Research Article

Corporate Pension Payment System under the Constraints of Cost of Capital: An Empirical Study

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Reducing the cost of capital is an effective way to increase stockholders' wealth and can also constrain the amount of corporate pension payments. This paper, taking the companies listed on A-share market during the year from 2008 to 2019 as samples, examines the influence path and effect of corporate pension on cost of capital. It is different from the research results of Western scholars that, in all the samples, corporate pensions reduce the cost of capital through debt and incentive effects. For labor-intensive enterprises and those whose effective income tax rate is less than zero, corporate pensions fail to reduce the cost of capital significantly. While for capital-and-technology-intensive enterprises, those whose effective income tax rate is more than zero, and those whose financing restraint is more or less than zero, corporate pension is proven to significantly reduce the cost of capital. Innovation performance has a partial mediating effect between corporate pensions and cost of capital.

1. Introduction

Residents' pensions after retirement are directly affected by the amount and mode of pension insurance payments. In order to make up for the shortfall of replacement rate of basic pension insurance and guarantee a better life of employees after retirement, the Ministry of Labor and Social Security of the People's Republic of China promulgated "Corporate Pension Trial Method" on December 30th, 2003, where enterprises and employees are endowed with the right to pay their corporate pension in addition to basic pension insurance. On December 20th, 2016, the Ministry of Human Resources and Social Security of the People's Republic of China promulgated "Corporate Pension Method," stipulating that the portion of corporate pension paid by enterprises shall not exceed 8% of the payroll of all employees and the total amount of corporate pension paid by both enterprise and employees shall not exceed 12% of the payroll of all employees in the previous year. A specific amount of corporate pension payments is under negotiation between the enterprise and employees. However, no specific basis was given for the actual consultation, and no specific payment

system was formulated from the perspective of protecting of shareholders' interests. The generation and completion of corporate pension payment obligations have both positive and negative impacts on the protection of shareholders' interests from several aspects. It is a topic worthy of in-depth study to ensure the healthy and lasting development of enterprises while protecting shareholders' interests and improving employees' pensions as much as possible. The income growth in enterprises does not necessarily increase stockholders' wealth. Only when the return rate of investment is higher than stockholders' required return rate, i.e., the cost of equity capital, the higher part can result in an increase in stockholders' wealth and the enterprise value. If other factors are fixed, reducing the cost of capital is an efficient way to increase stockholders' wealth [1]. If corporate pension payments increase the cost of capital, a higher return rate on investment will be required to balance the cost of capital. Then, the investment choices are reduced, or the difference between the return rate of investment and cost of capital is narrowed, and hence, the stockholders' interests are damaged. On the contrary, if corporate pension payments reduce the cost of capital, stockholders' interests

will increase correspondingly. Therefore, this paper examines the influence path and the effect of corporate pension on the cost of capital. The cost of debt capital is relatively fixed, while cost of equity capital changes greatly under the influence of other factors [1]. The cost of capital in this paper refers to the cost of equity capital.

There are two payment methods for corporate pension, i.e., defined benefit corporate pension plans and defined contribution corporate pension plans. The defined benefit corporate pension plans imply in-advance determination of supplementary pension benefits for employees after retirement. Regardless of the enterprise performance before employees retiring and whether the enterprise can pay a corporate pension in due, the annual accumulation rate of pension rights during employment has to be maintained at a certain level. Since the industrial revolution, corporate pension has begun to appear in Western countries, where defined benefit corporate pension plans were generally adopted, bringing a heavy financial burden to enterprises. Until the economic recession in America, when many enterprises went bankrupt due to excessive financial burden, defined contribution corporate pension plans gradually became a new favorite in Western countries. Many scholars take listed companies adopting defined benefit corporate pension plans in Western countries as samples to study the mechanism and effect of such a payment mode on the cost of capital. It is concluded that defined benefit corporate pensions increase the cost of capital (Rauh [2]; Franzoni [3]; Campbell et al. [4]; Michael and Neil [5]; Brian [6]; Berchtold et al. [7]). Other scholars show that a defined benefit corporate pension has no significant impact on the cost of capital [8]. However, listed companies in China are rarely taken as samples to study the mechanism and effect of the defined contribution corporate pension on the cost of capital. The defined contribution corporate pension plans adopted by Chinese enterprises claim that the amount of supplementary pension employees can get after retirement is not determined in advance but depends on the previous pension payment amount and its accumulated investment income, while the corporate pension payment amount of enterprises and employees is determined in advance. In this way, enterprises can selectively determine the proportion of corporate pension payments in salaries according to the level of business performance, so as to avoid excessive burden on enterprise finance and possible bankruptcy risk. Enterprises are allowed to determine their corporate pension payment proportions based on the service duration and the employee contribution. It is worthy of in-depth study to achieve a balance between the protection of shareholders' interests and the protection of supplementary pension rights and interests of employees by establishing a corporate pension payment system under the constraint of the cost of capital.

The contribution of this paper is reflected in two aspects. Firstly, it examines the influence mechanism and effect of corporate pension on the cost of capital under the defined contribution corporate pension plan based on the data in China. Western scholars generally do relevant research based on defined benefit corporate pension plans instead of defined contribution corporate pension ones, leaving there

little literature to consult. The research of this paper enriches the literature in related fields.

Secondly, based on cross-sectional heterogeneity, this paper examines the impact of corporate pension on the cost of capital in labor-intensive and capital-and-technology-intensive enterprises, enterprises with or without financing constraints, and enterprises with different effective income tax rates. The partial mediating effect of innovation performance between the corporate pension and cost of capital is examined as well. The studies provide a theoretical and empirical basis for enterprises to determine the appropriate payment proportion for the corporate pension. At present, there is little literature to do relevant research. The research of this paper enriches the literature in relevant fields.

