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Corporate social responsibility and corporate misconduct☆

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ABSTRACT

We analyze whether price fixing firms modify their Corporate Social Responsibility (CSR) activities around the revelation of the corporate misconduct. Our paper is the first empirical study to specifically explore the timing and the stability of the new CSR investments in firms involved in corporate misconduct. Our results show that firms that participate in illegal price fixing schemes increase their CSR initiatives around the time when they become the target of an antitrust investigation - not before. Moreover, the new CSR initiatives are mainly concentrated on improving positive CSR rather than in reducing further CSR concerns. Finally, we show that the new CSR efforts are not only associated with lower fines. We find that colluding firms tend to lose sales following a cartel breakup, although the decline in sales is less pronounced for those cartel firms that take anticipatory CSR actions to limit the negative impact of fraud revelation.

1. Introduction

A large and growing body of literature examines whether firms use Corporate Social Responsibility (CSR) policies to mitigate the negative implications of the revelation of corporate misconduct. Some of this work studies whether firms increase CSR following a serious corporate scandal, while other studies show that socially responsible firms receive more lenient settlements from prosecutors in case of fraud detection.[1] While the existing body of work indicates that there is a positive association between corporate misconduct and CSR, there is still an open question about the timing when firms tainted by the revelation of corporate scandals engage in new CSR projects and the stability of those CSR initiatives.

In this paper, we study the CSR policies of price fixing firms with special focus on the analysis of the timing and stability of the new CSR efforts in colluding firms. We think it is important to analyze CSR policies in colluding firms for a number of reasons. First, collusion is a kind of fraud that is especially harmful for consumers as price fixing schemes allow for price overcharges of about 20%, on average (Connor and Bolotova, 2006). Second, cartel enforcement actions imply sizeable economic costs for price fixing firms (Aguzzoni et al., 2013). Third, importantly, existing work shows that corporate policies such as specific CSR strategies and price fixing behavior are normally decided at the top of the organizations (Thomas and Simerly, 1995, Harjoto et al., 2015 and Harrington, 2006). Fourth, the analysis of CSR actions in colluding firms is especially illustrative as it allows us to precisely identify the timing of CSR reforms and the stability of these changes overtime.

Cartels have a number of "key dates": the timing when the cartel begins; the period when the cartel breakes up; the time when the cartel became a target of a new antitrust investigation and the exact date when an antitrust authority imposes a fine. Different from other kinds of corporate misconduct, in the setting of cartel investigations it is possible to identify the periods when price fixing fraud occurred, the time when the antitrust investigations becomes public and the exact date of the official fine announcement. We use this crucial information about collusion periods, official investigations and fine announcements to precisely pin down the timing of CSR changes in price fixing firms.

The main contribution of this paper is to analyze the timing and the stability of CSR reforms in firms that become subject to antitrust enforcement actions. Krüger (2015) shows that investors do value "offsetting CSR"; yet, we are unaware of any empirical study that analyzes the timing of the new CSR investments of firms that are likely to face official enforcement actions. We contribute to the existing literature on CSR as we show that CSR initiatives in price fixing firms arise following a cartel breakup

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[1] Examples include Karpoff et al. (2005); Kotchen and Moon (2012); Chakravarthy et al. (2014); Akey et al. (2018); Choi et al. (2018); Hong et al. (2019).

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and persist after the imposition of the official fine. Our evidence suggests that firms that participate in illegal price fixing schemes embark on preemptive efforts to improve their positive CSR actions as they become part of an official price fixing investigation and that those anticipatory CSR actions work as a mechanism to limit the negative impact of fraud revelation.

Our analysis uses the Private International Cartels (PIC) dataset, the most inclusive data set on global cartels available. We restrict the sample to U.S. publicly-traded firms, and use Compustat data to obtain the relevant firm characteristics. We measure Corporate Social Responsibility using the widely-used MSCI ESG Ratings from 1998 to 2016. The scores measure firm-level social responsibility along the lines of community relations, product characteristics, environmental impact, employee relations, diversity and governance. Following Albuquerque et al. (2019), we exclude corporate governance attributes from our analysis to focus on non-governance aspects of CSR and we perform a standardization to make CSR performance comparable over the years. Additionally, given the nature of the corporate misconduct in our study, we exclude the product dimension to capture CSR efforts that are not related to the product characteristics.[2] The MSCI ESG data captures a firm's CSR strengths and concerns, and also provides an overall CSR score for a firm, which is the sum of the indicators for various attributes or actions related to Corporate Social Responsibility.[3] The final sample includes 80 cartel firms that participated in 56 cartels over the years 1998–2012.

