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Customer relationships, Corporate Social Responsibility, and Stock Price Reaction: Lessons from China during health crisis times

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Abstract

This paper studies the effect of corporate social responsibility (CSR) and customer relationships on the stock price during the COVID-19 pandemic. The empirical results show that CSR practices improve firms' resilience to the negative health crisis shocks. The functional principal component analysis helps display the relationship between CSR and cumulative abnormal returns (CAR). It shows that CSR practices improve customers' cooperation willingness. Customers of high-CSR firms pay invoices faster during the crisis, which results in less increment of accounts receivable. Hence, high-CSR firms gain more cash support from their customers to overcome the COVID-19 pandemic, resulting in higher cumulative abnormal returns.

Keywords: COVID-19, Corporate social responsibility, Accounts receivables, Cumulative abnormal returns, China stock market

1. Introduction

Corporate social responsibility (CSR) practices constitute a reputation reservoir that can enhance firms' resiliency in financial crises (Godfrey et al., 2009; Jones et al., 2000). It acts like a buffer against losses in gloomy periods. When a firm experiences a shock due to a negative event, CSR practices help stakeholders keep a positive attitude toward the firm, leading to a smaller decline in cumulative abnormal stock return. Since the COVID-19 outbreak, the pandemic has seriously stalled economic activities. Comparing with the 2008 global financial crisis, the COVID-19 crisis is a non-economic shock. It constitutes a unique opportunity to test whether CSR practices and customers relationships can help firms overcome the adverse situation and mitigate the effects in the non-economic shock.

We apply functional principal component analysis to examine the effects of corporate social responsibility on firm resilience to overcome the disruption due to the COVID-19 pandemic in the Chinese stock market. The empirical results show that as the CSR score increases, the cumulative abnormal return (CAR) first increases, then slightly decreases. Such a pattern means that there are other firm characteristics at high CSR score levels that indirectly offset the effect on CAR. We build regression models to explain the non-linearity. Following Godfrey et al. (2009) and Lins et al. (2017) approaches, we use the changes in the accounts receivable ratios between the first quarter of 2020 and the fourth quarter of 2019 to represent the willingness of customers to cooperate. We find that firms with high CSR scores have a relatively smaller increase in accounts receivable ratios, and it is negatively correlated with CAR, which means that the cooperation willingness of customers contributes to buffering the risk caused by COVID-19.

This paper contributes to the existing literature on CSR in three ways. First, by taking advantage of the global exogenous COVID-19 shock, our empirical results show that CSR practices pay off in times of

crisis (Godfrey, 2005; Gardberg and Fombrun, 2006). We also provide more detailed insights into whether CSR generates value for firms. Second, this paper analyzes the joint effect of CSR and accounts receivable ratios. It offers an interesting perspective to assess the role of customers and CSR benefits in firm resilience. Third, the empirical analysis lends support to the studies of CSR practices in Chinese firms. Our results suggest that CSR investment should be regarded as an important part of firms' strategies that help firms accomplish a sustainable competitive advantage and survive crises (Porter and Kramer, 2006; Husted and Allen, 2007; Kramer and Porter, 2011).

The rest of the paper is organized as follows. Section 2 reviews prior CSR literature and develops the hypotheses. Section 3 presents sample and data. Section 4 gives the functional principal component analysis for the relationship between CSR and CAR. Section 5 provides the regression models and results. Section 6 concludes.

2. Literature and hypotheses development

Godfrey et al. (2009) and Jones et al. (2000) consider that CSR is not about creating value in daily operations. On the contrary, CSR investment is akin to insurance, creating goodwill and moral capital for firms faced with the risk or policy uncertainty (Rjiba et al., 2020). CSR activity sends a signal to the public that the firm has a good reputation. When the firm is passing through a crisis, the moral capital can play the role of buffering risk, thereby preserving firm value. Hence, corporate social responsibility practices can mitigate the COVID-19 negative effect (Pham et al., 2021; Huang et al., 2021).

Firms need cash to alleviate the crisis difficulties. Yet, it is often difficult for them to obtain cash from customers during crises (Tsai, 2008). *Ceteris paribus*, firms with relatively low accounts receivable will face less pressure on cash flow because operating activities can generate cash income in a prompt fashion (Dechow et al., 1998; Bowen et al., 1986). Hence, the insurance-like benefit generated by CSR investment varies with firms. In firms with high accounts receivable, the moral capital of CSR can buffer more risks. Therefore, following these arguments, we draw our first hypothesis.

