

Educational Heterogeneity in Executive Teams and CEO Power: Evidence from Chinese Listed Companies

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Abstract: This study examines the relationship between the educational heterogeneity of executive teams and CEO power using data from 480 Chinese A-share listed companies from 2008 to 2017. The findings reveal a significant inverted U-shaped relationship between educational heterogeneity in executive teams and CEO power.

Keywords: CEO power, Educational heterogeneity, Managerial overconfidence.

1. Introduction

With the continuous improvement of information disclosure in publicly listed companies, corporate internal data has become increasingly accessible for analysis. Investors now evaluate a company's value from diverse perspectives, beyond mere financial performance. Since the proposal of the Upper Echelons Theory by Hambrick and Mason in 1984 [1], extensive research has explored the influence of managerial characteristics on corporate governance and investment decisions. These studies generally fall into three areas: (1) the relationship between managerial background characteristics and corporate governance and performance, (2) managerial overconfidence and its effects, and (3) managerial heterogeneity and its implications.

Upper Echelons Theory emphasizes the use of demographic traits to represent psychological characteristics, providing new methodological and practical directions for research. Among these traits, CEO behavior significantly impacts corporate image and development. According to the rent-seeking hypothesis, CEOs may pursue short-term gains to meet external expectations, potentially compromising long-term corporate value [2]. This underscores the critical role of CEO characteristics in shaping investor decisions. However, the operational dynamics of a company require the collaboration of the entire executive team. This study aims to investigate the impact of executive team heterogeneity on CEO power, with a particular focus on educational diversity.

2. Literature Review

Research on the relationship between CEOs and the performance of publicly listed companies has a long history. For instance, Benston (1985) examined the correlation between CEO compensation and corporate performance [3]. Building on Benston's findings, Wang (1995) proposed that CEO compensation could serve as a tool to motivate CEOs to make decisions that benefit corporate development. Furthermore, adjusting CEO compensation was found to effectively alleviate conflicts between CEOs and company owners, thus reducing agency costs [4].

With the introduction of the Upper Echelons Theory, scholars worldwide began to focus on the abstract personal characteristics of CEOs, analyzing how these traits might influence corporate outcomes. For example, Xu Xiaoming (2007) constructed a model linking CEO tenure with

corporate performance, concluding that in highly market-oriented environments, a significant non-linear negative relationship exists between the two [5]. Similarly, Duan Haiyan (2008) found that the human capital characteristics of CEOs could affect corporate operations by influencing CEO compensation [6]. Subsequent studies have examined the impact of various CEO traits, such as educational background, overseas experience, reputation, and even arrogance, on corporate outcomes [7-10].

Although CEOs, as primary decision-makers, play a leading role in a company's management, the effective functioning of a company's daily operations often requires coordination across multiple departments. In recent years, scholars have extended their focus beyond individual CEOs to examine entire top management teams (TMTs) as a collective unit. Among these studies, the heterogeneity of TMTs has been a major topic. Research has revealed that TMT heterogeneity affects various aspects of a company, including financial risk, innovation, digital transformation, agency costs, and mergers and acquisitions [11-15].

In examining the relationship between TMT heterogeneity and corporate outcomes, CEO power is often used as a moderating variable to influence this relationship (e.g., Yao Bingshi, Hu Zemin, and Liu Bo) [16-18]. However, existing literature rarely explores the direct relationship between TMT heterogeneity and CEO power. To address this gap, this paper seeks to measure TMT characteristics and CEO power based on prior studies and aims to uncover the link between the two.

3. Sample Selection and Data

3.1. Sample and Datas

The sample comprises 480 A-share listed companies in China, observed from 2008 to 2017. Financial firms, companies under special treatment (ST/PT), and firms with significant missing data were excluded. The data were sourced from the CSMAR database, including executive characteristics, CEO power measures, and related financial indicators.

