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Corporate Governance against Systematic Risk during COVID-19 -- Empirical Findings Based on fs/QCA

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Abstract Based on samples of listed Chinese companies, we use fuzzy-set Qualitative Comparative Analysis (fs/QCA) to explore the relationship between corporate governance and systematic risk during COVID-19. Our findings are as follows: 1) Good corporate governance can slash the impact of systematic risk, and state-owned enterprises (SOEs) are more resistant to systematic risk. 2) Enterprises with both good board and ownership structures can reduce systematic risk by enhancing the benign interaction with stakeholders through information disclosure, a deed that will, on the contrary, increase business risks. 3) If the members of the board have the concept of governance and related professional background, there is no need to increase the proportion of independent directors. 4) The higher the shareholding ratio of the top ten shareholders or the more dispersed overall equity of a company, the more significantly positive effect on stabilizing its operation; a poorly operated enterprise may diminish its operation risks by increasing the proportion of institutional shareholders and inviting them to participate in the company's operation. Based on the above findings, we put forward corresponding suggestions for enterprises and regulators.

Keywords: *corporate governance, systematic risk, fuzzy-set Qualitative Comparative Analysis*

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1. Introduction

In response to the outbreak of COVID-19 that swept the globe in just a few months, China has taken preventive measures such as traffic blockade, enterprise shutdown, and gathering restrictions. These measures have driven most enterprises into stagnation, but since the fixed cost of operation continues to occur, many enterprises are facing the crisis of poor management or even bankruptcy. Indeed, the COVID-19 pandemic has affected almost all industries and battered China and the world at large. It is a typical systematic risk event with far-reaching influence and cannot be prevented by prior human efforts to avoid losses. Many enterprises, however, still survived the impact despite inevitable losses during the pandemic and suffered relatively slighter losses than other enterprises; in other words, their ability to resist risks is relatively high. Detailed analyses of how the pandemic impacts enterprises and their response strategies show that financial management is a key point. Because income sources plummet during the pandemic, enterprises cannot make ends meet. This plight is a great test on their abilities of fund scheduling, budgeting and cost control, as well as abilities to coordinate financial relations, and whether there is enough tax knowledge to take appropriate preferential policies to mitigate the financial losses caused by the pandemic, etc. In terms of cost control, enterprises should deliberate on how to broaden source channels and use correct investment decisions, reduce fixed costs, improve the flexibility of capital use, and coordinate with creditors and financial institutions to obtain financial support; in terms of preferential policies, they should seek, with the help of professionals or consultants, appropriate preferential policies, such as tax reduction, social security return or deferred payment, so as to reduce the impact of the pandemic on their financial conditions. All the above ways to deal with the pandemic entail a good corporate governance concept and sufficient professionals. Given the comprehensive impact of systematic risks, the ability to resist risks cannot be achieved in a short time. Thus enterprises also need to control all business risks and formulate preventive measures, to ensure the interests of stakeholders and realize effective operation and strategic objectives. In this way, enterprises may achieve their business objectives stably.

Since systematic risk is by definition a force majeure, many previous studies focus on issues about corporate governance and non-systematic risk, and there are few on systematic risk. Nevertheless, the measures against the pandemic are somewhat related to the company's management system. In addition, in recent years, relevant literature has shown that corporate governance can effectively mitigate the negative impact of systematic risk on enterprises, especially the one caused by financial

factors. [1], for example, finds that establishing an audit committee can effectively reduce systematic risk. Systematic risk events that do not occur as frequently as in 2020 can examine the substantive effect of corporate governance on systematic risk response. Our study therefore aims to explore whether corporate governance of Chinese enterprises has played a role in resisting risks during the COVID-19 pandemic. This is a brand-new perspective, since most of the previous studies employ the Ordinary Least Square (OLS) method. The difference between this study and previous researches is that we take into account the complexity of the causal factors of social phenomena and that the characteristics and operating conditions of each industry are different. To this end, we discuss the detailed elements of corporate governance, and crossly compare and analyze results via fuzzy-set Qualitative Comparative Analysis (fs/QCA) and Ordinary Least Square (OLS) methods, to attempt more than one causal solution. We expect that the research results can provide Chinese enterprises with a strong theoretical basis for implementing corporate governance, guide their corporate governance policy-making, and help them formulate relevant key implementation policies. The following chapters are a literature review, a summary of research hypotheses, methodology, analysis of our empirical results, and our suggestions based on our findings.

2. Literature Review

For related issues of the relationship between corporate governance and systematic risk, we will in this chapter review relevant literature and summarize our research hypothesis.

