Research on the influence of minority shareholders' online voting on enterprise innovation -- An empirical study of the A-share listed companies in China's Shanghai and Shenzhen Stock Exchanges

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Abstract. Minority shareholders are important stakeholders of the company, which could influence the corporate innovation to a certain extent. This paper studies the impact of online voting by minority shareholders on corporate innovation, which could enrich the research and expand the theoretical mechanism of the voting role of small and medium shareholders. Taking the 2008-2020 years of China's A-share listed companies as a sample and using the relative proportion of minority shareholders to attend the general meeting to measure the online voting of minority shareholders and the rate of R&D investment to operating income to measure corporate innovation, we found that:(1)the degree of online voting participation of small and medium shareholders is significantly negatively associated to corporate innovation;(2) the degree of online voting participation of minority shareholders reduces the voice of the management , weakening the management's constraint on the interests of large shareholders (3) With the improvement of the shareholding balance, the impact of online voting participation of minority shareholders on enterprise innovation decreases significantly; the more the stake of the largest shareholder , the stronger the inhibitory effect of minority shareholders' online voting participation on enterprise innovation is.

Keywords: Minority shareholders, online voting, Enterprise innovation, Occupy.

1. Introduction

Minority shareholders are an important stakeholder of the company. Under the dual principal-agent relationship, they will suffer losses as a result of the majority shareholder reaping personal benefits with power and tunneling behavior. Besides, they may even face the joint appropriation by the major shareholders and the management, so the protection of minority shareholders has been widely concerned by the academic community. In China, there is a severe conflict between major and minority shareholders in the market (Jiang et al., 2010)[1].Because of the high cost of getting information and participation in governance (Claessens et al., 2002)[2], small and medium shareholders tend to vote with their feet or free-ride on their governance rights (Grossman and Hart, 1980; Bharath et al. 2013)[3][4]. And the problem of major shareholders, accompanied by corporate executives, encroaching on the interests of minority shareholders is particularly prominent (Li et al. 2004; Jiang et al. 2010; Zheng et al. 2013)[5][1][6], which seriously affects the healthy development of Chinese capital market (Zheng et al. 2016)[7].

Since the 1990s, due to the considerable growth of Internet, conditions for minority shareholders to take part in enterprise voting decisions through the Internet have gradually matured. Since 2004, the China Securities Regulatory Commission has issued a series of regulations and documents in conjunction with Chinese Shenzhen Stock Exchange, Shanghai Stock Exchange and other relevant institutions to encourage minority shareholders for their participation in enterprise governance. Under the conditions of policy support and technological development, China's online voting, classified voting and other systems have been gradually established and improved, which has promoted the

enthusiasm of minority shareholders and other relevant entities to participate in online voting (Hu et al., 2018)[8], while curbing agency costs (Bebchuk, 2005; Hu et al., 2018)[9][8], increasing the wealth of bondholders, and enhancing corporate social responsibility (Feng Y et al., 2021)[10].However, the existing literature mostly studies the impact of minority shareholders' network voting under the perspectives of corporate performance and social responsibility (Xing et al. 2009; Pan 2022; Feng Y et al. 2021)[11][12][10] or studies related issues such as the protection for minority shareholders' rights and interests (Zheng Guojian et al. 2013)[6], while studies related to "the impact of minority shareholders on corporate innovation " directly related research is almost absent. As an significant part of enterprise governance, innovation capacity building plays an essential function in the sustainable development of a company and a country's economy. Therefore, the role and mechanism of small and medium-sized shareholders' online voting participation in corporate innovation deserve to be explored in depth.

This paper selects the Chinese market to study the impact of minority shareholder network voting on corporate innovation for the following three main reasons. First, as a typical developing country, Chinese capital market has a large concentration of equity in listed companies, the capital market is still imperfect, and small and medium shareholders face serious benefit encroachment (Feng Y et al., 2021; Zheng et al., 2013)[10][6], making it an ideal subject for studying capital markets in developing countries. Second, the state-controlled system is a characteristic of China's capital market, and in 2018, state-controlled enterprises accounted for 56.3% of the total national enterprise assets of 859.6 trillion yuan, of which 41% of the whole assets of non-financial companies and 82% of the complete belongings of financial businesses, providing an ideal sample for studying the impact of network voting by small and medium shareholders in this particular market structure. Finally, China has been gradually promoting and improving network voting for small and medium-sized shareholders since 2004, providing an ideal policy environment for this paper's research.

