

Research Article

Impact of Venture Capital on the Dividend Policy of Listed Companies and Management Platform Design

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Received 25 April 2022; Revised 10 May 2022; Accepted 12 May 2022; Published 6 June 2022

Academic Editor: Jie Liu

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This paper uses the data of Chinese A-share listed companies from 2003 to 2019 to study the impact of venture capital holdings on the dividend policy of listed companies. The research findings show that venture capital holdings increase the willingness to pay cash dividends and the payment level. This conclusion still stands after using the PSM matching method and other robustness methods, indicating that there is causality between venture capital holdings and the dividend policy of listed companies. Further research finds that the course of action for venture capital holdings to increase the willingness of listed companies to pay cash dividends and their dividend payment level is to increase the dividend payout ratio by alleviating the company's agency level. Further research finds that different types of venture capital will also have an impact on the dividend policy. Foreign investment venture capital organizations are more favorable for increasing the willingness of listed companies to pay cash dividends and their dividend payment level. In addition, the impact of venture capital holdings on the dividend policy is more obvious in the central and western regions where economic development is relatively backward and is less obvious in the eastern regions. Based on J2EE, a venture capital information management platform is designed and developed. The research of this paper shows that venture capital shareholding plays an important role in promoting dividend payment of listed companies, and has enriched the research results of the value-added role of venture capital. At the same time, from the perspective of dividend policy, it has brought to light the corporate governance effectiveness of venture capital and has provided certain theoretical evidence for the assertion that capital can better serve the real economy.

1. Introduction

The cash dividend policy is an important way for investors to share the business gain of an enterprise, an important means to protect the interests of investors, and an important tool to maintain the stability of the capital market [1]. In China, due to the short development cycle of the capital market, it takes time to uncover many development problems, and there is a large time lag in the follow-up of the regulatory system. Therefore, most listed companies do not pay cash dividends, and this has

become a “unique landscape” that accompanies the development of the Chinese capital market. The study of Lu and Wang [2] pointed out that the proportion of listed companies that did not distribute dividends in 1994 was about 9.28%, while the proportion of companies that did not distribute dividends rose sharply to 58.44% in 1998. Concomitantly, there is the problem of abuse resulting in a large amount of idle funds and free cash flow. In order to protect the interests of small and medium investors, restrain the excessive investment of listed companies, and promote the healthy development of the capital market,

the China Securities Regulatory Commission has continuously issued relevant policies since 2001 to encourage listed companies to distribute cash dividends. In 2004, a relevant policy was issued, stating that listed companies that have not distributed profits in the past three years are not allowed to issue shares publicly. In 2006, relevant policies were issued, requiring that the accumulated profits distributed by listed companies in cash in the past three years should not be lower than 20% of the average annual distributable profits achieved in the past three years. Additional revisions were made in 2008 to increase the profit distribution ratio to 30%. In 2012, the regulatory authorities further improved the regulations on dividend distribution, with a view to increasing return of investment for investors and thus promoting the healthy and sustainable development of the capital market. With the continuous improvement of policy perfection, China has gradually formed a special phenomenon of the “semimandatory” dividend policy, and the corresponding research is also plentiful. However, according to current documentary research findings, the implementation effect of the semimandatory dividend policy is not ideal, which also indirectly confirms the complexity of the “dividend policy problem”. The semimandatory dividend policy may affect the financial flexibility of growing companies, which is not conducive to their investment and development [3, 4], but it is still difficult to form strong policy constraints against the “Iron Roosters” listed companies that do not pay cash dividends [5, 6].

According to Jensen’s research [7], venture capital is a kind of special shareholder, that is, an “active investor”. One of the characteristics of venture capital that distinguishes it from other equity investments is that it will actively participate in the governance activities of investee companies, optimize the corporate governance structure, and ultimately achieve the goal of maximizing the value of its own investment. For the purpose of maximizing investment returns, will the venture capital holdings collude with major shareholders to “hollow out” the listed company, or will they constrain major shareholders, actively promote the distribution of cash dividends, protect the interests of small and medium shareholders, and alleviate the type II agency problem? If venture capital holdings can help alleviate the type II agency problem, then what mechanism will venture capital use to influence the dividend policy of listed companies?

In order to explain the above problems, this paper uses the data of all A-share listed companies in China from 2003 to 2019 to study whether venture capital holdings can help increase listed companies’ willingness to pay cash dividends and their level of dividend payment. The research results show that, compared with companies without venture capital holdings, companies with venture capital holdings have a stronger willingness to pay dividends and a higher level of dividend payment. Its impact mechanism is to promote the distribution of cash dividends by alleviating the agency problem of listed companies. In addition, the different characteristics of venture capital and the difference in

the level of economic development between different regions will have an impact on the cash dividend policy of investee companies.

The possible marginal contributions of this paper are as follows: Firstly, it enriches the relevant literature on the value-added role of venture capital. Previous studies have mostly focused on the impact of venture capital promotion on the listing of investee companies, promoting the specialization of investee companies, and affecting the investment and financing behavior of investee companies. However, there are few studies on the dividend policy of listed companies. Secondly, it expands research in the fields related to dividend policy. Previous studies on the influencing factors of cash dividends have focused on the impact of corporate profitability, company size, company growth ability, and ownership structure at the microlevel. However, there is less literature involved in research on the special shareholders of venture capital, and the research in this paper makes up for this gap.

The structural arrangement of the rest of this article is as follows: the second part is hypothesis; the third part is research design; the fourth part is empirical results; the fifth part is robustness and endogeneity checks; the sixth part is further research; the seventh part is design and implementation of venture capital information management platform based on J2EE, and the last part is the conclusion and implications.

2. Theoretical Analysis and Research Hypothesis

Will the participation of venture capital in the corporate governance of investee companies as an “active investor” help promote the distribution of cash dividends of listed companies?

First, from the perspective of the motivation of venture capital to actively participate in the governance of investee companies and influence the dividend policy of listed companies, there are two motives that affect the behavior of venture capital: on the one hand, the essence of venture capital is “financial investors”, and its ultimate goal is to obtain investment income [8]. Venture capital can obtain cash dividends and increase return on investment by actively encouraging investee companies to issue cash dividends. On the other hand, the operation mechanism of venture capital determines the fact that it will not hold the shares of listed companies for a long time, but will obtain capital gains and return on investment by successively reducing the shares of listed companies [9]. The impact of venture capital on dividend policy can play a role in providing the market with internal information of the company. According to the dividend signaling theory (signaling hypothesis), investors can know the company’s current operating conditions and future earnings expectations from its dividend announcements, so they can make corresponding investment choices and ultimately affect the stock price. If a listed company pays high level of cash

dividends, investors may think that the company has positive expectations for future earnings, and may be optimistic about the company's future development prospects, thereby driving up the stock price. If the listed company does not distribute cash dividends, investors may think that the earning capacity of the company is poor, and are affected in their judgment of the company's future value, which in turn leads to a drop in the stock price. Therefore, changes in dividend policy will cause stock price volatility [10, 11]. Research on China's capital market has also confirmed the signaling effect of dividend policy. For example, Chen et al. [12] confirmed that the first dividend distribution has a signaling effect, and Yu and Cheng [13] confirmed that dividend announcements also have signal transmission. Therefore, by influencing the cash dividend policy of investee companies, venture capital releases positive signals to the market about the company's future profit prospects, which helps to stabilize and even increase the stock price of listed companies, thereby increasing the capital gains of venture capital.

Second, from the perspective of the way that venture capital actively participates in the governance of investee companies and affects the dividend policy of listed companies, it is understandable how venture capital affects the cash dividend policy of listed companies. On the one hand, a large number of previous literature have confirmed that venture capital can provide all kinds of resources needed for the development of investee companies [14–18]. Dividend distribution will affect the investment and financing decisions of listed companies [19]. The implementation of the cash dividend policy requires listed companies to balance the relationship between profit distribution and subsequent retention of sufficient funds to meet subsequent development needs. Research on cash dividends has found that the cash dividend policy may reduce financial flexibility and increase the difficulty of financing growing companies [20]. In response to this problem, venture capital can help listed companies solve financing problems through their accumulated network resources and bring convenience to external debt and equity financing [21, 22]. The Gorman and Sahlman [23] survey found that 75% of US venture capital organizations not only provide funds directly to companies, but also actively help companies obtain equity or bond financing from other channels. Therefore, venture capital can effectively alleviate the financing pressure of listed companies for redevelopment after cash dividends are issued. On the other hand, previous studies have also fully certified the supervisory function of venture capital [24–27]. Venture capital can effectively restrain major shareholders from transferring residual income, abusing free cash flow to blindly expand investment, and establishing corporate empires that are detrimental to the interests of small and medium shareholders by playing an active supervisory role [28]. By promoting the distribution of cash dividends, the purpose of returning income to investors and protecting the interests of small and medium shareholders is realized.

