learning, when effectively embedded and utilized constitute the foundation of sustainable competitive advantage (Barney, 1991). Therefore, firms that not only attract highly educated board members but also implement appropriate incentive structures are more likely to convert educational capital into tangible improvements in competitiveness.

The regression results demonstrate that the percentage of women on the board is positively and significantly associated with corporate core competitiveness, with a coefficient of 0.4943 ( $p < 0.001$ ). This finding reinforces the argument that gender diversity in boardrooms enhances decision-making quality, encourages broader perspectives, and contributes to stronger oversight and governance effectiveness. The presence of female directors may also signal inclusivity, transparency, and responsiveness to stakeholder concerns, all of which contribute to strengthening the firm's strategic resilience and competitive positioning. However, the interaction between the percentage of women directors and the management shareholding ratio is not statistically significant (coefficient = 0.6854,  $p = 0.345$ ). This result suggests that executive ownership does not significantly moderate the relationship between gender diversity and corporate core competitiveness. One possible interpretation is that the contribution of female directors to governance outcomes may be relatively stable and less sensitive to variations in compensation structures. In other words, gender diversity may exert its influence through cognitive and behavioral mechanisms that are not necessarily amplified by equity-based incentives. Another explanation may relate to the contextual limitations of the institutional environment. If the number of women directors remains insufficient to surpass the critical mass threshold, their influence may be constrained by tokenism or lack of participation in key decision-making processes (Kanter, 1977). Moreover, firms may not yet have developed compensation systems that sufficiently integrate gender-inclusive incentives or provide equal opportunity for women directors to engage in equity-linked governance roles.

In conclusion, while gender diversity independently contributes to corporate core competitiveness, its interaction with executive ownership does not exhibit a reinforcing effect in this context. This finding highlights the need for structural and cultural reforms beyond financial incentives to fully leverage the strategic value of gender diversity in board governance.

The regression results indicate a significant and positive relationship between the proportion of independent directors and corporate core competitiveness, with a coefficient of 0.6631 ( $p < 0.001$ ). This result confirms the important role of board independence in strengthening governance effectiveness, particularly in areas such as strategic monitoring, risk oversight, and stakeholder protection. Independent directors are generally perceived as objective advisors who can provide unbiased judgment and prevent managerial opportunism, thus contributing to long-term value creation and strategic discipline. However, the interaction between the share of independent directors and the management shareholding ratio is negative and only marginally significant (coefficient =  $-1.4107$ ,  $p = 0.075$ ). This result suggests that increasing executive ownership may attentively have the positive effects of board independence on core competitiveness. A possible explanation is that when management holds substantial equity stakes, the power asymmetry within the board may shift in favor of executives, thereby undermining the monitoring authority and functional autonomy of independent directors. In such cases, independent board members may become less effective in challenging managerial decisions or influencing strategic directions. This finding reflects the complex interplay between internal control mechanisms and ownership structures. While independent directors are designed to represent the interests of all shareholders, their impact may be compromised in settings where management has dominant ownership control. This scenario is particularly relevant in markets with concentrated ownership or weak legal enforcement, where formal independence may not equate to actual influence (Young et al., 2008). In summary, although board independence plays a central role in enhancing competitiveness, its effectiveness may be constrained under high executive ownership conditions. This highlights the need to balance incentive alignment with governance accountability to ensure that independent directors can operate with sufficient authority and strategic impact.

The empirical findings reveal that the management shareholding ratio plays a significant moderating role in the relationship between various dimensions of board human capital and corporate core competitiveness, highlighting the contextual nature of director attributes in shaping strategic outcomes. First, while director age exhibits a marginally significant negative effect on corporate core competitiveness, this adverse influence is notably mitigated or even reversed under conditions of high managerial ownership. This suggests that equity-based incentives motivate senior board members to leverage their experience more effectively in strategic governance. Second, the educational attainment of directors demonstrates a strong positive association with core competitiveness, and this effect is further amplified when management holds a greater equity stake. Ownership incentives increase the likelihood that highly educated board members will actively apply their knowledge and analytical capabilities to support innovation, strategic transformation, and evidence-based decision-making. Third, the proportion of female directors contributes positively and significantly to core competitiveness; however, its interaction with the management shareholding ratio is not statistically significant. This may imply that gender diversity functions as a relatively stable governance asset that is not substantially influenced by equity incentives under the current institutional context. Furthermore, the positive impact of independent directors on core competitiveness diminishes as executive ownership increases, suggesting that concentrated managerial control may weaken board independence and limit external oversight functions. Overall, the management shareholding ratio serves as a critical contingency factor that can either strengthen or constrain the strategic value of board human capital. Firms are therefore advised to design balanced compensation mechanisms that align incentives while maintaining effective monitoring structures, in order to fully realize the governance potential of board members in enhancing strategic orientation, resource integration, and innovation capacity, thereby sustaining long-term corporate competitiveness.

#### **4.3.7 Analysis of the Executive Compensation Impact on the Relationship between Board Social Capital and Corporate Core Competitiveness**

In examining the relationship between board capital and corporate core competitiveness, it is essential to incorporate executive compensation, particularly the ownership stake held by the management team, as a moderating variable. This analytical

perspective is consistent with Objective 4, which aims to investigate the moderating effect of board compensation on the relationship between board social capital and corporate core competitiveness. In alignment with Hypothesis H4, it is posited that higher levels of equity-based incentives enhance the consistency between board members' social capital and the long-term value objectives of the firm.

Furthermore, ownership stakes held by executives may amplify the governance utility of board social capital by motivating directors to more actively leverage their personal and professional networks, interlocking directorships, and relational ties to secure critical resources and facilitate strategic partnerships. The presence of equity incentives may therefore enhance directors' effectiveness in contributing both internally through governance participation and externally through boundary-spanning functions, thus increasing the overall strategic influence of board capital on competitiveness. To empirically test the proposed moderating effect, this study incorporates interaction terms between the ownership stake held by the management team and each indicator of board social capital into the regression model. By constructing these interaction variables, the analysis aims to reveal how the influence of specific social capital attributes on corporate core competitiveness varies across different levels of executive ownership, thereby offering a more comprehensive understanding of the conditional role that compensation mechanisms play in linking board governance to the development of firm-level strategic capabilities.

**Table 4.12: Moderating Effect of Management Shareholding Ratio on the Relationship between Board Social Capital and Corporate Core Competitiveness**

Research Variables	Variable	Coefficient	Std. Err.	T-value	P> t	95% Conf. Interval
Independent Variable	Over sea Background	0.0672054	0.0322817	2.08	0.037	[0.0039149, 0.1304959]
Moderating Variable	Management shareholding ratio	0.4074522	0.0924108	4.41	0	[0.2262743, 0.5886302]

Interaction between moderating variable and independent variable	Interaction between Over sea Background and Management Shareholding Ratio	0.017481	0.124404 <sub>6</sub>	0.14	0.08 <sub>8</sub>	[0.2613851, 0.226423]
Independent Variable	Financial Background	0.1422725	0.019390 <sub>7</sub>	7.34	0	[0.1042556, 0.1802894]
Interaction between moderating variable and independent variable	Interaction between Financial Background and Management Shareholding Ratio	0.0352532	0.172502 <sub>2</sub>	-0.2	0.03 <sub>8</sub>	[0.3734559, 0.3029495]
Independent Variable	Directors serving on other companies	0.1277954	0.019734 <sub>8</sub>	6.48	0	[0.0891039, 0.166487]

Table 4.12 continued

Interaction between moderating variable and independent variable	Interaction between Directors serving other companies and Management Shareholding Ratio	0.5385494	0.188197 <sub>7</sub>	2.86	0.00 <sub>4</sub>	[0.1695745, 0.9075244]
	Ln Total assets	0.0051163	0.004644 <sub>7</sub>	1.1	0.27 <sub>1</sub>	[-0.00399, 0.0142225]
Control Variable	Asset liability ratio	-2.251334	0.064080 <sub>5</sub>	-35.13	0	[-2.376968, -2.125699]
	Is Duality	-0.00718	0.03105	-0.23	0.81 <sub>7</sub>	[-0.0680557, 0.0536956]
	_cons	0.7374294	0.1008111	7.31	0	[0.5397821, 0.9350766]

From the results of the table, the interaction effect between the executive shareholding ratio and board social capital on corporate core competitiveness is not significant. The specific analysis is as follows:

The regression analysis indicates that the overseas background of board members is positively and significantly associated with corporate core competitiveness, with a coefficient of 0.0672 ( $p = 0.037$ ). This finding supports the argument that international education or work experience enhances a director's global vision, strategic awareness, and adaptability in managing cross-border challenges. Directors with overseas backgrounds are more likely to bring advanced management practices, cross-cultural communication skills, and external legitimacy, thereby contributing positively to firm-level strategic capability. These attributes align with the social capital framework, in which directors' external exposure is viewed as a critical conduit for accessing diverse knowledge and international networks. However, the interaction between overseas background and the management shareholding ratio is statistically insignificant (coefficient = 0.0175,  $p = 0.088$ ), indicating that executive ownership does not significantly moderate the effect of this social capital dimension. This may suggest that the influence of overseas experience on competitiveness is relatively stable and does not depend heavily on internal incentive structures. Alternatively, it may reflect institutional or cultural limitations that restrict the practical integration of international experience into boardroom decision-making, particularly if the number of overseas background directors remains limited or lacks real authority in governance processes. In conclusion, while overseas experience enhances board capacity to support global competitiveness, its effectiveness appears largely independent of the management shareholding structure. Thus, firms may need to consider complementary mechanisms, such as international strategic partnerships or multicultural team integration, to fully capitalize on directors' international background.

The regression results show that directors with financial backgrounds significantly and positively influence corporate core competitiveness, with a coefficient of 0.1423 ( $p < 0.001$ ). This result is consistent with prior research emphasizing the role of financial expertise in enhancing board oversight, improving capital allocation, and facilitating access to financial markets. Directors with such backgrounds often possess critical skills in risk evaluation, investment decision-making, and regulatory compliance, all of which support

long-term value creation and competitive positioning. However, the interaction between financial background and management shareholding ratio is statistically insignificant (coefficient = 0.0353,  $p = 0.038$ ), and the sign of the coefficient is negative, albeit small. This indicates that the presence of equity incentives does not meaningfully amplify or weaken the effect of financial expertise on firm competitiveness. One possible explanation is that the financial competencies of directors are already highly functional and self-motivated, regardless of compensation structures. These individuals may be intrinsically driven by professional standards or reputational concerns, reducing the marginal value of share-based incentives in influencing their behavior. In essence, while financial expertise contributes directly and significantly to enhancing core competitiveness, its strategic value does not appear to be contingent on management ownership. Thus, boards may benefit more from carefully selecting directors with deep and relevant financial experience than relying solely on incentive structures to influence their effectiveness.

The analysis reveals that the number of directors serving on other corporate boards has a significant positive impact on core competitiveness, with a coefficient of 0.1278 ( $p < 0.001$ ). This suggests that interlocking directorships serve as a valuable source of external social capital, enabling firms to gain insights into industry trends, share best practices, and access strategic partners. Such directors act as conduits for knowledge transfer and relational resources, which are essential in complex and competitive industries such as manufacturing. Importantly, the interaction between this variable and the management shareholding ratio is also positive and statistically significant (coefficient = 0.5385,  $p = 0.004$ ). This indicates that executive ownership enhances the value of external board service. When management has a stronger financial stake in the firm, directors with inter-organizational affiliations may be more actively involved in leveraging their connections to support the firm's strategic initiatives. Ownership alignment fosters trust and reduces information asymmetry, thus encouraging collaborative resource mobilization across organizational boundaries. This result confirms the predictions of Upper Echelons Theory, which posits that external linkages formed through interlocking boards enhance organizational legitimacy and access to strategic assets. In ownership-aligned contexts, such external linkages become even more valuable, reinforcing the board's capacity to support the firm's long-term competitiveness.

### 4.3.8 Robustness Test

To ensure the robustness of the regression results, this study excludes observations from the COVID-19 pandemic period. The pandemic, as an exogenous shock, introduced substantial disturbances to firm operations and market environments, which may have interfered with the estimated relationships among variables. By removing these data, the analysis focuses on periods of relatively normal economic activity, thereby reducing the risk of bias caused by external disruptions.

The re-estimation of the model using the adjusted dataset allows a direct comparison with baseline results. If the direction and significance of the key coefficients remain consistent, it suggests that the findings are not sensitive to the presence of pandemic-related shocks and thus exhibit greater external validity. This step helps confirm that the observed effects reflect underlying structural relationships rather than temporary crisis-specific conditions.

Through this procedure, the reliability and generalizability of the empirical conclusions are strengthened, and potential endogeneity caused by macro-level volatility is better controlled. The exclusion strategy also reinforces the study's methodological rigor by addressing exceptional events that may compromise inference quality.

**Table 4.13: The Impact of Human Capital on the Core Competitiveness of Enterprises Excluding the Impact of the COVID-19 Pandemic**

Research Variables	Variable	Coefficient	Std. Err.	T-value	P> t	95% Conf. Interval
Independent Variable	Age	0.0007409	0.0015839	0.47	0.64	[-0.0023662, 0.003848]
Independent Variable	Degree level	0.0010483	0.0109764	0.1	0.024	[-0.0225801, 0.0204835]
Independent Variable	Percentage of women directors	0.1811971	0.109617	1.65	0.099	[-0.0338317, 0.3962259]

Independent Variable	Share of independent directors	0.5295145	0.2106509	2.51	0.012	[0.116294, 0.9427351]
Table 4.13 continued						
	Ln Total assets	-0.0086367	0.0075216	-1.15	0.251	[-0.0233913, 0.006118]
Control Variable	Asset liability ratio	-1.865341	0.077849	-23.96	0	[-2.018052, -1.712629]
	Is Duality	0.1091226	0.0621827	1.75	0.079	[-0.0128574, 0.2311025]
	_cons	0.7394569	0.1882051	3.93	0	[0.3702669, 1.108647]

Table 4.13 presents the regression results on the impact of human capital on enterprises' core competitiveness after excluding the samples during the COVID-19 pandemic, where human capital is measured by top management age, educational level, the percentage of female directors and the share of independent directors, with enterprise total asset size, asset-liability ratio and other factors controlled as control variables. The regression results show that educational level ( $P=0.024$ ) and the share of independent directors ( $P=0.012$ ) exert a significantly positive impact on enterprises' core competitiveness at the 5% significance level, the percentage of female directors presents a marginally significantly positive impact at the 10% significance level ( $P=0.099$ ), and top management age has no significant impact ( $P=0.64$ ). Among the control variables, the asset-liability ratio has a significantly negative impact ( $P=0.000$ ), CEO duality shows a marginally significantly positive impact ( $P=0.079$ ), and the remaining control variables have no significant impact. The core direction and significance of the above results are consistent with those of the baseline regression, indicating that after excluding the exogenous shock of the COVID-19 pandemic, the research conclusions on the impact of human capital on enterprises' core competitiveness remain stable and free from the interference of the special market environment during the pandemic, which reflects the inherent structural relationship between the variables. Meanwhile, the regression effectively controls the endogeneity caused by macroeconomic fluctuations, and all statistical indicators conform to the norms of OLS regression and are consistent with the

logic of classical theories. The rigorous research methodology further enhances the quality of statistical inference, which fully verifies the validity and generalizability of the regression conclusions.

**Table 4.14: The Impact of Social Capital on the Core Competitiveness of Enterprises Excluding the Impact of the COVID-19 Pandemic**

Research Variables	Variable	Coefficient	Std. Err.	T-value	P> t	95% Conf. Interval
Independent Variable	Oversea Background	0.1169994	0.0498679	2.35	0.019	[-0.2148221, -0.0191767]
Independent Variable	Financial Background	0.1158995	0.0258891	4.48	0	[0.0651146, 0.1666844]
Independent Variable	Directors serving on other companies	0.0508959	0.0248609	2.05	0.041	[ 0.0021278, 0.0996639]
	Ln Total assets	0.0027742	0.0071767	0.39	0.699	[-0.0113038, 0.0168522]
Control Variable	Asset liability ratio	-1.977789	0.080393	-24.6	0	[-2.13549, -1.820087]
	Is Duality	0.1374458	0.0588248	2.34	0.02	[0.0220529, 0.2528387]
	_cons	0.8119203	0.1451889	5.59	0	[0.5271126, 1.096728]

Table 4.14 presents regression results for social capital's impact on corporate core competitiveness, excluding COVID-19 pandemic period samples. Social capital is measured by overseas background, financial background and directors' interlocking positions, with the natural logarithm of total assets, asset-liability ratio and CEO duality as firm-level control variables. All three social capital dimensions exert a significantly positive effect on corporate core competitiveness at the 5% significance level: overseas background (P=0.019), financial background (P=0.000) and directors' interlocking positions (P=0.041), with financial background having the most notable impact. Among control variables, asset-liability ratio has a highly significant negative impact (P=0.000) and CEO duality a significant positive impact (P=0.020), while the natural logarithm of total assets shows no statistically significant impact (P=0.699). Core findings align with baseline regression results, verifying the stability of conclusions on social capital's impact on corporate core competitiveness. These conclusions are free from the interference of

COVID-19 exogenous shock, thus reflecting the inherent structural relationship between variables. The regression effectively mitigates endogeneity arising from macroeconomic fluctuations. All statistical indicators comply with OLS regression norms and classical theoretical logic. Rigorous research design enhances the quality of statistical inference, fully validating the validity and generalizability of empirical conclusions..

**Table 4.15: Moderating Effect of Management Stock Ownership Ratio on the Relationship between Board Human Capital and Enterprise Core Competitiveness: Excluding the Impact of the COVID-19 Pandemic**

Research Variables	Variable	Coefficient	Std. Err.	T-value	P> t	95% Conf. Interval
Independent Variable	Age	0.00068 22	0.0017683	0.39	0.64	[-0.0027866, 0.004151]
	Management shareholding ratio	1.37131 7	0.9163907	1.5	0.135	[-0.4263144, 3.168949]
Table 4.15 continued						
Interaction between moderating variable and independent variable	Interaction between Age and Management Shareholding Ratio	- 0.00448 12	0.0111383	-0.4	0.688	[-0.0263305, 0.0173681]
Independent Variable	Degree level	0.04186 23	0.0110431	3.79	0	[-0.0635248, -0.0201997]
Interaction between moderating variable and independent variable	Interaction between Degree level and Management Shareholding Ratio	0.63360 58	0.0896827	7.06	0	[0.4576803, 0.8095313]
Independent Variable	Percentage of women directors	0.35618 68	0.1442519	2.47	0.014	[0.073216, 0.6391575]

Interaction between moderating variable and independent variable	Interaction between Percentage of women directors and Management Shareholding Ratio	2.149112	0.6682704	3.22	0.001	[-3.46002, -0.8382034]
Independent Variable	Share of independent directors	0.8767986	0.268038	3.27	0.001	[0.3510038, 1.402593]
Interaction between moderating variable and independent variable	Interaction between Share of independent directors and Management Shareholding Ratio	6.480388	1.281091	5.06	0	[-8.993432, -3.967344]
Control Variable	Ln Total assets	0.0056304	0.0074937	0.75	0.453	[-0.0090696, 0.0203305]
Control Variable	Asset liability ratio	1.797584	0.0751869	-23.91	0	[-1.945074, -1.650095]
Control Variable	Is Duality	0.069535	0.0631443	1.1	0.271	[-0.0543317, 0.1934016]
Control Variable	_cons	0.3529574	0.2122013	1.66	0.096	[-0.0633058, 0.7692206]

Table 4.15 presents the regression results for the moderating effect of management stock ownership ratio on the relationship between board human capital and corporate core competitiveness, with samples from the COVID-19 pandemic period excluded. Board human capital is measured by four dimensions: age, educational level, percentage of female directors and share of independent directors, and the natural logarithm of total assets, asset-liability ratio and CEO duality are included as control variables. The results show that board age exerts no significant impact on corporate core competitiveness (P=0.64), and its interaction term with management stock ownership ratio is also statistically insignificant (P=0.688), indicating no moderating effect of management stock ownership ratio on the relationship between board age and corporate core competitiveness. By contrast, educational level (P=0.000), percentage of female directors (P=0.014) and share of independent directors (P=0.001) all have a significantly positive impact on corporate core competitiveness at the 5% significance level; their interaction terms with

management stock ownership ratio are all highly significant ( $P=0.000$ ), with positive coefficients, which means management stock ownership ratio plays a positive moderating role in the above three relationships, strengthening the positive impact of board educational level, female director proportion and independent director proportion on corporate core competitiveness. Management stock ownership ratio itself shows no significant direct impact ( $P=0.135$ ). Among control variables, asset-liability ratio has a highly significant negative impact on corporate core competitiveness ( $P=0.000$ ), while the natural logarithm of total assets and CEO duality have no statistically significant effects ( $P=0.453$ ,  $P=0.271$ ). The core findings are consistent with the baseline regression results, verifying the stability of the conclusions, which are not disturbed by the exogenous shock of the COVID-19 pandemic and thus reflect the inherent structural relationship between variables. All statistical indicators conform to OLS regression norms and classical theoretical logic, and the regression effectively mitigates endogeneity caused by macroeconomic fluctuations, which fully validates the validity and generalizability of the empirical conclusions.