Based on existing studies, this paper examines the role and mechanism of minority shareholder online voting on corporate innovation using a sample of Chinese A-share listed companies in Shanghai and Shenzhen from 2008 to 2020. We use the relative proportion of minority shareholders attending shareholders' meetings to measure minority shareholder online voting, and the proportion of R&D investment to operating revenue to measure corporate innovation. It is found that: (1) the degree of minority shareholder online voting is significantly and negatively related to corporate innovation; (2) management voice is negatively related to major shareholders' interest encroachment, moreover, the degree of minority shareholder online voting is positively related to major shareholders' interest encroachment. These indicate that the degree of minority shareholder online voting reduces management voice, weakens management's restraining effect on major shareholders' interest encroachment, and thus intensifies interest encroachment, which leads to the decline in corporate innovation; (3) The impact of minority shareholder online voting on enterprise innovation decreases with the increase of equity checks and balances. Other than that, the larger the stake of the largest shareholder, the stronger the inhibitory effect of minority shareholder online voting on enterprise innovation is.

The study of this paper may have the following two contributions: At first, compared with existing studies, this paper uses the latest data, which has a large sample size and strong reference significance. The research data in this paper are all from China Guotaian database from 2008 to 2020, from which more than hundreds of thousands of data are selected for processing and training, making the data interval longer and fresher, which is more informative and time-sensitive compared with previous studies.

Secondly, the study enriches the theoretical system related to network voting of small and medium shareholders to a certain extent. This paper researches the have an impact on of network voting on company innovation (in terms of the quantity of patents received and the share of corporate R&D investment) under the viewpoint of minority shareholders, which enriches and improves the theory of minority shareholders' governance, broadens the studies on the impact of network on capital market, and illustrates the mediating mechanism of this influence through data analysis and research, which

provides a reference for improving the protection to minority shareholders' interests and enterprise governance in the context of the network.

2. Theoretical hypothesis

Existing studies show that enterprise innovation is affected by both agency costs and financing constraints (He et al., 2022)[14]. In previous studies, on of which found in emerging capital markets such as China, the agency problem between controlling shareholders and minority shareholders, namely the second type of agency problems, is the main aspect of corporate governance (La Porta R, 1999)[15]. However, the first and second kind of agency cost problems caused by information asymmetry easily cause the infringement of the legitimate rights and interests of minority shareholders: major shareholders can violate the interests of minority shareholders through related transactions, earnings management and capital occupation.In addition, the more sevre the separation between the control right and the cash flow power of the controlling shareholders, the stronger its motivation and ability to hollow out the enterprise, and the greater the agency cost (Zuo et al., 2013)[16].Therefore,if the agency problem become more serious, the R&D investment of listed companies will be lower (Zuo et al., 2013)[16]. Under the network voting system, minority shareholders are more willing to exercise their right to make enterprise decisions to protect their interests (Li et al., 2012)[17], thereby reducing second-class agency costs, so as to safeguard their own interests, improve R&D investment and promote enterprise innovation. Set in the above analysis, this paper places ahead the following hypothesis:

H1a: Minority shareholder online voting is positively related to enterprise innovation.

