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Corporate social responsibility, strategic style and enterprise innovation: evidence from China

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ABSTRACT

We make contribution to the literature on corporate social responsibility (CSR) and innovation by studying how CSR affects corporate innovation activities. Using data from listed firms in China, we find that CSR derived from legitimacy has a significant positive effect on corporate innovation. Specifically, our evidence shows that firms' internal responsibility and business partners' responsibility can facilitate innovation activities, and the corporate strategy is the potential channel for this positive association. From the perspective of the impact of external environmental pressure, the environmental uncertainty and the shock of the industry prosperity weaken the positive effect of CSR on innovation, namely, in the case of fewer environmental uncertainties and less industry prosperity, CSR plays a stronger role in promoting corporate innovation. From the point of the influence of heterogeneity, for firms with high employee loyalty, low agency cost and few financing constraints, CSR have a stronger impact on innovation. Overall, our results suggest that CSR does have a measurable impact on corporate innovation and contributes to understanding the special role of "legitimacy" in corporate decision-making in emerging markets.

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1. Introduction

Against a backdrop that the concepts of sustainable growth, corporate social responsibility (CSR) and ethical code have been universally recognised by the international community, Chinese companies, as important players in emerging markets, face a daunting challenge of shouldering social responsibilities while creating new growth engines in the process of implementing sustainable growth strategies. At present, it is widely accepted by the government, consumers and other stakeholders that innovation is a critical strategy to achieve sustainable growth for businesses (Huang & Li, 2017). IBM and Qualcomm, for example, are international innovative companies that have established a good reputation for fully taking social responsibilities while

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accomplishing their own economic value. Although a majority of studies on the impacts of CSR on corporates themselves zoomed in on developed countries, it is developing countries that should have been virtually in the spotlight in the CSR studies (Dwekat et al., 2020; Velte, 2019). Meanwhile, some studies argue that the mediating role of innovation in CSR effects (Hang et al., 2022), but there are few studies on the direct influences of CSR on business innovations and on its influencing mechanism. Therefore, our research aims to investigate whether CSR can promote corporate innovations and how they manage to do so to provide new ideas for corporates that are committed to sustainable growth.

The integration of CSR and business operation to establish sustainable competitiveness in the market has been increasingly concerned by many large companies worldwide. Some studies find that CSR practices could improve the social images of corporates and have a significantly positive relationship with their innovations (Martinez-Conesa et al., 2017;), conducive to the improvement of their financial and market performances (Servaes & Tamayo, 2013). However, some other scholars believe that CSR practices are irresponsible behaviours of corporates that are ostensibly generous at the expense of others since corporate resources are occupied and the management took advantage of such practices for a manipulating purpose and as an excuse to shirk responsibilities (Manso, 2011), thus detrimental to shareholders' wealth. At present, no consensus has been reached in the literature on the relationship between CSR and innovations (Szutowski & Ratajczak, 2016). From our point of view, the main reason for the diametrical interpretations is that these studies are subject to substantial constraints. First of all, these studies mainly base their conclusions on developed markets regardless of the huge difference in the global market, giving rise to the fact that the effects of CSR in developing countries are studied to a limited extent (Dwekat et al., 2020; Velte, 2019). For corporates in emerging economies in transition, for example, CSR activities should first and foremost be legally motivated before serving as a driving force for consequent strategies (Borial, 2007). In view of that, we should give priority to checking the motivations of CSR practices before identifying the relationship between CSR and corporate innovations. Second, the two opposite interpretations have been investigated by some studies on the CSR-innovation correlation and the influencing mechanism. If there is a positive correlation, CSR would be considered to be a key action to realise long-term business strategies and improve corporate innovations (Lončar et al., 2019). If there is a negative correlation, practicing CSR would be deemed to crowd out the investment in innovations by irresponsibly squandering corporate resources (Halkos & Skouloudis, 2018). The above conclusions are given on a basis of the assumption that CSR and innovations would be in a trade-off relationship, but neglecting the fact that the legally-motivated CSR practices may vary the allocation of corporate resources or bring new resources (Chen et al., 2018; Flammer, 2018; Martin & Moser, 2016). In addition, different stakeholders have different effects on the value creation of firms. Firms may only need to maintain a good relationship with their core stakeholders, while the input for non-core stakeholders may not create value (Zhang et al., 2020). Previous literature regards the relationship between CSR and corporate innovations as the result of the sole effect of the former on the latter but ignored the effects of CSR from different

dimensions, that is, CSR performances from different dimensions may exert different impacts on corporate innovations.

In this study, we examine the role of CSR driven by legitimacy in corporate innovations, and answer four levels of questions: (1) Are firms with better CSR activities more willing to carry out innovation activities? If so, have higher innovation outcomes been achieved? (2) If there is a significant innovation effect of CSR, what is the transmit channel through which CSR influences corporate innovation? (3) Will the innovation effect of CSR be affected under the external environmental pressure? (4) How does corporate heterogeneity influence the innovation effect of CSR? Our results suggest that firms with better CSR performance have a higher innovation input and output, which indicates that CSR has a positive impact on innovation activities. From the sub-dimensions of different stakeholders, the innovation effect of CSR exists significantly in the internal responsibility and business partner responsibility, but not in the public responsibility, showing that the relationship between stockholders, employees and supply chain is an important condition for CSR to exert innovation effect. Positive strategic planning plays a mediating role in the innovation effect of CSR. In the case of fewer environmental uncertainties and lower industry prosperity, CSR promotes innovation better. In firms with low agency cost, high employee loyalty and few financing constraints, CSR has a more obvious accelerating effect on innovation performance.

Our study makes several contributions. First, we make a theoretical contribution to the CSR-innovation relation from a perspective of legitimacy. Although based on the stakeholder and information asymmetry theories, some studies find that firms' fulfilment of social responsibilities contributed to their development of innovations (Castillo, 2015; Martinez-Conesa et al., 2017)—an idea, however, is not universally accepted in the existing literature (Szutowski & Ratajczak, 2016). Our results reveal that legally-motivated CSR practices in emerging economies have positive impacts on the allocation of corporate innovative resources (Chen et al., 2018; Tornikoski & Newbert, 2007), which in return forces the firms to actively engage in innovations.

Second, our research extends the evidence on the impact of CSR on corporate innovations. Although many scholars—Carroll (1991), for example, who first proposed that CSR should be considered from the perspective of stakeholders—have the stakeholder theory applied to their social responsibility research (Aramburu & Pescador, 2019), the relations between CSR and corporate innovations are regarded as the sole effect of the former on the latter, regardless of CSR effects from different dimensions. Firms have two appeals: conforming legitimacy and strategic legitimacy (Zimmerman & Zeitz, 2002). Our article makes a more comprehensive and in-depth analysis of the impact of CSR on innovation through various sub-dimension scores. We find that two mechanisms of CSR, namely internal responsibility and business partner responsibility due to strategic legitimacy (Tornikoski & Newbert, 2007), have a positive impact on innovation activities, while public responsibility from conforming legitimacy (DiMaggio & Powell, 1983) does not have a positive and significant impact on corporate innovation.

Third, there are few studies on the direct influences of CSR on corporate innovations and on the influencing mechanism. Despite the existing study by Ko et al. (2020) based on social identity theory, this article includes the CSR-shaped corporate

behaviours and strategies into the research on the CSR-innovation relationship, indicating how the behaviours and the strategies are influenced and facilitating the understanding of how the sense of values, in which innovations are deeply rooted, play their role in the cultivation of and exert their influences on innovations. It also provides a new direction when the determinants of business innovations are under investigation, applicable not only to emerging economies but also to developed countries.

The reminder of this article is organised as follows: Section 2 summarises the related literature and theories, and lays out our hypothesis. Section 3 presents our data source, variable construction, and empirical specification. Section 4 reports our empirical results. The results of further analyses are reported in Section 5. Section 6 concludes the article, presents our study of theoretical and managerial significance and describes the major limitations of our research and the alternative means for further research.

2. Literature review and hypotheses development

As an important determinant for business competitiveness for a long time, innovations have a decisive role in a firm's survival, comparative advantages, market value and investment return (Huang & Li, 2017). Currently, there are several studies from the external perspectives of legal environment, tax policies, intellectual property protection, government subsidies, religions, and cultures, carrying out in-depth investigations of technological innovations (Kong, 2020; Mukherjee et al., 2017; Gao & Zhang, 2017). Based on the principal-agent framework, many studies find that corporate governance, unions, performance appraisal systems, characteristics of management, incentives for key R&D staff, tolerance for failure, threat of hostile takeover, going public and the liquidity of the stock market, all will affect corporate innovations (Xie et al., 2021; Sunder et al., 2017; Manso, 2011). In China, innovation strategies are facing challenges in the process of implementation, owing to the country's incomplete system and market—a typical problem in emerging economies: first, there is a paradoxical relation between the system and effectiveness, since the access to external resources (e.g. government subsidies) relies on firms in conformity with government regulations, while the optimal allocation of innovative resources requires firms to independently use their initiative; secondly, market orientation can provide an environment-friendly condition for firms to innovate (El-Kassar & Singh, 2019), but the ethically impaired behaviours (e.g. counterfeit products and deceptive advertisement) more or less in the course of the transformation of the market economy make companies' sustainable growth a non-starter.

