Research Article

Crisis Analysis and Prevention and Control of Financial Leverage Imbalance in Shareholder Equity Pledge Based on the DANP Model

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Research Background. The process of economic globalization is accelerating, and the financial risks that listed companies need to face are more complicated. *Research Purpose*. In order to clarify the impact of shareholder equity pledge on financial leverage imbalance crisis, research on the analysis and prevention of financial leverage imbalance crisis of shareholder equity pledge based on the DANP model is carried out. *Research Method and Process*. The DANP financial leverage imbalance early warning model is introduced to analyze the impact of shareholder equity pledge on financial leverage imbalance crisis by combining the financial leverage effect and potential risks of shareholder equity pledge, optimize the financial leverage imbalance early warning evaluation index system, preprocess the early warning evaluation indicators, determine the constant weight of each evaluation index, and obtain the final financial leverage imbalance crisis early warning evaluation value based on the determined constant weight. *Research Results*. The DANP model can accurately analyze the financial leverage imbalance crisis in the case of shareholder equity pledges, clarify the company's financial status in the case of shareholder equity pledges, propose to standardize equity pledge behavior, improve the company's internal control system in response to the crisis of shareholder equity pledge financial leverage imbalances, and improve the three prevention and control measures of the independent director system to enhance the ability of enterprises to resist the crisis of financial leverage imbalance.

1. Introduction

The financial market environment is complex and changeable, information technology is developing rapidly, and there is great uncertainty in the operation of enterprises. It is not uncommon for enterprises to go bankrupt due to financial risks [1]. Enterprises can find financial risks as early as possible and avoid and diversify risks in time to maintain the sustainable development of the enterprise. In enterprise risk management, financial leverage imbalance crisis early warning occupies an important position. Enterprise financial leverage imbalance crisis early warning is an important topic that is highly valued in the academic field. Efficient financial leverage imbalance crisis early warning methods have important early warning and supervision functions. The financial leverage imbalance crisis early warning method

can clarify the cause of the corporate financial crisis and facilitate timely measures and countermeasures to resolve the financial crisis.

The pledge of major shareholders' equity brings huge risks to the capital market. The risk of shareholder equity pledge mainly includes the risk of control transfer caused by the fluctuation of the company's stock price, the risk of excessive investment, and the risk of related party transactions. After the pledge of corporate shareholders' equity, the company's internal environment and performance decline will cause stock prices to fall and shareholders' inability to repay loans will change the company's control. After the pledge of shareholder equity, the company's scale continues to expand [2] and the company's frequent foreign investment will cause the company to form risks due to excessive investment. After the shareholder's equity pledge,

shareholders transfer the interests of the listed company through related transactions and other forms. The equity pledge risk will increase the business risk of the enterprise.

Corporate stakeholders such as investors, creditors, and managers attach great importance to corporate financial health. The correctness of corporate investment decisions can avoid corporate investment risks and maintain corporate funds in a safe and stable state. Investors use the risk warning results to correctly implement investment decisions [3], which can ensure the safety of corporate funds. Managers clarify the root causes of the financial crisis in strategic decision-making and can choose projects with lower risks and higher returns. In the production and operation process of managers, rational adjustment of capital structure can timely reverse the risks faced by enterprises due to financial crisis. An efficient financial crisis early warning model has extremely important practical value and theoretical significance.

Researchers at home and abroad have studied the risk of shareholder equity pledge and financial leverage. Xia and Khang studied the influence of investment heat and financial leverage on the excess return rate of stocks [4], taking full account of the influence of the excess return rate of stocks on financial leverage and investment heat influence, and clarifying the relationship between the three; Li and Xin studied the sensitivity of controlling shareholder's equity pledge to executive compensation performance [5], fully considering the impact of shareholder equity pledge on corporate executive compensation and performance; Liao et al. study the controlling shareholder's equity pledge and the dividend policy of listed companies [6] and clarify the relationship between the listed company's dividend policy and the shareholder's equity pledge; Lin and Wei studied analyzed the equity pledge of controlling shareholders, the nature of equity, and corporate performance and found that the controlling shareholders of private listed companies were more inclined to equity pledge than the controlling shareholders of state-owned listed companies [7], and it was clear that the shareholding ratio of shareholders was negatively correlated with equity pledge; Walthoff–Borm et al. have fully studied the relationship between equity crowdfunding, shareholder structure, and company performance [8], clarifying that company performance is affected by equity crowdfunding and shareholder structure. Although the above method analyzes the financial leverage imbalance crisis of shareholder equity pledge, the research method is not effective due to the unreasonable construction of the index system and the incomplete analysis of the financial leverage effect.