2.1. Definition and Functions of Corporate Governance

Corporate governance, an agent issue arising from the separation of "ownership" and "management right" of enterprises, belongs to risk management in corporate operation. The concept of corporate governance was developed earlier in the WEST. In 1992, Britain issued the Cadbury report, which incorporated internal control into the corporate governance framework, to avoid infringement on the interests of shareholders. The *OECD Principles of Corporate Governance* issued by the Organization for Economic Cooperation and Development (OECD) in 1999 formulated the standards and guidelines for corporate governance based on governance by governments, international organizations and the private sectors. The guidelines have become the common standard for corporate governance all over the world. In a narrow sense, corporate governance refers to the mechanism of owners supervising and balancing managers, i.e., to reasonably define the relationship between the rights and responsibilities of owners and managers through institutional arrangements; in a broad sense, corporate governance refers to a set of formal or informal, internal or external systems to coordinate the interests relationship between the company and the owner's equity, so as to ensure the reasonability and effectiveness of the company's decision-making and ultimately safeguard the interests of the company. According to the varied modes and structures of corporate governance in different countries because of their distinctive conditions and cultures, corporate governance can be generally divided into the British and U.S model, the German and Japan model and the Family model.

Based on the above definitions and the structures of various models, we can conclude that corporate governance falls into board structure and equity structure. The structure of the board of directors includes 1) the mechanism of external professionals supervising the main owners, and 2) the participation of professionals in the operation. The ownership structure includes the influence of major shareholders on the company's operation. These two levels mainly form the basis for evaluating the performance of corporate governance. In addition, because the main function of corporate governance is to reduce the information asymmetry inside and outside the company, information disclosure by listed companies is crucial to their governance. The operation information of a company must be disclosed to all stakeholders in time for prompt and corresponding decisions. Indeed, listed companies shall actively disclose necessary information, as stipulated in Article 9 of the latest *Code of Corporate Governance for Listed Companies* issued in 2018 by China Securities Regulatory Commission (CSRC):

A listed company should establish smooth and effective communication channels with shareholders, and facilitate shareholders' exercise of right to information of, participation in the decision-making on, and oversight of major matters of the company.

Hence, the performance of information disclosure must also be included in the elements of corporate governance.

2.2. Definition and Indicators of Systematic Risk

Systematic risk, also known as market risk or non-diversifiable risk, affects the whole market and cannot be eliminated through asset portfolios. Such risk include war, regime change, natural disasters, economic cycle, inflation, energy crises, and macro policy adjustment. The magnitude of systematic risk is usually measured by the beta coefficient. The beta coefficient of a single asset is a quantitative index that indicates the degree to which the change of the return rate of a single asset is affected by the change in the market average return rate, that is, the size of the systematic risk contained in a single asset relative to the average risk of the market portfolio. The most commonly recognized systematic risk coefficient originates from the capital asset pricing model (CAPM) [2], formulated as follows:

$$\beta_i = \frac{Cov(R_i, R_m)}{\sigma_m^2} = \frac{\rho_{im} \cdot \sigma_i \cdot \sigma_m}{\sigma_m^2} = \rho_{im} \cdot \frac{\sigma_i}{\sigma_m}$$

Where β_i stands for the beta coefficient of individual assets, R_i for the yield of individual assets, and R_m for the average market yield. Up to now, many evaluation methods of beta coefficient have been developed [3,4,5,6,7].

2.3. Literature on the Relationship between Corporate Governance and Systematic Risk

As defined, systematic risk cannot be reduced or avoided by human efforts. Recently, however, scholars have found that corporate governance can, to some extent, effectively lessen the impact of systematic risk [8,9]. According to [10], when small and micro enterprises have a low asset correlation coefficient, the investment and loan linkage carried out by commercial banks has the advantage of offsetting systematic risk. The reason behind this is that the asset correlation coefficient is significantly reduced thanks to the change in the capital market structure after the Split-Share Structure Reform. [11] explore how stock price collapse risk in systematic risk is affected by corporate governance or 'profit and loss' sustainability. They conclude that reasonable corporate governance methods, such as the selection of accounting policies and business means, will ensure the sustainability of the company's profit and surplus and improve the company's internal governance mechanism and ability to deal with risks. All these help a company reduce the risk of stock price collapse. [12] demonstrate that improving corporate governance quality, such as increasing the proportion of independent directors, separating the general management from the chair, increasing the number and remuneration of directors and senior executives, can markedly reduce the potential risk of stock market collapse. Different dimensions of corporate governance play different roles in the impact of equity pledge on financial risk [13]. The shareholding ratio of institutional investors pertains to the risk of stock price collapse and plays an enhanced role. The degree of equity concentration will also affect the stability of stock price. The higher the degree of equity concentration, the greater the positive impact of investor shareholding ratio on the risk of stock price collapse [14]. In addition, the research on Taiwan companies confirms that after setting up an audit committee, the systematic risk has indeed decreased considerably for those with low growth, multi-chain, multi-level ownership structure, low internal shareholding ratio and uncontrolled by the family, though not the case for most companies. This is because the enhanced regulation mechanism reduces over-investment by low-growth companies [1]. [15] believe that the different types of executive compensation adopted by the management in M & A will have a certain impact on the systematic risk. When managers get stock incentives, systematic risk may increase. If more external directors are elected during crises, a company will suffer less risk, a result applicable to systematic risk [16]. [17], however, show that companies with better corporate governance do not mean lower systematic risk, higher returns on investment or better risk-return ratio. In fact, systematic risk of a company is more affected by external finance, policies, and the international environment and less by the operation and governance mechanisms of individual companies [18].

