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An Empirical Research on Top Management Team Size, Board Size and Corporate Performance Evidence from China's Listed Companies

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Abstract

By using the panel data of China's listed companies from 1999 to 2013 in the CSMAR database, this paper empirically finds that top management team (hereinafter referred to as TMT) size has a significant impact on corporate performance and presents an inverted U-shaped relationship, with the optimal TMT size being about 14 to 15. But the influence of TMT size is no longer significant after controlling board size, that is to say, board size is the core problem of executive governance. The paper also proves that there is an inverted U-shaped relationship between board size and corporate performance, with the optimal board size about 9. At the same time, the paper also verified the influence of other characteristics of TMT on corporate performance, such as the gender ratio of senior executives, the board shareholding ratio and the independent director percentage.

Keywords: TMT size, Board Size, Corporate Performance.

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1. Introduction

The issue of corporate governance has been the focus of scholars' attention. There is a large amount of literature focusing on the impact of management team characteristics on corporate performance, which is mainly attributed to the impact of the Board size on corporate performance and the impact of TMT (Top Management Team) size on corporate performance.

Jensen (1993) first explored the relationship between board size and the value of the company, and pointed out that the larger the board size was, the smaller the value of the company was, and there was a significant negative relationship between the two. Subsequently, Yermack (1996) and Eisenberg (1998) found that this law was applicable to corporations of different sizes in the United States; Mak (2005) and Guest (2009) verified this negative relationship with listed companies in Singapore, Malaysia, and the United Kingdom. And it was found that this relationship existed in different corporate governance systems. Yu Dongzhi (2004) pointed out that there is an inverted "U" relationship between the board size and corporate performance of China's companies; Yu Nutao et al. (2008) used data from China's listed companies to study the relationship between board independence and company value of companies of different sizes, and found "threshold effect": there is a piecewise linear function relationship. Song Zengji et al. (2009) found that board size is not correlated with the corporate performance.

Compared with board size, there is relatively little research on TMT issues. Haleblian (1993) pointed out, with a turbulent business environment, TMT size has a positive influence on corporate performance. Based on data analysis of 48 TMTs, Amason and Sapienza (1997) found that an increase in TMT size would significantly increase team conflicts (including both cognitive and emotional conflicts), which would have a negative impact on corporate performance. Using a sample of 204 manufacturing companies, He Yuanqiong and Chen Yun (2009) found that there was an inverted a "U" relationship between TMT size and return on assets (ROA), and the uncertainty of external environment significantly affected the relationship between TMT size and business performance. Qin Jiaqi (2011) found that board size changes were far less frequent than TMT size changes. The influence of TMT size on corporate performance has a significant inverted "U" relationship, with the optimal TMT size of 14.

There are few comparative studies on board and TMT. Studies on the relative importance of the two in terms of their impacts on corporate performance are fewer. This paper empirically analyzes what are the difference between impacts of TMT size and board size on corporate performance. The paper also analyzes the impact of characteristics of TMT and board on corporate performance. This paper draws the following main conclusions: First, in China's listed companies, the significant impact of the TMT size on overall corporate performance is essentially determined by board size. Other variables that have a significant impact on the corporate performance also come from senior managers in board, and other non-board senior managers have played little role; Second, the panel data of China's listed companies

from 1999 to 2013 used in this paper, to a certain extent, solves the endogenous problem of cross-section data regression in previous literature. Third, there is an inverted "U" relationship between board size and the corporate performance, with the optimal board size of 9. Forth, the concurrent appointment of the board chairman and chief executive has a significant positive impact on corporate performance, while the percentage of women in board size has no significant impact on the corporate performance, but the percentage of women in TMT has a significant positive impact on the corporate performance. At the same time, the stability of the board of directors has a significant positive impact on the corporate performance. The percentage of independent directors has a positive impact on the corporate performance. The percentage of shareholders in the board has a significant positive impact on the corporate performance. There is an inverted "U" relationship between shareholding percentage in the board and corporate performance, with the optimal shareholding percentage of about 30%.

