Research on Corporate Bankruptcy Prediction Combining Financial Data and Algorithmic Models Based on the Impact of Deleveraging

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Abstract: This article investigates the relationship between centralized equity structure and deleveraging in non-financial listed companies in China's Shanghai and Shenzhen A-shares. The results show that a highly concentrated equity structure gives major shareholders stronger ability and motivation to drive deleveraging in the company, thereby having a supportive impact on the company's long-term profitability. This impact is particularly important in financial management, as deleveraging not only reduces financial risks but also helps improve the stability of capital structure. The study also suggests that excessively high levels of debt significantly moderate this main effect, possibly due to the increased financial risk caused by high debt, prompting major shareholders to take deleveraging measures. At the same time, the implementation of mandatory deleveraging policies further strengthens the connection between centralized equity structure and enterprise deleveraging. The heterogeneity analysis results show that this relationship is particularly evident in non-state-owned enterprises and companies with separated ownership, suggesting that policy makers should pay attention to the equity structure and industry characteristics of enterprises when designing deleveraging strategies, in order to formulate more targeted policies.

1. Introduction

High leverage poses a serious challenge to China's macro financial stability, and how to effectively reduce the leverage level of enterprises has become an important issue for the economy to avoid potential systemic financial risks[1]. Since 2015, the Central Committee of the Communist Party of China has included deleveraging as a core goal of supply side structural reform and implemented a series of mandatory policies, emphasizing the global nature of this issue. In 2020, the COVID-19 had a serious impact on enterprises, making the leverage ratio of China's real economy rise by 15.7 percentage points compared with the end of 2019, reaching 274.4%, and the quarterly growth rate exceeded the 15% peak during the financial crisis. This epidemic has put downward pressure on the economy at the beginning of the 14th Five Year Plan period, and the task of preventing and controlling financial risks remains arduous. In this context, during the 14th Five

Year Plan period, it is required to further strengthen risk awareness and accelerate the resolution of financial risks while continuously deepening structural reform and steadily promoting opening up, in order to promote enterprise deleveraging. With the deepening of China's financial system reform and the improvement of its financial regulatory system, the theoretical and practical significance of studying enterprise deleveraging is becoming increasingly prominent. Currently, the academic community has extensively discussed the factors that affect deleveraging, believing that deleveraging is essentially an adjustment of a company's capital structure, which in turn affects the effectiveness of deleveraging[2]. Considering the phenomenon of equity concentration in non-financial enterprises, it is worth conducting in-depth research on whether centralized equity structure affects the process of enterprise deleveraging, and whether deleveraging policies can promote the deleveraging of absolute centralized equity. This article will explore this topic[3].In an absolute centralized equity structure, the position of major shareholders is significant and has a direct impact on the company's governance and decision-making process. Their decision-making efficiency is high and they can effectively promote deleveraging measures. Research has shown that there is a "U-shaped" relationship between the shareholding ratio of the largest shareholder and the company's value[4]. When the equity increases, the behavior of hollowing out the company's interests will intensify. However, when the equity concentration reaches a certain level, they will tend to support the company's development[5]. In this case, the expropriation effect of major shareholders on the interests of minority shareholders is weakened, and a higher concentration of equity can stimulate their motivation to focus on long-term interests, thereby enhancing their willingness to promote deleveraging. On the other hand, as the shares held by major shareholders increase, their operational risks and bankruptcy risks caused by high leverage also increase accordingly, which makes them more actively promote deleveraging[6]. On the other hand, in the relatively centralized structure of dispersed equity, the mutual checks and balances and conflicts of interest among major shareholders are significant, leading to a decrease in decision-making efficiency and insufficient ability of controlling shareholders to promote deleveraging decisions[7]. Under this structure, larger shareholders are more inclined to pursue personal interests and lack incentives to maintain sustainable profitability of the company, thereby reducing the motivation to deleverage. In addition, diversified risk-taking further weakens the willingness to deleverage.

2. Research hypothesis

The relationship between centralized equity structure, excessive debt, and deleveraging can be explored through the concept of "structural deleveraging", which emphasizes controlling a company's asset liability ratio within a reasonable range to prevent the occurrence of excessive debt. Relying solely on the level of leverage to determine its reasonableness is not enough, and more attention should be paid to whether the enterprise is in an over leveraged state. According to the dynamic trade-off theory, enterprises should have an ideal capital structure, and when the actual debt level deviates from this goal, the enterprise will adjust accordingly. The balance between the benefits and costs of adjusting leverage, as well as the degree of deviation between actual liabilities and target liabilities, are important factors that determine whether a company deleverage and to what extent. For enterprises with absolute centralization, excessive debt can cause the actual debt level to deviate from the target, leading to an increase in bankruptcy risk, which puts greater pressure on major shareholders and drives them to reduce leverage. According to the trade-off theory, the benefits of deleveraging mainly come from reducing bankruptcy costs and agency costs. Under an absolute centralized structure, the bankruptcy and agency costs caused by excessive debt are usually higher than those of non excessive debt. Meanwhile, due to the diminishing marginal returns of tax shields, the tax shield returns of over indebted enterprises are lower than those of non

over indebted enterprises. Therefore, when deleveraging, over indebted enterprises can obtain higher returns and lower costs. Major shareholders generally show support for the company's sustained profitability. Under excessive debt, the benefits of leverage are significantly higher than the costs, promoting the long-term development of the company and enhancing the motivation of major shareholders to promote deleveraging. Therefore, the following research hypothesis is proposed: H1: Compared to non excessively indebted enterprises, excessive debt has a more significant deleveraging impact on absolute centralized structure enterprises.