Since we can exactly identify collusion and post collusion periods from the antitrust authorities' investigations, our empirical approach helps us reduce the concerns about alternative explanations regarding the CSR activities of colluding firms. We find that cartel firms and their non cartel industry peers exhibit similar CSR patterns during the collusion years (see Figs. 1 and 2). Our parallel trends analysis shows that colluding firms engage in more and new CSR investments after cartels breakup - not before. While we show that firms that participate in illegal price fixing schemes are not likely to modify their CSR initiatives during collusion, we also show that changes in CSR are mainly associated with the timing of the official investigation and the fine announcement. Our evidence shows an increase in CSR in price fixing firms that coincides with the timing of the regulatory investigations and that price fixing firms maintain their CSR initiatives following the antitrust enforcement actions and the imposition of fines. Moreover, the new CSR efforts after the cartel breakup are economically meaningful; positive CSR initiatives after the cartel dissolution represent an increase of 75% with respect to the sample mean.

Furthermore, our analysis shows that, when cartels break up, larger and more visible firms – that are more likely to be exposed to more pronounced costs of fraud revelation – modify their CSR initiatives more intensely (these firms are not necessarily the "cartel leaders", but are the largest firms within a cartel). Additionally, we use a new measure that captures the concept of "product-market fluidity" (Hoberg et al., 2014) to analyze whether firms in more competitive markets invest more in CSR post cartel breakups. Our results show that firms in more competitive industries have a stronger reaction in terms of CSR initiatives after the breakup of the cartel. Also, we show that price fixing firms with lower liquidity levels (for instance, cash holdings) implement only minor new CSR initiatives post collusion. The evidence highlights that firms with low liquidity levels might not be able to embark on new CSR investments, when needed. In sum, we find important cross-sectional variation in terms of the CSR dynamics of price fixing firms; i.e., cartel members react differently as they face "similar" antitrust investigations.

Our analysis suggests that firms that participate in illegal price fixing schemes embark on preemptive efforts to improve their positive CSR actions as they become part of an official price fixing investigation. Our view is that price fixing firms embark in two "rounds" of CSR reforms: some firms engage in a first round of CSR investments that normally coincides with the early stages of an antitrust investigation, while other firms embark in a posterior round of CSR investments that comes around the time of the imposition of fines. Interestingly, we show that firms that increase their CSR investments early on in the investigatory process receive lower fines. However, firms that increase their CSR initiatives only as an official antitrust investigation advances, receive larger official fines. Notably, we find that the sales levels of those colluding firms that implement positive CSR projects following cartel breakup decline by less when compared to the sales and market shares during the collusion periods. The fact that price fixing firms embark in new CSR projects around the time when they receive the official fines, suggests that the objectives of those CSR investments go beyond a mere reduction of the antitrust-related penalties. Our evidence shows that the CSR investments of colluding firms have positive implications in terms of sales and market share, post cartel breakup.

Our paper makes three primary contributions to the existing literature. First, our analysis contributes to the debate on the relationship between CSR investments and overall corporate performance. Busch and Friede (2018) and Friede et al. (2015) present exhaustive overviews of the body of academic research that studies the relationship between CSR and a firm's profitability showing that a large majority of studies report positive findings.[4] Ferrell et al. (2016) take a comprehensive look at CSR around the world and show a positive relation between CSR and firm value. Nguyen et al. (2017) suggest that CSR activities can create shareholder value as long as managers are properly monitored by long term investors. Other studies show that socially responsible firms have lower costs of capital and risk (El Ghoul et al., 2011; El Ghoul et al., 2018) and higher valuations (Albuquerque et al., 2019). Our results suggest that investments in CSR work as a mechanism to limit the negative impact of cartel scandals - in terms of the size of the official fines and in terms of the product market dynamics (i.e., sales and market shares). Nevertheless, we show that price fixing firms with lower liquidity levels are not likely to implement major new CSR initiatives even in cases when CSR proves to be valuable.

Second, our study is clearly related to the body of literature that analyzes the links between the revelation of corporate fraud and the engagement of firms in positive CSR activities. Hong et al. (2019) show that socially responsible firms receive more lenient settlements from prosecutors, but they do not examine the timing and stability of CSR reforms in firms that engage in Foreign Corrupt Practices Act (FCPA) violations. In the context of antitrust investigations, we find that price fixing firms do not modify their CSR strategies during collusion but adapt their CSR efforts as the official investigation advances. Our work indicates that firms modify their CSR initiatives in anticipation of the revelation of the corporate scandal and that the new CSR activities persist following cartel enforcement actions. We contribute to the existing literature on CSR as we show that new CSR initiatives in price fixing firms arise following a cartel breakup and persist even after the imposition of the official fine.

[2] Cartel firms can collude on prices and/or other product characteristics (i.e., quality).

[3] According to MSCI ESG guidelines, a one point increase in MSCI ESG requires a firm to change one corporate social responsibility indicator from a concern to neutral, or from neutral to a strength.

[4] In addition to the empirical research, Fatemi et al. (2015) provide a valuation model to show that under certain circumstances CSR expenditures create value for the firm. Also, Albuquerque et al. (2019) have a model and present empirical evidence predicting that CSR decreases systematic risk and increases firm value.