CSR practices are now increasingly concerned in China, since fulfilling social responsibilities can create more business and innovative opportunities, enabling firms to sharpen their competitive advantages in the market (Flammer, 2015). According to the Social Responsibility Guidelines for Listed Companies, listed firms in China should perform their social responsibilities while pursuing financial benefits and protecting shareholders' interests. Meanwhile, all firms directly under the central government should cultivate and strengthen the awareness of social responsibilities and establish a social responsibility reporting system as required in the Guiding Opinions on the Fulfillment of Social Responsibilities for Enterprises Directly under the Central

Government. From the perspective of legality, CSR practices should be first and foremost in compliance with government regulations. Moreover, firms are willing to undertake social tasks assigned by the government in order to establish or maintain political relations (Lin et al., 2015). Some studies argue that firms' legitimacy, as a strategic resource, can significantly improve their performances (Wei et al., 2017; Zhang et al., 2018). As a national mandatory policy, the mandatory CSR disclosure has positive impacts on CSR performances and the allocation of resources (Chen et al., 2018).

Legitimacy is generally regarded as a resource accessible via corporate strategies since firms can quickly coordinate and have access to necessary resources by taking legitimate actions (Tornikoski & Newbert, 2007). On the one hand, to maintain a favourable relationship with the government in pursuit of more governmental support in tax, credit supply, and government subsidies, to name a few, firms will change their strategic decisions and resource allocation patterns to enhance their CSR practices and meet the expectations of the government (Kumar & Shetty, 2018) while conveying real information about their political and social risks to the outside world (Hung et al., 2013), thus reducing the scenario of information asymmetry and increasing their access to finance (Cheng et al., 2014). In a word, on the strength of CSR practices, it is possible for firms to send positive signals to the outside world about their active compliance with policies and regulations, thus gaining recognition and trust from the government, consumers and other stakeholders, conducive to their access to key resources necessitated by innovative activities. On the other hand, CSR activities at a price may force firms to increase their R&D investment in technological innovations in response to the growing cost, giving rise to more added value due to product upgrading (McWilliams & Siegel, 2000). More importantly, in face of the regulations and demands of the government, consumers and suppliers, corporates must intensify their technological innovation ability in response to social pressure in an effective manner to maintain their legitimacy status in society and to promote their R&D efforts (Husted & Allen, 2007). In this sense, firms may, driven by fulfilling social responsibility and sustainable growth, manage to create new working methods, processes and products, thus realising technological innovations.

As an important means for firms to improve their relationship with stakeholders, CSR practices are, in return, influenced by stakeholders (Benabou & Tirole, 2010). Informally- contracted social responsibilities require firms in decision-making to take the rights and interests of stakeholders into consideration while pursing the maximum benefits for shareholders. As a result, firms should not only undertake the responsibilities for principals such as investors who provide equity capital, but also be responsible, as agreed, for employees who serve as human resources, customers and suppliers who bring along market resources, and society and government that supply environmental resources. Therefore, CSR practices are important to establish the corporate-stakeholder relationship (Cassiman & Veugelers, 2006). According to the stakeholder and information asymmetry theories, firms' fulfilment of their social responsibilities can reduce the scenario of information asymmetry and deepen their cooperation and communication with stakeholders (Castillo, 2015). Sufficient and favourable social responsibility performance can attract capital resources from investors (Martin & Moser, 2016), human resources from excellent employees

(Wiggenhorn et al., 2016), market resources from customers and suppliers (Ni et al., 2010), and public environment and institutional resources from the government and society (Flammer, 2018). The combination of external knowledge of stakeholders and internal knowledge of firms is necessary to provide technological and theoretical support for innovation activities (Strambach, 2017), thus facilitating innovation.

In general, in response to corporate misconducts arising from impaired ethics in the process of economic transformation, firms maintain their legitimacy by performing CSR to meet social expectations, which, in return, change their strategic decisions and resource allocation patterns motivates to facilitate innovations (Kumar & Shetty, 2018). Meanwhile, CSR practices are important to build a virtuous corporate–stakeholder relationship (Cassiman & Veugelers, 2006) on a long-term and stable basis and to help corporates to access stakeholder resources necessitated by their innovations. From this point of view, we propose the following hypothesis:

H1: CSR practices have a positive impact on corporate innovation.

Despite corporate misconducts due to impaired ethics in the course of China's economic transformation, corporates are endowed with morality more or less by performing CSR (Carroll, 1979). In addition, CSR performances reflect the common belief and moral value of an organisation (Gao et al., 2014), represent the business reputation and image (Fu et al., 2020), and direct the business behaviours to convey a positive signal that it is creditworthy to the government, customers and other stakeholders, since good ethics is good business (Van Beurden & Gossling, 2008). By fulfilling social responsibilities, firms may turn out to be an attraction for investors who are ready to make capital contribution (Martin & Moser, 2016), for talents as human resources (Wiggenhorn et al., 2016), for customers and suppliers as market resources (Ni et al., 2010), and for the government and society with environmental and institutional resources (Flammer, 2018). By creating trustworthy business images, optimizing resource allocation, and sharpening sustainable competitiveness (Tornikoski & Newbert, 2007), firms in practicing CSR may have more confidence to pursue or respond to a variety of risks since they are more prepared. As innovative activities require tolerance for long-term reward, high risk and substantial investment, firms with better risk appetite in strategic decisions will have better performances in innovations (Manso, 2011). As a result, firms with more CSR practices may form their own style of strategic decision-making. For example, firms are more likely and able to tackle uncertain risks by adapting more active strategies for the purpose of achieving sustainable growth, thus influencing their innovative activities. Based on that, we propose our second hypothesis as follows:

H2: Firms with more CSR practices can promote their innovations by making active strategic decisions.

3. Research design

3.1. Data sources

Our initial sample includes all A-share listed firms in China from 2010 to 2018. CSR performance data are obtained from HeXun social responsibility score. This database has been extensively employed in relevant Chinese studies (e.g., Lau et al., 2016;

Table 1. Sample selection process.This table reports the details of sample selection procedures.

Number of A-share listed companies in Shanghai and Shenzhen from 2010 to 2018 (firm-year observations)	24,756
- Observations are in the financial industry	(612)
- Observations belongs to ST and *ST companies	(2,149)
- Observations with missing values on key variables	(3,017)
Final sample size	18,978

Source: Authors.

McGuinness et al., 2017). These data are annual data and include all listed firms that publish CSR reports. CSR performance is calculated from several responsibilities, including shareholder responsibility, employee responsibility, supplier, customer and consumer responsibility, environmental responsibility and welfare (including tax payment, charity and donation) responsibility. The patent data are manually collected from the website of China National Intellectual Property Administration. Firm's R&D investment and other financial data are from China Stock Market & Accounting Research (CSMAR) database. The amount of social donations from the civil affairs department is taken from the CNRDS database. In accordance with the prior literature (Ko et al., 2020; Chen et al., 2018), our sample selection procedure is as follows: (1) we first include all A-share listed firms in Shanghai and Shenzhen Stock Exchange in the CSMAR database from 2010 to 2018, comprising 24,756 firm-year observations; (2) we exclude firms in the financial industry firms, because the financial statement structure and financial data of these firms are not comparable to other listed firms, resulting in a loss of 612 firm-years observations; (3) we excluded ST and *ST firms because these firms are "specially treated" and facing the risk of being delisted, further reducing 2,149 firm-year observations; (4) we finally eliminate observations with missing data on a key variable. Table 1 illustrates the details of this procedure. Our final sample includes 18,978 firm-year observations. All continuous variables are winsorized at the 1% and 99% levels.

3.2. Definition of variables

3.2.1. Measurement of CSR

We use CSR performance score from HeXun database, a professional evaluation system based on CSR reports disclosed by listed firms, to measure firm' corporate social responsibility performance. In addition, Clarkson (1995) argues that stakeholders can be ordered based on their connections with firms. We follow this argument and classify CSR into three sub-dimensions: internal responsibility, business partner responsibility, and public responsibility, corresponding to shareholder responsibility, employee responsibility, supplier, customer and consumer's rights & interests responsibility, environmental responsibility and welfare responsibility. The shareholder responsibility and the employee responsibility belong to the internal dimension (Xie et al., 2019), the supplier, customer and consumer's rights & interests responsibility are in the business partner dimension, and the left two responsibilities are divided into the public responsibility dimension. The total CSR score (*TCSR*) and each subdivision score are divided by 100.

3.2.2. Measurement of innovation

The innovation activity is an input-output process. We follow Brav et al. (2018) and use innovation input and innovation output to measure enterprise innovation. Innovation input is measured by the intensity of R&D investment, that is, the enterprise's R&D investment divided by the total assets of the year. Innovation output is measured based on the patent information. There are three types of patents in China: invention patent, design patent and utility patent. Since the latter two are relatively low in science and technology content and bear little reference value for measuring the technological innovation ability of firms, we measure the innovation output as the number of invention patents obtained by firms each year.

3.2.3. Measurement of corporate strategy

Following Bentley et al. (2013), we use a comprehensive discrete variable for the measurement of corporate strategic from the six financial indicators oriented by corporate strategic results. The specific measurement includes the following six financial indicators: (1) the proportion of R&D investment in sales revenue; (2) the ratio between the number of employees and sales revenue; (3) historical sales revenue growth rate; (4) the proportion of selling expenses and administrative expenses in sales revenue; (5) the fluctuation of the number of employees; (6) the proportion of fixed assets in total assets. The above 6 indicators are processed in three steps. First, the original indicators are converted. Except for the first indicator, which takes the value of the current year, the other five indicators take the moving average of the previous five years. Second, in each industry, the first 5 indicators are divided into 5 average groups in the order of small to large. The minimum group is assigned 1 point, by analogy, the maximum group is assigned 5 points. The sixth indicator is the inverse indicator of the positive degree of corporate strategy, with the minimum group assigned 5 points, by analogy, the maximum group assigned 1 point. Finally, the points of the six indicators are added together to obtain a comprehensive discrete variable of 6–30 points to measure the corporate strategy. The higher point means the more active corporate strategy.