2. Literature Review and Development of Hypotheses

2.1. The Influence of Corporate Pension on the Cost of Capital Based on Debt Effect and Incentive Effect

2.1.1. Debt Effect. Corporate pension is a detailed account of employee compensation payable, endowed with the nature of short-term liability. Corporate pension failing to be timely paid in this period will be converted into long-term liabilities. The increase in corporate pension this year is the corporate pension liability belonging to employees and needs to be paid this year. Therefore, the payment of corporate pension is essentially the payment of corporate pension liabilities. Corporate pension liabilities can affect the cost of capital in different sizes and directions through tax shield interests, financial risks, corporate governance, and signal transmissions.

On Jan 1st, 2008, the Ministry of Finance and State Administration of Taxation promulgated "Notice on Enterprise Income Tax Policies Related to Supplementary Endowment Insurance Premiums and Supplementary Medical Insurance Premiums" stipulating that the payment of corporate pension will be deducted before tax within the part not exceeding 5% of the total employee salaries, thus offsetting taxes and reducing the cost of capital. However, according to the trade-off theory, the increase of corporate pension liabilities increases the financial risk of enterprises. When the debt ratio reaches a certain height, the cost of financial crisis will gradually increase and tax shield benefits can be gradually offset, so that the cost of capital will increase.

Corporate pension also plays the role of corporate governance. Although its contribution proportion is not high, with an upper limit of 8%, the total amount of employee compensation has been increasing in recent years, resulting in a significant increase in the total amount of corporate pension liabilities, an increase in the financial burden of enterprises, an increase in the risk of bankruptcy, and an increase in the possibility of damage to the reputation and economic interests of managers. To avoid possible losses, managers have no alternative but to work harder to improve the quality of management, so as to reduce the risk of damage to investment income of investors and reduce the

cost of capital. Meanwhile, an obligation to pay corporate pension liabilities will restrain managers from misusing corporate funds, help curb excessive on-the-job consumption and overinvestment of the management, and reduce the risk of damage to investment income of investors, so as to reduce the cost of capital as well.

According to signal transmission theory, the burden of corporate pension liabilities means that the enterprise expects good performance in the future and sends a positive signal to the capital market. Only enterprises with confidence in future performance have the ability to bear corporate pension liabilities for a long time and receive positive feedback from the capital market, so that investors have a higher and more stable evaluation of its future performance and are willing to further maintain or increase their investment, reduce their investment risk expectations, and reduce the cost of capital. Enterprises with poor future performance do not have the ability to get positive feedback from the capital market by increasing corporate pension liabilities. Therefore, according to the signal theory, the burden of corporate pension sends a positive signal, which is conducive to the reduction of the cost of capital.

2.1.2. Incentive Effect.

Corporate pensions have the attribute of postincentive. Working years and employee performance determine the amount of rights and interests that employees can obtain from corporate pension payments. The longer the working years is, the greater the amount of corporate pension rights and interests employees obtains and the greater the gap between the ownership of corporate pension rights and interests and their marginal output will be. By contrast, the shorter the working years is, the less the ownership of corporate pension rights and interests employees obtains. The ownership rules of corporate pension rights and interests increase the losses caused by the unemployment of employees with short working years due to work slack and then encourage them to work hard in turn [9]. Therefore, corporate pensions are conducive to encouraging long-term and high-quality service behavior of employees and conducive to the long-term sustainable development of enterprises, the improvement of enterprise investment and operation efficiency, the reduction of investors' investment risk expectation, and the reduction of cost of capital.

Corporate pensions have the function as tax benefit incentives. The corporate pension paid by the enterprise and the income obtained by the enterprise through investment and operations using corporate pension funds can be exempted from paying individual income tax. The portion of corporate pensions within 4% of the tax base of employee salaries paid by employees can be deducted from their taxable income in the current period. These tax benefit incentive policies play an incentive role and further stabilize the workforce, encourage employees to improve their work quality, reduce investors' investment risk expectations, and reduce the cost of capital. However, the amount of corporate pensions is much smaller than that of salaries and bonuses,

and the incentive effect of individual income tax benefit policies on employees remains rather limited, leading to limited reduction in cost of capital correspondingly.

From the above analysis, it can be seen that corporate pensions play a positive role in reducing the cost of capital from the following paths, i.e., tax shield interest, corporate governance, signal transmission, postincentives, and tax benefit incentives. Financial risk paths play a positive role in increasing the cost of capital. However, given that Chinese enterprises adopt defined contribution corporate pension plans, the payment of corporate pension is controlled in a certain proportion and the amount is small, which brings a limited financial burden to enterprises and results in limited increasing in the cost of capital. It is therefore concluded that, on the whole, corporate pensions reduce the cost of capital.

Therefore, this paper proposes hypothesis 1: corporate pension will reduce the cost of capital.

2.2. The Effect of Corporate Pension on the Cost of Capital of Labor-Intensive Enterprises and Capital-and-Technology-Intensive Enterprises.

Enterprises with a result of more than 0.08 when the number of employees (10000 persons) is divided by the original price of fixed assets (100 million yuan) are defined as labor-intensive enterprises [10]. The labor cost of labor-intensive enterprises is higher than that of capital-and-technology-intensive enterprises, and its proportion of the total cost is also relatively higher. The payment of the corporate pension is determined by taking the salary as the base and multiplied by a certain proportion. Compared with capital-and-technology-intensive enterprises, the same payment proportion of corporate pension in labor-intensive enterprises produces more total payments for corporate pensions. A substantial increase in cost will negatively influence the effective investment and normal operation of enterprises, resulting in an increased risk of loss of enterprise profits, which will have an adverse impact on cash dividend distribution and stock price changes and increase the risk of damage to shareholders' interests, increase the financial burden, and increase the financial risk to a greater extent. This will boost a significant increase in the cost of capital.

Secondly, the burden of corporate pensions on labor-intensive enterprises transmits a signal that the financial burden of the enterprise is too heavy. This causes investors to improve the risk assessment level of investment income, and the cost of capital increases correspondingly. Given the small incentive effect of tax benefits, corporate pension can reduce the cost of capital relatively more significantly only through tax shield interests and corporate governance. In general, the higher payment base of corporate pensions in labor-intensive enterprises offsets the reduction in capital cost through other relevant paths.