Third, our work is also related to the recent literature on cartel firms and their effect on corporate policy decisions. González et al. (2019) document a number of empirical regularities indicating that cartel firms have relatively poor corporate governance, and also find that managers have higher job security and obtain relatively high compensation packages during collusion. Ferrés et al. (2021) show how price fixing firms modify their capital structure to signal their commitment to cartel stability. Campello et al. (2017) show that price fixing firms with more independent boards are more likely to conduct internal investigations in order to uncover price fixing practices and to favor cooperation with antitrust prosecutors. Our study contributes to this line of literature examining corporate policy decisions related to social responsibility as a mechanism to mitigate the costs associated with the revelation of price fixing scandals.

The remainder of the paper proceeds as follows. In Section 2, we review the relevant literature. In Section 3, we describe the institutional setting. In Section 4, we explain the dataset and summary statistics, while in Section 5 we present the evidence of CSR performance in price fixing firms. In Section 6, we present a number of cross-sectional tests that show different reactions in CSR investments following a cartel breakup depending on specific firm and industry characteristics. In Section 7, we discuss the implications of enhanced CSR initiatives in terms of corporate fines and product market performance after a cartel dissolution. Lastly, we conclude in Section 8.

2. Related literature

This paper contributes to the literature on the relationship between corporate finance and CSR. While CSR can lead to shareholder value maximization because it offers a channel for firms to promote their relations with relevant stakeholders (Albuquerque et al. (2019); Servaes and Tamayo (2013)), it could also be a reflection of agency problems, largely benefiting managers to the detriment of shareholders (Cheng et al., 2016). Busch and Friede (2018) and Friedew et al. (2015) highlight that most of the academic work that studies the relationship between CSR and a firm's profitability shows positive results. Nguyen et al. (2017) suggest that CSR activities can create value for shareholders as long as managers are properly monitored by long term investors. Masulis and Reza (2014) find that firms reduce charitable giving following an increase in managerial ownership stakes. Using a different perspective, Ferrell et al. (2016) find that well-governed firms that suffer less from agency concerns engage more in CSR. Our work adds new empirical evidence to this debate as it indicates that firms that participate in illegal price fixing schemes embark upon efforts to improve their positive CSR actions around the time when they face a new official antitrust investigation and that those new CSR actions persist even after the imposition of corporate fines. Although CSR can be an effective mechanism to reduce the costs of fraud revelation, we show that price fixing firms with lower liquidity levels do not engage in major CSR initiatives that might offset the negative impact of a cartel investigation.

Also, our study relates to the literature that analyzes whether firms use CSR initiatives to weather the storm following the revelation of the corporate misconduct. Existing work shows that fraudulent firms modify specific corporate policies during the years when they commit fraud or later on. Hoberg and Lewis (2017) show that fraudulent firms produce an excess of disclosure in their 10K MD&A sections. Zaldokas et al. (2019) empirically show that U.S. firms reduce their description about their competitive environment in 10-K statements following the dissolution of cartels. They also disclose it in a more noisy fashion. Chakravarthy et al. (2014) find that firms substantially increase reputation-building actions after a serious earnings restatement. Kotchen and Moon (2012) find support for the hypothesis that firms with more CSR controversies also have incentives to act more socially responsible. In particular, the authors find that companies engage in positive CSR initiatives in order to offset negative CSR actions that are perceived as socially irresponsible. Hong et al. (2019) show that socially responsible firms receive more lenient settlements from prosecutors in case of violation of the Foreign Corrupt Practices Act (FCPA). Our work indicates that price fixing firms increase their positive CSR initiatives in anticipation of the revelation of price fixing scandals and that this improvement in their overall CSR scores persists over time. Moreover, we show that the new CSR investments are associated with enhanced sales growth, in the post collusion years.

This paper is also related to the academic literature that analyzes corporate policies in price fixing firms. Existing work highlights that certain corporate governance structures and executive compensation schemes may facilitate or prevent collusive agreements. Harrington (2006) suggests that the decision of joining a cartel is typically decided at the very top level of the firm's hierarchy. Spagnolo (2005) argues that low-powered managerial incentives schemes (such as capped bonus plans) favor tacit collusion because managers lack incentives to ever undercut prices. On the empirical side, González et al. (2019) investigate the corporate governance of cartel firms. They document a number of empirical regularities indicating that cartel firms have relatively poor corporate governance. For example, cartel firms have a high proportion of "busy" directors; when directors resign, they are not often replaced, and new auditing firms are engaged significantly less often than expected. On the other hand, Campello et al. (2017) show that price fixing firms with more independent boards are more likely to cooperate with antitrust prosecutors. Our work adds new empirical evidence by showing that firms which participate in illegal price fixing schemes do not initiate new positive CSR actions during collusion, but invest in novel CSR initiatives as they face official antitrust investigations.

3. Institutional setting

On average, international cartels are formed by 6–7 corporate members from around the world and last for 5–6 years (see Levenstein and Suslow, 2006). During collusion, cartelists are able to artificially increase market prices by approximately 20% (Connor and Bolotova, 2006). Bos and Harrington (2010) explain that larger firms have stronger incentives to form a cartel than smaller ones because the collusive price is higher when larger firms jointly decide to restrain supply. Cartels are more common than is widely known. Since the late-1990s, a wave of price fixing scandals in important international markets such as the markets for vitamins, graphite electrodes, lysine, sorbates, air-travel and auto-parts has raised substantial concerns about the pervasiveness of cartel activity around the world.