Hypothesis 1: CSR firms are more resilient to the COVID-19 pandemic.

Downstream firms and customers are the salient stakeholders. They are particularly concerned about the firms' reputations and more sensitive to CSR practices (Welford and Frost, 2006). If a firm implements more CSR activities to improve its reputation, customers are likely to become more positive to the firm and willing to pay invoices faster (Ellouze, 2020). This reasoning leads to the following hypothesis.

Hypothesis 2: CSR reduces the increase in accounts receivable during the COVID-19 pandemic.

Ramelli and Wagner (2020) shows that cash holding becomes a significant value driver for firms when the COVID-19 spreads worldwide. Ding et al. (2020); Boubaker et al. (2020) illustrate the importance of cash including during COVID-19. In addition, Jadiyappa et al. (2021) find that CSR is positively correlated with cash holding based on a natural experiment in India. During the COVID-19 pandemic period, a smaller increase in accounts receivables translates a situation where firms have more stable cash flow from their customers, and their risks are correspondingly lower. In light of these arguments, we present the following hypothesis.

Hypothesis 3: The change of accounts receivable is negatively correlated with the risk during the COVID-19 pandemic.

3. Sample selection and data

Wuhan was locked down on January 23, 2020. At that date the COVID-19 pandemic began to dramatically affect economic activities. After the Chinese New Year holidays, Wuhan mobile cabin hospitals began to accept patients on February 5, 2020, and the epidemic was controlled. According to the timeline of the COVID-19 in China (Figure 1), we choose Wuhan lockdown on January 23, 2020 as the negative event, and January 20, 2020 to February 5, 2020 as the event window.

Our cumulative abnormal return is from the market model:

$$AR_{i,t} = R_{i,t} - \hat{\beta}_i(R_{m,t} - r_{f,t}) \quad (1)$$

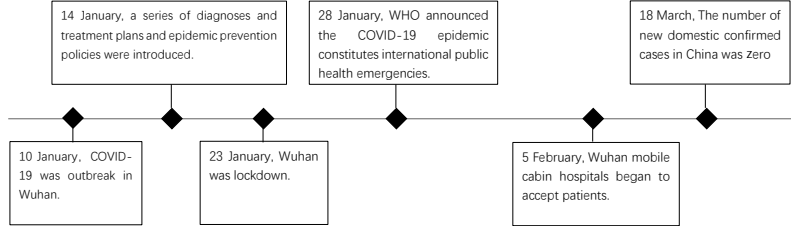


Figure 1: The Timeline of the COVID-19 in China

$$CAR_i = \sum_{t=1}^T AR_{i,t} \quad (2)$$

where $AR_{i,t}$ is the abnormal return of stock i at time t . $\hat{\beta}_i$ is estimated by the market model from January 1, 2019 to December 31, 2019. The CAR variable is the sum of the abnormal return during the event window.

Our corporate social responsibility score is from Hexun's 2019 Corporate Social Responsibility Report¹. We denote the ratio of accounts receivable to sales revenue as $RecRatio$ ². Our control variables are firm size($lnSize$), book-to-market ratio(BM), earnings per share(EPS), return on assets(ROA) and equity multiplier(EM) as of 31 December 2019. Financial data is from the China Stock Market and Accounting Research Database(CSMAR). We delete firms with missing data, those operating in the financial industry, and those listed on the Sci-Tech innovation board. We end up with 3414 firms. We divide our sample firms into four quartiles of equal size depending on the CSR level. Group 1 (4) is composed of firms with the lowest (highest) CSR scores. Table 1 presents the summary statistics of variables used in the analysis.

We note that the average value of CAR increases monotonically from group 1 to group 3, but the average value of CAR decreases in Group 4. The ratio of accounts receivable to sales revenue in the first quarter of 2020 is higher than the previous quarter in all CSR ranking groups, suggesting that COVID-19 did affect firms getting invoices paid.