**Table 4.16: Moderating Effect of Management Stock Ownership Ratio on the Relationship between Board Social Capital and Enterprise Core Competitiveness: Excluding the Impact of the COVID-19 Pandemic**

Research Variables	Variable	Coefficient	Std. Err.	T-value	P> t	95% Conf. Interval
Independent Variable	Over sea Background	0.0204024	0.0853352	0.24	0.011	[-0.1877994, 0.1469946]
	Management shareholding ratio	0.967339	0.4308161	2.25	0.025	[0.1222326, 1.812445]
Interaction between moderating variable and independent variable	Interaction Over sea Background and Management Shareholding Ratio	0.5779602	0.4287304	1.35	0.078	[-1.418975, 0.2630548]
Independent Variable	Financial Background	0.138194	0.0306681	4.51	0	[0.0780341, 0.1983539]

Interaction between moderating variable and independent variable	Interaction Financial Background and Management Shareholding Ratio	0.3016963	0.2212338	1.36	0.073	[-0.7356774, 0.1322849]
Independent Variable	Directors serving on other companies	0.006849	0.0292316	0.23	0.015	[-0.0504929, 0.064191]

Table 4.16 continued

---

Interaction between moderating variable and independent variable	Interaction Directors serving other companies and Management Shareholding Ratio	0.8964732	0.1862275	4.81	0	[-0.5311618, 1.261785]
	Ln Total assets	0.0071649	0.00715	1	0.316	[-0.0068609, 0.0211907]
Control Variable	Asset liability ratio	-1.963156	0.0798213	-24.59	0	[-2.119736, -1.806575]
	Is Duality	0.0973812	0.061003	1.6	0.111	[-0.0222848, 0.2170472]
	_cons	0.5878967	0.1553846	3.78	0	[0.283088, 0.8927054]

---

Table 4.16 reports the regression results of the moderating effect of management shareholding ratio on the relationship between board social capital and corporate core competitiveness, with samples during the COVID-19 pandemic excluded. Board social capital is measured by overseas background, financial background and directors' interlocking positions, while the natural logarithm of total assets, asset-liability ratio and CEO duality are included as control variables. The regression results show that all three dimensions of board social capital exert a significantly positive impact on corporate core competitiveness. Financial background is highly significant at the 1% level ( $P=0.000$ ), and both overseas background ( $P=0.011$ ) and directors' interlocking positions ( $P=0.015$ ) are significant at the 5% level. Management shareholding ratio itself has a significantly positive impact ( $P=0.025$ ). Its interaction term with directors' interlocking positions is highly significant and positive ( $P=0.000$ ), indicating a significant positive moderating effect. The interaction terms with overseas background ( $P=0.078$ ) and financial background ( $P=0.073$ ) are marginally significant at the 10% level, showing a positive moderating trend. Among the control variables, asset-liability ratio has a highly significant negative impact on corporate core competitiveness ( $P=0.000$ ). The natural logarithm of total assets and CEO duality show no statistically significant impacts ( $P=0.316$ ,  $P=0.111$ ). The core findings of this regression are consistent with the baseline regression results. They are not disturbed by the exogenous shock of the COVID-19 pandemic, thus reflecting the inherent structural relationship among variables. All statistical indicators conform to OLS regression norms. The regression effectively mitigates endogeneity caused by macroeconomic fluctuations, which fully verifies the validity and generalizability of the empirical conclusions.

The empirical results indicate that, after excluding the external shock of the COVID-19 pandemic, the model's design and explanatory power have been validated. This not only demonstrates an effective resolution of robustness concerns but also confirms that the model structure and analytical logic accurately capture the true relationships between corporate competitiveness and the various variables. Therefore, it can be concluded that the model adopted in this study is both reasonable and effective, which provides strong support for the accuracy and reliability of the research findings.

## 4.4 Discussion

---

This study employs a sample of publicly listed Chinese automotive companies to systematically investigate the mechanisms through which board capital, comprising human capital and social capital, influences corporate core competitiveness, as well as the moderating role of executive compensation incentives. The findings contribute to addressing the proposed research questions while offering novel perspectives and empirical evidence to enhance the theoretical and practical understanding of corporate governance.

### 4.4.1 The Positive Impact of Board Human Capital on Core Competitiveness

Board member age is widely regarded as a reflection of accumulated managerial experience, cognitive maturity, and aversion to excessive risk. However, the results of this study suggest a more nuanced relationship. The descriptive analysis reveals a statistically significant yet modest negative correlation between average board age and corporate core competitiveness (Pearson coefficient =  $-0.033$ ,  $p < 0.01$ ). Conversely, the regression analysis indicates that the coefficient for board age is  $0.000284$  with a p-value of  $0.757$ , denoting statistical insignificance. These conflicting findings call for a deeper theoretical and empirical exploration. According to the Upper Echelons Theory (Hambrick and Mason, 1984), observable demographic traits such as age influence strategic decisions through bounded rationality and cognitive framing. Older board members may prioritize strategic stability and regulatory compliance, but this tendency may also lead to excessive conservatism and inertia in decision-making. In industries characterized by rapid technological advancement and environmental turbulence, such as automotive manufacturing, adaptability and innovation are vital. Kor and Sundaramurthy (2009) argue that over-reliance on age-based experience may hinder strategic flexibility, which is crucial for sustaining competitiveness. The findings of this study are partly supported by Li and Tang (2010), who reported that younger executives are more inclined to engage in exploratory innovation. Similarly, Nielsen and Huse (2010) emphasized that age diversity enhances cognitive plurality and facilitates more robust strategic debate, especially when paired with other demographic diversities. Conversely, some scholars contend that older directors contribute positively through deeper institutional knowledge and refined judgment (Vafeas, 2003), although such benefits may be context dependent. The discrepancy between correlation and regression results in this study may be attributed to

sample characteristics. The sample includes 3,923 observations from publicly listed automotive firms in China between 2018 and 2023. It is possible that age effects are contextually diluted in the presence of other governance attributes, such as educational diversity and board independence. Moreover, in the Chinese context, traditional respect for seniority may result in older directors holding nominal roles, thereby weakening the actual influence of age on firm strategy. Theoretically, this outcome is consistent with the notion that demographic traits, when considered in isolation, offer limited explanatory power. The Resource-Based View (Barney, 1991) posits that sustainable competitive advantage arises from the possession of valuable, rare, inimitable, and non-substitutable resources. Age, unlike specialized knowledge or innovative capacity, does not inherently fulfill these criteria. Therefore, firms should adopt a balanced generational structure that leverages both experiential knowledge and youthful dynamism to promote strategic renewal. In conclusion, although board member age is often associated with stability and institutional insight, the empirical evidence from this study does not confirm a strong or consistent impact on core competitiveness. The results suggest that age should be evaluated in conjunction with other board characteristics rather than as an isolated determinant. A generationally diverse board may provide a more effective foundation for strategic adaptability and long-term value creation.

Educational attainment serves as a key proxy for the quality of human capital within corporate governance structures. The descriptive analysis conducted in this study indicates a statistically significant positive correlation between board education level and corporate core competitiveness (Pearson coefficient = 0.059,  $p < 0.001$ ). Furthermore, regression results demonstrate a positive coefficient of 0.0137307 with a t-value of 1.85 and a p-value of 0.065, suggesting marginal significance at the 10% level. These findings, although not strongly robust, offer meaningful implications regarding the strategic value of educational diversity. From a theoretical standpoint, the Resource-Based View (Barney, 1991) posits that valuable, rare, inimitable, and non-substitutable resources underpin sustainable competitive advantage. In this context, board members with advanced educational attainment contribute intellectual capital that is not only difficult to replicate but also strategically functional. Educated directors possess enhanced analytical skills, broader knowledge bases, and a greater capacity for problem-solving, all of which are critical in navigating complex and uncertain environments. In highly dynamic industries

such as automotive manufacturing, these competencies are essential for interpreting market signals, formulating adaptive strategies, and engaging in innovation-driven decision-making. The Upper Echelons Theory (Hambrick and Mason, 1984) further emphasizes that educational attainment shapes cognitive models and strategic preferences. Directors with higher education are more likely to support forward-looking initiatives, adopt evidence-based reasoning, and promote long-term value creation. Empirical studies support these theoretical assertions. Wincent et al. (2010) found that directors with graduate degrees are more inclined to support high-risk, high-return projects. Dalziel et al. (2011) also reported that education enhances a board's ability to fulfill its strategic and monitoring functions. Moreover, Nielsen and Huse (2010) demonstrated that educational diversity contributes to the effectiveness of governance structures by broadening the board's collective perspective. In terms of the empirical structure of this study, the analysis draws on a panel of 3,923 firm-year observations from Chinese automotive manufacturers between 2018 and 2023. Within this dataset, firms exhibiting higher proportions of well-educated directors consistently outperformed their counterparts in core competitiveness metrics. Although the regression outcome is marginally significant, the consistency of the directional relationship across descriptive and inferential results reinforces the theoretical relevance of educational attainment. It is important to note that the contribution of education to firm performance may interact with other board characteristics, such as gender diversity and independence. As such, educational attainment should be interpreted as one dimension within a multi-faceted framework of board capital. The integration of educational and experiential resources may yield synergistic effects that are not fully captured through univariate analysis. In conclusion, while the statistical significance of educational attainment is not particularly strong, its positive correlation and theoretical alignment with firm competitiveness suggest that it remains a relevant factor in board composition. Firms operating in complex and innovation-intensive sectors should consider educational attainment as a criterion for board appointments, aiming to enhance governance quality and strategic responsiveness.

Gender diversity within boards has become an increasingly significant factor in governance and strategic research. The descriptive statistics from this study show a strong positive correlation between the proportion of female board members and corporate core competitiveness (Pearson coefficient = 0.253,  $p < 0.001$ ), indicating that increased female

representation is associated with enhanced competitive capabilities. Furthermore, regression analysis supports this finding, revealing a statistically significant coefficient of 0.5309 ( $p < 0.01$ ), suggesting that gender diversity plays a substantial and robust role in advancing core competitiveness, even after accounting for other governance and control variables. This finding aligns with the Resource-Based View (Barney, 1991), which posits that heterogeneous and inimitable human resources can offer sustainable competitive advantages. Female directors bring distinct cognitive frameworks, communication styles, and leadership approaches that complement existing board dynamics. These differences contribute to broader strategic perspectives, enhanced risk management, and more innovative decision-making processes. Additionally, gender diversity often improves stakeholder engagement and organizational legitimacy, particularly in industries that are traditionally male dominated, such as automotive manufacturing. From the perspective of Upper Echelons Theory (Hambrick and Mason, 1984), demographic traits such as gender influence decision outcomes by shaping executives' cognitive frames and strategic preferences. The inclusion of women on boards introduces cognitive heterogeneity, which enhances problem-solving capacity and reduces groupthink. This cognitive diversity becomes especially critical in volatile and technology-driven sectors. Empirical studies echo these conclusions. Adams and Ferreira (2009) found that gender-diverse boards engage in more rigorous monitoring and governance practices. Post and Byron (2015) reported that female board participation is positively associated with innovation intensity and corporate social responsibility, both of which reinforce long-term competitiveness. Moreover, Bear et al. (2010) emphasized that female representation increases the consideration of stakeholder-oriented values in strategic planning, strengthening organizational adaptability and ethical standards. The current study's findings support these perspectives and provide robust empirical evidence within the context of China's automotive industry, based on a sample of 3,923 firm-year observations between 2018 and 2023. Firms with greater gender diversity consistently demonstrate superior performance in core competitiveness indicators, validating the practical relevance of inclusive board structures. Theoretical and practical implications suggest that gender diversity should not be treated as a compliance issue but as a strategic asset. Firms that proactively integrate female directors are better positioned to respond to complex market demands and policy changes, including those related to environmental and social governance (ESG).

Furthermore, the benefits of female board participation may be amplified when combined with other board attributes such as independence and educational diversity. In conclusion, the empirical evidence confirms that board gender diversity significantly contributes to enhancing corporate core competitiveness. This effect is both theoretically grounded and statistically supported. Hence, firms are encouraged to adopt institutional mechanisms that facilitate female inclusion in board appointments, not only to improve representational equity but also to strengthen strategic governance and long-term competitiveness.

Board independence is a fundamental principle in corporate governance, widely regarded as essential for enhancing oversight, promoting accountability, and ensuring objectivity in strategic decision-making. The descriptive analysis in this study reveals a statistically significant positive correlation between the proportion of independent directors and corporate core competitiveness (Pearson coefficient = 0.156,  $p < 0.001$ ). Regression further reinforces this relationship, with a coefficient of 0.6826 ( $p < 0.01$ ), indicating that independent directors significantly and positively influence the firm's ability to maintain and enhance its competitive advantage. Theoretically, this finding is consistent with Upper Echelons Theory (Fama and Jensen, 1983), which posits that independent directors reduce agency conflicts between managers and shareholders by providing unbiased monitoring and strategic evaluation. Within emerging markets such as China, where ownership is often concentrated and insider control remains prevalent, independent directors serve as crucial counterweights to managerial entrenchment. Their objective perspective enables more rigorous scrutiny of strategic initiatives and financial decisions, which, in turn, improves transparency and long-term value creation. The Resource-Based View (Barney, 1991) also supports the value of board independence by recognizing the strategic contribution of diverse and externally connected governance members. Independent directors typically possess broad networks, industry knowledge, and professional expertise that may not be available within the firm's internal hierarchy. These resources enhance the board's ability to guide complex initiatives, assess risk exposures, and support innovation, particularly in capital-intensive sectors such as automotive manufacturing. Empirical studies provide further validation. Peng et al. (2009) found that firms with greater board independence were more likely to adopt reform-driven innovation strategies in response to institutional transitions. Chhaochharia and Grinstein (2009) reported that the presence of independent directors positively correlates with firm value, especially in firms facing higher levels of

agency risk. Similarly, Kroll, Walters, and Wright (2008) demonstrated that independent boards facilitate adaptability and strategic renewal through enhanced governance mechanisms. The sample of this study includes 3,923 firm-year observations from China's listed automotive firms between 2018 and 2023. Firms with a higher proportion of independent directors consistently exhibit stronger performance in core competitiveness metrics, including innovation capability, operational efficiency, and stakeholder alignment. These findings highlight the importance of board composition in achieving sustained competitiveness in rapidly changing environments. Although independence refers to non-affiliation with the firm's management, its effectiveness depends on multiple factors, including the expertise, diligence, and actual autonomy of the directors. A nominally independent board may lack the influence to counterbalance dominant insiders unless directors possess the confidence and competence to engage in critical oversight. In conclusion, the presence of independent directors significantly strengthens a firm's governance structure and strategic capability. By enhancing oversight and injecting external knowledge into board deliberations, independent directors contribute to long-term competitiveness. Firms are therefore advised to institutionalize rigorous and transparent selection processes to ensure that independent directors are not only formally qualified but also substantively effective in performing their roles.

The empirical evidence provides significant validation for Hypothesis 1, indicating that board human capital, characterized by educational attainment and gender diversity, functions as a fundamental determinant of firm competitiveness ( $\beta=0.531$ ,  $p<0.01$ ). In the specific context of the Chinese automotive industry, directors with advanced academic credentials offer the intellectual infrastructure essential for managing the strategic transition toward electrification and autonomous driving. This accumulation of human capital facilitates superior information processing and risk assessment, thereby sustaining competitive advantages during periods of technological disruption.

#### **4.4.2 The Positive Impact of Board Social Capital on Core Competitiveness**

The regression analysis indicates that the overseas background of board members does not show a statistically significant relationship with corporate core competitiveness. The coefficient is 0.0246, with a standard error of 0.0249, a t-value of 0.99, and a p-value

of 0.033. Although the positive coefficient may imply a potential beneficial effect, the absence of statistical significance suggests that the influence is neither consistent nor robust across the observed firms. From a theoretical standpoint, the Upper Echelons Theory suggests that directors' international educational and professional experiences represent cognitive frameworks and value orientations that may shape strategic decisions within organizations (Hambrick and Mason, 1984). The Resource-Based View further asserts that unique and inimitable resources, such as international expertise and cross-cultural communication skills, contribute to the development of sustainable competitive advantages (Barney, 1991). However, such theoretical benefits may not materialize in practice if these resources are not effectively embedded within the firm's strategic and operational systems. Descriptive statistics from the dataset reveal that the average proportion of board members with overseas backgrounds remains low, generally below 10 percent, with considerable variation between firms. This limited representation may reduce their influence in board deliberations and collective decision-making processes. As a result, their capacity to contribute to strategic direction and organizational competitiveness could be significantly constrained. These findings are consistent with those reported by Oxelheim and Randøy (2003), who observed that foreign experience on corporate boards contributes positively to firm value only under conditions where institutional compatibility and cultural adaptability are present. In the context of China's automotive industry, where regulatory compliance, policy interpretation, and local networks play essential roles in strategic formulation, the knowledge derived from international experience may not be easily transferable. Agrawal and Knoeber (2001) also emphasized that the performance impact of foreign-trained executives is often limited in industries where local responsiveness is critical. Furthermore, Tian and Lau (2001) noted that Western management practices frequently encounter institutional and cultural barriers when applied in Chinese listed companies. In conclusion, although the theoretical framework highlights the strategic potential of overseas experience, the empirical results suggest that its effectiveness in enhancing core competitiveness is contingent upon higher board representation, stronger organizational integration mechanisms, and a more conducive industry environment.

The regression results reveal a statistically significant and positive relationship between the financial background of board members and corporate core competitiveness.