Levenstein and Suslow (2011) distinguish between those cartels for which the cause of breakup was government antitrust enforcement and those that dissolved for other reasons, such as cheating or a growing fringe of non cartel producers. Cartel investigations arise from several sources: governmental agencies investigating other corporate misconduct, formal complaints, amnesty applications, and proactive efforts by antitrust authorities (Baker, 2003). Some cartels are first revealed to the public when a fine, a guilty plea, or an indictment is announced in press releases by the relevant antitrust authority (Aguzzoni et al., 2013). In other cases, cartel investigations become known to the public as a result of the revelation of an early investigative event, such as surprise inspections conducted by an investigating antitrust agency. On average, antitrust investigations in our sample begin about one year after cartels break up while official fine announcements occur approximately 3–4 years after the dissolution of cartels. The official fine

Table 1
Summary Statistics. This table reports descriptive statistics for our sample of firms prosecuted for cartel participation (including observations from up to five years prior to the cartel formation to up to five years after the cartel breakup) and for the control firms (non-colluding industry peers). See Appendix A for complete variable definitions. Differences significant at: *10%, **5% and ***1%.

	Firms			Colluding Firms (CF)			Non-colluding Firms (NCF)			Mean test
	N	Mean	Std	N	Mean	Std	N	Mean	Std	CF-NCF
CSR-Strengths	4489	0.041	0.062	665	0.070	0.078	3824	0.035	0.058	0.035***
CSR-Concerns	4489	0.030	0.033	665	0.047	0.039	3824	0.027	0.031	0.020***
CSR-Score	4489	0.011	0.065	665	0.023	0.073	3824	0.009	0.063	0.014***
Market Share	4489	0.061	0.125	665	0.216	0.210	3824	0.034	0.076	0.182***
Sales Growth	4469	0.169	0.988	665	0.067	0.180	3804	0.187	1.067	−0.12***
Size	4489	7.438	1.776	665	8.826	1.460	3824	7.197	1.715	1.629***
ROA	4489	0.011	0.263	665	0.056	0.07	3824	0.004	0.283	0.052***
Leverage	4489	0.194	0.200	665	0.255	0.150	3824	0.183	0.206	0.072***
Tangibility	4489	0.254	0.227	665	0.315	0.191	3824	0.243	0.231	0.072***
MTB	4489	2.088	2.011	665	1.662	1.419	3824	2.162	2.089	−0.5***
Dividends	4489	0.013	0.025	665	0.018	0.024	3824	0.012	0.025	0.006***
Cash to Assets	4489	0.246	0.234	665	0.111	0.121	3824	0.269	0.240	−0.158***
CF Volatility	4489	0.054	0.232	665	0.023	0.025	3824	0.059	0.251	−0.036***

announcement is the confirmatory statement that "proves" the formal existence of a price-fixing misconduct.

4. Data

Our analysis uses the Private International Cartels (PIC) database, which contains information on virtually all the private international cartels identified by antitrust authorities between 1998 and 2012 (this database is described in detail in Connor, 2014). To our knowledge, it is the most inclusive data set on price fixing cartels available.

The PIC data includes only cartels with an "international" characteristic, i.e., cartels that include firms from multiple countries, or cases in which an antitrust authority prosecuted foreign firms. The information in the PIC database is collected from press releases issued by antitrust authorities such as the Department of Justice and the Federal Trade Commission in the U.S., the European Commission (Directorate-General for Competition), or Canada's Competition Bureau. Firms are included in the database if an antitrust authority imposed fines or if class action lawsuits were filed. Since many cartels remain undetected (Connor, 2014 estimates that only approximately 10–30% of all cartels are detected; see also Bryant and Eckard, 1991), the data does not include all cartels but only those that were detected and for which a conviction was possible. Also note that the PIC dataset covers only "private" cartels — public-sanctioned cartels (for example, the Organization of the Petroleum Exporting Countries – OPEC) are excluded, because they are not at risk of prosecution.

From the PIC database, we collect the following information for each cartel firm: name, country of incorporation, and the "key dates": the start and end dates of collusion, the time when the cartel became a target of a new antitrust investigation and the exact date when an antitrust authority imposed a fine. We restrict the sample to U.S. publicly-traded firms, since several of our tests use additional data sets that focus on U.S. firms. We require that these firms be included in Compustat and in the MSCI ESG dataset.

The PIC data includes a number of cartel firms that participated in more than one cartel, so they have multiple collusion periods that may overlap. Since the timing of collusion is central to our identification, we keep only those cases that allow us for a clear identification of the collusion and post collusion periods. Hence, in this paper we focus on cartel firms that participate in a single cartel at some point in time between 1998 and 2012. The final sample includes around 665 firm-year observations for 80 cartel firms that participated in 56 cartels. Of these firm-year observations, 235 observations correspond to active collusion years, 128 to pre-collusion years, and 302 to post-collusion years.

