Innovation as a differentiation strategy: Its differential substitution effects on corporate social responsibility

Abstract

The engineering management literature has long acknowledged that innovation is the most significant differentiation strategy for firms to achieve competitiveness and hence firm performance. More recently, corporate social responsibility (CSR) is recognized as another differentiation strategy which also contributes to firm performance. However, the joint performance effects of innovation and CSR have not been sufficiently investigated, particularly on the interplay between different types of innovation and CSR. This study classifies innovation into solitary and collaborative innovation as well as incremental and radical innovation to examine their differential effects. Employing a panel dataset of 2,377 Chinese manufacturing firms during the period of 2010–2019, we discover that there exists an inverted U-shaped CSR–performance relationship. More importantly, we reveal that collaborative innovation has a stronger attenuating effect on the inverted U-shaped performance effect of CSR than solitary innovation. Similarly, radical innovation has a stronger attenuating effect than incremental innovation. Our research advances the innovation and CSR literature by providing novel insights regarding how different types of innovation alter the curvilinear performance effect of CSR in an emerging economy.

Managerial relevance statement

This research provides several important managerial implications. First, managers

should be cautious that it is not as simple as whether engaging in CSR practices or not, but rather putting great emphasis on the optimal level of CSR. Our results indicate that compared with low or high levels of CSR, a medium level of CSR can lead to greater firm performance, implying that there is an optimal CSR level. Moreover, our findings provide managers with a nuanced understanding of the varying contingent roles of different types of innovation in shaping the CSR–performance linkage. Managers, especially those who implement innovation and engineering projects, need to be cautious that the financial benefits of CSR could be attenuated by other differentiation strategies such as collaborative and radical innovation. While these two typical types of innovation are being pursued actively by firms to enhance technological and engineering capabilities, managers need to be careful about their substitution effects on CSR. It is therefore highly recommended that companies focus on either a collaborative or radical innovation or a CSR strategy. Nevertheless, managers should also be mindful that solitary and incremental innovation do not significantly alter the financial returns associated with CSR.

Keywords: Innovation; Corporate social responsibility; Corporate financial performance; Solitary or collaborative innovation; Radical or incremental innovation

I. INTRODUCTION

Technological innovation reshapes the competitive landscape and is commonly regarded as a critical accelerator to firms' competitiveness, growth, and success [1] [2]. It has been widely acknowledged that innovation is a differentiation strategy, enabling the firm to become distinguishable in highly competitive and dynamic markets [3] [4]. To achieve varying degrees of competitive advantages, firms can invest resources to develop different types of innovation to compete in increasingly fierce and aggressive markets. Particularly, from the perspective of whether innovation spans across organizational boundaries, we follow previous research [5] and differentiate firms' innovation into solitary and collaborative innovation. The former refers to innovation activities that are implemented by firms independently, while the latter represents innovation activities that are jointly undertaken by firms and their partners (e.g., suppliers, customers, universities, and public research institutes) [5] [6]. For instance, Cisco collaborated with other leading firms and institutes to develop quantum networks [7]. Furthermore, based on the novelty of innovation, we classify firms' innovation into incremental and radical innovation [4] [8]. The former denotes minor technological changes to firms' existing products or processes to strengthen their potential value, whereas the latter is characterized by a new technological basis and comprises the development of novel products or processes [8]. For example, BYD, a leading automobile manufacturer in China, devoted great efforts to developing novel technical solutions to electric vehicles [9].

Previous engineering management literature has emphasized that innovation is closely

associated with corporate social responsibility (CSR) [10] [11], which is also viewed as an effective differentiation strategy and contributes to corporate financial performance (CFP). The notion of CSR denotes various pro-social practices (e.g., green supply chain practices, employee training and care programs, safety production activities, and philanthropic donations) implemented by firms to achieve sustainable development goals (SDGs) [12] [13] [14]. A growing number of enterprises has engaged in CSR to mitigate the adverse effects of their operations and supply chains on the environment and society. For example, Apple has proactively embraced CSR for the sake of enhancements in environmental well-being and employees' health and safety [15].

Researchers have underlined that since innovation is a strong differentiation strategy, it is debatable whether enterprises possessing high innovation still benefit from the differentiation effect of CSR [16] [17]. More importantly, given that different types of innovation may enable firms to achieve varying levels of differentiation advantages [5], they may exert distinct effects on the efficacy of CSR on CFP. Yet, there is a paucity of research untangling how different types of innovation alter the linkage between CSR and CFP, which inhibits a fine-grained understanding of the substitution effects among the two differentiation strategies.

This research intends to bridge this knowledge gap by uncovering the pivotal roles of different types of innovation in modifying the CSR–CFP link. This contingency analysis is particularly important, given that the ongoing empirical ambiguity on the CSR–CFP link has led to largely fragmented literature on CSR, hindering research and further progress. Recently,

a few scholars have observed that the CSR–CFP linkage is not as simple as linear, but demonstrates a non-linear pattern [18]. Drawing upon the resource-based view (RBV) [19] [20] and the law of diminishing marginal utility [17], we theorize an inverted U-shaped association between CSR and CFP. Specifically, we posit that at low levels of CSR, CFP increases because of the stakeholder-based resources (e.g., enhanced customer satisfaction and employee commitments, and favorable firm reputation) derived from CSR initiatives (dominance of the positive effect) [17]. Yet, beyond a critical point of CSR, CFP decreases since marginal benefits decline and become inadequate to cover the costs associated with CSR (dominance of the negative effect), which finally results in diminishing CFP [17] [21]. This suggests that the CSR–CFP link is far from being simple, following an inverted U-shaped pattern.

Furthermore, building on the tenet of RBV, we contend that since innovation is a strong differentiation strategy [2], companies with a higher level of innovation may gain fewer benefits from the differentiation effect of CSR [17]. Innovation activities might also consume numerous resources [22] and hence firms pursuing higher innovation may have lower priority and fewer available resources for CSR initiatives. This implies that firm innovation probably has a substitution effect on CSR. More importantly, as solitary and collaborative innovation denote varying degrees of differentiation strategies and resource consumption [23], they may exert different influences on the positive and negative mechanisms underlying the impact of CSR on CFP. Similarly, incremental and radical innovation are characterized with different levels of differentiation strategies and cost requirements [24], and thus they likely play

differing roles in shaping the inverted U-shaped CSR–CFP relationship.

Our research investigates these ideas by utilizing a panel dataset of 2,377 Chinese listed manufacturing companies during the period of 2010–2019. China, as an emerging economy, is a suitable and important empirical setting for our research in that the rapid economic development of the country has resulted in severe damages to the environment and brought about a large number of production safety incidents, rendering CSR as a salient issue [12] [17]. Moreover, Chinese enterprises are motivated to conduct innovation and engineering management activities under competitive pressures [49], which makes it interesting and worthwhile to unpack how different types of innovation alter the CSR–CFP linkage. We discover that there exists an inverted U-shaped linkage between CSR and CFP. Interestingly, collaborative innovation has a stronger attenuation effect on this curvilinear linkage than solitary innovation. Similarly, radical innovation has a stronger attenuation effect on this curvilinear linkage than incremental innovation.

This research has several important contributions. First, it provides sound empirical evidence on an inverted U-shaped association between CSR and CFP in the context of an emerging market (i.e., China) to reconcile and complement the extant conflicting findings. Only very few studies have explored the non-linear impact of CSR on CFP, yet they are restricted to the context of developed countries [18] [25]. Given that there exist significant differences in CSR between developed and developing countries [26], this study advances our understanding of the CSR–CFP linkage by untangling the inverted U-shaped pattern in an emerging economy context. More importantly, our research expands the innovation literature

by disentangling the varying contingent impacts of different types of innovation on the curvilinear CSR–CFP relationship. This echoes a fine-grained quest related to the contingency conditions of the CSR–CFP relationship [25]. Lastly, this study sheds light on the RBV literature by theoretically attesting to an inverted U-shaped CSR–CFP relationship and elucidating how distinct types of innovation moderate the underlying positive and negative mechanisms of this relationship.