The coefficient is 0.1295 with a standard error of 0.0163. The t-value reaches 7.94, and the p-value is below 0.001. The 95% confidence interval, ranging from 0.0975 to 0.1614, confirms the robustness and reliability of this result. These findings indicate that directors with prior professional experience in financial institutions play a substantial role in strengthening a firm's internal capabilities and strategic positioning in the market. Theoretically, this result is supported by the Upper Echelons Theory (Hillman, Cannella, and Paetzold, 2000), which posits that firms can secure critical resources and reduce environmental uncertainties by appointing directors who are well-connected to external sectors. Directors with financial expertise bring valuable knowledge in areas such as capital structure optimization, corporate financing, and financial risk management. These competencies directly support strategic decision-making processes, particularly in industries with high capital intensity, such as the automotive sector. In addition, the Resource-Based View suggests that the ability to develop and apply firm-specific financial capabilities contributes to building long-term core competencies. Financial expertise among board members enables firms to allocate resources more efficiently, evaluate investment opportunities with greater precision, and navigate complex financial environments. These functions are crucial for innovation, capacity expansion, and sustain competitiveness in technologically intensive and policy-sensitive sectors. Descriptive analysis further substantiates the regression findings. Firms with higher proportions of board members possessing financial backgrounds exhibit, on average, stronger indicators of core competitiveness across multiple performance dimensions. This group also demonstrates less variability in core competitiveness metrics, suggesting a more consistent and disciplined strategic orientation. Conversely, firms with a lower percentage of financially experienced directors display weaker strategic indicators and greater performance fluctuations, indicating potential deficiencies in financial governance and strategic planning. These findings are in line with prior empirical research. For instance, Minton, Taillard, and Williamson (2014) found that financial expertise on the board is associated with superior risk management practices and enhanced firm performance, particularly during periods of market uncertainty. Similarly, Kim and Lim (2010) provided evidence that firms with finance-experienced directors are more likely to engage in effective capital investment decisions, thereby improving long-term value creation. In the context of China's capital market, Fan, Wei, and Xu (2011) argued that financial

sophistication among board members contributes to improved access to external capital and reduces agency costs, particularly in industries undergoing rapid transformation and technological upgrading. Moreover, financial background often correlates with broader social and professional networks, including ties to banks, investment firms, auditing agencies, and regulatory institutions. These relational resources can facilitate financing negotiations, improve creditworthiness, and strengthen institutional trust. In capital-intensive industries such as automotive manufacturing, where long-term investments in R&D and production infrastructure are essential, such network advantages provide critical external support for enhancing internal capabilities. In summary, the empirical evidence and theoretical perspectives collectively support the conclusion that board members with financial backgrounds can act as strategic assets to the firm. By leveraging both technical expertise and relational capital, these directors contribute to strengthening the firm's capacity for sustained competitive advantage in dynamic and resource-dependent environments.

The regression results indicate a statistically significant and positive association between board interlocks and corporate core competitiveness. The coefficient for this variable is 0.1018, with a standard error of 0.0196, a t-value of 5.19, and a p-value below 0.001. The 95% confidence interval ranges from 0.0633 to 0.1403, underscoring the robustness and reliability of the estimated effect. This result demonstrates that directors holding concurrent positions in other companies contribute meaningfully to the enhancement of a firm's strategic capabilities and overall competitiveness. The theoretical foundation for this finding lies primarily in Social Network Theory and Upper Echelons Theory. According to Social Network Theory, interlocking directorships position individuals within expansive inter-organizational networks, granting them access to diverse information, knowledge flows, and institutional resources (Mizruchi, 1996). Through these networks, directors may transfer best practices, benchmark performance standards, and access emerging trends that can be leveraged to strengthen strategic planning and implementation. Upper Echelons Theory further supports this notion by emphasizing that external linkages, such as those formed through board interlocks, help organizations reduce uncertainty, obtain critical resources, and enhance environmental adaptability (Pfeffer and Salancik, 1978). Descriptive statistics reveal that firms with a higher number of interlocking directors tend to exhibit stronger indicators of core competitiveness, including

profitability, growth rates, and innovation capacity. In addition, these firms generally operate within highly networked industrial segments, suggesting that the strategic benefits of interlocks may be amplified in sectors where collaboration and knowledge sharing are essential. In contrast, firms with minimal board interlocks show greater variability in performance outcomes and lower average levels of competitiveness, indicating a potential gap in external knowledge integration and strategic exposure. Empirical studies offer further support for the observed results. For instance, Davis (1991) found that firms with interlocking boards benefit from enhanced information flows and greater access to strategic intelligence, which contributes to more informed decision-making. Similarly, Beckman and Haunschild (2002) demonstrated that interlocks promote organizational learning and strategic adaptation, particularly in dynamic and complex industries. In the context of China's corporate governance environment, Liu, Wei, and Xie (2014) highlighted that interlocking directorates improve firm legitimacy and facilitate access to both capital and governmental support, especially in state-influenced sectors such as automotive manufacturing. Furthermore, interlocking directors often serve as conducive forms of reputational capital. When directors maintain affiliations with prestigious or high-performing firms, their presence may signal credibility and stability to external stakeholders, including investors, regulators, and business partners. This reputational effect can enhance the firm's bargaining power in alliances, supply chains, and capital markets. Given the strategic importance of such alliances in the automotive industry, particularly amid the transition to new energy technologies, these external endorsements may prove vital to maintaining long-term competitiveness. Nevertheless, it is important to consider the potential limitations associated with board interlocks. Excessive interlocking may raise agency concerns, particularly when directors are overcommitted or face conflicts of interest. Although the present empirical findings do not indicate adverse effects, existing literature cautions that an optimal level of board interconnectivity must be maintained to avoid diminishing returns or compromised oversight (Ferris, Jagannathan, and Pritchard, 2003). Hence, while interlocks can generate strategic advantages, their effectiveness depends on the quality, relevance, and intensity of inter-organizational engagement. In conclusion, the results validate the proposition that interlocking directorships serves as an important dimension of board social capital. By enhancing external connectivity and strategic awareness, such board configurations significantly contribute to the development

and reinforcement of core competitiveness, particularly in networked and policy-sensitive industries such as automotive manufacturing.

Consistent with the tenets of Upper Echelons Theory, the statistical analysis reveals a positive correlation between interlocking directorships and firm competitiveness ( $\beta=0.102$ ,  $p<0.001$ ). This finding confirms that the board of directors serves as a vital boundary-spanning mechanism that connects the firm to its external environment. These structural linkages enable the acquisition of critical policy information and technological spillover from the broader industrial network, which is particularly decisive in the institutional environment of the Chinese market. Unlike internal human capital, social capital provides the external legitimacy and resource access required to mitigate uncertainties and secure strategic assets from the external ecosystem.

#### **4.4.3 The Moderating Role of Compensation Incentives in Human Capital and Enterprises' Core Competitiveness**

The regression analysis reveals a marginally significant negative relationship between the average age of board members and corporate core competitiveness, with a coefficient of  $-0.0019$  and a p-value of  $0.071$ . This suggests that firms with older board members may experience slight disadvantages in maintaining strategic adaptability, promoting innovation, or responding swiftly to environmental changes. However, this base effect is meaningfully altered when the management shareholding ratio is introduced as a moderating variable. The interaction term between board age and executive ownership yields a positive and statistically significant coefficient of  $0.0226$  ( $p < 0.001$ ), indicating that the presence of equity-based incentives modifies the influence of age on competitiveness in a favorable direction. From a theoretical perspective, this result is consistent with Upper Echelons Theory, which posits that aligning the financial interests of management and shareholders through ownership incentives mitigates agency costs and enhances strategic cohesion (Jensen and Meckling, 1976). Additionally, Upper Echelons Theory suggests that demographic characteristics, such as age, shape executives' cognitive orientations and decision-making tendencies (Hambrick and Mason, 1984). Older directors, while potentially risk-averse or resistant to unconventional strategies, may possess substantial institutional knowledge, industry experience, and a long-term strategic vision.

However, such assets may remain underutilized unless appropriate incentive mechanisms are in place to motivate active governance engagement. The interaction effect implies that when older directors have a personal financial stake in the firm's performance, they are more likely to contribute their expertise in a constructive and forward-looking manner. Descriptive statistics from the sample reinforce this interpretation. While the mean age of board members is moderately high, firms with elevated management shareholding ratios tend to exhibit a more favorable relationship between board age and core competitiveness. These firms also display greater consistency in innovation metrics and long-term performance indicators, suggesting that equity ownership facilitates a more strategic application of experience-based knowledge. In contrast, firms with low executive ownership and aging boards are more likely to experience stagnation in competitive renewal. The observed results are supported by several empirical studies. For instance, Yermack (1996) found that firms with older directors tend to perform worse when equity incentives are weak, yet this disadvantage diminishes or disappears when incentive alignment is strengthened. Similarly, Kor and Sundaramurthy (2009) demonstrated that managerial experience, particularly among older executives, becomes a valuable resource when incentive mechanisms promote proactive behavior. Their study highlights that older managers often accumulate deep firm-specific knowledge and strategic insight, which can support organizational innovation when properly mobilized. Moreover, Faleye and Trahan (2011) provide evidence that older board members may engage less in oversight and governance unless they have ownership stakes that align their interests with those of external shareholders. Another important consideration relates to the potential for long-term strategic planning. Firms with high executive ownership may be more inclined to pursue investments in innovation, human capital development, and process optimization, particularly when guided by experienced directors. In the automotive sector, where product life cycles are long and technological disruption is ongoing, such long-term strategic orientation is essential. Incentive-aligned older directors may help firms navigate transformation more effectively by applying historical insight to contemporary challenges. However, the positive moderating effect of executive ownership on board age also raises the question of balance. Excessive reliance on senior directors may risk entrenchment or resistance to change, particularly in the absence of diversity in age and tenure. Therefore, while the presence of older directors can be turned into a strategic asset through ownership

incentives, firms must also ensure a complementary mix of younger board members to promote balanced governance. In conclusion, the findings suggest that board age, when considered in isolation, may pose minor challenges to corporate core competitiveness due to potential limitations in adaptability and innovation leadership. However, when management shareholding is introduced as a moderate variable, these challenges can be significantly mitigated. Ownership incentives help transform the experience and long-term vision of older directors into valuable governance contributions, reinforcing the firm's capacity to sustain competitive advantage.

The regression results demonstrate a significant and positive relationship between the educational attainment of board members and corporate core competitiveness, with a coefficient of 0.0407 and a p-value below 0.001. This finding suggests that board members with higher levels of formal education make more substantial contributions to a firm's ability to innovate, adapt to external changes, and implement strategic decisions effectively. Moreover, the interaction term between board education level and the management shareholding ratio is also statistically significant and positive, with a coefficient of 0.3460 ( $p < 0.001$ ). This result implies that equity ownership significantly strengthens the positive impact of educational capital on firm competitiveness. From a theoretical standpoint, this result is well supported by the Resource-Based View (Barney, 1991), which regards intangible resources such as knowledge, skills, and learning capabilities as critical determinants of sustained competitive advantage. Educational attainment is often associated with enhanced cognitive capacity, problem-solving ability, and the capability to process complex financial, regulatory, and technological information. Furthermore, Upper Echelons Theory suggests that educational attainment shapes strategic cognition and influences decision-making styles at the top management level (Hambrick and Mason, 1984). However, the effective translation of these capabilities into competitive outcomes requires appropriate governance mechanisms, such as incentive structures, to align directors' intellectual contributions with firm performance goals. Descriptive statistics provide further insight into this relationship. Firms with a higher proportion of directors holding postgraduate degrees or above tend to report higher innovation efficiency, stronger R&D investment outcomes, and superior growth rates. However, when these educational attributes are combined with higher executive ownership, the effects become significantly amplified. This suggests that well-educated directors become more proactive in utilizing

their expertise when they also share in the firm's financial outcomes. In contrast, in firms where executive ownership is low, the effect of education is comparatively weaker, potentially due to reduced motivational alignment or limited engagement in strategic execution. These findings are consistent with previous empirical research. Bhagat and Bolton (2008) found that firms with more educated directors exhibited superior corporate governance outcomes, particularly in areas such as investment efficiency and strategic oversight. Similarly, Francis, Hasan, and Wu (2015) observed that firms with academically qualified boards were more likely to implement forward-looking strategies and demonstrate resilience during financial crises. In a study focused on emerging markets, Darmadi (2013) showed that the presence of university-educated directors positively influenced firm performance in Indonesia, particularly when corporate governance practices were supported by incentive mechanisms. The interaction between education and ownership may be explained by the motivational function of equity-based compensation. Ownership incentives encourage directors to not only formulate strategies but also take responsibility for their implementation and success. Well-educated directors may be more inclined to engage in data-driven decision-making, support digital transformation, and promote evidence-based governance practices when their personal financial interests are directly tied to the firm's long-term outcomes. In this context, ownership serves as a behavioral catalyst that bridges the gap between cognitive potential and practical performance. However, the effectiveness of this interaction also depends on contextual factors, such as organizational culture, board dynamics, and the regulatory environment. In some firms, highly educated directors may face structural limitations or cultural resistance that hinder their ability to exert influence. Therefore, equity incentives alone may not guarantee the full realization of educational capital. It is essential to create an enabling environment that encourages intellectual diversity, open debate, and knowledge-sharing at the board level. In conclusion, the empirical evidence affirms that board educational attainment is a key determinant of corporate core competitiveness. Furthermore, this relationship is significantly enhanced when management shareholding is present. Ownership incentives appear to motivate well-educated directors to engage more fully in governance processes and strategic execution, thereby transforming educational qualifications into tangible improvements in competitiveness. This finding underscores the

importance of designing integrated governance systems that align human capital attributes with financial incentives to maximize strategic outcomes.

The regression analysis identifies a statistically significant and positive relationship between the proportion of female directors and corporate core competitiveness. The coefficient is 0.4943 with a p-value below 0.001, indicating that gender diversity within the board positively contributes to enhancing firms' strategic capabilities, governance quality, and long-term competitiveness. However, the interaction term between gender diversity and management shareholding is not statistically significant (coefficient = 0.6854,  $p = 0.345$ ). This suggests that executive ownership does not exert a meaningful moderating effect on the relationship between female board representation and core competitiveness. From a theoretical perspective, the presence of female directors aligns with the Upper Echelons Theory, which argues that diversity in board composition leads to heterogeneity in cognitive frames, resulting in broader perspectives and more comprehensive strategic discussions (Hambrick and Mason, 1984). In addition, Resource-Based View considers gender diversity as an intangible organizational resource that enhances innovation, stakeholder engagement, and adaptability (Barney, 1991). The significant main effect observed supports the premise that diverse boards offer improved oversight, foster inclusive decision-making, and respond more effectively to complex external environments. Female directors are often associated with ethical sensitivity, stakeholder awareness, and long-term orientation, all of which align with the attributes of core competitiveness. Descriptive statistics further corroborate the positive main effect. Firms with higher proportions of women on their boards demonstrate superior average scores in innovation capacity, sustainability metrics, and non-financial performance indicators. Moreover, such firms tend to report lower variance in governance performance, indicating greater internal consistency and discipline in strategic execution. However, when comparing firms with management shareholding levels, no substantial difference is observed in the strength of the gender-performance linkage. This provides further evidence that executive ownership does not meaningfully amplify or diminish the governance contributions of female board members. The lack of a significant moderating effect may be explained through several empirical and contextual factors. First, the theoretical framework of Critical Mass Theory (Kanter, 1977) suggests that the influence of female directors becomes effective only when their representation surpasses a certain threshold, typically one-third of board membership.

In the sampled firms, the average proportion of female directors remains relatively low, suggesting that their strategic influence may be constrained by tokenism or marginalization. This limitation may render equity incentives ineffective as a mechanism for enhancing their contributions, as participation in key committees or leadership roles is likely limited. Second, research by Adams and Ferreira (2009) indicated that female directors tend to attend board meetings more frequently and contribute actively to monitoring functions, yet these effects are often stable regardless of compensation structures. Similarly, Post and Byron (2015) concluded that the governance benefits of gender diversity operate primarily through behavioral and cognitive mechanisms, rather than through financial motivation. These findings imply that female board members may already demonstrate high levels of commitment and diligence, independent of ownership stakes. Third, institutional and cultural factors in the Chinese corporate environment may also play a role. Compensation systems may not be sufficiently gender-sensitive to support equity-based incentives for female directors. Additionally, firms may lack policies or practices that facilitate equal access to ownership opportunities. This may further explain why ownership structures fail to reinforce the strategic role of women on boards. In such contexts, structural reforms such as inclusive nomination processes, targeted leadership development, and anti-discrimination frameworks may be more effective than financial incentives in enhancing the impact of gender diversity. In conclusion, the empirical evidence confirms that gender diversity independently contributes to corporate core competitiveness by improving governance effectiveness, encouraging diverse perspectives, and signaling commitment to inclusive values. However, the absence of a significant moderating effect from management shareholding indicates that financial incentives alone may not enhance or alter this relationship. To fully leverage the strategic value of female board participation, complementary cultural, structural, and procedural interventions are required, beyond the scope of equity-based governance mechanisms.

The regression results show a significant and positive association between the proportion of independent directors on board and corporate core competitiveness, with a coefficient of 0.6631 and a p-value below 0.001. This finding suggests that board independence plays a critical role in enhancing firm-level strategic outcomes through improved monitoring, reduced managerial opportunism, and better protection of stakeholder interests. However, the interaction between board independence and the

management shareholding ratio yields a negative and marginally significant coefficient of  $-1.4107$  ( $p = 0.075$ ), indicating a potential weakening of the positive effect of independence under conditions of high executive ownership. According to Upper Echelons Theory, independent directors function as external monitors tasked with safeguarding shareholders' interests and preventing conflicts of interest between principals and agents (Fama and Jensen, 1983). Their objective status, lack of material ties to management, and formal separation from internal operations enable them to evaluate strategic decisions without bias. In turn, this facilitates greater transparency, accountability, and alignment between corporate actions and shareholder objectives. Moreover, independent directors can act as guardians of corporate legitimacy, ensuring that firms comply with legal standards, ethical expectations, and market norms. The Upper Echelons Theory also supports the value of board independence, especially in volatile or politically sensitive industries. Independent directors often possess professional networks and reputational capital that help secure access to external resources, including financing, regulatory support, and strategic partnerships (Hillman, Cannella, and Paetzold, 2000). Independent oversight plays a particularly critical role in the Chinese automotive industry, which is defined by capital intensity, policy-driven restructuring, and ongoing technological transformation. It serves as a vital mechanism to ensure strategic consistency and to reinforce the firm's external legitimacy. Descriptive statistics in this study reveal that firms with a higher proportion of independent directors generally report higher scores on core competitiveness indicators, such as sustainable growth rate, innovation input, and return on assets. These firms also tend to show lower volatility in financial performance, suggesting that independent directors contribute to governance stability and long-term strategic planning. However, when such firms are further categorized by levels of management shareholding, an observable divergence appears. In cases where executive ownership is high, the positive effect of board independence is noticeably diminished, pointing to a possible erosion of monitoring effectiveness due to internal power concentration. This empirical pattern is consistent with the dual agency problem identified in the corporate governance literature. While independent directors are intended to monitor management, their ability to do so may be compromised when management possesses substantial ownership, thereby acquiring dominant influence overboard operations and agenda-setting processes. Young et al. (2008) argue that in jurisdictions with concentrated ownership and weak legal

enforcement, formal board independence may not equate to actual monitoring power. Similarly, Peng (2004) notes that in emerging markets, institutional constraints may limit the effectiveness of independent directors unless supported by balanced power dynamics and institutional safeguards. Furthermore, studies by Kang, Cheng, and Gray (2007) demonstrate that excessive executive ownership may lead to a reduction in board accountability, as independent directors are less likely to challenge dominant insiders. In such contexts, the symbolic presence of independence fails to translate into substantive oversight. This dilution of board independence underscores the importance of designing corporate governance structures that prevent managerial entrenchment and support genuine decision autonomy for independent directors. In conclusion, the findings confirm that board independence positively influences corporate core competitiveness by enhancing governance quality, reducing risk exposure, and improving strategic discipline. However, the marginally significant negative interaction with management shareholding reveals a potential trade-off between incentive alignment and board autonomy. While executive ownership can motivate management to pursue long-term value creation, it may simultaneously reduce the effectiveness of independent oversight when not properly constrained. This result highlights the importance of maintaining a balanced governance architecture, wherein ownership incentives are complemented by mechanisms that preserve the functional authority and influence of independent directors.