To implement our baseline tests we use a sample of "single cartel" firms (treatment group) and a control group that we obtain using the Hoberg-Phillips (H-P) pairwise product similarity data (Hoberg and Phillips, 2010). We identify firms considered as similar to the treated firms according to H-P one year before a cartel breakup. On top of that, we exclude from the control group firms that are similar according to H-P, but they belong to a different four-digit SIC. Hence, we consider only similar firms that are in the same industry as the cartel firms.

We measure CSR using the MSCI ESG Ratings, a widely-used database in the literature for measuring CSR.[5] MSCI ESG measures firm-level social responsibility along the lines of community relations, product characteristics, environmental impact, employee relations, diversity and governance. However, in this study we focus on the following CSR dimensions: community relations, environmental impact, employee relations and diversity. We follow Albuquerque et al. (2019) to exclude the governance dimension. Moreover, given the nature of the corporate misconduct in our study, we exclude the product dimension to capture CSR efforts that are not related to product characteristics. We obtain MSCI ESG data from 1998 to 2016, which allows us to analyze CSR dynamics in cartel firms for a longer period of time. While the cartel sample includes firms that participate in price fixing firms between 1998 and 2012, we are able to observe their CSR dynamics up to 2016. Effectively, using more updated CSR data allows to improve our analysis of the CSR dynamics in more recent cartels (especially during post collusion periods).

For each of the CSR categories, MSCI ESG compiles a set of "Performance Indicators/Attributes", divided into *CSR Strengths* and *CSR Concerns*. These indicators are based on annual assessments of a firm's CSR performance from multiple sources, such as company reports, media, academic and NGO datasets, among others. The variable *CSR Score* captures the aggregate MSCI ESG score, which is the difference between *CSR Strengths* minus *CSR Concerns*. However, given that the MSCI ESG ratings (strengths / concerns) change over the years, we follow Albuquerque et al. (2019) and normalize the *CSR Strengths, CSR Concerns* and *CSR Score* to make them comparable over the years.

In Table 1 we present the summary statistics. The sample for our baseline tests spans the 1998–2016 years and comprises 4489 firm-year observations. The subsample of colluding-firms contains 665 firm-year observations and the subsample of control firms (non-colluding firms, similar firms operating in the same industry) has 3824 firm-year observations. On average, colluding firms are larger and more profitable than non-colluding firms. Also, colluding firms have lower market-to-book values and lower cash flow volatility. The mean number of *CSR Strengths* (*CSR Concerns*) is

[5] See, for example, Kotchen and Moon (2012); Cheng et al. (2016); Krüger (2015); Statman and Glushkov (2009); Kempf and Osthoff (2007); Renneboog et al. (2008).

Table 2
CSR in Colluding Firms - Baseline. This table presents the CSR performance of cartel firms during collusion years and post collusion years. The dependent variable is CSR performance measured as: *Strengths, Concerns* and *Score*. In all the regressions we use as control firms those (non-colluding) firms that are similar according to H-P (Hoberg and Phillips, 2010) and operate in the same industry (4-digit SIC code) as the colluding firms. *Collusion(C)* takes the value of 1 for cartel firms during collusion years, and 0 otherwise. *Post Collusion (PC)* takes the value of 1 for cartel firms during the 5 years after the cartel breakup, and 0 otherwise. The set of control variables comprises *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout, Cash to Assets* and *Cash Flow Volatility*. In all the columns we include industry-year and firm fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at firm level. Statistical significance at the 10%, 5% and 1% levels are denoted by *, ** and ***, respectively.

CSR:	Strengths			Concerns			Score		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Collusion (C)	.008	.008		.006	.007		.002	.0008	
	(.011)	(.011)		(.005)	(.005)		(.013)	(.013)	
Post Collusion (PC)	.035	.035	.031	.006	.007	.004	.029	.027	.027
	(.012)***	(.012)***	(.008)***	(.006)	(.006)	(.004)	(.013)**	(.013)**	(.008)***
Size		.009	.009		-.003	-.003		.012	.012
		(.003)***	(.003)***		(.002)**	(.002)**		(.004)***	(.004)***
ROA		-.007	-.007		.001	.001		-.008	-.008
		(.003)**	(.003)**		(.001)	(.001)		(.003)**	(.003)**
Leverage		.003	.002		.006	.006		-.003	-.003
		(.007)	(.007)		(.004)	(.004)		(.009)	(.009)
Tangibility		-.006	-.006		.013	.013		-.019	-.019
		(.022)	(.022)		(.011)	(.011)		(.022)	(.022)
MTB		-.001	-.001		-.0004	-.0003		-.001	-.001
		(.0007)*	(.0007)*		(.0003)	(.0003)		(.0007)	(.0007)
Dividends		.104	.104		-.071	-.071		.175	.175
		(.054)*	(.054)*		(.022)***	(.022)***		(.056)***	(.056)***
Cash to Assets		.007	.007		.003	.003		.004	.004
		(.011)	(.010)		(.005)	(.005)		(.012)	(.012)
CF Volatility		.001	.001		.0004	.0004		.001	.001
		(.002)	(.002)		(.002)	(.002)		(.003)	(.003)
Industry-Year F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4489	4489	4489	4489	4489	4489	4489	4489	4489
R^2	.81	.813	.813	.786	.788	.788	.755	.76	.76
PC-C	0.027***	0.027***		0.000	0.000		0.027***	0.026***	