3.2.4. Control variables

Following prior studies (O'Connor & Rafferty, 2012; Brav et al., 2018; Ko et al., 2020), we include several control variables that are related to corporate innovation. For example, we control for firms' financial characteristics, such as asset-liability ratio (*Lev*), Tobin's Q (*Tobin_Q*), and cash asset ratio (*Cash*), because these characteristics present firms' financing ability and risk preference (Abel, 2018; Gebauer et al., 2018), and thus, these characteristics have a significant impact on corporate innovation activities (Brav et al., 2018; Ko et al., 2020; Zhang et al., 2022). In addition, we include growth opportunities (*Growth*) and corporate governance characteristics (*Sep and Esh*) because these factors are associated with innovation activities (Getz & Petersen, 2005; O'Connor & Rafferty, 2012; Belloc, 2012). Furthermore, since state-owned enterprises (SOEs) enjoy the benefits from government support (Qian et al., 2015; Firth et al., 2019) and have different incentives and supportive resources for innovation activities (Ko et al., 2020) compared to non-SOEs, we add the nature of

firms to our empirical specification as a control variable. All variables are defined in Appendix A.

3.3. Empirical specification

To test the relationship between CSR and corporate innovation, we use the following specification:

$$Innovation_{i,t} = \alpha + \beta TCSR_{i,t} + \sum \gamma_k Control_{i,t} + Year + Industry + Province + \varepsilon_{i,t} \quad (1)$$

Here, $Innovation_{i,t}$ is our dependent variable, representing the innovation performance of firm i in the year of t. This variable includes both innovation input and innovation output. The independent variable $CSR_{i,t}$ represents CSR performance, which is the total score of CSR and the score of the firm on the sub-dimension of internal responsibility, business partner responsibility and public responsibility, respectively. $Control_{i,t}$ is our control variable, including asset-liability ratio (*Lev*), Tobin's Q value (*Tobin_Q*), the separation of ownership and control (*Sep*), total cash flow recovery rate (*Cf_ratio*), cash asset ratio (*Cash*), executive shareholding ratio (*Esh*), business revenue growth rate of the enterprise (*Growth*) and equity nature (*State*). Furthermore, we include industry fixed effect, year fixed effect and fixed effects of provinces where the firms are located.

To test whether CSR influences innovation through strategic planning, we follow the approach from Baron and Kenny (1986) and Tofighi and MacKinnon (2011) and use the mediation model and Bootstrap test. The mediation model is as follows:

$$Strategy_{i,t} = \alpha_1 + \beta_1 TCSR_{i,t} + \sum \gamma_{k1} Control_{i,t} + Year + Industry + Province + \varepsilon_{i,t} \quad (2)$$

$$Innovation_{i,t} = \alpha_2 + \beta_2 TCSR_{i,t} + \eta Strategy_{i,t} + \sum \gamma_{k2} Control_{i,t} + Year + Industry + Province + \varepsilon_{i,t} \quad (3)$$

Here, $Strategy_{i,t}$ represents the corporate strategy of firm i in the year of t. α_2 represents the direct effect of CSR on innovation, and $\beta_1 \times \eta$ represents the individual mediating effect. Other variables are the same as those given in Equation (1).

3.4. Descriptive statistics

Panel A of Table 2 reports the descriptive statistics of our key variable. The mean value of invention patents obtained by firms is 7.739, the minimum value is 0, and the maximum value is 151, with a standard deviation as high as 20.66, indicating that large differences exist in the innovation of Chinese firms. Since R&D asset is voluntary disclosure information in China, there are many missing values, and the total sample is 15,232. The average ratio of R&D assets to total assets is 0.021, with a

Table 2. Descriptive statistics.

Panel A: full sample

Variables	N	Mean	Med.	Std. dev.	Minimum	Maximum
Patent	18,978	7.739	1	20.660	0	151
RD_asset	15,232	0.021	0.018	0.018	0	0.095
TCSR	18,978	0.255	0.222	0.169	−0.198	0.921
CSR_sh	18,978	0.142	0.147	0.061	−0.027	0.249
CSR_emp	18,978	0.027	0.014	0.033	0	0.141
CSR_sup	18,978	0.019	0	0.049	0	0.190
CSR_env	18,978	0.020	0	0.053	0	0.230
CSR_soc	18,978	0.048	0.043	0.041	−0.070	0.158
Lev	18,978	0.425	0.418	0.209	0.050	0.895
Tobin_Q	18,978	2.080	1.641	1.339	0.893	8.819
Sep	18,978	0.048	0	0.076	0	0.286
Cf_ratio	18,978	0.042	0.042	0.070	−0.172	0.237
Cash	18,978	0.165	0.126	0.130	0.011	0.633
Esh	18,978	0.134	0.003	0.202	0	0.687
Growth	18,978	0.212	0.125	0.481	−0.528	3.273
State	18,978	0.383	0	0.486	0	1

Panel B: T-test

	Low-CSR firms		High-CSR firms		
Variables	N	Mean	N	Mean	Mean diff.
Patent	11,097	6.487	7,881	9.503	−3.016***
RD_asset	9,260	0.020	5,972	0.022	−0.002***
TCSR	11,097	0.158	7,881	0.393	−0.235***
CSR_sh	11,097	0.113	7,881	0.183	−0.070***
CSR_emp	11,097	0.013	7,881	0.046	−0.034***
CSR_sup	11,097	0	7,881	0.046	−0.046***
CSR_env	11,097	0	7,881	0.048	−0.048***
CSR_soc	11,097	0.033	7,881	0.069	−0.036***
Lev	11,097	0.432	7,881	0.417	0.015***
Tobin Q	11,097	2.142	7,881	1.992	0.150***
Sep	11,097	0.046	7,881	0.051	−0.006***
Cf_ratio	11,097	0.030	7,881	0.060	−0.030***
Cash	11,097	0.149	7,881	0.187	−0.038***
Esh	11,097	0.140	7,881	0.126	0.014***
Growth	11,097	0.197	7,881	0.234	−0.036***
State	11,097	0.349	7,881	0.430	−0.081***

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively.
Source: Authors.

minimum value of 0 and a maximum value of 0.095. The average value of the total CSR score is 0.255, while the minimum value is −0.198. This is because some firms undertake no social responsibilities but evade tax or pollute the environment.

Panel B reported the results of the mean difference between high-CSR firms and low-CSR firms. It indicates that low-CSR firms are significantly lower than high-CSR ones no matter in terms of the number of invention patents they obtained or the strength of R&D assets. It is preliminarily confirmed that CSR may have a positive effect on innovation.

3.5. Pearson correlation analysis

Table 3 reports the Pearson correlation analysis of our key variables. CSR performance is positively correlated with innovation, consistent with H1. The coefficient on

Table 3. Pearson correlation analysis.

	Patent	*RD_asset*	*TCSR*	*Lev*	*Tobin Q*	*Sep*	*Cf_ratio*	*Cash*	*Esh*	*Growth*	*State*
Patent											
RD_asset	0.168***										
TCSR	0.106***	−0.003									
Lev	0.122***	−0.225***	0.012*								
Tobin Q	−0.093***	0.209***	−0.090***	−0.249***							
Sep	0.007	−0.022***	0.057***	0.080***	−0.012*						
Cf_ratio	0.039***	0.087***	0.175***	−0.154***	0.085***	0.037***					
Cash	−0.047***	0.194***	0.089***	−0.425***	0.157***	−0.030***	0.149***				
Esh	−0.075***	0.200***	−0.079***	−0.346***	0.007	−0.294***	−0.022***	0.189***			
Growth	−0.014*	0.024***	0.052***	0.048***	0.015**	−0.001	−0.011	0.003	0.044***		
State	0.117***	−0.178***	0.147***	0.311***	−0.142***	−0.048***	0.029***	−0.097***	−0.500***	−0.073***	

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively.
Source: Authors.

each variable is smaller than 0.5 and the mean-variance inflation factor (VIF) is 5.91, suggesting that multicollinearity is not a concern.

4. Empirical results analysis

4.1. Csr and enterprise innovation: overall effect test

4.1.1. Overall analysis of CSR

The regression results of Equation (1) are shown in Table 4. Panel A and Panel B take invention patents and R&D input as dependent variables, respectively. The estimated coefficients on *TCSR* are 15.934 and 0.003, respectively, and both are significant at the 1% level, indicating that the total CSR score (*TCSR*) has a positive impact on the innovation input and innovation output. Currently, there is no consensus in the literature on the relationship between CSR and innovation (Lončar et al., 2019; Halkos & Skouloudis, 2018; Szutowski & Ratajczak, 2016). As important participants in emerging markets, Chinese firms face the problem of moral absence and moral anomie in the process of economic transformation. The mandatory CSR disclosure policy improves the achievement of CSR activities (Chen et al., 2018). Firms can gain legitimacy by enhancing CSR activities in line with social expectations. In this way, firms can further gain recognition and trust from stakeholders, such as the government and consumers, and change their strategic decisions and resource allocation patterns (Kumar & Shetty, 2018). It is conducive to obtaining key resources needed for innovation and driving their active innovation. Meanwhile, CSR activities can alleviate information asymmetry, deepen cooperation and communication with stakeholders (Castillo, 2015), and provide technology and knowledge support for innovation (Strambach, 2017). In the end, it shows a higher level of innovation input and output, that is, CSR derived from legitimacy promotes innovation, consistent with H1.

