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# Corporate Social Responsibility Information Disclosure and Innovation Sustainability: Evidence from China

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**Abstract:** We selected the Chinese A-share listed companies during period of 2007 to 2017 as the research subject, and from the perspective of information and reputation effects, we examined the relationship between corporate social responsibility (CSR) information disclosure and innovation sustainability. The results show that CSR information disclosure has a significant positive relationship with innovation sustainability. Analysis of the effects channel suggests that the information effect plays a dominant role; CSR information disclosure can alleviate the information asymmetry between managers and investors, controlling shareholders and minority shareholders, and alleviate the financing constraint problems, thereby improving innovation sustainability. Our findings support the information hypothesis but not the reputation hypothesis. The relationship between CSR information disclosure and innovation sustainability is more significant in non-state-owned companies. The moderating effect shows that managerial stock incentives can strengthen the positive relationship between CSR information disclosure and innovation sustainability. A series of robustness test results show that the conclusions are reliable. The research is important for promoting the fulfillment of CSR, improving corporate innovation, and promoting the healthy development of the capital market.

**Keywords:** corporate social responsibility (CSR); information disclosure; innovation sustainability; managerial stock incentive

## 1. Introduction

Corporate social responsibility (CSR) is an important contributor to economic development [1–3] and reflects the continuing commitment by firms to responsible behavior [4]. With the transformation and upgrading of China's economy, innovation is playing an increasingly important role in maintaining sustainable corporate development. Innovation sustainability means that if a corporate has been innovative in the past, it has a high probability of being innovative in the next few years, showing certain continuity in time, with a time accumulation effect. Innovation sustainability is a type of benign and circular feedback innovation. The essence of innovation sustainability is that current innovation is positively correlated with past innovation and can produce sustainable innovation benefits for the firm [5]. As the competitive environment of the product market is constantly changing, companies must maintain innovation sustainability through long-term capital investment, thereby maintaining a competitive advantage in a fiercely competitive environment [6]. Innovation sustainability can increase the market share and sales revenue of a company's products, and provide financial support for future innovation [7]. However, innovation is characterized by high information asymmetry and adjustment costs, which often seriously financially constrain the process of innovation. Therefore, determining

how to treat the relationship between CSR information disclosure and innovation sustainability is worthy of further study.

CSR information disclosure is an important aspect of non-financial information disclosure. In 2008, China's listed companies began to issue CSR reports to reveal the company's achievements and detail their social responsibility [8]. CSR refers to the pursuit of social welfare maximization and sustainability through effective management to assume corporate responsibility for all stakeholders [9–11]. With the increasing importance of sustainability, a company's increase in CSR information disclosure has been widely recognized by various countries [12,13]. In January 2008, the Chinese State-owned Assets Supervision and Administration Commission of the State Council (SASAC) issued Guidance for the Central Enterprises to Disclose Their Social Responsibilities Information, which encourages the central enterprises to issue CSR reports. Related statistics showed that under the call of the SASAC, central enterprises should actively publish CSR reports for their special state-owned status. In 2014 and 2015, about 75.89% and 57.55% of central enterprises chose to issue CSR reports, respectively [14]. In terms of proportion, from 1998 to 2015, the proportion of China's total social research and development expenditure to gross domestic product (GDP) increased from 0.69% to 2.1%. In 2015, China's total social research and development expenditure reached RMB 1430 billion, of which, research and development expenditure accounted for more than 77%, accounting for 2.10% of GDP. In terms of distribution, in 2015, the proportion of R&D expenditure in Chinese enterprises, government-owned research institutions, and higher education institutions accounted for 76.8%, 15.1%, and 7%, respectively. However, many of China's A-share listed companies have not invested in innovation (or have not disclosed relevant information on innovation investment), the innovation efficiency of innovative enterprises is generally low, and about 94% of enterprises' innovation output investment is relatively low [15].

The CSR report provides useful and important information for understanding the company's situation as presented through a mechanism other than the annual financial report provided by the listed company [8]. However, the empirical analysis of the role of CSR information disclosure in corporate governance involves two opposing hypotheses. One hypothesis of CSR information disclosure is the "information effect" [16,17]. The other hypothesis CSR information disclosure is the "reputation effect". Therefore, it is necessary to explore the determination of which effect is primarily dominant on the relationship between CSR information disclosure and innovation sustainability in China's capital markets. However, studies of CSR information disclosure and innovation sustainability focusing on the Chinese capital markets are lacking. As scholars have mainly focused on CSR information disclosure and corporate financing constraints, few studies have directly discussed the relationship between CSR information disclosure and innovation sustainability. Therefore, we examined the relationship between CSR information disclosure and innovation sustainability in China, enriching and expanding the existing research and clarifying the impact mechanism of CSR information disclosure on innovation sustainability. This provided information to allow us to propose targeted comments and policy recommendations for the improvement of innovation sustainability.

We selected 2164 Shanghai and Shenzhen A-share listed companies in 2007–2017 as samples to explore the impact of CSR information disclosure under different motives on innovation sustainability, and to further examine the regulating effect of managerial stock incentive. The main contributions of our study are as follows: Firstly, we enrich the empirical research in the existing literature on innovation sustainability. The research, based on different motivations of CSR information disclosure, provides an empirical reference for the supervision of non-financial information disclosure behavior of listed companies. Secondly, we empirically tested whether CSR information disclosure has an information effect or a reputation effect on the innovation sustainability of Chinese listed companies. We found a positive relationship between CSR information disclosure and innovation sustainability, and the information effect of CSR information disclosure plays a crucial role, which broadens the theoretical research on the economic consequences of CSR information disclosure, providing reference for improving the quality of corporate governance, protecting the interests of investors and stabilizing the capital market from a new perspective. Thirdly, using different data and methods to test the

robustness of the empirical results, we again confirmed that information effect is the dominant effect in CSR information disclosure. Therefore, publishing the CSR information disclosure report improves the level of innovation sustainability.

The rest of the paper is organized as follows: Section 2 describes the theoretical analysis and research hypothesis, Section 3 outlines the variable selection and model setting, Section 4 discusses the hypothesis test and results of the analysis of the CSR information disclosure effect, and Section 5 concludes and proposes the policy recommendations.

