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Abstract

Purpose: The purpose of this paper is to disentangle a unique way in which corporate social responsibility (CSR) affects firm value in the context of product recalls in the automotive industry.

Methodology: Using a sample of product recall events in the automotive industry between 2002 and 2018 and controlling for the spread of product recalls across product lines, this study explores the underlying economic channels through which CSR improves investments in quality. For robustness check, self-selection bias is corrected for using a 2SLS approach and alternative measures for product failures and CSR.

Findings: The authors find that firms with higher CSR scores are associated with a lower frequency of recalls. Moreover, higher CSR scores are associated with a higher likelihood of voluntary recalls, higher product quality, higher capital expenditures, and higher employee productivity.

Unique Contribution to Theory, Practice, and Policy: This study offers insights to managers, investors, and board members, showing the potential benefits of engaging in CSR activities. This study contributes to the literature on the effect of CSR on different managerial decisions and the factors that affect product recalls. Additionally, the study reveals the connection between CSR and product recalls.

Keywords: *Corporate Social Responsibility, Product Recalls, Automotive Industry, Voluntary Recalls.*

1. INTRODUCTION

Companies spend significant resources on corporate social responsibility (CSR) investments to contribute positively to society while doing business, whether through lowering carbon emissions, providing employee benefits, promoting equality and inclusion in the workspace, or investing in environment-friendly production processes. CSR companies are aware of the multifaceted impact their decisions have on society, and their motivations for undertaking such strategies are multifold. However, the mechanisms through which CSR affects firms' decisions are still being debated. This study examines how CSR affects product recalls in the automotive industry. We focus on the automotive industry for several reasons. The number of recalls and their intensity in the automotive sector has grown significantly over the past 20 years (Aragon et al., 2019). Product recalls are typically high-visibility adverse events attributed to lapses in product quality, and they impose high costs on firms, including reputational damage (see Noack, Miller, and Smith, 2019; Kini, Shenoy, and Subramaniam, 2017; Matsa, 2011; Gormley and Matsa, 2011; Chen, Ganesan, and Liu, 2009; Malik and Jebari, 2023 among others). Extant research has studied the impact of insufficient maintenance of machinery, overutilization of plants (Taylor, 2011), the level of financial distress (Phillips and Sertsios, 2013), firm leverage (Kini, Shenoy, and Subramaniam, 2017), and lobbying (Singh and Grewal, 2020; Rayfield and Unsal, 2018) on product recalls. However, despite the negative consequences of product recalls, some companies choose to voluntarily initiate a recall and assume responsibility for their product failures. The direct relationship between CSR and firms' quality choice decisions remains largely unexplored. Moreover, the critical interplay between consumer safety, industry regulation, and a firm's product quality offers an interesting setting for testing the association between CSR and product recalls.

Theories for why firms invest in CSR fall into two broad camps. According to the shareholder view on CSR, Krüger (2015), Bénabou and Tirole (2010), and Barnea and Rubin (2010) argue that CSR is an outcome of agency problems and managers extract private benefits by improving their personal reputation when engaging in CSR, at the expense of shareholders' value. On the other hand, advocates of the stakeholder value maximization view argue that CSR is value-enhancing for firms (Deng, Kang, Low (2013), Flammer (2013), and Servaes and Tamayo (2013)). CSR firms generate long-term value by cultivating loyalty among employees, customers, suppliers, creditors, and the broader community. Godfrey, Merrill, and Hansen (2009) and Minor (2015) argue that CSR is value-enhancing because it offers insurance-like protection against stakeholders' sanctions by generating goodwill. On the other hand, Harjoto and Jo (2011) propose that CSR signals product quality, and Bardos, Ertugrul, and Gao (2020) document that CSR positively affects product market perception of firms by strengthening their brand and improving the perception of product quality.

We study our research question in light of two major views on CSR: the shareholder value-maximization view and the stakeholder value-maximization view. Using a sample of product recalls in the automotive sector from the National Highway Traffic Safety Administration

(NHTSA) database between 2002 and 2018, we examine the effect of CSR on the incidence of product recalls the proportion of voluntary recalls, the strength of products, the capital expenditure, and the productivity of employees of the recalling firms.

We find that firms with higher CSR scores are associated with a lower frequency of recalls. This result also bears out when we control for the inherent endogeneities and self-selection biases in our analysis. We further find that higher CSR scores are associated with a higher likelihood of voluntary recalls and product scores.

In further analysis, we explore the underlying economic channels through which CSR improves investments in quality. We find that CSR firms invest more in capital expenditures and have higher employee productivity. Thus, our findings are consistent with the stakeholders' value maximization hypothesis and suggest that firms with CSR are higher quality, more conscientious firms whose recalls are not as egregious in spread across product lines.

Our paper contributes to the literature in several dimensions. First, we add to the literature on the factors that affect product recalls. Extant research has studied the impact of insufficient maintenance of machinery, overutilization of plants (Taylor, 2011), the level of financial distress (Phillips and Sertsios, 2013), firm leverage (Kini, Shenoy, and Subramaniam, 2017), and lobbying (Singh and Grewal, 2020; Rayfield and Unsal, 2018) on product recalls. We extend this literature by including CSR along the lines of Harjoto and Jo (2011) and Bardos, Ertugrul, and Gao (2020). Our study adds to the literature by considering CSR as another factor impacting product recalls' incidence. Second, our study contributes to the large body of research on the effect of CSR on different managerial decisions. Previous studies explored the relationship between CSR and cash holdings (Cheung, 2016), mergers and acquisitions (Deng et al., 2013), dividend policy (Cheung et al., 2015; Rakotomavo, 2012), CEO compensation (Gillan et al., 2010; Jian and Lee, 2015), and CEO risk-taking incentives (Dunbar et al., 2020). We document a strategic role for CSR in product failures.