3.2. Definition of Variables

3.2.1. Dependent Variable: CEO Power

The theory of managerial power proposed by Finkelstein (1992) outlines a model of CEO power divided into four dimensions: organizational power, ownership power, expert power, and reputational power [19]. Following the study by

Zhang Cuizi et al., this paper defines these dimensions as follows [20]:

Organizational Power: Defined by whether the CEO also serves as the chairman of the board. If the CEO holds the position of chairman, the variable is assigned a value of 1; otherwise, it is 0. When the CEO serves as both chairman and CEO, they hold top authority in management while also wielding significant influence within the board of directors, reducing pressures from the board and amplifying their overall power within the organization.

Ownership Power: Defined by whether the CEO's shareholding exceeds the median shareholding in the industry. If the CEO's shareholding is above the industry median, the variable is assigned a value of 1; otherwise, it is 0. CEOs with significant shareholdings gain voting rights in shareholder meetings, enabling them to influence major decisions, personnel appointments, and even board elections.

Expert Power: Defined by whether the CEO holds a senior professional title. If the CEO possesses such a title, the variable is assigned a value of 1; otherwise, it is 0. Senior professional titles often signify substantial social capital, an important competitive advantage for the company [21]. CEOs with such titles tend to wield greater influence in the company's operations and interactions with external stakeholders.

Reputational Power: Defined by whether the CEO has an advanced degree (master's level or above). If the CEO holds such a degree, the variable is assigned a value of 1; otherwise, it is 0. Higher education credentials signify superior knowledge and abilities, fostering trust among subordinates and indirectly enhancing the CEO's authority.

The measure of CEO power in this study is the average value of the four dimensions mentioned above.

3.2.2. Independent Variable: Top Management Team (TMT) Heterogeneity

The independent variable in this study is TMT heterogeneity, which includes:

Age heterogeneity (Hage)

Professional background heterogeneity (Hpro)

Gender heterogeneity (Hsex)

Educational background heterogeneity (Hedu)

Following the method of Chen Zhongwei and Chang Ji (2009), this paper uses the Herfindahl-Hirschman Index (HHI) to measure heterogeneity, calculated as follows [22]:

$$H = 1 - \sum_{i=1}^n p_i^2$$

Where P_i represents the proportion of the i category in the TMT, and n represents the total number of categories. The H value ranges between 0 and 1, with higher values indicating greater heterogeneity within the TMT.

3.2.3. Control Variables

Referring to the study by Li Tao (2021), the following variables are included as controls:

Debt-to-asset ratio (Debt)

Growth (Growth)

Asset turnover ratio (Turn)

Ownership concentration (Own1)

Return on total assets (Roa)

Board size (Board)

Proportion of independent directors (Ib)

Firm size (Size)

Proportion of executive shareholding (Mshare)

Specific definitions of these variables are provided in Table 1.

Table 1. Definitions of variables

Variable Types	Variable Name	Variable Symbol	Variable Definition
Dependent Variable	CEO Power	Power	Power = (CEO Organizational Power + Ownership Power + Expert Power + Reputational Power) / 4
Independent Variable	Age Heterogeneity	Hage	Measured by Herfindahl-Hirschman Index: if age ≤ 20, Hage=1; if age between 20 and 30, Hage=2; if age between 30 and 40, Hage=3; if age between 40 and 50, Hage=4; if age between 50 and 60, Hage=5; else Hage=6
	Professional Background Heterogeneity	Hpro	Measured by Herfindahl-Hirschman Index: Production = 1, R&D/Design = 2, HR = 3, Finance/Accounting = 4, Law = 5, Management/Marketing = 6
	Gender Heterogeneity	Hsex	Measured by Herfindahl-Hirschman Index: Male = 1, Female = 0
	Educational Background Heterogeneity	Hedu	Measured by Herfindahl-Hirschman Index: High School or Below = 1, Associate Degree = 2, Bachelor's Degree = 3, Master's Degree = 4, Doctoral Degree or Above = 5
Control Variables	Debt-to-Asset Ratio	Debt	Total liabilities / Total assets
	Growth Opportunity	Growth	Revenue growth rate
	Asset Turnover	Turn	Revenue / Average total assets
	Ownership Concentration	Own1	Percentage of shares held by the largest shareholder
	Return on Assets	Roa	Net profit / Average total assets
	Board Size	Board	Natural logarithm of the total number of board members
	Firm Size	Size	Natural logarithm of total assets
	Executive Shareholding Ratio	Mshare	Executive shareholding / Total shares
	Management Expense Ratio	Fee	Management expenses / Main business revenue
Proportion of Independent Directors	Ib	Number of independent directors / Total number of board mem	