4.1.2. Analysis of CSR sub-dimensions

According to instrumental stakeholder theory, the proper development of stakeholder relationships provides firms with competitive advantages (Jones et al., 2018). Some studies argue that heterogeneous stakeholders have different demands, pressure, and influence mechanisms, and it is necessary for firms to consider some factors such as resource dependence and carry out differentiated management of stakeholders (Fehr & Falk, 2002; Mattingly & Berman, 2006). Different stakeholders have different effects on the value creation. If firms only maintain a good relationship with their core stakeholders, while ignoring the non-core stakeholders, then CSR activities may not create value (Zhang et al., 2020). Therefore, CSR activities of different dimensions may have different impacts on innovation. We follow the argument from Clarkson (1995) and classify CSR into three sub-dimensions, including internal responsibility, business partner responsibility and public responsibility, and further investigate the impact of CSR sub-dimensions on innovation.

Column (2)–(5) of Table 4 is the result of the relation between CSR sub-dimension score and corporate innovation. Panel A and Panel B take invention patents and R&D input as dependent variables, respectively. Internal responsibility includes

Table 4. Baseline findings.

Panel A: The regression results of CSR sub-dimensions on enterprise innovation output

Variables	(1)	(2)	(3)	(4)	(5)	(6)
TCSR	15.934***					
	(17.49)					
CSR_sh		44.712***				
		(16.80)				
CSR_emp			82.244***			
			(17.69)			
CSR_sup				38.480***		
				(12.37)		
CSR_env					42.472***	
					(14.76)	
CSR_soc						−3.205
						(−0.83)
Lev	14.490***	17.143***	12.779***	13.357***	13.189***	13.654***
	(16.73)	(19.26)	(14.75)	(15.38)	(15.20)	(15.66)
Tobin_Q	−1.404***	−1.336***	−1.520***	−1.540***	−1.507***	−1.591***
	(−11.73)	(−11.10)	(−12.74)	(−12.85)	(−12.60)	(−13.22)
Sep	−1.099	−1.523	0.035	0.182	0.29	1.315
	(−0.54)	(−0.75)	(0.017)	(0.09)	(0.14)	(0.64)
Cf_ratio	9.473***	5.382**	13.759***	14.333***	14.244***	16.489***
	(4.47)	(2.46)	(6.58)	(6.83)	(6.80)	(7.82)
Cash	3.348***	1.240	4.243***	4.481***	4.828***	3.977***
	(2.60)	(0.96)	(3.30)	(3.47)	(3.74)	(3.07)
Esh	−6.122***	−7.373***	−5.574***	−5.742***	−5.844***	−6.042***
	(−6.77)	(−8.12)	(−6.16)	(−6.32)	(−6.45)	(−6.63)
Growth	−0.617**	−0.987***	−0.533*	−0.258	−0.271	−0.315
	(−2.10)	(−3.32)	(−1.81)	(−0.88)	(−0.92)	(−1.06)
State	4.660***	5.099***	4.483***	4.939***	4.743***	5.332***
	(12.49)	(13.72)	(11.98)	(13.21)	(12.68)	(14.25)
Constant	−9.563***	−11.097***	−7.524***	−6.752***	−6.665***	−5.166***
	(−6.07)	(−6.96)	(−4.82)	(−4.31)	(−4.27)	(−3.28)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
N	18,978	18,978	18,978	18,978	18,978	18,978
Pseudo R^2	0.147	0.146	0.147	0.140	0.143	0.133

Panel B: The regression results of CSR sub-dimensions on enterprise innovation input

Variables	(1)	(2)	(3)	(4)	(5)	(6)
TCSR	0.003***					
	(3.42)					
CSR_sh		0.024***				
		(10.21)				
CSR_emp			0.039***			
			(9.45)			
CSR_sup				0.004*		
				(1.80)		
CSR_env					0.002	
					(0.66)	
CSR_soc						−0.039***
						(−10.88)
Lev	−0.002*	<0.001	−0.002***	−0.002*	−0.002**	−0.002**
	(−1.90)	(0.40)	(−2.66)	(−2.04)	(−2.12)	(−2.30)
Tobin_Q	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***
	(19.30)	(19.98)	(19.32)	(7.06)	(19.17)	(19.05)
Sep	0.013***	0.012***	0.013***	0.013***	0.014***	0.014***
	(7.24)	(6.65)	(7.18)	(6.74)	(7.49)	(8.04)
Cf_ratio	0.014***	0.009***	0.014***	0.015***	0.016***	0.018***
	(7.17)	(4.31)	(7.24)	(4.29)	(7.97)	(9.04)
Cash	0.009***	0.008***	0.010***	0.009***	0.009***	0.010***

(*continued*)

Table 4. Continued.

Panel B: The regression results of CSR sub-dimensions on enterprise innovation input

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	(8.09)	(6.91)	(8.33)	(4.65)	(8.17)	(8.56)
Esh	0.008***	0.008***	0.009***	0.008***	0.008***	0.008***
	(11.14)	(10.36)	(11.41)	(13.82)	(11.16)	(10.78)
Growth	0.000	−0.000	<0.001	<0.000	<0.001	0.001**
	(1.20)	(−0.22)	(1.00)	(0.83)	(1.46)	(2.00)
State	0.001***	0.001***	0.001*	0.001**	0.001***	0.001***
	(2.67)	(2.77)	(1.73)	(2.24)	(2.95)	(3.18)
Constant	−0.006***	−0.008***	−0.006***	−0.005***	−0.005***	−0.003**
	(−3.76)	(−5.25)	(−4.03)	(−3.63)	(−3.33)	(−2.38)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
N	15,232	15,232	15,232	15,232	15,232	15,232
Adj. R^2	0.297	0.301	0.300	0.296	0.296	0.301

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

shareholder responsibility and employee responsibility (Xie et al., 2019), and the regression are reported in Column (2)–(3) separately. The coefficient on *CSR_sh* and *CSR_emp* in Panel A and Panel B are both positive and significant at the 1% level, suggesting that the stronger the shareholder responsibility and employee responsibility are, the greater the innovation input and output will be. Good CSR performance facilitates the favourable relationship with stakeholders (Cheng et al., 2014). Firms actively create profits for shareholders and provide real information on operation and investment to shareholders, which can attract investors' investment attention (Martin & Moser, 2016) and gain financial support for innovation. In addition to the capital, innovation activities depend on human creativity. Firms with better employee responsibility are also conducive to attracting and retaining high-quality employees (Roy et al., 2016), enhancing employees' job security, improving employees' work enthusiasm and stimulating their innovation potential. Therefore, internal responsibility has a positive impact on innovation.

CSR activates are closely linked to business activities. From the perspective of business partner responsibilities, firms' active performance of its responsibilities to suppliers will affect the corresponding behaviours of its suppliers (La Bahn & Krapfel, 2000), alleviate information asymmetry, and facilitate the development of new products by taking advantage from the advanced technological of suppliers. By providing quality products and better after-sale service, firms gain the trust and loyalty of their customers (Lettl, 2007). Meanwhile, firms can know the market orientation of new product development and improve their innovation based on the feedback information from their customers. Therefore, deepening cooperation and communication with business partners may provide firms with better social resources for their innovation activities (Castillo, 2015), further improving their innovation. The regression results are presented in Column (4) of Table 4. The coefficient on *CSR_sup* is positive and significant at the 1% level and 10% level, respectively, indicating that supplier, customer and consumer's rights & interests responsibility have a positive impact on corporate innovation input and output.

Environmental responsibility and welfare responsibility belong to the dimension of public responsibility. Theoretically, in order to cope with increasingly strict environmental regulations and maintain their legality, it is necessary for firms to increase R&D investment and stimulate their potential innovation capabilities (Wu et al., 2018). The impacts of corporate environmental responsibility on innovation are reported in Column (5). The coefficient on *CSR_env* in Panel A is significantly positive, while that of *CSR_env* in Panel B is positive but not significant. It suggests that the stronger the corporate environmental responsibility is, the better the innovation achievement is, but the impact on innovation input is not obvious. The rationale is that firms cannot obtain economic benefits directly through environmental responsibility, and environmental responsibility will "crow out" corporate resources. In addition, environmental responsibility has mandatory features mostly: blowdown and excess carbon emissions will be punished. Technology innovation activities always have a high risk and long return cycle, managers are difficult to gain excess profits from these activities in a short period. Therefore, when making decisions on corporate innovation activities, myopia behaviours are quite obvious and prefer to innovation activities with lower capital and technology threshold, short R&D cycle and high success rate. Based on these arguments, the impact effect of corporate environmental responsibility on innovation is stronger in innovation output. Firms establish a positive image and improve their reputation by welfare responsibility (Fu et al., 2020), which is conducive to the expansion of market business and the launch of technological innovation activities. At the same time, welfare responsibility may crow out corporate resources and become an excuse for management to expropriation and shirk responsibilities (Manso, 2011;), resulting in insufficient investment in technological innovation resources, which is not conducive to innovation. The regression results are shown in Column (6). The coefficients on *CSR_sup* are all negative, indicating that welfare responsibility have a negative impact on innovation.