2. RELATED LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

CSR investments are substantial and vary significantly across firms (e.g., Hong et al., 2011; Giuli and Kostovetsky, 2014). CSR can take many forms and depends on the firm's size, industry, and culture. Extensive literature examines the relationship between responsible corporate practices and management decisions. Masulis and Reza (2015) study the relationship between CEO compensation and charitable contributions. Goss and Roberts (2011) examine the link between CSR and bank loans. El Ghoul et al. (2011) look at the impact of CSR on the cost of capital. Borghesi et al. (2014) document a relationship between CSR scores and the CEO's gender. Deng et al. (2013) study the benefit of CSR in the context of mergers and acquisitions. One of the inconclusive debates in this literature is whether CSR is a manifestation of agency problems or the result of good managerial decisions (Bénabou and Tirole, 2010)).

The classical view in finance advocates for shareholders' value maximization and suggests that corporations have no obligation to serve other stakeholders' interests (Friedman, 1970).

According to this line of thought, managers extract private benefits at the expense of shareholder wealth creation when they spend on CSR activities. Looking at CSR as an agency problem assumes that engaging in CSR activities represents a diversion of corporate resources. These arguments lead to the following hypothesis:

H.1. CSR firms tend to invest less in quality and have a higher incidence of product recalls.

In contrast, another view suggests that CSR is strategic and that managers invest in social capital by maintaining good relations with other stakeholders, such as employees and customers, for long-term rewards (Deng et al., 2013). This second hypothesis is based on the stakeholders' value maximization view, sometimes referred to as "doing well by doing good." This view suggests that managers perceive engaging with stakeholders as investments with positive net present value. Edmans (2011) finds a positive relationship between employee satisfaction and long-run stock returns. According to this view, CSR companies act less opportunistically and engage in stakeholder-oriented behaviors. Managers perceive engaging with stakeholders as investments with positive net present value. According to this view, CSR is value-enhancing because it offers insurance-like protection against stakeholders' sanctions by generating goodwill (Godfrey, 2005). Customers may think of socially responsible sellers as not involved in opportunistic behavior. These arguments lead to the following hypothesis:

H.2. CSR firms tend to invest more in quality and have a lower incidence of product recalls.

By studying the empirical connection between CSR and product recalls, we aim to understand the role of values in managerial decision-making.

3. DATA AND VARIABLES

3.1. Product Recalls

The National Highway and Transportation Safety Administration (NHTSA), which is part of the Department of Transportation (DOT) and the federal agency enforcing national safety standards, oversees the process of product recalls in the automotive industry. We collect data on automotive recall campaigns from the agency's website[1]. We specifically collect information on the product's manufacturer, the product being recalled, and the date of recall. The data available for this industry provides a clear differentiation between voluntary and involuntary recalls. Following the NHTSA's description, we define voluntary recalls as recalls willingly initiated by the manufacturer and involuntary recalls as recalls initiated by a mandate from the NHTSA through its two offices: the Office of Vehicle Safety Compliance and the Office of Defects Investigation. We limit our sample to publicly traded companies and obtain their financial information from Compustat.

It is essential to note that an automotive recall campaign can encompass the recall of different models of the same make. The recalls of models from various product lines are registered

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[1] See https://www-odi.nhtsa.dot.gov/downloads/ for more detailed information regarding the data.

under different reports. Considering unique recall campaigns does not allow for examining the difference between the breadths of product recall campaigns across different recalling firms. Therefore, our sample considers the recall of each model for a make as a separate product recall. We obtain 15,194 distinct product recall reports between 2002 and 2018. Voluntary recalls account for 11,116 recalls (around 73% of the sample), while government-initiated or involuntary recalls account for 4,078 recalls within our sample (around 27% of the sample). Table 1 provides a summary of our final sample.

3.2. Corporate Social Responsibility Measures

We construct CSR measures using data from the MSCI ESG STATS, known previously as the KLD database that reports the ratings on seven CSR areas: environment, community relations, human rights, employee relations, diversity, product characteristics, and corporate governance. The strengths and concerns indicators of each area are assigned a value of 0 or 1 yearly, depending on whether the company meets the assessment criteria established for each indicator. Following Deng et al. (2013), we calculate the adjusted CSR score to minimize the drawbacks of this data since the number of strengths and concerns in an area can vary over time. First, we divide the total of strengths (concerns) in each area by the maximum number of strengths (concerns) for that specific year area. Then, we take the difference between the scores of the adjusted total strengths and the adjusted total concerns to derive the adjusted score for each dimension. Finally, we calculate two aggregated adjusted scores, CSR 1 and CSR 2. The corporate governance dimension measures activities that benefit shareholders. We exclude it in CSR 2 to see if our results are sensitive to this differentiation. The dimension product characteristics reported in this database include product quality and safety indicators. Thus, we exclude this dimension in both CSR measures as this might give rise to the problem that our CSR variable may be correlated with the dependent variable. The aggregated adjusted CSR score is a simple average of the CSR scores of the six and five dimensions for CSR 1 and CSR 2, respectively.

Table 1: Sample distribution

Year	Total recalls	Voluntary recalls	Involuntary recalls
2002	488	282	206
2003	435	336	99
2004	499	326	173
2005	544	348	196
2006	2,049	1,266	783
2007	1,831	1,536	295
2008	626	324	302
2009	1,145	299	846
2010	687	642	45
2011	497	425	72
2012	323	244	79
2013	707	603	104
2014	1,578	1,179	399
2015	941	782	159
2016	961	808	153
2017	881	792	89
2018	1,002	924	78
Total	**15,194**	**11,116**	**4,078**

This table describes the sample of product recalls. The sample period is 2002-2018 and contains recalls covered by the National Highway and Transportation Safety Administration.