4. CSR and the stock price reaction

The functional data analysis (FDA) method is designed to find complex relationship structures between variables. We smooth the cross-sectional average CAR of each group into a continuous curve by the functional data analysis method(Ramsay and Silverman, 2007). Then we adopt the functional principal component analysis (FPCA) to find the correlation pattern between the CSR and the CAR. The functional principal component score is defined as follows

$$\frac{\sum_i^N f_i^2}{N} = \frac{\sum_i^N (\int \xi_1(t)x_i(t)dt)^2}{N}. \quad (3)$$

where $\xi_1^*(t)$ is the weight function on t for the l -th principal component, N is the sample size, x_i represents the sample function, f_i is i -th component score. Hence, our l -th principal component $P_l(t)$ is obtained by computing

$$P_l(t) = \frac{\sum_{i=1}^N \xi_l^*(t)x_i(t)}{N}. \quad (4)$$

¹The CSR score from Hexun Report has five components: shareholder responsibility with 30% weight, employee responsibility (15% weight), supplier, customer, and consumer rights responsibility (15% weight), environmental responsibility (20% weight), and social responsibility (20% weight). More specifically, the shareholder responsibility includes operation profit of entirety, dividend payout ratio, product development expenditure, etc. The employee responsibility includes the per capita income of employee and consolation money. The customer and consumer right responsibility includes the customer and supplier satisfaction and fair competition. The pollutant discharge is the criteria for the environmental responsibility, and the social donation is the criteria for the social responsibility.

² $RecRatio$ was winsorized at the 0.5% level on both sides to mitigate the effects of the extreme values.

Table 1: Summary statistics of CAR and control variables grouped by CSR score

CSR Quintile	CAR	lnSize	EM	BM	ROA	EPS	<i>RecRatio</i> of 2019Q4	<i>RecRatio</i> of 2020Q1
Low group								
Num	855	855	855	855	855	855	855	855
Mean	-0.0378	4.06	3.06	0.661	-0.00321	-0.425	0.377	3.09
Min	-0.271	2.35	1.01	0.0349	-0.0866	-10.4	0.00	0.01
Max	0.615	9.35	58.0	1.32	0.133	2.82	1.73	27.9
Median	-0.0542	3.93	1.99	0.659	-0.00287	-0.0561	0.275	1.52
2nd group								
Num	852	852	852	852	852	852	852	852
Mean	-0.0183	4.29	2.14	0.700	0.00181	0.215	0.278	2.01
Min	-0.223	2.145	1.03	0.0262	-0.0401	-0.410	0.00	0.00
Max	0.585	10.1	36.2	1.37	0.0573	5.07	1.44	28.3
Median	-0.0441	4.08	1.75	0.719	0.00231	0.159	0.220	1.13
3rd group								
Num	855	855	855	855	855	855	855	855
Mean	0.0979	1.22	1.04	0.259	0.0132	0.477	0.262	1.67
Min	-0.160	2.30	1.01	0.0710	-0.0539	-0.418	0.00	0.00
Max	0.574	10.6	14.8	1.44	0.0680	4.53	1.36	24.6
Median	-0.0360	4.33	1.623	0.669	0.00700	0.363	0.211	1.04
High group								
Num	852	852	852	852	852	852	852	852
Mean	-0.0110	4.81	2.03	0.649	0.0117	0.846	0.186	1.21
Min	-0.192	2.25	1.02	0.0698	-0.0544	-0.299	0.00	0.00
Max	0.514	11.4	45.4	1.33	0.191	34.3	1.22	23.6
Median	-0.0327	4.60	1.56	0.651	0.0100	0.585	0.136	0.695

Boubaker et al. (2021) gives detailed calculation method of solving the weight function.

The procedures and outcomes of the FPCA for the relation between CSR and stock price reaction are as follows.

1. Divide sample firms into 4 groups from low to high CSR score. On the trading day t in the event window, compute the average cumulative abnormal return $CAR_t(u)$ of each group u and obtain the discrete observed data $\{CAR_t(u), u = 1, 2, \dots, 4\}_{t=1,2,\dots,T}$.
2. Transform the discrete data into functional data by the B-spline system. If the number of trading days in the event window is T , there is a series of functional data $\{CAR_t(u)\}_{t=1,2,\dots,T}$ where u is no longer a discrete group number but the continuous quantile of the firm's CSR score.
3. Use the FPCA method to find the common characteristics of the curves of CAR versus the quantile of CSR score.