Therefore, this paper proposes hypothesis 2: corporate pensions of labor-intensive enterprises cannot significantly reduce the cost of capital, while corporate pensions of capital-and-technology-intensive enterprises can significantly reduce the cost of capital.

2.3. The Effect of Corporate Pension on the Cost of Capital under Different Effective Income Tax Rates. Modified MM theory (capital structure theory based on tax included) holds that in the case of enterprise income tax, debt interest can be deducted before tax, so as to reduce the cost of capital and improve enterprise value. The payment of corporate pensions also comes before income tax. When the enterprise is subjected to a higher income tax rate, the tax offset function generated by the payment of the same amount of corporate pension becomes stronger, which saves tax on the enterprise and reduces the cost of capital. For enterprises with a negative effective income tax rate, the payment of corporate pensions fails to produce a tax-saving effect or to reduce the cost of capital. It is found statistically that the mean and median of the effective income tax rate of enterprises with a positive effective income tax rate are both approximately 0.15, which can play an immediate role in reducing the cost of capital to a great extent. However, enterprises with a negative effective income tax rate lose this means that can have a significant effect on reducing their cost of capital. Although corporate pensions can reduce the cost of capital through the paths of corporate governance, signal transmission, postincentive, and tax benefit incentives, it still performs weakly to attract investors to make a low-level evaluation of their investment risk through signal transmission, since the securities market in China is obviously speculative. Employees in many enterprises are not clearly aware of the policy of corporate pensions, and the pension rights and interests available after retirement are uncertain. Therefore, the postincentive effect is rather limited. Moreover, the tax benefit incentives have little effect on cost of capital reducing. However, corporate pensions can increase the cost of capital through the financial risk path. Several factors mutually offset the effects on the cost of capital. Overall, for enterprises with negative income tax rate, the payment of corporate pensions cannot significantly reduce the cost of capital [11].

For enterprises with a positive enterprise income tax rate, the higher the income tax rate is, the better the corporate pension payment enables the enterprise to obtain tax shield benefits, which in turn reduces the capital cost more greatly. In these enterprise samples, corporate pension payments significantly reduce the capital cost.

Therefore, this paper proposes hypothesis 3 that for enterprises subjected to negative effective income tax rate, corporate pensions cannot significantly reduce the cost of capital; while for enterprises with a positive effective income tax rate, corporate pensions can significantly reduce the cost of capital.

2.4. The Effect of Corporate Pension on the Cost of Capital under Different Financing Constraints. Many Western scholars have studied the impact of corporate pensions on the cost of capital under external financing constraints, claiming that the payment of corporate pension liabilities urges the enterprise to carry out external financing, so as to raise sufficient funds. The existence of external financing constraints causes a high cost of external financing and thus leads to the increase of cost of capital. (Rauh [2]; Franzoni [3]; John et al. [4]; Michael and Neil [5], Brian [6]; Berchtold et al. [7]). However, in the Chinese securities market, the threshold for additional issuance of new shares is low, which makes the refinancing obstacles of listed companies small.

Listed companies can obtain large amounts of funds by issuing new shares. At the same time, the actual capital cost, that is, cash dividend, remains rather low. This is because, there are no mandatory policies or regulations requiring enterprises to pay cash dividends to shareholders for a long time. Many listed companies cannot provide shareholders with reasonable cash dividends to satisfy them, and the actual cost of equity financing is rather low. "Ring money" has become a pronoun for many listed companies to issue shares and raise funds. The majority of stock investors does not know or gradually ignores their legitimate rights and interests to obtain reasonable cash dividend returns, ignores the performance and dividend policies of listed companies, turns to pay attention to the stock market, and is forced to change their identity from investors to speculators. Even if the company's performance is not ideal or the dividend policy is not clear or ideal, it can successfully sell additional new shares. Most listed companies can issue shares at a low cost to raise a large amount of funds under a low threshold. Therefore, in contrast to the research results acquired by Western scholars, enterprises with obvious financing constraints will not experience a significant increase in the cost of capital [12]. In contrast, the payment of corporate pensions keeps reducing the cost of capital. Meanwhile, the financing constraint can be taken as a moderating variable to verify that the financing constraint has no significant impact on the correlation between corporate pensions and the cost of capital.

Therefore, this paper proposes hypothesis 4 that both enterprises with higher and lower financing constraints can significantly reduce the cost of capital. For enterprises with higher financing constraints, higher financing constraints do not significantly weaken the negative correlation between corporate pensions and cost of capital.

2.5. Mediating Effect Test of Enterprise Innovation Performance. According to the relevant policies on corporate pensions of Beixin Building Materials, if employees leave within five years of employment, they will lose part of the rights and interests formed by the enterprise payment included in the individual account and this part of loss will decrease with the extension of employees' working years. If dismissed within five years, the employee will lose all of his or her rights and interests. Therefore, the rights and interest vesting design of corporate pensions greatly increases the turnover cost of employees and reduces the desire of talent flow. The stability of human resources will help employees engage in innovative research and design more persistently and intensively and will be more conducive to the improvement of enterprise innovation performance. As a supplementary pension benefit, corporate pension can attract and retain knowledge workers with strong employability by increasing the expected benefits after their

retirement, so as to improve their satisfaction with and loyalty to the enterprise. Knowledge workers are the important driving factor in innovation [13]. Meanwhile, as high-quality human capital, knowledge workers have comparative advantages in terms of learning and using new technologies. They can effectively reduce the uncertainty in the process of enterprise innovation and improve the success rate in the innovating process of by means of imitation, learning by doing, and resource integration [14].