3.3. Other Explanatory Variables

In our multivariate analysis, we follow prior research in specifying controls that can affect product recalls to identify the impact of CSR on product recalls. Kini, Shenoy, and Subramaniam (2017), Matsa (2011), and Phillips (1995) show that a firm's financial condition impacts product quality. Thus, we control for the *Book leverage* as firms with a high level of leverage prioritize fulfilling their obligations toward their debtholders. We also control for *Free cash flow* as firms lacking resources may restrict their investment in quality and, therefore, avoid initiating product recalls. Firm size for the automobile industry reflects a bigger manufacturing capacity, a higher number of vehicles on the road, and more potentially defective vehicles. Steven, Dong, and Corsi (2014) find that larger firms are associated with more product recalls.

Consequently, firm size may also affect CSR's impact on the firm (D'Amato and Falivena, 2020). Therefore, we use the logarithm of total assets as a firm *Size* proxy. We control for the *analyst coverage* to capture the firm visibility as visible firms are more sensitive to publicly observable events. Analyst coverage is the number of analysts making quarterly earnings per share (EPS) forecasts each firm-year. Firms not covered by I/B/E/S are assumed to have zero analyst coverage. To capture the firm's focus on innovation, new product development, and long-term investment in quality, we follow Kini, Shenoy, and Subramaniam (2017) and control for *R&D intensity*. We calculate it as R&D expenditures scaled by total assets. We also control for the Herfindahl-Hirschman Index, *HHI,* as the level of market competitiveness can influence the firm's choice of recalling defective products voluntarily or not.

4. EMPIRICAL RESULTS

4.2. Descriptive Statistics

Our full sample has 15,194 observations, where 8,630 are for CSR firms, and 6,564 are for non-CSR firms. Table 2 provides the descriptive statistics of our sample. Total recalls represent the total number of recall reports per year for firms in our sample, with a mean of 395.56 and a median of 250. The CSR rating CSR 1 (CSR 2) has a mean value of 0.07 (0.06) and a median value of zero. The mean of book leverage is 0.37%, the mean of free cash flows scaled by total assets is -0.02%, the mean of firm size is $74,607 (=exp 11.22) million dollars, the mean of R&D expenses scaled by total assets is 0.03%, and the mean analysts' coverage is 16.71.

4.1. Baseline Model: Relation Between CSR and Product Recalls

We perform a multivariate analysis to first examine the relation between CSR and product recalls by estimating the regression model of the following form for the full sample of CSR and non-CSR firms.

$$Product\ Recalls_{i,t+1} = \quad \beta_0 + \beta_1\ CSR_{i,t} + \beta_2\ Controls_{i,t} + e_{i,t} \qquad (1)$$

We measure product recalls by calculating the total number of recalls for the firm in a year, and we measure CSR using three different variables. First, we use the variable dummy CSR, which is a dummy variable that takes the value of one for a CSR firm and zero otherwise. Second, we

use the first measure for CSR scores, CSR1, where we exclude the product characteristics dimension. Third, we use CSR2, excluding product characteristics and governance dimensions. All independent variables are lagged by one year.

Our results in Table 3 show that total product recalls decrease with CSR. Thus, the frequency of product recalls is lower for CSR firms compared to non-CSR firms. Our first and second specifications results show that CSR is negatively related to product recalls. In other words, companies with CSR have fewer product recalls than those without CSR. This result holds even when we control for other variables in model 3. We use two measures for CSR scores. We exclude the dimension product characteristics in CSR 1 and exclude both product characteristics and governance in CSR 2. In the fifth and sixth specifications, we find that the incidence of product recalls decreases with the increase of CSR scores. We understand that our results may be driven by a latent factor, as CSR could be correlated with some unobserved firm characteristics that also affect the incidence of recalls. To overcome this, we control for unobservable firms' characteristics with firm fixed effects in models 2 and 4, 5 and 6.

However, non-CSR firms are assigned a value of zero for CSR variables, which may be problematic for two reasons. First, firms with no assigned scores on the MSCI ESG STATS database implies a choice because a firm could have engaged in CSR activities but decided not to do so. This is not the case for firms that decided not to engage in CSR altogether. Second, firms do not randomly decide to engage in CSR activities, and this choice brings in a potential self-selection bias in our sample. To account for the bias, we use the 2-stage Heckman method. In the first stage, we estimate a probit model to test the likelihood of engaging in CSR based on financial constraints measured by the KZ index, sales growth, and other factors. We report the results of the first stage in Appendix B. We calculate the inverse mills ratio and include it in the second-stage regressions. We test how CSR impacts the incidence of product recalls while using the inverse mills ratio to correct for self-selection bias. We report our results in the rest of Table 3. Models 7 and 8 show that the incidence of product recalls is negatively related to CSR controlling for self-selection. Our results remain significant at the 1% level. Our findings show that CSR companies are quality companies, and the breadth of their recalls is less than other non-CSR firms. Therefore, they have fewer product lines affected.

Table 2: Descriptive statistics

Panel A: Descriptive statistics for the full sample of recalling firms with and without CSR

Variables	N	Mean	Median	S.D.	Min	Max
Total recalls	15194	395.56	250.00	354.67	1.00	1159.00
Environment	15194	0.19	0.00	0.37	-0.37	1.00
Community	15194	0.03	0.00	0.34	-1.00	1.00
Diversity	15194	0.04	0.00	0.38	-1.00	1.00
Employees	15194	0.06	0.00	0.18	-0.43	0.67
Human rights	15194	0.02	0.00	0.16	-0.25	1.00
Governance	15194	0.03	0.00	0.23	-0.67	1.00
CSR 1	15194	0.07	0.00	0.16	-0.25	0.44
CSR 2	15194	0.06	0.00	0.15	-0.22	0.49
Book leverage	15105	0.37	0.38	0.20	0.00	0.71
Analyst coverage	15176	16.71	17.00	12.90	0.00	40.00
R&D intensity	15095	0.03	0.03	0.02	0.00	0.09
Size	15105	11.22	12.18	2.45	4.81	13.08
FCF	15102	0.02	0.04	0.08	-0.21	0.13
HHI	15194	0.00	0.00	0.00	0.00	0.03

Panel B: Descriptive statistics for the subsample of recalling firms with CSR only