Based on the above discussion, venture capital has sufficient motivation to actively participate in the supervision of the promotion of the cash dividend policy of listed companies. There are also ways to alleviate the possible negative effects of cash dividends, promote the governance role of cash dividends, and protect the interests of small and medium shareholders. In view of the above, this paper proposes the following hypotheses to be tested:

H1a: Companies that have acquired venture capital holdings are more likely to distribute cash dividends than companies that have not received venture capital holdings;

H1b: Companies that have acquired venture capital holdings have a higher cash dividend payout ratio than companies that have not received venture capital holdings.

3. Research Design

3.1. Sample Data. In this paper, all A-share listed companies from 2003 to 2019 are used as initial samples, and initial samples are screened and cleaned up according to the following criteria: (1) delete the samples of listed companies in the financial industry; (2) delete the samples of ST and *ST companies; (3) delete variable samples with missing values; and (4) in order to exclude the influence of extreme values, all continuous variables are winsorized.

3.2. Variable Setting

3.2.1. Dependent Variable. Willingness to pay dividend ($Div_{i,t}$): First, this paper uses $Div_{i,t}$ to measure the company's cash dividend distribution propensity. $Div_{i,t}$ is a dummy variable. For company i , when distributing cash dividends in year t , $Div_{i,t}$ takes 1; otherwise, it takes 0.

Dividend payment level ($Pay_{i,t}$): Second, this paper uses $Pay_{i,t}$ to measure the company's cash dividend payment level, $Pay_{i,t}$ is equal to listed company i , and the cash dividend paid in year t is divided by the company's net profit in that year.

3.2.2. Independent Variables. Venture capital ($VC_{i,t}$) is the main research object of this paper, and thus, this paper takes the existence of venture capital organizations among the top ten shareholders of listed companies as the main explanatory variable. $VC_{i,t}$ is a dummy variable. When there are venture capital organizations holding shares among the top ten shareholders of the listed company, the value of $VC_{i,t}$ is 1; otherwise, it is 0. First, venture capital organizations are identified according to the classification of shareholders of listed companies in the China Stock Market and Accounting Research (CSMAR) Database. Second, using the Stata software, the names of venture capital organizations are matched with the characteristics information of venture capital organizations obtained from the CVSource database. Finally, drawing on the practice of predecessors (Wu et al., 2012; Wang et al., 2014) [29, 30], the results of matching the

names of shareholders of listed companies and the full names of venture capital organizations are manually confirmed again.

3.2.3. Control Variables. In order to control the influence of other factors, this paper refers to previous studies and sets the following control variables: performance variable (*Roe*), which represents the company's earning capacity; company size (*LnSize*), which is the natural logarithm of the company's total assets at the end of the period; growth level (*Growth*), which is the year-on-year growth rate of the operating income at the end of the period; debt-to-asset ratio (*Lev*) which is total liabilities at the end of the period divided by total assets at the end of the period; cash flow (*Cash*), which is the net cash flow generated by operating activities per share; the ratio of independent directors (*Ind*), which is the ratio of the number of independent directors to the total number of the board of directors; the size of the board of directors (*BoardSize*), which is the total number of the board of directors; the shareholding ratio of the largest shareholder (*Top1*), which is the shareholding concentration of the largest shareholder; CEO duality (*Dual*), if the chairman is concurrently the general manager, take 1, otherwise take 0; property rights (*Soe*), when the listed company is a state-owned holding company, take 1, otherwise take 0; finally, dummy variables such as industry and year are controlled. The variable definition is shown in Table 1.

3.3. Empirical Models. First, in order to test the impact of venture capital stockholding on the company's willingness to pay cash dividends, this paper draws on the practices of Wang et al. (2007) [31] and Wang et al. (2014) [30] to construct the following Logit model.

$$\text{Div}_{i,t} = \beta_0 + \beta_1 \times \text{VC}_{i,t} + \beta_2 \times \text{Controls}_{i,t} + \text{Industry}_{FE} + \text{Year}_{FE} + \varepsilon_{i,t}. \quad (1)$$

In formula (1), the dependent variable is company's willingness to pay cash dividends $\text{Div}_{i,t}$ in the basic test, this paper uses pretax cash dividends per share to represent it; $\text{Div}_{i,t}$ is dummy variable, if the listed company i distributes cash dividends in year t , that is, the pretax cash dividend per share is not 0, then $\text{Div}_{i,t} = 1$; otherwise, it is 0. The independent variable is, whether there are venture capital organizations among the top ten shareholders of the listed company ($\text{VC}_{i,t}$). If the listed company i has venture capital organizations among the top ten shareholders in year t , then $\text{VC}_{i,t}$ takes the value 1; otherwise, it is 0. $\text{Controls}_{i,t}$ is a series of control variables. In addition, the industry and year fixed effects are controlled, and $\varepsilon_{i,t}$ is the residual term.

Second, in order to test the impact of venture capital holdings on the company's cash dividend payment level, this paper draws on the practices of Wang et al. [30] and Wu et al. [22] to construct the following OLS model.

$$\text{Pay}_{i,t} = \beta_0 + \beta_1 \times \text{VC}_{i,t} + \beta_2 \times \text{Controls}_{i,t} + \text{Industry}_{FE} + \text{Year}_{FE} + \varepsilon_{i,t}. \quad (2)$$

In formula (2), the dependent variable is the company's cash dividend payment level $\text{Pay}_{i,t}$; in the basic test, it is represented by the dividend distribution rate in this paper. $\text{Pay}_{i,t}$ is the listed company i , the cash dividends distributed in the t -th year are divided by the net profit of the company i in the current year. The independent variable is whether there are venture capital organizations among the top ten shareholders of the listed company ($\text{VC}_{i,t}$), if there are venture capital organizations among the top ten shareholders of listed company i in year t , then ($\text{VC}_{i,t}$) takes the value 1; otherwise, it is 0. $\text{Controls}_{i,t}$ is a series of control variables. In addition, the industry and year fixed effects are controlled, and $\varepsilon_{i,t}$ is the residual term.

4. Empirical Results

4.1. Descriptive Statistics. Descriptive statistics results are shown in Table 2. In terms of dependent variables, during the sample statistics period, the average dividend payment willingness of listed companies ($\text{Div}_{i,t}$) is 0.735, indicating that 73.5% of companies distributed cash dividends; the dividend payment level of listed companies, the mean value of the dividend distribution rate ($\text{Pay}_{i,t}$) is 0.08, and the standard deviation is 0.131. In terms of independent variables, the mean value of venture capital holdings ($\text{VC}_{i,t}$) is 0.182 and the standard deviation is 0.386, which indicates that companies that have obtained venture capital during the sample period accounted for about 18.2% of the total sample.

4.2. Basic Test. Table 3 is one of the basic empirical test results of this paper. The influence of venture capital holdings ($\text{VC}_{i,t}$) on the willingness of listed companies to pay dividends is shown in the table. Among them, the empirical results in column (3) show that having controlled a series of factors of the possibility of venture capital holdings influencing the propensity of listed companies to pay dividends, as well as the fixed effects of industry and year, venture capital holdings ($\text{VC}_{i,t}$) is significantly positive at the 5% significance level with a net effect value of 0.087, assuming that H1a is confirmed, that is, companies that have acquired venture capital holdings have more propensity to pay cash dividends than companies that have not acquired venture capital holdings.

Table 4 is one of the basic empirical test results of this paper. The impact of venture capital holdings ($\text{VC}_{i,t}$) on the dividend payment level ($\text{Pay}_{i,t}$) of listed companies is shown in the table. The empirical results in column (3) show that the estimated coefficient of venture capital holdings ($\text{VC}_{i,t}$) is significantly positive at the 1% significance level with a net effect of 0.006, assuming that H1b is confirmed, that is, companies that have acquired venture capital holdings have a higher cash dividend

TABLE 1: Variable definition.