Figure 2 presents the results of FPCA³. The first principle component explains 99% of the cross-sectional variation and comprehensively reflects the shape of curves. The most obvious pattern is that the CAR increase at the beginning, then keeps constant, and finally decreases. Their relationship takes the shape of a U-inverted curve, and excessive CSR scores do not seem to lead to better stock price performance.

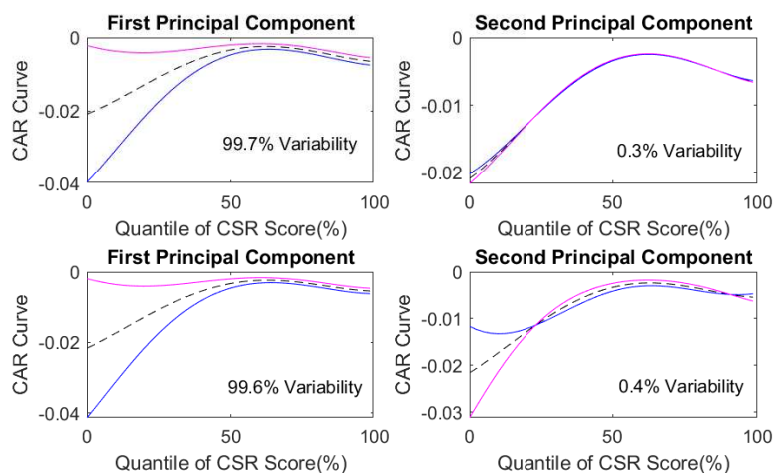


Figure 2: The three lines in the figure are the mean curve(black dash curve) of CAR and the mean curve plus(pink line) or minus(blue line) the principal component. The upper two figures show the result where the average CAR is equal weighted, and the lower two figures show the result where the average CAR is value weighted. X-axis is the quantile of firm's CSR score.

To verify the FPCA results, we establish a structural equation to give a confirmatory analysis. The regression of Equation 5 shows that β_1 is 0.0033, and β_2 is -0.000063, are both statistically significant. The coefficient of the quadratic term is negative, suggesting that CAR increases first and then decreases with the CSR score. The structural equation result is consistent with that of the FPCA.

$$CAR_i = \alpha + \beta_1 CSR_i + \beta_2 CSR_i^2 + \epsilon_i \quad (5)$$

5. The role of accounts receivable

The nonlinear results of the FPCA suggest the need to further explore the relationship between CSR and stock price reaction. The ratio of accounts receivable to sales revenue can reflect the ability of firms to gain cash flows from their customers. Therefore, the customer perspective may be appropriate to assess how CSR impacts the stock price reaction.

³We notice that the use of different weighing methods do not significantly affect the patterns of the curves.

5.1. Accounts receivable ratios and CAR

We first analyze whether the accounts receivable indirectly affect stock price reaction to test hypothesis 1. We include *RecRatio* and the interaction term between CSR and *RecRatio* in explaining CARs as follows.

$$CAR_i = \alpha + \beta_1 CSR_i + \beta_2 RecRatio_i + \beta_3 CSR_i * RecRatio_i + \beta Control_i + IndustryFE + \epsilon_i \quad (6)$$

Table 2: Regression results of CAR on *RecRatio* and CSR

Variables	CAR	CAR	CAR	CAR	CAR	CAR	CAR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CSR score	0.0009*** (3.49)		0.0009*** (3.49)	0.0002 (0.66)	0.0010*** (3.83)	0.0006** (2.06)	0.0011*** (4.09)
<i>RecRatio</i>		-0.0013 (-0.15)	0.0037 (0.43)	-0.0279*** (-2.59)			
CSR* <i>RecRatio</i>				0.0025*** (4.11)			
<i>RecRatio_high</i>					-0.0004 (-0.08)	-0.0166* (-1.77)	
<i>RecRatio_low</i>					-0.0260*** (-4.85)		-0.0109 (-0.92)
CSR* <i>RecRatio_high</i>						0.0012** (2.56)	
CSR* <i>RecRatio_low</i>							-0.0007 (-1.53)
<i>EPS</i>	0.0064*** (2.61)	0.0104*** (3.21)	0.0065*** (2.60)	0.0061** (2.57)	0.0064*** (2.61)	0.0063*** (2.60)	0.0065*** (2.63)
<i>BM</i>	-0.0059 (-0.66)	-0.0066 (-0.73)	-0.0059 (-0.65)	-0.0074 (-0.82)	-0.0060 (-0.66)	-0.0071 (-0.78)	-0.0057 (-0.64)
<i>lnSize</i>	0.0057*** (3.14)	0.0064*** (3.42)	0.0058*** (3.14)	0.0067*** (3.55)	0.0066*** (3.56)	0.0062*** (3.35)	0.0068*** (3.68)
Constant	-0.0551*** (-5.77)	-0.0413*** (-4.33)	-0.0568*** (-5.38)	-0.0487*** (-4.62)	-0.0542*** (-5.53)	-0.0509*** (-5.02)	-0.0580*** (-5.94)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.244	0.241	0.244	0.247	0.249	0.245	0.249
Number of observations	3414	3414	3414	3414	3414	3414	3414