## 2. Theoretical Analysis and Research Hypothesis

### 2.1. Literature Review

As societal sustainability has drawn increased public attention, the research on CSR information disclosure has also increased. As the information source of listed companies, the CSR information disclosure directly affects the information of the company obtained by investors and is reflected in the innovation investment risk. Some scholars think that CSR information disclosure can significantly reduce the information asymmetry, reduce the capital cost, and improve the company's financing environment, thus affecting the company's innovation investment. Richardson et al. [18] found that CSR information disclosure can reduce information asymmetry, reduce forecasting risk and liquidity risk, and thus reduce the cost of equity capital. Dhaliwal et al. [1] reported that listed companies disclosing CSR information have lower analyst earnings forecast error, and this phenomenon is more obvious in countries with lower corporate transparency. Although various aspects of research are involved, in-depth explorations into the effect of CSR information disclosure are lacking.

The published studies analyzed innovation sustainability from two aspects: the influencing factors and the innovation smoothing mechanism. From the perspective of the influencing factors, Peters [19] conducted a regression analysis on the impact of the previous R&D expenses on the innovation expenses of the current period, and found that the greater the R&D investment in the past, the greater the probability of continuing innovation activities in the future. Clausen et al. [20] studied the role of market factors in innovation sustainability, and found that market-oriented innovation strategy has a strong impact on the corporate technology innovation sustainability. Le Bas and Poussing [21] reported that the size of the enterprise impacts innovation sustainability, and the larger the company, the stronger the innovation sustainability. Brown and Petersen [22] proposed that corporate savings have a smoothing effect on the innovation sustainability of U.S. listed companies.

The impact of the relationship between internal/external factors and CSR should be considered on the company's investment and financing process and the innovation activities [23–26]. For example, Hong et al. [23] found that providing executives with direct incentives for CSR is an effective tool for increasing firm social performance. The findings identified corporate governance as a determinant of managerial incentives for social performance, and suggested that CSR activities are more likely to be beneficial to shareholders, as opposed to an agency cost. Ikram and Li [24] found that CSR contracts are primarily granted by large firms with a history of being socially responsible, particularly in industries where employee safety and environmental protection concerns are likely to be important. Li and Thibodeau [25] stated that executives are more likely to manipulate earnings to achieve their personal compensation goals as well as their CSR-contingent compensation when the CSR rating is low. Dunbar and Li [26] reported that CSR standing is positively related to chief executive officer (CEO) pay risk sensitivity, demonstrating that firms whose sustainable initiatives are viewed as successful are more likely to offer their CEOs greater risk-motivating financial incentives.

Whereas these prior studies indicate that CSR information disclosure can reduce information asymmetry, improve information transparency, and reduce financing constraints, the literature on the relationship of CSR information disclosure and innovation sustainability is nascent. The major causes of innovation sustainability are the principal–agent problem, information asymmetry, and financing constraints, whereas CSR information disclosure is an important factor that directly affects

the above major causes. CSR information disclosure may also trigger managerial professional attention and affect company innovation sustainability. Therefore, the effect of CSR information disclosure on innovation sustainability was the focus of this study. Lerner and Wulf [27] stated that more long-term incentives (e.g., stock options and restricted stock) are associated with more heavily-cited patents, and performance pay of corporate R&D heads is associated with more innovative firms. Lin et al. [28] opined that the presence of CEO incentive schemes increases both corporate innovation effort and innovation performance. Although these earlier studies showed that managerial incentive has a significant influence on the corporate innovation, they failed to consider the role of managerial stock incentive as a mediator of the relationship between CSR information disclosure and innovation sustainability. Our findings contribute to the literature by identifying an important mediator and by explaining the influential effect of CSR information disclosure on innovation sustainability.

## 2.2. The Information Effect of CSR Information Disclosure

As a reflection of the interaction between companies and stakeholders, CSR information disclosure not only conveys more internal corporate information to the outside, but also has important value relevant to investors' decisions. From the perspective of corporate information transparency, CSR information disclosure provides investors with more internal information, which is called the information effect. Managers often face higher non-distributable employment risks than shareholders, so they tend to show high-risk aversion in company decision-making and tend to avoid risky investment projects, such as R&D and technology innovation projects. Innovative investment has its own unique features, such as high uncertainty, intangibility, and severe information asymmetry [29]. The company's short-term performance improvement not only affects the stock price, but also affects management salary, which prompts managers to focus on the short-term investment projects and abandon the risky innovation investment projects [30]. CSR information disclosure increases the number of stakeholders to whom managers are beholden, thereby increasing the number of monitors of managerial behavior, creating implicit contracts with an expanded set of stakeholders. This enhanced monitoring and expanded implicit contract set should mitigate agency conflicts that arise between managers and shareholders [4,31]. Stated differently, managers of firms that commit to higher levels of CSR information disclosure are better able to create value for shareholders through efficient decision-making, investment opportunities, and innovation [4]. With the increase in CSR information disclosure, the agency problem between managers and shareholders is reduced, and the ability of shareholders to supervise managers increases, so the willingness of managers to reduce risk also decreases. Therefore, increased CSR information disclosure improves the information environment and the quality of accounting information [31–35], thereby reducing information asymmetries between managers and shareholders [36]. A better information environment should lead to enhanced and expedited decision making and a greater capacity for innovation.

The controlling shareholders usually hold more shares and innovation investment projects will increase their shareholding risk, so they are more willing to choose investment projects with lower value but can produce private benefits; thus, they tend to display risk aversion behaviors [37]. The controlling shareholders have certain information advantages compared with the external small and medium shareholders, and increased CSR information disclosure will undoubtedly alleviate information asymmetry between the controlling shareholder and the external minority shareholders, thus improving the effectiveness of the vote by foot behavior of small and medium shareholders [16], and this will reduce the possibility of controlling shareholders abandoning the risky innovation projects.