CSR derived from legitimacy has positive effects on innovation, while we find that the sub-dimensions of CSR have different effects on innovation. This is because firms have both appeals of Conforming legitimacy and Strategic legitimacy (Zimmerman & Zeitz, 2002). Both internal stakeholders and business partners are contractual stakeholders, which will directly affect firms' investment and financing decisions and business operations. For strategic legitimacy, firms regard it as scarce resources that can bring competitive advantages to the organization (Tornikoski & Newbert, 2007). The better the corresponding responsibilities are fulfilled, the stronger the effect on innovation. Environmental responsibility and welfare responsibility belong to the dimension of public responsibility. It is a kind of feedback to the surrounding environment and community, as well as a response to external environmental stress (Williams & Barrett, 2000). Due to the conforming legitimacy, firms can alleviate the impact of external pressure by complying with institutional control (DiMaggio & Powell, 1983). Public responsibility cannot generate direct economic benefits. It will crow out corporate resources and does not have a significant positive impact on innovation.

Table 5. Results of mechanism analyses.

	Innovation output			Innovation input		
Variables	*Patent* (1)	*Strategy* (2)	*Patent* (3)	*RD_asset* (4)	*Strategy* (5)	*RD_asset* (6)
TCSR	16.050***	1.846***	14.974***	0.004***	1.480***	0.002***
	(14.04)	(8.92)	(13.13)	(4.42)	(6.28)	(2.73)
Strategy			0.583***			0.001***
			(12.09)			(29.64)
Lev	15.272***	−0.777***	15.720***	−0.000	−1.637***	0.001
	(13.61)	(-3.83)	(14.09)	(-0.44)	(-6.81)	(1.57)
Tobin_Q	−1.594***	0.216***	−1.720***	0.002***	0.357***	0.002***
	(-10.20)	(7.64)	(-11.05)	(14.41)	(10.54)	(11.82)
Sep	−1.447	1.594***	−2.376	0.011***	1.888***	0.009***
	(-0.56)	(3.43)	(-0.93)	(5.39)	(3.57)	(4.56)
Cf_ratio	9.677***	−4.506***	12.305***	0.013***	−5.497***	0.019***
	(3.44)	(-8.85)	(4.39)	(5.30)	(-8.93)	(8.17)
Cash	3.164	3.663***	1.027	0.012***	4.209***	0.008***
	(1.63)	(10.40)	(0.53)	(7.47)	(10.14)	(4.74)
Esh	−8.184***	5.058***	−11.134***	0.012***	4.613***	0.007***
	(-4.94)	(16.87)	(-6.69)	(10.06)	(14.78)	(6.02)
Growth	−0.585	1.522***	−1.393***	0.000	1.751***	−0.002***
	(-1.37)	(22.72)	(-3.71)	(0.00)	(28.75)	(-6.07)
State	4.563***	−1.084***	5.195***	0.001***	−1.075***	0.003***
	(9.75)	(-12.80)	(11.09)	(3.57)	(-11.03)	(6.98)
Constant	−33.815***	5.950***	−37.286***	−0.034***	9.679***	−0.045***
	(-3.05)	(2.96)	(-3.38)	(-6.95)	(7.91)	(-9.59)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
N	13,044	13,044	13,044	9,896	9,896	9,896
Adj. R^2/ Pseudo R^2	0.154	0.170	0.163	0.294	0.206	0.352
Sobel Z			7.180***			6.147***
Proportion of intermediary effect			6.71%			40.70%

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

4.2. CSR and enterprise innovation: influence channel test

Columns (1)–(3) and (4)–(6) in Table 5, respectively, report the mediating effect of corporate strategic planning when the dependent variables are innovation output and innovation input of the enterprise. In columns (1) and (4), the coefficients on *TCSR* are both significantly positive at the 1% level, consistent with our baseline findings. In columns (2) and (5), the coefficients on *TCSR* are both positive and significant in statistics. It suggests that CSR derived from legitimacy has an influence on resource allocation (Chen et al., 2018), leading to corresponding strategies. Firms with higher *TCSR* are associated with competitive advantage (Tornikoski & Newbert, 2007). These firms are risk-seeking ones as well and take a positive corporate strategy. We further add *Strategy* and *TCSR* into Equation (1), and the results are reported in columns (3) and (6). The coefficients on *TCSR* and *Strategy* are both significantly positive at the 1% level, suggesting that the corporate strategy has a partial mediating effect of 6.71% when CSR impacts innovation. After a further test through Bootstrap, the confidence interval of _bs_2 can be obtained after repeating 1000 times, which is [14.97101,19.16328], excluding 0. It further suggests that CSR activities focus on the goal of survival and development and serve for it (Gao et al., 2014). A higher CSR

Table 6. Results of instrumental variables approach.

Variables	*TCSR* (1)	*Patent* (2)	*TCSR* (3)	*RD_asset* (4)
TCSR		58.292***		0.155***
		(4.62)		(4.20)
Donation	0.009***		0.006***	
	(7.89)		(4.79)	
Lev	−0.069	7.455***	-.0173	−0.004*
	(-0.66)	(6.71)	(-1.31)	(-1.77)
Tobin_Q	−0.017***	0.337	−0.012***	0.004***
	(-15.02)	(1.40)	(-8.57)	(8.08)
Sep	0.121***	−9.054***	0.164***	−0.016**
	(4.61)	(-2.98)	(5.31)	(-2.04)
Cf_ratio	0.411***	−5.490	0.541***	−0.067***
	(16.33)	(-0.99)	(17.18)	(-3.24)
Cash	0.084***	−5.416***	0.090***	−0.001
	(6.39)	(-2.98)	(6.05)	(-0.24)
Esh	−0.023***	0.215	−0.009	0.011***
	(-2.38)	(0.24)	(-0.88)	(5.62)
Growth	0.026***	−2.786***	0.034***	−0.005***
	(7.86)	(-6.14)	(7.32)	(-3.14)
State	0.060***	−1.117	0.069***	−0.011***
	(13.11)	(-1.38)	(12.22)	(-4.41)
Constant	0.244***	−11.331***	0.223***	−0.023***
	(31.87)	(-3.40)	(24.55)	(-2.69)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
N	10,832	10,832	8,245	8,245
Weak IV test (F)	60.40		22.27	
Adj. R^2/ Pseudo R^2	0.082		0.086	

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

performance represents the sustainable development-oriented behaviour pattern. Firms with higher CSR performance are associated more strategic and behavioural supports in innovation, leading to a higher level of innovation inputs and outputs. These results suggest that corporate strategy is a potential channel for CSR to promote innovation, consistent with H2.

4.3. Robustness test

Our baseline findings that the positive association between CSR and innovation may be subject to reverse causality and sample selection. In this section, we use various methods to verify the robustness of our findings.

4.3.1. Endogenous test: Instrumental variable approach

This article mainly studies the impact of CSR on innovation, but a reverse causality may also exist, that is, firms with high levels of innovation may perform their social responsibilities better. Firstly, we used the instrumental variable (IV) approach to address this issue. Our IV is the amount of social donations from the civil affairs department of the province where the firm is located. From the perspective of relevance, the donation from civil affairs departments reflects the potential incentive effect of the government in advocating social responsibility. The regions where the

civil affairs departments contribute to more social donations will have higher moral requirements for business operators and a stronger relation with CSR. Further, there is no evidence showing an obvious logical relationship between social donations from civil affairs departments and corporate innovation.

The data on the number of social donations from the civil affairs department come from the CNRDS database, and the results of instrumental variables are shown in Table 6. The first-stage regression results are shown in columns (1) and (3). The coefficient on *Donation* is significantly positive at the 1% level, indicating that the increase in social donation by civil affairs departments will improve the social responsibility performance of local firms. The second-stage regression results are reported in columns (2) and (4). The coefficients on *TCSR* are still positive and significant in statistics. The F value of the weak instrumental variable test is all greater than 10, overturning the null hypothesis of the weak instrumental variable. These results confirm that our baseline findings are robust after considering the endogeneity issue.

4.3.2. Endogenous test: Heckman Two-Stage regression

Heckman two-stage regression is also used in this article to address sample selection bias. In the first stage, the dummy variable (*CSR_dummy*) of social responsibility defined by the median of social responsibility in the sample year is used as the dependent variable to conduct probit regression. At the same time, the model adopts the mean of social responsibility (*Region_CSR*) of other listed firms in the same year and the same region as the exogenous variable of the dummy variable of social responsibility. Generally speaking, the CSR performance of listed firms in the same region is similar to some extent due to the same cultural atmosphere and the same policy and system supervision, but the CSR of other listed firms in the same region will not directly affect the innovation level of the firm itself. In addition, other factors that may affect CSR are also controlled in our model, including asset-liability ratio, Tobin's Q value, the separation rate of two rights, total cash flow recovery rate, cash asset ratio, executive shareholding ratio, business revenue growth rate and equity nature. In the second stage, the inverse Mills ratio (IMR) is added to Equation (1) as an additional control variable.