Variables	N	Mean	Median	S.D.	Min	Max
Total recalls	8630	295.79	269.00	202.36	1.00	778.00
Environment	8630	0.33	0.39	0.44	-0.37	1.00
Community	8630	0.06	0.00	0.45	-1.00	1.00
Diversity	8630	0.08	0.00	0.51	-1.00	1.00
Employees	8630	0.11	0.07	0.23	-0.43	0.67
Human rights	8630	0.03	0.00	0.22	-0.25	1.00
Governance	8630	0.05	0.00	0.30	-0.67	1.00
CSR 1	8630	0.12	0.12	0.19	-0.25	0.44
CSR 2	8630	0.11	0.08	0.18	-0.22	0.49
Book leverage	8630	0.41	0.39	0.21	0.00	0.71
Analyst coverage	8622	16.92	17.00	11.09	0.00	40.00
R&D intensity	8621	0.03	0.03	0.01	0.00	0.08
Size	8630	11.00	12.25	2.57	4.81	13.08
FCF	8630	0.05	0.04	0.03	-0.04	0.13
HHI	8630	0.00	0.00	0.00	0.00	0.03

This table presents distributional statistics for the variables used in our analysis. The sample period is 2002-2018 and contains recalls covered by the National Highway and Transportation Safety Administration (NHTSA). The variables are defined in Appendix A.

From the perspective of economic significance, it indicates that a one standard deviation increase in CSR1 decreases the number of product recalls by -82.10 (= -513.12 x 0.16), and a one standard deviation increase in CSR2 decreases the number of product recalls by 73.96 (= -493.12 x 0.15) after controlling for other antecedents of product recalls. This is consistent with the stakeholder theory that supports the idea of companies effectively implementing corporate social responsibility and genuinely fulfilling their commitments.

4.2. Voluntary Recalls

According to the NHTSA, a recall is issued when a manufacturer of the NHTSA determines that a specific product fails to meet safety regulations or poses an unreasonable safety risk to users. Automotive safety recalls are classified by the way the recall is announced, which consist of voluntary recalls and government-initiated or involuntary recalls (Gao, Xie, Wang, and Wilbur, 2015). Voluntary recalls occur when firms' internal inspection procedures and processes determine that a safety problem exists with a specific product. At this point, firms decide if a recall is warranted. Consequently, firms notify the NHTSA, and the product recall is announced and initiated.

On the contrary, a government-initiated recall happens when the NHTSA obligates a company to recall a product based on the results of an investigation conducted by this government entity. The process usually involves a long and tedious investigation that concludes if a recall is needed. The investigation process follows four main steps[2]: Screening, analysis, investigation, and management. During the screening phase, the NHTSA examines consumer complaints and other defect allegations about a product. Next, the federal agency analyzes the complaints and determines if the complaints require an investigation. Then, the agency makes a final decision and notifies the firms. Finally, during the management process, the NHTSA manages the effectiveness of product recalls.

We investigate whether engaging in CSR activities impacts managerial decisions. Thus, we analyze the effect of CSR on the likelihood of initiating voluntary recalls by estimating a likelihood regression of the dummy variable voluntary recalls on CSR variables and other controls. The dummy variable takes the value of one if a firm initiates voluntary recalls and zero otherwise.

We examine the effect of CSR on voluntary recalls for our full sample by estimating the model below:

$$Likelihood\ of\ Voluntary\ Recalls_{i,t+1} = F(\beta_0 + \beta_1\ CSR_{i,t} + \beta_2\ Controls_{i,t} + e_{i,t}) \qquad (2)$$

The coefficient of the variable dummy CSR in Panel A of Table 4 is positive and statically significant at the one percent level. This result shows that firms with CSR have a higher probability of initiating voluntary product recalls than non-CSR firms. We estimate the marginal effects associated with an increase in CSR score, where a 10% increase in CSR scores for five dimensions (CSR 1) will result in 1719 additional voluntary recalls (1.140*0.10*15,081). On the other hand, a 10% increase in CSR scores for six dimensions (CSR 2) will result in 1576 additional voluntary recalls (1.045*0.10*15,081).

To provide finer evidence, we further test the effects of different CSR dimensions on the incidence of product recalls. The results in Panel B show that all CSR activities drive the likelihood of voluntary recalls

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[2] See https://vinrcl.safercar.gov/vin/faq.jsp for more detailed information regarding the steps associated with the product recall process.

Table 3: Impact of CSR on the incidence of product recalls

	(1) # of Recalls	(2) # of Recalls	(3) # of Recalls	(4) # of Recalls	(5) # of Recalls	(6) # of Recalls	(7) # of Recalls	(8) # of Recalls
Dummy CSR	-147.843***	-86.493***	-9.697***	-35.564***				
	(4.112)	(4.524)	(3.739)	(4.041)				
CSR 1					-513.120***		-352.224***	
					(11.910)		(12.208)	
CSR 2						-493.128***	-771.615***	-306.862***
						(9.988)	(22.316)	(11.517)
Book leverage			-416.978***	-1,408.304***	-1,353.670***	-1,356.626***	23.026***	-859.583***
			(10.723)	(20.629)	(19.262)	(18.936)	(0.223)	(23.202)
Analyst coverage			9.821***	20.105***	21.360***	22.021***	-4,459.131***	23.555***
			(0.137)	(0.274)	(0.247)	(0.245)	(116.472)	(0.224)
R&D intensity			-1,531.850***	-3,524.813***	-3,829.774***	-3,733.191***	59.956***	-4,380.412***
			(109.705)	(174.522)	(155.316)	(152.762)	(6.083)	(116.975)
Size			23.425***	38.234***	-5.944	-2.953	-484.591***	62.196***
			(0.852)	(8.115)	(7.643)	(7.501)	(70.056)	(6.124)
FCF			-1,415.202***	-1,947.567***	-1,894.787***	-1,893.587***	11,558.191***	-792.955***
			(30.345)	(29.155)	(24.593)	(24.114)	(692.533)	(74.042)
HHI			-6,821.732***	12,189.112***	11,078.802***	10,256.251***		10,906.518***
			(501.656)	(999.673)	(933.865)	(918.894)		(696.982)
IMR							38.803***	50.605***
							(2.796)	(2.676)
Constant	479.528***	444.887***	154.802***	211.120**	-1,353.670***	-1,356.626***	-271.907***	-286.023***
	(2.962)	(2.917)	(8.189)	(91.727)	(19.262)	(18.936)	(71.930)	(71.595)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Observations	15,194	15,186	15,081	15,078	15,078	15,078	11,929	11,929
R^2	0.600	0.770	0.834	0.882	0.894	0.898	0.952	0.953