Variable name	Variable symbol	Variable description
<i>Main variable</i>		
Willingness to pay dividends	$Div_{i,t}$	Indicates whether the listed company i will issue a cash dividend in the t year. If the pretax cash dividend per share is $\neq 0$, then $Div_{i,t} = 1$; otherwise, it is 0
Dividend payout level	$Pay_{i,t}$	Represents the dividend payment level of the listed company i in year t , which is equal to the cash dividend issued by listed company i in year t divided by the net profit of the year
Venture capital	$VC_{i,t}$	Dummy variable, if the company has VC holdings in the current year, the value is 1; otherwise, it is 0
<i>Control variable</i>		
Enterprise size	$LnSize$	Natural logarithm of total assets at the end of the current period
Growth	$Growth$	The growth rate of operating income at the end of the current period relative to the operating income at the end of the previous period
Cash holdings	$Cash$	Net cash flow from operating activities per share
Assets-liabilities ratio	Lev	Debt to asset ratio at the end of the period
Performance variable	Roe	Return on net assets
Proportion of independent directors	Ind	Proportion of independent directors = number of independent directors/size of the board of directors
Board size	$Boardsize$	Number of board of directors at the end of the year
Two jobs in one	$Dual$	When the two positions of the chairman and general manager are combined as one, take 1, otherwise take 0
The largest shareholder	$Top1$	The shareholding of the largest shareholder as a percentage of the total share capital
Nature of property rights	Soe	The nature of the property rights of the listed company, if the company is a state-owned enterprise, take 1, otherwise take 0
Industry dummy variable	$Industry$	According to the 2012 version of the industry classification standard of the China Securities Regulatory Commission
Year dummy variable	$Year$	The standard deviation of the stock's daily return for the year

TABLE 2: Descriptive statistics.

Variable name	Sample size	Mean value	Standard deviation	Minimum value	Maximum value
Div	28485	0.735	0.442	0.000	1.000
Pay	28485	0.080	0.131	0.000	0.761
Vc	28485	0.182	0.386	0.000	1.000
Roe	28485	0.079	0.075	-0.215	0.318
Lev	28485	0.439	0.199	0.056	0.858
$Growth$	28485	0.428	1.230	-0.662	9.189
$Cash$	28485	0.048	0.071	-0.167	0.249
$Dual$	28485	0.236	0.425	0.000	1.000
Ind	28485	0.370	0.052	0.286	0.571
$Boardsize$	28485	8.810	1.796	5.000	15.000
$Top1$	28485	35.634	15.137	8.950	74.960
Soe	28485	0.438	0.496	0.000	1.000
$LnSize$	28485	22.087	1.267	19.822	26.049

payout ratio than companies that have not acquired venture capital holdings.

4.3. Mechanism Test: Alleviating the Agency Problem. As one of the top ten shareholders of listed companies, venture capital holds shares of listed companies, and one of the ways to encourage listed companies to increase their willingness to pay dividends and the level of dividend payment is to play an active role in supervision and governance, and to promote active dividend distribution of listed companies, thereby alleviating and restraining tunneling of major shareholders and other problems that

damage the interests of small and medium shareholders, that is, by alleviating the agency problem between large shareholders and small and medium shareholders, improving corporate governance, thereby improving the dividend payment willingness and the dividend payment level of listed companies. Specifically, as an active investor, venture capital has motivation and the ability to actively alleviate the agency problem of listed companies. First, the motivation aspect. The operation mode of venture capital institution determines its need to maintain good social reputation. Reputational capital is a manifestation of the fund management level of venture capital organizations, and it is one of the important guarantees for venture capital

TABLE 3: Venture capital holdings and dividend payment propensity.

	(1) <i>Div</i>	(2) <i>Div</i>	(3) <i>Div</i>
<i>VC</i>	0.128*** (0.04)	0.114*** (0.04)	0.087*** (0.04)
<i>Roe</i>	11.175*** (0.32)	11.082*** (0.32)	11.758*** (0.34)
<i>Lev</i>	-3.817*** (0.10)	-3.981*** (0.10)	-3.723*** (0.11)
<i>Growth</i>	-0.071*** (0.01)	-0.075*** (0.01)	-0.083*** (0.01)
<i>Cash</i>	0.840*** (0.24)	1.178*** (0.25)	1.348*** (0.25)
<i>Dual</i>	-0.177*** (0.04)	-0.173*** (0.04)	-0.138*** (0.04)
<i>Ind</i>	-0.504 (0.33)	-0.276 (0.34)	-0.379 (0.34)
<i>Boardsize</i>	0.024** (0.01)	0.044*** (0.01)	0.061*** (0.01)
<i>Top1</i>	0.011*** (0.00)	0.013*** (0.00)	0.014*** (0.00)
<i>Soe</i>	-0.256*** (0.03)	-0.177*** (0.04)	-0.061 (0.04)
<i>LnSize</i>	0.611*** (0.02)	0.662*** (0.02)	0.579*** (0.02)
<i>Constant</i>	-11.434* (0.37)	-12.968*** (0.43)	-11.977*** (0.46)
Observations	28,485	28,468	28,468
Industry FE	NO	YES	YES
Year FE	NO	NO	YES
Wald	3612	4136	4316
Pseudo R2	0.182	0.205	0.216

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and *** is $p < 0.01$.

organizations to continue financing new funds and participate in investment activities of high-quality investee companies [32–34]. Therefore, by alleviating the agency problem of listed companies, venture capital increases the willingness of listed companies to pay dividends and their level of dividend payment, effectively protects the interests of small and medium shareholders and improves the company's governance level, which is conducive to the accumulation of its own reputational capital. Second, in terms of ability. The rich post-investment management experience of venture capital organizations has been confirmed by a large number of studies [22, 24, 25, 27, 29, 35–38]. Venture capital can effectively alleviate the conflicts of interest between large shareholders and small and medium shareholders by providing consultation for listed companies, thereby promoting the improvement of their own governance level, and dividend payment willingness and level.

In view of the above, the following inferences are made as follows.

Inference 4–1: The effect of venture capital holdings on the company's dividend policy is more pronounced in companies with more serious agency problem.

TABLE 4: Venture capital holdings and dividend payout levels.

	(1) <i>Pay</i>	(2) <i>Pay</i>	(3) <i>Pay</i>
<i>VC</i>	0.006*** (0.00)	0.006** (0.00)	0.006*** (0.00)
<i>Roe</i>	0.007 (0.01)	0.005 (0.01)	0.010 (0.01)
<i>Lev</i>	-0.071*** (0.01)	-0.083*** (0.01)	-0.082*** (0.01)
<i>Growth</i>	-0.003*** (0.00)	-0.003*** (0.00)	-0.003*** (0.00)
<i>Cash</i>	0.037*** (0.01)	0.049*** (0.01)	0.051*** (0.01)
<i>Dual</i>	-0.010*** (0.00)	-0.009*** (0.00)	-0.009*** (0.00)
<i>Ind</i>	0.013 (0.02)	0.021 (0.02)	0.020 (0.02)
<i>Boardsize</i>	0.003*** (0.00)	0.003*** (0.00)	0.003*** (0.00)
<i>Top1</i>	0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)
<i>Soe</i>	-0.016*** (0.00)	-0.012*** (0.00)	-0.011*** (0.00)
<i>LnSize</i>	-0.034*** (0.00)	-0.033*** (0.00)	-0.033*** (0.00)
<i>Constant</i>	0.821*** (0.03)	0.801*** (0.03)	0.791*** (0.03)
Observations	28,485	28,485	28,485
R-squared	0.165	0.177	0.183
Industry FE	NO	YES	YES
Year FE	NO	NO	YES
F	145.5	131.5	124.3
Adj R-squared	0.164	0.175	0.181

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and *** is $p < 0.01$; all regression coefficient estimates are based on robustness adjusted for corporate clustering standard error.

In reference to the research of Wang and Guo (2021) [39], dividend information is a part of the company's information disclosure, and the company's overall information disclosure level is an important response to agency problem. Therefore, drawing on the research of Dechow et al. [40] and Kothari et al. [41], the absolute value of the controllable accrued profit is selected as the proxy variable (*DA*) of the company's information disclosure level. This section groups the samples according to the median of the information disclosure level, and divides the samples into two groups: companies with higher information disclosure quality ($DA \leq MidDA$) and companies with lower information disclosure quality ($DA > MidDA$).

Table 5 reports one of the test results of inference 1, namely, the effect of the quality of corporate information disclosure on the willingness to pay dividends. Among them, column (1) is the group with better information disclosure quality, and column (2) is the group with poor information disclosure quality. As can be seen from Table 5, in the group with better information disclosure quality, although the coefficient of venture capital is

TABLE 5: Information disclosure quality and willingness to pay dividends.