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

A. Innovation and CSR

The engineering management literature has long acknowledged that innovation is an effective differentiation strategy, which is favorable for the firm to acquire competitive edge and long-term prosperity [3] [22]. Innovation is a fundamental pathway through which enterprises can realize technological advancements and boost engineering capabilities [22]. Researchers have underlined that firms can focus on the development of different types of innovation for accomplishing different objectives. Firms' innovation can be classified into solitary and collaborative innovation according to whether innovation activities span across organizational boundaries [5]. In addition, innovation can be classified into incremental and radical innovation according to their novelty [4] [8] [27].

Previous research on innovation has mainly focused on its performance outcomes [2] [3] [22]. For example, Wang *et al.* [6] investigate the impact of collaborative innovation on ecological efficiency. Henao-Garcia and Cardona Montoya [22] examine the effects of product, process, and technological innovations on firms' financial performance. More

recently, scholars start investigating the bidirectional relationship between innovation and CSR [28] [29]. One stream of literature centers on the impact of CSR on firm innovation. For instance, some researchers pinpoint that CSR enables firms to establish deep relationships with their key stakeholders, which promote the exchange of valuable information and knowledge and thus facilitate innovation [11] [30]. Palacios-Manzano *et al.* [10] also link innovation to CSR and uncover its mediating role in the linkage between CSR and CFP. Another stream of literature unravels the influence of firm innovation on CSR. It is posited that innovation enables firms to incorporate responsible attributes into their products and services and undertake responsible production practices, thus playing a vital role in driving firms' engagement in CSR activities [28] [29]. Mishra [31] provides evidences that innovation is conducive to promoting CSR, which in turn enhances firms' market value.

While the relationship between innovation and CSR has gained increasing scholarly attention, little is known about the joint performance effects involving different types of innovation and CSR. Since innovation is viewed as a differentiation strategy, some scholars have stressed the importance of uncovering whether firms with high innovation can still benefit from the differentiation effect of CSR [17]. It has been advocated that different types of innovation might bring varying impacts on firms' competitiveness and require differential levels of resource consumption [5] [32]. In this sense, the effectiveness of CSR on CFP might hinge on different kinds of innovation. Nonetheless, there is a void of research that investigates whether different types of innovation exert distinct effects on the CSR–CFP association, which impedes an in-depth understanding of its boundary conditions. The extant

studies have primarily concentrated on several moderating factors that influence the CSR–CFP relationship, such as competitive action [13], operational productivity [33], product quality [34], advertising intensity [35], managerial efficiency [36], and industry munificence and dynamism [37]. Nevertheless, the extant empirical research has largely neglected the pivotal contingent roles of different types of innovation. We therefore endeavor to address this knowledge gap by delving into the nuance of innovation and unraveling the differential substitution effects of different types of innovation on the CSR–CFP linkage. This can provide a comprehensive understanding of the interplay between the two differentiation strategies (i.e., innovation and CSR).

B. Inverted U-shaped Impact of CSR on CFP

In general, CSR refers to "a company's activities and status related to its perceived societal or stakeholder obligations" [34]. CSR is multifaceted and denotes the firm's responsibility for a range of stakeholders, including employees, suppliers, customers, local communities, and shareholders [17] [38]. Typical CSR activities encompass green engineering practices, safety production initiatives, employees' welfare and caring programs, and charitable donations [11] [12] [38]. Undertaking CSR activities enables firms to enhance societal well-being by mitigating environmental and social issues [39] [40].

We conceptualize the linkage between CSR and CFP as the combination of the benefit and cost functions, which capture the positive and negative effects of CSR on CFP, respectively. In this study, RBV is adopted as the theoretical lens to explain the positive impact of CSR on CFP. RBV suggests that enterprises can differentiate themselves and gain

competitive advantages by accumulating resources that are rare, valuable, inimitable, and non-substitutable [19] [41] [42]. We posit that embracing CSR can help firms fulfill the needs of diverse stakeholders (e.g., employees, suppliers, customers, government, and shareholders), which is conducive for firms to obtain stakeholder-based intangible resources (e.g., employee commitment, firm reputation, brand identity, and customer loyalty) [12] [40]. These intangibles are valuable resources that are hard to accumulate and are not easy to be imitated or substituted by rivals, which contribute to the attainment of superior financial performance [19] [43]. For instance, CSR is favorable for firms to improve employee commitment through offering a safe and decent working environment, and extensive employee training and care programs [10] [17]. Moreover, CSR can boost firm reputation, which is helpful for companies to gain political resources from regulatory bodies and government [13]. Additionally, firms engaging in CSR activities (e.g., consumer protection and green operations and engineering practices) can enhance customer satisfaction and loyalty, thus promoting customers' willingness to purchase their products or services [14] [33].

Along with the positive effect, however, CSR also undermines CFP by expanding significant costs. CSR practices consume substantial resources. For instance, such practices involve the procurement of new eco-innovation facilities and safety equipment, employee training, and charitable donations, which could place an economic burden on firms [18]. Additionally, firms engaging in CSR activities are required to evaluate, plan, and manage them, thus inducing vast managerial costs and jeopardizing CFP [44]. Besides, implementing CSR initiatives may draw significant resources and efforts away from firms' core business

areas, thereby engendering the issues of resource competition between different departments and loss of strategic focus [25]. Some scholars have also pinpointed that the nonprofit utilization of firms' limited resources may impair their ability to deal with unexpected failures and thus profitability [17].

By integrating the positive and negative mechanisms simultaneously, we assume that the net effect of CSR on CFP is inverted U-shaped. Specifically, at low to moderate CSR levels, CFP will rise because the stakeholder-based benefits acquired from CSR outweigh the associated costs. Nevertheless, when CSR exceeds a turning point, its benefits are likely to level off gradually and further be counteracted by expanded costs, thereby leading to declined CFP. Thus, it is likely that the CSR–CFP association is inverted U-shaped. According to the law of diminishing marginal utility [17], we maintain that as the CSR level grows up, its marginal benefits will gradually decrease for several reasons. First, while good CSR performance can help firms gain stakeholder-based resources, there exist limits to the type and amount of these resources which various stakeholders could offer to them [45]. This restricts the amount of intangible resources which enterprises can obtain from CSR, thereby leading to decreased marginal benefits of CSR. For instance, as one of the largest developing countries, China encounters the paradox of investing resources to promote economic development and tackle the socially irresponsible issues [46]. As such, the Chinese government possesses limited resources which can be provided for numerous pro-social enterprises. Second, scholars have argued that stakeholders may not appreciate the over-investment in CSR when the degree of CSR deviates from stakeholder expectations to resolve

socially responsible issues [21]. As such, when CSR is at moderate to high levels, it can create trivial marginal benefits for firms. Accordingly, the substantially increased costs of CSR will outweigh the stakeholder-based benefits, leading to declining CFP [25] [47] [48]. Thus, we posit that there exists an inverted U-shaped relationship between CSR and CFP.

Hypothesis 1: The link between CSR and CFP is inverted U-shaped.