The dependent variable total recalls is the total number of recalls for the firm in a year. Dummy CSR is a dummy variable that takes the value of one when a firm engages in CSR and zero otherwise. The variable CSR 1 represents the CSR score for six dimensions (Product characteristics dimension excluded). The variable CSR 2 represents the CSR score for five dimensions (Product characteristics and Governance dimensions excluded). The control variables are for the year prior to the year of product recall and they are defined in the appendix. ***, **, and *indicate significance at the 1%, 5%, and 10% level, respectively.

Table 4: CSR and voluntary recalls

Panel A: The likelihood of voluntary product recalls

Dep=Dummy Vol. recalls	(1)	(2)	(3)
Dummy CSR	0.421***		
	(0.051)		
CSR 1		1.140***	
		(0.189)	
CSR 2			1.045***
			(0.160)
Book leverage	-3.419***	-2.942***	-2.951***
	(0.149)	(0.140)	(0.140)
Analyst coverage	0.018***	0.017***	0.017***
	(0.002)	(0.002)	(0.002)
R&D intensity	-5.988***	-5.915***	-5.835***
	(1.492)	(1.496)	(1.484)
Size	0.025*	-0.020	-0.020
	(0.013)	(0.013)	(0.013)
FCF	-2.458***	-1.568***	-1.550***
	(0.393)	(0.355)	(0.349)
HHI	60.975***	54.892***	55.797***
	(11.244)	(10.527)	(10.570)
Constant	1.555***	2.086***	2.086***
	(0.137)	(0.136)	(0.135)
Observations	15,081	15,081	15,081

Panel B: CSR dimensions and voluntary product recalls

Dep=DummyVol. Recalls	(1)	(2)	(3)	(4)	(5)	(6)
Governance	1.197***					
	(0.094)					
Environment		0.910***				
		(0.058)				
Employee			1.446***			
			(0.110)			
Human rights				1.989***		
				(0.160)		
Community					0.138***	
					(0.050)	
Diversity						0.196***
						(0.053)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,081	15,081	15,081	15,081	15,081	15,081

Panel A reports the result of a logit regression. The dependent variable Dummy voluntary recall is a dummy variable capturing whether or not the recall is voluntary or involuntary. It takes the value of one for voluntary recalls. The variable CSR1 represents the CSR score for six dimensions (Product characteristics dimension excluded). The variable CSR2 represents scores for five dimensions (Product characteristics and Governance dimensions excluded). Panel B reports the result of a logit regression of dummy voluntary recalls on different CSR dimensions and controls. The control variables are for the year prior to the year of product recall and they are defined in the appendix. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

4.3. Subsample Analysis

We focus on the subsample of CSR firms only and we differentiate between firms with high and low CSR. The variable Dummy Low CSR takes the value of one when the firm CSR score is in the 25th percentile. The variable Dummy High CSR takes the value of one when the firm's CSR score is in the 75th percentile. The results in Table 5 show that CSR is negatively related to product recalls for both firms with low and high CSR. The magnitude of the decrease in the incidence of product recalls is higher for firms with low CSR compared to those with high CSR.

Similar to our results in the full sample, our results show a positive association between the likelihood of voluntary recalls and CSR. We estimate the marginal effects associated with an increase in CSR score based on the results of models 3 and 4, as reported in Table 6. We find that a 10% increase in CSR scores for five dimensions (CSR 1) will result in 860 additional voluntary recalls (0.998*0.10*8,616). On the other hand, a 10% increase in CSR scores for six dimensions (CSR 2) will result in 1077 additional voluntary recalls (1.250*0.10*8,616).

When we focus on firms with high CSR and low CSR scores, we find that companies with low CSR scores have lower likelihood of initiating voluntary recalls but those with high CSR scores have higher likelihood of initiating product recalls. Our results show that different levels of engagement in CSR activities have different impacts on firms' decisions.

Moreover, the results reported in Table 7 show that corporate governance, environment, employee relations, human rights, and diversity dimensions drive the likelihood of voluntary recalls.

4.4. Robustness Tests

Our main findings have shown a negative association between CSR and the incidence of product recalls. Therefore, to check the robustness of our results, we employ alternative specifications for product recalls and CSR.

4.4.1. Alternative Definition of Product Quality

So far, we have defined quality failure as the number of product recalls for each firm yearly. For robustness, we use an alternative measure for product quality. First, we consider the dimension product characteristics from the MSCI ESG STATS a proxy for the quality of products. We calculate the adjusted score for the dimension product characteristics by dividing this dimension's total strengths (concerns) by the maximum number of strengths (concerns) for each year. Then, we take the difference between the total adjusted strengths and the total adjusted concerns to derive the adjusted score for product characteristics. We create a new dummy variable, *strong product,* based on each firm's product characteristics score. This dummy variable takes the value of one if the score of product characteristics is positive and zero otherwise. We estimate the likelihood regression below for the subsample of CSR firms. We don't control for *R&D intensity* as it's an indicator forming the score of product characteristics:

$$\textit{Likelihood of Strong Product}_{i,t+1} = F(\beta_0 + \beta_1\ CSR_{i,t} + \beta_2\ Controls_{i,t} + e_{i,t}) \qquad (3)$$

Columns 1 through 4 reported in Table 8 suggest that CSR increases the likelihood of producing quality products. These results indicate that firms engaging in CSR activities are concerned about the quality of their products.