	(1) $DA \leq MidDA$ <i>Div</i>	(2) $DA > MidDA$ <i>Div</i>
<i>VC</i>	0.051 (0.06)	0.124** (0.06)
<i>Roe</i>	10.520*** (0.39)	13.259*** (0.65)
<i>Lev</i>	-3.738*** (0.15)	-3.650*** (0.16)
<i>Growth</i>	-0.084*** (0.02)	-0.075*** (0.03)
<i>Cash</i>	0.609** (0.28)	3.977*** (0.65)
<i>Dual</i>	-0.094* (0.05)	-0.193*** (0.06)
<i>Ind</i>	-0.314 (0.48)	-0.251 (0.49)
<i>Boardsize</i>	0.055*** (0.02)	0.066*** (0.02)
<i>Top1</i>	0.011*** (0.00)	0.017*** (0.00)
<i>Soe</i>	0.022 (0.05)	-0.136** (0.06)
<i>LnSize</i>	0.598*** (0.03)	0.562*** (0.03)
<i>Constant</i>	-11.824*** (0.64)	-12.489*** (0.68)
Observations	14,241	14,222
Industry FE	YES	YES
Year FE	YES	YES
Wald	2229	2202
Pseudo R2	0.215	0.226

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and *** is $p < 0.01$.

positive, it is not significant. However, in the group with poor information disclosure quality, the coefficient of venture capital is significantly positive. The above regression results show that in the sample of companies with poor information disclosure quality, the role of venture capital in alleviating the agency problem is more obvious, which proves that venture capital can promote the inference of listed companies' willingness to pay dividends by alleviating the agency problem.

Table 6 reports one of the test results of inference 1, that is, the impact of the quality of corporate information disclosure on the level of dividend payments. As can be seen from Table 6, in the group with better information disclosure quality, although the coefficient of venture capital is positive, it is not significant. But in the group with poor information disclosure quality, the coefficient of venture capital is significantly positive. The above results show that in the companies with poor information disclosure quality, the role of venture capital in alleviating the agency problem is more obvious, which proves the inference that venture capital encourages listed companies to improve the level of dividend payment by alleviating the agency problem. The above results show that inference 1 in this section is confirmed.

TABLE 6: Information disclosure quality and the dividend payment level.

	(1) $DA \leq MidDA$ <i>Pay</i>	(2) $DA > MidDA$ <i>Pay</i>
<i>VC</i>	0.005 (0.01)	0.007** (0.00)
<i>Roe</i>	0.021* (0.01)	-0.014 (0.02)
<i>Lev</i>	-0.078*** (0.01)	-0.082*** (0.01)
<i>Growth</i>	-0.002*** (0.00)	-0.003*** (0.00)
<i>Cash</i>	0.034*** (0.01)	0.084*** (0.03)
<i>Dual</i>	-0.007** (0.00)	-0.011*** (0.00)
<i>Ind</i>	0.015 (0.02)	0.030 (0.03)
<i>Boardsize</i>	0.003*** (0.00)	0.003*** (0.00)
<i>Top1</i>	0.001*** (0.00)	0.001*** (0.00)
<i>Soe</i>	-0.007** (0.00)	-0.017*** (0.00)
<i>LnSize</i>	-0.032*** (0.00)	-0.034*** (0.00)
<i>Constant</i>	0.762*** (0.03)	0.823*** (0.03)
Observations	14,247	14,232
R-squared	0.169	0.205
Industry FE	YES	YES
Year FE	YES	YES
F	81.61	97.45
Adj R-squared	0.163	0.199

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and *** is $p < 0.01$; all regression coefficient estimates are based on robustness adjusted for corporate clustering standard error.

5. Endogeneity and Robustness Checks

5.1. Endogenous Processing. The basic test above proves the influence of venture capital on the dividend policy of listed companies, but the above results are likely to be affected by selection bias, that is, because of the "selection effect" of venture capital on the investee company, there may be existing differences between the treatment group and the control group, which leads to the difference between the dividend policies of the treatment group and the control group. In order to alleviate the endogeneity issue caused by sample selection bias, this paper uses the propensity score matching method (PSM) to select a group of new control groups with the most similar characteristics for companies that have acquired venture capital holdings, thereby reducing the systematic differences between firms with venture capital holdings and firms without venture capital holdings. The specific matching method is as follows: Taking 2003–2019 as the sample period, the control group is companies that are not selected by venture capital during the sample period, and the variables that affect the choice of

TABLE 7: PSM matching balance effect.

Variable	Unmatched matched	Mean		% bias	% reduct bias	t -test t	$p > t $
		Treated	Control				
Roe	U	0.0805	0.0786	2.500		1.570	0.116
	M	0.0805	0.0816	-1.600	37.30	-0.790	0.430
Lev	U	0.446	0.437	4.300		2.790	0.00500
	M	0.446	0.443	1.400	68	0.700	0.486
Cash	U	0.0431	0.0493	-8.700		-5.620	0
	M	0.0431	0.0440	-1.300	85.50	-0.640	0.520
Dual	U	1.773	1.762	2.800		1.790	0.0730
	M	1.773	1.781	-1.900	32.40	-0.970	0.334
Boardsize	U	8.849	8.801	2.700		1.740	0.0820
	M	8.849	8.831	1	61.80	0.530	0.597
Top1	U	35.25	35.72	-3.100		-2.010	0.0440
	M	35.25	35.49	-1.600	49.50	-0.800	0.423
Soe	U	0.463	0.432	6.100		4	0
	M	0.463	0.464	-0.200	97.50	-0.0800	0.937
LnSize	U	22.30	22.04	20		13.31	0
	M	22.30	22.30	-0.100	99.40	-0.0600	0.954

venture capital holdings are sorted out, including specifically, performance variables, company debt ratio, cash holdings, the ratio of CEO duality, the size of the board of directors, the shareholding ratio of the largest shareholder, the nature of corporate property rights, and the size of the company, and use them as covariates to perform logit regression, to obtain propensity matching scores, and to find a suitable control group for the experimental group according to the nearest neighbor 1 : 1 matching method, among them, the caliper radius is selected as 0.01.

The balance test results in Table 7 can reflect the matching effect of PSM. From the t -test, except ROE, other covariates show significant differences before matching, but after PSM, the differences between covariates disappear, illustrating the fact that PSM reduces the systematic difference between the experimental group and the control group, and the effect of PSM is better than that of the control group. In addition, from the perspective of deviation percentage, the standardized differences of covariates are all below 10%. Compared with what is before matching, the standardized deviations of most variables are greatly reduced. Based on the above analysis, PSM satisfies the equilibrium assumption better.

The regression results based on the samples after the propensity score matching method are shown in Table 8. It can be seen from Table 8 that after using propensity score matching, the influence coefficient of venture capital holdings on the dividend payment willingness and the dividend payment level of listed companies is still significantly positive. It shows that after controlling possible endogeneity problem, the results are still robust.

5.2. Robustness Check

5.2.1. Replacing Dependent Variables and Models. In order to enhance the robustness of the basic test results, in reference to the methods of Wu et al. [29] and Wang et al. [30], this section firstly uses the method of replacing

variables and corresponding models to check the robustness of the basic test results. Specifically, this subsection replaces the measurement method of the dependent variable and selects the dividend per share (DPS) instead of the dividend payout ratio. The formula is as follows: dividends per share = dividend distribution rate * earnings per share, and the Tobit model is used accordingly to recheck the null hypothesis. The results are shown in Table 9. Column (3) of Table 9 shows that after changing the dependent variable measurement method and using the corresponding model, the coefficient of venture capital ($VC_{i,t}$) is still significantly positive at the 1% significance level, and the net effect is 0.005. That is to say, venture capital holdings can effectively increase the dividend payment level of listed companies.

5.2.2. Substitution of Independent Variable. In reference to the research of Wang et al. [30], this section uses the method of replacing independent variables to test the robustness of basic test results. Specifically, it is to use venture capital holdings ($VCholding$) to replace the original independent variable if there is existing venture capital ($VC_{i,t}$) among the top ten shareholders and repeat regression. The results are shown in Tables 10 and 11.

It can be seen from column (3) of Table 10 that after replacing the independent variable, the regression coefficient of venture capital holdings ($VCholding$) on the willingness of listed companies to pay cash dividends ($Div_{i,t}$) is significantly positive at the 1% significance level with a net effect of 0.007. That is to say, the larger the venture capital's holdings, the more favorable it is to increase the willingness of listed companies to pay dividends.

It can be seen from column (3) of Table 11 that after replacing the independent variable, the regression coefficient of venture capital holdings ($VCholding$) on the level of cash dividend payment ($Pay_{i,t}$) of listed companies is significantly positive at the 1% significance level, with a net effect of 0.001. That is to say, the greater the amount of venture capital

TABLE 8: Regression results of the propensity score matching method.