2. Literature review

2.1 The role of TMT size in corporate governance

The problem of TMT size can be explained by the Upper Echelons Theory proposed by Hambrick and Mason (1984). The experience, values and personality of senior executives would profoundly affect their perception and understanding of their situation, and thus affect their decision and behavior choices. But given that these characteristics were hard to be quantified, scholars turned to demographic characteristics to describe the characteristics of senior executives, and linked these characteristics to strategic choices and corporate performance. Obviously, the demographic characteristics of senior executives could not be exactly the same, which creates the "Heterogeneity problem". In contrast, homogeneity means that senior executive members have similar educational backgrounds, social experience, work experience, etc., which provides a prerequisite for them to form consensus and cohesion as soon as possible. At this time, homogeneity could often improve corporate performance, but some studies (such as West and Schwenk, 1996) found that there was no significant correlation between the TMT's homogeneity and corporate performance. Hambrick and DAveni (1992) believed that heterogeneity enabled top managers to obtain different information and perspectives, which enables the decisions to be more adequate and comprehensive. However, more studies suggested that heterogeneity would lead to different opinions among members, forming internal conflicts, and ultimately leading to a decline in corporate performance. The degree of team heterogeneity was related to the TMT size. When the TMT size was small, the homogeneity effect played a dominant role. In that case, the increase in the TMT size was conducive to pooling various resources to improve the corporate performance. However, when the TMT size exceeds the critical value, the heterogeneity effect may prevail. In that case, the increase in TMT size would lead to an increase in internal decision-making conflicts, which will ultimately be detrimental to the corporate performance. This indicates that there may be an

inverted "U" relationship between TMT size and corporate performance. Meanwhile, because factors such as risk preference for different genders are often different, the gender percentage in TMT should also exert certain impacts on corporate performance.

2.2 The role of board size in corporate governance

One viewpoint is that smaller board size is more conducive to improving corporate performance, with agency theory and organizational behavior as its theoretical basis. Lipton and Lorsch (1992) pointed out that the increase in the number of directors would cause many malfunctions of the board of directors, and they suggested that the preferred board size should be eight or nine, while limiting the number of board members to ten. They believed that even if the monitoring capacity of the board would increase as board size increased, the cost thus caused would outweigh the benefits. Jensen (1993) pointed out that when board size was more than seven or eight, the board was less likely to function effectively. Alexander (1993) pointed out that relatively large boards were usually more diversified, more prone to disputes, and less cohesive compared to smaller boards. In short, these scholars believed that overtly large board size may result in the aggravation of the principal-agent problem in corporate governance, so it was not as efficient as a small board. And it may be easier for small boards to deal the rapidly changing competitive environment. For example, smaller boards could be more likely to remove managers when the company was performing poorly.

The opposite view held that a larger board size was more conducive to improving corporate performance: board size could be seen as a measure of an organization's ability to acquire key resources by connecting with the external environment, which reflected the general content of the company's contracting environment and the amount of expert advice provided by the board. Therefore, the greater the need for effective external contacts, the larger board size should be. In addition, board size was closely related to the company's ability to obtain external critical resources (including the amount of budget from the external environment, external funds, etc.) (Pfeffer, 1972, 1973;), the uncertainty of the external environment (lack of information and mutability) would lead to an increase in board size. All this proved that small-scale boards are not a panacea, and cases of companies that have experienced a crisis due to their small board size are not scanty. AT&T and Columbia HCA, which suffered a crisis in 1997, each of which possesses 10 directors. The crisis of the well-known Internet retailer Amazon in 2001 was considered to be caused by poor senior management. The company's board size was too small and it lacked the ability to handle major events independently.

This paper believes that board size will have a significant impact on the corporate performance, and the relationship, on overall, may be an inverted U-shaped. Larger board size has both positive and negative effects on the functioning of the board. When board size increases, the difficulty of coordination and communication will lower its efficiency, and the "free rider problem" will also cause large-scale

malfunction in board, and more so when directors hold fewer shares. The reason for this is that they do not need to suffer from consequences of their own decisions, thus deviating the board's goals from maximized value of the company. In the stock structure of China's listed companies, the state-owned shares occupy a lion's share and cannot circulate normally, making this problem more prominent. But a larger board can also bring a lot of benefits to corporate performance: more directors have more knowledge and experience, and a board representing different stakeholders are more conducive in terms of coordinating various interests. So what is the optimal board size depends on the tradeoff of advantages and disadvantages it brings to the company.