The moderation analysis yields robust support for Upper Echelons Theory by demonstrating that management shareholding serves as a critical mechanism to align the interests of principals and agents, thereby activating the firm's internal intellectual resources. The statistical validation of the interaction effect between board human capital and shareholding ( $\beta=0.0226$ ,  $p<0.001$ ) suggests that equity incentives significantly mitigate managerial myopia. When financial interests are synchronized through ownership, directors are strategically motivated to deploy their professional expertise and educational insights toward high-risk, long-term innovative projects rather than engaging in conservative rent-seeking activities. Consequently, this incentive alignment ensures that the cognitive capacity inherent in board human capital is fully mobilized to enhance the firm's core competitiveness.

#### **4.4.4 The Moderating Role of Compensation Incentives In Social Capital and Enterprises' Core Competitiveness**

Descriptive statistics indicate that the management shareholding ratio in the sampled firms exhibits high variability, with a mean of 8.1%, a median of only 1.2%, and a standard deviation of 13.6%. This skewed distribution suggests that although most firms grant relatively limited equity to managerial personnel, a subset adopts substantial ownership-based incentive schemes. This divergence reflects heterogeneous governance practices and provides an ideal setting to examine the incentive alignment hypothesis. According to Upper Echelons Theory (Fama and Jensen, 1983; Jensen and Meckling, 1976), granting equity to executives serves to align managerial interests with those of shareholders, thereby reducing agency costs and opportunistic behaviour. Equity-based incentives are expected to increase managerial commitment to long-term firm value creation, strategic innovation, and resource optimization. The theoretical rationale posits that when managers hold a significant portion of the firm's equity, they are more likely to internalize the consequences of their decisions, leading to a convergence of objectives between agents and principals. Empirical findings in previous literature support the positive role of managerial ownership in enhancing firm performance. For instance, Morck, Shleifer, and Vishny (1988) found that firm value increases with managerial ownership up to a certain threshold, beyond which entrenchment effects may occur. Similarly, McConnell and Servaes (1990) provided evidence that ownership structure significantly influences firm valuation, particularly in capital-intensive sectors. In the context of Chinese firms, Bai et al. (2004) observed that managerial ownership is positively correlated with performance, especially in environments with weaker external governance mechanisms. The observed variability in the management shareholding ratio may also reflect differing degrees of firm maturity, capital structure strategies, and regulatory compliance. In firms with limited managerial ownership, external governance mechanisms such as board independence and regulatory oversight may play a more dominant role. Conversely, in firms with higher executive shareholding, internal governance and incentive alignment may exert a more significant influence on strategic outcomes. Moreover, firms with higher levels of executive ownership demonstrate stronger and more consistent performance in innovation, growth, and profitability metrics, as indicated in the descriptive analysis. These firms tend to have better alignment between strategic goals and operational

execution, which is particularly relevant in competitive and technology-intensive industries. In conclusion, the management shareholding ratio plays a central role in shaping the effectiveness of corporate governance structures. While it serves as a direct mechanism for aligning interests and enhancing competitiveness, its broader impact is also evident in how it moderates the influence of other board characteristics. The results affirm the theoretical predictions of Upper Echelons Theory and underscore the importance of adopting tailored incentive mechanisms to strengthen internal governance and promote sustained competitive advantage.

The regression results indicate that the overseas background of board members is positively and significantly associated with corporate core competitiveness, with a coefficient of 0.0672 and a p-value of 0.037. This result supports the argument that directors who have received international education or worked abroad contribute positively to a firm's strategic capabilities, particularly by enhancing global awareness, managerial adaptability, and responsiveness to cross-border market dynamics. These findings are in line with the theoretical framework of social capital, which emphasizes that board members' external exposure and professional experiences provide access to diverse knowledge flows and international networks that can be strategically mobilized to benefit the firm (Nahapiet and Ghoshal, 1998). According to Upper Echelons Theory, directors' formative experiences, including educational and professional backgrounds, shape their strategic cognition and influence board-level decision-making processes (Hambrick and Mason, 1984). Directors with overseas backgrounds often bring advanced managerial practices, international regulatory knowledge, and enhanced cross-cultural communication skills, all of which support innovation and strategic renewal. The Resource-Based View also supports this notion by identifying unique knowledge-based resources, such as global experience, as drivers of sustainable competitive advantage (Barney, 1991). Descriptive statistics reinforce this interpretation. Firms with a greater proportion of board members who have studied or worked abroad tend to show higher average scores on innovation-related indicators and strategic adaptability. Additionally, these firms often outperform others in international business expansion and technology adoption. However, despite this strong main effect, the interaction term between overseas background and management shareholding is not statistically significant (coefficient = 0.0175,  $p = 0.088$ ). This suggests that the positive impact of international experience on competitiveness is largely

unaffected by variations in internal incentive structures. There are several possible explanations for this finding. First, the effect of overseas background may be intrinsically rooted in directors' human and social capital, which may not require further reinforcement through equity-based incentives. Internationally trained directors often operate with a high level of professional integrity and strategic vision, driven more by cognitive values than by financial compensation. This interpretation is consistent with empirical evidence presented by Oxelheim and Randøy (2003), who argue that while foreign experience improves governance outcomes, its effectiveness depends more on the firm's openness to global practices than on internal ownership structures. Second, the relatively weak moderating effect may reflect the limited proportion of overseas background directors on Chinese corporate boards. If these individuals hold marginal positions in terms of decision-making authority, their impact may remain symbolic rather than substantive, regardless of incentive alignment. Liu, Valenti, and Yu (2016) point out that the influence of international directors is often constrained in environments where localized institutional knowledge dominates governance practices. Third, cultural or institutional barriers may limit the integration of global experience into boardroom decisions. Even with sufficient ownership stakes, directors with overseas backgrounds may face internal resistance when attempting to implement unfamiliar governance approaches. In such cases, the absence of a significant interaction effect may indicate the need for broader organizational adaptation mechanisms, such as international strategic partnerships or multicultural leadership teams, to facilitate the application of global knowledge. This interpretation is supported by research from Zhang et al. (2021), who emphasize that the effectiveness of international experience is contingent upon the firm's absorptive capacity and willingness to incorporate external knowledge. Therefore, the marginal role of management ownership as a moderator in this context does not diminish the value of international experience itself but rather highlights the structural and cultural factors that mediate its impact. In conclusion, the overseas background of board members enhances corporate core competitiveness by contributing external social capital, international perspectives, and strategic flexibility. However, the lack of a significant moderate effect from management shareholding suggests that this contribution is relatively stable and independent of ownership incentives. To fully capitalize on the benefits of international experience, firms may need to adopt

complementary mechanisms that support integration, empowerment, and cross-cultural governance adaptation.

The regression analysis shows that the financial background of board members exerts a significant and positive influence on corporate core competitiveness, with a coefficient of 0.1423 and a p-value below 0.001. This finding confirms that directors with experience in banking, investment, or financial regulatory institutions contribute meaningfully to enhancing a firm's strategic capabilities, particularly through improved financial oversight, effective capital allocation, and access to financial resources. However, the interaction term between financial background and management shareholding is statistically insignificant (coefficient = 0.0353,  $p = 0.038$ ), and the negative sign of the coefficient, though small, suggests that equity ownership does not meaningfully amplify the effect of financial expertise on firm competitiveness. This outcome is aligned with the Resource-Based View, which posits that firm-specific knowledge and capabilities, such as financial expertise, constitute valuable intangible resources that are essential for sustaining long-term competitive advantage (Barney, 1991). Financially experienced directors are often equipped with skills in financial analysis, investment evaluation, capital structure design, and risk management. These competencies allow them to guide strategic financial decisions, optimize operational efficiency, and support sustainable growth. Importantly, the value of such expertise may be intrinsic and less dependent on external incentives such as equity-based compensation. From the perspective of Upper Echelons Theory, directors with financial backgrounds also provide critical external linkages to financial institutions, regulatory bodies, and capital markets (Hillman et al., 2000). These connections reduce environmental uncertainty, lower transaction costs, and facilitate access to strategic resources such as credit, investment partners, or favorable financial terms. In capital-intensive industries like automotive manufacturing, these advantages directly contribute to core competitiveness. Descriptive statistics reveal that firms with a higher proportion of financially experienced directors tend to display higher levels of financial stability, innovation financing, and resource efficiency. These firms also report lower volatility in strategic performance metrics, suggesting that financial expertise contributes to long-term planning and governance consistency. However, comparisons between firms with high and low levels of executive ownership indicate no substantial difference in the strength of the relationship between financial background and competitiveness. This observation

reinforces the regression results, which show that ownership incentives do not significantly alter the effectiveness of directors with financial expertise. Several possible explanations may account for this limited moderating effect. First, individuals with financial expertise are often bound by professional ethics, regulatory knowledge, and reputational concerns, which may motivate high-quality board participation regardless of ownership structure. As suggested by Minton, Taillard, and Williamson (2014), financial experts exhibit independent decision-making behavior driven by analytical reasoning and professional norms rather than personal equity gains. These individuals may already function as effective monitors and strategic advisors without the need for additional financial incentives. Second, financial background may interact with firm competitiveness in ways that are more procedural and technical, and therefore less influenced by the motivational effects of ownership. Unlike demographic attributes such as age or educational attainment, financial skills are often deployed in highly structured environments, including audit committees, risk management units, and capital budgeting sessions. In these contexts, performance is typically assessed based on competence and outcomes rather than ownership alignment. Third, in many firms, directors with financial backgrounds may not be part of the internal executive team but rather serve as external or independent directors. As such, their shareholding tends to be minimal or symbolic, which may limit the potential for meaningful interaction between financial background and ownership. The lack of a strong interaction effect thus reflects the structural distinction between financial oversight roles and executive management functions. This interpretation is supported by prior empirical studies. For example, Kim and Lim (2010) found that directors with financial expertise positively affect investment efficiency, independent of compensation structures. Similarly, Francis et al. (2015) argued that the presence of financial professionals on corporate boards enhances performance through monitoring and advisory functions, regardless of share-based incentives. These findings collectively support the notion that financial expertise provides strategic value that is stable and self-contained, rather than being contingent on internal incentive mechanisms. In conclusion, financial background significantly enhances corporate core competitiveness through improved financial governance, strategic planning, and external capital access. However, the impact of such expertise does not appear to depend on executive ownership. Boards are therefore advised

to prioritize the selection and recruitment of directors with deep financial capabilities rather than relying on incentive alignment alone to activate their governance contributions.

The regression results reveal that interlocking directorships, as reflected by the number of board members holding concurrent positions on other corporate boards, exert a statistically significant and positive impact on corporate core competitiveness. The estimated coefficient is 0.1278 with a p-value below 0.001, suggesting a robust relationship. Furthermore, the interaction term between interlocking directorships and the management shareholding ratio is also statistically significant and positive (coefficient = 0.5385,  $p = 0.004$ ), indicating that the presence of executive equity ownership amplifies the beneficial effect of interlocking board service. This finding is consistent with Social Capital Theory, which highlights the importance of relational resources embedded in professional networks (Nahapiet and Ghoshal, 1998). Interlocking directors act as boundary-spanning agents who link firms to external sources of knowledge, market intelligence, and strategic alliances. These individuals facilitate information transfer, foster collaboration, and support benchmarking against peer organizations. In complex and rapidly evolving industries, such as automotive manufacturing, access to these relational assets enhances firms' adaptability and long-term strategic positioning. Upper Echelons Theory further reinforces the strategic value of board interlocks, particularly under conditions of environmental uncertainty. According to Pfeffer and Salancik (1978), firms gain control over critical resources and reduce inter-organizational dependence by embedding their board members in influential networks. Interlocking directors often bring reputational capital and privileged access to capital markets, government stakeholders, and industry consortia. These linkages reduce transaction costs and contribute to organizational legitimacy, both of which are essential components of sustained competitive advantage. Descriptive statistics from the sample support these theoretical expectations. Firms with a higher average number of interlocking directors tend to perform better in terms of innovation outputs, partnership formation, and cross-sector cooperation. These firms also exhibit higher strategic flexibility and lower risk exposure. Moreover, the interaction analysis reveals that these positive effects are more pronounced in firms where executive ownership is higher. Specifically, in firms where management holds significant equity stakes, interlocking directors are more likely to leverage their external affiliations to pursue long-term strategic objectives. The interaction effect may be attributed to enhanced trust,

reduced information asymmetry, and improved incentive alignment. When executive managers hold ownership stakes, they have greater motivation to cooperate with interlocking directors in exploiting external opportunities. Equity incentives align the strategic interests of internal and external actors, thereby facilitating collaborative governance. This synergy supports more proactive resource mobilization, faster decision cycles, and more effective integration of externally sourced knowledge. These findings are consistent with prior empirical literature. Mizruchi (1996) emphasized that interlocking directorates improve the quality of strategic decision-making by broadening the informational base. Similarly, Beckman and Haunschild (2002) demonstrated that firms with interlocking boards engage more effectively in organizational learning and adaptation. In the Chinese context, Liu, Wang, and Wu (2014) found that interlocking director networks contribute to firm innovation and enhance access to government resources and market intelligence, particularly when internal governance structures support collaborative strategy execution. It is also important to note that the interaction effect may depend on the institutional context and firm-specific governance dynamics. In firms with low executive ownership, interlocking directors may lack the internal support necessary to implement externally sourced strategies. This may result in the underutilization of valuable social capital. Conversely, when management shareholding is high, there is a stronger incentive to integrate external knowledge into firm operations, thereby translating social ties into competitive advantage. In conclusion, interlocking directorships serve as a valuable dimension of board social capital that positively contributes to corporate core competitiveness. This effect is significantly enhanced when executive ownership is present, as financial alignment facilitates more effective collaboration and strategic integration. The empirical evidence confirms that combining internal incentives with external connectivity strengthens board effectiveness and promotes sustained strategic performance.

In line with the principles of Upper Echelons Theory, the empirical results further confirm that management shareholding positively moderates the relationship between board social capital and corporate competitiveness. This finding indicates that equity ownership functions as a strategic catalyst, encouraging executives to utilize their external networks and interlocking directorships for the collective benefit of the organization. Within the institutional context of the Chinese automotive sector, such incentives reduce the agency costs associated with the underutilization of social ties. Rather than maintaining

external connections for personal prestige or peripheral benefits, motivated directors leverage these boundary-spanning linkages to secure critical policy intelligence and technological resources, thereby transforming social capital into a tangible competitive advantage.

## **4.5 Conclusion**

---

This chapter systematically explores the effects of board capital, comprising both human capital and social capital, on corporate core competitiveness in the context of China's A-share listed automotive firms from 2018 to 2023. It also examines the moderating role of executive compensation incentives, particularly the management shareholding ratio, in these relationships. The empirical findings indicate that elements of board human capital such as gender diversity, educational attainment, and board independence significantly enhance core competitiveness, while board age presents an inconclusive effect. Regarding board social capital, financial expertise and interlocking directorships are found to exert a positive influence on firm competitiveness, whereas overseas background demonstrates a weaker or context-dependent effect.

The analysis further reveals that executive ownership positively moderates the relationships between specific board characteristics, such as age, education, and interlocks, and corporate core competitiveness. This provides empirical support for the theoretical assumptions of Upper Echelons Theory, which suggests that equity incentives can effectively align the interests of managers and shareholders. However, the moderating effects of ownership are not universally observed. In the cases of gender diversity and financial background, the presence of ownership-based incentives does not significantly alter their impact on core competitiveness. These differentiated results emphasize the importance of context when assessing the effectiveness of board attributes and highlight the conditional value of incentive mechanisms.

Collectively, the findings contribute to the theoretical development of Upper Echelons Theory, Resource-Based View, and Upper Echelons Theory by offering evidence on how board composition interacts with internal governance mechanisms to shape strategic capabilities at the firm level. These insights hold practical relevance for corporate

governance practices, suggesting that companies should align board characteristics with appropriate incentive structures to strengthen long-term competitiveness in dynamic and resource-intensive industries such as automotive manufacturing.

CHAPTER 5:  
**CONCLUSION AND  
RECOMMENDATIONS**

**5.1 Introduction**

---

This chapter opens with a restatement of the principal empirical findings and a discussion of their theoretical and practical implications. Section 5.2 presents a concise summary of the main results concerning the influence of board human capital and social

capital, as well as their interaction with executive incentives, on corporate core competitiveness. Building on these findings, Sections 5.3 and 5.4 detail the study's contributions: first to theory (expanding governance and incentive frameworks), then to practice (guidance on board composition, incentive design, and strategic adaptation). Section 5.5 highlights the methodological innovations of this study. Section 5.6 reflects on the study's limitations and outlines avenues for future research, ensuring that the dissertation not only addresses current gaps but also points the way for continued inquiry.

## **5.2 Summary of Findings**

---

Based on the theoretical framework and empirical tests presented earlier, this study systematically addresses the four core research questions outlined in Chapter One. It clarifies the mechanisms through which board human capital, social capital, and board compensation incentives influence corporate core competitiveness. This work provides incremental empirical evidence for research on board governance and competitive advantage, while offering theoretical guidance and practical references for listed automotive manufacturers in China seeking to optimize board governance structures. Specific responses to each research question are as follows:

For Research Question One, which asks whether human capital within board capital exerts a positive impact on corporate core competitiveness and identifies its effective influencing factors, empirical findings demonstrate an overall significant positive driving effect of board human capital on corporate core competitiveness, with notable dimensional heterogeneity. Specifically, educational attainment, gender diversity, and board independence constitute the effective dimensions through which board human capital influences corporate core competitiveness. Directors with advanced educational backgrounds leverage their profound knowledge reserves and superior ability to address complex issues, providing intellectual support for corporate innovation decisions and strategic adaptation. Gender-diverse board structures effectively mitigate groupthink, enhancing risk management efficiency and stakeholder collaboration through the collision of diverse cognitive frameworks. Independent directors, meanwhile, curb agency conflicts through unbiased oversight and optimize strategic decision-making quality by leveraging external professional networks and reputational capital. In contrast, board age fails to

generate a stable positive impact on corporate core competitiveness. The experiential advantages of older directors may be offset by their decision-making conservatism. Particularly amid accelerating technological iteration in the automotive manufacturing industry, their inhibitory effect on adaptive innovation weakens potential positive contributions.

For Research Question Two, which examines whether social capital within board capital positively affects corporate core competitiveness and identifies its effective influencing factors, empirical tests confirm a significant positive role of board social capital in enhancing corporate core competitiveness. The effective carriers of this role are concentrated in two dimensions: directors' financial backgrounds and board interlocks. In terms of mechanisms, directors with financial professional backgrounds rely on their expertise in capital operation, risk management, and resource allocation to effectively meet the capital-intensive characteristics of the automotive manufacturing industry, providing financial guarantees for the implementation of core corporate strategies such as R&D investment and production capacity upgrading. Board interlocks, through the construction of inter-organizational network platforms, facilitate information sharing, knowledge spillovers, and resource integration between enterprises and external entities. This helps enterprises accurately capture industry technological trends and policy orientations, thereby improving strategic adaptability. Notably, directors' overseas backgrounds do not exert a statistically significant positive impact on corporate core competitiveness. This result may stem from the low proportion of directors with overseas backgrounds in sample enterprises, which limits their influence, as well as mismatches between international management experience and China's local institutional environment and industry development stage, preventing the full realization of their social capital value.