	(1) <i>Div</i>	(2) <i>Pay</i>
<i>VC</i>	0.097* (0.06)	0.007** (0.00)
<i>Roe</i>	9.834*** (0.53)	-0.029 * (0.02)
<i>Lev</i>	-4.104*** (0.19)	-0.080*** (0.01)
<i>Growth</i>	-0.044 * (0.03)	-0.003** (0.00)
<i>Cash</i>	1.098** (0.45)	0.030 (0.02)
<i>Dual</i>	-0.054 (0.07)	-0.007* (0.00)
<i>Ind</i>	-0.254 (0.62)	0.034 (0.03)
<i>Boardsize</i>	0.071*** (0.02)	0.004*** (0.00)
<i>Top1</i>	0.014*** (0.00)	0.001*** (0.00)
<i>Soe</i>	-0.136** (0.07)	-0.008** (0.00)
<i>LnSize</i>	0.622*** (0.03)	-0.032*** (0.00)
<i>Constant</i>	-12.679*** (0.79)	0.776*** (0.03)
Observations	9,058	9,072
R-squared		0.195
Industry FE	YES	YES
Year FE	YES	YES
Wald	1236	—
Pseudo R2	0.189	—
F	—	65.44
Adj R-squared	—	0.186

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and *** is $p < 0.01$.

holdings, the more conducive it is for increasing the payment level of cash dividends of listed companies.

In conclusion, whether it is concerning the willingness to pay cash dividends or the level of cash dividend payment, the null hypothesis still stands after the independent variable is replaced, and the conclusion remains robust.

6. Further Research

6.1. Venture Capital Experience. The value-added services and supervision responsibilities of venture capital organizations to investee companies will be affected by the different characteristics of venture capital. In their research, Zhang and Liao [42] divided the background of Chinese venture capital organizations into four categories, namely, state-owned, private, foreign investment, and mixed backgrounds. Venture capital organizations of different backgrounds have different operating mechanisms, different scope and capabilities of resource acquisition, and large differences in the demand for return on investment. Therefore, the shareholding of venture capital organizations of different backgrounds will have significantly different impacts on the

TABLE 9: Replacing dependent variables and models.

	(1) <i>DPS</i>	(2) <i>DPS</i>	(3) <i>DPS</i>
<i>VC</i>	0.001 (0.00)	0.007*** (0.00)	0.005*** (0.00)
<i>Roe</i>	0.720*** (0.02)	0.490*** (0.02)	0.460*** (0.01)
<i>Lev</i>	-0.201*** (0.01)	-0.177*** (0.01)	-0.172*** (0.01)
<i>Growth</i>	-0.005*** (0.00)	-0.003*** (0.00)	-0.003*** (0.00)
<i>Cash</i>	0.223*** (0.02)	0.075*** (0.01)	0.105*** (0.01)
<i>Dual</i>	-0.013*** (0.00)	-0.002 (0.00)	-0.001 (0.00)
<i>Ind</i>	-0.020 (0.03)	0.045 (0.03)	0.004 (0.02)
<i>Boardsize</i>	-0.000 (0.00)	0.001 (0.00)	0.002** (0.00)
<i>Top1</i>	0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)
<i>Soe</i>	-0.028*** (0.00)	-0.017** (0.01)	-0.008 * (0.00)
<i>LnSize</i>	0.033*** (0.00)	0.040*** (0.00)	0.036*** (0.00)
<i>Constant</i>	-0.582*** (0.04)	-0.783*** (0.05)	-0.707 (0.03)
Observations	28,485	28,359	28,359
R-squared	0.301	0.629	0.648
Industry FE	NO	YES	YES
Year FE	NO	NO	YES
F	128.7	86.57	355.1
Adj R-squared	0.300	0.578	0.598

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and *** is $p < 0.01$; all regression coefficient estimates are based on robustness adjusted for corporate clustering standard error.

business decisions of investee companies. From the perspective of operation mechanism, as the development of China's venture capital market is far behind in comparison with the international venture capital market, foreign venture capital organizations have rich international investment experience superior to other types of venture capital organizations [43]. Therefore, in each stage of venture capital, including the selection of investment projects, the cultivation, and supervision of investment projects, a relatively standardized and mature mechanism has been formed. However, China's local venture capital organizations have a short development cycle and limited market experience. In particular, venture capital organizations with a state-owned background have special strategic objectives, and their operating mechanisms cannot be completely market-oriented [44, 45], as previous studies have also proved this. For example, Yu et al. [46] shows that, compared with venture capital organizations of other backgrounds, venture capital with a state-owned background does not significantly promote corporate innovation. From the perspective of resource acquisition, because the foreign venture capital industry started earlier and developed more maturely, the accumulation of resources is more abundant, including good

TABLE 10: Shareholding and dividend payment willingness.

	(1) <i>Div</i>	(2) <i>Div</i>	(3) <i>Div</i>
<i>VCholding</i>	0.005*** (0.00)	0.005*** (0.00)	0.007*** (0.00)
<i>Roe</i>	11.022*** (0.32)	10.935*** (0.32)	11.560*** (0.34)
<i>Lev</i>	-3.803*** (0.10)	-3.973*** (0.10)	-3.676*** (0.11)
<i>Growth</i>	-0.070*** (0.01)	-0.074*** (0.01)	-0.083*** (0.01)
<i>Cash</i>	0.802*** (0.24)	1.155*** (0.25)	1.337*** (0.25)
<i>Dual</i>	-0.175*** (0.04)	-0.171*** (0.04)	-0.132*** (0.04)
<i>Ind</i>	-0.519 (0.33)	-0.285 (0.34)	-0.399 (0.34)
<i>Boardsize</i>	0.019* (0.01)	0.039*** (0.01)	0.057*** (0.01)
<i>Top1</i>	0.008*** (0.00)	0.010*** (0.00)	0.009*** (0.00)
<i>Soe</i>	-0.232*** (0.03)	-0.153*** (0.04)	-0.018 (0.04)
<i>LnSize</i>	0.619*** (0.02)	0.670*** (0.02)	0.577*** (0.02)
<i>Constant</i>	-11.715*** (0.37)	-13.249*** (0.43)	-12.194*** (0.46)
Observations	28,485	28,468	28,468
Industry FE	NO	YES	YES
Year FE	NO	NO	YES
Wald	3615	4142	4355
Pseudo R2	0.183	0.206	0.218

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and *** is $p < 0.01$.

cooperation with investment banks, underwriters, law firms, and accounting firms, as well as political resources, such as government agencies, etc. These relationship networks can provide important support in the process of corporate governance. Organizations of other backgrounds, on the one hand, have a slight disadvantage in terms of resource advantages compared with foreign venture capital, and on the other hand, their investment demands may be quite different from foreign venture capital; especially for state-owned venture capital organizations, their investment demands are not limited to capital returns, and even to a certain extent, capital return demands give way to strategic demands, for example, in recent years, China has successively established two phases of the State-owned Enterprise Structural Adjustment Fund, and in September 2021, the National Energy Group Green and Low-Carbon Development Investment Fund was established. This type of venture capital often undertakes the important political mission of promoting the realization of important national strategic goals and promoting industrial and regional economic development [47, 48]. Based on the above analysis, in this section, venture capital organizations are divided into foreign investment capital and nonforeign investment capital according to the capital background of venture capital, and it is expected that listed companies held by foreign investment capital will have

TABLE 11: Shareholding and the dividend payment level.

	(1) <i>Pay</i>	(2) <i>Pay</i>	(3) <i>Pay</i>
<i>VCholding</i>	0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)
<i>Roe</i>	-0.016 (0.01)	-0.018* (0.01)	-0.008 (0.01)
<i>Lev</i>	-0.067*** (0.01)	-0.079*** (0.01)	-0.075*** (0.01)
<i>Growth</i>	-0.003*** (0.00)	-0.003*** (0.00)	-0.003*** (0.00)
<i>Cash</i>	0.033*** (0.01)	0.047*** (0.01)	0.049*** (0.01)
<i>Dual</i>	-0.009*** (0.00)	-0.009*** (0.00)	-0.008*** (0.00)
<i>Ind</i>	0.011 (0.02)	0.019 (0.02)	0.019 (0.02)
<i>Boardsize</i>	0.002*** (0.00)	0.002*** (0.00)	0.002*** (0.00)
<i>Top1</i>	0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)
<i>Soe</i>	-0.013*** (0.00)	-0.009*** (0.00)	-0.007*** (0.00)
<i>LnSize</i>	-0.033*** (0.00)	-0.033*** (0.00)	-0.033*** (0.00)
<i>Constant</i>	0.791*** (0.02)	0.770*** (0.02)	0.780*** (0.03)
Observations	28,485	28,485	28,485
R-squared	0.175	0.188	0.194
Industry FE	NO	YES	YES
Year FE	NO	NO	YES
F	154.7	141.4	134.7
Adj R-squared	0.175	0.186	0.191

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and *** is $p < 0.01$; all regression coefficient estimates are based on robustness adjusted for corporate clustering standard error.

a stronger willingness to pay cash dividends. The results are shown in Table 12.