The results are presented in Table 7. In columns (1) and (3), the coefficient on the exclusive constraint variable *Region_CSR* is significantly positive at the 1% level, demonstrating that the CSR fulfilment of other listed firms in the same year and region would have a positive impact on the firm's social responsibility decision, which met the selection conditions of the exclusive constraint variable. Columns (2) and (4) report the regression results after controlling for selection bias. It can be seen that the estimated coefficient on social responsibility (*TCSR*) fulfilment is still significantly positive and our conclusion remains unchanged.

4.3.3. Endogenous test: lag phase processing

To avoid the impact of reverse causality, we next deal with the explanatory variables with a lag of one and two phases, and the results are shown in Table 8. It can be seen that CSR is significantly positively correlated with the innovation output and innovation input at the level of 1%, no matter whether the CSR processing is delayed for one phase or two phases, consistent with our baseline findings.

Table 7. Results of Heckman two-stage regression.

Variables	Select model *CSR_dummy* (1)	Result model *Patent* (2)	Select model *CSR_dummy* (3)	Result model *RD_asset* (4)
TCSR		15.944***		0.003***
		(13.31)		(3.17)
IMR		−7.564***		−0.007***
		(-9.27)		(-9.62)
Region_CSR	2.114***		2.538***	
	(5.24)		(5.49)	
Lev	−0.340***	16.567***	−0.400***	<0.001
	(-5.53)	(18.10)	(-5.58)	(0.11)
Tobin_Q	−0.071***	−0.943***	−0.029***	0.002***
	(-7.99)	(-9.35)	(-2.86)	(20.22)
Sep	1.134***	−10.319***	1.363***	0.005**
	(8.02)	(-4.60)	(8.51)	(2.57)
Cf_ratio	3.771***	−11.880***	4.529***	−0.008**
	(24.89)	(-4.28)	(25.20)	(-2.57)
Cash	0.407***	4.207***	0.305***	0.008***
	(4.49)	(3.37)	(2.97)	(7.25)
Esh	0.058	−5.809***	0.054	0.009***
	(0.90)	(-8.44)	(0.079)	(11.83)
Growth	0.118***	−1.003	0.163***	>-0.001
	(5.71)	(-3.59)	(6.33)	(-0.75)
State	0.317***	2.978***	0.349***	−0.001***
	(12.13)	(7.76)	(11.57)	(-4.01)
Constant	−1.680***	−0.326***	−1.870***	0.005***
	(-9.42)	(-0.20)	(-9.05)	(2.73)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
N	18,978	18,978	15,232	15,232
Adj. R^2/ Pseudo R^2	0.131	0.120	0.130	0.270

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

4.3.4. Alternative measure of CSR

We also employ two alternative measures of CSR in our robust checks. First, the CSR level of HeXun is used. For A, it is assigned to 5; for B, it is assigned to 4; for C, it is assigned to 3; for D, it is assigned to 2; and for E, it is assigned to 1. In this way, the variable obtained is called *CSRR*. Second, the data from Rankings CSR Ratings (RKS) are used again for a robustness check. The CSR score of RKS is based on the social responsibility report of listed firms. In order to avoid the result deviation caused by using the sample of social responsibility report disclosure only, in this article, firms that have disclosed social responsibility report is required to take the Runling social responsibility score directly, and the firms that have not disclosed social responsibility report takes the score of 0, from which the variable obtained is recorded as CSRL. The results are reported in Table 9, the positive relation between CSR and innovation remains unchanged.

4.3.5. Alternative measure of corporate innovation

We further use an alternative measure of corporate innovation in our robust checks. The alternative measure, *Patent_apply*, is measured as t the total number of patent applications. The results are presented in column (1) of Table 10. Consistent with our baseline findings, CSR is still positively associated with corporate innovation.

Table 8. Results of lagged independent variables.

Variables	*Patent* (1)	*Patent* (2)	*RD_asset* (3)	*RD_asset* (4)
L.TCSR	18.748***		0.003***	
	(18.66)		(3.61)	
L2.TCSR		20.202***		0.003***
		(18.66)		(3.21)
Lev	15.079***	15.628***	−0.002*	−0.001
	(14.80)	(13.43)	(-1.83)	(-0.99)
Tobin_Q	−1.476***	−1.404***	0.002***	0.002***
	(-10.24)	(-8.74)	(16.37)	(15.47)
Sep	−2.211	−1.602	0.012***	0.011***
	(-0.93)	(-0.59)	(5.99)	(5.11)
Cf_ratio	10.849***	10.420***	0.015***	0.017***
	(4.31)	(3.57)	(6.63)	(7.11)
Cash	3.775**	4.977***	0.010***	0.011***
	(2.37)	(2.60)	(7.67)	(6.92)
Esh	−6.218***	−6.288***	0.008***	0.008***
	(-5.58)	(-4.66)	(9.53)	(8.09)
Growth	0.046	0.358	<0.001	<0.001
	(0.13)	(0.88)	(1.32)	(1.28)
State	4.953***	5.282***	0.001**	0.001***
	(11.38)	(10.70)	(2.42)	(2.83)
Constant	−10.328***	−10.781***	−0.001	0.003
	(-5.76)	(-5.27)	(-0.77)	(1.58)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
N	15,033	12,356	12,189	10,120
Adj. R^2/ Pseudo R^2	0.155	0.166	0.298	0.298

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

4.3.6. Alternative regression model

Poisson regression is applied when the dependent variable is the counting variable. One of our dependent variables is the number of invention patents, and it is a counting variable. Therefore, Poisson regression is used in the robust check. The results are in column (2) of Table 10. The coefficient on *TCSR* is significantly positive.

5. Further analysis

5.1. Heterogeneity analyses: external environment

5.1.1. Environmental uncertainty test

Environmental uncertainty is a state in which managers are unable to predict the environment of the organisation or the changes in future technology and market due to a lack of information or ability. The innovation activity is a process in which firms invest a large amount of capital in the intangible asset, featuring a high degree of investment irreversibility. Therefore, when environmental uncertainty increases, firms will be more conservative and cautious in their behaviours. They may be inclined to delay or reduce innovation input, thus inhibiting corporate innovation. To investigate the impact of environmental uncertainty on the relationship between CSR and innovation, we introduce the interaction term $TCSR \times EU$ into models (1) and (2), where *EU* represents environmental uncertainty. The standard deviation of sales revenue is

Table 9. Results of alternative measure of CSR.

Variables	*Patent* (1)	*RD_asset* (2)	*Patent* (3)	*RD_asset* (4)
CSRR	3.522***	0.001**		
	(14.54)	(2.18)		
CSRL			0.328***	<0.001**
			(39.16)	(2.08)
Lev	13.865***	−0.001**	11.293***	−0.002**
	(15.99)	(-2.05)	(13.43)	(-2.23)
Tobin_Q	−1.488***	0.002***	−1.211***	0.002***
	(-12.42)	(19.22)	(-10.43)	(19.26)
Sep	−0.122	0.013***	−2.112	0.013***
	(-0.06)	(7.39)	(-1.08)	(7.42)
Cf_ratio	12.916***	0.015***	9.016***	0.015***
	(6.14)	(7.71)	(4.44)	(7.78)
Cash	4.383***	0.009***	4.122***	0.009***
	(3.40)	(8.21)	(3.31)	(8.14)
Esh	−5.835***	0.009***	−4.107***	0.009***
	(-6.44)	(11.19)	(-4.68)	(11.26)
Growth	−0.431	0.0004	0.297	0.001
	(-1.46)	(1.38)	(1.04)	(1.58)
State	4.781***	0.001***	2.860***	0.001***
	(12.79)	(2.80)	(7.83)	(2.61)
Constant	−13.431***	−0.006***	−4.397***	−0.005***
	(-8.10)	(-3.83)	(-2.91)	(-3.28)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
N	18,980	15,232	18,980	15,232
Adj. R^2/ Pseudo R^2	0.1429	0.2962	0.1983	0.2962

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

generally considered an indicator to measure environmental uncertainty (Ghosh & Olsen, 2009). Thus, we use the standard deviation of sales revenue in the past five years to measure environmental uncertainty (*EU*). This variable equals 1 when the environmental uncertainty index of an enterprise is greater than the average of the industry, and 0 otherwise. The coefficients on the interaction term $TCSR \times EU$ are significantly negative, indicating that the impact of CSR on innovation is weaker when environmental uncertainty increases. When environmental uncertainty increases, the risk goes up to the main consideration for firms to carry out innovation activities, and the driving force of CSR on innovation is weakened by environmental uncertainty (Table. 11).

5.1.2. Industry prosperity test

The sustainability of innovation requires a large amount of long-term and sustainable capital investment as a guarantee. Without sufficient capital supply, the technological development may be interrupted. Therefore, the acquisition of external financing resources turns into the key factor that affects whether the R&D investment can promote innovation smoothly and continuously. When the industry is booming, both internal and external financing channels are smooth for firms and the innovative activities can enjoy a stable source of funds. However, when the industry is in a downturn, corporate innovation may be impacted by its financing ability. In such a case, fulfilling CSR can win the trust of stakeholders and wider social resources

Table 10. Results of alternative measure of dependent variable and alternative regression method.

