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## Article

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# Does corporate social responsibility (CSR) have spillover effect?—Based on the binary relationship of supply chains in China

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## ABSTRACT

With data sampled from listed suppliers and customers in China from 2010 to 2017, the presenting work investigates how corporate social responsibility (CSR) is realised from the perspective of supply chains. Results found that socially responsible customers improved CSR performance of suppliers, revealing a significant CSR spillover effect among supply chains and further suggesting customers' bargaining power as an important realisation path. In addition, both the CSR sensitivity of customers and the CSR fulfilment ability of suppliers strengthened CSR spillover effect in supply chains. More importantly, suppliers' CSR performance is positive feedback to customers' need rather than a publicity stunt to cater to customers. This paper expands current understanding on corporate behavioural coordination from the perspective of supply chains and provides insights for promoting CSR fulfilment in the Chinese scenario.

## KEYWORDS

Corporate social responsibility; supply chains; spillover effect; bargaining power

## 1. Introduction

In recent years, corporate social responsibility (CSR) in China has explosively increased. Nonetheless, such increment fails to improve the performance of CSR<sup>1</sup> when listed companies are evaluated as a whole. Instead, companies' immoral conducts, such as food safety issues, counterfeiting, shoddy products and environmental pollution, were frequently exposed, leading to an increasing voice for CSR performance improvement by the government and the public. Meanwhile, comparing with the current progress of economic transformation in China, the Chinese formal system is imperfect, if not lagging behind, resulting in limited ability and repeated failures of the legal system in regulating CSR fulfilment. The failures have harmed stakeholders' interests and thereby induced

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them to protect their own interests through pushing the company to engage in CSR (De Bettignies & Robinson, 2018). Customers of the company, as important stakeholders of supply chain networks and fundamental sources of corporate profits, are believed to have a vital influence on CSR performance of the company (Freeman, 2010; R. Dai et al., 2021).

It is worth noting that with the value-chain-centred strengthening of the production network division system, economic interactions between companies have become increasingly close and CSR fulfilment has begun to expand from individual companies to the entire supply chains. Further, CSR performance has also become an important parameter to measure the competitiveness of supply chains (Huang & Chen, 2015). Under the linkage effect of supply chains, companies rarely stand or fall alone. Poor CSR performance in any one segment may trigger a crisis in the whole supply chains. Such linkage effect shall harm other companies with good CSR performance, i.e. socially responsible companies, in the chain. Foreseeably, to avoid being harmed by the effect, socially responsible customers are motivated to ensure their suppliers to well fulfil CSR. However, as supply chain networks become increasingly globalised and complex, managing supply chains has become increasingly expensive. It is, therefore, challenging for suppliers to bear these additional yet expensive CSR costs. Moreover, others also suggested that CSR fulfilments are more often a passive response under external compulsion rather than an internal constraint of voluntary commitment (Jin, 2017). Altogether, the controversies call for further investigations into whether socially responsible customers do push their suppliers to fulfil CSR, or if suppliers' public implementation of CSR commitments is just publicity stunts (Kitzmueller & Shimshack, 2012). Notably, instead of investigating the surface associations between customers' characteristics and suppliers' CSR performance as most existing works did, the presenting work focuses on the direct effect of customers' CSR on suppliers and investigates the existence of CSR spillover effect among supply chains.

This work uses hand-collected data of both customers and suppliers from 2010 to 2017 to explore whether customers' CSR do have spillover effect on suppliers along supply chains. Results revealed CSR spillover effect among supply chains, namely that socially responsible customers will positively affect the CSR performance of suppliers. The result was robust after controlling for endogeneity problems such as sample selection bias and omitted variables. Moreover, greater spillover effect was observed when there were greater customer bargaining power, higher customer-switching costs and greater relationship-specific investments. Further analysis showed that the spillover effect was more significantly manifested when customers were state-owned or in CSR-sensitive industries. Intriguingly, suppliers with low willingness but strong ability were more likely to give customers a positive response to fulfil CSR in supply chains. Further, this paper also excluded the possibility of the observed spillover effect being manager' s cover-up because of their self-interest.

This study makes several contributions to the literature. First, this paper adds to the studies on how to boost CSR performance from the perspective of supply chains. With China's economic transformation in progress, how to promote CSR performance has brought broad attention from both the academic and the practice field (J. Chen & Zheng, 2020). Previous research has provided valuable insights from the perspective of external institutional environment (Jia & Liu, 2014), industry competition (B. Liu & Lu, 2018) and internal characteristics of companies (Barako et al., 2006; Jin, 2017). This paper

focused on supply chain relationships and directly examined the effect of customers' CSR on suppliers' CSR performance, contributing to the existing body of research on CSR performance from the perspective of supply chain relationships.

Second, this paper extends the research on the consequences of customers' behaviour. Existing literature has examined the effect of customers on corporate financial behaviour from a broad spectrum of dimensions, including investment and financing (Campello & Gao, 2017; Chiu et al., 2019), dividend distribution (J. Wang, 2012), corporate performance (Hui et al., 2019), corporate governance (Hui et al., 2012) and cash holdings (Itzkowitz, 2013). In this paper, we focused on CSR spillover effect in supply chains and verified the influence of socially responsible customers on suppliers' CSR performance, which manifested the cooperation effect among supply chains and advanced the customers relationship research from the overall average to a more detailed, customers' characteristic-based level.

Thirdly, this paper supplements the research on the interactivity of supply chain relationships among the main actors of supply chains. Most existing literature focuses on a single subject and its influence on supply chains, with a few literatures examining the risk contagion effect among supply chains (Hertzel et al., 2008). From the perspective of CSR fulfilment, this paper provided direct evidence for the spillover effect among supply chains. Besides, we supplement the existing research on peer effect of CSR.