C. Moderating Roles of Different Types of Innovation

We first explicate how technological innovation attenuates the positive mechanism and reinforces the negative mechanism underlying the impact of CSR on CFP, which can help us better elaborate on how different types of innovation exert differential effects on the CSR–CFP link. Specifically, CSR works as a differentiation strategy, which is advantageous for firms to acquire intangible resources and establish close relationships with key stakeholders, thereby contributing to the improvements in CFP [14] [43]. From the perspective of RBV [3], innovation also functions as a differentiation strategy, which may have a substitution effect on CSR's influence on CFP. Enterprises with a high level of innovation probably have already differentiated themselves and possessed relatively favorable relations with stakeholders, and thus the impact of CSR on relation enhancement might be limited [16]. This suggests that innovation is likely to undermine the positive influence of CSR on CFP. Moreover, innovation may exacerbate the negative effect of CSR on CFP. Innovation activities are costly and risky because they require substantial resource investment and might induce numerous failures before success [27] [49]. Hence, for firms with higher innovation, they are likely to possess fewer available resources for the implementation of CSR initiatives.

Consequently, the growing investment in CSR for firms with high innovation might result in even lower CFP than for those with low innovation. Therefore, it is likely that innovation attenuates the inverted U-shaped CSR–CFP link.

Furthermore, we dive into the nuance of innovation and elucidate the differential effects of solitary and collaborative innovation on the inverted U-shaped CSR–CFP linkage. In light of the significant differences between solitary and collaborative innovation in terms of their varying roles in differentiation strategy and resource consumption, we argue that the negative moderating effect of collaborative innovation on the inverted U-shaped CSR–CFP link is stronger than that of solitary innovation. Specifically, compared with solitary innovation, collaborative innovation functions as a stronger differentiation strategy since it can provide firms with more novel opportunities to cooperate with partners (e.g., supply chain members, universities, and research institutions) for developing new products or transforming operational processes, thus generating greater competitive advantages for firms [23] [50]. Heil and Bornemann [51] concur by pointing out that collaborative innovation is a valuable means for firms to learn their partners' proprietary knowledge to further enhance competitive advantages. Zhou *et al.* [52] also emphasize that collaborative innovation represents an important management approach to acquire external technological knowledge and complementary resources, thereby further boosting firms' competitiveness. In this sense, collaborative innovation may have a greater attenuating effect on the positive impact of CSR on CFP than solitary innovation.

In addition, engaging in collaborative innovation activities with external partners (e.g.,

suppliers, customers, universities, and public research institutions) may induce the risk of opportunism and lift up the required coordination and managerial costs. Specifically, researchers have maintained that partnerships might be fraught with opportunistic intent [53]. Other external partners may seek self-interest and adopt opportunistic behaviors such as "cheating, shirking, distorting information, misleading partners, providing substandard products/services, and appropriating partners' critical resources" [54]. Particularly, Badir and O'Connor [55] point out that when firms implement collaborative innovation projects, opportunistic behavior may arise since other partners are unlikely to avail significant resources to these projects or even violate the spirit of an agreement. Restraining opportunism probably entails time-consuming negotiations of the contract, costly monitoring and control mechanisms, and lock-in relationship-specific assets [53] [56], which exacerbates the investment risk and cost burdens on firms. Besides, due to cultural and organizational differences between cooperative partners, it is difficult for firms to coordinate and accomplish collaborative innovation activities in such heterogeneous settings [5]. Thus, it becomes necessary for firms to spend relational investments to support communication and coordination among collaborating partners, aggravating coordination efforts and costs [57]. In addition, previous research suggests that collaborative innovation may trigger involuntary leakages of additional information and knowledge to unintended external partners [27] [58]. Hence, firms need extra resources to carefully manage related innovation projects and prevent this severe issue, provoking increase in managerial costs [27]. Overall, compared with solitary innovation, collaborative innovation may incur more costs, thus exerting a

stronger reinforcing effect on the negative influence of CSR on CFP. Taken together, we postulate that collaborative innovation has a stronger attenuating influence on the inverted U-shaped CSR–CFP link than solitary innovation.

Hypothesis 2: The attenuating effect of collaborative innovation on the inverted U-shaped CSR–CFP link is stronger than that of solitary innovation.

We further conjecture that radical innovation has a greater attenuating effect on the inverted U-shaped CSR–CFP association than incremental innovation. Specifically, from the perspective of RBV, researchers have underlined that radical innovation activities are technology-intensive and can help transform firms' existing products or processes significantly and develop novel products, thereby yielding greater competitive advantages [4] [8]. In contrast, incremental innovation activities entail fewer R&D efforts and comprise minor changes to existing products or processes, which bring lower competitive edge for enterprises [59]. This implies that compared with incremental innovation, radical innovation serves as a stronger differentiation strategy, thus exerting a greater attenuating effect on the positive impact of CSR on CFP.

Moreover, compared with incremental innovation, radical innovation requires firms to invest more resources (e.g., financial capital, human resources, and time) to conduct related innovation projects [24] [32]. As a result, firms pursuing high radical innovation are likely to spare fewer resources for the implementation of CSR practices than those undertaking high incremental innovation. This indicates that radical innovation might has a stronger augmenting influence on the negative impact of CSR on CFP. Overall, the foregoing

discussion suggests that radical innovation exerts a greater negative moderating impact on the inverted U-shaped CSR–CFP link than incremental innovation.

Hypothesis 3: The attenuating effect of radical innovation on the inverted U-shaped CSR–CFP link is stronger than that of incremental innovation.

III. METHOD

A. Data and Sample

To test our hypotheses, we compile and combine secondary data from multiple sources. First, we obtain data about firms' different types of innovation from the Chinese Research Data Services (CNRDS) Platform, which acquires patent information from the China National Intellectual Property Administration (CNIPA) and identifies patents based on the classification system of the World Intellectual Property Organization (WIPO). Then, data about firms' CSR performance come from Hexun, a third-party rating agency in China, which offers comprehensive and professional assessment of the CSR performance of Chinese listed companies [17]. Next, we gather other data from the China Stock Market and Accounting Research (CSMAR) database. CNRDS and CSMAR databases are viewed as authoritative data sources in China and have been extensively adopted by prior studies [46] [60].

We focus on Chinese listed manufacturing firms in Shanghai and Shenzhen Stock Exchanges during the period of 2010–2019. We select 2010 as the starting year because Hexun published the first CSR rating scores in 2010. We center on manufacturing enterprises since they are regarded as the major sources of socially irresponsible issues in China [60]. We remove several observations from our sample if they meet one of the following criteria: (1)

firms that are marked with Special Treatment (ST) because they have severe financial constraints; (2) B-share companies because these shares are bought and sold in different currencies; and (3) observations that had missing values on the variables of interest in this research. Finally, we gain a sample which has 15,782 observations covering 2,377 firms during the period of 2010–2019. Table I displays the descriptive statistics of sample distribution across industry and year.