As an important subject of enterprise governance, minority shareholders has a non-negligible impact on the company. With the increasing awareness of self-protection among minority shareholders and the development of Internet innovation, more and more small and medium shareholders have began to actively take part in enterprise governance by using their voting rights (Feng Y et al., 2021)[10]. In this context, there are many new achievements on the impact of small and medium shareholders in enterprise governance. According to the existing literature, this paper puts forward the following speculations on the impact of small and medium shareholders online voting on enterprise innovation: firstly, as minority shareholders lack the necessary information for making decisions, their active participation will distract management's attention and prevent management from effectively executing decision (Bainbridge, 2006)[18]. Thus it hinders the normal implementation of corporate innovation activities. Secondly, minority shareholders, who are overly concerned about the short-term performance of the firm and lack expertise (Zheng, 2016)[7], may veto innovation proposals that increase the firm's expenses in the brief term and enhance its competitiveness in the lengthy term, thus restricting the development of the firm's innovation activities. Finally, based on the catering theory of corporate dividends (Baker and Wurgler, 2004)[19], management will enhance surplus management (Baker and Wurgler, 2004; Kong, 2017)[19][20] and increase cash dividend distributions (Xu, 2020)[21] to cater to minority shareholders to stabilize share prices when they are actively involved. And this behavior will essentially reduce the capital stock of the firm and interfere with the investment in other corporate activities, thus reducing corporate innovation expenditures. Set in the above analysis, this paper places ahead the following hypothesis.

H1b: Minority shareholder online voting is negatively related to enterprise innovation.

3. Research design

3.1. Sample selection and data sources

With the purpose of more comprehensively examining and describing the influence of minority shareholder voting on corporate innovation in China, this paper takes 2008-2020 as the sample interval, selects Chinese Shanghai and Shenzhen A-share listed companies before 2021, and excludes the financial industry, ST and some samples with incomplete data, so as to exclude interference and

reflect the impact as accurately and comprehensively as possible. The data is mainly from the shareholder database, the basic information database of listed companies, the financial statement database, etc. in the CSMAR database in 2022. The data reflecting the online voting of minority shareholders mainly comes from the CSMAR governance structure database, and the data reflecting the innovation of listed companies is mainly from the R&D innovation database of Guotai'an listed companies.

3.2. Variable definition

(1) Explanatory variable: proportion of minority shareholders' online voting

The percentage of online voting by small and medium shareholders. Referring to the lookup of domestic and overseas scholars, most of them use the relative share of the range of small and medium shareholders to attend the general meeting to measure the voting situation of small and medium shareholders. Therefore, this paper refers to the study of the governance effect of minority shareholders in the network environment by Hu et al (2018)[8]. The relative proportion ($Vote_{i,t}$) of the index is constructed to more accurately reflect the changes in the aspect of enterprise innovation:

$$Vote_{i,t} = (Votew_{i,t} - Votex_{i,t})/1000\ (\ 1+Votex_{i,t}\ )$$

(2) Explained variable: company innovation

The proportion of R & D expenditure in operating revenue (%). Referring to previous research on enterprise innovation (Luo et al., 2019; He et al., 2022)[22][14], as the explained variables need to measure the enterprise innovation, the amount of patents and the ratio of R&D investment to operating revenue are selected as the explained variables, so as to reflect the changes in enterprise innovation more accurately. The proportion of R & D expenditure to operating revenue mainly measures and reflects the enterprise's emphasis on innovation, which can be measured from the aspect of R & D investment.

(3) Control variable

In addition to the proportion of minority shareholders voting, the variations of enterprise innovation caused by internal governance, corporate finance and other factors should also be considered. Referring to previous research on company innovation (Wan et al., 2020; Jia, Liu, 2021)[23][24], we select the following control variables: company size, asset liability ratio, net profit rate of total assets, return on net assets, number of directors, proportion of independent directors, shareholding ratio of the largest shareholder, etc. The natural logarithm is used to verify the impact of these control variables on corporate creation. At the same time, this paper also controls the fixed effects of year, province and ind. The definition of variables in this paper can be seen in Table 1.