Variables	Transformation innovation index *Patent_apply* (2)	Transformation regression model *Patent* (4)
TCSR	81.289***	1.771***
	(9.54)	(17.18)
Lev	89.347***	1.714***
	(11.02)	(15.06)
Tobin_Q	−6.821***	−0.276***
	(-6.09)	(-12.46)
Sep	−7.814	−0.223
	(-0.41)	(-0.89)
Cf_ratio	84.283***	1.640***
	(4.25)	(5.79)
Cash	24.765**	0.197
	(2.06)	(1.08)
Esh	−32.929***	−0.737***
	(-3.89)	(-6.41)
Growth	−3.133	−0.093**
	(-1.14)	(-2.38)
State	11.410***	0.425***
	(3.27)	(8.80)
Constant	−52.256***	−2.149***
	(-3.55)	(-6.64)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	18,980	16,811
Pseudo R^2	0.045	0.354

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t(z)-statistics are reported in parentheses.
Source: Authors.

because the stakeholders are more willing to help enterprises with higher CSR to tide over difficulties. Then, it can be expected that in the case of industry depression, firms with better CSR activities will have a better promoting effect on innovation.

In order to investigate the impact of industry prosperity on the relationship between CSR and innovation, we add the interaction term $TCSR \times Prosperity$ into models (1) and (2). *Prosperity* represents industry prosperity. To measure industry prosperity, we obtained the prosperity index of each industry by comparing MROA (the median of total assets of each industry (*ROA*)) and MMROA (the median of MROA of each industry) during the sample period. If the MROA of year t is greater than MROA, it represents that the industry is prosperous, then the prosperity index of the industry in that year is 1, and 0 otherwise. The coefficients on interaction term $TCSR \times Prosperity$ are significantly negative, indicating that the effect of CSR on innovation is weakened by industry prosperity. In other words, the positive association between CSR and innovation is stronger when the industry is depressed.

5.2. Heterogeneity analyses: firm characteristics

5.2.1. Employee loyalty

Human resource ranks top among all the resources of firms, and it is also the core driving force of corporate innovation. When the employees show a high degree of

Table 11. Results of heterogeneity analyses: external environment.

	Environmental uncertainty		Industry Prosperity	
Variables	*Patent* (1)	*RD_asset* (2)	*Patent* (3)	*RD_asset* (4)
TCSR	18.383***	0.003**	16.396***	0.001
	(3.20)	(2.52)	(9.77)	(1.34)
TCSR × *EU*	−3.986**	−0.003*		
	(-2.17)	(-1.72)		
EU	−1.240**	−0.003***		
	(-2.41)	(-4.95)		
TCSR × *Prosperity*			−8.299***	−0.003**
			(-3.74)	(-2.00)
Prosperity			2.762***	0.003***
			(4.64)	(5.62)
Lev	18.820***	−0.004***	10.725***	−0.004***
	(3.35)	(-3.93)	(12.49)	(-4.72)
Tobin_Q	−1.648***	0.003***	−1.110***	0.003***
	(-10.611)	(14.895)	(-12.19)	(18.01)
Sep	−0.379	0.010***	2.806	0.013***
	(-0.08)	(4.66)	(1.31)	(6.86)
Cf_ratio	8.323	0.016***	9.870***	0.009***
	(1.39)	(5.77)	(4.97)	(4.09)
Cash	2.177	0.015***	1.518	0.016***
	(0.38)	(7.88)	(1.22)	(11.20)
Esh	−5.666**	0.008***	−2.302***	0.011***
	(-2.43)	(7.19)	(-3.57)	(13.56)
Growth	0.140	0.001***	−0.942***	0.000
	(0.47)	(2.67)	(-3.40)	(1.03)
State	6.000***	0.000	3.392***	−0.000
	(4.95)	(1.20)	(9.00)	(-1.08)
Constant	−15.277**	0.008***	−7.465***	0.001
	(-2.54)	(5.44)	(-7.06)	(1.11)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
N	12,366	9,892	18,978	15,232
Adj. R^2/ Pseudo R^2	0.153	0.287	0.089	0.179

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

loyalty, if the firm can be more responsible to the employees and fulfil its employee responsibilities, such as improving the working environment, the sense of belonging of the employees will be easier to be stimulated and they will be encouraged to work harder to reward the firm, thus promoting the innovation. However, for firms with a lower degree of employee loyalty, employee responsibility is more like a kind of "compensation" and "health care" for employees, which may not have a more promoting effect on employees. Through the interaction term between employee responsibility (*CSR_emp*) and employee loyalty, we compare whether there is a significant difference in the promotion effect of employee responsibility on corporate innovation under different employee loyalty. The results are shown in Table 12. We use the ratio of employee pay payable to operating revenue to measure employee loyalty. If the ratio of firm *i* is greater than the industry average, the value is 1, and 0 otherwise. As given in Table 12, the coefficient on interaction term *CSR_emp* × *Loyalty* is significantly positive, indicating that the impact of employee responsibility on corporate

Table 12. Results of heterogeneity analyses: employee loyalty.

Variables	*Patent (1)*	*RD_asset (2)*
CSR_emp	72.516***	0.016***
	(13.06)	(3.30)
CSR_emp × *Loyalty*	32.755***	0.047***
	(3.55)	(5.78)
Loyalty	−0.814*	0.002***
	(-1.95)	(5.67)
Lev	12.925***	−0.001
	(14.67)	(-1.21)
Tobin_Q	−1.597***	0.002***
	(-13.04)	(17.21)
Sep	0.313	0.013***
	(0.15)	(7.07)
Cf_ratio	13.746***	0.013***
	(6.50)	(6.83)
Cash	4.203***	0.009***
	(3.23)	(7.70)
Esh	−5.543***	0.009***
	(-6.06)	(11.33)
Growth	−0.568*	<0.001
	(-1.91)	(1.35)
State	4.495***	<0.001
	(11.90)	(1.27)
Constant	−7.141***	−0.006***
	(-4.53)	(-4.00)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Province FE	Yes	Yes
N	18,773	15,078
Adj. R^2/ Pseudo R^2	0.149	0.307

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

innovation is indeed affected by employee loyalty and the two aspects are positively correlated.

5.2.2. Agent conflict

According to the agency theory, in the absence of effective supervision and incentives, managers tend to choose robust investment projects that can improve business performance in the short term, while reducing innovative R&D projects with the long cycle and high risk even though they are conducive to the long-term value improvement (Jensen & Meckling, 1976). In order to investigate whether there is a significant difference in the impact of shareholder responsibility on corporate innovation among enterprises with different agency conflicts, we add the interaction term between shareholder responsibility (*CSR_sh*) and agency conflict (*AC*) to our specification. We use two indicators of the operation expense ratio (*Operation*) and total asset turnover (*Turnover*), respectively, to measure the agency conflict from two aspects of cost and efficiency. If the operating expense ratio of firm *i* is greater than the industry average, the value is 1, and 0 otherwise. Similarly, if the total assets turnover of firm *i* is greater than the industry average, the value is 1, and 0 otherwise.

The results of agent conflicts are shown in Table 13. In columns (1) and (2), we use the operating expense ratio to measure agency conflicts. The coefficients on interaction term *CSR_sh* × *Operation* are both negative and statistically significant when

Table 13. Results of heterogeneity analyses: agent conflicts.

Variables	*Patent* (1)	*RD_asset* (2)	*Patent* (3)	*RD_asset* (4)
CSR_sh	55.262***	0.030***	29.744***	0.008**
	(15.26)	(9.40)	(7.81)	(2.37)
CSR_sh × Operation	−20.197***	−0.008*		
	(-4.05)	(-1.85)		
Operation	3.485***	0.005***		
	(4.45)	(7.53)		
CSR_sh × Turnover			31.067***	0.016***
			(6.19)	(3.77)
Turnover			−3.500***	0.004***
			(-4.52)	(5.50)
Lev	17.225***	0.002*	16.520***	−0.004***
	(18.18)	(1.92)	(17.26)	(-4.42)
Tobin_Q	−1.387***	0.002***	−1.347***	0.002***
	(-11.19)	(16.19)	(-10.96)	(17.93)
Sep	−0.897	0.011***	−0.824	0.010***
	(-0.42)	(5.98)	(-0.39)	(5.41)
Cf_ratio	6.775***	0.008***	4.602**	0.002
	(2.96)	(3.60)	(1.99)	(1.09)
Cash	0.505	0.006***	1.478	0.009***
	(0.37)	(5.13)	(1.09)	(7.22)
Esh	−7.439***	0.006***	−7.097***	0.007***
	(-7.67)	(7.98)	(-7.30)	(9.34)
Growth	−1.123***	−0.000	−1.204***	−0.001**
	(-3.66)	(-0.01)	(-3.91)	(-2.47)
State	4.786***	0.001***	4.754***	0.001*
	(12.25)	(3.18)	(12.14)	(1.80)
Constant	−21.993***	−0.023***	−17.301***	−0.018***
	(-6.97)	(-8.00)	(-5.50)	(-6.19)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
N	16,811	13,301	16,507	13,079
Adj. R^2/ Pseudo R^2	0.151	0.312	0.148	0.324

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

the dependent variable is innovation output, indicating that the agency cost is negatively correlated with the effect of shareholder responsibility on innovation. In columns (3) and (4), we use the total asset turnover to measure the agency conflict, and the coefficients on interaction term are significantly positive, indicating that a higher turnover (a smaller agency conflict) contributes to a stronger promoting effect of shareholder responsibility on innovation input and innovation output.