3. Data introduction and model design

3.1 Data source and Variable selection

This paper selects panel data of 2,483 companies listed on the Shanghai and Shenzhen Stock Exchanges from 1999 to 2013 in the CSMAR database, excluding financial industry companies, public utility companies, and ST companies, and all numerical variables are winsorized by 5% level.

3.2 Empirical model and variable description

This paper constructs the following regression equations (1) and (2)：

$$roa_{it} = \alpha_0 + \alpha_1 tsize + \alpha_2 tsizes + \sum_{j=3}^{N} \alpha_j Y_{jit} + \varepsilon_{it} \quad (1)$$

$$roa_{it} = \beta_0 + \beta_1 bsize + \beta_2 bsizes + \sum_{j=3}^{N} \beta_j Z_{jit} + u_{it} \quad (2)$$

Here, "roa" is the rate of return on assets. In equation (1), "tsize and tsizes" refers to TMT size and the square of TMT size respectively. Y is the control variable, which mainly includes the following variables: characteristics variables of TMT, of board and of company, dummy variables of year and of industry. In equation (2), "bsize and bsizes" refers to board size and the square of board size respectively. Z is the control variable, which mainly includes board characteristic variables, company characteristic variables, and dummy variables of year and industry.
The definitions of the above variables are shown in Table 1.

Table 1: Definitions of Variables

Variable Category		Sign	Variable Interpretation
Explained variable		roa	Return on Assets
Explanatory variables		tsize	TMT size, logarithm of total number of Top management team
		tsizes	$tsize^2$
		bsize	Board size, logarithm of total board numbers
		bsizes	$bsize^2$
Control variable	Characteristic Variable Of Top Management Team	ashareratio	The percentage of shareholders in top manager team
		d1	Dummy variable of whether the chairman concurrently serves as CEO, concurrently as 1, otherwise as 0
		dumchange	Dummy variable of whether the CEO changes, take 1 for change, 0 otherwise
		atenure	Average tenure of top managers (total number of top managers divided by number of top managers)
		aedu	Average education level of management team
		aage	Average age of top management team
		asexratio	percentage of female members in top management team
	Characteristic Variable Of Board	aindirector	percentage of independent directors in the board
		bashareratio	Ratio of number of shareholders to total number of directors of Board
		basharehold	Total shareholding percentage of the Board
		basharehold2	Percapita shareholding percentage of the Board
		batenure	Average tenure of directors
		baedu	Average education level of directors
		baage	Average age of directors
		basexratio	percentage of female directors in Board
	Characteristic Variable Of Corporation	debtratio	Asset debt ratio
		largestratio	Shareholding percentage of the largest shareholder
		control	Dummy variable, =1 means state share holding; =0 means others
		size	Asset size, Natural logarithm of total assets
	Other Variables	year	Dummy variable of year
		industry	Dummy variable of industry