Table I

DESCRIPTIVE STATISTICS OF SAMPLE FIRMS

Panel A: The distribution of sample firms by industry

three-digit CSRC code	Industry	Frequency	Percentage (%)
C13	Farm products processing	363	2.30
C14	Food manufacturing	286	1.81
C15	Wine, drinks, and refined tea manufacturing	307	1.95
C17	Textile	342	2.17
C18	Textiles, garments and apparel industry	247	1.57
C19	Leather, fur, feathers, and related products and shoe-making	57	0.36
C20	Wood processing, and wood, bamboo, rattan, palm, and grass products	64	0.41
C21	Furniture manufacturing	109	0.69
C22	Papermaking and paper products	231	1.46
C23	Printing and reproduction of recorded media	53	0.34
C24	Culture and education, arts and crafts, sports, and entertainment products manufacturing	86	0.54
C25	Petroleum processing, coking and nuclear fuel processing	156	0.99
C26	Raw chemical materials and chemical products	1,706	10.81
C27	Pharmaceutical manufacturing	1,479	9.37
C28	Chemical fiber manufacturing	207	1.31
C29	Rubber and plastic product industry	512	3.24
C30	Non-metallic mineral products	644	4.08
C31	Smelting and pressing of ferrous metals	294	1.86
C32	Smelting and pressing of nonferrous metals	497	3.15
C33	Metal products	416	2.64
C34	General equipment manufacturing	928	5.88
C35	Special equipment manufacturing	1,446	9.16
C36	Automobile manufacturing	807	5.11
C37	Railway, shipbuilding, aerospace, and other transportation equipment manufacturing	343	2.17
C38	Electric machines and apparatuses manufacturing	1,530	9.69
C39	Computer, communication, and other electronical device manufacturing	2,176	13.79
C40	Instrument and meter manufacturing	313	1.98

C41	Other manufacturing	169	1.07
C42	Utilization of waste resources	14	0.09
Total		15,782	100

Panel B: The distribution of sample firms by year

Year	Frequency	Percentage (%)
2010	1,118	7.08
2011	1,260	7.98
2012	1,379	8.74
2013	1,426	9.04
2014	1,485	9.41
2015	1,569	9.94
2016	1,715	10.87
2017	1,935	12.26
2018	1,877	11.89
2019	2,018	12.79
Total	15,782	100

B. Measures

Dependent variable. In accordance with prior studies [61] [62], CFP is operationalized as return on assets (ROA), which is calculated as the ratio of net profit to the average of firms' total assets at the beginning and the end of each year.

Independent variable. CSR performance of firms is operationalized with the rating score offered by Hexun, which evaluates Chinese listed enterprises' CSR scores based on their official CSR reports and annual reports. Companies' CSR performance is comprehensively evaluated in terms of five aspects: shareholder responsibility, employee responsibility, supplier and customer responsibility, environmental responsibility, and community responsibility. These five primary indicators include 13 secondary indicators and 37 tertiary indicators. The CSR rating score of firms is a weighted total of these indicators, which provides a comprehensive measure of CSR performance. The CSR rating system of Hexun is reliable and has been growingly employed by researchers who examine CSR's impact in the Chinese context [12] [17] [39] [60] [63].

Moderators. Our research focuses on four types of innovation as moderating factors.

Following the common practice [17] [64], we utilize the natural logarithm of 1 plus the number of granted patents to measure each type of innovation. Specifically, for the measurement of solitary innovation, we use data about granted patents which are acquired by firms independently. For the measurement of collaborative innovation, we employ data about granted patents which are obtained by firms collaboratively with external partners (e.g., suppliers, customers, universities, and public research institutions). For the measurement of incremental innovation, we focus on utility model and design patents which consist of minor changes to products or processes. For the measurement of radical innovation, we concentrate on invention patents which are strong in novelty and creativity and involve emerging technical solutions for products and processes.

Control variables. We control for a number of factors that might exert influences on CFP. First, firm size is controlled for since larger companies normally possess abundant resources and enjoy economies of scale [46]. It is measured with the natural logarithm of an enterprise's sales [18]. Second, firm age is likely to affect the implementation of management practices and thus CFP. It is operationalized with the natural logarithm of a corporation's operating years [12]. Third, financial slack might engender agency issues and hence negatively influence CFP. We measure financial slack using the ratio of current assets to current liabilities [12]. Fourth, it is suggested that financial leverage (i.e., total debt divided by total assets) might restrict firms' opportunities to probe into new business areas, thus impeding their capability to generate profits [13]. Fifth, state ownership is included as a control variable because privately controlled enterprises may have higher flexibility and thus

achieve higher CFP than their state-owned counterparts. It is operationalized as a dummy variable that is coded as 1 if a company's ultimate controller is the Chinese government or its agencies, and is coded as 0 if a company is privately controlled [12]. Sixth, firms with higher marketing intensity may be better able to satisfy customers' needs and hence gain improvements in CFP. It is operationalized with selling, general, and administrative expenses (SG&A) divided by sales [65]. Seventh, we include export intensity as a control variable because companies operating in the global market often encounter extensive competition and hence are likely to experience lower CFP. We operationalize export intensity as foreign sales divided by total sales [66]. Eighth, we control for industry competition, industry dynamism, and industry growth since these industry-level factors might influence the extent of financial returns that firms can obtain. Following previous literature [67], we operationalize industry competition with 1 minus the industry Herfindahl index, which is computed as the sum of all firms' squared terms of market share in the same three-digit CSRC industry. We calculate industry dynamism by regressing industry sales over the prior five consecutive years against time, and utilizing the ratio of standard errors of the regression slope coefficients to industry average sales [65]. We measure industry growth as the rate of annual change in industry sales [49]. Finally, to account for unobserved time-specific impacts, we control for year dummies in our models.

C. Model Specification

Having a panel dataset of 15,782 firm-year observations covering 2,377 companies from 2010 to 2019, this study employs a panel data model estimation method to examine our

hypotheses. First, we perform the Hausman test to ascertain the selection of fixed-effect or random-effect regression models. The results (χ^2 (21) = 206.51, $p < 0.01$) imply that firm fixed-effect regression models are more proper for our data. Next, we conduct the Wald test to check whether heteroskedasticity exists [61]. It is found that our data suffer from the heteroskedasticity issue. To alleviate this concern, we estimate the regression models using robust standard errors.

In view of the time lag between CSR and CFP [13], we lag the explanatory variables by one year. The model specification is as follows:

$$\begin{aligned} ROA_{it+1} = {} & \beta_0 + \beta_1 CSR_{it} + \beta_2 CSR_{it}^2 + \beta_3 Independent\_innovation_{it} \\ & + \beta_4 Collaborative\_innovation_{it} + \beta_5 Incremental\_innovation_{it} \\ & + \beta_6 Radical\_innovation_{it} + \beta_7 Independent\_innovation \times CSR_{it} \\ & + \beta_8 Independent\_innovation \times CSR_{it}^2 + \beta_9 Collaborative\_innovation \times CSR_{it} \\ & + \beta_{10} Collaborative\_innovation \times CSR_{it}^2 + \beta_9 Incremental\_innovation \times CSR_{it} \\ & + \beta_{10} Incremental\_innovation \times CSR_{it}^2 + \beta_{11} Radical\_innovation \times CSR_{it} \\ & + \beta_{12} Radical\_innovation \times CSR_{it}^2 + \beta_i \boldsymbol{X}_{it} + Year\_dummies_{it} + \varepsilon_{it} \end{aligned}$$

where β_0 is the constant term; β_n represents a set of coefficients for the exploratory variables; $\boldsymbol{X}$ denotes the vector of control variables; and ε_{it} represents the error term. For interpretation purposes, we follow prior research [68] and mean-center CSR and moderating variables before generating the squared and interaction terms.

IV. RESULTS

A. Main Results

Table II presents the descriptive statistics of all the variables and correlations between them. We compute the variance inflation factor (VIF) values of all variables, which range from 1.04 to 4.03. The VIF values are well below the cut-off value of 10 [61], thus implying that multicollinearity is not a major concern in this research.