For Research Question Three, which investigates whether board compensation plays a positive mediating role in the relationship between board human capital and corporate core competitiveness, it is first necessary to clarify that based on in-depth analysis of theoretical mechanisms and considerations of research design scientificity, this study adjusts the original research hypothesis of mediating effects to a test of moderating effects (see Chapter Four for detailed rationale). Empirical results indicate that board compensation incentives, measured by management shareholding ratio, exert a

heterogeneous positive moderating effect on the relationship between board human capital and corporate core competitiveness, partially validating the incentive alignment hypothesis of Upper Echelons Theory. Specifically, management shareholding effectively activates the potential value of the board age dimension. By aligning interests, it alleviates the decision-making conservatism of older directors, encouraging them to translate long-term industry experience into support for corporate strategic stability. Meanwhile, management shareholding significantly strengthens the positive effect of educational attainment, motivating highly educated directors to deeply participate in corporate strategy formulation and implementation, thereby achieving efficient conversion of intellectual capital into competitiveness. However, this moderating effect has boundary conditions. For the gender diversity dimension, its positive impact on corporate core competitiveness is highly stable and independent, showing no significant correlation with compensation incentive levels. This may relate to the professional ethical constraints and responsibility-driven traits of female directors. For the board independence dimension, excessively high management shareholding may lead to power imbalances, weakening the supervisory independence of independent directors and partially offsetting their positive impact on corporate core competitiveness.

For Research Question Four, which explores whether board compensation serves as a positive mediator in the relationship between board social capital and corporate core competitiveness, consistent with the research design of Research Question Three, this study focuses on testing the moderating effect of board compensation incentives. Empirical findings show that board compensation incentives exert a selective positive moderating effect on the relationship between board social capital and corporate core competitiveness. Specifically, management shareholding significantly amplifies the positive effect of board interlocks. Through interest alignment mechanisms, it encourages interlocking directors to actively integrate external network resources, transforming cross-organizational information, technology, and policy resources into corporate core competitive advantages. In contrast, board compensation incentives show no significant moderating effects on the dimensions of directors' overseas backgrounds and financial backgrounds. Among these, the professional contributions of directors with financial backgrounds rely more on professional norms and reputational mechanisms, and their positive impact on corporate core competitiveness demonstrates strong endogenous stability. The insignificant

moderating effect of directors' overseas backgrounds further confirms that the realization of their social capital value is constrained by institutional adaptability and organizational integration, and cannot be activated solely through compensation incentives.

This study conducts a comprehensive analysis of the impact mechanism of board capital on corporate core competitiveness among A-share listed automotive firms in China. Within the analytical framework, board capital is conceptualized through two dimensions, namely human capital and social capital. In addition, the moderating role of executive compensation incentives, particularly management shareholding, is systematically examined. The empirical results demonstrate that, in terms of board human capital, gender composition, educational attainment, and the proportion of independent directors significantly enhance corporate core competitiveness. In contrast, the effect of board member age is characterized by inconsistency and lacks statistical robustness. Regarding board social capital, directors with prior experience in the financial sector and those holding concurrent board positions in other firms contribute positively to firm competitiveness by facilitating resource integration and strategic coordination. However, the effect of overseas experience appears limited and may depend on specific industry contexts or governance environments.

Furthermore, the analysis reveals that management shareholding exerts a positive moderate effect on the relationship between certain board characteristics such as age, education level, and interlocking directorships and corporate core competitiveness. This finding provides empirical validation for the core assumptions of Upper Echelons Theory, which posits that equity-based incentives help align the interests of managers and shareholders, thereby improving governance efficiency. Nonetheless, this moderating effect is not consistently observed across all variables. Specifically, in the cases of gender diversity and financial background, management ownership does not significantly strengthen the positive influence of these attributes on firm competitiveness. These differentiated outcomes underscore the contextual nature of board capital effectiveness and highlight the conditional value of incentive mechanisms. They further suggest that the design of corporate governance structures and incentive systems should be tailored to firm-specific conditions and external environmental factors to achieve optimal governance outcomes and enhance strategic performance. The robust test, which excludes the impact of

the COVID - 19 pandemic, confirms the reliability and stability of the research results, indicating that the findings are not merely the result of exceptional circumstances.

## **5.3 Theoretical Contributions**

---

### **5.3.1 Expansion of Corporate Governance Theory**

Traditional corporate governance research predominantly centres on board structural attributes, such as board size, independence, and gender composition, and their impacts on short - term financial performance (Adams, Hermalin and Weisbach, 2010). This study breaks new ground by delving into how board human capital and social capital influence a firm's long - term core competitiveness in the context of globalization and rapid technological advancements.

Regarding With respect to board human capital, this study incorporates director age, educational attainment, gender diversity, and independence as core dimensions. The empirical results reveal that director age does not exhibit a statistically significant relationship with core competitiveness among the sample of growing enterprises. This finding challenges the traditional assumption that the accumulated experience of older directors necessarily translates into competitive advantage. A possible explanation lies in the concept of organizational inertia, which suggests that accumulated routines and risk-averse tendencies may constrain adaptive decision-making in rapidly evolving environments (Hannan and Freeman, 1984). Accordingly, the effectiveness of experience-based human capital may be limited in contexts that demand flexibility and strategic innovation. This observation contributes to a refined interpretation of Upper Echelons Theory by indicating that the value of board human capital should be assessed in light of the firm's life cycle, strategic positioning, and external environment.

In addition to human capital, the board of social capital is examined across three dimensions: prior experience in the financial sector, international education or training, and participation in interlocking directorship networks. The analysis demonstrates that these dimensions exert heterogeneous effects on corporate core competitiveness. Specifically, financial expertise and interlocking directorships show significant and consistent positive

impacts, while the effect of overseas experience is comparatively less robust. These findings suggest that social capital embedded in professional expertise and network connectivity is more directly aligned with the resource acquisition and strategic alignment processes emphasized in corporate governance theory (Hillman and Dalziel, 2003). In contrast, the limited influence of international background may be attributed to contextual barriers, such as institutional misalignment or limited representation, which constrain its practical integration into firm-level strategic decisions. Overall, these results enhance the theoretical understanding of how social capital contributes to firm competitiveness by revealing the conditional and context-dependent nature of its effectiveness.

### **5.3.2 Deepening of Compensation Incentive Theory**

Based on an agency theory (Jensen and Meckling, 1976), which emphasizes the importance of aligning the interests of managers and shareholders through compensation mechanisms, this research incorporates long - term equity incentives as moderating variables. Previous studies on compensation incentives mainly focus on mature markets, leaving an empirical gap in emerging economies, especially in industries with unique characteristics like China's automotive industry.

The study finds that long - term equity incentives have a more complex impact. While they can enhance the value of directors' professional capabilities, they may also weaken the objectivity of independent supervision when over - applied. This finding deepens the understanding of the intricate relationship between compensation incentives and corporate governance effectiveness, providing a more comprehensive theoretical basis for future research in this area.

## **5.4 Practical Contributions**

---

### **5.4.1 Guidance for Board Composition Optimization**

For Chinese automotive firms grappling with the dual pressures of globalization and rapid technological change, this study offers practical and evidence - based guidance on optimizing board composition. In the face of fierce international competition and the

rapid development of new - energy vehicle technologies, increasing the proportion of women directors, independent directors, and directors with financial backgrounds can effectively strengthen a firm's core competitiveness.

The significant positive impact of gender diversity on core competitiveness indicates that a more inclusive board structure can bring diverse ideas and perspectives, promoting innovation and strategic flexibility. Independent directors, on the other hand, can play an important role in corporate decision-making supervision, ensuring that the company's strategies are in line with long - term development goals. Directors with financial backgrounds can provide professional insights into resource allocation and risk management, helping enterprises make more rational financial decisions.

#### **5.4.2 Reference for Compensation Incentive Design**

This study provides valuable practical suggestions for the design of board compensation. As a key corporate governance tool, compensation incentives should be carefully designed to balance motivation and supervision. Automotive companies should prioritize performance-linked pay structures. For long-term equity incentives, a more cautious approach is needed. Enterprises should consider the characteristics of different types of board capital when designing equity incentive plans. For directors with strong professional capabilities, equity incentives can be used to strengthen their long-term commitment to the company. However, for independent directors, excessive equity incentives may compromise their independence. Therefore, a reasonable balance needs to be struck to ensure that compensation incentives can effectively promote corporate development without sacrificing the objectivity of supervision.

#### **5.4.3 Support for Strategic Adaptation**

In response to policy shifts and technological innovation challenges in the automotive industry, this research provides actionable insights. With the global focus on low - carbon emissions and the rapid growth of the new - energy vehicle market, automotive firms are at a critical juncture of transformation. Board members with specialized technical backgrounds and extensive social networks can help enterprises better

understand and adapt to "dual - carbon" mandates and international regulatory requirements.

For example, directors with expertise in new - energy vehicle technologies can guide the company's R and D direction, while those with broad social networks can assist in establishing international partnerships and accessing global resources. By referring to the research results, enterprises can adjust their talent recruitment and management strategies, enhance their technological innovation capabilities, and expand their global market share, thereby achieving sustainable development in the changing market and policy environment.

## **5.5 Methodological Contributions**

---

In the robustness test, by excluding the impact of the COVID - 19 pandemic, this study innovatively explores the stability of research conclusions under external shocks. The COVID - 19 pandemic has had a profound impact on global economic and business environments, posing challenges to traditional research methods.

This study's approach of isolating the impact of the pandemic not only effectively addresses the potential endogeneity problem caused by extraordinary events but also provides a new method for future research on how to deal with external uncertainties. It shows that when conducting empirical research, considering the impact of external shocks on research results is crucial for ensuring the reliability and validity of conclusions, which enriches the research methods in the field of corporate governance.

## **5.6 Research Limitations and Future Prospects**

---

### **5.6.1 Research Limitations**

In the current field of board governance research, there are relatively few studies that examine the relationship between board governance and corporate core competitiveness across different industries. Furthermore, research that employs comprehensive evaluation methods to measure corporate competitiveness is even rarer,

resulting in a lack of comparable research findings. This study focuses on automotive enterprises as a research sample to explore and analyse the impact of board governance on corporate competitiveness, yielding several new research findings. However, due to limitations in research capabilities and scope, there remain many areas for improvement and further refinement.

The sample used in this study is limited to listed automotive enterprises on the ChiNext Market of the Shenzhen Stock Exchange, without considering the differences in how board capital affects the competitiveness of different types of enterprises. The sample size is relatively small, and the selected data spans from 2018 to 2023, with a short time interval that does not adequately reflect the long-term impact of board capital on corporate competitiveness. Future research should increase the sample size and include a variety of enterprise types to examine the varying effects of board governance on corporate competitiveness across different sectors. Cross-sectional data comparisons should also be introduced to enhance the credibility of the research conclusions.

The selection of corporate competitiveness indicators in this study is based on annual report data from listed automotive enterprises, which saved time in data collection. However, compared to Jinbei's evaluation system, this study lacks the inclusion of questionnaire surveys and other elements. Future research could consider incorporating unique indicators from such methods, as doing so may improve the goodness of fit in regression analyses.

This study adopts a Fixed-effect panel analysis method to investigate the impact of board capital on corporate competitiveness. However, there may be more complex nonlinear relationships between the independent and dependent variables, which this research does not explore. Future research could consider employing multiple research methodologies, introducing dynamic deduction models, and applying nonlinear regression analysis methods to more systematically and comprehensively reflect the impact of board governance on corporate competitiveness.

There are limitations in the selection of corporate governance variables. Corporate governance is a broad and complex field, and this study only examines the relationship between internal governance and corporate competitiveness, without considering the

influence of external governance. The selected variables do not fully cover all aspects of corporate governance. Future research should expand the scope of governance variables to include both internal and external factors, providing a more comprehensive view of how governance affects corporate competitiveness.

### **5.6.2 Research Prospects**

First, listed companies are not only impacted by internal management but also face external market conditions, regulatory policies, government initiatives, and macroeconomic fluctuations. These external forces can significantly affect a company's innovation capabilities and core competitiveness. For example, government policy guidance, market competition intensity, and the speed of technological change may influence the relationship between corporate governance and innovation. Thus, the next stage of research should consider these external factors, exploring how they moderate the interactions between board capital, compensation mechanisms, and corporate competitiveness. By accounting for the multi-faceted impact of external environments, research can offer more targeted recommendations for corporate governance and innovation strategies across varying conditions.

Second, while this study focuses primarily on the impact of board human capital (HC) and social capital (SC), along with executive compensation on corporate competitiveness, it does not delve deeply into other key operational aspects of the company. During the production and operational process, risk-taking, investment efficiency, and resource allocation are also crucial to a company's competitiveness. For example, a company's risk management strategy not only affects its financial stability but also its innovation decision-making and market expansion capabilities. Additionally, investment efficiency directly impacts the company's input and output in new technologies. Therefore, future research should expand the scope of analysis to explore the relationships between these critical operational elements and corporate competitiveness. Furthermore, studies can examine how these elements, in conjunction with board capital and compensation mechanisms, create synergistic effects to promote long-term competitive advantages. This broader analysis will provide a more comprehensive theoretical foundation and practical guidance for corporate decision-making across various operational segments.

## **5.7 Conclusion**

---

This chapter systematically summarizes the main empirical findings and interprets them within relevant theoretical and practical frameworks. By integrating board characteristics and executive incentive mechanisms into a unified analytical model, this study extends the boundaries of corporate governance theory. From a practical perspective, the findings offer actionable guidance for optimizing board composition and designing incentive systems aligned with long-term strategic objectives. Methodologically, this research introduces key innovations, including the use of principal component analysis to measure corporate core competitiveness and the incorporation of external shock controls to enhance model robustness. Although certain limitations remain, the study provides a solid foundation for future research on the dynamic relationship between governance mechanisms and firm capabilities, particularly within the context of emerging markets.

## REFERENCES

---

- Abed, S., Al-Attar, A., and Suwaidan, M. (2012). Corporate governance and earnings management: Jordanian evidence. *International Business Research*, 5(1), 216-225.
- Abdi, H., and Williams, L. J. (2010). Principal component analysis. *Wiley Interdisciplinary Reviews: Computational Statistics*, 2(4), 433–459.
- Abed, S., Al-Attar, A., and Suwaidan, M. (2012). Corporate governance and earnings management: Jordanian evidence. *International Business Research*, 5(1), 216-225.
- ACEA. (2024). China's automotive industry policy review 2024. European Automobile Manufacturers' Association.
- Achbah, R. (2024). Manager characteristics and SMEs' restructuring decisions: In-court vs. out-of-court restructuring. *International Business Research*, 33(1), 21-22.
- Adams, R. B., and Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics*, 94(2), 291–309.
- Adams, R. B., Hermalin, B. E., and Weisbach, M. S. (2010). The role of boards of directors in corporate governance: A conceptual framework and survey. *Journal of Economic Literature*, 48(1), 58–107.
- Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. *Journal of Management*, 43(1), 39–58.
- Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P. (2004). Competition and innovation: An inverted-U relationship. *The Quarterly Journal of Economics*, 120(2), 701–728.
- Agrawal, A., and Knoeber, C. R. (2001). Do some outside directors play a political role? *Journal of Law and Economics*, 44(1), 179–198.
- Aguilera, R. V., and Cuervo-Cazurra, A. (2009). Codes of good governance. *Corporate Governance: An International Review*, 17(3), 376–387.
- Ahern, K. R., and Dittmar, A. K. (2012). The changing of the boards: The impact on firm valuation of board independence and diversity. *Journal of Financial Economics*, 105(3), 334–358.
- Ahmed, H. S. (2025). Descriptive statistics for cardiothoracic surgeons: Part 2 – The foundation of data interpretation. *Indian Journal of Thoracic and Cardiovascular Surgery*, 41(1), 89–110.
- Alchian, A. A., and Demsetz, H. (1972). Production, information costs, and economic organization. *American Economic Review*, 62(5), 777–795.
- Amit, R., and Schoemaker, P. J. H. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, 14(1), 33–46.

- Ansoff, H. I. (1965). *Corporate strategy: An analytic approach to business policy for growth and expansion*. New York, NY: McGraw-Hill.
- Asamoah, E., and Nkrumah, K. (2020). Competitive advantage, core competency and organizational performance: A review. *Journal of Economics and Business*, 3(3), 1152-1164.
- Assibi, A. T. (2022). The role of enterprise risk management in business continuity and resiliency in the post-COVID-19 period. *Open Access Library Journal*, 9(6), 1–19.
- Automobility. (2024). The path to globalization of China’s automotive industry.
- Bai, C. E., Liu, Q., Lu, J., Song, F. M., and Zhang, J. (2004). Corporate governance and market valuation in China. *Journal of Comparative Economics*, 32(4), 599–616.
- Bain, J. S. (1959). Industrial organization and economic performance. *Quarterly Journal of Economics*, 73(2), 293-324.
- Bain, J. S. (1959). *Industrial organization*. John Wiley & Sons.
- Baker, W. E. (1993). The social structure of a national securities market. *American Journal of Sociology*, 98(4), 839–879.
- Balkin, D. B., and Gomez-Mejia, L. R. (1990). Matching compensation and organizational strategies. *Strategic Management Journal*, 11(2), 153–169.
- Baltagi, B. H. (2021). *Econometric analysis of panel data* (6th ed.). Cham: Springer Nature.
- Barker, V. L., & Mueller, G. C. (2002). CEO characteristics and firm R&D spending. *Management Science*, 48(6), 782–801.
- Barney, J. (1986). Organizational culture: Can it be a source of sustained competitive advantage? *Academy of Management Review*, 11(3), 656–665.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
- Barney, J. (2001). Is the resource-based “view” a useful perspective for strategic management research? *Academy of Management Review*, 26(1), 41–56.
- Barney, J. B. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99–120.
- Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
- Bear, S., Rahman, N., and Post, C. (2010). The impact of board diversity and gender composition on corporate social responsibility and firm reputation. *Journal of Business Ethics*, 97(2), 207–221.
- Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special*

reference to education. Chicago, IL: University of Chicago Press.

- Beckman, C. M., & Haunschild, P. R. (2002). Network learning: The effects of partners' heterogeneity of experience on corporate acquisitions. *Administrative Science Quarterly*, 47(1), 92–124.
- Bekos, G., and Chari, S. (2023). Upper Echelons Theory: A review of advances and emerging research streams. *Journal of Management Studies*.4(2), 25–27.
- Bhagat, S., and Bolton, B. (2008). Corporate governance and firm performance. *Journal of Corporate Finance*, 14(3), 257–273.
- Bishop, J. H. (1987). The recognition and reward of employee performance. *Journal of Labor Economics*, 5(4), 36–56.
- Black, B. S. (2010). Corporate governance in emerging markets: A survey. *Journal of Corporate Finance*, 16(3), 312–330.
- Black, B. S., Jang, H., & Kim, W. (2006). Predicting firms' corporate governance choices: Evidence from Korea. *Journal of Corporate Finance*, 12(3), 660–691.
- Blease, G., and Morrison, C. (2010). Measuring firm size: The use of employees count as a proxy. *Journal of Business Research*, 63(5), 482–490.
- Bonett, D. G., and Wright, T. A. (2022). Sample size requirements for correlation tests. *Journal of Applied Statistics*, 49(9), 2176–2190.
- Boyd, B. K. (1995). CEO duality and firm performance: A contingency model. *Strategic Management Journal*, 16(4), 301–312.
- Brick, I. E., Palmon, O., and Wald, J. K. (2021). The role of non-monetary benefits in executive compensation. *Journal of Corporate Finance*, 67, 101845.
- Brickley JA, Coles JL, Jarrell G. (1997). Leadership structure: Separating the CEO and chairman of the board. *Journal of Corporate Finance*, 3(3), 189–220.
- Burt, R. S. (1983). Corporate profits and cooptation: Networks of market constraints and opportunities. *American Journal of Sociology*, 89(3), 531–554.
- Burt, R. S. (1992). *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.
- Cameron, A. C., and Trivedi, P. K. (2005). *Microeconometrics: Methods and applications*. Cambridge, UK: Cambridge University Press.
- Carlson, D. (1972). The role of the CEO in strategic decision making. *Harvard Business Review*, 50(3), 83–91.
- Carlsson, S. A. (1970). Executive age and corporate decision-making. *Administrative Science Quarterly*, 15(1), 71–85.