0.07 (0.047) for colluding-firms and 0.035 (0.027) for non colluding firms, respectively. The *CSR Score* for colluding and non-colluding firms is 0.023 and 0.009, respectively. In sum, price fixing firms have higher levels of *CSR Strengths, CSR Concerns* and *CSR Score.*

5. Empirical results

In this section, we analyze whether price fixing firms engage in positive CSR following a cartel breakup. Given that we use very granular data about the collusion periods and the dates of the official enforcement announcements, we precisely pin down the timing of the new CSR dynamics in firms that participate in illegal price fixing schemes.

We first use graphical analysis (univariate tests) to show that cartel firms and their industry peers exhibit similar pre-treatment CSR dynamics (during collusion). In Fig. 1, we show that price fixing firms increase their CSR strengths about 1–2 years just after cartels dissolve. Importantly, the "net" CSR scores - measured as the difference between CSR strengths and concerns - increase post collusion. Notably, we find that only the CSR dimensions of cartel firms change after cartels breakup.

5.1. Baseline regression

To analyze the relation between collusion and Corporate Social Responsibility we follow Ferrés et al. (2021) and employ a baseline empirical model using cartel firms and non-cartel firms in those industries where the collusion agreement took place:

$$y_{it} = \alpha + \beta_1 Collusion_{it} + \beta_2 Post\,Collusion_{it} + \Omega' Z_{it} + \phi_i + \mu_{jt} + \epsilon_{it} \quad (1)$$

The subscript i indexes firms, j indexes industries, and t indexes years. We analyze a number of CSR outcomes: y_{it} captures the *CSR Strengths, CSR Concerns* and *CSR Score.*

The specification of Eq. (1) is essentially a difference-in-differences strategy with two treatments: *Collusion* and *Post Collusion. Collusion* takes the value of 1 for cartel firms during collusion years, and 0 otherwise; for non-cartel firms, *Collusion* takes the value of 0. *Post Collusion* takes the value of 1 for cartel firms during the 5 years after a cartel is dissolved, and 0 otherwise; for non cartel firms, *Post Collusion* takes the value of 0. This research design allows us to compare differences in CSR in collusion years of cartel firms with both non-cartel firms and non-collusion years of cartel firms. It also differentiates years after collusion from other non-collusion years (until 5 years prior to the collusion period) to capture the potential effects of a cartel dissolution on its members' CSR policies.[6]

It is important to highlight that our objective is to understand the timing and the intensity of CSR in colluding firms during collusion and after the breakup of the cartel. Hence, the key parameters of interest are β_1 and β_2, which should be positive if price fixing firms increase their CSR policies *(CSR Strengths* and *CSR Score*) during or after the collusion years. We include a set of control variables Z: *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout*, the ratio of *Cash/Total Assets* and *Cash Flow Volatility*. See Appendix A for complete variable definitions. Firm and industry-year fixed effects are represented by ϕ_i and μ_{jt}, respectively.[7] Similar to Ferrés et al. (2021), including industry-year fixed effects allows us to control for industry trends (or industry shocks) that affect both cartel and non-cartel firms simultaneously.

In Table 2 we present the results of estimating Eq. (1). The coefficients associated with the *Collusion* dummy are not statistically

[6] We do not include observations for the years following *Post Collusion*, so the default period consists only of pre-collusion years. Although, in alternative specifications we exclude the dummy *Collusion* as well. In those cases, the default periods would be pre-collusion and collusion years.

[7] In all our specifications we adjust standard errors for heteroscedasticity. We cluster standard errors at the firm level. We obtain similar results if we cluster at industry level.

significant, which suggests that there is no impact of collusion on CSR (compared to the pre-collusion years). The results show that *CSR Strengths* (columns 1–3) increase following a cartel breakup; i.e., the coefficients associated with the *Post Collusion* dummy are positive and statistically significant at conventional levels (p-value is 5%). These results are robust to different specifications; for instance, the magnitude and statistical significance of *Post Collusion* is not affected by the inclusion of control variables in our tests (see columns 1 and 2). Importantly, the difference in coefficients between *Post Collusion* and *Collusion* is statistically significant (see bottom of table).

In column (3), we also show an alternative specification where we exclude the *Collusion* dummy to test whether cartel firms increase their CSR efforts after the dissolution of the cartel relative to pre-collusion and collusive periods altogether. We find that the coefficient of *Post Collusion* remains significant, and similar in magnitude to those coefficients in previous columns. These results suggest that cartel firms improve *CSR Strengths* after a cartel breakup and the improvement is not only with respect to pre-collusion years but also compared to the period when the illegal price fixing scheme took place. The increase in *CSR Strengths* after the cartel breaks up is economically significant. *CSR Strengths* increase by 0.031-0.035 and given that the mean of *CSR Strengths* in the full sample is 0.041, we consider that the increase is economically meaningful. In fact, the impact on positive CSR initiatives after the cartel dissolution represents an increase of 75% with respect to the sample mean.