As a part of the external mechanism of corporate governance, tax can affect the internal capital structure through various stakeholders, thereby intervening in the choice of corporate governance. Tax avoidance of a company will have an obvious impact on the mechanism and level of its governance. According to [19], when tax avoidance is mild, the cost of enterprise equity capital will decrease with increasing fierceness of tax avoidance; if the tax avoidance is radical, however, increased tax avoidance will induce various consequences, such as rising risks of stock price collapse and the ones caused by uncertain measurement of future net cash flow. There is, therefore, a certain relationship between tax avoidance and systematic risk of a corporate. Under the circumstance of mild corporate tax avoidance, the degree of tax avoidance is negatively correlated with its systematic risk; the correlation between moderate tax avoidance and systematic risk cannot be determined; radical tax avoidance is positively correlated with systematic risk. That is, there is a U-shaped curve in this regard. As the core of a corporate, the board of directors plays a major role in its governance. Improving board governance can increase the ownership of the company's management, and higher management ownership raises the quality of board governance. Those two combined will be conducive to less lower-end systematic risk [20]. According to [21], corporate governance of listed Chinese companies has a significant impact on systematic risk. Based on a panel data model, they empirically unfold a negative correlation between the board scale/ the proportion of independent directors and system risk. The higher the company's equity concentration and the proportion of senior executives, the greater its systematic risk will be. Moreover, the systematic risk of state-owned listed holding companies is greater than that of non-state-owned holding ones, and greater risk exists in companies without a concurrent chairman and general manager than with.

Based on the above literature, we can see that corporate governance has a certain impact on systematic risk. Few studies, however, comprehensively and systematically summarize the relationship between the two; worse still, there are even few studies on this topic in recent years. It is therefore pragmatic, against the backdrop of the COVID-19 pandemic, to deeply explore the relationship between, and influence of, corporate governance and systematic risk.

3. Methodology

Based on the above literature review, we hypothesize that corporate governance can reduce systematic risk. We take the systematic risk during COVID-19 as the dependent variable and the performance of corporate governance as the independent one. Taking China's A-share listed companies as a sample, we investigate the relationship between corporate governance performance and systematic risk during the pandemic in 2020. The sample data are obtained from WIND and CSMAR databases. After deleting the incomplete data first and then the extreme values, we obtain a total of 1,329 samples.

In terms of the variable setting of corporate governance, we adopt the approach of [22], and integrate the following six variables into a comprehensive index from the two levels of "board structure" and "ownership structure", representing the overall corporate governance, as shown in the table below.

Table 1. Description of relevant variables of comprehensive indicators of corporate governance

Variable	Definition	Calculation method	Literature source
1. Composition of the board of directors			
(1) Board size (SIZE)	Total number of board seats.	From large to small and transformed into percentile grade scores. The closer the value is to 1, the better the governance mechanism is.	[23]
(2) The general manager concurrently serves as the chairman (CHGM)	Dummy variable. 0 when the general manager concurrently serves as the chairman, otherwise 1.	If the general manager concurrently serves as the chairman. A value of 0 indicates poor corporate governance; A value of 1 means that the corporate governance mechanism is better.	[24]
(3) Number of independent directors and supervisors (INDEP)	Number of independent directors and supervisors / total number of directors and supervisors.	Rank from small to large and convert it into percentile grade score. The closer the value is to 1, the better the governance mechanism is.	[25]
2. Ownership structure			
(1)Shareholding ratio of directors and supervisors (DIRECST)	Number of shares held by directors and supervisors / total number of shares of the company.	Sort from small to large and convert it into percentile grade score. The closer the value is to 1, the better the governance mechanism is.	[26]
(2)Shareholding ratio of top ten shareholders (BIG10ST)	The shareholding ratio of the top ten shareholders in the company.	Sort from small to large and convert it into percentile grade score. The closer the value is to 1, the better the governance mechanism is.	[27]
(3)Shareholding ratio of institutional investors (INSTST)	Chartered funds, securities firms, insurance, social security funds, trusts, finance companies, banks and qualified overseas institutional investors.	Rank from small to large and convert it into percentile grade score. The closer the value is to 1, the better the governance mechanism is.	[28]

Note: the comprehensive index value of corporate governance is between 0 and 6. The closer it is to 6, the better the overall governance mechanism.