4.4.2. Alternative Measure of CSR

We follow Cheung (2016) and use an alternative measure of CSR, *Csrstr,* calculated as the total strengths of CSR only. Two firms with identical adjusted scores can be very different in terms of their total strengths or total concerns.

Table 5: High and low CSR in the subsample of CSR companies

Dependent Variable =	(1) # of Recalls	(2) # of Recalls	(3) # of Recalls	(4) # of Recalls
Dummy Low CSR	-187.198***		-171.552***	
	(2.973)		(3.391)	
Dummy High CSR		-123.425***		-88.182***
		(3.767)		(3.447)
Book leverage	-116.451***	-377.693***	-162.727***	-662.950***
	(8.728)	(9.697)	(31.466)	(32.136)
Analyst coverage	-0.171	4.012***	2.216***	10.057***
	(0.124)	(0.147)	(0.406)	(0.413)
R&D intensity	-2,323.280***	-888.911***	-5,735.900***	-7,803.363***
	(75.224)	(82.173)	(137.096)	(141.354)
Size	8.269***	45.379***	-8.398	-148.247***
	(0.876)	(0.867)	(7.129)	(7.539)
FCF	-274.708***	14.637	4.418	116.296***
	(37.976)	(42.858)	(40.917)	(44.847)
HHI	-8,260.806***	-5,626.688***	-2,751.599***	7,374.089***
	(299.827)	(337.896)	(578.155)	(595.908)
Constant	391.873***	-49.724***	637.174***	2,264.260***
	(8.798)	(7.235)	(81.881)	(85.658)
Year FE	Yes	Yes	Yes	Yes
Firm FE	No	No	Yes	Yes
Observations	8,616	8,616	8,613	8,613
R^2	0.865	0.825	0.900	0.879

The dependent variable, total recalls, is the total number of recalls for the firm in a year (regression 1-4). The dependent variable, dummy voluntary recall, is a variable that captures whether or not the recall is voluntary or involuntary (regression 5-6). It takes the value of one for voluntary recalls. The variable Dummy Low CSR takes the value of one when the firm CSR score is in the 25th percentile. The variable Dummy High CSR takes the value of one when the firm CSR score is in the 75th percentile. The control variables are for the year prior to the year of product recall and they are defined in the appendix. ***, **, and *indicate significance at the 1%, 5%, and 10% level, respectively.

Table 6: The likelihood of voluntary recalls in the subsample of CSR firms

Dep= Dummy Vol. recalls	(1)	(2)	(3)	(4)	(5)	(6)
CSR 1	0.769*** (0.163)		0.998*** (0.245)			
CSR 2		0.722*** (0.138)		1.250*** (0.223)		
Dummy Low CSR					-0.130* (0.068)	
Dummy High CSR						1.236*** (0.084)
Book leverage			-4.609*** (0.218)	-4.537*** (0.217)	-4.764*** (0.215)	-3.849*** (0.217)
Analyst coverage			0.014*** (0.004)	0.011*** (0.004)	0.020*** (0.003)	0.005 (0.004)
R&D intensity			-10.289*** (2.402)	-11.103*** (2.398)	-8.991*** (2.380)	-7.647*** (2.380)
Size			0.120*** (0.021)	0.113*** (0.021)	0.129*** (0.021)	0.065*** (0.021)
FCF			4.330*** (0.891)	5.048*** (0.906)	3.798*** (0.876)	3.993*** (0.999)
HHI			44.729*** (11.539)	45.921*** (11.516)	44.492*** (11.656)	28.351*** (10.306)
Constant	0.887*** (0.028)	0.878*** (0.028)	1.500*** (0.190)	1.564*** (0.188)	1.466*** (0.209)	1.756*** (0.185)
Observations	8,630	8,616	8,616	8,616	8,616	8,630

The dependent variable Dummy voluntary recall is a dummy variable capturing whether or not the recall is voluntary or involuntary. It takes the value of one for voluntary recalls. The variable CSR 1 represents CSR score for six dimensions (Product characteristics dimension excluded). The variable CSR 2 represents CSR score for five dimensions (Product characteristics and Governance dimensions excluded). The control variables are for the year prior to the year of product recall and they are defined in the appendix. ***, **, and *indicate significance at the 1%, 5%, and 10% level, respectively

Considering strength scores only represent an investment in CSR activities. We re-estimate formula (1) by replacing the CSR variable with *Csrstr* for the subsample of CSR firms only. We construct two different variables: *Csrstr1* and *Csrstr2*. The variable Csrstr1 is calculated yearly as the total adjusted strengths for each firm, excluding the product characteristics dimension. The variable Csrstr2 is calculated yearly as the total adjusted strengths for each firm, excluding product characteristics and corporate governance dimensions. Columns 5 and 6 in Table 8 show that there is a negative relationship between investing in CSR activities and the incidence of product recalls. The results reported in columns 7 and 8 show that the quality of the products measured by the dummy variable *strong product* increases with the increase in total strengths.

Our results using alternative measures reinforce the main finding that engaging in CSR activities decreases the incidence of product recalls.

Table 7: CSR dimensions and Voluntary Recalls in the subsample of CSR firms

Dep=DummyVol. Recalls	(1)	(2)	(3)	(4)	(5)	(6)
Governance	1.042***					
	(0.107)					
Environment		0.902***				
		(0.071)				
Employee			1.350***			
			(0.120)			
Human rights				2.043***		
				(0.169)		
Community					0.051	
					(0.053)	
Diversity						0.245***
						(0.059)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,616	8,616	8,616	8,616	8,616	8,616

This table reports the result of a logit regression of dummy voluntary recalls on different CSR dimensions and controls. The control variables are for the year prior to the year of product recall and they are defined in the appendix. ***, **, and *indicate significance at the 1%, 5%, and 10% level, respectively.