## 2. Literature review and theoretical analysis

### 2.1. CSR

Existing research articles and reviews suggest that CSR fulfilment is driven by the following motivations: (1) Altruistic motivation. Firms regard CSR as an ethical and social behaviour without expecting anything in return (Ohreen & Petry, 2012). (2) Strategic motivation or value-enhancing motivation. Companies fulfil CSR to enhance their strategic position and acquire strategic resources such as reputation capital, which are ultimately expected to improve their performance (Porter & Kramer, 2002). (3) Rent-seeking motivation. Companies use positive CSR performance as a rent-seeking tool to establish or maintain political relationships. Research shows that charitable donation of private firms in China is a kind of political contribution, which is used to establish beneficial political relations (Tian & Zhang, 2013; Y. Dai et al., 2014). (4) Self-interested motivation. Hemingway and Maclagan (2004) believe that one of the motivations of firms to engage in CSR activities is to cover up unethical management behaviours. In China, where the legal environment is not yet perfect, studies have confirmed that CSR has a 'concealment effect', which reveals its 'instrumental' feature (Gao et al., 2012; Quan et al., 2015; Tian & Wang, 2017).

With advances in CSR studies, leading factors of CSR fulfilment have gradually become the focus of the field. Existing studies have investigated external institutional environment and pressure (Li et al., 2011), industry competition and peer effect (B. Liu & Lu, 2018; J. Liu & Wang, 2017), internal characteristics of companies (Barako et al., 2006; H. Wang et al., 2014) and corporate culture (Jin, 2017), all of which thoroughly discussed the influencing factors of CSR performance from different dimensions. However, the existing discussion on CSR seldom pay attention to customers, the important external

stakeholders of the enterprise. A few literatures have examined the role of customers from the perspectives of supply chains pressure caused by foreign firms (Huang & Chen, 2015) and bargaining power of customers (J. Chen & Zheng, 2020). In contrast, this paper focuses on the direct impact of customers' CSR performance on suppliers and examines how CSR performance passes along supply chains.

## *2.2. The spillover effect of CSR among supply chains*

In modern market economy, supply chains replace firms and become the main body of market competition. Accordingly, CSR behaviours extend from a single firm to the whole supply chains and become an important parameter of supply chain competitiveness (Huang & Chen, 2015). Customers, being important strategic resources and economically dependent stakeholders of firms (Freeman, 2010), are closer to consumer market. The pressure from consumers and other stakeholders can be effectively transformed into their monetary votes, thus becoming the most fundamental intrinsic motivation for customers to improve their CSR performance. Customers' positive CSR performance motivated them to demand suppliers' CSR performance. On the one hand, suppliers need to response to customers' demand in return of enjoying customers' market resources and incremental value (Donaldson & Dunfee, 1994). On the other hand, under the linkage effect of supply chains, customers need suppliers to perform better in CSR to prevent supply chain risk contagion and crisis caused by poor CSR performance of either party (Huang & Chen, 2015).

Then, how do customers influence the CSR performance of suppliers? According to the resource dependence theory, individuals or groups have the power to influence or control the behaviour of firms because they have important resources that firms need (Frooman, 1999). As the fundamental sources of corporate profits, the basis for the spillover effect of customers on suppliers' CSR performance is customers' bargaining power and advantages in supply chain relationships. In other words, only by playing a dominant role in the supply chain game can customers significantly influence suppliers' CSR performance. Existing studies on supply chain relationships verified the influence of customers' bargaining advantage on suppliers from different dimensions, e.g. corporate financing (Campello & Gao, 2017), investment (Chiu et al., 2019), operating performance (Hui et al., 2019), profit distribution (J. Wang, 2012), cash holding (Itzkowitz, 2013) and risk contagion (Hertzel et al., 2008). In the context of supply chains, the bargaining power and advantages of customers are expected to be manifested as customers' regulation power on corporation behaviours and customers' substitution treats, which shall help to improve suppliers' CSR performance.

First, from the perspective of behaviour regulation, dominant customers in supply chain relationships can directly influence suppliers' productive business activities. Therefore, in order to gain support from socially responsible stakeholders, mainly consumers and other social public (Bhattacharya & Sen, 2004), customers will place higher CSR requirements on upstream suppliers. For example, customers may ask for higher-quality products, better production environment and protection of workers' rights and interests. Under such circumstance, suppliers shall improve their CSR performance and positively response to customers' requirement in order to maintain key customers and stable supply chain relationships. In line

with the argument, Huang and Chen (2015) found that foreign customers significantly improve CSR by regulating suppliers' CSR behaviour through setting standards such as codes of production conduct. Further, customers can enforce code of production conduct more directly by sending professionals to monitor suppliers' CSR performance. In addition, when customers and suppliers have a common network of institutional investors or directors, customers can directly influence suppliers' CSR decisions. R. Dai et al. (2021) found that the existence of such a common network is significantly associated with improved suppliers' CSR performance.

Second, substitution threat is another powerful tool originated from customers' bargaining power that affects suppliers' CSR performance. In supply chains, asymmetric bargaining power makes the risk and cost loss between firms completely different when the supply chain relationship is broken. Dominant firms tend to be less economically dependent on the other party and have relatively lower specific investment, thus the values of dominant firms are less impacted by the sunk costs and switching costs brought by relationship breakdown (Raman & Shahrur, 2008). However, firms that are in a secondary position need to pay high costs for establishing new supply chain relationships. Therefore, when customers perceive that the risk caused by suppliers' unsatisfactory CSR is large enough, customers may terminate the contract or interrupt supply chain relationships. Research by Banerjee et al. (2008) and R. Dai et al. (2021) shows that customers disassociate from suppliers when suppliers fail to meet customers' CSR requirements. Based on this logic, substitution threats from customers can promote the willingness of suppliers to fulfil CSR, thereby improving the overall CSR level of supply chains.

Finally, beyond external motivations and threats, companies may also be self-motivated to fulfil CSR for its own benefits. Firstly, CSR feedback from suppliers helps to strengthen their cooperation with customers. Given the customers' high pressure and demand for CSR fulfilment, suppliers' CSR can be an important means to build corporate reputation and get compliance identification from stakeholders (Chahal & Sharma, 2006). Taking on CSR helps suppliers to show its trustworthiness, and the cost of CSR fulfilment prevents other companies from copying it. This helps to deepen strategic synergies between suppliers and customers, leading to collaborative effects and incremental benefits (Patatoukas, 2012; R. Dai et al., 2021). Secondly, in the Chinese system, CSR tends to be neutral (neither willing to take the lead nor willing to lag behind), which shows the characteristics of industry similarity and imitateness (B. Liu & Lu, 2018; J. Liu & Wang, 2017). Therefore, CSR performance of customers often conveys the information required by their industry. Under such context, suppliers actively fulfilling CSR is not only a positive feedback to specific customers but also a wise move in line with market trends.