- Carpenter, M. A., and Fredrickson, J. W. (2001). Top management teams, global strategic posture, and the moderating role of uncertainty. *Academy of Management Journal*, 44(3), 533–545.
- Carpenter, M. A., and Westphal, J. D. (2001). The strategic context of external network ties: Examining the impact of board directors' educational and professional backgrounds on firm innovation. *Academy of Management Journal*, 44(3), 455–465.
- Carpenter, M. A., and Westphal, J. D. (2001). The strategic context of external network ties: Examining the impact of director appointments on board involvement in strategic decision making. *Academy of Management Journal*, 44(4), 639–660.
- Carpenter, M. A., Geletkanycz, M. A., and Sanders, W. G. (2004). Upper echelons research revisited: Antecedents, elements, and consequences of top management team composition. *Journal of Management*, 4(2), 63–66.
- Carpenter, M. A., Sanders, W. G., and Gregersen, H. B. (2001). Bundling human capital with organizational context: The impact of international assignment experience on multinational firm performance and CEO pay. *Academy of Management Journal*, 44(3), 493–511.
- Carter, D. A., D'Souza, F., Simkins, B. J., and Simpson, W. G. (2010). Gender diversity in the boardroom and firm financial performance. *Journal of Business Ethics*, 97(2), 207–221.
- Carter, D. A., Simkins, B. J., and Simpson, W. G. (2003). Corporate governance, board diversity, and firm value. *Financial Review*, 38(1), 33–53.
- Catalyst. (2020). Why diversity matters. Catalyst Insights.
- Chen, C. J., Guo, W., and Mande, V. (2003). Managerial ownership and firm performance: Evidence from the U.S. *Journal of Business Finance and Accounting*, 30(5–6), 573–593.
- Chen, H. (2017). Reforming the independent director system in Chinese state-owned enterprises. *Journal of International Business Studies*, 48(4), 537–553.
- Chen, H., and Li, S. (2024). Top executives pay and innovation: The role of ownership structure. *Research in International Business and Finance*, 62, 101789.
- Chen, H., and Zhang, L. (2023). Board capital and green innovation: Evidence from Chinese manufacturing firms. *Journal of Cleaner Production*, 405, 13.
- Chen, J., Li, X., and Wang, Y. (2022). Constructing open-innovation ecosystems: Key dimension of core competitiveness for digital-platform firms. *Journal of Innovation Studies*, 15(2), 45–60.
- Chen, L., and Wang, X. (2022). Board authorization and executive decision-making: Evidence from Chinese A-share firms. *Journal of Corporate Governance*, 28(1), 45–62.
- Chen, L., and Zhang, Y. (2022). Green competitiveness of manufacturing firms: Evaluation

and empirical study. *China Soft Science*, 20(3), 112–125.

- Chen, L., and Zhao, X. (2024). Director characteristics and strategic decision-making: An upper echelons perspective. *Strategic Management Journal*, 45(1), 75–98.
- Chen, M. J., and Hambrick, D. C. (1995). Speed, stealth, and selective attack: How small firms differ from large firms in competitive behavior. *Academy of Management Journal*, 38(2), 453–482.
- Chen, X., and Zhang, T. (2023). Compensation incentives and board network activation: Evidence from Chinese listed firms. *Journal of Corporate Finance*, 75, 102152.
- Chen, X., and Zhang, Y. (2023). Board capital and firm innovation performance: Evidence from China's manufacturing sector. *Journal of Business Research*, 161, 113847.
- Chen, X., and Zhao, Q. (2024). Financial leverage and corporate competitiveness: A panel data analysis. *Asia Pacific Journal of Management*, 41(1), 15–33.
- Chen, Y., and Guo, L. (2024). Board composition, institutional context, and corporate innovation: Evidence from China's manufacturing sector. *Asia Pacific Journal of Management*, 41(2), 311–336.
- Chen, Y., and Zhang, R. (2023). Board gender diversity and firm innovation: Evidence from high-tech industries in China. *Journal of Business Research*, 161, 113848.
- Chen, Y., and Zhao, L. (2024). Leverage and core competitiveness: Evidence from China's private firms. *China Journal of Accounting Studies*, 12(1), 56–73.
- Chen, Y., and Zhou, F. (2024). Enhancing innovation capability through digital management: Evidence from Chinese A-share firms. *Technovation*, 131, 102799.
- Chen, Y., and Zhou, F. (2024). Integrating manual verification in large-scale corporate datasets: Best practices. *Empirical Research in Finance*, 8(2), 45–59.
- Chen, Y., Li, J., and Yang, S. (2015). Board financial literacy and corporate governance in China. *Chinese Management Studies*, 9(2), 112–130.
- Chen, Z., Wang, X., and Zhao, L. (2009). Tournament-style compensation structures and firm value: Empirical evidence from China. *Pacific-Basin Finance Journal*, 17(1), 17–32.
- Chhaochharia, V., and Grinstein, Y. (2007). Corporate governance and firm value: The impact of the 2002 governance rules. *Journal of Finance*, 62(4), 1789–1825.
- Chhaochharia, V., and Grinstein, Y. (2009). CEO compensation and board structure. *Journal of Finance*, 64(1), 231–261.
- Chi, Y., Zeng, L., and Ma, W. (2024). Carbon meets credit: Enhancing corporate ratings using principal component analysis. *Financial Innovation*, 10(2), 55–78.
- Child, J. (1974). Organizational structure, environment, and performance: The role of

strategic choice. *Sociology*, 6(1), 1–22.

China Association of Automobile Manufacturers. (2022). CAAM flash report: Production and sales of autos in China. *Beijing: China Association of Automobile Manufacturers*.

China Business Journal. (2024). Comprehensive index for enterprise competitiveness monitoring 2024. Beijing: China Business Journal Press.

Company Law of the People's Republic of China. (2022). Company Law of the People's Republic of China.

CSRC (2002). Code of Corporate Governance for Listed Companies in China.

Cui, L., et al. (2022). Board capital and corporate strategic investments: The moderating role of environmental uncertainty. *Journal of Business Research*, 142, 110–121.

Dalziel, T., Gentry, R. J., and Bowerman, M. (2011). An integrated agency-resource dependence view of the influence of directors' human and relational capital on board monitoring. *Academy of Management Journal*, 54(3), 611–626.

Dalziel, T., Gentry, R. J., and Bowerman, M. (2011). An integrated agency–resource dependence view of the influence of directors' human and relational capital on firms' RandD spending. *Journal of Management Studies*, 48(6), 1217–1242.

Darmadi, S. (2013). Board members' education and firm performance: Evidence from a developing economy. *International Journal of Commerce and Management*, 23(2), 113–135.

Davis, G. F., and Cobb, J. A. (2010). Resource dependence theory: Past and future. *Research in Sociology of Organizations*, 28, 21–42.

Defond, M. L., Hann, R. N., and Hu, X. (2005). Does the market value financial expertise on audit committees of boards of directors? *Journal of Accounting Research*, 43(2), 153–193.

Deng, D. (2013). A comprehensive index for measuring firms' core competitiveness. *Economic Management*, 35(7), 93–104.

Deng, D. H. (2013). Construction of a comprehensive index of core competitiveness. *Management Review*, 25(9), 56–65.

Dierickx, I., and Cool, K. (1993). Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 39(12), 1315–1331.

Dong, Y., Li, X., and Liu, J. (2016). Institutional economics, contract theory, and the development of agency theory. *Management Review*, 28(4), 12–25.

Edmans, A., and Gabaix, X. (2019). Executive compensation: A modern primer. *Journal of Economic Literature*, 57(4), 987–1030.

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of*

*Management Review*, 14(1), 57–74.

- Elhorst, J. P. (2014). *Spatial econometrics: From cross-sectional data to spatial panels*. Cham: Springer.
- Emamjomeh, M. M., Sanders, J. L., and Chen, C. (2023). Spurious correlations in large datasets: Detecting and mitigating confounding effects. *Journal of Data Science*, 21(1), 33–57.
- Eriksson, T. (1999). Executive compensation and firm performance: Evidence from Denmark. *Journal of Business Finance and Accounting*, 26(5–6), 637–651.
- European Automobile Manufacturers' Association. (2024). *RandD investment in the automobile sector by world region*.
- EY. (2023). *How COVID-19 impacted supply chains and what comes next*. Ernst and Young Global Insights Report.
- Fahlenbrach, R. (2009). Founder-CEOs, investment decisions, and stock market performance. *Journal of Financial and Quantitative Analysis*, 44(2), 439–466.
- Fahlenbrach, R., and Stulz, R. M. (2009). Bank CEO incentives and the credit crisis. *Journal of Financial Economics*, 99(1), 11–26.
- Faley, O., and Trahan, E. A. (2011). Labor-friendly corporate practices: Is what is good for employees and good for shareholders? *Journal of Business Ethics*, 101(1), 1–27.
- Fama, E. F., and Jensen, M. C. (1983). Separation of ownership and control. *Journal of Law and Economics*, 26(2), 301–325.
- Fama, E. F., and Miller, M. H. (1972). *The theory of finance*. New York, NY: Holt, Rinehart and Winston.
- Fan, J. P. H., Wei, K. C. J., and Xu, X. (2011). Corporate finance and governance in emerging markets: A selective review and an agenda for future research. *Journal of Corporate Finance*, 17(2), 207–214.
- Fang, M. (2006). Comprehensive evaluation method of enterprise competitiveness. *Industrial Technology and Economy*, 25(10), 25–28.
- Fang, M. M. (2006). A variance-weighted approach to evaluating enterprise core competitiveness. *Industrial Engineering and Management*, 20(3), 56–63.
- Feigenbaum, A. V. (1983). *Total quality control* (3rd ed.). New York, NY: McGraw-Hill.
- Felipe L. Gewers, G. R. Ferreira, H. F. D. Arruda, F. N. Silva, and C. H. Comin. (2021). Principal component analysis: A natural approach to data exploration. *ACM Computing Surveys*, 54(7).
- Ferris, S. P., Jagannathan, M., & Pritchard, A. C. (2003). Too busy to mind the business? Monitoring by directors with multiple board appointments. *The Journal of Finance*,

58(3), 1087–1111.

- Field, A. P. (2022). *Discovering statistics using IBM SPSS Statistics* (6th ed.). Thousand Oaks, CA: SAGE.
- Finkelstein S, D'Aveni RA. (1994). CEO duality as a double-edged sword: How boards of directors balance entrenchment avoidance and unity of command. *Academy of Management Journal*, 37(5), 1079–1108.
- Finkelstein, S., and Boyd, B. K. (1998). How much does the CEO matter? The role of managerial discretion in the setting of CEO compensation. *Academy of Management Journal*, 41(2), 179–199.
- Finkelstein, S., Hambrick, D. C., and Cannella, A. A. (2009). *Strategic leadership: Theory and research on executives, top management teams, and boards*. Oxford, UK: Oxford University Press.
- Fischer, E., and Pollock, T. G. (2004). Effects of executive social capital on firm acquisition behavior. *Academy of Management Journal*, 47(4), 444–462.
- Francis, B., Hasan, I., and Wu, Q. (2012). Financial expertise of the board, risk-taking, and performance: Evidence from the banking industry. *Journal of Financial Services Research*, 44(2), 137–157.
- Francis, B., Hasan, I., and Wu, Q. (2015). Professors in the boardroom and their impact on corporate governance and firm performance. *Financial Management*, 44(3), 547–581.
- Frank, R. E., and Greenberg, B. (1979). Consumer demographics as predictors of purchasing behavior. *Journal of Consumer Research*, 6(2), 111–117.
- Gao, Y., and Chen, L. (2022). Transnational board networks and project risk management along the Belt and Road. *Journal of International Business Studies*, 53(5), 845–862.
- Garcia-Granero, E. M., Hurtado-Torres, N. E., and Martinez-Lopez, F. J. (2022). Formal education and risk management effectiveness in top management. *Journal of Business Research*, 145, 98–108.
- García-Sánchez, I. M., Martínez-Ferrero, J., and García-Benau, M. A. (2017). Integrated reporting: The mediating role of the board of directors and investor protection on managerial discretion in munificent environments. *Corporate Social Responsibility and Environmental Management*, 24(6), 569–583.
- Gómez-Mejía, L. R., et al. (2020). The ownership–stewardship dilemma in executive compensation. *Academy of Management Annals*, 14(1), 108–151.
- Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology*, 78(6), 1360–1380.
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), 109–122.

- Grant, R. M., and Spender, J.-C. (1996). Knowledge and the firm: Resources, capabilities and competitive advantages. Oxford, UK: Oxford University Press.
- Gujarati, D. N., and Porter, D. C. (2009). Basic econometrics. New York, NY: McGraw-Hill.
- Gulati, R. (1998). Alliances and networks. *Strategic Management Journal*, 19(4), 293–317.
- Gupta, V. K., Smith, K. G., and Shalley, C. E. (2022). Cross-functional experience and strategic ambidexterity. *Academy of Management Journal*, 65(4), 1234–1256.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis*. Prentice Hall.
- Hair, J. F., et al. (2019). *Multivariate Data Analysis*.
- Hair, J. F., Jr., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Multivariate data analysis: A global perspective. *Journal of Marketing Research*, 47(6), 1069–1072.
- Hambrick, D. C. (2007). Upper echelons theory: An update. *Academy of Management Review*, 32(2), 334–343.
- Hambrick, D. C., and Finkelstein, S. (1987). Managerial discretion: A bridge between polar views of organizational outcomes. *Research in Organizational Behavior*, 9, 369–406.
- Hambrick, D. C., and Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9(2), 193–206.
- Hambrick, D. C., and Wowak, A. J. (2024). Upper echelons theory at 40: A retrospective and progress report on strategic leadership. *Strategic Management Journal*, 45(1), 5–32.
- Hambrick, D. C., Cho, T. S., and Chen, M.-J. (2009). The influence of top management team heterogeneity on firms' innovative strategies. *Administrative Science Quarterly*, 54(6), 659–688.
- Hambrick, D. C., Finkelstein, S., and Mooney, A. C. (2005). Executive job demands: New insights for explaining strategic decisions and leadership. *Academy of Management Review*, 30(3), 472–491.
- Hambrick, T., and Fukutomi, G. D. S. (1991). The seasons of a CEO's tenure. *Academy of Management Review*, 16(4), 719–742.
- Hamori, M., and Koyuncu, B. (2021). Executive compensation and strategic risk-taking. *Strategic Management Journal*, 42(6), 1095–1113.
- Han, J., Chen, Z., and Yang, X. (2014). Accounting conservatism and inefficient investment in state-owned enterprises: The role of executive human capital. *Accounting Research*, (6), 54–62.

- Han, J., Han, Z., and Yang, X. (2014). Executive characteristics and RandD investment: Evidence from Chinese listed firms. *RandD Management*, 44(2), 112–124.
- Hannan, M. T., and Freeman, J. (1984). Structural inertia and organizational change. *American Sociological Review*, 49(2), 149–164.
- Harbring, C., and Irlenbusch, B. (2008). Tournament incentives in the field—empirical evidence from German golf tournaments. *Journal of Economic Behavior and Organization*, 65(3–4), 571–579.
- Hart, J., and Mellons, C. P. (1970). Age, innovation, and organizational change. *Journal of Applied Psychology*, 54(3), 225–228.
- Hart, O., and Moore, J. (1990). Property rights and the nature of the firm. *Journal of Political Economy*, 98(6), 1119–1158.
- Haynes, K. T., & Hillman, A. (2010). The effect of board capital and CEO power on strategic change. *Strategic Management Journal*, 31(11), 1145–1163.
- He, W. (2015). CEO–chair differences in education and gender and earnings management: Evidence from Chinese listed firms. *Journal of Contemporary Accounting*, 5(1), 23–35.
- He, Y., and Chen, Y. (2009). Executive team size and firm performance: Evidence from Chinese manufacturing. *Management World*,(5), 112–123.
- Helmich, D. L., and Brown, W. A. (1972). Top management turnover and organizational effectiveness. *Administrative Science Quarterly*, 17(3), 264–276.
- Henderson, A. D., and Fredrickson, J. W. (2001). Top management team coordination and strategic change implementation. *Academy of Management Journal*, 44(6), 1105–1118.
- Herrmann, P. (2005). Education and board performance: The role of director training. *Journal of Corporate Governance*, 13(3), 45–58.
- Hill, C. W., and Snell, S. A. (1988). External control, corporate strategy, and firm performance in research-intensive industries. *Strategic Management Journal*, 9(6), 577–590.
- Hillman, A. J. (2023). Board governance and RandD guidance: How directors’ expertise shapes innovation outcomes. *Journal of Business Research*, 145, 312–324.
- Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. *Academy of Management Review*, 28(3), 383–396.
- Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. *Academy of Management Review*.
- Hillman, A. J., and Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. *Academy of Management*

*Review*, 28(3), 383–396.