The DANP (network hierarchy analysis) model is based on the analytic hierarchy process (AHP) model with high analytical effectiveness and has been applied to the financial field; it is of great significance to apply it to the financial leverage imbalance crisis analysis. The DANP model has the advantages of a systematic analysis method, practical decision-making, being simple, and having less quantitative data information, which can effectively evaluate the system evaluation without structural characteristics and the multiobjective, multiquasi side, and multiperiod system. The

structure is simple and clear, and it can solve the practical problems that cannot be solved by optimization technology.

Therefore, to solve these problems, this paper analyzes the imbalance crisis of shareholders' equity pledge and financial leverage. The Danp model is introduced to optimize the index system and model.

2. Research Methods

2.1. Financial Leverage. The effect of financial leverage is the change in earnings per common stock caused by the fluctuation of corporate earnings before interest and taxes due to corporate fixed debt. When the capital structure is fixed, interest expenses need to be paid, that is, the debt financing cost is fixed. When the preinterest and tax profit is increased, the debt interest on the preinterest and tax profit of each unit will be reduced [9], the distribution to shareholders after tax deduction will be increased, and shareholders will get additional financial leverage benefits and financial risks of financial leverage. At this point, the leverage effect is positive and negative, respectively.

The effect of financial leverage will form a positive effect and a negative effect; that is, both returns and risks exist simultaneously [10]. The DFL indicator is selected as a measure of financial leverage income and risk indicators. DFL refers to the financial leverage coefficient, which is obtained from the change rate of the company's profit before interest and tax and the change rate of each share's return. Table 1 shows the calculation process of the DFL value when the enterprise finances ordinary liabilities.

According to Table 1, the available financial leverage formula is as follows:

$$\text{DFL} = \frac{\Delta EPS/EPS}{\Delta \text{EBIT}/\text{EBIT}}. \tag{1}$$

The formula of ΔEPS for earnings per share is as follows:

$$\begin{aligned}
\Delta EPS &= \frac{(\text{EBIT}' - U)(1 - E)}{N} - \frac{(\text{EBIT} - U)(1 - E)}{N} \\
&= \frac{(1 - E)\Delta \text{EBIT}}{N}.
\end{aligned} \tag{2}$$

Then, we have the following:

$$\frac{\Delta EPS}{EPS} = \frac{\Delta \text{EBIT}}{\text{EBIT} - U}. \tag{3}$$

Substituting the previous formula into formula (1), the following formula can be obtained:

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - U}. \tag{4}$$

In the above-mentioned formula, DFL and *EPS*, respectively, represent the financial leverage factor and earnings per share; EBIT and U represent the preinterest and tax profit and debt interest, respectively; and E and N represent the income tax rate and the number of ordinary shares issued.

TABLE 1: DFL value calculation process.

	Base period	Reporting period
EBIT	EBIT	EBIR'
Debt interest	U	U
Income tax rate	E	E
Profit after interest and tax	(EBIT-U) (1-E)	(EBIT'-U) (1-E)
Earnings per share	(EBIT-U) (1-E)/ N	(EBIT'-U) (1-E)/ N

The above analysis shows that the following conditions are required to obtain the financial leverage factor: (1) the total assets of the enterprise, the total debt interest paid, the debt interest rate, and the capital structure are all fixed; (2) the corporate income tax rate has not changed, and income tax is levied at a fixed rate, but not converted into non-payment of income tax; (3) there is no change in the number of ordinary shares issued by the company, and there is no preference stock.

Under the above assumptions, the financial leverage coefficient can be used to clarify the changes in corporate profits, which is convenient for analyzing the crisis of financial leverage imbalance in shareholder equity pledge.