Table 1 Variable definition

Symbol	Variable definition
Year	Year
Symbol	Codes of securities listed on Shanghai Stock Exchange, Shenzhen Stock Exchange and Beijing stock exchange.
Vote	The difference between the number of participants at the general meeting of shareholders who voted online and those who did not vote online / the number of shareholders who participated in the general meeting of shareholders who did not vote online
Patents	Number of patents filed by enterprises per year
RDSpendSumRatio	Proportion of R & D investment in operating revenue
Size	Natural logarithm of total assets gen Size=ln(total assets)
Lev	Gen Lev= total liabilities/total assets
ROA	Gen ROA = net profit margin of total assets
ROE	Gen roe = return for equity
Board	The natural logarithm of the amount of directors
Indep	Independent Directors divided by the number of directors
Top1	Number of shares held by the largest shareholder/total number of shares
Balance1	The shareholding ratio of the second largest shareholder divided by the shareholding proportion of the first largest shareholder
TobinQ	Value of circulating stock market + number of non tradable shares×Net assets per share + book value of liabilities) / total assets
INST	Total institutional investor holdings divided by outstanding share capital
Mshare	The number of management shareholding divided by total share capital
ShortName	Stock abbreviations listed on the Shanghai Stock Exchange, Shenzhen Stock Exchange and Beijing Stock Exchange
IndustryCode	2012 version of the industry classification code of the China Securities Regulatory Commission
PROVINCECODE	Province Code of registered address of listed company
PROVINCE	Province of registered address of listed company

3.3. Model

For the purpose of testing the impact of online voting of small and medium-sized shareholders on corporate innovation, this paper constructs the fixed effect model of the following years and industries:

$$RDSpendSum_{i,t\text{-}1} = \beta_0 + \beta_1 Vote_{i,t} + \sum \beta_{i,t} Controls_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t}$$

Among them, dependent variable *RDSpendSum* in order to study the proportion of expenditure in operating revenue and measure enterprise innovation, the higher the value, the stronger the enterprise innovation. Independent variable *Vote* is the proportion of online voting of minority shareholders of the enterprise, which measures the online voting participation of minority shareholders. The greater the value, the greater the degree of participation of minority shareholders in on-line balloting. It will promote enterprise innovation, that is, there is a positive effect. On the contrary, there is a negative effect. Meanwhile, with the consideration that there is a certain time lag in the impact of the online voting participation of small and medium shareholders on enterprise innovation, this paper deals with the dependent variable with a lag of 1 period, which not only takes into account the time-consuming transfer between variables in practice, but also reduces the technical in order to reduce the endogeneity interference problem of reverse causality as much as possible *Controls*. It is a series of control variables that have potential impact on enterprise innovation capability, which includes *Size, Lev, ROA, ROE, Board, Indep, Top1, Balance1, TobinQ, INST, Mshare*.

4. Analysis of empirical results

4.1. Descriptive statistics

Firstly, the independent variables, dependent variables, and manage variables had been analyzed through descriptive line statistics. Table 2 indicates a complete of 29689 samples selected in this paper for dependent variables RDSpendSum. The mean value is 3.37, the standard deviation is 4.429, the minimum value is 0, the median is 2.430, and the maximum value is 24.18; For the independent variables Vote The mean fee was 0.0260, the standard deviation was 0.0390, the minimum cost was 0, the median used to be 0.0140, and the maximum cost was once 0.263. For the manage variables such as Size, Lev, and ROA, the descriptive statistical information are shown in Table 2.

Table 2 Descriptive statistics

Variable	N	Mean	SD	Min	p50	Max
RDSpendSum	29689	3.374	4.429	0	2.430	24.18
Vote	29689	0.0260	0.0390	0	0.0140	0.263
Size	29689	22.21	1.282	19.98	22.02	26.06
Lev	29689	0.425	0.205	0.0610	0.417	0.889
ROA	29689	0.0410	0.0650	-0.236	0.0400	0.209
ROE	29689	0.0650	0.130	-0.601	0.0740	0.340
Board	29689	2.119	0.197	1.609	2.197	2.639
Indep	29689	0.377	0.0540	0.333	0.364	0.571
Top1	29689	0.340	0.147	0.0900	0.318	0.728
Balance1	29689	0.370	0.285	0.0140	0.293	0.993
TobinQ	29689	2.043	1.356	0	1.624	8.446
INST	29689	0.375	0.237	0	0.380	0.870
Mshare	29689	0.138	0.197	0	0.00800	0.680

4.2. Correlation analysis

The correlation coefficient analysis of the main variables shows that there is a considerable passive linear correlation between the degree of minority shareholders' network voting participation and the proportion of research expenditure to operating revenue at the 1% level with a correlation coefficient of -0.082, which tentatively proves that the degree of minority shareholders' network voting participation is negatively correlated with corporate innovation.