Financing constraint theory holds that when a company's financing costs are high and internal cash flow is insufficient, the risky investment projects with a positive net present value are usually abandoned. When companies face higher financing constraints, managers usually avoid risks and adopt relatively cautious investment decisions. When companies face lower financing constraints, managers are more willing to take more risks and make relatively loose investment decisions because the funding source is relatively sufficient. With increasing CSR information disclosure, the information

disadvantages and risks faced by investors are also reduced. They are also willing to provide more funds for the company to reduce the capital cost, thus effectively alleviating the effect of financing constraints on the level of innovation sustainability [38–40]. Based on these extant studies, we formed the first hypothesis:

**Hypothesis 1 (H1):** *CSR information disclosure helps to improve innovation sustainability.*

### 2.3. The Reputation Effect of CSR Information Disclosure

CSR information disclosure is mainly provided for stakeholders, such as consumer demand, product quality, corporate financial status, and environmental performance. When these signals are continuously released and effectively received by external investors, the managerial reputation capital is formed. From the perspective of the reputation effect, increased CSR information disclosure reduces the company's willingness to select risky innovation investments [41–43].

First, because shareholders mostly evaluate managers based on their business performance, and the potential benefits of innovation projects must be outweighed by a high probability of failure [44,45], the manager will consider the existing reputation in the innovation investment projects decisions to send strong signals to shareholders, so they tend to choose low-risk investment projects. Hirshleifer and Thakor [46] established a selection model for managerial reputation and risky investment projects and found that managers showed cautiousness in their investment decisions based on their existing reputations. Eisenmann [47] and Mishra [48] also reported that based on the future reputation and career development considerations, managers will adopt a conservative investment strategy to obtain more private profits, thereby reducing the corporate innovation investment.

Second, with concentrated managerial personal wealth, the professional concern generates the problem of insufficient risk-taking [49], even give up some innovation investment projects with relatively high risks but positive net present value [42]. Chakraborty et al. [41] found that managers will consider firing risk in innovation investment decisions, and a 10% increase in firing risk would lead to a 5% to 23% decrease in stock return volatility. Therefore, the willingness of a manager to take risky innovation investments depends on the relative importance of dismissal risk and salary. When the dismissal risk faced by a manager is relatively important, the manager will reduce the level of innovation investment to avoid being dismissed by the company, thus reducing the level of innovation sustainability [42]. CSR information disclosure may lead to the company's unique information being obtained by the competitors, which will affect the company's competitive position, and increase costs; the existence of the proprietary costs and manager compensation may damage the company's interests due to CSR information disclosure [50,51], thereby reducing the company's willingness to choose risky innovation investments. Based on the above mechanism analysis, the second hypothesis is proposed:

**Hypothesis 2 (H2):** *CSR information disclosure helps to reduce innovation sustainability.*

### 2.4. CSR Information Disclosure, Nature of Ownership, and Innovation Sustainability

The heterogeneous nature of corporate ownership leads to firm resource allocation and investment opportunities being significantly different. The nature of ownership not only affects the company's business strategy and the information disclosure environment, but also affects the company's innovation decisions. Evidence from the U.S. and Europe shows that state ownership has inefficient bureaucratic structures and incentives to innovate are reduced [52]. China has recently become one of the world's largest economies [5] and the world's leading generator of patents [53]. As China's economy is dominated by state-owned enterprises, the attention of practitioners and academics alike is focused on whether or not these state-owned enterprises are innovative.

The principal–agent problem decreases the motivation of the managers of state-owned enterprises to consider innovation sustainability. Managers of state-owned enterprises in China are usually

appointed by the higher levels of government and have shorter tenure, whereas the return on innovation investment is longer, which focuses these managers on their short-term benefits. State-owned enterprises are protected by the government, and the loss due to innovation failure is lower than that of private enterprises. Therefore, state-owned enterprises face lower innovation sustainability risks. Under China's current financial system, private companies face stricter financing constraints than state-owned enterprises, and obtaining innovative funds through formal channels.

Compared with private enterprises, the controlling shareholders of state-owned enterprises have stronger motives for encroachment, thus hindering innovation sustainability. Shleifer and Vishny [54] reported that the gradual increase in the degree of separation of control right and cash flow right increases the severity of the agency problem between controlling shareholders and minority shareholders, thus enhancing the motivation of enterprise controllers to encroach the benefits of minority shareholders. However, the controlling shareholder's cash flow right and control right are less deviated, and this benefit on encroachment behavior is lower in private enterprises. Tan et al. [55] reported that the privatization of state-owned enterprises in China has a positive causal effect on firm innovation output. Managers of private companies are more motivated to maximize their personal and corporate interests through continuous innovation investments, thereby driving corporate sustainable growth.

**Hypothesis 3 (H3):** *The CSR information disclosure of private enterprises has a more pronounced positive effect on improving innovation sustainability than that of state-owned enterprises.*

### 2.5. CSR Information Disclosure, Managerial Stock Incentive, and Innovation Sustainability

Generally, there are two reasons that managers are more risk-averse than firm owners. First, whereas the firm owners can diversify their risk by owning shares in other businesses, managers' wealth and employment security are directly and uniquely linked to the success or failure of a firm's specific projects and cannot be diversified. Therefore, their incentives to take risks are curtailed [28,56]. Second, managers tend to have a more short-term focus than owners since they generally do not have equity ownership in the firm and are rewarded by short-term incentives such as base pay and bonuses [28,57]. Risk-averse managers usually focus on projects that can improve short-term business performance while avoiding innovative research and development activity with risk uncertainty. An effective managerial incentive mechanism can guarantee corporate innovation investment and company operation. Deciding whether to engage in risky innovation projects is one of the most fundamental investment decisions of the top managers of a firm. Therefore, managerial incentives play an important role in influencing innovation sustainability [28]. The implementation of an incentive mechanism can effectively motivate management to take risks and increase innovation [58]. Managerial stock incentives can mitigate the effects of agency problems and managerial risk aversion so that managers are more willing to accept risky projects [59].