Against the backdrop of the State Council's mandatory implementation of the deleveraging policy, it is particularly important to explore the relationship between this policy and centralized equity structure and enterprise deleveraging. With the continuous introduction of deleveraging measures, public opinion and market pressure have increased the governance responsibility of major shareholders, prompting highly centralized enterprises to take corresponding deleveraging actions. On the one hand, these policies indicate that China is committed to controlling and reducing the leverage level of enterprises, and guiding the direction of media opinion. The media plays an active role in corporate governance, particularly in reporting on high leverage enterprises. For companies with absolute centralized equity structures, major shareholders attach great importance to the sustainable development of the enterprise. Media exposure may cause small and medium-sized shareholders to lose confidence, thereby having a negative impact on the company's operating conditions. Public opinion pressure prompts major shareholders to reduce their leverage levels. On the other hand, in an environment of forced deleveraging, financial institutions pay attention to the leverage ratio of enterprises when providing credit. These institutions are more cautious due to their ability to resist risks, which further affects the financing situation of high leverage enterprises. In this policy context, the high leverage level of absolute centralized enterprises may limit their financing, thereby prompting major shareholders to push for deleveraging. Therefore, a research hypothesis can be proposed: H2: Absolute centralized equity structure helps to effectively implement deleveraging policies and promote enterprise deleveraging.

3. Research design

To explore the impact of centralized equity structure of Chinese listed companies on corporate deleveraging, this article takes non-financial companies from 2010 to 2020 as samples. Given the threat posed by high leverage to China's macro financial stability after the financial crisis, the starting year of the study is set to 2010. In order to ensure the integrity and accuracy of the data, this article integrated data from the CSMAR and Wind databases. After screening, deduplication, and other steps, a preliminary dataset was finally constructed. On this basis, data from financial and securities companies were excluded, samples with missing values were excluded, and records with asset liability ratios exceeding 1 were deleted, resulting in 2228 annual samples. To reduce the impact of outliers and improve the credibility of empirical analysis, 1% and 99% tail reduction were applied to continuous data. In terms of variable definition, this article calculates the difference between the asset liability ratio of the enterprise at the end of the current period and the previous period ($LEVB_t$-$LEVB_{t-1}$), and divides it by the asset liability ratio at the end of the previous period to obtain the degree of deleveraging (DLEV). When DLEV is negative, it indicates that the company is reducing leverage; If it is positive, it indicates that the company is increasing leverage. The main explanatory variables include absolute centralization (CONCERN1) and relative centralization (CONCERN2), and the moderating variables are the degree of excessive debt of the enterprise (EXLEVB) and year (YEAR). For determining whether a company has excessive debt, this article constructs a dummy variable EXLEVB using the median debt magnitude.

When conducting main effects analysis, this article aims to verify hypothesis H1, therefore

taking deleveraging degree (DLEV) as the dependent variable and centralized equity structure as the independent variable, while fixing the impact of year and industry. In order to conduct a comprehensive evaluation, the nature of property rights (NATURE), size of the enterprise (SIZE), cash ratio (CASHRATIO), growth rate of the enterprise (GROWTH), separation of ownership and control (SEPERATION), profitability (ROA), and asset liability ratio (ALDIO) were also included as control variables to construct the following baseline regression model.

$$DLVE_{i,t} = \beta_0 + \beta_1 CONCERN_{i,t} + \beta_j CONTROLS_{j,t} + YEAR + CODE + \varepsilon \tag{1}$$

In model construction, all explanatory and control variables are based on the current observed values. Considering that the sample data covers non-financial listed companies from different years, in order to eliminate this impact, the year (YEAR) and industry code (CODE) are fixed. The focus of this study is on absolute centralization structure, therefore in the main effects regression, absolute centralization structure (CONCERN1) is used as the main explanatory variable. In terms of the moderation effect model, based on the trade-off theory, this article aims to explore whether excessive debt of enterprises has a moderating effect on the relationship between absolute centralization structure and deleveraging. For this purpose, the degree of corporate debt (EXLEVB) is set as a dummy variable, with the median of the extent of corporate debt as the standard. Companies with excessive debt are marked as 1, while those that do not exceed the median are marked as 0.