In conclusion, this paper proposes the following core hypothesis:

**H1:** Higher level of customers' CSR leads to the better CSR performance of suppliers, which proves to be the existence of a spillover effect of CSR in supply chains.

### 3. Empirical research design

#### 3.1. Sample selection and data source

We began with an initial sample of all listed companies published on A-share market during the period 2010–2017. From the top five customers data publicly disclosed by the company, we manually screened and kept data that fully disclosed the names of customers. Next, according to the customers' name, we collected information about whether the customer is a listed company and, if so, its listing code on the Tianyancha.<sup>2</sup> After excluding the customers that are listed on B-share, H-share, New Third Board Market and New Fourth Board Market, we identified a total of 2,343 pairs of customers–suppliers data of listed companies. Further excluding financial firms, ST and ST\* companies, and companies missing key financial data and CSR data, we finally obtained 1,974 groups of suppliers–customers–annual samples. In order to eliminate the influence of outliers, we winsorised the continuous variables at 1% level. We collected corporate financial information from the China Security Market and Accounting Research (CSMAR) database and CSR data from the HeXun.

#### 3.2. Model setting and variable definitions

In order to examine the causal impact of customers' CSR on suppliers' CSR performance, we established the following model based on Peng and Wang (2018), B. Liu and Lu (2018) and R. Dai et al. (2021):

$$SCSR_{i,t} = a_0 + a_1CCSR_{i,t} + a_2 \sum Control_{i,t} + a_3Year + a_4Industry + \varepsilon_{i,t} \quad (1)$$

Where  $i$  and  $t$  indicate firm and year, respectively. The dependent variable  $SCSR$  represents the suppliers' CSR performance, using CSR score derived from *HeXun* to measure. The core independent variable  $CCSR_{i,t}$  represents the customers' CSR, specifically including two indicators,  $CCSR\_D$  and  $CCSR\_G$ .  $CCSR\_D$  is a dummy variable that equals to 1 when customers published CSR report in a given year and zero otherwise.  $CCSR\_G$  is customer's CSR performance, proxying with CSR score.

Referring to existing researches (B. Liu & Lu, 2018; Jin, 2017; Shen, 2007),  $Controls_{i,t}$  includes a set of time-varying firm characteristics that may affect the suppliers' CSR, such as corporate size (*Size*), age (*Age*), capital structure (*Leverage*), growth (*Growth*), property rights (*State*), share proportion of managers (*Manager*), share proportion of institutional investors (*Institution*), shareholding ratio of the largest shareholder (*First*), board size (*Board*) and the fixed effects of year (*Year*) and industry (*Industry*).  $\varepsilon_{i,t}$  is the random error term of the model.

#### 3.3. Summary statistics

Table 1 provides the summary statistics for our sample. In Panel A, the mean value of customer's CSR report ( $CCSR\_D$ ) is 0.64, which means that nearly 64% of customers have published CSR report; the mean value of the customer's CSR score ( $CCSR\_G$ ) is 0.43. The mean value of supplier's CSR score is 0.26, which is lower than the customers' average CSR

<sup>2</sup><https://www.tianyancha.com/>.

**Table 1.** Summary statistics.

Panel A: Descriptive Statistics								
Variable	Number	Mean	SD	Min	P25	Median	P75	Max
<i>CCSR_D</i>	1,974	0.64	0.48	0	0	1	1	1
<i>CCSR_G</i>	1,974	0.43	0.25	-0.11	0.22	0.36	0.68	0.90
<i>SCSR</i>	1,974	0.26	0.18	-0.12	0.17	0.22	0.28	0.80
<i>Size</i>	1,974	21.82	1.23	19.40	20.91	21.67	22.61	25.95
<i>Age</i>	1,974	2.59	0.46	1.09	2.40	2.64	2.94	3.33
<i>Leverage</i>	1,974	0.41	0.21	0.05	0.24	0.40	0.58	0.91
<i>Growth</i>	1,974	0.24	0.65	-0.60	-0.01	0.13	0.30	4.65
<i>State</i>	1,974	0.43	0.49	0	0	0	1	1
<i>Manager</i>	1,974	0.14	0.20	0	0	0	0.26	0.68
<i>Institution</i>	1,974	0.05	0.04	0	0.01	0.03	0.07	0.21
<i>First</i>	1,974	0.35	0.16	0.09	0.23	0.32	0.48	0.75
<i>Board</i>	1,974	2.18	0.18	1.61	2.08	2.20	2.20	2.71

Panel B: The difference test of suppliers CSR							
		Customers CSR Report			Customers CSR score		
		Yes (1,265)	No (709)	Different	High (978)	Low (996)	Different
<i>SCSR</i>	Mean	0.27	0.24	0.03***	0.29	0.24	0.05***
	Median	0.22	0.22	5.41**	0.23	0.21	22.78***

Note: We use t-test in different test. \*, \*\* and \*\*\* denote significance at the 10%, 5% and 1% level, respectively.

score. This is possibly because customers are closer to consumer market than suppliers, therefore facing a more stressful public preference on CSR.

Panel B of [Table 1](#) provides a different test of suppliers' CSR under the different level of customers' CSR. The results show that suppliers have better CSR performance when their customers are issuing CSR report (*CCSR\_D* = 1) or have a higher CSR score (*CCSR\_G* is bigger), which indicates that customers' CSR performance may have spillover effect to their suppliers through supply chains.

## 4. Basic results and robustness tests

### 4.1. CSR spillover effect: basic result

Regression results for specification (1) are reported in [Table 2](#). Results without control variables are presented in Column (1) and Column (2); the coefficients of customers' CSR are significant and positive at the 1% level. Further, in columns (3) and columns (4), we controlled the financial characteristic variables of suppliers and year and industry fixed effects. Results show that the coefficients of customers' CSR are significantly positive whether the dependent variable is *CCSR\_D* or *CCSR\_G*. This implies that the higher the level of customers' CSR, the better the suppliers' CSR performance, which supports the existence of a spillover effect of customers' CSR.