3.1. Research Methods

Considering the different operating conditions of the sample companies, we add the fs/QCA method, apart from OLS, for more in-depth discussion and thereby better practical value of our results. In terms of variable setting, the six elements of corporate governance in Table 1 are set as independent variables to help explore in more detail which of the six elements are the most important in resisting systematic risk. The following are the OLS and fs/QCA models.

3.1.1. OLS Model

$$BETA_{it} = \alpha_0 + \alpha_1 CGT_{it} + \alpha_2 DISCL_{it} + \alpha_3 SCALE_{it} + \alpha_4 DEBT_{it} + \alpha_5 AGE_{it} + \alpha_6 STATE_{it} + \alpha_7 IND_{it} + \varepsilon_{it} \quad (1)$$

$$BETA_{it} = \alpha_0 + \alpha_1 BOARDSUB_{it} + \alpha_2 STOCKSUB_{it} + \alpha_3 DISCL_{it} + \alpha_4 SCALE_{it} + \alpha_5 DEBT_{it} + \alpha_6 AGE_{it} + \alpha_7 STATE_{it} + \alpha_8 IND_{it} + \varepsilon_{it} \quad (2)$$

$$BETA_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 CHGM_{it} + \alpha_3 INDEP_{it} + \alpha_4 DIRECST_{it} + \alpha_5 BIG10ST_{it} + \alpha_6 INSTST_{it} + \alpha_7 DISCL_{it} + \alpha_8 SCALE_{it} + \alpha_9 DEBT_{it} + \alpha_{10} AGE_{it} + \alpha_{11} STATE_{it} + \alpha_{12} IND_{it} + \varepsilon_{it} \quad (3)$$

3.1.2. fs/QCA Model

$$\sim BETA = fx\left(\begin{matrix} CGT, DISCL, SCALE, \\ DEBT, AGE, STATE, IND \end{matrix}\right) \quad (4)$$

$$\sim BETA = fx\left(\begin{matrix} BOARDSUB,\ STOCKSUB, DISCL, \\ SCALE,\ DEBT, AGE, STATE, IND \end{matrix}\right) \quad (5)$$

$$\sim BETA = fx\left(\begin{matrix} SIZE, CHGM, INDEP, DIRECST, \\ BID10ST, INSTST, STOCKSUB, \\ DISCL, SCALE, DEBT, \\ AGE, STATE, IND \end{matrix}\right) \quad (6)$$

3.2. Variable Description

3.2.1. Dependent Variable

Dependent variable_-- systematic risk (BETA): we take the 2020 systematic risk as the dependent variable, and the sample data are the annual beta values of the CSMAR database as the alternative variable for systematic risk. In the fs/QCA model, "~" in "~ BETA" represents "negation", that is, which variables in the causal relationship of the model will cause lower systematic risk.

3.2.2. Independent Variables

3.2.2.1 Corporate governance: we adopt the total score of corporate governance (CGT), the subtotal score of board structure (BOARDSUB), and the subtotal score of ownership structure (STOCKSUB) in the corporate governance evaluation model of Yang and Wu (2009), as well as six detailed elements: the size of the board of directors (SIZE), the general manager and chairman being the same person (CHGM), the proportion of independent directors (INDEP), the shareholding ratio of directors (DIRECST), shareholding ratio of top ten shareholders (BIG10 ST) and institutional investors (INSTST)

3.2.2.2 Information disclosure rating of listed companies (DISCL): DISCL is divided into three levels: A, B and C. We convert the ratings from low to high to the corresponding scores of 1 to 3.

3.2.3. Control Variables

Control variables: the company size, the proportion of liabilities to assets, the company age, the nature of property rights and industry.

3.2.3.1 Company size (SCALE): [29] find that debt leverage ratio and company size are the main factors affecting systematic risk. Therefore, we list the ratio of liabilities to assets as one of the control variables. The total assets of the sample company are taken as the alternative variable of the company size. We use the total assets of the sample companies as a proxy variable for

firm size, and adopt its natural logarithm to narrow the gap between the absolute value of this variable and other variables but not to affect their relationship.

3.2.3.2 Debt to asset ratio (DEBT): [29] find that debt leverage ratio and company size are the main factors affecting systematic risk. We therefore list the debt to asset ratio as one of the control variables.

3.2.3.3 Company age (AGE): [30] argue that the company age has a significant impact on the systematic risk. Company age is therefore used as one of the control variables, and the calculation basis is the number of years from the year of establishment to December 31, 2020.

3.2.3.4 Property right nature (STATE): according to [31], the state-owned shareholding level is closely related to the extent to which enterprises are affected by systematic risk. Thus we select the property right nature as one of the control variables-- a virtual variable. A state-owned enterprise (SOE) is set as "1", otherwise "0".

3.2.3.5 Industry type (IND): [32] reveal that most traditional industries are at lower risk than high-tech ones. In this study, therefore, we include industry type as one of the control variables and use dummy variables. IT industry set as "1"; otherwise, as "0".