4. Empirical analysis

The average deleveraging level of non-financial listed companies in China is 8%, indicating that compared to the previous period, the overall enterprise is in a state of increasing leverage, reflecting the challenge of deleveraging, which is indeed an important issue that urgently needs to be addressed. In the classification of centralized equity structures, absolute centralized enterprises account for 26.6% of the total sample, while relative centralized enterprises account for 20.3%, totaling nearly 50%. In addition, statistics show that 61.5% of the samples belong to enterprises with excessive debt. The average deleveraging value of absolute centralized enterprises is 0.058, while the average value of relative centralized enterprises is 0.082, both of which are lower than the deleveraging level of the overall sample and have significant differences at the 1% significance level. This means that a centralized structure helps companies deleverage, especially with an absolute centralized structure, which may have a more significant effect, thus preliminarily verifying H1. There is a significant negative correlation between absolute centralized ownership structure (CONCERN1) and corporate deleveraging, indicating that when a company adopts an absolute centralized structure, its debt ratio significantly decreases, further promoting deleveraging.

The nature of property rights plays a crucial role in the relationship between centralized equity structure and deleveraging. Research has shown that the leverage level of state-owned enterprises is generally higher than that of non-state-owned enterprises, but non-state-owned enterprises are more prominent in terms of the risk and degree of excessive debt. When state-owned enterprises face losses, the government often finds it difficult to accurately determine the nature of the losses due to its policy responsibility, and therefore often provides assistance through financial subsidies or loans. In addition, the government will leverage its resource allocation advantages to provide more credit support for state-owned enterprises. In this situation, state-owned enterprises under an absolute centralized structure face relatively less deleveraging pressure from major shareholders due to their ability to obtain richer resources to maintain sustainable development. In contrast, non-state-owned enterprises often face greater bankruptcy risks due to the lack of financing advantages and soft budget constraints, which forces major shareholders to adopt deleveraging strategies. To test the

empirical results of the impact of differences in property rights on deleveraging in absolute centralized enterprises, this paper sets property rights as dummy variables and conducts group regression. The specific results are shown in Table 1.

Table 1: Regression Results of Heterogeneity of Property Rights Nature

VARIABLES	M1	M2
	DLEV	DLEV
CONCERN1	-0.001 (-0.08)	-0.087*** (-3.14)
CODE FE	YES	YES
YEAR FE	YES	YES
R-squared	0.230	0.182
Number of CODE	984	1831

M1 and M2 present the regression analysis results of state-owned and non-state-owned enterprises. In the sample of state-owned enterprises, the regression coefficient of absolute centralized ownership structure (CONCERN1) is not significant; In the sample of non-state-owned enterprises, the regression coefficient of this structure is significant and negative. This indicates that absolute centralization has little impact on the deleveraging of state-owned enterprises, but has a promoting effect on the deleveraging of non-state-owned enterprises.

Regarding the impact of the separation of ownership and control on centralized equity structures and deleveraging relationships, it was found that in absolute centralized equity structures, the predatory behavior of major shareholders relies on the cooperation of the general manager. Implementing the separation of ownership and control can enhance the independence of the general manager, effectively reduce the degree of plundering by major shareholders, and thus improve the decision-making efficiency of the company. When companies face high leverage, this structure is more likely to drive deleveraging decisions. To verify this mechanism, this paper conducts grouped regression on the separation of weights based on the main effects model. The results show that in the case of separation of ownership and control, the regression coefficient of the absolute centralized equity structure is significant at the 1% significance level, but not significant in the case of no separation. This indicates that an absolute centralized structure can effectively promote deleveraging in enterprises implementing separation of powers. The specific results are shown in Table 2.

Table 2: Heterogeneity regression results of two weight separation

VARIABLES	M3	M4
	DLEV	DLEV
CONCERN1	-0.087*** (-3.14)	-0.011 (-0.44)
CONSTANT	-0.034 (-0.53)	-0.196 (-1.12)
CODE FE	YES	YES
YEAR FE	YES	YES
R-squared	0.214	0.183
Number of CODE	1502	1703

5. Conclusion

Under an absolute centralized equity structure, major shareholders face significant deleveraging pressure due to their high decision-making efficiency and concentration in assuming bankruptcy risks, which enhances their ability and motivation to drive the company's deleveraging; In a relatively centralized structure, although the deleveraging ability and motivation of major

shareholders are insufficient, there is still a significant relationship with the deleveraging of the enterprise. The excessive debt level of enterprises has a moderating effect on the relationship between absolute centralization structure and deleveraging. Specifically, excessive debt leads to actual leverage levels deviating from targets, increasing the risk of bankruptcy and putting greater pressure on major shareholders, thereby strengthening their motivation to deleverage. The continuous deleveraging policy guides media public opinion and prompts financial institutions to pay more attention to the leverage ratio of enterprises in credit decisions, further affecting the financing situation of enterprises. In this policy context, the external public opinion and market pressure borne by major shareholders in an absolute centralized structure have prompted companies to adopt deleveraging measures. When absolute centralized enterprises are in a high leverage state, non-state-owned enterprises face huge bankruptcy risks due to the lack of financing advantages, and therefore have to deleverage. At the same time, the separation of power between major shareholders and the general manager helps to reduce the "hollowing out" behavior of major shareholders, improve the efficiency of corporate decision-making, and promote the deleveraging process of companies with separation of power.

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