6. ECONOMIC CHANNELS

Thus far, we have shown that firms engaging in CSR activities have better quality products and are more conscientious firms whose recalls are not as egregious in spread across product lines. In the following, we investigate the likely economic channels behind our results.

6.1. The Capital Expenditures Channel

If engaging in CSR impacts firms' decisions, we should observe a significant positive relation between CSR and investments in capital expenditures, as this type of investment directly affects the efficiency of the business processes. Capital expenditures are used to purchase new assets or improve old ones. For this, we estimate the model below:

$$Capex_{i,t+1} = \beta_0 + \beta_1\, CSR_{i,t} + \beta_2\, Controls_{i,t} + Firm\ FE + e_{i,t} \qquad (4)$$

In this regression, we use the variable Market to Book to control for growth opportunities. Our findings are reported in Table 9 (specifications 1 to 3). Our results suggest that there is a positive relationship between CSR and investments in capital expenditures.

Table 8: Alternative measure of product quality

Dep Vble=	(1) Dum. Strong Pdct	(2) Dum. Strong Pdct	(3) Dum. Strong Pdct	(4) Dum. Strong Pdct	(5) # of product recalls	(6) # of product recalls	(7) Dum. Strong Pdct	(8) Dum. Strong Pdct
Dummy Low CSR	1.348***							
	(0.081)							
Dummy High CSR		1.796***						
		(0.084)						
CSR 1			14.394***					
			(0.469)					
CSR 2				12.974***				
				(0.391)				
Csrstr1					-9.708***		2.571***	
					(2.851)		(0.090)	
Csrstr2						-26.999***		3.105***
						(3.419)		(0.096)
Book leverage	-4.110***	-1.729***	-0.829***	-1.255***	-1,329.126***	-1,187.252***	-9.555***	-8.748***
	(0.235)	(0.244)	(0.226)	(0.227)	(45.656)	(47.628)	(0.378)	(0.339)
Analyst coverage	-0.031***	-0.037***	-0.129***	-0.134***	7.876***	7.761***	-0.162***	-0.178***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.471)	(0.470)	(0.005)	(0.006)
Size	0.944***	0.608***	0.507***	0.608***	-7,630.055***	-7,521.657***	-19.980***	-27.275***
	(0.029)	(0.028)	(0.026)	(0.025)	(143.763)	(142.596)	(5.757)	(5.923)
FCF	30.793***	33.063***	42.178***	51.570***	-65.850***	-71.485***	0.643***	0.604***
	(1.221)	(1.570)	(1.557)	(1.639)	(8.288)	(8.011)	(0.035)	(0.032)
HHI	12.450	-28.539*	-11.673	-12.109	-476.086***	-496.750***	8.548***	14.883***
	(13.197)	(16.509)	(15.173)	(15.343)	(51.043)	(50.031)	(2.099)	(1.764)
					4,617.775***	5,012.606***	45.018***	60.580***
					(619.262)	(611.367)	(13.585)	(12.898)
Constant	-10.667***	-7.743***	-7.031***	-8.248***	1,708.652***	1,735.884***	-6.138***	-6.232***
	(0.313)	(0.287)	(0.282)	(0.284)	(93.441)	(90.705)	(0.448)	(0.410)
Observations	8,622	8,622	8,622	8,622	7,838	7,838	7,841	7,841
R-squared					0.891	0.892		

This table reports the results of formula (1) using alternative measures of product quality failure and CSR. Columns 1 – 4, 7 and 8 are logit regressions. Columns 5 and 6 are OLS regressions. The

dependent variable Strong product is a dummy variable that takes the value of one if the adjusted score of the product characteristic dimension is positive and zero otherwise. The variable Csrstr1 is calculated yearly as the total adjusted strengths for each firm excluding the product characteristics dimension. The variable Csrstr2 is calculated yearly, as the total adjusted strengths for each firm excluding product characteristics and corporate governance dimensions. The control variables are for the year prior to the year of product recall and they are defined in the appendix. ***, **, and *indicate significance at the 1%, 5%, and 10% level, respectively

Table 9: Economic channels

	(1) Capex	(2) Capex	(3) Capex	(4) Employee productivity	(5) Employee productivity	(6) Employee productivity
CSR dummy	0.010***			76.948***		
	(16.80)			(46.82)		
CSR 1		0.041***			254.564***	
		(21.83)			(46.55)	
CSR 2			0.039***			211.013***
			(24.86)			(46.28)
Book leverage	0.016***	0.011***	0.009***	-36.900***	-74.249***	-81.523***
	(5.43)	(3.83)	(3.21)	(-4.35)	(-8.80)	(-9.64)
Mkt to Book	0.010***	0.012***	0.013***	11.643***	26.588***	29.389***
	(8.24)	(10.11)	(10.79)	(3.29)	(7.53)	(8.31)
Size	-0.006***	-0.004***	-0.003***	-41.481***	-23.346***	-25.164***
	(-5.51)	(-3.14)	(-3.08)	(12.60)	(-7.09)	(-7.64)
FCF	0.052***	0.053***	0.053***	36.575***	94.622***	110.933***
	(13.76)	(14.84)	(14.95)	(3.37)	(9.09)	(10.75)
Constant	0.106***	0.078***	0.076***	1,040.720***	862.798***	883.165***
	(8.13)	(6.00)	(5.92)	(27.75)	(23.00)	(23.56)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,913	15,026	15,026	14,913	15,026	15,026
R-squared	0.521	0.527	0.531	0.839	0.840	0.840

This table presents the results of an OLS regression of the impact of CSR on Capex (1-3) and Employee productivity (4-6) in the breath sample from 2002 to 2018. The dependent variable CAPEX, is defined as capital expenditures to total assets, and the dependent variable Employee growth, is defined as the change in the number of employees for each firm. The CSR dummy is a dummy variable that takes the value of one when a firm engages in CSR and zero otherwise. The variable CSR 1 represents the CSR score for six dimensions (Product characteristics dimension excluded). The variable CSR 2 represents the CSR score for five dimensions (Product characteristics and Governance dimensions excluded). All independent variables are measured in the year-end prior to the recall campaign, and they are defined in the appendix. T-stats are in parentheses. ***, **, and *indicate significance at the 1%, 5%, and 10% level, respectively

In addition, we find evidence that the impact of CSR on investment decisions in capital expenditures is more pronounced for firms with high CSR scores.