2.2. Potential Risks of Shareholder Equity Pledge.

The listed company entity is an independent legal person, and the independent legal person is separated from each shareholder. Shareholder pledge of equity indicates that the parent company has a financing gap. A shareholder equity pledge is a financing method when there is no effective financing channel and shareholders are already short of funds. Under the situation of shrinking market liquidity, shareholders can easily choose equity pledge financing. The main risks of shareholder equity pledge are as follows: In the case of pledge default, when the stock price is too low, the pledgee may sell and retain the pledged equity. At this time, the equity pledge shareholder may lose control of the company; shareholders have financial leverage risk [11], and shareholder pledges are likely to be unpayable due to financial deterioration. The research results of Wang Xiongyuan and others showed that the decline in the value of shareholder pledged equity will have the risk of control transfer and pressure to cover positions; when the constraint state and specific conditions are fixed, the shareholder pledge of equity can fully consider the benefits and costs and formulate self-interested financial behaviors against equity pledge risks. The pledge of shareholders' equity may cause deviations from the actual development needs of listed companies and fail to bring expected benefits to the company; the pledge of shareholder's equity will consume a lot of resources and affect the stability of the company's capital chain; market investors do not favor shareholder equity pledge investment projects. Raising the company's share price has not brought a positive impact.

The pledge of shareholder equity can easily cause a crisis of corporate financial leverage imbalance. In the case of shareholder equity pledges, when shareholders' investment preferences change, radical subjective ideas will increase corporate debt pressure and increase corporate capital flow risks. A shareholder pledge would send a negative signal to the market, which will affect the company's financing environment and increase the crisis of the company's financial leverage imbalance.

2.3. DANP Financial Leverage Imbalance Early Warning Model

2.3.1. Early Warning Evaluation Index System for Financial Leverage Imbalance.
The profit quality is selected as the evaluation index of the financial leverage imbalance crisis, which is reflected in continuity, solvency, capability, and stability. Profitability continuity can reflect whether a company can maintain sustainable development; profitability stability can reflect the degree of corporate profit volatility; profitability can reflect the level of cash obtained by the company, and debt solvency can reflect the operating efficiency of the main business of the enterprise [12]. The higher the value of the evaluation index, the better the performance of the enterprise. The impact of shareholder equity pledge on the financial operation of the enterprise is the main reason for the imbalance of financial leverage.

The uncertainty of the enterprise when facing risks can reflect the operation of the enterprise. The organizational ability and adaptability of the enterprise cannot operate stably when the indicators are behind [13], which causes the crisis of financial leverage imbalance. Combining the quality of corporate earnings to measure the crisis of corporate financial leverage imbalance, the established financial leverage imbalance crisis early warning evaluation index system is shown in Table 2.

2.3.2. Preprocessing of Early Warning Evaluation Index Values.
The established financial leverage imbalance crisis early warning evaluation indicator system has large differences in various indicator dimensions, and each indicator needs to be normalized. The extreme value processing method in the linear normalization method is selected for dimensionless processing of each index data [14], so that all the index data are placed in the interval [0, 1].

Suppose the original data set is $U^{m \times n}$; the data set contains the number of rows and the dimensions are m and n, respectively, $D^{m \times n}$ represents the normalized data set, and $\max(\cdot)$ and $\min(\cdot)$ represent the maximum function and the minimum function, respectively. The extreme value normalization operation formula is as follows:

$$U^{m \times n} = \frac{D^{i \times j} - \min(D^j)}{\max(D^j) - \min(D^j)}. \tag{5}$$

Here, $i = 1, 2, \ldots, m$ and $j = 1, 2, \ldots, n$.

2.3.3. Determination of the Constant Weight.
We use the network hierarchy analysis method (DANP) to determine the weight of each index in the evaluation index system; the process is as follows:

TABLE 2: Financial leverage imbalance crisis early warning evaluation index system.

Target layer	Criterion layer	Measure layer
	Profitability continuity	Net profit growth rate
		Sustainable growth rate
		ROE growth rate
		Net cash flow growth rate
	Solvency	Asset load rate
		Earned interest multiple
		Current ratio
Financial leverage imbalance crisis warning		Cash ratio
	Profit stability	Coefficient of variation of operating margin
		Coefficient of variation of profit rate of total assets
		Coefficient of variation of profit rate of net assets
		Coefficient of variation of main business profit
	Profitability	Working capital turnover rate
		Accounts receivable turnover rate
		Net cash content of net profit
		Cash content of operating income

(1) The expert questionnaire method is used to establish the direct influence matrix formula of each index and each dimension in the evaluation index system as follows:

$$E_t = (e_{ij})_{m \times n}. \tag{6}$$

Here, e_{ij} represents the degree of influence of j index by i index.