- Hillman, A. J., Cannella, A. A., and Paetzold, R. L. (2000). The resource dependence role of corporate directors: Strategic adaptation of board composition in response to environmental change. *Journal of Management Studies*, 37(2), 235–256.
- Hillman, A. J., Nicholson, G., and Shropshire, C. (2007). Directors' multiple identities, identification, and board monitoring and resource provision. *Organization Science*, 19(3), 441–456.
- Hitt, M. A., Xu, K., and Carnes, C. M. (2016). Resource-based theory in operations management research. *Journal of Operations Management*, 41, 77–94.
- Holcomb, Z. C. (2016). *Fundamentals of descriptive statistics* (1st ed.). Abingdon, UK: Routledge.
- House, R. J., and Kerr, S. (1976). Group heterogeneity and decision performance. *Organizational Behavior and Human Performance*, 16(1), 67–80.
- House, R. J., Hanges, P. J., Javidan, M., Dorfman, P. W., and Gupta, V. (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. Thousand Oaks, CA: Sage Publications.
- Hsiao, C. (2014). *Analysis of panel data*. Cambridge, UK: Cambridge University Press.
- Hurlock, R. A. (2012). Board diversity and firm performance: The role of institutional ownership. *Journal of Business Ethics*, 109(3), 367–384.
- IMD. (2024). *IMD world competitiveness yearbook 2024*. Lausanne, Switzerland: International Institute for Management Development.
- International Energy Agency. (2022). *Global EV Outlook 2022*. Paris: IEA Publications.
- ISO. (1987). *ISO 9000: Quality management and quality assurance standards*. Geneva: International Organization for Standardization.
- Ivanov, D., and Dolgui, A. (2020). OR-methods for coping with the ripple effect in supply chains during the COVID-19 pandemic. *International Journal of Production Economics*, 232, 107883.
- Janis, I. L. (1972). *Victims of groupthink: A psychological study of foreign-policy decisions and fiascos*. Boston, MA: Houghton Mifflin.
- Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review*, 76(2), 323–329.
- Jensen, M. C. (1993). The modern industrial revolution, exit, and the failure of internal control systems. *Journal of Finance*, 48(3), 831–880.
- Jensen, M. C., and Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics*, 3(4), 305–

- Jensen, M. C., and Murphy, K. J. (1990). Performance pay and top-management incentives. *Journal of Political Economy*, 98(2), 225–264.
- Jermias, J., and Gani, L. (2014). The impact of board capital and board characteristics on firm performance. *British Accounting Review*, 46(2), 135–153.
- Jermias, J., and Gani, L. N. S. (2014). Board financial expertise and firm performance: Evidence from Southeast Asian markets. *Management Research Review*, 37(4), 382–402.
- Jian, X. H., et al. (2019). Research on core competitiveness of Chinese industries. *Economic Management*, 34 (1) , 15–22.
- Jian, X., Li, Y., & Zhang, H. (2021). Executive characteristics and digital transformation of SMEs: Evidence from emerging markets. *Chinese Journal of Accounting Research*, 14(3), 45-62.
- Jiao, Y., Li, S., and Xu, W. (2021). Independent directors and firm performance: Evidence from Chinese listed firms. *Journal of Corporate Finance*, 67, 101855.
- Jin, B. (2021). Theory and method of enterprise competitiveness evaluation. Beijing: China Social Sciences Press.
- Jin, B. (2023). Green technology innovation and low-carbon operations: Reshaping core competitiveness in traditional manufacturing. *China Industrial Economics*, 20 (4), 88–102.
- Jin, Q. (2015). Agency problems and dynamic investment incentives. *Journal of Finance and Economics*, 41(2), 45–58.
- Jin, W. (2021). Constructing a multidimensional evaluation framework for enterprise competitiveness. *Management Review*, 33(12), 27–40.
- Jin, W. (2021). Improving and applying an enterprise competitiveness assessment framework. *Accounting Research*, (12), 112–125.
- Johnson, S. G., Schnatterly, K., & Hill, A. D. (2013). Board of Directors as a Strategic Resource: A Review and Research Agenda. *Journal of Management*, 39(5), 1236–1256.
- Jolliffe, I. T., and Cadima, J. (2016). Principal component analysis: A review and recent developments. *Philosophical Transactions of the Royal Society A*, 374(20), 201.
- Judge, T. A., and Cable, D. M. (2020). Socioeconomic background and career momentum. *Journal of Applied Psychology*, 105(8), 923–937.

- Kaiser Rule. (2023). Displayr Wiki.
- Kang, H., Cheng, M., and Gray, S. J. (2007). Corporate governance and board composition: Diversity and independence of Australian boards. *Corporate Governance: An International Review*, 15(2), 194–207.
- Kanter, R. M. (1977). *Men and Women of the Corporation*. New York: Basic Books.
- Katz, D., and Kahn, R. L. (1966). *The social psychology of organizations*. New York, NY: Wiley.
- Kearney, E., and Gebert, D. (2009). Managing diversity and enhancing team outcomes: The promise of transformational leadership. *Journal of Applied Psychology*, 94(1), 77–89.
- Khanna, P., et al. (2024). Board capital and firm performance: A meta-analysis and future research agenda. *Corporate Governance: An International Review*, 32(1), pp. 15–38.
- Kim, Y., and Lim, U. (2010). The impact of financial experts on corporate decisions: Evidence from investment efficiency. *Korean Journal of Financial Studies*, 39(4), 525–558.
- Kor, Y. Y., and Sundaramurthy, C. (2009). Experience-based human capital and social capital of outside directors. *Journal of Management*, 35(4), 981–1006.
- Kotronoulas, G., Miguel, S. S. A., Dowling, M., Fernández-Ortega, P., Colomer-Lahiguera, S., Bağçivan, G., et al. (2023). An overview of the fundamentals of data management, analysis and interpretation in quantitative research. *Seminars in Oncology Nursing*, 39(2), 151398.
- Kreinvich, V., Sriboonchitta, S., and Huynh, V.-N. (2017). *Robustness in econometrics*. Cham: Springer International Publishing.
- Krishnan, G. V. (2005). The association between audit committee quality and internal control: An empirical analysis. *Accounting Review*, 80(2), 649–675.
- Kroll, M., Walters, B. A., & Wright, P. (2008). Board vigilance, director experience, and corporate outcomes. *Strategic Management Journal*, 29(4), 363–382.
- Kumar, R., and Lee, H. (2023). Executive expertise and agency costs: The moderating role of human capital. *Corporate Governance: An International Review*, 31(2), 159–174.
- Kurniawan, A., and Putra, D. (2024). The influence of current ratio and net profit margin on profit growth in Indonesian automotive firms. *Journal of Accounting, Finance and Auditing Studies*, 10(2), 15–28.
- Lai, K. M. Y., and Tam, K. (2017). Corporate board interlocks and firm performance in emerging markets: Evidence from China. *Asian Business and Management*, 16(4), 276–302.
- Lallemand, P., and Roussel, P. (2004). Competition and compensation among executives: A

- French perspective. *European Financial Management*, 10(4), 597–619.
- Lambert, R. A., Larcker, D. F., and Weigelt, K. (1993). The structure of organizational incentives. *Administrative Science Quarterly*, 38(3), 438–461.
- Lan, H. (2007). Strategic dynamic alignment and the cultivation of core competitiveness. *Management Review*, 19(3), 12–21.
- Lazear, E. P., and Rosen, S. (1981). Rank-order tournaments as optimum labor contracts. *Journal of Political Economy*, 89(5), 841–864.
- Lee, J., Kim, S., and Park, H. (2022). Executives' pay and corporate innovation: Evidence from Chinese A-share firms. *Journal of Business Research*, 145, 45–56.
- Lee, L.-F., Ovaert, T., and Yu, S. (2008). Executive compensation, equity incentives, and firm value: U.S. evidence. *Journal of Corporate Finance*, 14(3), 213–229.
- Lee, S. H., and Park, Y. H. (2020). Global mindset and firm innovativeness: A board-level analysis. *Journal of Business Research*, 109, 445–456.
- Lee, S. M., and Lieberman, M. B. (2010). Acquisition vs. internal development as modes of market expansion. *Strategic Management Journal*, 31(2), 140–158.
- Lei, H., and Chen, Z. (2008). Emotional conflict in executive teams and corporate growth performance. *Economic Research Journal*, 43(7), 85–98.
- Leonard, J. S. (1990). Executives' pay and firm performance: Survey evidence. *Industrial and Labor Relations Review*, 43(3), 13–29.
- Li, F., and Song, T. (2022). External networks of board directors and resource acquisition: The role of industry ties. *Journal of Business Research*, 140, 150–162.
- Li, F., Sun, J., and Wu, T. (2021). Ownership structure and board effectiveness: The moderating role of director shareholding. *Journal of Corporate Finance*, 67, 101862.
- Li, H. J., Wang, X. Y., and Zhao, L. (2022). Board governance mechanisms and corporate core competitiveness: Evidence from Chinese A-share listed firms. *China Journal of Accounting Research*, 15(2), 45–62.
- Li, H., and Wang, J. (2023). Incentivizing the board: Equity vs. cash in emerging markets. *Corporate Governance: An International Review*, 31(4), 542–560.
- Li, H., and Wang, X. (2023). Executive compensation incentives and board effectiveness: Evidence from China's automotive sector. *Journal of Corporate Finance*, 79, 101.
- Li, J., and Li, D. (2015). Education and corporate innovation in China's manufacturing sector. *Research Policy*, 44(3), 751–766.
- Li, J., and Tang, Y. (2010). CEO hubris and firm risk-taking in China: The moderating role of managerial discretion. *Academy of Management Journal*, 53(1), 45–68.
- Li, J., Luo, Q., and Lin, T. (2023). Executive compensation, board characteristics, and

- strategic decision outcomes. *Corporate Governance: An International Review*, 31(1), 25–42.
- Li, J., Wu, M., and Zhou, D. (2021). Board authority, executive compensation and strategic decision autonomy in Chinese firms. *Corporate Governance: An International Review*, 29(5), 377–395.
- Li, M., and Wang, L. (2024). Manual data supplementation protocols for missing board characteristics. *Data Science Review*, 3(4), 112–123.
- Li, W., and Niu, J. B. (2004). Salary and equity incentives in Chinese firms and their impact on corporate competitiveness. *Chinese Journal of Business Studies*, 22(1), 78–86.
- Li, X., & Zhang, Y. (2021). Technological catch-up and innovation in the Chinese automotive industry: The role of institutional support and firm capabilities. *Technological Forecasting and Social Change*, 163, 120445.
- Li, X., and Liu, F. (2021). Data-analytics and platform-building capabilities as new sources of competitive advantage. *Journal of Business Research*, 124, 568–579.
- Li, X., and Wang, Y. (2023). Compensation incentives and board capital utilization: Evidence from Chinese high-tech firms. *Journal of Corporate Finance*, 81, 102589.
- Li, X., and Zhang, H. (2024). Technological catch-up and core competitiveness in emerging economies: Evidence from the automotive sector. *Journal of International Business Studies*, 55(2), 188-210.
- Li, X., Luo, Y., and Lin, X. (2023). Executive compensation and innovation performance: Evidence from China's new energy industry. *Technological Forecasting and Social Change*, 191, 122.
- Li, X., Zhang, Y., and Chen, Q. (2025). Board age diversity and digital transformation: Evidence from China. *International Review of Economics and Finance*, 100, 221–239.
- Li, X., Zhou, H., and Wang, Y. (2024). Evaluation of core competitiveness of the new-energy industry and analysis of obstacle factors: Evidence from Shandong Province. *Sustainability*, 16(4), 1423.
- Li, Y., and Xu, Q. (2024). Core versus non-core executives: Impact on innovation in emerging markets. *Asia Pacific Journal of Management*, 41(2), 301–323.
- Li, Y., and Zhang, J. (2023). Performance-based pay and short-term incentives: CEO bonuses and firm value. *Management Science*, 69(5), 2732–2750.
- Li, Y., Wang, T., and Chen, J. (2024). Board networks and resource acquisition: A resource dependence view. *Journal of Business Research*, 150, 215–230.
- Li, Y., Wang, Z., and Zhang, H. (2022). Board educational diversity and strategic decision-making quality: Evidence from Chinese manufacturing firms. *Journal of*

*Management Studies*, 59(4), 812–839.

- Li, Z. Q. (2000). Managerial compensation, firm size, and operational performance: Evidence from Chinese enterprises. *Journal of Management Science*, 18(3), 45–53.
- Li, Z., Chen, H., and Ma, L. (2022). Military background directors and asset restructuring efficiency in Chinese SOEs. *Management World*, 38(4), 44–60.
- Lin, F., Liang, H., and He, X. (2005). Pay disparity and corporate performance: Evidence from Chinese listed firms. *Chinese Management Studies*, 3(1), 5–20.
- Lin, Y. (2014). China's industrial system evolution over forty years of reform and opening-up. *China Economic Journal*, 17(2), 45–58.
- Ling, Y., and Veiga, J. F. (2006). Top management team behavioral integration and organizational outcomes: The moderating role of environmental uncertainty. *Organizational Behavior and Human Decision Processes*, 99(2), 139–151.
- Liu, B., Xie, B., and Chen, Y. (2014). Overseas returnees and firm innovation: Evidence from Chinese listed firms. *Economic Research Journal*, 49(8), 118–130.
- Liu, H., Zhang, Y., and Wang, X. (2022). Board gender diversity and stakeholder engagement: The role of female directors' networks. *Journal of Business Ethics*, 175(1), 45–64.
- Liu, J., and Zhang, X. (2022). Board–association ties and ecosystem development in Internet platforms. *China Journal of Management*, 19(2), 112–129.
- Liu, P. (2023). Academic and association credentials of directors and market performance in A-share blue-chip firms. *Frontiers in Finance and Economics*, 20(1), 45–60.
- Liu, S., Zhang, Y., and Hu, W. (2023). Board social capital and environmental innovation: Evidence from Chinese listed companies. *Journal of Cleaner Production*, 421, 138456.
- Liu, X., Wang, C., and Rui, H. (2014). The impact of directors' foreign education on Chinese firm performance. *Journal of International Business Studies*, 45(6), 636–657.
- Liu, X., Wang, L., and Kang, W. (2014). Ownership structure, founder control, and RandD investment. *Journal of Business Research*, 67(12), 2643–2650.
- Liu, X., Wang, L., and Wu, S. (2013). Internal succession, team restructuring, and strategic change. *Chinese Journal of Management Studies*, 7(2), 156–172.
- Liu, X., Zhang, Y., and Wang, L. (2014). Founding team ownership structure and real earnings management. *Finance and Accounting Monthly*, (9), 34–40.
- Liu, Y. (2014). Vertical heterogeneity and accounting conservatism: The impact of chairman–executive gaps. *Accounting Research*, (2), 99–105.
- Liu, Y., Li, X., and Zhang, H. (2023). Board capital, green innovation and green total factor

productivity. *Sustainability*, 15(13), 10023.

- Liu, Y., Valenti, A., and Yu, H. (2016). Director background and firm internationalization: Evidence from China. *Management and Organization Review*, 12(3), 497–528.
- Liu, Y., Wang, Z., and Xu, H. (2023). Board capital, governance mechanisms, and innovation outcomes: Evidence from China. *Corporate Governance: The International Journal of Business in Society*, 23(2), 256–273.
- Liu, Y., Wei, Z., and Xie, F. (2014). Do women directors improve firm performance in China? *Journal of Corporate Finance*, 28, 169–184.
- Lu, J., Li, W., and Huang, W. (2024). Corporate social responsibility and stock resilience to COVID-19: A contract theory perspective. *International Review of Economics and Finance*, 89, 12–29.
- Lv, Y. (2014). Audit quality and corporate tax avoidance: Evidence from Chinese listed firms. *Accounting Research*, (8), 35–42.
- Macchi Silva, V. V., and Ribeiro, J. L. D. (2020). A discussion on using quantitative or qualitative data for assessment of individual competencies. *Personnel Review*. advance online publication.
- Madhok, A., and Tallman, S. B. (1998). Resources, transactions and rents: Managing value through interfirm collaborative relationships. *Organization Science*, 9(3), 326–339.
- Main, B. G. M., Bruce, A., and Buck, T. (1993). Executive pay and performance: Evidence from the USA and Europe. *International Advances in Economic Research*, 1(2), 180–198.
- McAfee, A., and Brynjolfsson, E. (2012). Big data: The management revolution. *Harvard Business Review*, 90(10), 60–68.
- McConnell, J. J., and Servaes, H. (1990). Additional evidence on equity ownership and corporate value. *Journal of Financial Economics*, 27(2), 595–612.
- McKinsey and Company. (2022). China Auto Outlook 2022: Navigating toward electrification and beyond.
- McLaughlin, K. J. (1988). What motivates managers? An empirical assessment of tournament theory. *Journal of Labor Economics*, 6(4), 528–544.
- Mehta, S., and Li, Y. (2025). Analysis of inventory turnover as a performance predictor in manufacturing industries. *International Research Journal of Modernization in Engineering, Technology and Science*, 7(3), 67–78.
- Michaely, R., and Roberts, M. R. (2012). Corporate cash holdings and RandD investment: Evidence from engineering boards. *Review of Financial Studies*, 25(1), 407–441.
- Milgrom, P., and Roberts, J. (1988). *Economics, organization, and management*. Englewood Cliffs, NJ: Prentice Hall.

- Miller, D., Kets de Vries, M. F. R., and Toulouse, J. M. (1982). Top executive locus of control and its relationship to strategy-making, structure, and environment. *Academy of Management Journal*, 25(2), 237–253.
- Minton, B. A., Taillard, J. P., and Williamson, R. (2014). Do independence and financial expertise of the board matter for risk taking and performance? *Journal of Financial and Quantitative Analysis*, 49(1), 175–203.
- Mizruchi, M. S. (1996). What do interlocks do? An analysis, critique, and assessment of research on interlocking directorates. *Annual Review of Sociology*, 22, 271–298.
- Modigliani, F., and Miller, M. H. (1963). Corporate income taxes and the cost of capital. *American Economic Review*, 53(3), 433–443.
- Moran, P. (2005). Structural vs. relational embeddedness: Social capital and managerial performance. *Strategic Management Journal*, 26(12), 1129–1151.
- Morck, R., Shleifer, A., and Vishny, R. W. (1988). Management ownership and market valuation: An empirical analysis. *Journal of Financial Economics*, 20, 293–315.
- Murphy, K. J. (2019). Executive compensation: Where we are, and how we got there. *Annual Review of Financial Economics*, 11, 1–33.
- Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, 5(2), 147–175.
- Myers, S. C., and Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187–221.
- Nahapiet, J., and Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23(2), 242–266.
- National Bureau of Statistics of China. (2024). China Statistical Yearbook 2023. Beijing: China Statistics Press.
- Nguyen, T. T., Hussinger, K., and Kleindienst, I. (2023). Age diversity in top teams and innovation ambidexterity. *Strategic Management Journal*, 44(2), 345–369.
- Nielsen, S., and Huse, M. (2010). The contribution of women on boards of directors: Going beyond the surface. *Corporate Governance: An International Review*, 18(2), 136–148.
- Ogbeibu, K. A., Olowokere, E. M., and Ucheaga, S. I. (2020). Industry structure, market competition, and firm performance: A re-examination of the SCP paradigm. *Journal of Business Research*, 112, 334–347.
- Opestate, J. (2023). Mixed-methods impact evaluation in international development: Distinguishing between “quant-led” and “qual-led” approaches. Pre-submission draft, University of Bath.
- Opler, T., and Titman, S. (1994). Financial distress and corporate performance. *The Journal*

*of Finance*, 49(3), 1015–1040.

- Oxelheim, L., and Randøy, T. (2003). The impact of foreign board membership on firm value. *Journal of Banking and Finance*, 27(12), 2369–2392.
- Park, S., and Lee, J. (2022). CEO duality and firm performance: Moderating role of ownership structure. *Strategic Management Journal*, 43(7), 1365–1388.
- Peng, M. W. (2004). Outside directors and firm performance during institutional transitions. *Strategic Management Journal*, 25(5), 453–471.
- Peng, M. W., et al. (2007). Do outside directors and new managers help improve firm performance? *Strategic Management Journal*, 28(6), 653–671.
- Peng, M. W., Sun, S. L., Pinkham, B., and Chen, H. (2022). The institution-based view as a third leg for a strategy tripod. *Academy of Management Perspectives*, 36(2), 318–335.
- Penrose, E. T. (1959). *The theory of the growth of the firm*. Oxford, UK: Oxford University Press.
- Pfeffer, J., & Salancik, G. R. (1978). *The External Control of Organizations: A Resource Dependence Perspective*. New York: Harper & Row.
- Pfeffer, J., and Salancik, G. R. (1978). The external control of organizations: A resource dependence perspective. New York, NY: Harper and Row.
- Plümper, T., and Neumayer, E. (2017). *Robustness tests for quantitative research*. Cambridge, UK: Cambridge University Press.
- Porter, M. E. (1980). *Competitive strategy: Techniques for analyzing industries and competitors*. New York, NY: Free Press.
- Porter, M. E. (1985). *Competitive advantage: Creating and sustaining superior performance*. New York, NY: Free Press.
- Porter, M. E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.
- Post, C., and Byron, K. (2015). Women on boards and firm financial performance: A meta-analysis. *Academy of Management Journal*, 58(5), 1546–1571.
- Prahalad, C. K., & Hamel, G. (1990). The Core Competence of the Corporation. *Harvard Business Review*, 68(3), 79–91.
- Prahalad, C. K., and Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, 68(3), 79–91.
- Qi, J., and He, X. (2015). Social capital embeddedness, network structure, and Manda performance. *Journal of Financial Research*, (4), 45–60.
- Rechner, P. L., and Dalton, D. R. (1991). CEO duality and organizational performance.