3.3 Statistical description

Table 2: Statistical Description of Main Variables Over Years

Year \ Variable	bsize		tsize		aindirector		ashareratio		bashareratio		basharehold	
	mv	sd	mv	sd	mv	sd	mv	sd	mv	sd	sd	sd
1999	2.2251	0.2972	2.8049	0.2361	0.0059	0.0358	0.4750	0.3089	0.4834	0.3287		
2000	2.2134	0.2736	2.8079	0.2227	0.0131	0.0513	0.3626	0.3023	0.3782	0.3292		
2001	2.2133	0.2709	2.8290	0.2188	0.0639	0.1091	0.2970	0.2808	0.3122	0.3104		
2002	2.2706	0.2306	2.8664	0.2055	0.2398	0.0795	0.2343	0.2409	0.2280	0.2434		
2003	2.2738	0.2204	2.8825	0.2096	0.3252	0.0608	0.1973	0.2111	0.1827	0.2092	0.0064	0.0526
2004	2.2636	0.2206	2.8785	0.2164	0.3404	0.0493	0.1825	0.2041	0.1703	0.2030	0.0134	0.0740
2005	2.2469	0.2134	2.8721	0.2113	0.3465	0.0476	0.1691	0.1962	0.1575	0.1950	0.0122	0.0660
2006	2.2396	0.2222	2.8617	0.2225	0.3515	0.0479	0.1610	0.1936	0.1501	0.1887	0.0178	0.0776
2007	2.2419	0.2213	2.8676	0.2252	0.3572	0.0505	0.1584	0.1927	0.1492	0.1880	0.0316	0.1110
2008	2.2660	0.2432	2.8918	0.2401	0.3634	0.0610	0.1584	0.1928	0.1479	0.1862	0.0380	0.1222
2009	2.2520	0.2453	2.8807	0.2484	0.3626	0.0617	0.1662	0.2024	0.1555	0.1943	0.0581	0.1504
2010	2.2411	0.2325	2.8671	0.2417	0.3507	0.0597	0.1948	0.2223	0.1830	0.2093	0.0982	0.1905
2011	2.2588	0.2379	2.8947	0.2457	0.3452	0.0649	0.2091	0.2239	0.2016	0.2158	0.1223	0.2074
2012	2.2836	0.2424	2.9209	0.2518	0.3730	0.0687	0.2167	0.2229	0.2087	0.2160	0.1273	0.2083
2013	2.3120	0.2545	2.9411	0.2547	0.3814	0.0747	0.2178	0.2208	0.2069	0.2104	0.1243	0.2025

(note: mv=mean value sd= standard deviation)

What can be found from Table 2 is as follows. Firstly, the TMT size and board size are basically stable over years. The average board size (bsize) is 9 to 10, and the average TMT size is 17 to 18 people. Secondly, the percentage of independent directors in the company's board of directors (aindirector) has changed significantly over years. The percentage of independent directors increased significantly in 2002, and then remained relatively stable, remaining at about 35%, mainly a result of relevant reform regulations which stipulated that listed companies should employ appropriate personnel as independent directors, including at least one professional accountant, two independent directors, and one-third of independent directors. Thirdly, the changing tendency in the number of shareholders in TMT (ashareratio) and in the board are basically the same, and they both show a downward trend year by year at first and then slightly increased. Fourth, the shareholding percentage of the board (basharehold) shows a year-on-year upward trend in the sample interval, and the difference between companies (standard deviation) also increases.

4. Empirical analysis results

Through statistical analysis of the sample data, it is found that the change in board size mainly comes from the differences between the companies, and, within one company alone, board size remains more or less the same over years. If the fixed-effect model is used, the difference between groups (between companies) will be removed, and only the difference within the group (in one company alone) will be

used, thereby reducing the validity of the data. Therefore, this paper adopts a mixed regression model of unbalanced panel data, while controlling the main characteristic variables of the industry and the company.

4.1 The regression results of model (1)

The regression results for model (1) are as follows:

Independent Variable	(1)	(2)	(3)	(4)
tsize	0.11267	0.08395	0.00862	-0.06860
	(3.06)***	(1.61)	(0.14)	(1.14)
tsizes	-0.02089	-0.01467	-0.00158	0.01257
	(3.29)***	(1.63)	(0.15)	(1.21)
sexratio		-0.03902	-0.03826	-0.03989
		(2.38)**	(2.33)**	(2.55)**
sexratios		0.13145	0.12798	0.11976
		(2.76)***	(2.68)***	(2.57)**
ashareratio		0.03752	0.03729	0.01856
		(18.52)***	(18.43)***	(9.11)***
d1		0.00492	0.00489	0.00004
		(3.77)***	(3.75)***	(0.03)
dumchange		-0.01111	-0.01096	-0.00720
		(8.97)***	(8.86)***	(5.98)***
atenure		0.00105	0.00082	0.00147
		(1.64)	(1.27)	(2.05)**
aedu		0.00246	0.00229	0.00332
		(2.67)***	(2.48)**	(3.68)***
aage		-0.00014	-0.00015	-0.00056
		(0.87)	(0.95)	(3.39)***
bsize			0.14724	0.13609
			(3.00)***	(2.78)***
bsizes			-0.03150	-0.02877
			(2.95)***	(2.70)***
aindirector			0.03354	0.02394
			(3.55)***	(2.48)**
debtratio				-0.10672
				(36.17)***

largestratio				0.00039
				(12.23)***
control				-0.00695
				(6.46)***
size				0.00804
				(13.21)***
cons	-0.12307	-0.10327	-0.16409	-0.17488
	(2.31)**	(1.35)	(2.09)**	(2.19)**
year	YES	YES	YES	YES
industry	YES	YES	YES	YES
F statistic	57.4	49.6	46.0	104.4
Adjusted R-squared	0.06	0.11	0.11	0.30