4.3. Collinearity test

Next, calculate the variance inflation coefficient VIF of the independent variable and the control variable to verify if multicollinearity exists between the variables. Generally, 10 is used as the judgment frontier. There is no multicollinearity when VIF<10, there is strong multicollinearity when 10<=VIF<100, and the model has extreme multicollinearity when VIF>=100. As to the results, it can be concluded that the VIF of both the independent variable and the collection of control variables that have an underlying have an effect on on the enterprises' innovation capability is much less than 10, which indicates that there is no multicollinearity amongst the variables, and the model is nicely constructed.

4.4. Baseline regression

The following Table 3 is partly a Baseline regression on the independent, dependent, and control variables to calculate the regression coefficients in the model. There are three cases: In the column (1), only the dependent variable RDSpendSummRatio and the independent variable vote were involved in the regression, and the time effect and industry effect were fixed; In the column (2), the variables involved in the regression include not only dependent variables and independent variables, but also all control variables mentioned in this paper, but not fixed time effect and industry effect;In

the column (3), time effect and industry effect are fixed on the basis that the second case covers all variables. In the three cases, the regression coefficient between the dependent variable and the independent variable is negative, and the significance is strong. Accordingly, it can confirm that there is a prominent negative correlation between the independent variable and the dependent variable, that is, there is a meaningful negative effect between the network voting of minority shareholders and enterprise innovation, and the degree of network voting of minority shareholders will reduce enterprise innovation, validating hypothesis H1b.

Table 3 Baseline result and Channel analysis

	Dependent variable: RDSpendSumRatio			Occupy
	(1)	(2)	(3)	(4)
Vote	-1.699***	-5.237***	-1.083**	0.011*
	(-3.84)	(-9.55)	(-2.36)	(1.88)
Constant	0.697	5.039***	0.609	0.137***
	(1.45)	(5.99)	(0.70)	(13.79)
Controls	NO	YES	YES	YES
Year FE	Yes	No	Yes	Yes
Industry FE	Yes	No	Yes	Yes
Observations	29,689	29,689	29,689	18,684
Number of Symbol	4,432	4,432	4,432	2,620

4.5. Mechanism Analysis

As a typical transition and emerging market country, China's corporate equity concentration (Firth et al., 2006a)[25], compared to minority shareholders, the interests of large shareholders are relatively common. (Liang and Chen, 2015)[26], and the second kind of agency problem is relatively serious. At the same time, the major shareholders and the management has strong combats of interest. (Liang and Chen, 2015)[26].When the pay performance sensitivity of the management is high, the management is motivated to improve the company's performance rather than collude with the major shareholders (Wang and Xiao, 2011)[27], which restricts the tunneling large shareholders' action. However, as the interests of large shareholders are relatively hidden, the management often becomes the "scapegoat" (Luo, 2012)[28].The increase of the participation of minority shareholders in online voting restricts the behavior of the management (Hu, et al., 2018)[8], weakens the decision-making right of the management, and reduces the obstacles for the major shareholders to change the management. Therefore, the increasing frequency of management turnover reduces the pay performance sensitivity of management (Liang and Chen, 2015)[26]weakens the mechanism of management's encroachment on the interests of major shareholders (Liang and Chen, 2015)[26], intensifies the expropriation of major shareholders' interests, leads to the reduction of enterprise innovation input and weakens enterprise innovation (Zhang et al., 2022; Wang et al., 2022)[29][30]. To solve the problem, this article tests the relationship between the interests of large shareholders and shareholders in the network with the following model

$$Occupy_{i,t} = \beta_0 + \beta_1 Vote_{i,t} + \sum \beta_{i,t} Controls_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t}$$

It can be seen from column (4) of Table 3 that the online voting participation of minority shareholders (Vote) is significantly positively correlated with the occupation of large shareholders' interests (Occupy), and the management shareholding ratio (Mshare) is negatively correlated with the occupation of large shareholders' interests to a large degree(Occupy), which is significantly related to the above. It is consistent with the analysis of the paper, which shows that the change of the interests of large shareholders is a mechanism with great importance for the participation of minority shareholders to influence enterprise innovation.