The results in Table 12 show the effect of venture capital holdings on the willingness of listed companies to pay dividends. The results in column (2) show that the coefficient of the foreign investment group is significantly positive at the 10% significance level, while the nonforeign investment group is not significant. Therefore, the inference of this subsection is confirmed. The venture capital with foreign investment background, using its own experience, has played an active supervisory role, effectively restrained the agency behavior of listed companies, and increased the willingness of listed companies to pay dividends.

6.2. Regional Development Level. As China is a large country with a vast territory, there are large cultural gaps between regions, and the level of economic development is very unbalanced [49, 50]. In terms of the degree of market-oriented development, the market-oriented development degree of the eastern coastal provinces has matured progressively, while the nonmarket-oriented factors in the economic development of the central and western regions

TABLE 12: Background of foreign capital and willingness to pay dividends.

	(1) Nonforeign <i>Div</i>	(2) Foreign investment <i>Div</i>
<i>VC</i>	0.070 (0.04)	0.081* (0.04)
<i>Roe</i>	11.761*** (0.34)	11.762*** (0.34)
<i>Lev</i>	-3.738*** (0.11)	-3.725*** (0.11)
<i>Growth</i>	-0.082*** (0.01)	-0.083*** (0.01)
<i>Cash</i>	1.392*** (0.26)	1.346*** (0.25)
<i>Dual</i>	-0.139*** (0.04)	-0.136*** (0.04)
<i>Ind</i>	-0.422 (0.34)	-0.378 (0.34)
<i>Boardsize</i>	0.060*** (0.01)	0.061*** (0.01)
<i>Top1</i>	0.014*** (0.00)	0.014*** (0.00)
<i>Soe</i>	-0.071* (0.04)	-0.059 (0.04)
<i>LnSize</i>	0.583*** (0.02)	0.579*** (0.02)
<i>Constant</i>	-12.003*** (0.47)	-11.986*** (0.46)
Observations	27,953	28,437
Industry FE	YES	YES
Year FE	YES	YES
Wald	4258	4313
Pseudo R2	0.217	0.216

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and ***, ** is $p < 0.01$.

TABLE 13: Regional development level and dividend payment willingness.

	(1) Eastern <i>Div</i>	(2) Central and western <i>Div</i>
<i>VC</i>	0.062 (0.05)	0.174** (0.07)
<i>Roe</i>	12.043*** (0.43)	11.734*** (0.55)
<i>Lev</i>	-3.381*** (0.13)	-4.400*** (0.20)
<i>Growth</i>	-0.092*** (0.02)	-0.067*** (0.03)
<i>Cash</i>	1.408*** (0.32)	1.263*** (0.44)
<i>Dual</i>	-0.162*** (0.05)	-0.045 (0.07)
<i>Ind</i>	-0.741* (0.45)	-0.092 (0.55)
<i>Boardsize</i>	0.053*** (0.01)	0.070*** (0.02)
<i>Top1</i>	0.015*** (0.00)	0.010*** (0.00)
<i>Soe</i>	-0.119** (0.05)	0.142** (0.06)
<i>LnSize</i>	0.508*** (0.02)	0.729*** (0.03)
<i>Constant</i>	-10.689*** (0.62)	-15.205*** (0.76)
Observations	19,418	9,035
Industry FE	YES	YES
Year FE	YES	YES
Wald	2783	1626
Pseudo R2	0.215	0.229

Note. The marking criteria for statistical significance in this table are as follows: * is $p < 0.10$, ** is $p < 0.05$, and ***, ** is $p < 0.01$.

still occupy relatively important regions. The imbalance of regional development affects the supervision and governance of venture capital in at least two aspects. First, the degree of legal perfection. Regions with developed markets tend to have better legal facilities, more robust investor protection mechanisms, and more standardized corporate governance-related policies. In the event there are behaviors that harm the interests of investors, investors can hold the company accountable in a more timely manner, and at the same time, when the regulator is unable, they can still more efficiently punish behaviors that harm the interests of investors [51]. Second, information transparency. The eastern coastal area was the first to complete the reform and opening up, and in the development of the market economy, the development of various standardized facilities is relatively complete. In the central and western regions, where economic development is relatively backward, the corporate governance mechanism, supervision mechanism, and information disclosure mechanism may be more backward than those in the eastern region, information transparency is low, and there are more nonmarket factors interfering with the company's operations and decision-making. In conclusion, in regions with a low level of economic

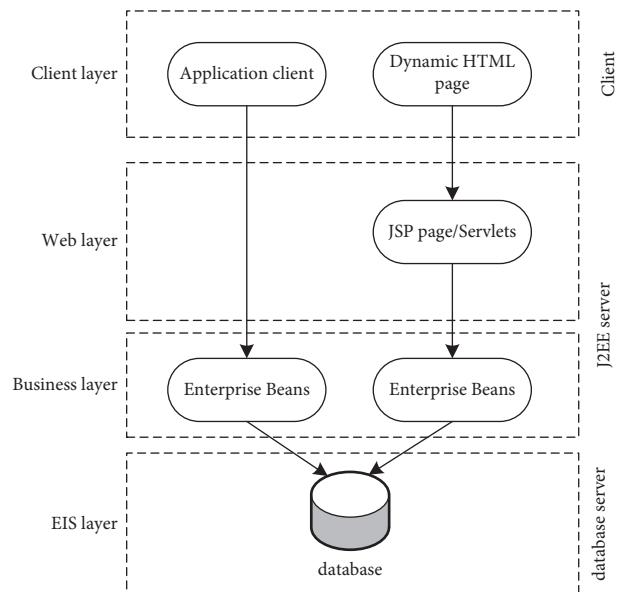


FIGURE 1: J2EE architecture.

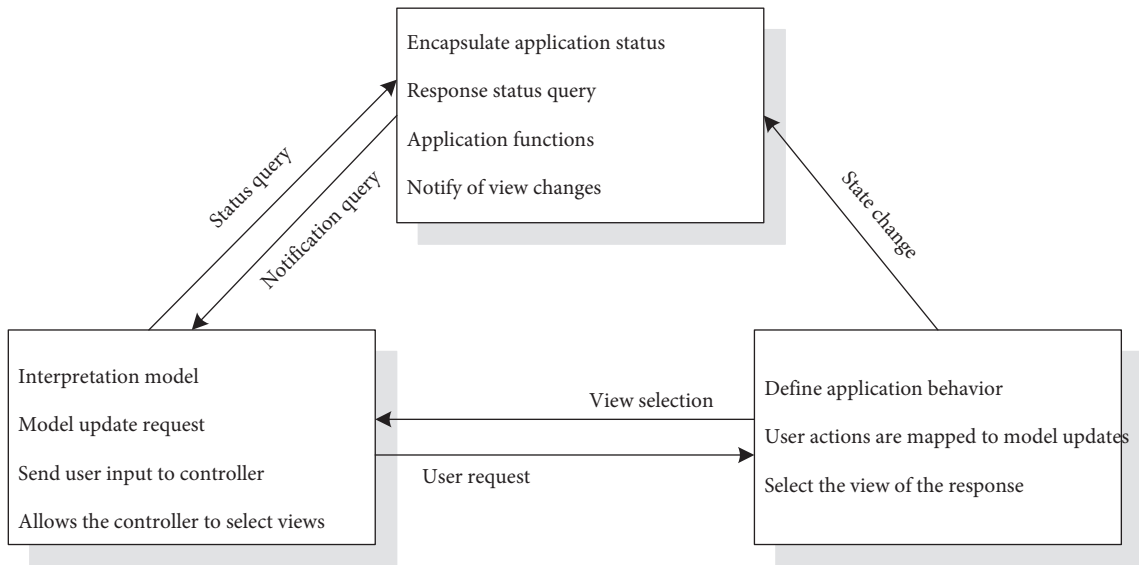


FIGURE 2: MVC mode.

development, the role of venture capital in supervision, governance, and consultation can better reflect the stage of increasing marginal returns. However, in regions with a higher level of economic development, the marginal returns of supervision and consultation may decline [52]. Therefore, this section infers that the supervision and consultation role of venture capital is more significant in the central and western regions.

The results in Table 13 show the effect of venture capital holdings on the willingness of listed companies to pay dividends. Among them, column (2) shows that the impact of venture capital in the central and western regions on the willingness to pay dividends is significantly positive at the 5% significance level, and the net effect is 0.174. However, in column (1), the coefficient of venture capital is not significant in the eastern region sample. The above results confirm the inference of this section, that is, the impact of venture capital holdings on relatively underdeveloped central and western regions is more significant [53].