Table 2 reports the results. The coefficient of *RecRatio* is not statistically significant, which means that the ratio of accounts receivable to sales in the fourth quarter of 2019 alone does not directly affect CARs. However, if we add the interaction term between CSR and *RecRatio*, the coefficients of *RecRatio* and the interaction term become statistically significant as shown in Column (4). The negative coefficient on *RecRatio* indicates that firms with difficulties in collecting payments from customers have performed worse. The coefficient of the interaction term is positive and statistically significant implying that CSR has a greater impact on CARs in firms with higher *RecRatio*.

To control the endogeneity, we define two dummy variables *RecRatio_high* and *RecRatio_low*. *RecRatio_high*(*RecRatio_low*) equals 1 when *RecRatio* is the highest(lowest) 25%, and 0 otherwise. *RecRatio_low*. columns (5)-(7) of Table 2 present similar results. The term CSR**RecRatio_high* is significantly positive and the term CSR**RecRatio_low* is negative, indicating that CSR has a more significant impact on firms with high *RecRatio* and a weaker but insignificant effect on firms with low *RecRatio*.

5.2. CSR and customers' cooperation

Our second hypothesis proposes that customers of high-CSR firms pay invoices faster than those of low-CSR firms during the crisis period. Hence, we define the variable $\Delta RecRatio$ as the difference between the ratio of accounts receivable to sales in the first quarter of 2020 and the fourth quarter of 2019. If customers are loyal and willing to cooperate, they choose to make payments on invoices faster. Hence, $\Delta RecRatio$ can be regarded as a proxy for customers' cooperation.

We construct the regression model (7) with $\Delta RecRatio$ as the dependent variable and the CSR score as the variable of interest to test the hypothesis 2.

$$\begin{aligned} \Delta RecRatio_i = & \alpha + \beta_1 CSR_i + \beta_2 RecRatio_Dummy_i \\ & + \beta_3 CSR_i * RecRatio_Dummy_i + \beta \mathbf{Control}_i + IndustryFE + \epsilon_i. \end{aligned} \quad (7)$$

Table 3: Regression results of $\Delta RecRatio$ on CSR and $RecRatio$

Variables	$\Delta RecRatio$	$\Delta RecRatio$	$\Delta RecRatio$	$\Delta RecRatio$
	(1)	(2)	(3)	(4)
CSR Score	-0.0450*** (-14.06)	-0.0257*** (-9.79)	-0.0058*** (-2.70)	-0.0499*** (-14.01)
<i>RecRatio_high</i>		3.1307*** (54.11)	4.5719*** (32.18)	
<i>RecRatio_low</i>		-0.6998*** (-21.44)		-2.2490*** (-28.21)
CSR* <i>RecRatio_high</i>			-0.0792*** (-11.32)	
CSR* <i>RecRatio_low</i>				0.0468*** (12.31)
<i>EPS</i>	-0.1723*** (-3.89)	-0.1386*** (-3.89)	-0.1303*** (-3.91)	-0.1731*** (-3.96)
<i>lnSize</i>	-0.2426*** (-12.69)	-0.1038*** (-6.22)	-0.1464*** (-8.93)	-0.2083*** (-11.36)
<i>BM</i>	-0.0251 (-0.29)	-0.2230*** (-2.89)	-0.1632** (-2.17)	-0.0462 (-0.55)
Constant	3.7194*** (31.40)	2.2534*** (23.30)	1.8023*** (19.85)	3.9820*** (32.61)
Industry FE	Yes	Yes	Yes	Yes
R-squared	0.181	0.351	0.356	0.205
Number of observations	3414	3414	3414	3414