3.3. About fs/QCA

fs/QCA is used to study causality, but it differs from the traditional quantitative method. In linear regression, for example, fs/QCA can only explore the relationship between specific explanatory variables and explained ones, and a single regression formula can only yield a set of causality. Nonetheless, in the social sciences, where phenomena are complex and a particular phenomenon may be caused by a combination of several different factors, fs/QCA can provide a more in-depth exploration of causality.

[33] proposes that QCA is a case-study-oriented approach to theoretical set research. That approach emphasizes the construction of the causal relationship of research topics from small sample data through the continuous dialogue between empirical data and related theories. This analysis is based on the set theory and Boolean algebra, i.e. examining the relationship between conditions and results in terms of sets rather than correlations, and using Boolean algebra algorithm to formalize the logical process by which people analyze problems. QCA attempts to go beyond the traditional case study approach by systematically investigating the causes of events, the interactions, and possible relationship combinations among internal generating factors. The method attempts to explain the key factors contributing to events, the interconnections between factors, and the complex combinations of generating factors that contribute to events, so as to deepen the understanding of the complex causality of events. [33] combines Boolean algebra and set theory to develop the QCA technique for dichotomous variables, for both explanatory and result variables of dichotomous variables; in other words, it is a definitive/clear crisp-sets QCA (cs/QCA). By introducing again fuzzy sets into QCA, [34] proposes fuzzy-sets QCA (fs/QCA).

Different from the traditional linear regression approach, fs/QCA in this paper can provide a combination of corporate governance elements that can help reduce the systematic risk, and will provide more substantive research suggestions.

4. Results

This chapter shows our empirical results. Firstly, all variables are analyzed via descriptive statistics, so as to conduct a preliminary and comprehensive review of all sample data.

Table 2. Descriptive Statistics (n = 1,329)

	Min.	Max.	Ave.	Std.
BETA	0.3127	1.6571	1.0400	0.2710
SIZE	0.0000	0.9880	0.3558	0.2546
CHGM	0.0000	1.0000	0.7276	0.4454
INDEP	0.0080	0.9840	0.3524	0.3523
BOARDSUB	0.4240	2.6300	1.4357	0.5466
DIRECST	0.0000	0.9900	0.4787	0.3178
BIG10ST	0.0090	0.9900	0.4995	0.2888
INSTST	0.0090	0.9900	0.4995	0.2888
STOCKSUB	0.3370	2.5460	1.4775	0.5245
CGT	1.1380	4.5550	2.9135	0.7516
DISCL	0.0000	3.0000	1.9676	0.7361
SCALE	10.5658	17.4561	13.3337	1.3216
DEBT	0.0742	1.0974	0.4647	0.2099
AGE	11.9945	36.3096	21.8898	5.4938
STATE	0.0000	1.0000	0.2867	0.4524
IND	0.0000	1.0000	0.1061	0.3081

Note 1: For the definition of each variable, see "3.2 Variable description".

As can be seen from Table 2, the data of variables in the samples are widely distributed, indicating that the corporate governance performance of each company differs greatly from the business conditions such as company size. The fs/QCA we adopt, therefore, may enhance the practical value of our conclusion. Regarding the average value and standard deviation of variables, most variables are abnormally distributed. It should thus be reasonable to winsorize extreme values.

Next, we perform the OLS method to check whether the fit index of the regression formula is within a reasonable range to determine whether our model design is rational. The results are listed in Table 3 to Table 5.

Table 3. Empirical results of model (1) (n = 1,329)

	Coef.	t	p	VIF
Con_	0.658	8.338	0.000***	
CGT	-0.036	-3.517	0.000***	1.155
DISCL	0.047	4.121	0.000***	1.346
SCALE	0.041	6.073	0.000***	1.532
DEBT	-0.164	-4.147	0.000***	1.336
AGE	-0.004	-2.678	0.007***	1.029
STATE	0.012	0.758	0.449	1.057
IND	0.007	0.298	0.766	1.007
F value	14.615	Significance	***	

Note 1: For the definition of each variable, see "3.2 Variable description".
Note 2: If $p <= 0.01$, the significance is * * *, if $0.01 < p <= 0.05$, the significance is * *, and if $0.05 < p <= 0.1$, the significance is *.

Table 4. Empirical results of model (2) (n = 1,329)

	Coef.	t	p	VIF
Con_	0.662	8.387	0.000***	
BOARDSUB	-0.024	-1.732	0.083*	1.085
STOCKSUB	-0.054	-3.698	0.000***	1.148
DISCL	0.048	4.264	0.000***	1.353
SCALE	0.042	6.212	0.000***	1.540
DEBT	-0.171	-4.295	0.000***	1.350
AGE	-0.004	-2.898	0.004***	1.055
STATE	0.009	0.545	0.586	1.076
IND	0.009	0.368	0.713	1.009
F value	13.271	Significance	***	

Note 1: For the definition of each variable, see "3.2 Variable description".
Note 2: If P < = 0.01, the significance is * * *, if 0.01 < < = 0.05, the significance is * *, and if 0.05 < p < = 0.1, the significance is *.