### 4.2. A discussion of the channels of CSR spillover effect

The spillover of CSR along supply chains is hypothesised to be originated from customers' dominant position in supply chain relationships and their bargaining power. These factors presumably influence suppliers' CSR through behavioural regulations and substitution threats. To test this hypothesis, we explored the impact channels of CSR spillover effect in

three dimensions: customers' bargaining power, switching cost of suppliers and specific-relationship investment.

#### 4.2.1. Customer bargaining power

In the process of supply chain production and goods selling, customers are the basic source of corporate profits. Major customers are the representatives of market demand, and suppliers rely heavily on the relationship with major customers and are very susceptible to their behaviour. Existing studies have found that major customers help stabilising supply chain relationships, increasing the overall revenue of supply chains, reducing demand uncertainty and forming the knowledge spillover effect and value-added effect on supply chains (Patatoukas, 2012; R. Dai et al., 2021). Furthermore, major customers also have a positive external governance effect (Hui et al., 2012). The existence of large customers magnifies both suppliers' profit brought by customer management and the risk and cost loss brought by relationship interruption. Therefore, we expect that the more important the customer is to suppliers and the stronger bargaining power the customer has, the greater 'behaviour regulation' and 'substitution threat' effect it shall have on suppliers and more conducive it shall be in improving suppliers' CSR performance.

We empirically tested this prediction. We sorted the sample into two groups according to the customers' ranking and sales ratio, separately. Specifically, according to the distribution characteristics of customers' ranking, the sample was sorted into *High* group if the customers' ranking is in the top 2, or, otherwise, sorted into the *Low* group.

**Table 2.** CSR spillover effect: basic result.

	<i>Dep. Var. = SCSR</i>			
	(1)	(2)	(3)	(4)
<i>CCSR_D</i>	0.030*** (3.74)		0.019** (2.42)	
<i>CCSR_G</i>		0.103*** (6.41)		0.035** (2.13)
<i>Size</i>			0.066*** (17.22)	0.066*** (17.30)
<i>Age</i>			0.012 (1.28)	0.012 (1.25)
<i>Leverage</i>			-0.241*** (-11.14)	-0.240*** (-11.11)
<i>Growth</i>			0.005 (1.16)	0.005 (1.16)
<i>State</i>			0.024** (2.51)	0.023** (2.47)
<i>Manager</i>			0.006 (0.34)	0.005 (0.28)
<i>Institution</i>			0.200** (2.42)	0.197** (2.40)
<i>First</i>			-0.022 (-0.88)	-0.022 (-0.89)
<i>Board</i>			0.038* (1.83)	0.039* (1.84)
<i>Year FE</i>	No	No	Yes	Yes
<i>Industry FE</i>	No	No	Yes	Yes
<i>Observations</i>	1,974	1,974	1,974	1,974
<i>Adjusted R<sup>2</sup></i>	0.006	0.021	0.254	0.254

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with *t* values in parentheses.

In addition, referring to Meng et al. (2018), we sorted the sample into two subsamples, *Yes* and *No*, according to whether the customer is a big customer (customers whose sales accounted for more than 10% of the annual sales of the suppliers). Results are shown in Table 3; *CCSR\_D* and *CCSR\_G* are only significantly positive in the groups with higher customers' ranking and higher proportion of procurement, suggesting that the dependence of suppliers on customers strengthens the spillover effect of customers' CSR, which verifies the basic logic of this paper.

#### 4.2.2. Switching costs of suppliers

Another key factor affecting the CSR spillover effect in supply chains is the switching costs of suppliers (Barrot & Sauvagnat, 2016). When suppliers have higher switching costs, they face greater specific investment losses and contract costs in finding new customers (S. Chen & Liu, 2021) and thus have a stronger incentive to retain existing customers. Itzkowitz (2013) has shown that the level of competition in customers' industry directly affects the switching costs of suppliers. Hence, we posited that the higher switching costs it requires for suppliers to change their customers, the easier it is for the substitution threat to come into play, and, eventually, the easier it is for customers to realise the spillover effect of CSR among supply chains.

Referring to Itzkowitz (2013) and S. Chen and Liu (2021), we measured the switching costs of suppliers by the level of competition in the customers' industry and sorted them into two groups according to the median, with a lower level of competition in customers' industry indicating a higher switching cost for suppliers. Results are shown in Table 4. In the group with higher switching costs of suppliers, the regression coefficients of customers' CSR are all positive and statistically significant at 1% level, while no similar conclusion is presented in the subsample with lower switching costs of suppliers. This suggests that higher relative costs for suppliers to switch customers, i.e. the stronger the substitution threat, the more pronounced the spillover effect of CSR among supply chains.

#### 4.2.3. Relationship-specific investment

The long-term and close supply chain relationships mean that both transaction parties are increasingly dependent on each other. As a credible commitment to express the

**Table 3.** A discussion of the channels of CSR spillover effect: customers' bargaining power.

	Dep. Var. = SCSR							
	Customers Range				Big Customers			
	High	Low	High	Low	Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>CCSR_D</i>	0.046*** (3.92)	-0.004 (-0.43)			0.046** (2.52)	0.011 (1.30)		
<i>CCSR_G</i>			0.094*** (3.80)	-0.009 (-0.43)			0.135*** (3.82)	0.017 (0.93)
<i>Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	867	1,107	867	1,107	374	1,600	374	1,600
<i>Adjusted R<sup>2</sup></i>	0.267	0.245	0.267	0.246	0.289	0.257	0.305	0.257
<i>Different test</i>		11.21***		9.78***		3.17*		8.27***

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with *t* values in parentheses.

willingness of long-term strategic cooperation, suppliers and customers will make certain relational investments, such as R&D expenses, after-sales service costs and assets invested to meet customers' specific needs, to achieve the lock-in effect between the suppliers and the customers (Williamson, 1985). In the game of supply chains, suppliers in a weak position will invest more to build or maintain their relationships with customers, but this is also accompanied by higher customers' switching costs (Krolikowski & Yuan, 2017). Therefore, the corporate relationship-specific investment not only represents customers' bargaining power, it also conveys the degree of substitution threat that customers have to suppliers. J. Wang (2012) showed that high-cost loss caused by relationship-specific investment is the key channel through which supply chain relationships affect the distribution of corporate dividends. Therefore, suppliers with higher relationship-specific investment shall be more significantly affected by the customers, and suppliers' CSR performance will be better.