7. Design and Implementation of Venture Capital Information Management Platform Based on J2EE

The vigorous development of information technology makes it possible to design and develop venture capital information management platform based on the research conclusions of this paper [54–59]. The design, development technology, and development mode of information service system are very important, which affects the performance of the system. For later maintenance and function expansion, there are two main development platforms: J2EE and .NET. The system developed by .NET runs on Windows operating system, while the system developed by J2EE can run on Linux, UNIX, and Windows operating system, so it is more suitable for the software and

hardware environment in this paper. Therefore, J2EE is used as the development platform here. Based on J2EE [56, 59], a venture capital information management platform is built.

The multitier distributed application model of J2EE divides the different layers in the two-tier model into many layers, as shown in Figure 1.

With the rapid development of Internet, how to construct the three-tier B/S structure quickly and effectively has become a research hotspot. MVC divides web applications into three layers: model, view, and controller. Its structure is shown in Figure 2.

As shown in Figure 2, (1) the model refers to the business logic layer, which is usually composed of Java, JavaBean or EJB, or Java + EJB. All businesses are processed by this layer; (2) view refers to the presentation layer, that is, functional web page display. JSP plays a major role in this layer; and (3) the controller is used to accept and distribute the request to the business layer, and pass the data returned by the business logic to the view layer for presentation to the requester.

The corresponding relationship between MVC and J2EE architecture is shown in Figure 3. The view is in the web layer and the client layer, usually JSP/servlets. The controller is also in the web layer and is usually implemented with servlets. The model is in the business logic layer and is usually implemented with server-side JavaBeans or EJB.

7.1. Requirement Analysis. According to the above research, the system requirements of venture capital information management platform include the following:

- (1) Realize the release and sharing of venture capital information, including investment projects, financing projects, investment and financing hotspots, investment and financing institutions, and other information

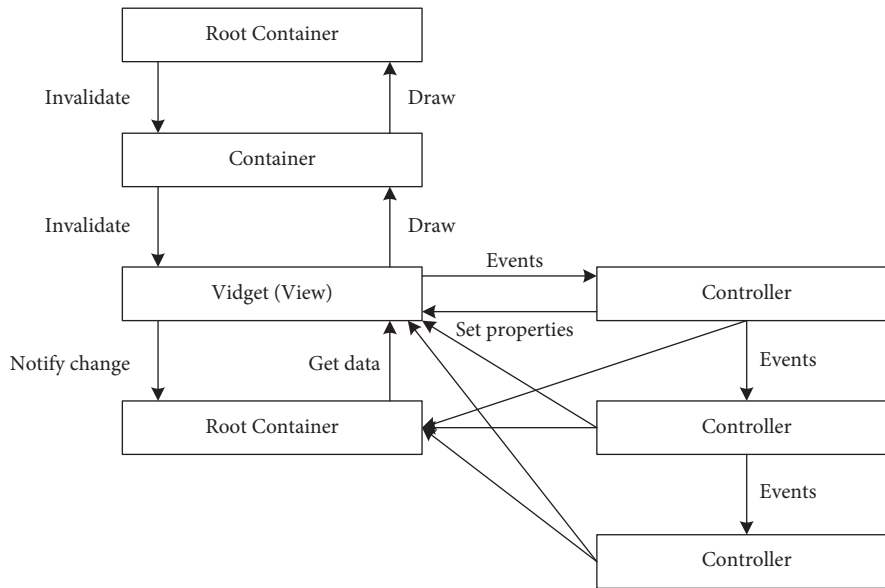


FIGURE 3: The corresponding relationship between MVC and J2EE architecture.

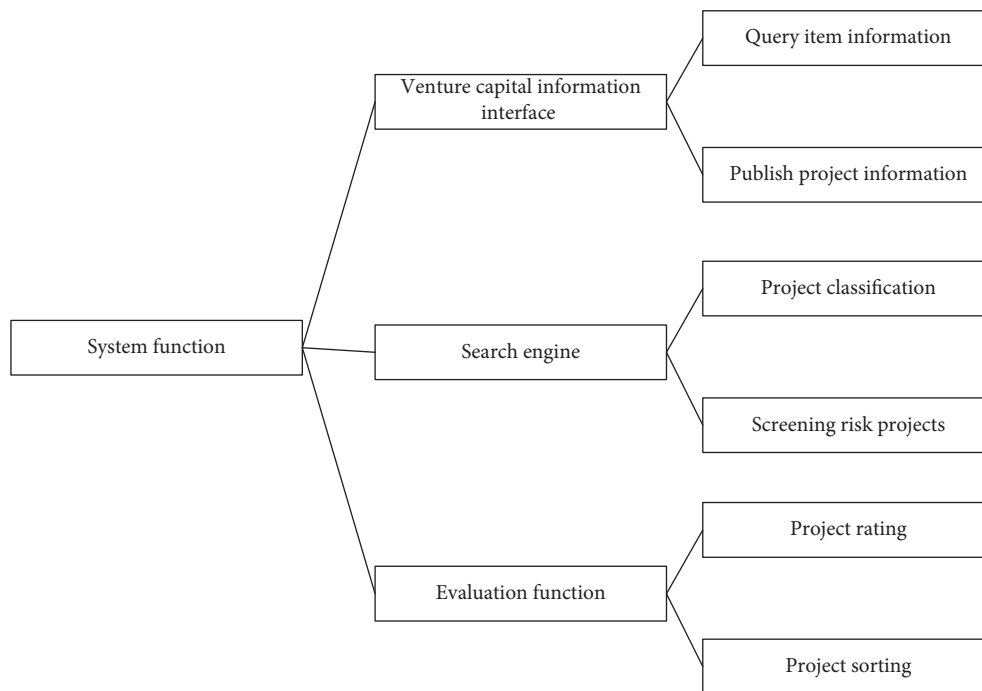


FIGURE 4: Functional planning of the designed platform.

- (2) Realize the classification and retrieval of venture capital information, including project classification and retrieval, organization classification and retrieval, ranking list of hot investment, and financing projects, etc.
- (3) Realize the rating of venture capital projects, including the government’s rating of venture capital institutions, the rating of venture capital projects, and rating release

For these requirements, the functional planning of the platform is shown in Figure 4.

7.2. Use Case Model. Use case is a dynamic description of system behavior. Through use case modeling, it describes the external roles interested in the system and their functional requirements for the system. According to the analysis of

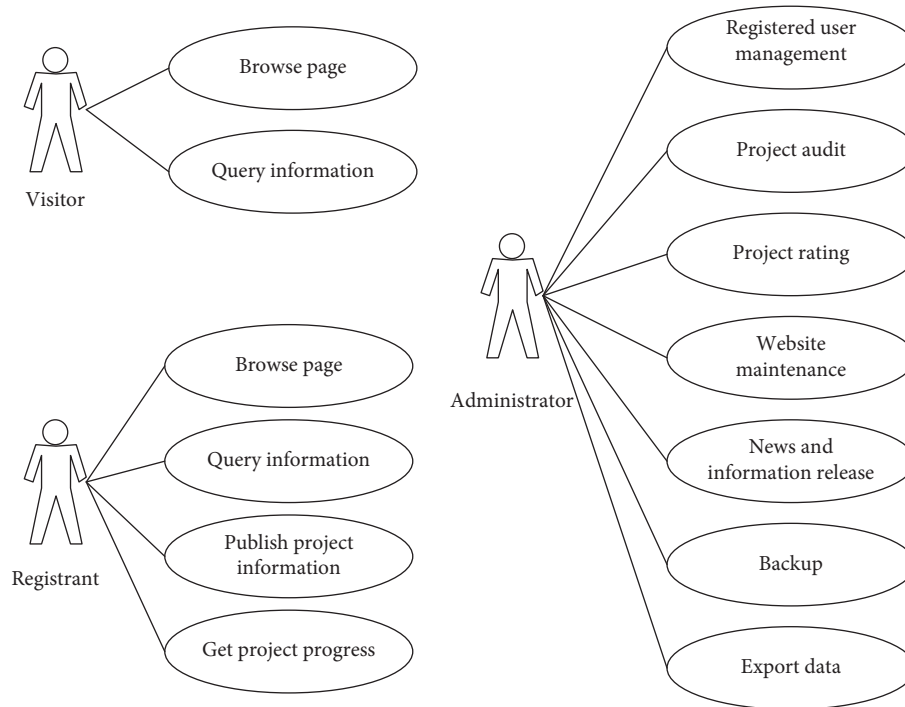


FIGURE 5: Use case diagram.

user behavior, users are divided into tourists, registered users, and administrator users. When different users carry out relevant operations, they have relatively different permissions.

Visitors can only browse the web and query information. Registered users can browse web pages, query information, publish project information, and obtain project related progress. Administrator users can manage the registered users of the website, review the investment and financing projects, rate the investment and financing projects, and be responsible for the maintenance of the website and the release and update of relevant news information. Their use case diagram is shown in Figure 5.