Enterprises can improve their original products or develop new products through technological innovation, so as to enhance the differentiation advantages of their products, which is also conducive to the stability and improvement of their market competitive position. Additionally, enterprise innovation accumulates and integrates technology, optimizes production processes, improves production efficiency, reduces production costs, makes products and services provided by enterprises with strong exclusivity and added value, improves the imitation difficulty of competitors, and further enhances their long-term competitive advantage. The advantageous competitive position of enterprises can give play to the "hedging effect," transmit the favorable signal of their sound future development, reduce the investment risk of investors, attract more potential investors to invest in stocks, and reduce the cost of capital [15]. Charles believes that innovation activities of enterprises can improve their innovation ability and produce innovation performance, which enables investors to expect the economic benefits generated by innovation performance, and attracts more shareholder investment and enhance the willingness of shareholders to hold corporate shares. Finally, the higher the innovation performance is, the greater the probability that investors can get investment income, and hence, the lower the risk of investment damage will be and then the lower the cost of enterprise capital [16]. Fateh and Sajjad propose that innovation performance can reduce the required return rate by investors and reduce the cost of capital of enterprises through "competitiveness enhancement effect" and "investor concern effect" [17].

Therefore, this paper proposes hypothesis 5 that innovation performance is a mediating variable between corporate pension and the cost of capital.

3. Research Methodology

3.1. Variable Selection.
All variables including dependent variables, independent variables, control variables, mediating variables, moderating variables, and dummy control variable are listed in Table 1.

3.1.1. Dependent Variable: Cost of Capital.
As the cost of debt capital is determined by the debt contract and has little variability, the impact of corporate pension is examined on the cost of equity capital, where the cost of capital refers to the cost of equity capital. This paper selects the cost of equity capital of A-share listed companies in the Shanghai and Shenzhen stock market as the dependent variable. The estimation methods of equity capital cost are divided into two

types, i.e., the cost of the capital estimation model of risk compensation technology based on historical data and the implicit capital cost estimation model based on future forecast data. The cost of the capital estimation model of risk compensation technology well reflects the required return rate by investors based on risk assessment. The CAPM model is the representative one, which has been widely used in both the theoretical and practical circles [18]. It is also the estimation model used in this paper. However, it is unreasonable to estimate the beta coefficient based on historical data to estimate the cost of capital to provide data analysis for future decision-making. The implicit cost of capital estimation model based on future forecast data avoids this defect. Comparatively speaking, the PEG model $R_e = \sqrt{eps_2 - eps_1/P_0}$ has been applied more broadly in theoretical and practical circles [19]. However, it fails to guarantee the accuracy of future forecast data, and the error can only be reduced by taking the average of forecast data of analysts.

Therefore, this paper uses the PEG and CAPM models to estimate the capital cost and takes the average value as the estimation result of equity capital cost. The combination of two different types of estimation models makes up for shortcomings of each other and allows them to learn from strengths of each other and compensate for their weakness.

3.1.2. Independent Variable: Corporate Pension.
The added value of corporate pension, also the independent variable selected in this paper, in the current year reflects the corporate pension payable in the current period, which is endowed with the nature of short-term liabilities, and well reflects the payment amount of supplementary endowment insurance borne by enterprises.

3.1.3. Control Variables.
This paper selects asset-liability ratio, enterprise size, beta coefficient, book-to-market ratio, and asset turnover ratio as control variables of model 2 based on the research of Mokhova and Zinecker [20], Faysal et al. [21], Muslim and Setiawan [22], and Franc-Dąbrowska et al. [23]. Meanwhile, this paper selects shareholding ratio of the largest shareholder, board size, shareholding ratio of senior executives, return on total assets, and asset-liability ratio as control variable of model 4 on the basis of the research of Jones [24], Duong et al. [25], and Steele and Stefan [26]. Besides, this paper selects dummy variables of the industry and year as the control variables for all models.

3.1.4. Moderating Variable: Financing Constraints.
Scholars have proposed many indicators to measure financing constraints, including univariate and multivariable indicators. Some scholars take company size as the evaluation index of financing constraints, while others use dividend payment level as the evaluation index of financing constraints. However, given the diversity of the influencing factors of financing constraints, the method of single index evaluation of financing constraints has been widely doubted.

TABLE 1: Variable definition.

Variable category	Variable	Variable definition
Dependent variable	Re	Cost of equity capital
Independent variable	CP	Corporate pension: the ending added value of corporate pension is taken as logarithm
Control variable	Lev	Asset liability ratio: total liabilities at the end of the period/total assets at the end of the period
	Size	Size: natural logarithm of total assets
	Beta	Beta: β of that year's stock value
	B/M	Book to market ratio: book value of owner's equity/market value
	AT	Operating efficiency: main business income of the current year/total assets
	First	Shareholding ratio of the largest shareholder
	Board	Board size: natural logarithm of the number of directors
	Msh	Shareholding ratio of senior executives: number of shares held by senior executives/total shares
	Roa	Return on total assets: net income/total assets
Moderating variable	FC	Financial constraints
Mediating variable	Patent	Innovation performance: natural logarithm of the total number of patent applications of the enterprise in the current year plus 1
Dummy control variable	Indu	Industry dummy variable: according to the "Guidelines for Industry Classification of Listed Companies" issued by the CSRC in 2001, the industries are divided into 13 categories, excluding finance and insurance industry (I); the dummy variable is 1, when the enterprise belongs to an industry, otherwise 0
	Year	Year dummy variable: the dummy variable is 1, when the investigation time is the current year, otherwise 0

The main methods of multi-index evaluation of financing constraints are KZ index, WW index, ZFC index, LFC index, DFC index, and SA index. However, KZ index, WW index, ZFC index, LFC index, and DFC index involve endogenous indicators such as debt ratio, Tobin Q, and cash flow, which are seriously disturbed by endogenous factors. Hadlock and Pierce construct the SA index on the basis of two exogenous variables, i.e., enterprise size and enterprise age, and it is found that the two constituent variables of the index have a great degree of substitution for some constituent variables of other indexes [27]. Therefore, SA index is adopted to evaluate the degree of financing constraints of enterprises in this paper. The greater the absolute value of the index is, the lower the degree of financing constraints becomes.

$$SA = -0.737 \times (Ln\text{Size}) + 0.043 \times (Ln\text{Size})^2 - 0.04 \times \text{Age}. \tag{1}$$

3.1.5. Mediating Variable: Innovation Performance.
The natural logarithm of the total number of patent applications plus 1 is chosen as the innovation performance of the enterprise based on the research of Steele and Stefan [26].