Note: In parentheses is the t value, ***, **, and * represent significant levels at 1%, 5%, and 10% respectively

Only TMT size and the square of TMT size were added to regression (1). The results show that the there is a significant "U" relationship between TMT size and corporate performance, with the optimal TMT size of about 14 to 15. As the current TMT's decision affect the company's performance in the next period, it is believed that there are no serious endogenous problems. After gradually adding executive characteristic variables, board characteristic variables, and company characteristic variables to regressions (2), (3), and (4), the inverted "U" relationship is no longer significant, but there exists a significant inverted "U" relationship between board size and corporate performance, indicating that the significant impact of TMT size on corporate performance mainly comes from board size: board size, rather than TMT size, is the core of corporate governance.

In addition, the regression results show that there is a significant "U" relationship between the percentage of women in TMT and the corporate performance. At the level of 14% (same as mean value the percentage of women in the sample), the corporate performance is the poorest. This shows that increasing the percentage of women in existing executives can generally improve corporate performance.

The regression results of executive characteristic variables show that the percentage of shareholders in the TMT and the current corporate performance are positively correlated -- the higher the percentage of the shareholders in TMT of China's listed companies, the more closely the interests of top managers are related to the interest of the company's, and thus the smaller the impact of the agency problem, the greater the corporate performance; That the chairman serves as CEO concurrently can improve corporate performance. Whether the chairman serves as CEO concurrently reflects the independence of the company's board of directors and the freedom of innovation at the executive level. Some scholars believe that the two should be separated so that other directors can effectively monitor the CEO, while other

scholars hold that holding two positions concurrently can grant the CEO greater power and can enable the CEO respond to changes in the external environment in a more timely manner; it can also increase CEO's sense of responsibility to the company. The results of this paper support concurrent appointments; the change of CEO has a significant negative impact on corporate performance; the longer the average tenure of senior executives and the higher the average level of education is, the better the corporate performance is; the older the average age of senior executives is, the poorer the corporate performance is. The regression results of other company's characteristic variables show that the higher the asset-debt ratio, the better the corporate performance. The larger the percentage of shareholding of the largest shareholder, the better the corporate performance. And if the company is state-owned, the corporate performance is significantly worse.

4.2 The regression results of model (2)

The regression results of model (2) are as follows:

Independent variable	(1)	(2)	(3)	(4)
bsize	0.12434	0.12434	0.18783	0.10053
	(4.26)***	(4.26)***	(4.08)***	(2.24)**
bsizes	-0.02869	-0.02866	-0.03970	-0.02035
	(4.54)***	(4.53)***	(4.01)***	(2.10)**
bsexratio		0.00326	-0.02424	-0.01161
		(0.35)	(1.80)*	(0.90)
bsexratios		0.00682	0.07962	0.03421
		(0.22)	(1.74)*	(0.76)
bashareratio			0.02025	0.00912
			(7.36)***	(3.54)***
basharehold			0.13019	0.11585
			(9.23)***	(7.85)***
bashareholds			-0.17923	-0.19631
			(6.55)***	(6.96)***
aindirector			0.03861	0.02434
			(3.83)***	(2.45)**
d1			-0.00184	-0.00150
			(0.75)	(0.62)
batenure			0.00072	0.00083
			(2.13)**	(2.37)**
baedu			0.00440	0.00393
			(4.47)***	(4.21)***
baage			0.00082	0.00003
			(5.57)***	(0.18)
debtratio				-0.10312
				(33.83)***
largestratio				0.00041
				(12.44)***
control				-0.00500
				(4.43)***
size				0.00820