7.3. System Design. The system design of venture capital information management platform is an important stage in the process of system construction. The platform adopts a three-tier structure of standard database layer, data processing layer, and dynamic web page presentation layer. The database is mainly responsible for data storage, retrieval, change, and deletion. The data processing layer is mainly responsible for the generation of SQL statements, database state feedback, data information inspection, etc. The dynamic web page presentation layer is responsible for generating relevant web pages according to the obtained data or web page requests, and finally displaying them on the browser. The overall architecture of the platform is shown in Figure 6.

The object relation model is designed as follows: The object of the platform consists of three objects: enterprise, project, and project index. The project index object can be included in the project object, so as to reduce the number of

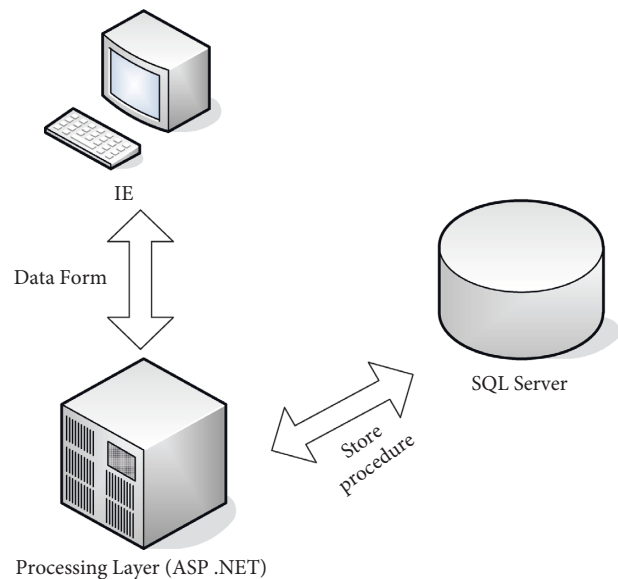


FIGURE 6: The overall architecture.

objects and simplify the object relationship. However, considering that the project index and project rating are the core content of the website, and the project rating itself is flexible, it may be added and changed according to the actual situation within a certain period of time. Therefore, project indicators are listed here as a special object. Although it brings some system overhead, it reduces the coupling of the system model and conforms to the characteristics of the system itself. An entity-relationship (E-R) diagram is shown in Figure 7.

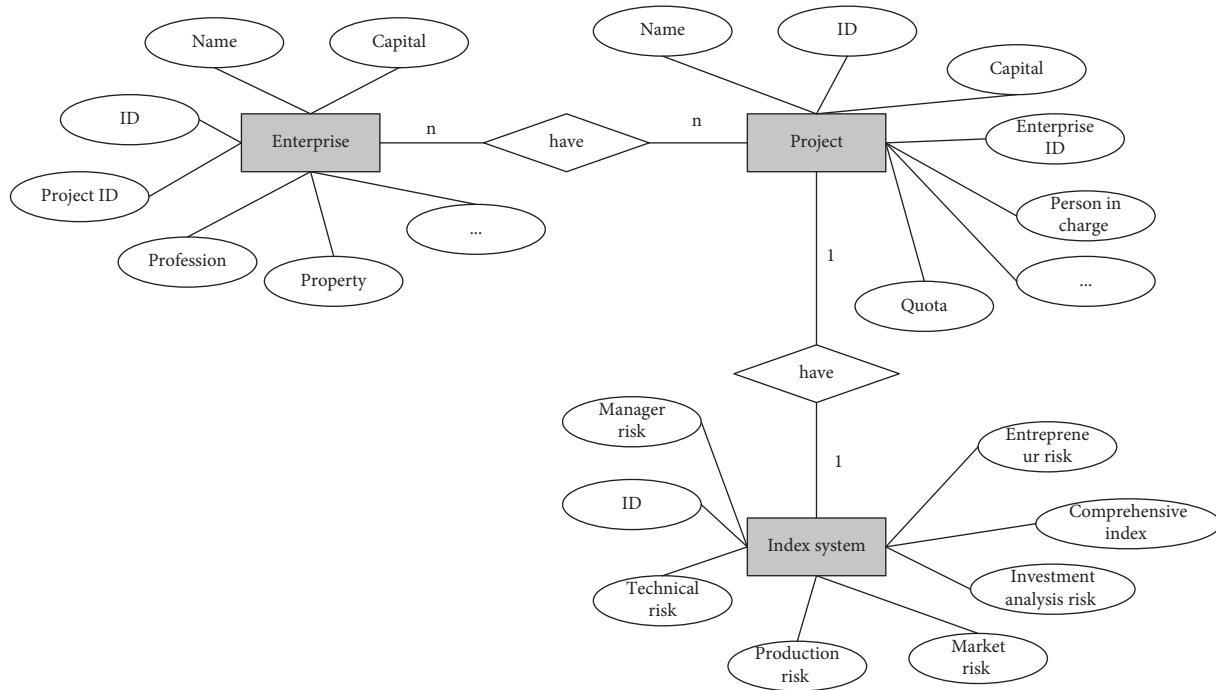


FIGURE 7: E-R diagram.

TABLE 14: The specification design.

Definition of platform	Medium-sized government level website
Number of people online	<3000
Number of registered users	>10000
Home page hits/day	<5000
Home page unique IP	<5000
Total flow	<5G
Page views	<300000
Platform access frequency	<500 times/second
Home page flow/day	<1G
IP quantity	<50000

7.4. *Specification Design.* The venture capital information management platform developed by the project is a medium-sized government level website. The website visit frequency supports less than 500 people per second, supports online access of less than 2000 people, and supports the registration of tens of thousands of users. The specification design is shown in Table 14.

8. Conclusion

This paper takes all A-share listed companies from 2003 to 2019 as samples, and studies the impact of venture capital holdings on the dividend policy of listed companies. This paper examines the effects of venture capital holdings on the willingness of listed companies to pay dividends and their level of dividend payment. The research results are as follows: First is the basic test. By constructing the logit model, it can be seen that companies that have obtained venture capital holdings have a stronger willingness to pay dividends than

companies that have not obtained venture capital holdings. By constructing the OLS regression model, it can be seen that the listed companies with venture capital holdings among the top ten shareholders have a higher level of dividend payment. Second is the mechanism test. According to the derivation logic of this paper, the influence of venture capital on the dividend policy of listed companies is achieved by exerting its supervisory function and alleviating the agency problem of listed companies. Therefore, this paper examines the difference in the impact of venture capital on the dividend policy of listed companies at different levels of agency problem. The results show that in the group with more serious agency problem, the positive promotion effect of venture capital on the dividend payment willingness and the dividend payment level of listed companies is more significant. Third is endogeneity and robustness checks. In order to alleviate the possible problems of sample selection, this paper designs a propensity score matching method to control the possible endogeneity problem. The results show that the sample regression results after propensity score matching are still robust. At the same time, in order to enhance the robustness of the conclusion, a series of robustness checks, such as replacing the dependent variable, replacing the estimated model with the Tobit model, and replacing the independent variable, have been carried out successively, and the conclusion still holds. Fourth is further research. Further research finds that venture capital organizations of different backgrounds have different effects on the cash dividend policy of investee companies. The situation is reflected in the following aspects: companies with foreign investment venture capital holdings are more inclined to distribute cash dividends, and at the same time, the cash dividend payment rate is higher because foreign investment

venture capital has a more complete corporate governance experience. At the same time, the uneven level of regional development and the difference in the degree of marketization will also affect the role of venture capital supervision and governance. In the central and western regions, where the level of economic development is relatively backward, the impact of venture capital on the promotion of the dividend policy of listed companies is more significant.

Taking the cash dividend policy of listed companies as the starting point, this paper studies the specific role of venture capital shareholding in corporate governance, and provides empirical evidence on dividend policy for the research on the role of venture capital governance.

From the conclusion of this paper, we can get the following two implications: First, as far as the regulatory bodies are concerned, the China Securities Regulatory Commission has continuously issued relevant policies since 2001, in order to encourage listed companies to actively distribute cash and strengthen the protection of the interests of small and medium shareholders, thereby increasing the returns of capital market investors. However, the promotion effect of the semimandatory dividend policy is far from satisfactory. The research in this paper effectively proves the positive role that venture capital organizations play in the governance of listed companies. Therefore, as far as the regulatory bodies are concerned, actively guiding social capital to participate in social and economic construction in an orderly and steady manner has a positive driving effect on promoting the healthy development of the capital market and alleviating the “new normal” situation that China’s economy is currently in. Second, as far as listed companies are concerned, actively introducing financial intermediaries such as venture capital and “active investors” and relying on the rich industry experience and complete corporate governance experience of such investors will help alleviate the internal agency problem of listed companies, so as to enhance the company’s efficiency and increase the company’s value.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this work.

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