Moreover, the *CSR Concerns* remain about the same as compared to the overall levels for industry peers during both time periods (columns 4–6). The coefficients associated with *Collusion* and *Post Collusion* are equal in magnitude, although they are not statistically significant in all specifications. These results suggest that cartel firms do not reduce CSR *Concerns* as a way to offset the problems caused by the revelation of the price fixing scandal.

Interestingly, the coefficients for *Post Collusion* in the *CSR Score* tests are positive and statistically significant in all the specifications (see columns 7–9). Note that those coefficients are exactly equal to the difference between the coefficients for *Post Collusion* in the *CSR Strengths* and CSR *Concerns* tests. For instance, the coefficient in column (7) is 0.029 (0.035 minus 0.006) which is equal to the coefficient in column (1) minus the coefficient in column (4). Hence, we find that colluding firms only engage in positive CSR initiatives (the final effect on *CSR Score* is mainly driven by improvements in *CSR Strengths*) following a cartel breakup and we interpret this finding as an attempt by firms to engage in new repairing actions post collusion. Finally, after the cartel breakup *CSR Score* increases by 0.027 (on average); and given that the mean of *CSR Score* for the full sample is 0.011, the effect is economically meaningful.

5.2. Robustness

We implement a robustness test using a refined control group obtained using the Coarsened Exact Matching (CEM) technique (Balsmeier et al., 2017; Blackwell et al., 2009; Ferrés et al., 2021; Iacus et al., 2012). In this matching approach, "treated" and "control" samples are divided into cells by multivariate sorting and then matched within each cell. A key advantage of CEM over other matching techniques is that there is no need to fix the control sample size ex ante (e.g., 1:N matching in the case of propensity score matching). Within the industries of cartel firms, we sort the observations by *Size* (15 bins), *MTB* (30 bins), and *ROA* (80 bins).

In Panel A of Table 3 we show the results of the matching technique. Even though we match on *Size, MTB* and *ROA* cartel firms

Table 3
CSR in Colluding Firms - Matching. This table presents the CSR performance of cartel firms during collusion years and post collusion years using a matched sample. The dependent variable is CSR performance measured as: *Strengths, Concerns* and *Score.* In all the regressions we use as control firms those (non-colluding) firms that are similar according to H-P (Hoberg and Phillips, 2010) and operate in the same industry (4-digit SIC code) as the colluding firms. We employ coarsened exact matching (CEM) procedure to obtain a set of control observations comparable to those from the single-cartel sample. Panel A shows the results of matching process. Panel B shows the baseline results using the matched sample. *Collusion (C)* takes the value of 1 for cartel firms during collusion years, and 0 otherwise. *Post Collusion (PC)* takes the value of 1 for cartel firms during the 5 years after the cartel breakup, and 0 otherwise. The set of control variables comprises *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout, Cash to Assets* and *Cash Flow Volatility*. In all the columns we include industry-year and firm fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at firm level. Statistical significance at the 10%, 5% and 1% levels are denoted by *, ** and ***, respectively.

Panel A: Cartel firms vs. matched non-cartel firms

Variable (mean)	Cartel Firms	Non-Cartel Firms	Difference
Size	8.714	8.743	-0.029
ROA	0.057	0.056	0.001
Leverage	0.262	0.261	0.001
Tangibility	0.302	0.286	0.016
MTB	1.554	1.664	-0.110
Dividends	0.015	0.017	-0.002
Cash to Assets	0.102	0.132	−0.030**
CF Volatility	0.022	0.020	0.002
N Obs	335	906	
N Firms	58	190	

Panel B: CSR performance of cartel firms during collusion years and post-collusion years

CSR:	Strengths			Concerns			Score		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Collusion (C)	.017	.011		-.001	-.003		.018	.014	
	(.016)	(.013)		(.008)	(.009)		(.017)	(.015)	
Post Collusion (PC)	.045	.033	.028	-.001	-.006	-.004	.047	.039	.032
	(.020)**	(.016)**	(.011)**	(.010)	(.009)	(.006)	(.016)***	(.015)***	(.010)***
Control Variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry-Year F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1241	1241	1241	1241	1241	1241	1241	1241	1241
R^2	.944	.949	.949	.913	.918	.917	.925	.929	.929
PC-C	0.028***	0.022***		0.000	−0.003		0.029**	0.025**	