3.3. Model Design

Based on the descriptive statistics and a review of the

relevant literature, this paper proposes the first hypothesis, which suggests that top management team (TMT) heterogeneity has a suppressing effect on CEO power.

According to Hypothesis 1, to test the relationship between CEO power and TMT heterogeneity, the following model is constructed:

$$\text{Power} = \beta_0 + \beta_1 H + \beta_2 X + \varphi + \phi + \varepsilon$$

Where:

Power represents CEO power.

H represents TMT heterogeneity, including age heterogeneity, professional background heterogeneity, educational heterogeneity, and gender heterogeneity.

X represents all control variables.

μ_t denotes year fixed effects.

ν_i denotes firm-specific fixed effects.

ε is the error term.

4. Empirical Research

Table 2 presents the descriptive statistics of the main variables. From Table 2, it can be observed that the average value of the dependent variable, CEO power, is 0.264, with a maximum value of 0.75. This suggests that, on average, the CEO power across 480 listed companies over the past decade is not very high.

Table 2. Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
hsex	4,800	0.255	0.134	0	0.500
hedu	4,800	0.629	0.231	0	0.997
hpro	4,800	0.400	0.209	0	0.778
hage	4,800	0.461	0.163	0	0.776
debt	4,800	0.489	0.204	0.0291	1.223
growth	4,800	0.233	3.704	-0.930	251.8
turn	4,800	0.766	0.544	0.0116	6.250
size	4,800	22.29	1.356	19.20	28.10
fee	4,800	0.0883	0.136	0.00402	7.714
mshare	4,800	0.0442	0.115	0	0.754
own1	4,800	0.343	0.146	0.0389	0.900
board	4,800	2.163	0.207	0.693	3.045
ib	4,800	0.366	0.0513	0	0.667
roa	4,800	0.0430	0.0640	-0.999	0.480
Pro_power	4,800	0.0113	0.105	0	1
Organ_power	4,800	0.179	0.383	0	1
Control_power	4,800	0.403	0.490	0	1
Repu_power	4,800	0.465	0.499	0	1
power	4,800	0.264	0.218	0	0.750

Among the independent variables, the various measures of top management team heterogeneity show that educational heterogeneity is the highest, while gender heterogeneity is the lowest. This may be due to the glass ceiling phenomenon within companies, where the majority of top management are male and women are in the minority. Regarding educational background, there is also significant educational discrimination within the top management teams—those with higher educational qualifications tend to hold more prominent positions within the team.

In terms of control variables, it can be seen that the average proportion of shares held by the largest shareholder is 34.3%, indicating a relatively concentrated ownership structure. The

average proportion of independent directors on the board is 36.6%, suggesting that internal governance is at a relatively high level and complies with the basic requirements for the proportion of independent directors in listed companies.

4.1. Empirical Results Analysis

This paper first conducts a regression analysis using Ordinary Least Squares (OLS) for Model (1), including year fixed effects and firm-specific fixed effects in all regressions, and robust standard errors. The regression results are shown in Table 3.

From Table 3, it can be seen that not all dimensions of top management team heterogeneity have a significant impact on CEO power. Among the four heterogeneity characteristics, only educational background heterogeneity affects CEO power. This can be understood. Compared to gender or age heterogeneity, differences in educational background are more likely to cause internal disagreements within the top management team. Due to differing values shaped by distinct cultural backgrounds, opinions on the company's future development may vary. Additionally, individuals with higher educational qualifications tend not to easily submit to the CEO's authority, as the company needs them to voice alternative perspectives, thus exerting some suppression on CEO power to prevent its abuse. Therefore, it can be observed that educational heterogeneity within the top management team has a significant negative correlation with CEO power, which is consistent with real-world conditions.