Jensen and Meckling [31] found that equity incentives can align the interests of managers and shareholders, thereby prompting managers to value innovation, increasing their support for innovation. Stock incentive, as a long-term incentive mechanism, can combine the interests of managers and shareholders to maximize their interests, thereby increasing the willingness of the managers to rationally use the corporate resources for innovation activities. Wright and Sarin [60] considered that managers who lack stock incentives are reluctant to take risks to support and drive corporate innovation. Therefore, equity incentives can help to increase a company's investment in R&D, and then improve its innovation ability [61]. As innovation is possibly one of the riskiest long-term investments, which are more susceptible to asymmetric information, it is essential to incentivize managers to work for the benefit of the firm's owners. However, as an effective corporate governance mechanism, equity incentives not only improve the transparency of CSR information and reduce information asymmetry, but also improve innovation sustainability. Based on this, the following hypothesis was constructed:

**Hypothesis 4 (H4):** *Managerial stock incentive will strengthen the positive correlation between CSR information disclosure and innovation sustainability.*

### 3. Empirical Study Design

#### 3.1. Sample and Data

We selected all the Shanghai and Shenzhen A-shares companies from 2007 to 2017 in China as the initial sample. CSR information disclosure data were obtained from the Rankin's CSR Ratings (RKS) database, whereas other data were sourced from the WIND and CSMAR databases in China. CSMAR refers to the China stock market and accounting research, providing an economic and financial database developed from academic research combined with the actual situation in China. It covers 18 series of research data, including factor research, green economy, stocks, and company research. The WIND Data Service, as the leading financial data provider in China, equips investment professionals with accurate and complete data on stocks, bonds, funds, derivatives, indices, and the macro-economy. To ensure the reliability of the results, we conducted the following screening and pretreatments: (1) eliminating samples with missing variable data; (2) eliminating special treatment (ST) companies; (3) given the particularity of the financial indicators of financial companies, excluding financial companies; (4) deleting firm-year observations with many missing values to maintain the integrity and consistency of the whole sample; and (5) processing all continuous variables using 1% up and down Winsorizing to eliminate the effects of extreme values. Finally, we obtained a total of 10,103 sample observations for 2164 listed companies. We performed the regression analyses using STATA 14.0 software.

#### 3.2. Innovation Sustainability Measures

Intangible assets are closely related to corporate innovation activities, which can better represent innovation activities and better measure the innovation investment of enterprises. Increases in intangible assets are mainly the result of corporate innovation investment. Therefore, referring to Ju et al. [62], we used the incremental intangible assets (INNOV) to measure innovation sustainability.

#### 3.3. CSR Information Disclosure Measures

Referencing the methods in the literature [8,11,13], according to the information in the CSR report of listed companies in the CSMAR database, we defined a binary dummy variable for the CSR disclosure status. If the company published CSR reports in the year, the CSR is 1; vice versa, the value is 0.

#### 3.4. Corporate Governance Variables Measures

The corporate governance regulatory variable, the managerial stock incentive (MSI), refers to the total percentage of shares held by all the executives with greater than 1% shareholding [63].

We controlled for other variables that might affect innovation sustainability. Referring to the literature [64–66], and combined with the actual situation of listed companies in China, we selected institutional ownership (INST), firm size (Size), growth opportunity (GO), capital structure (LEV), investment opportunities (Tobin's Q), ownership concentration (FIRST), and the dummy variables for year and industry as the control variables. To minimize the time lag effect of variables on the innovation sustainability and endogenous problem, the explanatory variables and the control variables all adopted the value of the lag period. Table 1 provides the names, definitions, and specific measurements of variables.

**Table 1.** Definitions of the main variables used in this study.

Variable Name	Symbol	Definition
Innovation sustainability	INNOV	The incremental intangible assets
CSR information disclosure	CSR	The value is 1 if the CSR report is disclosed, otherwise 0
Managerial stock incentive	MSI	The total percentage of shares held by all the executives with greater than 1% shareholding
Institutional ownership	INST	Shareholding ratio of institutional investors
Firm Size	SIZE	LN (year-end total assets)
Growth opportunity	GO	Increase rate of main business revenue
Capital structure	LEV	Total liabilities/total assets
Investment opportunities	Tobin's Q	The market value of a company divided by its assets' replacement cost
Ownership concentration	FIRST	Total stockholding of the first major shareholders/equity

### 3.5. Empirical Model

We constructed multiple regression models to examine our hypotheses, and then used an empirical test for analysis. To reduce the endogenous problem, we adopted the lagging independent variable to construct the empirical model [66]. Model (1) was established to test the effect of CSR information disclosure on innovation sustainability (H1 and H2). Model (2) was established to test the effect of managerial stock incentives on the relationship between CSR information disclosure and innovation sustainability (H4).

$$INNOV_{i,t} = \alpha_0 + \alpha_1 \times CRS_{i,t-1} + \gamma \times ControlVariables_{i,t-1} + \varepsilon_{i,t-1} \quad (1)$$

$$INNOV_{i,t} = \lambda_0 + \lambda_1 \times CRS_{i,t-1} + \lambda_2 \times MSI_{i,t-1} + \lambda_3 \times CRS_{i,t-1} * MSI_{i,t} + \gamma \times ControlVariables_{i,t-1} + \varepsilon_{i,t-1} \quad (2)$$

In Model (1), if  $\alpha_1$  is significantly positive, H1 is supported, indicating that the effect of CRS information disclosure plays a crucial role. If  $\alpha_1$  is significantly negative, H2 is supported, indicating that the reputation effect of CRS information disclosure plays a crucial role.

We divided the nature of ownership into state-owned enterprises and non-state-owned enterprises, and then we repeated Model (1). If H3 is supported, then the absolute value of the coefficient of non-state-owned enterprises will be higher than that of state-owned enterprises.

We also constructed Model (2) to test the moderating effect of managerial stock incentives on the relationship between CSR information disclosure and innovation sustainability. If  $\lambda_3$  is positive, H4 is supported.

## 4. Empirical Results

### 4.1. Descriptive Statistics

The descriptive statistics of the full sample are provided in Table 2. From Table 2, during 2007–2017, the average INNOV value was 16.979, (SD 2.166), indicating that significant differences exist in innovation sustainability among companies. The average CSR information disclosure was lower, at 0.386, indicating that the overall quality of CSR information disclosure of Chinese enterprises is poor. This is also directly related to the late start of China's CSR disclosure and imperfect development. The standard deviation is 0.487, indicating that the CSR information disclosure levels between samples are different, which is also fully reflected in the other control variables below. The standard deviations of institutional ownership, investment opportunities, firm size, and firm ages were slightly larger than the other variables, indicating that some differences were present between the variables in different companies. In summary, the average value of each variable is within the normal range, which reflects the sufficient sample size, and indicates that the results are credible.