Table II

DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9
1. ROA	0.0391	0.1403	1.0000								
2. CSR	0.2335	0.1530	0.1583***	1.0000							
3. Solitary innovation	2.5111	1.5640	0.0100	0.1132***	1.0000						
4. Collaborative innovation	0.5849	1.0636	0.0103	0.1336***	0.3554***	1.0000					
5. Incremental innovation	2.2844	1.6144	0.0018	0.1065***	0.9314***	0.4440***	1.0000				
6. Radical innovation	1.3692	1.2707	0.0218***	0.1387***	0.7174***	0.5415***	0.5745***	1.0000			
7. Firm size	21.3632	1.3808	0.0337***	0.2400***	0.4283***	0.3841***	0.4201***	0.4367***	1.0000		
8. Firm age	2.6957	0.4161	–0.0330***	–0.0621***	0.0884***	0.0976***	0.0793***	0.1277***	0.2201***	1.0000	
9. Financial slack	2.9406	4.7230	0.0692***	0.0434***	–0.1183***	–0.0838***	–0.1234***	–0.1000***	–0.2709***	–0.1280***	1.0000
10. Financial leverage	0.3940	0.2134	–0.1729***	–0.1067***	0.1452***	0.1355***	0.1573***	0.1398***	0.4386***	0.1744***	–0.4503***
11. State ownership	0.3093	0.4622	–0.0420***	0.1024***	0.1067***	0.1740***	0.1044***	0.1678***	0.3511***	0.2047***	–0.1502***
12. Marketing intensity	0.1763	0.1528	–0.0305***	–0.0506***	–0.0662***	–0.0518***	–0.0920***	–0.0233***	–0.3528***	0.0029	0.1224***
13. Export intensity	0.1347	0.2168	–0.0289***	–0.0116	0.0669***	0.0213***	0.0669***	0.0471***	–0.0118	–0.0576***	0.0009
14. Industry competition	0.9235	0.0640	0.0234***	–0.0164**	–0.0127	0.0099	–0.0632***	0.0877***	–0.1195***	0.0031	0.0374***
15. Industry dynamism	0.0329	0.0226	–0.0066	0.0359***	–0.0335***	–0.0317***	–0.0249***	–0.0437***	–0.0569***	–0.1722***	0.0220***
16. Industry growth	0.1842	0.1722	0.0226***	0.0446***	–0.0651***	–0.0425***	–0.0585***	–0.0711***	–0.0713***	–0.1427***	0.0458 ***
			10	11	12	13	14	15	16		
10. Financial leverage			1.0000								
11. State ownership			0.3025***	1.0000							
12. Marketing intensity			–0.1412***	–0.1205***	1.0000						
13. Export intensity			–0.0105	–0.1270***	–0.0881***	1.0000					
14. Industry competition			–0.1050***	–0.0590***	0.1529***	0.0206***	1.0000				
15. Industry dynamism			0.0155*	0.0015	–0.0777***	0.0586***	–0.1352***	1.0000			
16. Industry growth			–0.0248***	–0.0094	–0.0249***	0.0433***	–0.0255***	0.4129***	1.0000		

Notes: $N = 15{,}782$. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (two-tailed test).

The results of firm fixed-effect regression analyses are reported in Table III. In Model 1, we only include control variables. Then, in Model 2, we add CSR and its quadratic term (i.e., CSR^2) in Model 2 to test the inverted U-shaped CSR–CFP association. Next, in Models 3 to 6, we add each moderator and its interaction terms with CSR and CSR^2, respectively.

Model 2 shows that the coefficient of CSR is significant and positive ($\beta = 0.0621$, $p < 0.01$) and that of CSR^2 is significant and negative ($\beta = -0.1505$, $p < 0.01$). This corroborates that the CSR–CFP linkage is inverted U-shaped, thereby lending support to H1. To further examine this non-linear linkage, we follow prior research [70] and perform an inverted U-test, which is significant (t-value = 3.58, $p < 0.01$). We find that the turning point occurs at CSR = 0.206, with a 95% Filler confidence interval of [0.172, 0.251], which is within the range of CSR data (i.e., [–0.405, 0.675][1]). The slope at the minimum CSR is significant and positive ($\beta = 0.1841$, $p < 0.01$), while the slope at the maximum CSR is significant and negative ($\beta = -0.1411$, $p < 0.01$). This further validates the inverted U-shaped CSR–CFP linkage.

In Models 3 and 4, we discover that the coefficient of the interaction term $CSR^2 \times Solitary\ innovation$ is insignificant ($\beta = 0.0119$, $p > 0.1$), whereas that of the interaction term $CSR^2 \times Collaborative\ innovation$ is significant and positive ($\beta = 0.0408$, $p < 0.05$). This implies that collaborative innovation attenuates the inverted U-shaped CSR–CFP link, while solitary innovation has no significant impact on this link. Thus, the negative moderating impact of collaborative innovation is stronger than that of solitary innovation, which supports H2. For greater clarity, we further plot the CSR–CFP link at low (mean – S.D.)

[1] This represents the range of centered CSR data. Additionally, we divide CSR by 100 for easing the interpretation of its coefficient.

and high (mean + S.D.) levels of collaborative innovation. Figure 1 displays that for companies with a higher level of collaborative innovation, the inverted U-shaped CSR–CFP curve is flatter.

In Models 5 and 6, we observe that the coefficient of the interaction term $CSR^2 \times Incremental\ innovation$ is insignificant (β = 0.0112, p > 0.1), while that of the interaction term $CSR^2 \times Radical\ innovation$ is significantly positive (β = 0.0441, p < 0.1). This reveals a stronger negative moderating impact of radical innovation than that of incremental innovation, thus lending support to H3. To further delineate the interaction effect, we depict the CSR–CFP relationship at low (mean – S.D.) and high (mean + S.D.) levels of radical innovation. As depicted in Figure 2, the inverted U-shaped curve for firms with higher radical innovation is flatter.

Table III

RESULTS OF FIXED-EFFECT REGRESSION ANALYSES

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.2160*** (0.0635)	0.2554*** (0.0636)	0.2476*** (0.0642)	0.2505*** (0.0635)	0.2471*** (0.0641)	0.2493*** (0.0634)
Firm size	–0.0044* (0.0027)	–0.0068** (0.0027)	–0.0064** (0.0028)	–0.0066** (0.0027)	–0.0063** (0.0028)	–0.0066** (0.0027)
Firm age	–0.0095 (0.0088)	–0.0079 (0.0088)	–0.0076 (0.0089)	–0.0075 (0.0089)	–0.0077 (0.0088)	–0.0074 (0.0089)
Financial slack	–0.0006** (0.0002)	–0.0006** (0.0003)	–0.0006** (0.0002)	–0.0006** (0.0003)	–0.0006** (0.0002)	–0.0006** (0.0003)
Financial leverage	–0.0851*** (0.0207)	–0.0750*** (0.0238)	–0.0753*** (0.0238)	–0.0746*** (0.0239)	–0.0752*** (0.0238)	–0.0747*** (0.0238)
State ownership	–0.0279*** (0.0079)	–0.0252*** (0.0077)	–0.0250*** (0.0076)	–0.0250*** (0.0077)	–0.0251*** (0.0076)	–0.0250*** (0.0077)
Marketing intensity	–0.0447* (0.0261)	–0.0420* (0.0241)	–0.0413* (0.0240)	–0.0415* (0.0239)	–0.0414* (0.0240)	–0.0410* (0.0237)
Export intensity	–0.0134* (0.0077)	–0.0126* (0.0076)	–0.0127* (0.0077)	–0.0126* (0.0076)	–0.0127* (0.0076)	–0.0122 (0.0077)
Industry competition	0.0049 (0.0327)	0.0078 (0.0324)	0.0081 (0.0323)	0.0088 (0.0324)	0.0082 (0.0323)	0.0093 (0.0324)
Industry dynamism	–0.0350 (0.0427)	–0.0319 (0.0424)	–0.0297 (0.0422)	–0.0318 (0.0424)	–0.0304 (0.0423)	–0.0313 (0.0426)
Industry growth	0.0131*** (0.0044)	0.0125*** (0.0045)	0.0124*** (0.0044)	0.0124*** (0.0045)	0.0124*** (0.0044)	0.0124*** (0.0045)
Year dummies	Included	Included	Included	Included	Included	Included
CSR		0.0621*** (0.0165)	0.0619*** (0.0164)	0.0623*** (0.0166)	0.0619*** (0.0164)	0.0627*** (0.0167)
CSR^2		–0.1505*** (0.0406)	–0.1535*** (0.0421)	–0.1558*** (0.0426)	–0.1545*** (0.0419)	–0.1563*** (0.0444)
Innovation						
CSR × Innovation						
CSR^2 × Innovation						
Solitary innovation			–0.0016** (0.0007)			
CSR × Solitary innovation			–0.0028 (0.0056)			
CSR^2 × Solitary innovation			0.0119 (0.0144)			
Collaborative innovation				–0.0022*** (0.0008)		
CSR × Collaborative innovation				–0.0157* (0.0085)		
CSR^2 × Collaborative innovation				0.0408** (0.0207)		
Incremental innovation					–0.0016** (0.0006)	
CSR × Incremental innovation					–0.0017 (0.0053)	
CSR^2 × Incremental innovation					0.0112 (0.0131)	
Radical innovation						–0.0021** (0.0008)
CSR × Radical innovation						–0.0180* (0.0100)
CSR^2 × Radical innovation						0.0441* (0.0266)
F statistic	19.58***	20.76***	18.86***	18.62***	18.92***	18.89***
R^2	0.0178	0.0260	0.0259	0.0261	0.0262	0.0263