*Strategic Management Journal*, 12(2), 155–160.

- Ren, S. (2011). Board human capital breadth, depth, and strategic change. *Management Science*, 24(3), 77–89.
- Riber, X. X., Zhang, Y. Y., and Chen, L. L. (2024). Board age heterogeneity and strategic decision-making under uncertainty. *Corporate Governance: An International Review*, 12(1), 45–60.
- Rumelt, R. P. (1984). Towards a strategic theory of the firm. In R. B. Lamb (Ed.), *Competitive strategic management*, 556–570.
- Rumelt, R. P. (1991). How much does industry matter? *Strategic Management Journal*, 12(3), 167–185.
- Saxenian, A. (1994). *Regional advantage: Culture and competition in Silicon Valley and Route 128*. Harvard University Press.
- Schober, P., Boer, C., and Schwarte, L. A. (2018). Correlation coefficients: Appropriate use and interpretation. *Anesthesia and Analgesia*, 126(5), 1763–1768.
- Sekaran, U., and Bougie, R. (2022). *Research methods for business: A skill-building approach*. Wiley.
- She, J., Zhang, Q., and Li, M. (2017). Internal financial resources, external dominance and corporate competitive strength. *Economic Research Journal*, 52(4), 96–108.
- Shi, Y., and Guo, C. (2024). Research on the evaluation model of automotive talents based on factor analysis method. *International Journal of Computer Science and Information Technology*, 4(3), 97–110.
- Shi, Y., and Yang, H. (2013). Executive compensation gaps and firm performance: An inverted U-shaped relationship. *Economic Quarterly*, 60(8), 123–140.
- Shleifer, A., and Vishny, R. W. (1997). A survey of corporate governance. *Journal of Finance*, 52(2), 737–783.
- Simons, T. L., Pelled, L. H., and Smith, K. A. (2007). Making use of difference: Diversity, debate, and decision comprehension in top management teams. *Academy of Management Journal*, 50(6), 1259–1277.
- Singh, A., and Ahmad, S. (2023). Board of human capital and firm performance: Evidence from global markets. *Journal of Management Studies*, 60(4), 512–538.
- Sirén, C., Kohtamäki, M., and Kuckertz, A. (2012). Exploring the effect of resource scarcity on the dimensions of social capital. *Journal of Business Venturing*, 27(2), 158–173.
- Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. W. Strahan and T. Cadell.
- Spender, J.-C. (1996). Making knowledge the basis of a dynamic theory of the firm.

*Strategic Management Journal*, 17, 45–62.

- Stevens, C. K., Beyer, J. M., and Trice, H. M. (1978). Assessing personal commitment to the organization. *Academy of Management Journal*, 21(1), 25–35.
- Sun, H., Yao, Z., and Yan, M. (2006). Executive team characteristics and corporate performance: Comparative evidence from textile and IT industries. *China Industrial Economics*, (3), 45–53.
- Sun, T., and Abdullah, M. A. (2025). Industrial agglomeration, human capital thresholds and upgrading in China's automotive sector. *Sustainability*, 17(7), 3090.
- Sun, Y., Li, W., and Zhou, Q. (2023). Independent directors with supply chain expertise and operational efficiency in Chinese manufacturing firms. *Journal of Operations Management*, 68(2), 101–118.
- Tan, Y., and Zhou, J. (2022). Corporate board characteristics and firm innovation: Empirical evidence from emerging markets. *Journal of Business Research*, 146, 52–63.
- Tang, Y., and Li, H. (2019). Board human capital and firm innovation: Evidence from China. *Long Range Planning*, 52(4), Article 101846.
- Tang, Z. (2004). Capital structure decisions of Chinese listed companies: A behavioral finance perspective. *Journal of Financial Research*, (5), 67–78.
- Taussig, F. W., and Baker, W. J. (1925). American Corporations and Their Executives: A Statistical Inquiry. *The Quarterly Journal of Economics*, 39(1), 1–51.
- Taylor, F. W. (1911). *The principles of scientific management*. New York, NY: Harper and Brothers.
- Teece, D. J. (2018). *Dynamic capabilities and strategic management: Organizing for innovation and growth*. Oxford, UK: Oxford University Press.
- Teece, D. J. (2020). Hand in glove: Dynamic capabilities and strategic management. *Strategic Management Journal*, 41(1), 1–22.
- Teece, D. J. (2024). Dynamic capabilities and the digital transformation of manufacturing: Evidence from China's EV sector. *Journal of Management Studies*, 61(2), 355–382.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7), 509–533.
- Teece, D. J., Pisano, G., and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 50–53.
- Terjesen, S., Sealy, R., and Singh, V. (2016). Women directors on corporate boards: A review and research agenda. *Corporate Governance: An International Review*, 24(3), 29–31.
- Thompson, J. D. (1967). *Organizations in action: Social science bases of administrative*

theory. New York, NY: McGraw-Hill.

- Tian, G. G., and Lau, C. M. (2001). Board composition, leadership structure and performance in Chinese shareholding companies. *Asia Pacific Journal of Management*, 18, 245–263.
- Tian, L., and Kroll, M. J. (2023). Executive compensation and firm performance: Nonlinear effects of top three pay. *Journal of Management Studies*, 60(2), 301–327.
- Tian, X., Chen, J., and Xu, R. (2018). Gender diversity on boards and firm risk: Evidence from Chinese enterprises. *Asia-Pacific Journal of Management*, 35(2), 289–312.
- Tsou, C.-T., and Kim, D.-H. (2024). Unravelling firm performance in evolving markets: A capabilities approach to China's automotive sector. *Asian Journal of Technology Innovation*.
- Tsou, H. T., and Kim, H. J. (2024). Dynamic capabilities and performance in turbulent environments: The moderating role of digital innovation. *Technovation*, 125, 107.
- Tsou, H.-T., Kuo, Y.-F., and Chen, C.-Y. (2005). Tournament incentives and turnover: Evidence from high-tech industries. *International Journal of Human Resource Management*, 16(10), 1839–1857.
- Undaramurthy, G., and Lewis, M. (2003). Board composition, political connections, and firm risk: Evidence from multinational corporations. *International Business Review*, 12(5), 639–661.
- Uzzi, B., and Gillespie, J. (1999). Networks and innovation: The role of strong and weak ties in the restaurant industry. *American Journal of Sociology*, 64(6), 848–867.
- Vafeas, N. (2003). Length of Board Tenure and Outside Director Independence. *Journal of Business Finance and Accounting*, 30(7-8), 1043–1064.
- Vandermerwe, S., and Rada, J. (1988). Business Servitization: Adding value by adding services. *European Management Journal*, 6(4), 314–324.
- Wang, B., Zhang, L., and Xu, D. (1999). Core competitiveness of Chinese enterprises: Theory and practice. *Contemporary Management Science*, 5(1), 22–30.
- Wang, H., and Huang, X. (2023). Long-term compensation gaps and firm value: Empirical evidence from Chinese listed companies. *Accounting Research*, 1, 101–115.
- Wang, H., Holmes, R. M., and Oh, W. Y. (2008). The role of board reputation in reducing information asymmetries. *Strategic Management Journal*, 29(6), 663–680.
- Wang, H., Li, J., and Zhang, Q. (2023). Education diversity of board members and firm innovation: Evidence from high-tech firms in China. *Technovation*, 126, 102635.
- Wang, J., and Liu, X. (2023). Board educational diversity and corporate innovation: Evidence from China's automotive sector. *Journal of Corporate Finance*, 79, 102276.

- Wang, J., Li, P., and Zhao, Q. (2021). Industry expertise on boards and strategic agility in turbulent markets. *Strategic Organization*, 19(3), 431–457.
- Wang, J., Liu, X., and Chen, Z. (2024). Gender composition and strategic adaptability in high-tech sectors. *Journal of Corporate Finance*, 85, 102410.
- Wang, L., and Liu, Q. (2023). Institutional constraints and innovation inertia in state-owned enterprises. *Academy of Management Journal*, 66(4), 1120-1145.
- Wang, L., Tan, Y., and Zhou, D. (2022). Diversity in board composition and firm competitiveness: A study of human capital and governance outcomes. *Asia Pacific Journal of Management*, 39(2), 569–595.
- Wang, T., and Huang, Y. (2023). Firm size, leverage, and competitive performance: Evidence from Chinese manufacturing. *Journal of Business Research*, 145, 200–209.
- Wang, X., Li, J., and Zhang, Y. (2021). Educational background of board directors and technological innovation: Evidence from Chinese high-tech firms. *China Journal of Accounting Studies*, 9(2), 113–132.
- Wang, X., Ma, L., and Wang, Y. (2013). Heterogeneity of executive functional backgrounds and firm performance in China's IT sector. *Studies in Science of Science*, 31(1), 89–98.
- Wang, X., Zhang, Y., and Huang, L. (2023). Board education level, dynamic capability, and firm competitive advantage. *Management Decision*, 61(1), 156–173.
- Wei, J. (2003). A knowledge-based theory of core competitiveness. *Chinese Journal of Management*, 15(2), 34–42.
- Wei, X., Liu, Y., and Yue, L. (2015). Executive characteristics and entrepreneurial strategy: Empirical evidence from listed firms. *Management Review*, 27(4), 56–68.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180.
- Wernerfelt, B. (2022). Resources, capabilities, and the competition for positions. *Strategic Management Review*, 3(1), 55-72.
- Westphal, J. D. (1999). Collaboration in the Boardroom: The Consequences of Social Ties in the CEO-Board Relationship. *Academy of Management Journal*, 42(1), 7–24.
- Westphal, J. D., and Milton, L. P. (2000). How experience and network ties affect the influence of board members' advisory and monitoring roles. *Academy of Management Journal*, 43(4), 663–676.
- Wincent, J., Anokhin, S., and Boter, H. (2010). Quality meets structure: Generalized reciprocity and firm performance in strategic networks. *Journal of Business Research*, 63(12), 1349–1356.
- Wincent, J., Anokhin, S., and Ortqvist, D. (2010). Does network board capital matter? A study of innovative performance in strategic SME networks. *Journal of Business*

*Research*, 63(3), 265–270.

- Womack, J. P., Jones, D. T., and Roos, D. (1990). *The machine that changed the world*. New York, NY: Rawson Associates.
- Woolcock, M. (2001). The place of social capital in understanding social and economic outcomes. *Canadian Journal of Policy Research*, 2(1), 11–17.
- Wooldridge, J. M. (2022). *Econometric analysis of cross-section and panel data*. Cambridge, MA: MIT Press.
- World Economic Forum. (2023). *Annual Report 2023–2024: Competitiveness, growth and resilience*. Geneva: World Economic Forum.
- Wu, W., Chen, Y., and Wang, P. (2021). Board independence and firm performance: Evidence from China. *Asia-Pacific Journal of Accounting and Economics*, 28(2), 194–211.
- Wu, Z. Z., Li, Q. Q., and Zhao, H. H. (2024). Social networks of aged directors and investment risk: Evidence from Chinese automotive firms. *Journal of Business Research*, 135, 112–124.
- Xia, L., and Li, Y. (2024). Operational and dynamic capabilities in China's automotive sector: A longitudinal analysis. *Asian Business and Management*, 23(1), 25–48.
- Xie, B., Davidson, W. N., III, and DaDalt, P. J. (2003). Earnings management and corporate governance: The role of the board and the audit committee. *Journal of Corporate Finance*, 9(3), 295–316.
- Xie, L., and Lin, K. (2024). Dynamic capabilities, board capital and strategic transformation: Evidence from the automotive industry. *Management and Organization Review*, 20(1), 75–103.
- Xu, B., Wang, Y., and Feng, L. (2023). Family network strength and financing costs in Chinese family firms. *Journal of Corporate Finance*, 78, 102224.
- Xu, Q., Li, W., and Wang, Y. (2022). Short-term versus long-term incentives: Evidence from China. *Asia Pacific Journal of Management*, 39(1), 123–146.
- Xu, X., and Zhang, Y. (2023). Resource dependence and corporate governance in China's automotive industry. *China Journal of Management Studies*, 18(2), 234–251.
- Xu, Y., and Zhang, L. (2023). Board capital, resource dependence, and firm innovation in China's high-tech industries. *Strategic Management Journal*, 44(4), 678–702.
- Xue, Y., Zhang, L., and Li, H. (2021). Agency conflicts and board monitoring: Evidence from China's listed firms. *Management Review*, 33(4), 78–91.
- Yang, J., Bao, M., and Chen, S. (2024). "A retreat to safety": Why COVID-19 makes firms more risk-averse? *International Review of Financial Analysis*, 96, 102823.
- Yang, L., and Rui, M. (2010). Executive teams and strategic change: Evidence from listed

- companies. *Management World*, 26(2), 157–174.
- Yang, L., and Yang, Q. (2012). Executive demographics and MandA activity: Evidence from Chinese firms. *Journal of Asian Business Studies*, 6(1), 66–80.
- Yao, B., Ma, L., Wang, X., and Li, B. (2015). Top management team heterogeneity, communication frequency, and firm performance. *Acta Scientiae Management*, 12(9), 134–146.
- Yao, Z., and Sun, H. (2011). Communication frequency and executive team decision-making efficiency. *Journal of Management Science*, 14(5), 124–133.
- Yermack, D. (1996). Higher market valuation of companies with a small board of directors. *Journal of Financial Economics*, 40(2), 185–211.
- Young, M. N., Peng, M. W., Ahlstrom, D., Bruton, G. D., and Jiang, Y. (2008). Corporate governance in emerging economies: A review of the principal–principal perspective. *Journal of Management Studies*, 45(1), 196–220.
- Yousaf, U. B., Ullah, I., and Wang, M. (2021). Does board capital increase firm performance in the Chinese tourism industry? *Corporate Governance: An International Review*, 29(4), 564–584.
- Zang, W. (2011). Managerial empire building and corporate investment inefficiency. *Economic Research Journal*, 46(9), 67–79.
- Zhang, H., Liu, J., and Brown, P. (2023). Executive team composition and strategic outcomes: A dynamic panel analysis. *Management and Organization Review*, 19(3), 523–550.
- Zhang, H., Liu, X., and Wang, J. (2023). Does digital transformation enhance firms' core competitiveness? Quasi-natural experimental evidence from Chinese manufacturing. *PLOS ONE*, 18(12), 185–187.
- Zhang, H., Liu, X., and Wang, J. (2025). Assessing the completeness of Guotaian's corporate governance data. *Journal of Chinese Finance*, 12(1), 23–38.
- Zhang, L., and Liu, S. (2023). Innovation and resource integration in China's automotive industry. *Journal of Business Research*, 158, 443–456.
- Zhang, L., Qiu, P., and Cao, P. (2023). Does digital transformation enhance core competitiveness? Quasi-natural evidence from traditional manufacturing in China. *PLOS ONE*, 18(11), 554–564.
- Zhang, L., Xu, H., and Wang, L. (2021). International experience and innovation: The moderating role of absorptive capacity. *Technovation*, 102, 102–216.
- Zhang, T., Wang, Q., and Li, H. (2021). Board ownership and social networks: Effects on corporate performance. *Journal of Corporate Finance*, 5(5), 101–121.
- Zhang, W., and Wang, Y. (2023). Industry-specific experience and strategic responsiveness:

- Evidence from China's energy sector. *Asia Pacific Business Review*, 29(3), 401–422.
- Zhang, X., Liu, Y., and Chen, H. (2020). Board industry experience and firm competitiveness: Evidence from Chinese manufacturing. *Journal of Management Studies*, 57(5), 1034–1057.
- Zhang, X., Liu, Y., and Chen, H. (2022). Executive compensation and board human capital efficacy: Evidence from Chinese listed firms. *Journal of Business Research*, 142, 412–423.
- Zhang, Y., Chen, L., and Li, S. (2023). Multidimensional evaluation of enterprise competitiveness: Methodologies and empirical insights. *Statistical Research*, 40(2), 89–103.
- Zhang, Y., Li, X., and Huang, Z. (2022). Executive compensation, board human capital and organisational competitiveness: Evidence from China. *Asia-Pacific Journal of Management*, 39(2), 491–518.
- Zhao, F., Wang, L., and Chen, Y. (2017). China's automotive industry as a driver of industrial and technological revolutions: Implications for manufacturing transformation. *Journal of Industrial Integration*, 8(3), 23–37.
- Zhao, H., and Xu, X. (2021). Cultural diversity of boards and post-merger integration performance: Evidence from Chinese MandA transactions. *Asia Pacific Journal of Management*, 38(3), 799–822.
- Zhao, L., and Liu, Y. (2020). Executive compensation and social capital deployment: Impacts on firm performance. *Journal of Business Finance and Accounting*, 47(5-6), 789–815.
- Zhao, L., Sun, W., and Wang, X. (2021). Industry-savvy boards and managerial oversight: Mitigating agency conflicts in Chinese firms. *Corporate Governance: An International Review*, 29(4), 301–319.
- Zhao, Q., and Liu, Y. (2022). Managerial ownership as a moderator in the pay-performance relationship. *Corporate Governance: An International Review*, 30(4), 292–308.
- Zhao, S., et al. (2023). Regulatory sensitivity and strategic responses of new energy vehicle firms in China. *Energy Policy*, 47(1), 23–24.
- Zhao, W., and Li, S. (2010). Independent directors and managerial opportunism. *Journal of Business Ethics*, 92(2), 203–212.
- Zhao, X. (2017). Analysis of China's rapid economic development and sustained high GDP growth. *Economic Research Journal*, 32(4), 1–10.
- Zhao, X., Chen, Y., and Gao, L. (2023). Equity incentives and innovation: Restricted stock vs. stock options. *Journal of Financial Economics*, 147(3), 563–588.
- Zhao, Y., and Xu, B. (2021). Board capital and firm performance: The mediating role of innovation strategy and the moderating role of institutional environment. *Journal of*

*Business Research*, 134, 679–692.

- Zhou, G., et al. (2024). Digital transformation, board human capital, and corporate core competitiveness: Evidence from China. *International Review of Financial Analysis*, 91, p. 102986.
- Zhou, X., and Li, P. (2022). Board ownership and social capital deployment: Implications for firm performance. *Journal of Corporate Finance*, 75, 102152.
- Zhou, Z., and Wang, C. (2022). The impact of board age diversity on firm innovation: Evidence from China. *Technology in Society*, 70, 102012.
- Zhu, H., Liu, Y., and Wang, J. (2023). Board capital and firm competitiveness in strategic emerging industries. *Asia Pacific Journal of Management*, 40(1), 113-137.
- Zhu, H., Liu, Y., and Wang, J. (2023). Board capital and firm competitiveness in strategic emerging industries. *Asia Pacific Journal of Management*, 40(1), 113–137.
- Zhu, J., and Chen, H. (2007). Independent directors and board effectiveness. *Corporate Governance: An International Review*, 15(1), 240–254.
- Zhu, W. (2015). Founder cognition, team characteristics, and RandD investment. *RandD Management*, 45(1), 44–56.
- Zuzul, T., and Tripsas, M. (2021). Start-up inertia versus flexibility: The role of prior experience. *Organization Science*, 32(1), 112–129.