**Table 2.** Descriptive statistics.

Variable	N	Min	Max	Mean	Median	SD
INNOV	10,103	5.304	24.575	16.979	17.150	2.166
CRS	10,103	0.000	1.000	0.386	0.000	0.487
MSI	10,103	0.000	13.851	0.269	0.001	0.576
SIZE	10,103	19.105	28.509	22.261	22.065	1.350
GO	10,103	−0.464	4.094	0.272	0.157	0.569
INST	10,103	0.000	21.839	5.171	3.845	4.942
Tobin's Q	10,103	0.926	7.332	2.003	1.625	1.148
LEV	10,103	0.046	0.934	0.442	0.437	0.219
FIRST	10,103	0.088	0.749	0.357	0.335	0.152

After creating the descriptive statistics of the overall sample, we calculated descriptive statistics on the overall sample group by group. One of our aims was to explore the impact of the nature of ownership on the relationship between CSR information disclosure and innovation sustainability. Therefore, we divided the total sample into groups, state-owned enterprises and non-state-owned enterprises, for descriptive analysis. Table 3 shows that a large difference exists between the two types of entities. The average CSR information disclosure of state-owned enterprises was 0.828, whereas that of non-state-owned enterprises was 0.650. This shows that the quality of the CSR information disclosure of state-owned enterprises is much higher than that of non-state-owned enterprises. Comparing their standard deviations, we found that the SD of the CSR information disclosure of state-owned enterprises was higher than that of non-state-owned enterprises. The sample size of state-owned enterprises was 4366, and that of non-state-owned enterprises was 5737. This information indicates that the proportion of state-owned enterprises that publish CSR information disclosure is higher than that of non-state-owned enterprises, but the quality of their disclosures is uneven.

**Table 3.** Descriptive statistics of state-owned enterprises and non-state-owned enterprises.

Variable	State-Owned Enterprise					Non-State-Owned Enterprise				
	N	Min	Max	Mean	SD	N	Min	Max	Mean	SD
INNOV	4366	10.816	22.610	17.349	2.268	5737	11.023	21.012	16.704	1.933
CRS	4366	0.000	1.000	0.828	0.377	5737	0.000	1.000	0.650	0.218
MSI	4366	0.000	0.411	0.011	0.054	5737	0.000	2.733	0.449	0.627
SIZE	4366	20.069	27.121	22.791	1.451	5737	19.885	25.056	21.853	1.062
GO	4366	−0.481	3.996	0.246	0.570	5737	−0.427	4.330	0.294	0.579
INST	4366	0.000	23.250	5.234	5.155	5737	0.000	20.140	5.121	4.772
TOBIN'S Q	4366	0.905	6.309	1.782	0.966	5737	0.982	8.087	2.174	1.262
LEV	4366	0.054	0.932	0.468	0.215	5737	0.044	0.937	0.423	0.219
FIRST	4366	0.101	0.770	0.392	0.157	5737	0.084	0.716	0.330	0.142

#### 4.2. Correlation Analysis

Table 4 provides the correlation coefficient of the main variables, the Spearman correlation coefficient in the lower-left corner, and the Pearson correlation coefficient in the upper right corner. From the correlation analysis results, CSR and INNOV showed consistency at the 1% level, which indicates that CSR information disclosure had a significant positive correlation with innovation sustainability within univariate influencing factors. The correlation coefficients between the other variables were less than 0.520, so we inferred that no collinearity problem existed between variables.

**Table 4.** Correlation matrix.

	INNOV	CRS	MSI	SIZE	GO	INST	TOBIN'S Q	LEV	FIRST
INNOV	1.000	0.163 **	0.123 **	0.012	0.491 **	0.063 **	−0.016 *	−0.042 **	−0.169 **
CRS	0.159 **	1.000	0.359 **	−0.017	0.324 **	0.019	0.076 **	−0.022 *	−0.136 **
MSI	0.137 **	0.519 **	1.000	−0.009	−0.283 **	−0.084 **	−0.104 **	−0.025 *	−0.025 *
SIZE	0.084 **	−0.074 **	0.099 **	1.000	0.014	−0.014	−0.001	−0.018	−0.013
GO	0.484 **	0.310 **	−0.297 **	0.026 **	1.000	0.070 **	0.044 **	−0.058 **	−0.341 **
INST	0.095 **	0.020 *	0.025 *	0.158 **	0.152 **	1.000	0.024 *	−0.080 **	0.132 **
TOBIN'S Q	−0.026 **	0.077 **	−0.127 **	−0.035 **	0.063 **	0.013	1.000	−0.087 **	−0.024 *
LEV	−0.008 *	0.082 **	−0.088 **	−0.053 **	0.078 **	−0.155 **	−0.037 **	1.000	0.040 **
FIRST	−0.226 **	−0.196 **	0.169 **	0.093 **	−0.457 **	0.197 **	−0.035 **	−0.023 *	1.000

Notes: \*\* and \* denote statistical significance at the 1% and 5% levels, respectively.

### 4.3. Regression Analysis

#### 4.3.1. CSR Information Disclosure and Innovation Sustainability

According to the results of the Hausman test, we found that the  $p$ -value in all models was less than 0.05; therefore, we finally selected the ordinary least squares (OLS) model and fixed effect (FE) model. Columns (1) and (2) in Table 5 show the regression results of OLS and FE models for all the samples, respectively. Table 5 shows that the coefficient of CSR information disclosure was 0.182 using the OLS model, and 0.619 using the fixed effect model, with a significance level of 1%; that is, a significant positive correlation exists between CSR information disclosure and innovation sustainability. Therefore, H1 is supported: the governance effect of CSR information disclosure plays a crucial role in innovation sustainability.

**Table 5.** Regression results of corporate social responsibility (CSR) information disclosure and innovation sustainability.