(2) The formula for obtaining the average direct influence matrix is as follows:

$$B = \frac{1}{n} \sum_{t=1}^{n} E_t = (b_{ij})_{m \times n}. \tag{7}$$

(3) The consistency test directly affects the matrix, and the consistency average gap ratio test formula is as follows:

$$p = \frac{1}{m(m-1)} \sum_{i=1}^{m} \sum_{i=1}^{n} \left| \frac{b_{ij}^n - b_{ij}^{n-1}}{b_{ij}^n} \right| \leq 6\%. \tag{8}$$

b_{ij}^n represents the elements in the average influence matrix obtained when the number of experts is n.

(4) The normalization processing matrix B obtains the normalization result N as follows:

$$N = \frac{1}{k} \times B,$$

$$k = \max \left\{ \sum_{i=1}^{m} b_{ij}, \quad \sum_{j=1}^{n} b_{ij}, \right\}. \tag{9}$$

Here, k represents the normalization coefficient.

(5) solve the total influence matrix as follows:

$$T = N(I - N)^{-1}. \tag{10}$$

Here, I represents the identity matrix.

(6) The unweighted super matrix W^α is obtained by using the index total influence matrix T_C.

$$W^\alpha = (T_C^\alpha)' = \begin{array}{c} B_1 \\ \vdots \\ B_4 \\ c_{11} \\ \vdots \\ \vdots \\ c_{44} \end{array} \begin{array}{ccc} B_1 & \cdots & B_4 \\ c_{11} & \cdots & \cdots & c_{44} \\ \begin{bmatrix} W^{11} & \cdots & W^{41} \\ \cdots & \cdots & \cdots \\ W^{14} & \cdots & W^{44} \end{bmatrix}_{16 \times 16} \end{array}. \tag{11}$$

Here, B_i and T_C^α, respectively, represent the system dimension and the block normalization matrix of the total influence matrix and c_{ij} represents the i index in the i dimension of the system.

(7) The unweighted super matrix W^α and the total influence matrix are used to establish a weighted super matrix.

$$W = T_B^\alpha W^\alpha. \tag{12}$$

Here, T_B^α represents the normalized matrix of T_B.

(8) The self-multiplying weighted supermatrix is repeated until convergence, and the limit supermatrix $\lim_{n \to \infty} W^n$ is obtained. The global constant weight vector w^g is a random column vector in the limit hypermatrix, and each index weight vector in the index system is obtained.

2.3.4. Obtaining Early Warning Evaluation Value. There is a positive relationship between corporate shareholder equity pledge and corporate financial leverage imbalance [15]. We use the construction of double-level penalty variables to determine the final result of the financial leverage imbalance crisis warning; the process is as follows:

(1) We set type equalization function and power function and use δ to represent the penalty coefficient; the value range is $[0, 1]$, and the available penalty variable weight vector under the equalization function and power function is as follows:

$$D^{\delta}(x_1, x_2, x_3, x_4) = \sum_{i=1}^{4} x_i^{\delta}. \tag{13}$$

x_i represents the value of dimension B_i in the index system, and when the penalty coefficient is 1, the penalty variable weight vector is a constant weight vector.

(2) The results of using index penalty variable weight $w_{ij}^{\delta_i}(x_{i1}, x_{i2}, x_{i3}, x_{i4})$ to obtain dimension iB_i are as follows:

$$x_i^{\delta_i}(x_{i1}, x_{i2}, x_{i3}, x_{i4}) = \sum_{j=1}^{4i} w_{ij}^{\delta_i}(x_{i1}, x_{i2}, x_{i3}, x_{i4}) x_{ij}. \tag{14}$$

We use the dimensional penalty variable weight $w_{ij}^{\delta_i}(x_{i1}, x_{i2}, x_{i3}, x_{i4})$ to obtain the DANP early warning evaluation value as follows:

$$V^{\delta}\left(x_1^{\delta_1}, x_2^{\delta_2}, x_3^{\delta_3}, x_4^{\delta_4}\right) = \sum_{i=1}^{4} w_i^{\delta}(x_1, x_2, x_3, x_4) x_i^{\delta_i}. \tag{15}$$