3.2. Sample Selection and Data Source.
Since 2008, the number of enterprises paying corporate pensions has begun to increase and Damodaran's market risk premium rate was estimated to be only as high as 2019. Therefore, A-share listed companies in the Shanghai and Shenzhen stock markets from 2008 to 2019 are selected as the research object in this paper. The ST and ST∗ data are from the RESSET database. Other data are obtained from the CSMAR database. The total number of samples is 2198, with ST and ST∗ companies, financial and insurance companies, companies with missing data, and extreme outlier companies excluded. The sample size of labor-intensive enterprises is 150, and the sample size of capital-and-technology-intensive enterprises is 2038. The sample size of effective income tax rate less than 0 is 384, and the sample size of effective income tax rate greater than 0 is 1635. In this paper, a nonequilibrium panel regression analysis is conducted. This paper winsorizes all variables at the level of 1%.

3.3. Model Setting.
For the six hypotheses, the regression models constructed in this paper are as follows:

$$R_e = \alpha + \beta_1 CP + \beta_2 \text{Lev} + \beta_3 \text{Size} + \beta_4 \text{Beta} + \beta_5 B/M \\ + \beta_6 \text{AT} + \sum \beta_i \text{Indu} + \sum \beta_i \text{Year} + \varepsilon. \tag{2}$$

$$R_e = \alpha + \beta_1 CP + \beta_2 FC + \beta_3 CP * FC + \beta_4 \text{Lev} \\ + \beta_5 \text{Size} + \beta_6 \text{Beta} + \beta_7 B/M + \beta_8 AT \\ + \sum \beta_i \text{Indu} + \sum \beta_i \text{Year} + \varepsilon. \tag{3}$$

$$\text{Patent} = \alpha + \beta_1 CP + \beta_2 \text{First} + \beta_3 \text{Board} + \beta_4 Msh \\ + \beta_5 Roa + \beta_6 \text{Lev} + \sum \beta_i \text{Indu} + \sum \beta_i Year + \varepsilon. \tag{4}$$

$$R_e = \alpha + \beta_1 \text{Patent} + \beta_2 CP + \beta_3 \text{Lev} + \beta_4 \text{Size} + \beta_5 \text{Beta} \\ + \beta_6 B/M + \beta_7 \text{AT} + \sum \beta_i \text{Indu} + \sum \beta_i \text{Year} + \varepsilon. \tag{5}$$

Equation (2) is adopted to test hypotheses 1, 2, 3, and 4 and to test the correlation between corporate pension and cost of capital in full samples and small samples divided according to different factors. Equation (3) is used to test hypothesis 4, the correlation between corporate pension and capital cost in the samples with high financing constraints, and whether the financing constraints weaken the negative correlation between corporate pensions and the cost of

capital [28]. Equations (4) and (5) are used to test hypothesis 5 and the mediating effect of enterprise innovation performance between corporate pensions and the cost of capital.

4. Results and Discussion

4.1. Descriptive Statistics. The descriptive statistics in Table 2 show that the capital cost of the whole sample company is mainly concentrated between 0.0512 and 0.1801, with a 25th quantile at 0.0793 and a 75th quantile at 0.1079, indicating that there are certain differences in the cost of capital between the samples. Doubt on whether the difference in the payment of corporate pensions contributes to difference in the cost of capital needs to be further tested by virtue of univariate empirical analysis. The median is 0.0924, and the mean is 0.0955. They are close to each other and equivalent to the experience level of capital cost of listed companies in China. The corporate pension is mainly in the range of 7.9860–20.4900, with the 25th quantile at 14.4070 and the 75th quantile at 16.9857, indicating that there is a certain gap in the sample companies' corporate pension payment amounts. Since the samples selected in this paper include labor-intensive and capital-and-technology-intensive enterprises, different industry characteristics may be an important reason for the difference in the payment level of corporate pensions, which will be further empirically tested in the multiple regression test.

4.2. Correlation Analysis. In this paper, the correlation coefficient of each variable is examined by virtue of the Pearson test in the whole sample, so as to judge whether there is a serious multicollinearity problem between each variable.

As shown in Table 3, the correlation coefficient of each variable is lower than 0.6. According to Ho and Wong, multicollinearity does not exist, when the correlation coefficient of each variable does not exceed 0.8 [29]. Therefore, it can be reasonably concluded that there is no multicollinearity problem among the variables of the entire sample.

4.3. Univariate Empirical Test. The mean difference and median difference of multiple variables in both high and low corporate pension enterprise groups are tested in Table 4 in order to further verify the correlation between corporate pension and the cost of capital. The high and low corporate pension groups are distinguished by higher or lower corporate pension than the median of the corporate pension. The mean of capital cost of the high corporate pension enterprise group is 0.078, and the mean of capital cost of the low corporate pension enterprise group is 0.113. The mean of capital cost of the high corporate pension enterprise group is lower. The mean difference is 0.036, which is significant at the level of 1%. The median of capital cost of the high corporate pension enterprise group is 0.079, and the median of capital cost of the low corporate pension enterprise group is 0.108. The median of capital cost of the high corporate pension enterprise group is lower. The median difference is 0.029,

which is significant at the level of 1%. It can be once again concluded that the higher the current corporate pension liabilities are, the lower the enterprise capital cost becomes.