5.2.3. Financial constraints

Fazzari and Athey (1987) believed that information asymmetry would lead to financial constraints. Corporate innovation activities are a long-term process that requires a large amount of capital to maintain. However, the high risk of innovation failure and the uncertainty of whether the achievements bear commercial value will also put the investors and other stakeholders in the dilemma of information asymmetry, and firms may therefore face the challenge of financial constraints. Firms with strong responsibility to the supplier, customer and consumer's rights & interests enjoy a good image and reputation in the supply chain, and stakeholders will respond

Table 14. Results of heterogeneity analyses: financial constraints.

Variables	(1) Patent	(2) RD_asset	(3) Patent	(4) RD_asset
CSR_sup	40.954***	0.006**	44.439***	0.005
	(11.11)	(1.99)	(10.25)	(1.24)
CSR_sup × WW	−27.894***	−0.012**		
	(-4.36)	(-2.04)		
WW	−5.170***	−0.000		
	(-14.57)	(-1.10)		
CSR_sup × SA			−11.620**	−0.002
			(-2.03)	(-0.40)
SA			−4.376***	−0.002***
			(-13.45)	(-6.44)
Lev	10.693***	−0.003***	13.314***	−0.002**
	(11.08)	(-3.24)	(14.61)	(-2.36)
Tobin_Q	−1.110***	0.002***	−1.612***	0.002***
	(-8.44)	(17.16)	(-13.30)	(17.63)
Sep	0.013	0.013***	1.079	0.013***
	(0.01)	(6.61)	(0.51)	(6.93)
Cf_ratio	11.799***	0.014***	15.929***	0.014***
	(5.13)	(6.79)	(7.29)	(6.97)
Cash	1.151	0.009***	2.917**	0.008***
	(0.81)	(7.06)	(2.19)	(7.13)
Esh	−5.237***	0.007***	−7.829***	0.007***
	(-5.08)	(7.88)	(-8.05)	(8.30)
Growth	−1.392***	<0.001	−0.555*	<0.001
	(-4.35)	(0.43)	(-1.83)	(0.64)
State	4.132***	0.001**	4.776***	0.001***
	(10.17)	(2.52)	(12.22)	(2.85)
Constant	−11.242***	−0.016***	−13.262***	−0.016***
	(-3.48)	(-5.62)	(-4.27)	(-5.60)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
N	15,660	12,266	16,811	13,301
Adj. R^2/ Pseudo R^2	0.163	0.295	0.154	0.296

Note: ****, **, and * indicate significance at the 1%, 5%, and 10 % levels, respectively. The t-statistics are reported in parentheses.
Source: Authors.

positively to the firms. Therefore, information can be disseminated and fed back effectively, which helps the firms to obtain the resources needed for innovation. Then, an intuitive question comes, that is, whether the promoting effects of supplier, customer and consumer's rights & interests responsibility on corporate innovation differ significantly among firms with various financial constraints? To test our conjecture, we introduce the interaction between shareholder responsibility (*CSR_SUP*) and financing constraint (*FC*) to our specification. *FC* represents financing constraint. We follow the empirical model from Li (2011) and Hadlock and Pierce (2010) and employ the WW index and SA index, respectively, to measure the degree of financial constraints. The specific model is as follows:

$$WW = -0.091Cf - 0.062Divops + 0.021Tltd - 0.044Lnta + 0.102Isg - 0.035Sg \quad (4)$$

$$\mathrm{SA} = -0.737Size + 0.043Size^2 - 0.040Age \quad (5)$$

All variables are defined in Appendix B. A larger WW index equals a higher degree of financial constraints. If the SA index is negative, the absolute value will be larger, implying that the firm confronts a higher degree of financial constraints. Based on the mean values of the WW index and SA index, we partition our sample into high- and low-financing constrained firms. If the firm belongs to the high-financing constrained group, then our measure equals 1, and 0 otherwise.

The test results based on financial constraints are shown in Table 14. In columns (1) and (2), financial constraints are measured by the WW index. The coefficients on interaction term CSR_SUP × WW are significantly negative, indicating that the financial constraints are negatively associated with the promoting effect of supplier, customer and consumer's rights & interests responsibility on corporate innovation input and innovation output. SA index is used to measure financial constraints in columns (3) and (4). The coefficients on the interaction term *CSR_SUP* × *Sa* are all negative and are statistically significant when the dependent variable is innovation output. It suggests that the impact of supplier, customer and consumer's rights & interests responsibility on corporate innovation is stronger when financial constraints are lower.

6. Conclusion

CSR and innovation activities are both components of the long-term development strategy of firms, while the prior literature has not reached an agreement on the relationship between CSR and corporate innovation. Using listed firms in China, we examine the impact of CSR derived from legitimacy on corporate innovation. We find that CSR has a significant positive impact on innovation activities, that is, the higher CSR is, the higher innovation output and input level is. We also find that the sub-dimension of CSR has different impacts on corporate innovation. Internal responsibility and business partner responsibility have a significant positive impact on innovation effects, but public responsibility does not due to the existence of complying with both conforming legitimacy and strategic legitimacy (Zimmerman & Zeitz, 2002). In addition, we find that the positive strategic style plays an intermediary role in the relationship between CSR and innovation. Furthermore, the environmental uncertainty and industry prosperity weaken the positive effect of CSR on innovation. The positive association between CSR and innovation is stronger in firms with lower agency cost, high employee loyalty and lower financial constraints.

Under the pressure of intense competition, firms actively pay attention to innovation activities, while they do not pay enough attention to social responsibility. The business concepts advocated by CSR, such as fair operation, green and environmental protection, are actually the sustainable development strategy. Our findings reveal that CSR derived from legitimacy in emerging economies can have a positive impact on corporate innovation activities. It enriches the literature on the relationship between CSR and innovation, makes a beneficial supplement to the mechanism of CSR influencing innovation, and helps the government and firms' managers to further improve social responsibility. According to our results, there are several recommendations. First, firms should re-examine and position the relationship between CSR and innovation at the strategic level, and change their myopia behaviour. Although CSR activities may consume resources to a

certain extent, it also affects stakeholders' perception and evaluation of firms' value, the establishment of long-term business activities and cooperation, which is conducive to improving firms' anti-risk ability. Changing the myopia behaviour is also the motivation to strengthen corporate social responsibility and promote corporate innovation. Second, in the face of the society and the market, firms should actively respond to the demands of stakeholders, acquire various key knowledge and resources needed for innovation, and enhance their sustainable competitiveness. In this way, firms can occupy the market, gain profits, and better fulfil their social responsibilities to shareholders, employees, and consumers. Third, firms need to strengthen their public responsibilities according to their own conditions. Although public responsibility cannot generate direct economic benefits, it can make it ethically correct and make firms meet the requirement for conforming legitimacy in their operations and business management. In the process of undertaking public responsibility, firms can strive to obtain potential resources. In general, our results suggest that firms can promote their innovation through CSR activities and maintain the needs of sustainable development.

There are several limitations to our study. First, our article does not examine the relationship between CSR and corporate innovation in different industries. Firms in different industries may have great differences in the degree of dependence and emphasis on innovation. Future studies can be conducted on the relationship between CSR and innovation in different industries, which may provide stronger evidence for exploring the impact of CSR on innovation activities. Second, different firms alternate and replace old and new technologies at different times. Thus, the heterogeneity of different corporate characteristics and their life cycle can be further explored in the relation between CSR and innovation. Third, this study only examines the relationship between CSR activities and innovation in China, while future studies can investigate this relationship in other emerging markets or using multinational data, and explore possible changes and causes of this relationship in different institutional environments.

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Appendix A. Variable definitions

Variables	Variable name	Variable definition
Patent	The invention patent Obtained	Number of invention patents obtained
RD_asset	Research and development strength	R&D investment/total assets
TCSR	CSR total score	Overall CSR score from HeXun
CSR_sh	Shareholder responsibility	Shareholder responsibility score from HeXun
CSR_emp	Employee responsibility	Employee responsibility score from HeXun
CSR_sup	Supplier, customer and consumer's rights & interests responsibility	Supplier, customer and consumer's rights & interests responsibility score from HeXun
CSR_env	Environmental responsibility	Environmental responsibility score from HeXun
CSR_soc	Welfare responsibility	Welfare responsibility score from HeXun
Strategy	Corporate strategy	A comprehensive index based on six financial indicators for the measure of corporate strategy. A higher value presents more active corporate strategy.
Lev	Asset-liability ratio	Total assets/ liabilities
Tobin_Q	Tobin's Q value	Enterprise market value/replacement cost of an asset
Sep	The separation of ownership and control	The difference between voting rights and cash flow rights of a firm's controlling owner
Cf_ratio	Total cash flow recovery rate	Net operational cash flow /total assets
Cash	Cash asset ratio	Vault cash/ total assets
Esh	Executive shareholding ratio	Management shareholding/ total number of shares
Growth	The growth rate of business revenue	(Amount of operating income for the current period-Amount of operating income for the last period)/ Amount of operating income for the last period
State	Ownership property	A dummy variable that equals 1 if the firms is state-owned enterprise, and 0 otherwise.

Appendix B. Variable definitions of the WW index and the SA index

Index sign	Corresponding meaning
Cf_ratio	The ratio of the net cash flow from operations to total assets.
DIVPOS	This variable equals 1 if the firm pays a cash dividend, and 0 otherwise.
TLTD	The ratio of long-term liabilities to total assets.
LNTA	The natural logarithm of total assets.
ISG	The average growth rate of operation income in the industry
SG	The growth rate of operation income of a firm
Age	The number of years since IPO of a firm
Size	The natural logarithm of the total corporate assets (in millions)