To test the hypothesis, referring to J. Wang (2012) and Peng and Wang (2018), we use R&D expense to measure corporate relationship-specific investment and divide samples into two groups, *high* and *low*, according to the median of R&D expense. Greater R&D expense indicates higher relationship-specific investment and a more proprietary relationship between customers and suppliers. Results are shown in Table 5. Relatively speaking, the positive effect of customers' CSR is more significant in firms with higher relationship-specific investment. This result is consistent with our previous findings and indicates that the spillover effect of CSR is associated with higher relationship-specific investment of suppliers.

### 4.3. Robustness tests

#### 4.3.1. Sample self-selection

In China, disclosure of customer information by listed firms is voluntary. Firms that did not provide customer information were not included in our sample, which may have led to sample selection bias. Following Di et al. (2020), we used the Heckman two stages to mitigate this concern. In the first stage, we set up a Probit equation of whether the firm disclosed customer name information and controlled for *State*, *Growth*, *ROA*, *Leverage*, *Size*

**Table 4.** A discussion of the channels of CSR spillover effect: switching cost of suppliers.

	Dep. Var. = SCSR			
	Low (1)	High (2)	Low (3)	High (4)
CCSR_D	0.007 (0.68)	0.030*** (2.66)		
CCSR_G			0.005 (0.22)	0.068*** (2.81)
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	1,018	956	1,018	956
Adjusted R <sup>2</sup>	0.303	0.259	0.303	0.260
Different test		3.22***		3.60***

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with *t* values in parentheses.

**Table 5.** A discussion of the channels of CSR spillover effect: specific-relationship investment.

	<i>Dep. Var. = SCSR</i>			
	High (1)	Low (2)	High (3)	Low (4)
<i>CCSR_D</i>	0.030** (2.02)	-0.006 (-0.49)		
<i>CCSR_G</i>			0.046 (1.55)	-0.009 (-0.36)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes
<i>Observations</i>	658	659	658	659
<i>Adjusted R<sup>2</sup></i>	0.212	0.212	0.210	0.212
<i>Different test</i>	3.41*		1.86	

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with *t* values in parentheses.

and *Age*. We then calculated the Inverse Mill's Ratio (*IMR*) from the first stage and added it to the basic model. Table 6 reports the regression results of Heckman two-stage. After controlling *IMR*, the regression coefficient is still significantly positive, indicating that the spillover effect of customers' CSR is still robust.

#### 4.3.2. Changes in supply chain relationships

In order to further eliminate possible endogenous problems such as sample selection bias and missing variables that interfere with the basic research conclusions, we draw on the practice of J. Wang (2012) and use the scenario of supply chain relationship changes to investigate the changes in the CSR spillover effect among supply chains. This article defines suppliers–customers relationship to be of three stages: before construction, during existence and after dissolution. If the customers' CSR spillover effect to the suppliers is based on the supply chain relationship rather than other internal and external factors, then it should be difficult to observe this spillover effect before the suppliers–customers relationship exists. Similarly, dissolution of the suppliers–customers relationship will also make this spillover effect disappear or weaken.

To examine this, we only retained the listed customers with the highest proportion of purchases at the firm-annual level and defined their relationship stage as during existence. Accordingly, the before construction stage of their relationship is when the customer has not yet occupied such a significant proportion of purchase, and after dissolution stage is when the purchase ceased.<sup>3</sup> The staged regression results are shown in Table 7. Before the establishment of the vendor–customers relationship (i.e. *t*-1, *t*-2 and *t*-3), the regression coefficient of customers' CSR is not statistically significant, indicating that customers do not observably promote suppliers' CSR performance before the suppliers–customers relationship is established. However, when the suppliers–

<sup>3</sup>Thanks for the advice of experts. After retaining the sample with the highest percentage of annual customer purchases by companies, a total of 1,439 samples were obtained, involving a total of 674 listed companies. Then, we obtained complete data for 674 listed companies between 2010 and 2017, with a total of 4,868 sample observations. Then, we take the existence period of the supply chain relationship (i.e. *t* = 0) as the base, and divide the remaining sample into pre-construction (i.e. *t* < 0) and post-dissolution (i.e. *t* > 0) of the supply chain relationship. The order of division is: period *t*-1 and period *t* + 1, then period *t*-2 and period *t* + 2, and so on.

**Table 6.** Robustness tests: Heckman two-stage regression.

<i>Dep. Var. =</i>	<i>Disclosure</i>		<i>SCSR</i>	
	(1)		(2)	(3)
<i>State</i>	0.106*** (3.22)	<i>CCSR_D</i>	0.017** (2.22)	
<i>Growth</i>	-0.000 (-0.78)	<i>CCSR_G</i>		0.026* (1.88)
<i>ROA</i>	0.005 (0.50)	<i>IMR</i>	0.023*** (2.89)	0.032*** (3.14)
<i>Leverage</i>	-0.134*** (-2.69)	<i>Size</i>	0.064*** (16.28)	0.057*** (10.85)
<i>Size</i>	-0.074*** (-6.37)	<i>Age</i>	0.012 (1.30)	-0.000 (-0.01)
<i>Age</i>	-0.007 (-0.41)	<i>Leverage</i>	-0.242*** (-11.52)	-0.232*** (-9.43)
		<i>Growth</i>	0.006 (1.03)	0.014*** (3.06)
		<i>State</i>	0.022** (2.36)	0.019 (1.43)
		<i>Manager</i>	0.005 (0.23)	-0.025 (-0.84)
		<i>Institution</i>	0.199** (2.42)	0.283*** (3.66)
		<i>First</i>	-0.024 (-0.97)	-0.042 (-1.20)
		<i>Board</i>	0.042** (2.03)	0.039 (1.56)
<i>Year &amp; Industry FE</i>	Yes	<i>Year &amp; Industry FE</i>	Yes	Yes
<i>Observations</i>	17,695	<i>Observations</i>	1,974	1,974
<i>Pseudo R<sup>2</sup></i>	0.062	<i>Adjusted R<sup>2</sup></i>	0.257	0.290

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with *t* values in parentheses.

customers relationship is established ( $t = 0$ ), the coefficient of the independent variable is significantly positive at the level of 1%, that is, the CSR spillover effect in supply chains is obvious. After the suppliers–customers relationship is dissolved (i.e.  $t = 1$ ,  $t = 2$  and  $t = 3$ ), the CSR spillover effect in supply chains does not disappear immediately, yet gradually weakens, and is no longer statistically significant at  $t = 3$ . Overall, the CSR spillover effect in supply chains does not exist until the relationship between suppliers and customers is established, and, with the interruption of the relationship, the spillover effect gradually weakens and disappears. This conclusion alleviates the endogeneity problem that may exist in this paper to some extent and ensures the robustness of the basic conclusion.