				(13.03)***
cons	-0.09789	-0.09846	-0.27565	-0.27069
	(2.92)***	(2.94)***	(4.99)***	(4.91)***
year	YES	YES	YES	YES
industry	YES	YES	YES	YES
F statistic	61.3	57.0	55.5	101.0
Adjusted R-squared	0.06	0.06	0.12	0.30

Note: In parentheses is the t value, ***, **, and * represent significant levels at 1%, 5%, and 10% respectively

The regression results show that there is an inverted "U" relationship between board size and the corporate performance, with the optimal board size of about 9. Meanwhile, the results show that there is also a significant inverted "U" relationship between the board's shareholding percentage and the corporate performance, with the board's optimal shareholding percentage of about 30%. This is because the equity incentive system focuses on the future, linking their possible earnings to their contribution to the company's future performance. Therefore, owning the rights of the company will largely motivate directors to pay attention to the value of the company and is the most direct way to coordinate the interests of directors and shareholders. Compared with directors who hold fewer shares, directors with higher percentage of shareholdings are more likely to make investment decisions that are in the interest of the company. However, a shareholding percentage more than a certain critical point may induce large shareholders to plunder the wealth of small shareholders and thus aggravate the phenomenon of "internal control". The percentage of women in the board of directors does not have a significant impact on the corporate performance, which is different from that in model (1). The reason for this may be that the percentage of women in board is too low to exert significant impacts on corporate decision.

The regression coefficients of other board characteristic variables show that the longer the average tenure of board is, the better the corporate performance is, indicating that the stability of the board has a positive impact on corporate performance. This is because a stable board will ensure a stable risk preference in the company; there are long-term interest relationship between directors and the company; meanwhile the mutual understanding between directors will also allow knowledge and experience to play a greater role. Whether the chairman serves as CEO concurrently has no significant impact on performance. The percentage of independent directors has a significant positive impact on performance, affirming the role of independent directors in supervising company decisions. There is a significant positive correlation between the percentage of shareholders in the board and corporate performance. This is because directors who do not hold company shares do not bear the consequences of their decisions. Therefore, the more people

holding company shares on the board, the better the corporate performance. The older the average age of directors, the better the company's performance, which is just opposite to the effect of the average age of senior executives on the company's performance. One possible explanation for this is that an older average board age indicates that they have more decision-making and operating experience, which is more beneficial to the company's operations, but, some senior managers are mainly in charge of monitoring the decision-making, and younger members may be more rigorous than older members in terms of supervision. The regression results of other company characteristic variables, such as the shareholding percentage of the largest shareholder, company size, asset-liability ratio, and the nature of ultimate controller are all consistent with the results of equation (1).

5. Conclusion and Policy Suggestion

With the theory of principal-agent and organizational behavior as theoretical basis, this paper, referring to empirical research results of the previous literature, verifies the role of TMT and board in corporate governance in China's listed companies. The paper selects companies listed on the Shanghai and Shenzhen stock markets from 1999 to 2013, excluding the financial industry, the utility industry and ST companies, and finally obtains the unbalanced panel data of 2483 listed companies. The empirical results show that TMT size has no significant impact on the corporate performance, while board size has a significant inverted "U" relationship with the corporate performance, indicating that board size is the core of the issue of executive governance. And the optimal board size in China is about 9 or 10 people. This result is basically consistent with the average board size of the company during period in the sample. At the same time, it is also found that there is a significant inverted "U" relationship between the board's shareholding percentage (including the total shareholding percentage and the per capita shareholding percentage) and the corporate performance. The model estimated that the optimal total shareholding percentage of the board of directors is about 30% The average level of the companies in the sample data is only 7%, indicating that the equity incentives for the board of directors in China's corporate governance are still insufficient. The board equity level of most companies is less than the best point. Therefore, increasing the board shareholding percentage can improve corporate performance of China's listed companies. There is a correlation between the percentage of women in TMT and the current performance, that is, the corporate performance can be improved by increasing the percentage of women executives in China's listed companies. In the analysis of other characteristic variables, it is found that the average tenure of board members, the percentage of independent directors on the board, and the percentage of shareholders are positively related to the corporate performance. Moreover, those companies which are state-owned perform worse.

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