Notes: $N = 15{,}782$. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (two-tailed test). Robust standard errors in parentheses.

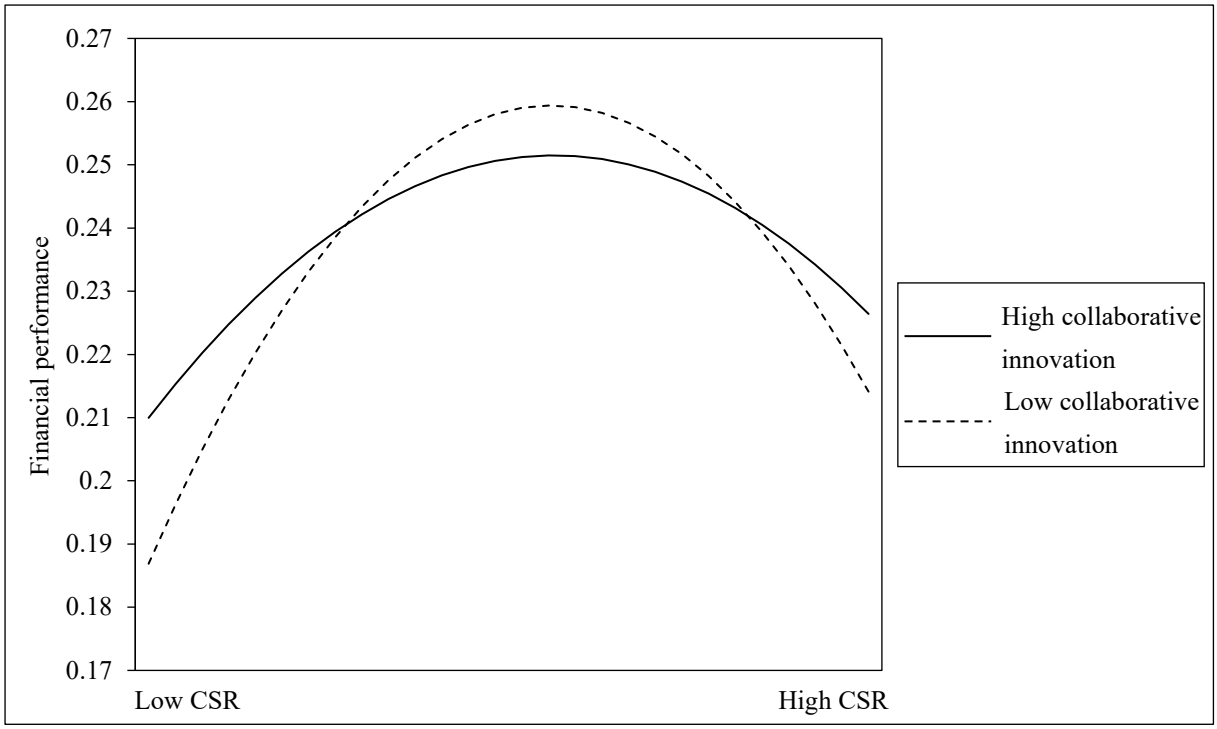

Figure 1. Interaction effect between CSR and collaborative innovation on CFP.

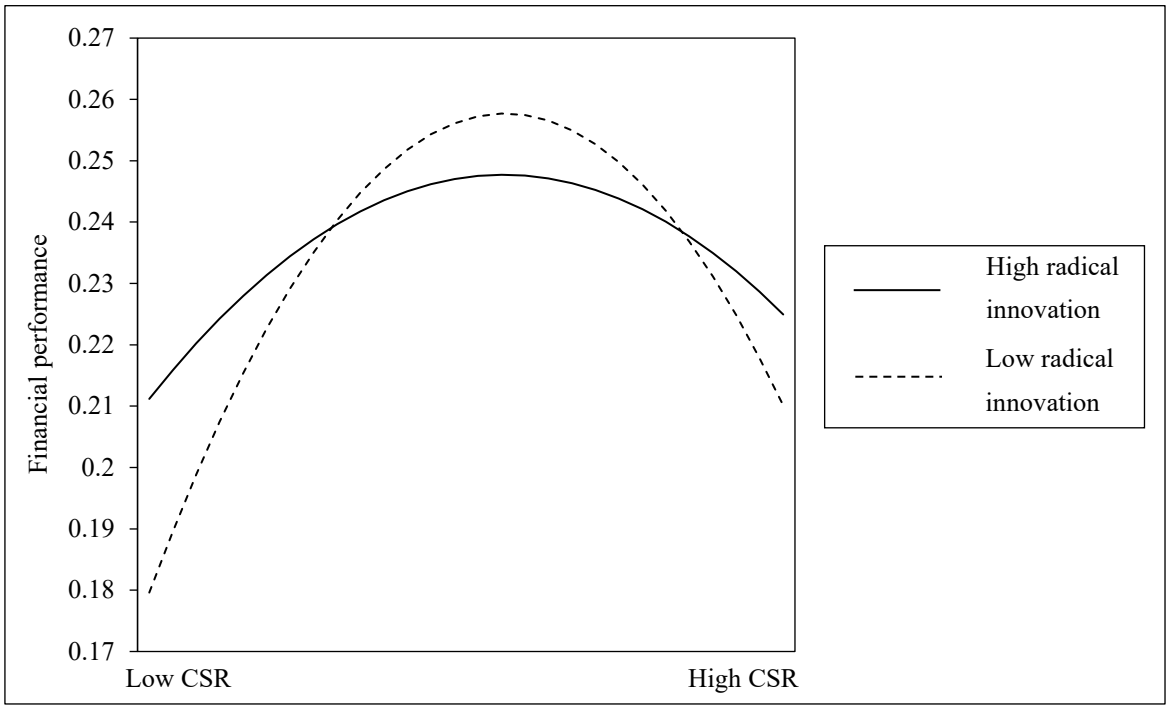

Figure 2. Interaction effect between CSR and radical innovation on CFP.