#### 4.3.3. Other robustness tests

- (1) We used the propensity score matching method to control possible sample selection bias. First, we used Logit model to examine the probability of customers disclosing CSR reports on the basis of controlling corporate characteristic variables (consistent with basic regression) and calculated the propensity score. Second, according to the propensity score, samples were matched using the nearest neighbour matching method.<sup>4</sup>

<sup>4</sup>Complete details and results are available from the authors.

Table 7. Robustness tests: changes in supply chain relationships.

	Dep. Var. = SCSR											
	Before construction			During existence			After dissolution					
	t=-3	t=-2	t=-1	t=0	t=1	t=2	t=3					
CCSR_D	0.025 (0.96)	0.025 (1.25)	0.003 (0.17)	0.025*** (2.81)	0.024** (2.14)	0.020 (1.36)	0.004 (1.56)					
CCSR_G	0.055 (1.30)	0.025 (1.16)	0.019 (0.61)	0.057*** (2.94)	0.039*** (2.35)	0.025** (2.27)	0.015 (1.19)					
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes					
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes					
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes					
Observations	134	269	493	1,439	597	510	447					
Adjusted R <sup>2</sup>	0.402	0.384	0.233	0.252	0.219	0.224	0.254					

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with t values in parentheses.

- (2) Referring to the practices of B. Liu and Lu (2018), the CSR rating was used to measure the level of CSR (HeXun divides CSR into five grades from high to low: A-E, with the values of 5-1, respectively).
- (3) Considering the importance of customers, samples whose customers' proportion is less than 1% were removed.
- (4) We only retained customers with the highest sales proportion among the suppliers in the year.
- (5) We deleted samples whose customers and suppliers are located in the same industry, given that CSR performance among one industry is often similar and imitative (B. Liu & Lu, 2018; J. Liu & Wang, 2017).
- (6) In order to prevent customers characteristics from biasing the results, we further controlled the customers characteristic variables, such as customer size, age, the asset-liability ratio, the management shareholding and the equity structure, as proposed by Peng and Wang (2018).
- (7) Considering that firms in the same region are more likely to establish supply chain relationships, and that the common variation in CSR performance may be due to changes in regional regulatory efforts, therefore, we exclude samples where customers and suppliers are in the same city.
- (8) To further prevent potential endogeneity issues, we also controlled customer and supplier fixed effect.
- (9) In order to confirm that the spillover effect of CSR is based on the specific supply chain relationships rather than any other firms, we applied the approach proposed by Dasgupta et al. (2020) to randomly disrupt the correspondence between suppliers and customers and re-regress the basic model. We repeated the above steps 500 times and found that the regression coefficients under the virtual supply chain correspondence were concentrated around 0, while the true regression coefficients lied outside the 99% confidence interval in all 500 simulations. These results suggest that supplier CSR improvements are based on specific supply chain relationships rather than other factors.

## 5. Additional analyses

### 5.1. Customers CSR sensitivity and the spillover effect

The previous section verified the existence of CSR spillover effect in supply chains. Further, we zoomed in customers that bear greater external pressure in fulfilling CSR. These companies are envisioned to cause greater spillover effect of CSR in supply chains. Promotion of suppliers' CSR performance, therefore, shall be more significant. In the following, we discussed, from the perspective of customer ownership attributes and industry characteristics, how the CSR spillover effect of supply chains is differed by customers' different CSR sensitivity.

Firstly, the nature of ownership affects the pressure of CSR. In China, state-owned enterprises (SOEs) are more exposed to government control and public concerns. External stresses make these firms more motivated to fulfil CSRs. Consequently, SOEs perform significantly better in CSR disclosure and CSR fulfilment as compared to non-state-owned enterprises (non-SOEs). B. Liu and Lu (2018) showed that the extensive external

institutional environmental pressure faced by SOEs forces them to actively fulfil CSR for a good corporate image and reputation. In contrast, CSR of non-SOEs is more likely a free-riding behaviour with instrumental overtones (Gao et al., 2012; Tian & Zhang, 2013). Therefore, we expected the spillover effect of customers' CSR to be more significant when customers are SOEs. To verify our hypothesis, samples were sorted into two groups according to the ownership nature of customers. Results are shown in columns (1) to (4) of Table 8. The positive effect between customers CSR and suppliers CSR is salient when customers are SOEs, which indicates that the spillover effect of customers' CSR is more obvious for state-owned customers who receive more external institutional pressures.

Works of Shen (2007) and Yin et al. (2014) listed extractive industries, food industries and industries prone to heavy pollution (e.g. metallurgy, chemicals, petrochemicals, coal, thermal power, building materials, paper-making, brewing, pharmaceuticals, fermentation, textiles, tanning and mining) as CSR-sensitive industries. These industries are theoretically more likely to be involved in CSR-relating issues, such as environmental pollution and food safety issues, and therefore are subject to greater external pressure from the public and consumers (B. Liu & Lu, 2018). Hence, it can be expected that customers in CSR-sensitive industries are more likely to have positive influence on suppliers through supply chain pressure, which in turn shall present as a higher level of CSR performance of their suppliers. We thus sorted the sample into two subgroups, *Yes* and *No*, according to whether customers belong to the above-mentioned CSR-sensitive industries. We re-estimated our main regression using the two subsamples and reported the results in Columns (5) to (8) of Table 8. Results show that the spillover effect is more pronounced in CSR-sensitive industries. This suggests that the customers' industry attribute affects the level of CSR spillover effect: the higher the sensitivity of customers' CSR, the more obvious the spillover effect on suppliers CSR.