(3) Comprehensive evaluation value: we set the evaluation annual limit to 3, and the comprehensive evaluation value formula of financial leverage imbalance crisis is as follows:

$$H = \sum_{K=1}^{3} w^{t-k} V_{t-k}^{\delta}\left(x_1^{\delta_1}, x_2^{\delta_2}, x_3^{\delta_3}, x_4^{\delta_4}\right). \tag{16}$$

Here, w^{t-k} represents the time series weight of the year $t-k$ and the comprehensive evaluation value of the financial leverage imbalance crisis is in the range of $[0, 1]$.

3. Result Analysis and Discussion

A total of 95 listed companies with shareholder equity pledges provided by the Shanghai Securities News were selected, and listed companies with incomplete data were excluded to obtain a total of 87 superior companies. Thirty companies out of 87 listed companies were selected as test samples, and the remaining 57 listed companies were used as training samples. The listed company data comes from the Guotaian database.

The DANP model is used to calculate the weight of each indicator in the established financial leverage imbalance crisis rating indicator system. The calculation results are shown in Table 3.

The DANP model selects the median as the critical value and uses the accuracy of the model as the objective function to predict the crisis of financial leverage imbalance. The criteria for judging the financial leverage imbalance of listed companies using the DANP model are shown in Table 4.

It can be seen from Table 4 that the higher the financial crisis warning value, the lower the financial leverage imbalance crisis of the company due to shareholder equity pledge; when the warning value is higher than 0.6537, it indicates that the company has no financial leverage imbalance crisis and is in a safe state.

According to Table 3, the financial leverage imbalance crisis weights are determined using the DANP model to predict financial leverage imbalance crises for 87 listed companies with shareholder equity pledges. Compared with Table 4, the financial leverage imbalance crisis judgment criteria can be predicted as follows: among 87 listed companies, there are 12 companies with financial leverage imbalance crisis; 2 companies at the critical state of financial leverage imbalance crisis; and 73 companies without financial leverage imbalance crisis. The forecast results are consistent with the actual financial operation of listed companies, verifying the research and utilization of the DANP model in analyzing the effectiveness of the crisis of financial leverage imbalance in the pledge of shareholder equity.

The DANP model can accurately analyze the financial leverage imbalance crisis in the case of shareholder equity pledge, clarify the company's financial status in the case of shareholder equity pledge in real time, determine the cause of the financial leverage imbalance crisis based on the early warning results of different indicators in the established indicator system, and develop corresponding measures for specific indicators.

In view of the risk of financial leverage imbalance caused by shareholder equity pledge, the following preventive measures are proposed.

3.1. Standardizing Equity Pledge Behavior. Economic behaviors are heavily influenced by legal support and the market environment. The pledge of shareholder equity has been legalized, and the pledge of shareholder equity has strong convenience and is favored by many shareholders. The pledge of shareholder equity affects both the market environment and the financial changes of equity companies. In the operation of the pledge of shareholders' equity, the vital interests of investors and the financial risks of the company shall be fully considered, legal restrictions shall be considered, and the law shall be used to regulate shareholders' equity pledge behavior. The legal restraints for standardizing equity pledges are as follows.

3.1.1. Limited Equity Transactions. At present, there are no specific legal provisions restricting equity transactions in my country. The risk of control transfer is the main risk of

TABLE 3: Weight calculation results.

Criterion layer	Constant weight	Measure layer	Global constant weight	Local constant weight
Profitability continuity	0.3521	Net profit growth rate	0.0682	0.3215
		Sustainable growth rate	0.0582	0.1524
		ROE growth rate	0.0555	0.2355
		Net cash flow growth rate	0.0645	0.2906
Solvency	0.1526	Asset load rate	0.0583	0.1528
		Earned interest multiple	0.0616	0.2564
		Current ratio	0.0553	0.2314
		Cash ratio	0.0791	0.3594
Profit stability	0.2354	Coefficient of variation of operating margin	0.0755	0.3512
		Coefficient of variation of profit rate of total assets	0.0485	0.1254
		Coefficient of variation of profit rate of net assets	0.0582	0.2451
		Coefficient of variation of main business profit	0.0625	0.2783
Profitability	0.2599	Working capital turnover rate	0.0778	0.3524
		Accounts receivable turnover rate	0.0545	0.2159
		Net cash content of net profit	0.0592	0.1582
		Cash content of operating income	0.0631	0.2735

TABLE 4: Standards for judgment of financial leverage imbalance.