The insignificance of professional background heterogeneity is easily understandable. An efficient top management team requires collaboration among individuals from different positions to manage the company effectively. This type of heterogeneity is unavoidable and is a common phenomenon in every listed company, so its variation does not have a significant impact on CEO power.

Table 3. Regression results of CEO power

VARIABLES	(1) power	(2) power	(3) power	(4) power
hsex	-0.0419 (-1.386)			
hedu		-0.0539** (-2.270)		
hpro			-0.0212 (-0.912)	
hage				-0.0334 (-1.585)
Constant	-0.433* (-1.651)	-0.405 (-1.533)	-0.433* (-1.659)	-0.435* (-1.662)
Observations	4,800	4,800	4,800	4,800
R-squared	0.023	0.025	0.022	0.023
Numberofstkcd	480	480	480	480
CompanyFE	YES	YES	YES	YES
YearFE	YES	YES	YES	YES

Robustt-statisticsinparentheses

***p<0.01, **p<0.05, *p<0.1

Based on the above, it can be preliminarily concluded that top management team heterogeneity has a significant impact on CEO power. However, according to the research by

Amason and Sapienza, the diversity of backgrounds among top management team members helps improve decision-making quality, which suggests that the diversity of the top management team's backgrounds may have multiple effects on CEO power. From a theoretical perspective, top management team heterogeneity exhibits two contradictory effects: on one hand, when the education level of team members reaches a certain threshold, non-CEO executives with similar characteristics may form an alliance to collectively oppose the CEO's autocratic dominance, exerting a suppressive effect on CEO power. On the other hand, when heterogeneity exceeds a certain level, the dispersed individuals are insufficient to form enough strength to suppress the CEO's dominance. To avoid being fired or excluded from the team, they often choose to "go along" with the CEO, thereby strengthening the CEO's power within the organization.

Therefore, based on the first hypothesis, this paper proposes a second hypothesis, suggesting that there is an inverted U-shaped relationship between CEO power and top management team heterogeneity.

According to Hypothesis 2, to examine whether there is a non-linear relationship between CEO power and top management team heterogeneity, the following model is constructed:

$$\text{Power} = \beta_0 + \beta_1\text{Hedu} + \beta_2\text{Hedu}^2 + \beta_3X + \varphi + \phi + \varepsilon$$

Model (2) only tests the heterogeneity of the top management team's educational background (Hedu) and introduces the square term of this variable to test the non-linear relationship between CEO power and top management team educational background heterogeneity. The empirical results are shown in Table 4.

Table 4. Regression results of CEO hedu power

VARIABLES	(1) power	(2) p-value
hedu	0.262*** (4.117)	0.000
hedu2	-0.298*** (-4.881)	0.000
Constant	-0.433 (-1.644)	0.101
Observations	4,800	
Numberofstkcd	480	
R-squared	0.038	
CompanyFE	YES	
YearFE	YES	

Robustt-statisticsinparentheses
***p<0.01, **p<0.05, *p<0.1

(In the table, "hedu2" represents the square term of the top management team's educational background heterogeneity.)

From Table 4, it can be seen that CEO power (Power) and the square term of Hedu are significantly correlated, but Hypothesis 2 is not supported. On the contrary, this empirical result contradicts our original hypothesis. The calculation shows that before the threshold of 0.453 for top management team educational background heterogeneity is reached, an increase in heterogeneity leads to an increase in CEO power.

However, once this threshold is exceeded, CEO power begins to decrease.

Based on these empirical results, this paper argues that, in China's listed companies, the members of the top management team often have backgrounds as board directors. Before the number of executives with different educational backgrounds reaches the threshold, they stimulate the CEO, encouraging the CEO to expand their power to maintain their absolute authority within the company. However, when the number of top management team members from different director factions exceeds the threshold, a power struggle between the company's owners begins to emerge, and the CEO gradually becomes a powerless figurehead, with their authority being undermined by the company's upper management.