Table 5. Empirical results of model (3) (n = 1,329)

	Coef.	t	p	VIF
Con_	0.509	6.114	0.000***	
SIZE	-0.054	-1.643	0.101	0.699
CHGM	-0.009	-0.533	0.594	0.915
INDEP	0.012	0.536	0.592	0.802
DIRECTORST	0.096	3.557	0.000***	0.680
BIG10ST	-0.179	-5.934	0.000***	0.659
INSTITUTEST	0.018	0.512	0.609	0.498
DISCL	0.050	4.510	0.000***	0.737
SCALE	0.045	6.549	0.000***	0.606
DEBT	-0.156	-3.989	0.000***	0.738
AGE	-0.002	-1.606	0.108	0.889
STATE	0.023	1.415	0.157	0.887
IND	0.020	0.858	0.391	0.984
F value	13.166	Significance	***	

Note 1: For the definition of each variable, see "3.2 Variable description".
Note 2: If P < = 0.01, the significance is * * *, if 0.01 < p < = 0.05, the significance is * *, and if 0.05 < p < = 0.1, the significance is *.

Table 3 to Table 5 show the empirical results of research models (1) to (3). First, we check whether there is excessive homogeneity among the variables in the regression equation. The index of homogeneity is collinearity. As required in most academic literature, a VIF value of over 10 indicates excessive homogeneity among variables. There are also strict standards that set the upper limit of VIF to 5. Since the maximum VIF values in Table 3 to Table 5 do not exceed 1.54, we can confirm that the variables in our models are not exceedingly homogeneous.

Next, we test the F value, i.e., to examine whether two or more variables are significantly different in linear regression. A significant difference means predictive linear regression. Since the F values in Table 3 to Table 5 are all significant, the OLS model design in this study should be appropriate.

The empirical results from Table 3 to Table 5 show that the higher the degree of information disclosure, the greater the impact of systematic risk. Since information disclosure means disclosing the company's operating conditions to the public, the public will, accordingly, quickly obtain relevant information and make investment decisions when the external environment adversely impacts operation. Nevertheless, well-performed overall corporate governance and well-designed board and ownership structures all help to reduce systematic risk; still, the effect of ownership structure is more obvious than that of board structure. By further exploring the constituent elements at both dimensions, we find that only the shareholding ratio of the top ten shareholders in the ownership structure has a significantly negative impact on systematic risk, while the shareholding ratio of the board of directors has a significantly positive impact.

The empirical results of the OLS method are the average results of the whole sample. Given that the operating conditions of the sample individuals contained in the whole sample vary considerably, we adopt the fs/QCA method for further discussion and more practical value of our results.

There are three main steps of the fs/QCA method. The first is to convert the actual figure of each variable into values of 0 to 1. This step needs to be calibrated and converted according to 95%, 50% and 5% of the actual figure of each variable. The calibration basis for them is shown in Table 6.

Table 6. Calibration basis for 5%, 50% and 95% of variables (n = 1,329)

Variable	95%	50%	5%
BETA	1.48	1.038	0.553
SIZE	0.905	0.416	0.045
CHGM	1	1	0
INDEP	0.942	0.498	0.008
BOARDSUB	2.403	1.424	0.424
DISCST	0.951	0.50	0
BIG10ST	0.951	0.50	0.049
INSTST	0.951	0.50	0.049
STOCKSUB	2.323	1.503	0.598
CGT	4.190	2.911	1.562
DISCL	3	2	1
SCALE	15.781	13.200	11.421
DEBT	0.829	0.453	0.151
AGE	31.745	21.773	13.084
STATE	1	0	0
IND	1	0	0

Note: For the definition of each variable, see "3.2 Variable description".

The second step is necessary condition analysis (NCA). A specific variable higher than 0.8 means that the variable is a necessary condition.

Table 7 shows that all variables are less than 0.8, except SOEs (STATE in the table) for which the consistency is greater than 0.8, meaning that SOEs are a necessary condition for systemic risk stability. SOEs are the characteristics of China's corporate governance, and the analysis of necessary conditions reveals the essential role of state-owned shareholding in enterprises.