## 5.2. Suppliers CSR response and the spillover effect

Furthermore, from the perspective of suppliers' CSR response, we observed which type of suppliers is more sensitive to customers' CSR spillover. Theoretically, CSR performance depends on both corporate willingness and ability. First of all, the willingness of firms to

**Table 8.** Customers' CSR sensitivity and the spillover effect.

	Dep. Var. = SCSR							
	Customers ownership attributes				Customers in CSR-sensitive industries			
	SOE	NSOE	SOE	NSOE	Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>CCSR_D</i>	0.021** (2.08)	0.014 (0.90)			0.034** (2.32)	0.011 (1.20)		
<i>CCSR_G</i>			0.033* (1.67)	0.025 (0.75)			0.061** (2.20)	-0.010 (-0.58)
<i>Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	1,440	461	1,440	461	733	1,241	733	1,241
<i>Adjusted R<sup>2</sup></i>	0.272	0.190	0.272	0.189	0.359	0.205	0.365	0.210
<i>Different test</i>		1.04		1.02		2.70***		2.63***

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with *t* values in parentheses.

fulfil CSR is limited by the direct cost of engaging in CSR activities and the opportunity cost of participating in CSR activities (Sprinkle & Maines, 2010). Companies in a competitive environment are more likely to misconduct as their subjective initiative of fulfilling CSR is reduced. In the supply chain networks, the demand of customers' CSR improves the willingness of suppliers to fulfil their CSR either actively or passively. In order to maintain supply chain relationships and to realise interest coordination, suppliers shall actively respond to customers' appeals. Second, from the perspective of ability, the neoclassical school of economics represented by Friedman (1970) believes that the corporate investment in CSR shall consume corporate resources, increase costs and put companies in a disadvantageous competitive position. Therefore, whether companies fulfil CSR is constrained by their resources (Preston & O'bannon, 1997); profitable companies are able to undertake more CSR (Shen, 2007). Altogether, the incremental CSR spillover effect of customers should be more obvious for suppliers with strong ability but low willingness to fulfil CSR in the early stage (i.e. before establishing supply chain relationships with customers).

Referring to J. Chen and Zheng (2020) and Berger and Hann (2007), we used the social contribution value per share (*SCPS*)<sup>5</sup> of suppliers in the first 3 years of the sample period to measure suppliers' willingness and used abnormal earnings (*AP*)<sup>6</sup> to measure suppliers' ability to fulfil CSR. Then, we sorted the samples into *high* and *low* groups according to the median of *SCPS* and *AP*, respectively. Further, in order to comprehensively examine the influence of suppliers' ability and initial willingness, samples were classified as 'low willingness but high ability' group (*SCPS* = 0 and *AP* = 1), and 'other' group. The results of Table 9 show that *CCSR\_D* and *CCSR\_G* are significantly positive in 'low willingness but high ability' group, while similar results were not observed in the 'other' group, indicating that suppliers with strong ability are more likely to give positive CSR response to customers.

### 5.3. CSR spillover: benefit synergy? or information manipulation?

Based on the principal–agent theory, CSR information disclosure may be a dissembling tool, under which there may lie management opportunism, and agency costs. Thus, it cannot guarantee the convergence and unification of interests of shareholders and stakeholders (Quan et al., 2015). In China, where the formal system is not yet perfect, many studies have revealed the camouflage effect of CSR (B. Liu & Lu, 2018; Gao et al., 2012; Tian & Zhang, 2013; Y. Dai et al., 2014). Quan et al. (2015), based on the perspective of stock price crash risk, uncovered managers' behavioural tendency in manipulating information disclosure by using the construction of CSR. Therefore, it is worth to investigate whether the spillover effect of customers' CSR observed here is indeed a positive feedback of supply chain benefit synergy or merely a pseudo-CSR to cater customers. Such motivation difference between the two behaviours of the suppliers provides us with a beneficial perspective. If suppliers' CSR fulfilment under supply chain pressure is a result of opportunistic management and

<sup>5</sup>Social Contribution per share (*SCPS*) = (Net profit + income tax expense + business taxes and surcharges + cash paid to and for employees + employee compensation payable in the current period – employee compensation payable in the previous period + financial expenses + donations – sewage and clean-up costs)/average of total shares at the beginning and end of the period.

<sup>6</sup>Abnormal earnings (*AP*) are measured by the company's annual ROA minus the same industry ROA in the year.

**Table 9.** Suppliers CSR response and the spillover effect.

	<i>Dep. Var. = SCSR</i>			
	Low intention and high ability		Low intention and high ability	
	(1)	(2)	(3)	(4)
<i>CCSR_D</i>	0.025* (1.68)	0.001 (0.25)		
<i>CCSR_G</i>			0.104*** (2.95)	-0.012 (-0.74)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes
<i>Observations</i>	443	1,531	443	1,531
<i>Adjusted R<sup>2</sup></i>	0.339	0.259	0.347	0.258
<i>Different test</i>	5.80***		5.86***	

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with *t* values in parentheses.

**Table 10.** CSR spillover: benefit synergy? or information manipulation?.

	<i>Dep. Var. = SCSR</i>							
	Management Self-interest				Information Opacity			
	High (1)	Low (2)	High (3)	Low (4)	High (5)	Low (6)	High (7)	Low (8)
<i>CCSR_D</i>	0.010 (0.88)	0.026** (2.30)			0.006 (0.59)	0.033*** (3.00)		
<i>CCSR_G</i>			-0.001 (-0.02)	0.067*** (2.87)			0.014 (0.63)	0.056** (2.23)
<i>Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	1,048	926	1,048	926	974	1,000	974	1,000
<i>Adjusted R<sup>2</sup></i>	0.263	0.249	0.262	0.252	0.288	0.239	0.288	0.237
<i>Different test</i>	1.07		4.34**		1.57**		1.50**	

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with *t* values in parentheses.

information manipulation, these suppliers should have more agency problem and higher information asymmetry. The principal-agent problem is the internal cause of suppliers' CSR information manipulation while information asymmetry is the external cause, which creates conditions and environmental spaces for insiders to achieve opportunistic CSR information manipulation. In contrast, suppliers' behaviours are more aligned with the interests of stakeholders if the suppliers' CSR fulfilment is positive feedback to the customers.