Financial status	Warning value
Leverage crisis	0–0.6483
Leverage crisis critical	0.6484–0.6536
Safety	0.6537–1

shareholder equity pledge. In the case of a high proportion of pledges, the risk of control transfer is more obvious. Using the law to restrict the pledge time period and pledge ratio and prohibit the high proportion of shareholder pledges, one can prevent and control the financial leverage imbalance crisis caused by the pledge of shareholder equity.

3.1.2. Supervising and Disclosing Information on Pledged Shareholder Equity. At present, relevant laws require that more than 5% of shareholders' equity pledges must be disclosed in a timely manner, and the disclosure content is not comprehensive. The controlling shareholder will influence the company due to their own financial status and pledge motivation. Improving laws and regulations will help the company make more detailed disclosures of shareholders' equity pledges and in the timely display of shareholders' solvency and personal financial status, and stakeholders can clarify the company's future direction and the purpose of equity pledges. Relevant control departments should timely strengthen the supervision and tracking of equity pledge of the high proportion of shareholders to avoid authenticity, sufficiency, and timeliness of the disclosed equity pledge information and avoid subsequent shareholder pledges that affect market stability and cause the company's financial leverage imbalance crisis.

With a sound supervision mechanism and complete information disclosure, market investors will be more clear about the company's operations after the shareholder's equity pledge, restrict shareholders to use equity pledge to cause the company's financial leverage imbalance crisis, protect the relevant interests of investors, ensure market stability, and prevent and control the financial leverage imbalance crisis caused by the pledge of shareholder equity.

3.2. Improving the Company's Internal Control System. Listed companies need a sound internal control system. The company's financial leverage imbalance crisis will be effectively prevented and controlled due to reasonable business decisions. A reasonable internal control system can avoid the encroachment of interests due to shareholder equity pledges and prevent the company's debt crisis. Listed companies not only need a sound internal control system but also improve the management efficiency of the internal control system, prevent and control corporate risks, fully consider the objective situation of the company, and avoid the company's financial leverage imbalance crisis. The superior company can formulate relevant internal control systems based on the pledge of corporate shareholders' equity to avoid risky projects due to equity pledges and prevent shareholders from encroaching on the company's interests. The company's internal audit agency is an important part of restraining shareholders' tunneling behavior. It should perform its internal audit functions in strict accordance with relevant procedures, reduce the risk of financial leverage imbalance caused by shareholder equity pledges, and protect the interests of listed company shareholders and related investors.

3.3. Improving the Independent Director System. The establishment of independent directors by the company can avoid the financial leverage imbalance crisis caused by the pledge of shareholders' equity. Independent directors can actively supervise the pledge of shareholders' equity. The independent board of directors currently accounts for about 30% of

the total number of board members in most of the superior companies. Many listed companies have the defects that independent directors are too superficial and have poor supervision.

Independent directors actively participate in the company's financial behavior and business decision-making, helping to safeguard the rights of small and medium shareholders, avoid irrational financial behaviors caused by the pledge of controlling shareholders' equity, and enhance the financial enthusiasm of the superior company. The independent director management system helps to play a huge role, enabling the company to maintain sustainable development through good operations.

The superior company should improve the independent director system through independent selection of independent directors, try to avoid management nominations, and select independent directors through recruitment; listed companies should improve the independent director mechanism through incentive mechanisms, which can encourage independent directors to work through incentives and economic remuneration; through the establishment of an evaluation system to adjust the allowances and remunerations of independent directors, independent directors should have the right to know information and have the right to vote and know the company's internal analysis data to have the right to realize supervision assistance and ensure the correctness and rationality of the company's operating procedures and business decisions.