Table 7. Analysis of necessary conditions (n = 1,329)

Variable	Consistency	Coverage	Variable	Consistency	Coverage
SIZE	0.563	0.694	~SIZE	0.772	0.621
CHGM	0.762	0.526	~CHGM	0.336	0.554
INDEP	0.509	0.614	~INDEP	0.712	0.581
BOARDSUB	0.694	0.656	~BOARDSUB	0.656	0.659
DIRECST	0.616	0.599	~ DIRECST	0.664	0.647
BIG10ST	0.664	0.648	~ BIG10ST	0.619	0.602
INSTST	0.646	0.630	~INSTST	0.634	0.617
STOCKSUB	0.660	0.645	~STOCKSUB	0.650	0.631
CGT	0.681	0.655	~ CGT	0.657	0.648
DISCL	0.658	0.635	~DISCL	0.699	0.688
SCALE	0.630	0.632	~SCALE	0.709	0.671
DEBT	0.662	0.661	~DEBT	0.658	0.626
AGE	0.673	0.667	~AGE	0.654	0.626
STATE	0.816	0.632	~STATE	0.570	0.749
IND	0.779	0.693	~IND	0.685	0.738

Note 1: "*" stands for "and";"~" stands for "negative".
Note 2: For the definition of each variable, see “3.2 Variable description”.

The third step is to establish a truth table as the basis for carrying out empirical results. This truth table automatically summarizes the data by fs/QCA 2.0 software on a case-by-case basis, to obtain all configurations of cause and result variables. Empirical results of the fs/QCA are shown in Table 8 to Table 10.

Table 8. Empirical results of fs/QCA of model (4) (n = 1,329)

	Solution	Raw coverage	Unique coverage	Consistency
1	IND*STATE*AGE*DEBT*~DISCL*~CGT	0.327	0.101	0.849
2	IND*STATE*~AGE*DEBT*~SCALE*~DISCL*CGT	0.270	0.053	0.864
3	IND*STATE*AGE*~SCALE*DISCL*CGT	0.322	0.111	0.839

Note 1: "*" stands for "and";"~" stands for "negative".
Note 2: For the definition of each variable, see “3.2 Variable description”.

Table 9. Empirical results of fs/QCA of model (5) (n = 1,329)

	Solution	Raw coverage	Unique coverage	Consistency
1	IND*STATE*~DEBT*~SCALE*DISCL*STOCKSUB*BOARDSUB	0.296	0.033	0.834
2	IND*STATE*AGE*~DEBT*DISCL*STOCKSUB*BOARDSUB	0.283	0.034	0.843
3	IND*STATE*AGE*DEBT*~SCALE*~DISCL*~STOCKSUB*~BOARDSUB	0.253	0.056	0.881
4	IND*STATE*~AGE*DEBT*~SCALE*~DISCL*~STOCKSUB*BOARDSUB	0.247	0.039	0.869

Note 1: "*" stands for "and", and "~" for "negative".
Note 2: For the definition of each variable, see “3.2 Variable description”.

Table 10. Empirical results of fs/QCA of model of model (6) (n = 1329)

	Solution	Raw coverage	Unique coverage	Consistency
1	IND*STATE*AGE*~DEBT*SCALE*DISCL*INSTST*~DIRECST*~INDEP*CHGM*SIZE	0.188	0.0460	0.866
2	IND*STATE*AGE*~DEBT*SCALE*DISCL*INSTST*BIG10ST*~DIRECST*INDEP*CHGM	0.140	0.012	0.911
3	IND*STATE*AGE*DEBT*~SCALE*~DISCL*~INSTST*~BIG10ST*DIRECST*INDEP*~CHGM*~SIZE	0.111	0.016	0.945
4	IND*STATE*~AGE*DEBT*~SCALE*~DISCL*~INSTST*BIG10ST*DIRECST*INDEP*CHGM*~SIZE	0.120	0.014	0.934
5	IND*STATE*AGE*DEBT*SCALE*DISCL*~INSTST*~BIG10ST*~DIRECST*INDEP*CHGM*~SIZE	0.117	0.008	0.924
6	IND*STATE*AGE*DEBT*SCALE*DISCL*~INSTST*BIG10ST*~DIRECST*~INDEP*CHGM*SIZE	0.141	0.011	0.925

Note 1: "*" stands for "and";"~" stands for "negative".
Note 2: For the definition of each variable, see “3.2 Variable description”.

Among the three solutions shown in Table 8, SOEs are the necessary conditions, and all the three contain industrial factors (IND), a result that follows the state’s current focus on the IT industry. Since the IT industry is state-encouraged, promising state-owned IT enterprises have relatively easy access to state support, even if they perform poorly and are financially disadvantageous in the short term. From the perspective of corporate governance, these three solutions can be summarized into two kinds. The first kind includes old companies with poor governance and financial structure and new ones with good governance but imperfect financial structure.

Threatened by the external environment, these companies should as far as possible hide information unfavorable to themselves, to avoid stakeholders' negative impressions and detrimental actions toward their operation. The second includes well-governed small-scale companies. When encountering external risks, these "small and beautiful" companies can get the support of stakeholders and reduce the adverse impact of systematic risk by disclosing favorable information to stakeholders. Our empirical results are consistent with those of the OLS method.