B. Endogeneity

Given that reverse causality may result in potential endogeneity issues, we lag the exploratory variables by one year. We also control for a series of firm- and industry-level variables, and firm and year fixed effects to mitigate the issue of omitted variables. Despite such efforts, the endogeneity concern may not be fully eliminated in that unobservable or unmeasurable factors might exist and affect CFP. Hence, we adopt a two-stage least squares (2SLS) regression method, which has been commonly utilized to address the endogeneity concern [61]. We employ industry average CSR as the instrumental variable (IV). Scholars have argued that owing to the pressures arising from competitors in the same industry, companies tend to imitate their rivals' socially responsible behaviors [67]. In this way, industry average CSR will positively influence the CSR performance of a firm. Nevertheless, it represents the industry-level CSR engagements and thus will not significantly affect a firm's CFP. As such, industry average CSR is a proper IV for our study.

In the first stage of 2SLS regressions, we employ industry average CSR and control variables to estimate the endogenous variable (i.e., CSR). Then, in the second stage, we use CFP as the dependent variable and regress it on the fitted values of CSR and its quadratic term and control variables. Table IV documents the results of 2SLS regressions. The *R*-squared values for the first-stage and second-stage regressions are 0.2078 and 0.0149, respectively, which are comparable to those reported in other studies [40] [69]. Besides, the *F* statistic for the first-stage regression model is 42.78 ($p < 0.01$) and that for the second-stage regression model is 20.82 ($p < 0.01$), implying that these two models are significant [3].

We discover that the coefficient of industry average CSR is significantly positive (β = 0.8338, $p < 0.01$), suggesting that the IV is significantly associated with CSR. We follow previous research [61] and perform two tests to check the validity of the IV. The χ^2 statistic for the Anderson-Rubin test is 8.67 ($p < 0.01$) and that for the Stock-Wright test is 10.68 ($p < 0.01$), manifesting that our IV is valid. Furthermore, the *F* statistic for the Cragg–Donald–Wald test is 377.42 ($p < 0.01$), which rejects the hypothesis of weak instrument [17]. For the results in the second stage of 2SLS, we observe that the coefficient of the fitted CSR is significantly positive (β = 0.1692, $p < 0.01$), whereas that of the fitted CSR^2 is significantly negative (β = –0.4152, $p < 0.01$). This further validates the inverted U-shaped CSR–CFP association. Overall, the 2SLS analysis indicates that our results are not influenced by endogeneity.

Table IV
RESULTS OF 2SLS REGRESSION ANALYSES

Variable	First-stage regression	Second-stage regression
	Dependent variable: CSR	Dependent variable: ROA
Constant	–0.8590*** (0.1090)	0.3550*** (0.0750)
Firm size	0.0416*** (0.0041)	–0.0131*** (0.0034)
Firm age	0.0331** (0.0147)	–0.0135 (0.0083)
Financial slack	–0.0004 (0.0003)	–0.0004** (0.0002)
Financial leverage	–0.1086*** (0.0343)	–0.0480*** (0.0122)
State ownership	–0.0246* (0.0140)	–0.0241*** (0.0080)
Marketing intensity	–0.0035 (0.0215)	–0.0386 (0.0251)
Export intensity	–0.0110 (0.0110)	–0.0110 (0.0078)
Industry competition	–0.1018** (0.0450)	0.0135 (0.0332)
Industry dynamism	–0.0307 (0.0570)	–0.0109 (0.0415)
Industry growth	–0.0034 (0.0070)	0.0133*** (0.0045)
Year dummies	Included	Included
Industry average CSR	0.8338*** (0.0764)	
CSR_IV		0.1692*** (0.0462)
CSR_IV^2		–0.4152*** (0.1596)
F statistic	42.78***	20.82***
R^2	0.2078	0.0149

Notes: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (two-tailed test). Robust standard errors in parentheses.

C. Robustness Checks

We perform a set of additional analyses to verify that our findings are robust. Detailed results are available upon requests. First, we adopt alternative measures of financial slack and financial leverage to assess the robustness of our findings. Alternatively, we utilize quick ratio (i.e., quick assets divided by current liabilities) to measure financial slack [65] and employ the ratio of long term debt to total assets to measure financial leverage [17]. We discover that the results remain the same. Second, we trim the sample by 0.1% in each tail based on the independent variable (i.e., CSR) to ensure that outliers do not bias our results. The findings are consistent with those in Table III. Finally, we employ generalized least squares (GLS) method as an alternative estimation approach to run the regression models [71]. Besides, although the Hausman test indicates firm fixed-effect models are more proper, we also run firm random-effect models to validate the robustness of our findings [61]. Additionally, we use ordinary least squares (OLS) method and calculate bootstrapped standard errors with 50 repetitions. Our results from alternative estimation approaches remain unchanged.

V. DISCUSSION AND IMPLICATIONS

A. Discussion

Our results reveal that CSR has an inverted U-shaped impact on CFP. Debate on the CSR–CFP relationship is perennial and prior studies have generated mixed results (e.g., positive, negative, and unrelated) [10] [14] [36] [43] [44]. In view of these controversies, a few researchers have underlined that the CSR–CFP linkage is not as simple as linear, but

might follow a non-linear pattern [18] [25]. Our finding echoes by demonstrating that CSR exerts an inverted U-shaped effect on CFP, which supports the argument that there is an optimal level of CSR [21] [48]. Specifically, our result shows that at low to moderate CSR levels, firms' financial performance will ascend since the stakeholder-based benefits (e.g., improved employee commitments and customer loyalty, and increased firm reputation) derived from CSR are more salient and outweigh the associated costs [25] [45]. Nonetheless, as the CSR pursued by firms exceeds a certain point, their financial performance will decrease because the marginal performance benefits of CSR decline and the substantially increased costs of CSR become burdens and outweigh the benefits [47] [48].

Moreover, our results indicate that collaborative innovation significantly weakens the inverted U-shaped CSR–CFP association, whereas solitary innovation does not significantly influence this association. This implies that collaborative innovation brings a stronger attenuating effect than that of solitary innovation. This finding is consistent with the notion that since solitary and collaborative innovation generate distinct levels of competitiveness for firms and incur varying levels of resource consumption [5] [23], they may play different roles in altering the efficacy of CSR on CFP. Specifically, prior research has highlighted that compared with solitary innovation, collaborative innovation serves as a stronger differentiation strategy because it allows firms to attain codified and tacit knowledge and complementary assets from their partners, thus enabling them to command a better position to innovate products and processes [23] [50] [52]. Besides, implementing collaborative innovation activities may induce opportunistic behavior of partners and entail additional

coordination and managerial costs [27] [55] [58]. As a result, collaborative innovation significantly flattens the inverted U-shaped CSR–CFP linkage by attenuating the positive mechanism and aggravating the negative mechanism underlying this linkage. Yet, firms undertaking solitary innovation lack valuable technological knowledge from external partners, and hence it might be difficult for them to realize significant advanced innovation in isolation [5]. As such, solitary innovation may not be recognized as an effective differentiation strategy and thus not significantly contributing to the effectiveness of CSR on CFP.

In addition, our results display that radical innovation significantly flattens the inverted U-shaped CSR–CFP relationship, while incremental innovation has no significant influence on this relationship. This suggests that the attenuating effect of radical innovation is stronger than that of incremental innovation. This intriguing finding aligns with the assertion that incremental and radical innovation yield varying levels of competitive advantages for firms and impose differential levels of costs on them [8] [32], thus exerting distinct impacts on the curvilinear CSR–CFP linkage. Specifically, previous studies have emphasized that compared with incremental innovation, radical innovation is characterized by higher levels of technology novelty and resource consumption [32] [59], thus working as a stronger differentiation strategy and significantly weakening the inverted U-shaped CSR–CFP linkage. Nevertheless, incremental innovation represents minor improvements of firms' existing products or processes with low impact and requires fewer efforts and resources [4] [8], thereby implying that it might not serve as an effective differentiation strategy. Therefore, incremental innovation may not significantly alter the efficacy of CSR on CFP. Overall, our

findings offer nuanced insights into the differential substitution effects of different types of innovation on the inverted U-shaped CSR–CFP association.