It is also shown in Table 4 that enterprises in the high corporate pension group have more investment value, perfectly reflected in the two indicators of operating efficiency and book-to-market value ratio. The mean and median of operating efficiency of enterprises in the high corporate pension group are higher than those in the low corporate pension group. The differences are significant at the level of 1%, indicating that the enterprise unit assets of the high corporate pension group create more operating income. The mean and median of the book-to-market ratio of enterprises in the high corporate pension group are higher than those in the low corporate pension group. The differences are also significant at the level of 1%. A higher ratio of book value to market value indicates that the market underestimates the actual value of the enterprise and there will be better investment return and growth potential in the future. Fama and French take the relevant data of American listed companies for 27 years as samples and find that the monthly average return of the portfolio with the highest book-to-market ratio is 1.53% higher than that of the portfolio with the lowest book-to-market ratio [30]. Jun and Xu explore A-shares in Shanghai and Shenzhen and figure out that when an enterprise is believed to have a higher investment value by investors, the risk assessment level of its investment will be reduced and so will the cost of capital [31].

4.4. Multivariate Regression Test. The regression results of the whole sample in Table 5 confirm a significant negative correlation between corporate pension and capital cost at the level of 1%, indicating that corporate pension can significantly reduce the cost of capital, thus verifying hypothesis 1. The regression results of the labor-intensive samples show that there is no significant negative relationship between corporate pensions and the cost of capital [28]. It shows that for labor-intensive enterprises, the corporate pension payment burden is too heavy due to the high labor cost. There are many adverse effects on effective investment and normal operation, and financial risk increases significantly. It also transmits the signal of an overburden to the capital market, resulting in the positive effect of corporate pension liabilities on reducing the cost of capital being offset by the negative effect, and corporate pensions cannot significantly reduce the cost of capital. The regression results of capital-and-technology-intensive samples show a significant negative correlation between corporate pensions and the cost of capital at the level of 5%, indicating that for capital-and-technology-intensive enterprises, the positive effect of corporate pension liabilities determined by relatively low human cost expenditure on reducing cost of capital exceeds the negative effect and corporate pension can significantly reduce the cost of capital. Hypothesis 2 is therefore verified. The regression results of samples with effective income tax rates less than 0 show that there is no significant negative correlation between corporate pensions and the cost of capital. This shows that the effective income tax rate is less

TABLE 2: Descriptive statistic of the whole samples.

Variable	Re	CP	Lev	Size	Beta	B/M	AT
Number of samples	2198	2198	2198	2198	2198	2198	2198
Mean	0.0955	15.4957	0.5025	23.4498	1.1075	1.1040	0.6096
Median	0.0924	15.7979	0.5065	23.3282	1.1116	0.9021	0.5154
Max	0.1801	20.4900	0.8732	27.2498	2.0514	5.0568	2.5683
Min	0.0512	7.9860	0.1031	20.0346	0.3528	0.1482	0.0921
25th quantile	0.0793	14.4070	0.3658	22.4150	0.9148	0.5858	0.3215
75th quantile	0.1079	16.9857	0.6544	24.3195	1.2900	1.1825	0.7445
Standard deviation	0.0234	2.3887	0.1889	1.3983	0.2979	0.8874	0.4391

TABLE 3: Correlation coefficient of each variable of the whole samples.

	Re	CP	Lev	Size	Beta	B/M	AT
Re	1.0000						
CP	−0.0333	1.0000					
Lev	0.2966***	0.1426***	1.0000				
Size	0.0916***	0.5509***	0.5032***	1.0000			
Beta	0.3244***	−0.1304***	0.0299	0.1962***	1.0000		
B/M	0.2107***	0.2022***	0.5495***	0.5300***	−0.0177	1.0000	
AT	0.0157	0.0027	0.0277	−0.0946***	0.0386*	−0.0772***	1.0000

Note. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

TABLE 4: Univariate empirical test.

	Means			Median		
Variable name	High corporate pension (1099)	Low corporate pension (1099)	Mean difference t-test	High corporate pension (1099)	Low corporate pension (1099)	Median difference z-test
Re	0.078	0.113	−0.036***	0.079	0.108	−0.029***
Lev	0.465	0.540	−0.075***	0.464	0.561	−0.097***
Size	23.546	23.354	0.192***	23.389	23.282	0.107
Beta	1.020	1.195	−0.174***	1.024	1.178	−0.154***
B/M	1.229	0.979	0.251***	0.957	0.854	0.103***
AT	0.624	0.596	0.028***	0.520	0.500	0.020***

*Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

TABLE 5: Multivariate regression test (whole sample and grouping sample).

Re	Whole sample	Labor-intensive sample	Capital technology-intensive sample	Samples with effective income tax rate less than 0	Samples with effective income tax rate more than 0	Samples with low financing constraints	Samples with high financing constraints
CP	−0.0005*** (−2.66)	−0.0008 (−0.92)	−0.0005** (−2.23)	−0.0001 (−0.17)	−0.0007*** (−3.11)	−0.0004* (−1.65)	−0.0055* (−1.68)
Lev	0.0185*** (6.18)	0.1423 (1.26)	0.0182*** (5.84)	0.0560*** (4.11)	0.0110*** (3.45)	0.0097*** (2.58)	0.0207*** (4.66)
Size	0.0012** (2.56)	0.0051*** (3.14)	0.0009** (1.96)	−0.0019 (−1.07)	0.0013** (2.62)	0.0010 (1.38)	0.0028*** (4.12)
Beta	0.0307*** (20.93)	0.0389*** (7.13)	0.0302*** (19.97)	0.0285*** (6.97)	0.0295*** (17.65)	0.0289*** (13.94)	0.0304*** (16.79)
B/M	0.0028*** (3.49)	0.0009 (0.38)	0.0030*** (3.66)	0.0027 (1.16)	0.0032*** (3.77)	0.0042*** (3.40)	0.0010 (1.11)
AT	0.0008 (0.75)	−0.0029 (−0.50)	0.0011 (0.98)	−0.0011 (−0.26)	0.0015 (1.37)	0.0016 (1.12)	0.0023 (1.57)
FC						—	0.0175 (0.99)
CP∗FC						—	0.0012 (1.36)
Indu	Control	Control	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control	Control	Control
N	2198	150	2038	384	1635	1090	1090
Adj-R^2	0.3784	0.582	0.3724	0.3743	0.3862	0.3342	0.4276