Table 3 provides the results. We notice that the coefficient on CSR is significantly negative, which means high-CSR firms have more loyal customers and stronger connections with them to control their accounts receivable during the crisis period. The result confirms that high-CSR firms are more likely to collect payments from their customers faster. The interaction term between CSR and *RecRatio_high* is negative while that between CSR and *RecRatio_low* is positive, suggesting that that high CSR, for firms with higher *RecRatio*, encourages customers to pay invoices faster as a result of firm reputation. High CSR rating has a greater marginal effect on improving firms' reputation.

5.3. CSR, customers' cooperation and CAR

We empirically study how CSR impacts stock price reaction for the third hypothesis. We add $\Delta RecRatio_i$ term to the model (6) and replace the interaction term with $\Delta RecRatio_i * RecRatio_i$ to establish the new

regression model:

$$CAR_i = \alpha + \beta_1 \Delta RecRatio_i + \beta_2 CSR_i + \beta_3 RecRatio_i + \beta_4 \Delta RecRatio_i * RecRatio_i + \beta \mathbf{Control}_i + IndustryFE + \epsilon_i. \quad (8)$$

Table 4 reports the results. We notice that except for columns (2), (4), (7), and (9), the coefficients of $\Delta RecRatio$ are significantly negative, which indicates that the stock performance is positively related to customers cooperation. The reason why the coefficient is not significant for the columns (2) and (9) is that $RecRatio$ and the interaction term with $RecRatio$ are added while the coefficients of these interactions are salient. According to the interaction terms of $\Delta RecRatio$ and $RecRatio$, we can propose that only in firms with a high $RecRatio$, reducing the ratio of accounts receivable to sales revenue can effectively improve firm resilience. Also, we note that the coefficients of CSR decrease after adding $\Delta RecRatio$ which implies that $\Delta RecRatio$ plays a mediating role. Hence, the high CSR ratings are more useful and valuable for high- $RecRatio$ firms through gaining reputation and cash support from their customers during the crisis period.

Based on these results, the non-linearity is caused by different CSR impacts on the stock price reactions of firms with varying $RecRatio$. Although CSR can help firms gain cash support from customers, for firms with a higher $RecRatio$, customer cooperation is particularly critical during the COVID-19 crisis period. On the contrary, for firms with a low $RecRatio$, the influence of gaining cash support from customers is relatively small.

To check the robustness of our results, we chose July 16, 2020, to July 31, 2020, as another period around the COVID-19 event when there is a small outbreak of COVID-19 in China. We use these two periods to run the panel regression that controls for firm fixed effects. The panel regression results show that the coefficients of CSR score are 0.005 (Equation 6) and -0.0182 (Equation 7), and the coefficient of $\Delta RecRatio$ is -0.002 (Equation 8). The signs, the economic and statistical significance of the coefficients do not qualitatively change. The CSR score is still positively related to CAR and negatively related to $\Delta RecRatio$. As for the seasonal effects, we use the difference between the ratio of accounts receivable to sales revenue in the first quarter of 2020 and the first quarter of 2019 as the alternate definition of $\Delta RecRatio$ and run the same regressions. The change on a year-over-year basis can eliminate seasonal effects. The results show that the coefficient of CSR score is -0.0153 (Equation 7), and $\Delta RecRatio$ is -0.0028 (Equation 8). The seasonal effects do not qualitatively affect our results, suggesting that our conclusions are not affected by seasonal effects.

6. Conclusion

This study suggests that corporate social responsibility practices can mitigate the negative effect caused by the COVID-19 pandemic. The functional principal component analysis on the CSR and the CAR suggests that there is a non-linear relationship between them during the COVID-19 crisis period. To further develop the explanations, we construct a series of regression models from the perspective of customers to examine the joint effect of accounts receivables ratios and CSR on stock prices. Our empirical results show that for firms that have high accounts receivable, CSR practices buffer more risk and bring about higher CAR. CSR practices improve the firm's reputation and strengthen cooperation with customers, making them pay invoices faster. Hence, the high-CSR firms are better able to overcome the crisis.

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