In Table 9, we evaluate the overall corporate governance from the two dimensions: the composition of the board and the equity structure. Here, we obtain four solutions. Same as the results in Table 8 is that SOEs and IT industry are the common conditions of the four solutions. After an in-depth analysis, we divide the four solutions into two categories: The first two solutions are companies with good corporate systems and governance (low debt ratio, and good board and equity structures). By disclosing good information, the companies can interact more benignly with stakeholders, thus reducing the adverse impact of systematic risk. The other two solutions are companies with poor corporate governance and financial structure. These companies tend to hide information to avoid external negative impressions and behaviors. The fourth solution includes emerging young companies that have a good board structure but lack a stable ownership structure and professional team for their operation. They therefore tend not to disclose information, despite their well-developed philosophy of corporate governance. All These show that the stability of equity and the professionalism of the executives lay a vital investment decision-making basis for investors. Our empirical results are consistent with those of the OLS method (the influence of ownership structure is greater than that of the board of directors).

In Table 10, we explore the key influencing factors of corporate governance from six detailed elements. Among them, the factors of SOEs and industries are the same as those in Table 8 and Table 9. Through an in-depth analysis, we summarize the six solutions in the table into four types: the first type includes the first and second solutions, i.e., companies with sound management concept (chairman and general manager not the same person), financial structure, and system (old and large companies). Because most of their company information is good news, active disclosure can improve the benign interaction with all stakeholders and thus reduce the adverse impact of systematic risk. The second type is the third solution, i.e., companies with a poor governance philosophy (chairman and general manager as the same person) and poor operating conditions (small-scale old companies with high debt ratio). In these companies, institutional investors hold a low ratio of shares, albeit a high proportion of independent directors in board and a high shareholding ratio of board of directors. On this basis, we can judge that most of the directors of such companies are non-professionals and therefore the information about their operation is usually not good news. Consequently, they are disinclined to disclose information, to avoid stakeholders' negative impression of them. The third type is the fourth solution. Different from the second type, this type includes emerging companies with imperfect financial structure and corporate system yet good governance concept (separate chair and general management positions and a high proportion of independent directors). They may have future planning, though they are disinclined to disclose information due to their unsound corporate systems. By doing so, they avoid misunderstanding by stakeholders and negative impacts on their operation. The fourth type includes the fifth and sixth solutions. The governance concept and financial structure of these companies are poor (poorly-operated old companies which may be inadequately professional, where the chairman and general manager are different but institutional investors hold a small proportion of shares). These companies disclose their information by convention thanks to their mature systems. Such disclosure can help stabilize the stock price, given the stable concentration of equity held by the top ten shareholders' or the excessive dispersion of equity. All these results are also consistent with those of the OLS in Table 7, indicating that the shareholding ratio of the board of directors is significantly positive with the systematic risk, and the top ten shareholders are significantly negative with that risk.

5. Conclusion

In this study, using the listed Chinese companies during COVID-19 as samples, we explore the effectiveness of corporate governance against systematic risk using the OLS and fs/QCA methods. Our research findings are as follows:

(1) Sound corporate governance can significantly mitigate the impact of systematic risk, and SOEs are more resilient to systematic risk.

(2) Whether they are in good financial conditions or have temporarily poor financial structure but hire professional personnel or institutions, enterprises with both good board and equity structures can interact benignly with stakeholders through information disclosure, thus reducing systematic risk; on the contrary, information disclosure will increase the business risk, if corporate governance performance and financial condition are poor.

(3) Regarding the structure of the board of directors, the proportion of independent directors does not need to be increased if the members of the board have a frontier governance philosophy and related professional knowledge.

(4) For the ownership structure, the higher the shareholding proportion of the top ten holders or the more dispersed the overall ownership of the company, the more positive and significant effect on stabilizing operation. When an enterprise operates poorly, increasing the proportion of institutional ownership and allowing institutional holders to participate in the company's operation can positively and significantly reduce its operation risk.

Based on the above research findings, we put forward our suggestions as follows:

(1) For enterprises: our empirical results show that sound corporate governance is indeed instrumental in resisting systematic risks. In terms of the board structure, we should evaluate our own needs, appropriately introduce professional external directors, and avoid the same person holding concurrent chair and general management positions. And the equity can be appropriately dispersed to institutional

investors to obtain professional operating resources and suggestions. Moreover, information disclosure is the communication channel between enterprises and stakeholders. Specifically, good news is a way to increase benign interaction but bad news will increase enterprise risk. Enterprises should thus pay attention to how to improve the adverse factors of their operation instead of hiding information.

(2) For regulators: information disclosure by listed companies is a very important part of corporate governance but not all investors or other stakeholders have sufficient professional judgment ability. Under certain circumstances, the adverse information of the enterprise is only a short-term phenomenon. Investors' misjudgement will not only jeopardize the enterprise, but also cause a great loss to the investors. We, therefore, suggest that regulators should improve the rules and regulations of information disclosure and formulate a more detailed and understandable framework for information expression, so as to accommodate the rights and interests of the enterprise and all stakeholders.

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