Note. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

than 0, resulting in the enterprise being unable to obtain the benefit of the tax shield and losing an important positive lever in reducing the cost of capital. Generally, corporate pensions do not significantly reduce the cost of capital. The regression results of samples with an effective income tax rate greater than 0 show a significant negative correlation between corporate pensions and cost of capital at the level of 1%. This reflects that the tax shield benefits generated by corporate pensions, together with other factors, play a more positive than negative role in reducing the cost of capital. Corporate pensions significantly reduce the cost of capital. Hypothesis 3 is therefore verified. The regression results of samples with low financing constraints and high financing constraints both show a significant negative correlation between corporate pension and cost of capital at the level of 10%, indicating that corporate pensions can significantly reduce the cost of capital, regardless of whether there is financing constraint. In addition, there is no significant positive correlation between the intersection item of financing constraints, corporate pension, and cost of capital. This indicates that financing constraints cannot significantly weaken the negative correlation between corporate pensions and cost of capital. Hypothesis 4 is therefore verified.

The test results of mediating effects in Table 6 show a significant positive correlation between corporate pensions and innovation performance at the level of 1%, indicating that corporate pensions can significantly increase the innovation performance of enterprises. Innovation performance is negatively correlated with the cost of capital at the level of 10%, indicating that innovation performance can significantly reduce the cost of capital. There is a significant negative correlation between corporate pension and the cost of capital at the level of 5%. Hypothesis 5 is thus verified, indicating that innovation performance has a partial mediating effect between corporate pensions and the cost of capital.

4.5. Robustness Check

4.5.1. Endogeneity.
Endogeneity affects the explanatory power of the relationship between corporate pensions and the cost of capital. Therefore, the two-stage least square (2SLS) method is adopted for the test of endogeneity. Certain important variables might be omitted in the regression equation between corporate pensions and the cost of capital, resulting in endogeneity problems.

Some enterprises with lower cost of capital may possess stronger competitiveness, stronger capital, and stronger ability to pay corporate pensions, which creates a two-way impact between corporate pensions and the cost of capital. In order to eliminate the interference of the above problems with the research conclusions, instrumental variables and the two-stage least square method (2SLS) are adopted to regress the model. Given the certain path dependence of the increase of corporate pension, the past corporate pension liabilities of the enterprise will affect its current corporate pension liabilities and the industry standards on corporate pension will affect its

TABLE 6: Multivariate regression test (mediating effects).

Patent		Re	
CP	0.1536*** (6.42)	Patent	−0.0009* (−1.90)
First	0.6630** (1.97)	CP	−0.0007** (−2.39)
Board	0.3044 (1.40)	Lev	0.0173*** (3.97)
Msh	1.4914** (2.37)	Size	0.0030*** (4.70)
Roa	0.7123 (0.67)	Beta	0.0267*** (15.14)
Lev	1.7054*** (5.89)	B/M	0.029* (1.69)
		AT	0.0002 (0.2)
Indu	Control	Indu	Control
Year	Control	Year	Control
N	1078	N	1078
Adj-R^2	0.2833	Adj-R^2	0.3642

Note. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

corporate pension. Therefore, corporate pensions of enterprises lagging behind the first phase and the corporate pension at the industry level are taken as instrumental variables to test the endogeneity.

As shown in Table 7, the regression results of the first stage show that the coefficient of MeanCPt is 0.4168 and the correlation coefficient between corporate pensions at the industry level and the cost of capital has a significant negative correlation at the level of 1%. The coefficient of CP_{t-1} is 0.4316, and there is significant negative correlation between corporate pensions with one lag and the cost of capital at the level of 1%.

It shows that these two instrumental variables meet the correlation requirements. In the first stage, the F-statistic is 360.99, which is much higher than the empirical value of 10, indicating that the assumption of weak instrumental variables is rejected. The p value of the Sargan overidentification test result is 0.3019, indicating that the two instrumental variables are reasonable and effective exogenous variables. Additionally, the regression results of the second stage show that the coefficient of CP is −0.0016 and there is a significant negative correlation between corporate pensions and cost of capital at the level of 5%, which is consistent with the previous regression results.

4.5.2. Replacing Variable.
Ohlson and Juettner-Nauroth propose the OJ model [32]. The formula of the model is as follows: $R_e = A + \sqrt{A^2 + eps_1/P_0\left[g - (\gamma - 1)\right]}$. $A = \gamma - 1 + dp \, s_1/P_0/2$ and $g = (eps_2 - eps_1)/eps_1$, where $\gamma - 1$ is the long-term revenue growth rate, and the value is 0.05 according to the practice of Hongbo Shen [33]. When $eps_1 > eps_2$, let $eps_1 = eps_2$. When the value under the root sign is negative, let Re = A [34]. Gode and Mohanram show that the OJ model can fully reflect the market's estimation level of risk premium and reduce restrictions on estimation of the cost of capital [35]. Therefore, the value of the OJ model is applied to replace the average value of the PEG and CAPM models used in the previous part of the paper for the estimation of the cost of capital, and the value of corporate pension divided by total assets is used to replace the value of the logarithm of corporate pension. The regression analysis is carried out again and passes the robustness tests, as depicted in Table 8.

TABLE 7: 2SLS regression test.

	First stage CP		Second stage Re
MeanCP$_t$	0.4168*** (9.52)	CP	−0.0016** (−2.36)
CP$_{t-1}$	0.4316*** (17.65)		
Lev	−1.3633*** (−5.73)	Lev	0.0283*** (8.87)
Size	0.7048*** (18.84)	Size	0.0009 (1.39)
Beta	0.0942 (0.76)	Beta	0.0249*** (16.58)
B/M	−0.1361*** (−2.87)	B/M	0.0022*** (2.81)
AT	0.3539*** (4.25)	AT	0.0005 (0.49)
Indu	Control	Indu	Control
Year	Control	Year	Control
N	2197	N	2197
Adj-R^2	0.5173	Adj−R^2	0.1928
F-test of instruments	360.99 (0.00)		
Sargan overidentification test	0.3198 (0.3019)		

Note. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

TABLE 8: Substitution variable regression test.