Variables	All Samples		Non-State-Owned Enterprise		State-Owned Enterprise	
	(1) OLS	(2) FE	(3) OLS	(4) FE	(5) OLS	(6) FE
CRS	0.182 *** (4.420)	0.619 *** (14.261)	0.377 *** (3.420)	0.638 *** (13.586)	0.170 ** (2.080)	0.528 *** (10.210)
SIZE	0.776 *** (48.910)	0.016 *** (0.004)	0.771 *** (33.170)	0.913 *** (20.091)	0.792 *** (32.810)	0.698 *** (13.240)
GO	0.004 *** (7.111)	0.005 *** (7.102)	0.005 *** (7.110)	0.004 *** (7.101)	0.004 *** (7.110)	0.003 *** (3.520)
INST	0.012 *** (3.291)	(0.012 *** 3.291)	0.010 ** (2.051)	0.013 ** (1.990)	0.012 ** (2.241)	0.014 ** (2.052)
Tobin's Q	−0.010 *** (−3.711)	−0.011 *** (−3.951)	−0.011 *** (−3.951)	−0.019 *** (−3.841)	−0.015 *** (−3.470)	−0.019 *** (−4.150)
LEV	−0.035 *** (−0.007)	−0.032 *** (−0.006)	−0.031 *** (−0.006)	−0.030 *** (−0.005)	−0.033 *** (−0.007)	−0.038 *** (−0.009)
FIRST	0.018 *** (3.102)	0.023 *** (0.005)	0.021 *** (0.005)	0.009 ** (1.921)	0.004 ** (2.131)	0.017 *** (3.341)
INDUSTRY	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes
$N$	10,103	10,103	5737	5737	4366	4366
$F$	358.13	86.89	144.53	59.76	179.70	27.85
Adj_ $R^2$	0.241		0.184		0.269	
Within_ $R^2$	0.090		0.111		0.069	

Notes: The statistics in brackets are  $t$  statistics. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively. OLS is ordinary least squares, and FE is fixed effects.

Firms need to invest large amounts of capital in innovation, and investors judge the future development of companies using the disclosed information. Corporate innovation not only reflects the managerial ability, but also the future development potential of the company. However, corporate innovation is highly uncertain, and its innovation benefits cannot be accurately predicted, which creates opportunities for managers to pursue private interests. The release of CSR reports is an important channel for information disclosure. Stakeholders and investors can obtain a comprehensive and in-depth grasp of the workings of the enterprise publishing its CSR activities. CSR information disclosure can help companies disseminate responsibility concepts internally, increase the transparency of information between companies and stakeholders, and provide key information for external investors' investment decisions. CSR information disclosure improves the company's information transparency, enables more investors to understand the company's development status and social responsibility, improves the company's reputation in the capital market, and thus can be used as support for obtaining more funds for innovation.

#### 4.3.2. CSR Information Disclosure, Nature of Ownership, and Innovation Sustainability

From the results in Table 5, we can compare the influence of ownership on the relationship between CSR information disclosure and innovation sustainability. Comparing the regression results, in columns (3) and (4) of Table 5, the regression coefficients of CSR information disclosure and innovation sustainability in the non-state-owned enterprises are 0.377 and 0.638, and the significance level is 1%; the regression coefficients of state-owned enterprises are 0.170 and 0.528 in columns (5) and (6), but the significance levels are 1% and 5%, respectively. The positive correlation between CSR information disclosure and innovation sustainability of non-state-owned enterprises is more significant, which supports H3.

Non-state-owned enterprises usually receive less supervision and attention than the state-owned enterprises, and they can only continuously increase their own strengths, strive to assume more responsibility, and improve their social reputation by increasing innovation so that the company can maintain sustainable development. However, state-owned enterprises are more mature, and they are more inclined to maintain the company status quo, lacking innovation sustainability consciousness. Although state-owned enterprises disclose more social responsibility information than non-state-owned enterprises, the purpose of information disclosure of state-owned enterprises is to maintain a good social reputation. Compared with non-state-owned enterprises, the impact of CSR information disclosure on innovation sustainability is relatively weak in state-owned enterprises.

#### 4.3.3. CSR Information Disclosure, Managerial Stock Incentive, and Innovation Sustainability

The regression results for H4 are shown in Table 6. In columns (1) and (3), the regression coefficients of MSI and innovation sustainability are positive, at a 5% significance level, which indicates that managerial stock incentive improves innovation sustainability. Columns (2) and (4) of Table 6 show that the coefficients of cross-term  $CSR \times MSI$  are positive and most of them are significant. The results indicate that managerial stock incentive strengthens the positive effect of CSR information disclosure on innovation sustainability, that is, H4 is supported. For listed companies in China, managerial stock incentive can play an active role in corporate innovation behavior, and influence management to improve the information disclosure quality of CSR.

**Table 6.** Regression results of the influence of managerial stock incentives.

Variables	OLS Model		FE Model	
	(1)	(2)	(3)	(4)
CRS	0.518 *** (13.901)	0.482 *** (11.060)	0.334 *** (3.177)	0.346 *** (3.586)
MSI	0.079 ** (2.190)	0.080 ** (2.191)	0.083 ** (1.511)	0.081 ** (1.500)
CRS*MSI		0.130 ** (2.121)		0.269 ** (3.012)
SIZE	0.784 *** (48.301)	0.784 *** (48.260)	0.824 *** (25.190)	0.824 *** (25.180)
GO	0.004 *** (7.110)	0.005 *** (7.112)	0.001 * (1.820)	0.001 * (1.821)
INST	0.012 *** (3.391)	0.012 *** (3.400)	0.015 ** (3.191)	0.015 ** (3.190)
Tobin's Q	-0.011 *** (-3.712)	-0.010 *** (-3.710)	-0.009 *** (-3.650)	-0.008 *** (-3.650)
LEV	-0.035 *** (-0.007)	-0.034 *** (-0.007)	-0.041 *** (-0.019)	-0.040 *** (-0.018)
FIRST	0.020 *** (3.131)	0.021 *** (3.131)	0.009 *** (2.760)	0.009 ** (2.761)
INDUSTRY	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes
N	10,103	10,103	10,103	10,103
F	358.83	322.92	86.75	78.07
Adj_R <sup>2</sup>	0.242	0.242		
Within_R <sup>2</sup>			0.090	0.089

Notes: The statistics in brackets are *t* statistics. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The managerial stock incentive will encourage managers to more actively support innovation activities for the long-term benefit and core competitiveness of the company. Under the Chinese background, the managerial stock incentive has a governance effect on corporate innovation and is beneficial to corporate innovation investment. Due to self-interest incentives and agency costs, when managers hold company equity, their private interests tend to be consistent with the company's overall interests, and they are more likely to disclose CSR information in the long term.