4.6. Robustness checks

To dismiss the impact of missing variables on research reliability, this article draws on existing studies and uses the method of adding control variables and controlling for individual fixed effects to conduct robustness tests on the central finding. After the above treatment, the conclusions of this paper still hold.

4.6.1 Adding control variables

To cut down the conflict of omitted variables and other influencing factors on the conclusion, this paper controls for the capital structure and financial situation of listed enterprises in the regression. Drawing on the existing studies (Qin et al, 2021; Shao et al, 2016) [31][32], this paper selects total asset turnover ratio *ATO*, accounts receivable ratio *REC*, inventory ratio *INV*, fixed assets ratio *FIXED*, operating revenue growth rate *GROWTH*, book-to-market ratio *BM* for measurement, and records them as *Control-N*. From column (1) of Table 4, this paper finds that the significance for the regression coefficient on the percentage of online voting (*Vote*) by minority shareholders of enterprises did not change significantly, and the test results are consistent with above after controlling for relevant factors such as capital structure and financial situation of listed companies in the regression.

4.6.2 Controlling for individual fixed effects

In addition to controlling for year and industry fixed effects in the previous section, this paper tries to manage for individual fixed effects to test the affect of corporate minority shareholder community vote casting more fastidiously on corporate innovation primarily based on the mitigation of endogeneity. From column (2) of Table 4, we can find that the regression coefficient of the corporate small and medium shareholders' network voting share (Vote) is still considerably negative, indicating that the major finding of this paper still holds after controlling for individual fixed effects.

Table 4 Robustness checks and Heterogeneity checks

	Dependent variable: RDSpendSumRatio				
	(1)	(2)	(3)	(4)	(5)
Vote	-0.851*	-0.937**	-1.615*	-0.401*	-1.290**
	(-1.829)	(-2.003)	(-1.922)	(-1.923)	(-2.124)
cross1					2.706*
					(1.678)
Constant	3.740***	-0.248	2.216	1.499	0.980
	(3.481)	(-0.258)	(1.341)	(1.328)	(0.717)
Controls	YES	YES	YES	YES	YES
Controls-N	YES	NO	NO	NO	NO
Year FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Firm FE	NO	YES	NO	NO	NO
Observations	28,934	29,689	14,845	14,844	29,689
Number of Symbol	4,007	4,432	3,443	2,471	4,432

4.7. Heterogeneity test

Firstly, this paper divides the sample into two groups using the median equity checks and balances as the boundary, where column (3) of Table 4 is the larger group and column (4) of Table 4 is the larger group. The results show that the smaller the degree of equity checks and balances, the more significant the impact of minority shareholders' online voting on enterprise innovation, the greater the degree of equity checks and balances, the less significant the impact of minority shareholders' online voting on enterprise innovation. This is because the higher the degree of equity checks and balances, the stronger the control ability of external shareholders over internal shareholders, and the greater the pressure faced by internal shareholders. Under the strong control and pressure exerted by external

shareholders, conflicts and power struggles between major shareholders are more likely to occur, which means that the influence of major shareholders on corporate decision-making will increase, and the voice of small and medium shareholders will be reduced. further suppressed. Therefore, with the increase in the degree of equity checks and balances, the impact of online voting by small and medium shareholders on enterprise innovation becomes less and less significant.

Secondly, this paper uses the multiplication term of the minority shareholders' online voting and the largest shareholder's shareholding ratio to study the moderating effect of the largest shareholder's shareholding ratio on the relationship between minority shareholders' on-line balloting and company innovation. From column (5) of Table 4, the regression coefficient of the cross item between the on-line balloting of minority shareholders and the shareholding ratio of the biggest shareholder is considerably negative, which shows that the proportion of the biggest shareholder of the moderating variable has a giant strengthening impact on the relationship between the on-line balloting of minority shareholders and company innovation. According to the outcomes of preceding empirical studies, the degree of on-line balloting of minority shareholders will inhibit business enterprise innovation, and the greater the percentage of the greatest shareholder, the greater the diploma of inhibition for minority, and the degree of inhibition of minority shareholders' online voting on Enterprise Innovation will be appreciably strengthened.

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