4.2. Heterogeneity Analysis

To further understand how the heterogeneity of the top management team's educational background influences the changes in CEO power, this paper further analyzes the extent of the top management team's educational background heterogeneity and its impact on the conditions that influence CEO power. Since CEO power is composed of four parts—organizational power, ownership power, expert power, and reputational power—this paper follows the structure of Model (2), replacing the dependent variable with the four sub-indicators and conducting regression analyses. The regression results are shown in Table 5.

Table 5. Heterogeneity Analysis

VARIABLES	(1) pro_po wer	(2) organ_p ower	(3) control_ power	(4) repu_po wer
hedu	0.0195 (0.575)	0.0593 (0.584)	0.151 (1.163)	0.820*** (4.422)
hedu2	-0.0167 (-0.488)	-0.0941 (-0.973)	-0.161 (-1.218)	-0.922*** (-5.256)
Constant	-0.176 (-0.943)	-0.198 (-0.412)	-1.228** (-2.101)	-0.132 (-0.227)
Observations	4,800	4,800	4,800	4,800
R-squared	0.006	0.008	0.038	0.040
Numberofstkcd	480	480	480	480
CompanyFE	YES	YES	YES	YES
YearFE	YES	YES	YES	YES

Robustt-statisticsinparentheses

***p<0.01, **p<0.05, *p<0.1

(In Table 5, "org_power," "pro_power," "control_power," and "repu_power" represent organizational power, expert power, ownership power, and reputational power, respectively.)

As shown in Table 5, the educational background heterogeneity of the top management team does not have a significant impact on organizational power, expert power, or ownership power, but it does have a significant impact on the CEO's reputational power. This result clearly aligns with our initial expectation, as the CEO's reputational power is determined by the CEO's own education level. Only when the educational background heterogeneity of the company's top executives changes can it affect the CEO's reputation within

the organization. Additionally, from the empirical results, there is little difference from the original findings, and the threshold has not changed significantly.

4.3. Robustness Test

In the heterogeneity test, it can be observed that the top management team's educational background heterogeneity primarily influences the CEO's overall power through its effect on the CEO's reputational power. However, as the definition of CEO reputational power indicates, it is essentially a binary variable. Therefore, to ensure the validity of the empirical results, this paper further verifies the reliability of the findings using a logit model. The output results are shown in Table 6, where it can be seen that the relationship between the explanatory variable and the dependent variable remains significant.

Table 6. Robustness Test

VARIABLES	(1) logit
edu	8.980*** (6.241)
edu2	-9.367*** (-7.538)
debt	-0.664 (-1.050)
growth	0.084 (1.024)
turn	0.036 (0.146)
size	0.262 (1.615)
fee	1.767 (1.499)
mshare	-3.624** (-2.405)
own1	0.308 (0.305)
board	-0.217 (-0.591)
ib	-0.788 (-0.454)
roa	-2.594** (-2.097)

z-statistics in parentheses

***p<0.01, **p<0.05, *p<0.1

5. Conclusion and Recommendations

In the development of a company, the CEO, as the highest decision-maker, often plays a critical role in the company's life cycle. However, excessive CEO power can lead to conflicts with the company's owners. For outstanding CEOs, their focus is on the survival and development of the company. In contrast, some CEOs may prioritize immediate personal gains, often taking actions that harm the company's long-term development. Excessive CEO power can result in the abuse of power, leading to decisions that benefit the CEO personally but are detrimental to the company's long-term interests. Therefore, it is crucial to strengthen the constraints on CEO

power.

This paper, by studying the relationship between the heterogeneity of the top management team and CEO power, concludes that there is an inverted U-shaped relationship between the educational background heterogeneity of the top management team and CEO power. This finding is beneficial for shareholders, as it suggests that introducing different management team members based on the company's development can limit and constrain the CEO's power, achieving better internal control. For business owners, this paper provides an important solution to balance CEO power and mitigate agency costs by verifying the relationship between the heterogeneity of the management team and CEO power.

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