#### 4.4. Robustness Test

We used the robustness test to ensure the reliability and validity of our results. During the hypothesis testing process, we defined CSR information disclosure as a dummy variable for empirical analysis. First, referring to the research [8,11], we used Runling global rating data (RKS) to measure the quality of the corporate social responsibility information disclosure (CSR2). By introducing companies that have not disclosed social responsibility, we tested the overall sample to determine whether the information effect of CSR information disclosure was still effective.

The robustness test results in Table 7 show that the coefficient of CSR2 in the full sample is significantly positive, which indicates that H1 is supported. That is, a positive relationship exists between CSR information disclosure and innovation sustainability. CSR information disclosure can inhibit corporate irregularities and improve information transparency, thus increasing the motivation to invest in corporate innovation.

Table 7. Robustness test (H1, H2, and H3).

Variable	All Samples		Non-State-Owned Enterprise		State-Owned Enterprise	
	(1) OLS	(2) FE	(3) OLS	(4) FE	(5) OLS	(6) FE
CSR2	0.161 *** (4.011)	0.426 *** (12.310)	0.324 *** (3.350)	0.647 *** (13.520)	0.165 ** (2.073)	0.504 *** (13.330)
SIZE	0.774 *** (48.890)	0.014 *** (0.004)	0.770 *** (33.160)	0.910 *** (20.080)	0.790 *** (32.800)	0.701 *** (13.310)
GO	0.004 *** (7.101)	0.004 *** (7.100)	0.005 *** (7.111)	0.004 *** (7.100)	0.004 *** (7.101)	0.003 *** (3.515)
INST	0.011 *** (3.209)	0.011 *** (3.210)	0.011 ** (2.050)	0.012 ** (1.980)	0.012 ** (2.240)	0.014 ** (2.050)
Tobin's Q	−0.012 *** (−3.710)	−0.011 *** (−3.751)	−0.012 *** (−3.950)	−0.019 *** (−3.840)	−0.016 *** (−3.476)	−0.018 *** (−4.150)
LEV	−0.025 *** (−0.005)	−0.025 *** (−0.006)	−0.032 *** (−0.007)	−0.035 *** (−0.007)	−0.034 *** (−0.007)	−0.038 *** (−0.008)
FIRST	0.013 *** (2.952)	0.012 *** (0.006)	0.020 *** (0.005)	0.008 ** (1.911)	0.014 ** (3.131)	0.017 *** (3.340)
INDUSTRY	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes
N	10,103	10,103	5737	5737	4366	4366
F	346.25	85.62	142.35	58.26	168.81	26.68
Adj_R <sup>2</sup>	0.226		0.182		0.258	
Within_R <sup>2</sup>		0.090		0.110		0.069

Notes: The statistics in brackets are *t* statistics. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Second, Table 7 indicates that the coefficient and positive relationships between CSR information disclosure (CSR2) and innovation sustainability are more significant in non-state-owned enterprises than that in state-owned enterprises, which supports H3. Non-state-owned enterprises can increase market competitiveness by actively disclosing more CSR information and strengthening innovation; the operations and management of the state-owned enterprises are more mature so there is less incentive to innovate.

The results in Table 8 show that the coefficient of cross-term  $CSR2 \times MSI$  is significantly positive, indicating that H4 is still supported. Overall, the regression results in Tables 7 and 8 are consistent with the previous results, demonstrating the reliability of the conclusions.

We also performed other robustness tests. (1) A causal relationship may exist between CSR information disclosure and innovation sustainability. We can never exhaust all the factors that determine innovation sustainability. The residual endogeneity may still lead to an inconsistent estimation of the direct effect of the CSR information disclosure on innovation sustainability. Therefore, we referred to Li's research method [67] and employed an instrumental variable (IV) approach to isolate this direct effect, in which the instruments should be correlated with the CSR information disclosure but not with the structural residual of innovation sustainability. We selected the lagging second-phase sales growth rate as an instrumental variable, and the results showed that the results are robust. (2) The other method to address the endogeneity problem is to include as many important and time-variant control variables as possible. These variables are the potential factors that jointly influence CSR information disclosure and innovation sustainability. The endogeneity problem can be driven by unobservable CEO characteristics. Referring to Coles and Li [68], we added duality (when the CEO and the chairman are the same person, Duality is valued as 1; otherwise, Duality is valued 0), TENURE (the length of time that the CEO has been in their position), and INDIR (the proportion of independent directors).

In all cases, the results held, demonstrating that our conclusions are is robust. For the sake of brevity, we do not report these results.

**Table 8.** Robustness test (H4).

Variable	OLS Model		FE Model	
	(1)	(2)	(3)	(4)
CRS2	0.511 *** (13.881)	0.479 *** (11.010)	0.321 *** (3.160)	0.304 *** (3.011)
MSI	0.068 ** (2.150)	0.070 ** (2.170)	0.080 ** (1.500)	0.081 ** (1.502)
MSI*CRS		0.142 ** (2.265)		0.246 ** (2.890)
SIZE	0.783 *** (48.300)	0.784 *** (48.300)	0.811 *** (25.010)	0.814 *** (25.080)
GO	0.004 *** (7.110)	0.005 *** (7.110)	0.001 * (1.821)	0.001 * (1.820)
INST	0.014 *** (3.400)	0.013 *** (3.400)	0.015 ** (3.190)	0.015 ** (3.191)
Tobin's Q	−0.009 *** (−3.700)	−0.010 *** (−3.700)	−0.009 *** (−3.660)	−0.008 *** (−3.660)
LEV	−0.035 *** (−0.006)	−0.034 *** (−0.006)	−0.041 *** (−0.018)	−0.040 *** (−0.018)
FIRST	0.022 *** (3.131)	0.022 *** (3.130)	0.009 *** (2.761)	0.008 ** (2.760)
INDUSTRY	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes
N	10,103	10,103	10,103	10,103
F	360.12	319.26	83.49	73.55
Adj_R <sup>2</sup>	0.240	0.241		
Within_R <sup>2</sup>			0.088	0.088