In reference to the existing research (Quan et al., 2015; Tian & Wang, 2017), the absolute value of accrual surplus estimated by modified Jones model was used to measure the degree of information asymmetry. Agency problems were measured by the operating expense ratio (the sum of management expense and sales expense divided by operating income). Grouping regression results are shown in Table 10, *CCSR* are more significant in suppliers with less agent problems and less information opacity, which indicates that the spillover effect of customers' CSR to suppliers is not

an opportunistic information manipulation, but more likely positive feedback of supply chain relationships.

## 6. Conclusions

Under the background of the new normal of China's economy, how to improve CSR performance is of both theoretical value and practical significance. In view of customer–supplier relationships, this paper analysed the effect of customers' CSR on suppliers' CSR and investigated the existence of CSR spillover effect in supply chains.

Specifically, this paper manually collected the supply chain data from 2010 to 2017 and used it to verify the spillover effect of CSR among supply chains. Result revealed that customers' CSR performance has a spillover effect on suppliers, and that the bargaining power of customers is an important channel for generating this effect. As for the CSR pressure of customers, customers, in the CSR sensitive industry or are SOEs, have a stronger CSR spillover effect as they are facing higher CSR pressure from the government and the public. In addition, the lower the willingness and stronger the ability of suppliers to fulfil their CSR before the supply chain relationship is established, the more obvious their CSR is affected by the spillover effect of supply chains. Finally, through an exclusivity test, we found that the spillover effect is positive feedback from suppliers to customers rather than a masking effect under management self-interest.

The above findings provide corresponding policy implications for promoting the practice of CSR in China at this stage. Governments and regulators should recognise the positive role of supply chain relationships in CSR fulfilment, that is, customers can influence suppliers' CSR performance by non-market methods and achieve the spillover effect along supply chains. Therefore, regulatory authorities should primarily strengthen regulations and requirements of CSR fulfilment of downstream firms in supply chains, whose chain effect is envisioned to consequently force improvement of CSR in whole supply chains. In addition, it should be aware that CSR in China is majorly fulfilled by SOEs and firms in CSR-sensitive industries, while other firms present yet limited CSR performance. Therefore, the government should strengthen policy regulations and incentives of the latter to promote their contribution in improving the well-being of society. Concrete practical paths, however, have not yet been reached by the work presented, which awaited to be proposed in subsequent studies.

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**Appendix A: Other robustness tests**

Dependent variable	SCSR	
	CCSR_D	CCSR_G
Panel A: Propensity score matching method		
CCSR	0.020** (2.218)	0.028* (1.698)
<i>Controls &amp; Year FE &amp; Industry FE</i>	Yes	Yes
<i>Observations</i>	1692	1692
<i>Adjusted R<sup>2</sup></i>	0.262	0.282
Panel B: Social responsibility rating is used to measure the level of CSR		
CCSR	0.066** (2.24)	0.147** (2.29)
<i>Controls &amp; Year FE &amp; Industry FE</i>	Yes	Yes
<i>Observations</i>	1974	1974
<i>Adjusted R<sup>2</sup></i>	0.186	0.186
Panel C: Delete customers which purchase proportion is less than 1%		
CCSR	0.017** (2.09)	0.030* (1.81)
<i>Controls &amp; Year FE &amp; Industry FE</i>	Yes	Yes
<i>Observations</i>	1872	1872
<i>Adjusted R<sup>2</sup></i>	0.250	0.250
Panel D: Delete samples where the supplier and customer are in the same industry		
CCSR	0.021** (2.30)	0.047** (2.55)
<i>Controls &amp; Year FE &amp; Industry FE</i>	Yes	Yes
<i>Observations</i>	1533	1533
<i>Adjusted R<sup>2</sup></i>	0.264	0.264
Panel E: A supplier only retain a customer with the highest sales proportion		
CCSR	0.025*** (2.75)	0.057*** (3.01)
<i>Controls &amp; Year FE &amp; Industry FE</i>	Yes	Yes
<i>Observations</i>	1,439	1,439
<i>Adjusted R<sup>2</sup></i>	0.252	0.253
Panel F: Control customers characteristic variables		
CCSR	0.027** (2.56)	0.059** (2.55)
<i>Firm Controls &amp; Customer Controls &amp; Year FE &amp; Industry FE</i>	Yes	Yes
<i>Observations</i>	1,388	1,388
<i>Adjusted R<sup>2</sup></i>	0.252	0.253
Panel G: Delete samples where the supplier and customer are located in the same city		
CCSR	0.020** (2.40)	0.030* (1.76)

*(Continued)*

(Continued).

Dependent variable	SCSR	
Independent variable	CCSR_D	CCSR_G
Controls & Year FE & Industry FE	Yes	Yes
Observations	1,676	1,676
Adjusted R <sup>2</sup>	0.260	0.258
Panel H: Controlling supplier and customer fixed effect		
CCSR	0.017*	0.048**
	(1.72)	(2.18)
Controls & Year FE & Firm FE & Customer FE	Yes	Yes
Observations	1,974	1,974
Adjusted R <sup>2</sup>	0.701	0.687

Note: \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively, with *t* values in parentheses.

### Appendix B

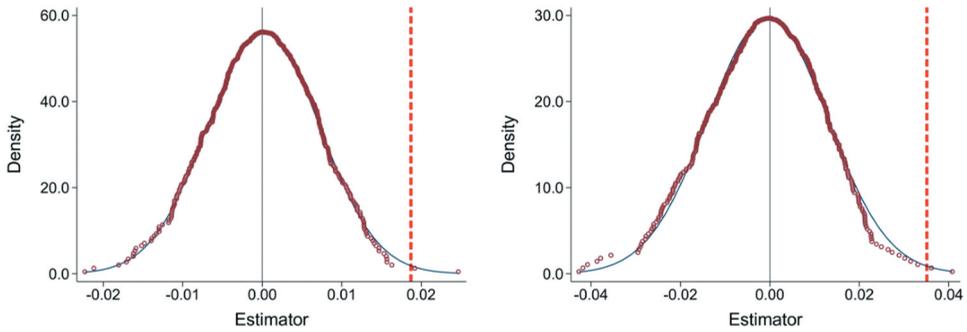


Figure B1. Placebo test (500 runs).