Re	The value of OJ model is used to replace the average value of the PEG model and CAPM model	The value of corporate pension divided by the total assets is used to replace the value of the logarithm corporate pension
CP	−0.0016*** (−3.28)	−1.6581** (−2.10)
Lev	0.0298*** (4.50)	0.0382*** (6.64)
Size	0.0045*** (4.42)	0.0008 (1.05)
Beta	0.0001 (0.05)	−0.0026 (−0.95)
B/M	0.0006 (0.45)	0.0059*** (3.96)
AT	0.0047* (1.94)	0.0022 (0.99)
Indu	Control	Control
Year	Control	Control
N	1788	2196
Adj-R^2	0.1977	0.2284

Note. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

5. Conclusive Remarks

5.1. Basic Conclusion.
This paper theoretically analyzes and empirically tests the impact of corporate pensions on the cost of capital for the whole sample and grouping sample (labor-intensive and capital-and technology-intensive, effective income tax rate less than 0 and effective income tax rate greater than 0, financing constraints less than 0 and financing constraints greater than 0) based on the data of listed companies in Chinese A-share market from 2008 to 2019. The results show that corporate pensions can affect the cost of capital in two ways, i.e., debt and incentive effects. Corporate pensions can significantly reduce the cost of capita in the full samples, capital-and-technology-intensive samples, samples with effective income tax rate greater than 0, and samples with financing constraint more or less than 0. While for labor-intensive samples and samples with effective income tax rates less than 0, the positive effects of corporate pensions have an offsetting effect on reducing the capital cost and increasing the capital cost, resulting in the inability of corporate pensions to significantly reduce the cost of capital. Innovation performance is proven to have a partial mediating effect between corporate pensions and cost of capital.

In general, defined contribution corporate pension plans in China play a positive role in reducing the cost of capital, protecting the interests of shareholders, and increasing the value of enterprises under certain factors.

5.2. Policy Implication.
Firstly, enterprises are supposed to increase the payment amount of corporate pensions as much as possible under the condition where the effective investment, normal operation, and on-the-job salary expenditure of employees are guaranteed. Sustainable and effective investment and normal operation are the most important means for enterprises to achieve long-term sustainable development and continuous growth of shareholders' wealth. Limited funds must be set aside for this part of expenditure. The efficient work quality of employees is inseparable from the incentive for a scientific and reasonable salary. Compared with the guarantee of a corporate pension for life after retirement, salary is the basic source to guarantee the existing living standard of employees. Generally speaking, salary lasts longer, the amount is higher, and the incentive intensity for employees' work enthusiasm will be higher. Therefore, limited funds must serve to guarantee the payment of employees' reasonable salaries simultaneously. Except for the payment of effective investment, normal operation, and employee salaries, enterprises must increase the payment of corporate pensions as much as possible, in order to reduce the cost of capital through the debt effect and incentive effect of corporate pension so as to increase stockholders' wealth finally.

Secondly, enterprises can appropriately increase the payment of corporate pensions to benefit from the tax shield and reduce the cost of capital as the increase of effective income tax rate. "Appropriately" here refers to suitable increase of corporate pension to a certain extent, but it cannot be too high. Otherwise, excessive financial burden will lead to excessive financial risks, and the final comprehensive effect may increase the cost of capital or fail to maximize the reduction in the cost of capital.

Thirdly, corporate pension payments can promote the increase of enterprise innovation performance and ultimately reduce the cost of capital for innovative enterprises, i.e., enterprises with a large number of patents. Therefore,

compared with other types of enterprises, innovative enterprises can place more emphasis on the improvement of the proportion of corporate pension payments, so as to increase the enterprise innovation performance and then reduce the cost of capital.

Fourthly, the construction of Chinese stock market requires further improvement. At present, the dividend distribution policies of Chinese listed companies are not optimistic. Generally speaking, the dividend level remains low and many enterprises fail to distribute any cash dividend. Therefore, it is necessary to promulgate corresponding rules for the supervision over listed companies, urging them to respect stockholders' interests and maintain a sufficiently high-level-cash dividend distribution, so as to guide investors to focus more on the performance and dividend policy of listed companies and guide investors to transfer their stock purchasing idea from short-term speculation to long-term investment. Therefore, the financing threshold of listed companies can be improved to guide investors to prudently treat enterprises with large financing constraints in order to avoid loss from blind speculation. Although this guidance will improve investors' assessment risk level for enterprises by virtue of larger financing constraints and increase the cost of capital correspondingly, it still helps investors avoid speculation loss, increase their long-term investment interest, and eventually increase their wealth.

Finally, in order to avoid excessive financial risk and increase of cost of capital resulting from the transmission of bad signals to the capital market, labor-intensive enterprises are supposed to maintain their best caution when paying corporate pensions. Limited funds must be spared to meet effective investment, normal operations, and payment of employee salaries, while the remaining funds should be used for the payment of corporate pensions.

5.3. Limitation and Further Research. This paper fails to analyze specific enterprises and lacks policy suggestions from specific case analysis. Individual enterprises can be selected for case analysis from the samples of labor-intensive enterprises, capital-and-technology-intensive enterprises, enterprises with effective income tax rate greater than 0 and less than 0, and enterprises with financing constraints greater than 0 and less than 0, so as to make further research on the impact of corporate pension payment on capital cost. Based on the principle of protecting the interests of shareholders, this paper further explores the rules to be followed in the payment of corporate pension for different types of enterprises.

Data Availability

Data are from CSMAR and RESSET databases (https://www.gtarsc.com/ and http://www.resset.cn/).

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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