4. Conclusion

Financial issues are the primary issue of corporate management, and maximizing returns is the main purpose of corporate capital optimization. We use the DANP model to analyze the crisis of financial leverage imbalance in shareholder equity pledge and propose relevant measures to prevent and control the crisis of financial leverage imbalance. Verification analysis shows that there are 12 companies with financial leverage imbalance crisis and 2 companies with crisis critical state. Therefore, this method effectively analyzes the influence of shareholder equity pledge on financial leverage imbalance, and through standardizing equity pledge behavior and improving the company's internal control system and independent director system, it effectively avoids the financial leverage imbalance crisis and major losses caused by shareholder equity pledge and realizes the sustainable development of enterprises. Due to time constraints, although the research method algorithm is simple, it takes a long time to run. Therefore, further research will be conducted in this aspect to improve the efficiency of the analysis method.

Data Availability

The data used in this study can be accessed upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

References

[1] X. Y. Xie and X. Y. Zhu, "Equity pledge and technological innovation investment of controlling shareholders in new third board Enterprises -- Based on the dual perspectives of financing mode and controlling shareholder behavior," *Research on Financial and Economic Issues*, vol. 5, pp. 68–75, 2020.

[2] C. Hong, H. Li, and L. L. Zhu, "Model construction and Key factors identification of knowledge collaboration in social Q&A platforms from the perspective of activity theory: an approach based on fuzzy DANP," *Information Studies:Theory & Application*, vol. 11, pp. 100–106, 2019.

[3] T. Xia, Y. C. Wen, and P. Yuan, "The path analysis on large shareholder's share pledge affecting firm value," *Journal of Shanxi Finance and Economics University*, vol. 8, pp. 93–108, 2018.

[4] X. L. Xia and M. Kang, "Research on the influence of investment enthusiasm and financial leverage on excess return rate of listed companie——empirical analysis based on the multi-factor asset pricing model of a-share market," *Price: Theory & Practice*, vol. 12, pp. 106–109+185, 2019.

[5] C. Q. Li and W. Xin, "Does the controlling shareholder equity pledge affect-executive pay-for-performance sensitivity?" *Economic Management Journal*, vol. 5, pp. 157–174, 2018.

[6] K. Liao, C. Y. Cui, and D. R. Xie, "Controlling shareholders' share pledging and dividends policy choice of listed companies," *Journal of Financial Research*, vol. 4, pp. 176–193, 2018.

[7] Y. Lin and L. B. Wei, "Research on controlling shareholder's equity Pledge, Equity nature and corporate performance," *Commercial Research*, vol. 2, no. 2, pp. 50–56, 2018.

[8] X. Walthoff-Borm, T. Vanacker, and V. Collewaert, "Equity crowdfunding, shareholder structures, and firm performance," *Corporate Governance: An International Review*, vol. 26, pp. 314–330, 2018.

[9] L. Pan, L. P. Zhang, and C. Y. Ouyang, "Stock rights pledge of controlling shareholders and trade credit financing ——an analysis based on internal control quality and audit quality," *The Theory and Practice of Finance and Economics*, vol. 4, pp. 80–87, 2018.

[10] D. S. Huang, Y. S. Huang, and J. N. Zhou, "Does controlling shareholder's share pledge affect the firm's decision on large stock dividends?" *Journal of Management Sciences in China*, vol. 12, pp. 22–40+98, 2018.

[11] F. Jiang, Y. Shen, X. Cai, and L. Jiang, "Corporate governance effects of multiple blockholders: a perspective from controlling shareholders' share pledge," *The Journal of World Economy*, vol. 2, pp. 74–98, 2020.

[12] C. Y. Xia and F. S. Jia, "Stock pledge of controlling shareholder and corporate crash risk," *Nankai Business Review*, vol. 5, pp. 165–177, 2019.

[13] C. Liu, Y. Zhang, and X. Z. Bao, "Dynamic crisis early warning of patent-backed loan for SMEs," *Science & Technology Progress and Policy*, vol. 15, pp. 138–143, 2018.

[14] M. Zhao and F. Yuan, "Controlling shareholder's share pledge, earnings management and audit decision—based on regression method in statistics," *Journal of Physics: Conference Series*, vol. 1616, Article ID 012045, 2020.

[15] Y. F. Wang and Y. Liu, "Share pledge of controlling Shareholders, Industry expertise of auditors and comparability of financial reports," *Journal of Nanjing Audit University*, vol. 6, pp. 39–49, 2019.