Notes: The statistics in brackets are *t* statistics. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

## 5. Conclusions and Suggestions

In this study, we selected China's A-share listed companies from 2007 to 2017 as the research object and empirically examined the impact of CSR information disclosure of listed companies on innovation sustainability. The results showed that a positive relationship exists between CSR information disclosure and innovation sustainability, indicating that CSR information disclosure is characterized by a significant information effect. That is, as the CSR information disclosure level increases, the CSR information disclosure can improve the motivation to innovate, thus increasing innovation sustainability. CSR disclosure by companies will increase the company's exposure to the public, thereby increasing supervision by the public. CSR information disclosure can not only increase investors' trust, so that the public can understand the actual operating conditions of listed enterprises, but also improve information transparency and corporate reputation, thereby helping enterprises to obtain innovation funds. Compared with non-state-owned enterprises, state-owned enterprises have a higher level of social responsibility information disclosure. However, significant differences exist between state-owned and non-state-owned enterprises in terms of the impact of ownership type on social responsibility information disclosure and innovation sustainability. The positive relationship between social responsibility information disclosure and innovation sustainability

is more significant in non-state-owned enterprises. Non-state-owned enterprises usually disclose more social responsibility information and invest more in innovation to improve innovation sustainability, achieve sustainable development, and create a positive social reputation. As the leaders of the country, the central enterprises should play an exemplary role in promoting the quality of their own social responsibilities, not just to meet the policy requirements, but also to instill the corporate responsibility concept and provide a positive example for the securities market. Managerial stock incentive is positively related to the level of social responsibility information disclosure, and has a positive adjustment effect on the relationship between CSR information disclosure and innovation sustainability. When formulating innovation strategy or innovation policy, enterprises should not only fully consider their own management stock mechanism, but also design the contract according to the innovation level of the enterprise to determine the level of managerial incentive.

The research results are important for enriching existing research systems and understanding the role of CSR information disclosure. First, we expanded the research on the impact of CSR information disclosure. CSR information disclosure can significantly improve firms' incentives to innovate, which means that CSR information disclosure has a significant information effect but not the reputation effect on Chinese innovation sustainability. CSR information disclosure mitigates the problem of information asymmetry and financing constraints. Quality differences exist in the CSR reports of different companies, and the effects of improving innovation sustainability vary considerably. Companies with higher CSR are more credible. Second, the CSR information disclosure level of state-owned enterprises is higher than that of non-state-owned enterprises. However, the impact of ownership type on the relationship between social responsibility information disclosure and innovation sustainability varies between state-owned and non-state-owned enterprises. Because non-state-owned enterprises have weak political disadvantages and face greater financing constraints, they are more willing to invest in innovative ventures to enhance market competitiveness and company reputation. Third, the managerial stock incentive is conducive to reducing agency costs and improving CSR information disclosure, thus strengthening the positive relationship between CSR information disclosure and innovation sustainability. In conclusion, we systematically analyzed the micro mechanism of CSR information disclosure and provide new empirical support for the academic debate on the economic consequences of CSR information disclosure. The above research conclusions can help listed companies to strengthen CSR information disclosure and improve innovation sustainability and to provide a new perspective for improving the protection of the interests of enterprise owners and investors.

By researching the mechanism influencing CSR disclosure, we provide the following suggestions and policy recommendations to encourage CSR disclosure and to improve innovation sustainability behaviors in Chinese capital markets. (1) We emphasize the importance of CSR information to corporate sustainable development. When the level of CSR information disclosure is low, improving corporate innovation ability is difficult. Therefore, we encourage the listed companies to enhance their sense of responsibility as members of society, to combine their own development with the overall balanced development of society, and to protect the interests of stakeholders in all sectors of society while pursuing their own economic benefits. (2) The CSR disclosure of state-owned enterprises has an unsatisfactory effect on the improvement of innovation sustainability, indicating that some state-owned enterprises have taken advantage of undue gains from the information provided with CSR disclosure. Therefore, the government should issue some rigorous laws, regulations, and policies to enhance the quality of CSR disclosure information. (3) Managerial stock incentive plays an important internal governance role in listed companies. To further improve corporate governance and promote the development of the capital market, the managerial incentive should be further regulated and guided to enhance the role of these incentives in the future.

The disclosure system and background of CSR information disclosure in China are different from those in developed countries. Many large enterprises in developed countries attach considerable importance to employee welfare, charity, and environmental pollution control, and voluntarily undertake these social responsibilities and disclose the activities. However, in China, CSR information

disclosure has become a means of image promotion and financing, and the reliability of CSR information has decreased, creating difficulties for users to obtain true information, thus misleading investors, customers, and other stakeholders in judging the fulfillment of CSR. Based on CSR information disclosure in China as the research background, we found that CSR information disclosure can significantly improve innovation sustainability. Although the results increase our understanding of innovation sustainability research in developed countries, because the system of CSR information disclosure is different from developed countries, whether the results can be extended internationally need to be closely combined with the background of the country's particular information disclosure.

Although our research is theoretically and practically important, there are limitations. Firstly, the method for measuring the variables should be further improved to ensure the reliability of the research. Because no unified non-financial indicator exists for the measurement of CSR either at home or abroad, we defined a binary dummy variable for the CSR disclosure status, but this involves a certain degree of subjectivity that needs to be improved. Secondly, the increase in intangible assets is mainly the result of corporate innovation investment; therefore, we used the incremental intangible assets to measure innovation sustainability. Scholars worldwide mainly use this method to measure innovation sustainability as no other, more reasonable methods are available. Therefore, this is not only a limitation for our research, but is one of the issues that need attention in future research. Thirdly, although we conducted research from the perspective of managerial stock incentives, we did not systematically research the role of other internal and external governance factors. Future studies could consider the role of other internal and external governance factors on the relationship of CSR information disclosure and innovation sustainability. Future studies could consider the role of other internal/external factors, such as executive compensation, CEO characteristics, risk-taking, and institutional investors, on the relationship of CSR information disclosure and innovation sustainability.

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