B. Theoretical Implications

This research offers several theoretical contributions. First, it expands previous studies on CSR by empirically unraveling the inverted U-shaped impact of CSR on CFP in the context of an emerging country (i.e., China). Prior research has mostly centered on the linear CSR–CFP relationship [10] [14] [36]. Only very few studies have alluded to the non-linearity of this relationship in the situation of developed countries like U.K. [47] and U.S. [25], yet they obtain ambiguous results (e.g., U-shaped and inverted U-shaped). Nevertheless, literature has provided very limited knowledge on whether CSR exerts a curvilinear impact on CFP in China. Scholars have contended that there exist significant differences in CSR between developed and developing economies [26], highlighting the importance of further investigating the non-linear effect of CSR on CFP in emerging markets like China [17]. Echoing this call, our research extends the CSR literature by representing the first attempt to offer nuanced arguments and rigorous empirical evidence regarding the inverted U-shaped linkage between CSR and CFP in the Chinese context. Indeed, in light of the fact that environmental and production safety incidents are salient issues in China and the Chinese regulatory bodies have been pushing companies to resolve these issues [12] [17], our research offers timely and significant contributions by providing insight at greater depth regarding the merits and downsides of CSR within the Chinese context.

Second and more importantly, our research brings together the innovation and CSR

literature by advancing our understanding of the differential effects of different types of innovation on the inverted U-shaped CSR–CFP association. Previous innovation and engineering management literature has highlighted that innovation is closely related to CSR [10] [28]. Some scholars have documented that CSR is instrumental in boosting firms' innovation [10] [11] [30], while others have observed that innovation plays an important role in facilitating the implementation of CSR activities [29] [31]. Despite that the relationship between innovation and CSR has received growing attention from scholars, there is a paucity of research exploring how different types of innovation interact with CSR to affect firm performance. As noted by recent studies [13] [33], it is highly desirable to examine the boundary conditions that potentially modify the linkage between CSR and CFP. The extant studies have focused on some contextual factors (e.g., firm size, advertising intensity, competitive action, managerial efficiency, and operational productivity) [13] [33] [34] [35] [36] [43], yet rare efforts have been devoted to the moderating roles of different types of innovation. Our study narrows this gap by delving into the nuance of innovation and disentangling the distinct moderating effects of different types of innovation on the inverted U-shaped CSR–CFP link. We validate that collaborative innovation has a stronger attenuating effect on this curvilinear link than that of solitary innovation. Furthermore, radical innovation has a stronger attenuating effect than that of incremental innovation. These findings broaden and enrich the literature stream pertaining to innovation and CSR with knowledge contributions by offering fine-grained insights into the critical yet overlooked substitution effects of different types of innovation on the inverted U-shaped CSR–CFP linkage.

Lastly, this research adds to the RBV literature by attesting to the contingency effects of different types of innovation on the inverted U-shaped CSR–CFP association. Leveraging the tenet of RBV and the law of diminishing marginal utility [20] [42], we theoretically demonstrate that CSR can help firms gain improved stakeholder-based resources, yet the marginal benefits will gradually decline and beyond the optimal point, the benefits are offset by the associated costs. This could exhibit an inverted U-shaped CSR–CFP relationship. Additionally, underpinned by RBV, we further verify that two typical types of innovation (i.e., collaborative and radical innovation) function as another differentiation strategies, which have substitution effects on CSR, thereby flattening the inverted U-shaped CSR–CFP curve. This lends support to the tenet of RBV that different differentiation strategies might have conflicting effects on the attainment of competitive advantage and firms have limited resources for competing activities [17]. Despite that several previous studies have applied RBV to explicate the CSR–CFP link [20] [42], scarce research has illuminated the interplay between different types of innovation and CSR from the RBV perspective. In this sense, our research enriches the understanding of RBV by deeply elucidating how different types of innovation exert varying influences on the efficacy of CSR on CFP.

C. Managerial Implications

This research also provides managerial implications. First, managers in China should be cautious that it is not as simple as whether engaging in CSR practices or not, but rather putting great emphasis on the optimal level of CSR. Our results indicate that compared with low or high levels of CSR, a modest level of CSR can lead to high firm performance,

implying that there is an optimal CSR level. As such, we strongly recommend that Chinese companies with a low degree of CSR proactively engage in more socially responsible initiatives (e.g., green engineering and operations practices, and safety production practices) to fully realize their financial benefits. Nevertheless, it is also advisable that managers should be mindful of the excessive investments in CSR. Our finding warns that an overabundance of CSR would give rise to considerable costs but yield very few benefits for firms, which could be detrimental to their financial performance.

Second, our findings provide managers with a fine-grained understanding of the varying effects of different types of innovation on the CSR–CFP linkage. We observe that collaborative and radical innovation flatten the inverted U-shaped CSR–CFP association, whereas solitary and incremental innovation have no significant impacts on this association. Hence, managers, especially those who implement innovation and engineering projects, ought to be cautious that the financial benefits of CSR could be attenuated by other differentiation strategies such as collaborative and radical innovation. While these two typical types of innovation are being pursued actively by firms, managers need to take heed of their substitution effects on CSR. It is therefore recommended that companies focus on either a collaborative or radical innovation or a CSR strategy. Nonetheless, managers should also be aware that solitary and incremental innovation do not significantly alter the financial returns associated with CSR. Taken together, it is advisable that before embarking on CSR activities, firms should carefully assess their innovation strategies.

VI. CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH

Drawing upon RBV, this study investigates the linkage between CSR and CFP as well as the moderating effects of different types of innovation on this linkage. We test the proposed hypotheses using a panel dataset of 2,377 Chinese manufacturing firms between 2010 and 2019. The results indicate that CSR has an inverted U-shaped relationship with CFP. Furthermore, collaborative innovation has a stronger attenuating effect than solidarity innovation on the inverted U-shaped CSR–CFP relationship than solitary innovation. Similarly, radical innovation has a stronger attenuating effect than incremental innovation in the relationship.

Our research has a few limitations which indicate the directions for future studies. First, our study is restricted to Chinese firms, which hinders the generalization of our findings to the context of other nations. Hence, it is worth replicating this study in other countries, which could add more insights on innovation and CSR research. Second, our sample includes enterprises in manufacturing industries which mainly focus on engineering and production activities. Although this is helpful for ensuring high internal validity, caution is warranted in generalizing our findings to the context of other industries, such as shipping and retailing industries. Therefore, we highly encourage future studies to advance the literature by uncovering the financial implications of CSR for service firms. Third, this research unravels the critical roles of different types of innovation in altering the curvilinear CSR–CFP relationship, yet other moderating factors (e.g., operational strategies and capabilities) may also influence this relationship, which deserve further attention. Hence, a promising pathway

for future studies is to unravel other potential operational moderators affecting the CSR–CFP association. Finally, recent research calls for more investigation into corporate social innovation (CSI) which shares some similarities with CSR, but differs from CSR by representing a firm's adoption of innovative activities through deep collaborations across organizational functions and engaging external stakeholders to co-create something new that offers sustainable solutions to resolve environmental and social problems [72]. Given the similarity and difference between CSI and CSR, one promising research avenue is to extend the innovation literature by further delving into the performance effect of CSI and the operational factors that modify this effect.

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