6.2. The Employees' Channel

We investigate the employees' channel as we believe that human capital is essential in the automotive industry. Our results in Panel B of Table 4 support this and show that all CSR activities drive the likelihood of voluntary recalls, including the employee dimension. Guiso, Sapienza, and Zingales (2015) find that employees' positive perception of the management reinforces the integrity within a company. Edmans (2011) documents a positive correlation between employee satisfaction and corporate performance. Lins, Servaes, and Tamayo (2017) find a positive relationship between CSR and employee productivity during the crisis. We follow Lins et al. (2017) and measure employees' productivity as sales divided by the number of employees. We examine whether CSR firms achieve higher sales per employee. For this, we estimate the model below:

$$EmployeeProductivity_{i,t+1} = \beta_0 + \beta_1\ CSR_{i,t} + \beta_2\ Controls_{i,t} + Firm\ FE + e_{i,t} \qquad (5)$$

Our results in Table 9 (specifications 4 to 6) suggest a positive association between CSR and employees' productivity and reinforce the argument about CSR companies being quality firms acting in the best interest of the stakeholders.

7. CONCLUSION

With a recent emphasis on firms' CSR activities and the mechanisms through which CSR affects firm value, this paper examines whether CSR relates to product recalls. Using a sample of product recall events from the automotive industry. After accounting for the breadth of recall campaigns, we find that CSR is negatively and significantly correlated with the incidence of product recalls. We also find that CSR companies initiate more voluntary recalls than non-CSR companies. Thus, our findings support the argument that firms with CSR are higher quality, more conscientious firms whose recalls are not as egregious in spread across product lines. Our results are robust to alternative measures of CSR and product quality. Thus, they provide strong support for the impact of corporate social responsibility on the firm's quality choice.

8. RECOMMENDATIONS

This study contributes to both the literature on the effect of CSR on different managerial decisions and the factors that affect product recalls. Additionally, the study reveals the connection between CSR and product recalls and offers insights to managers, investors, and board members, showing the potential benefits of engaging in CSR activities for the automotive industry. Further research is needed to investigate the relevance of our findings to other industries.

Our results suggest that CSR is a strategic tool in mitigating the risk of product recalls. This highlights the importance of collaboration between regulatory bodies, industries, and CSR experts to develop guidelines and best practices for CSR and reward companies for maintaining high levels

of CSR. CEOs who recognize the potential impact of CSR on product quality and brand reputation can integrate CSR strategies into their core business model. Moreover, the board of directors may consider incorporating CSR metrics into executive compensation to incentivize responsible corporate behavior.

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Appendix A: Details of the construction of control variables

Variable	Definition	Source
Total recalls	Total number of recall product recalls for each firm in each year.	NHTSA
CSR 1	Following Deng et al. 2013, this is an adjusted CSR score that divides the strength and concern scores for six dimensions (product characteristics is excluded) by its respective number of strength and concern indicators in a year and then subtracts adjusted total concern score from adjusted total strength scores.	MSCI ESG
CSR 2	Following Deng et al. 2013, this is an adjusted CSR score that divides the strength and concern scores for five dimensions (corporate governance and product characteristics are excluded) by its respective number of strength and concern indicators in a year and then subtracts adjusted total concern score from adjusted total strength scores.	MSCI ESG
Csrstr 1	Calculated as total adjusted strengths across as the total adjusted strengths excluding the product characteristics dimension.	MSCI ESG
Csrstr 2	Calculated yearly, as the total adjusted strengths for each firm excluding product characteristics and corporate governance dimensions.	MSCI ESG
Product characteristics score	Calculated as the total of adjusted strengths minus total of adjusted concerns for the product characteristic dimension.	MSCI ESG
Book leverage	The sum of the long-term debt and debt in current liabilities (dltt+dlc) divided by total asset (at).	Compustat
Analyst coverage	Number of analysts issuing quarterly EPS forecasts for the year prior to the year of recall. Set equal to zero if the firm is not covered by IBES.	IBES
Free cash flow	Free cash flow is defined as operating income before depreciation minus expenditures on capital expenditure, tax, and interest (oibdp - capx - txt - xint) divided by total asset (at).	Compustat
R&D intensity	R&D intensity is the ratio of research & development expenditure (xrd) to total assets (at).	Compustat
Herfindahl-Hirschman Index	HHI is the sales-based Herfindahl-Hirschman Index at the 3-digit SIC.	Compustat
Size	Size is the logarithm of total assets (at).	Compustat
Market to book	Market to book is market value of assets (prcc_f * csho + at - ceq) divided by book value of assets (at).	Compustat
Sales growth	Change in sales between year t and t-1	Compustat
Employee productivity	Calculated as sales divided by the number of employees (sale/emp).	Compustat
Capex	Calculated as capex to total assets (capx/at)	Compustat

Appendix B: Probit first stage for Heckman method

	(1)
	Dummy CSR
KZ Index	-0.018
	(0.024)
Book leverage	7.043***
	(0.190)
Size	-0.282***
	(0.011)
FCF	31.031***
	(0.788)
HHI	20.810***
	(4.882)
Sales growth	1.930*
	(1.147)
Tobin's Q	0.072
	(0.058)
Constant	0.293
	(0.200)
Observations	11,938

This table displays the results of a probit regression for the Heckman correction model. KZ index as defined by Kaplan and Zingales (1997). Sales growth is defined as the change in sales between two years. Tobin's Q is defined as the market value of assets divided by book value of assets.