Table 4
CSR in Colluding Firms - Timing. This table presents the timing of CSR performance of cartel firms after the collusion years. The dependent variable is CSR performance measured as: *Strengths*, *Concerns* and *Score*. In all the regressions we use as control firms those (non-colluding) firms that are similar according to H-P (Hoberg and Phillips, 2010) and operate in the same industry (4-digit SIC code) as the colluding firms. *Collusion (C)* takes the value of 1 for cartel firms during collusion years, and 0 otherwise. *Post Collusion* $t+\tau$ ($PC_{t+\tau}$) takes the value of 1 for cartel firms in the year τ after the cartel breakup, and 0 otherwise. *Collusion* $t-\tau$ ($C_{t-\tau}$) takes the value of 1 for cartel firms in the year τ before the cartel breakup, and 0 otherwise. For instance, *Collusion Breakup* ($t=-2$) and *Collusion Breakup* ($t=-1$) are dummy variables indicating two years and one year before the cartel breakup, respectively. Moreover, *Collusion Breakup* ($t=0$) takes the value of one the year of the cartel dissolution, and zero otherwise. The set of control variables comprises *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout, Cash to Assets* and *Cash Flow Volatility*. In all the columns we include industry-year and firm fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at firm level. Statistical significance at the 10%, 5% and 1% levels are denoted by *, ** and ***, respectively.

CSR:	Strengths			Concerns			Score		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Collusion (C)	.008			.007			.001		
	(.011)			(.005)			(.013)		
Collusion Breakup ($t=-2$)			.011			.001			.009
			(.009)			(.005)			(.011)
Collusion Breakup ($t=-1$)			.011			.002			.009
			(.010)			(.006)			(.013)
Collusion Breakup ($t=0$)			.016			.003			.013
			(.010)*			(.006)			(.013)
Post Collusion $t+1$ (PC_{t+1})	.027	.023	.027	.006	.002	.003	.021	.021	.025
	(.015)*	(.010)**	(.012)**	(.006)	(.005)	(.006)	(.017)	(.011)*	(.014)*
Post Collusion $t+2$ (PC_{t+2})	.028	.024	.028	.007	.003	.004	.021	.020	.024
	(.013)**	(.009)**	(.011)**	(.007)	(.005)	(.006)	(.014)	(.010)**	(.012)**
Post Collusion $t+3$ (PC_{t+3})	.035	.030	.035	.011	.008	.009	.023	.023	.026
	(.013)***	(.009)***	(.011)***	(.007)	(.006)	(.007)	(.014)	(.010)**	(.012)**
Post Collusion $t+4$ (PC_{t+4})	.040	.036	.041	.008	.004	.005	.033	.032	.036
	(.013)***	(.012)***	(.012)***	(.007)	(.005)	(.006)	(.013)**	(.011)***	(.012)***
Post Collusion $t+5$ (PC_{t+5})	.038	.035	.039	.004	.001	.002	.034	.034	.037
	(.013)***	(.011)***	(.012)***	(.007)	(.005)	(.006)	(.015)**	(.013)***	(.013)***
Post Collusion $t+6$ (PC_{t+6})	.022	.018	.022	.004	.0005	.001	.018	.018	.021
	(.011)**	(.009)*	(.010)**	(.006)	(.005)	(.005)	(.011)*	(.009)*	(.009)**
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4548	4548	4548	4548	4548	4548	4548	4548	4548
R^2	.814	.814	.815	.791	.79	.79	.762	.762	.762
$PC_{t+1}-C$	0.019**			−0.001			0.020**		
$PC_{t+2}-C$	0.020**			0.000			0.020**		
$PC_{t+3}-C$	0.027***			0.004			0.022***		
$PC_{t+4}-C$	0.032***			0.001			0.032**		
$PC_{t+5}-C$	0.030**			−0.003			0.033**		
$PC_{t+6}-C$	0.014			−0.003			0.017		

and the new control observations are similar in all the covariates, except *Cash/TA*. Unfortunately, the number of treated firms and observations is reduced. Now, our sample contains roughly 70% of the treated firms that we use in the baseline regression. That is because the number of firms in the MSCI ESG data set is a subset of the Compustat universe which reduces the possibilities to find a control firm for each cartel firm (CEM drops those observations in the treated sample without a counterpart in the set of potential control firms).

In Panel B of Table 3, we present the results of estimating Equation (1) using the control group that we obtain using the CEM technique. As before, the results show that *CSR Strengths* (columns 1–3) and *CSR Score* (columns 7–9) increase following a cartel breakup; i.e., the coefficients associated with the *Post Collusion* dummy are positive and statistically significant. Moreover, the difference in the coefficients associated with *Post Collusion* and *Collusion* is statistically significant for CSR *Strengths* and *Score*. Hence, taking the results in Table 2 and Table 3 together, we find robust evidence that colluding firms increase CSR in the post cartel years.

5.3. CSR dynamics

Further, we analyze the exact timing of the CSR changes in price fixing firms. To address this question, we look at CSR activity for each year after collusion. Instead of using the *Post Collusion* dummy variable, we create a dummy variable for each year after the collusion period. *Post Collusion*$_{it}(t+\tau)$, is a dummy variable that takes the value of 1 in the year τ after the collusion period for cartel firms. *Post Collusion*$_{it}(t+\tau)$ takes the value of 0 for control firms.[8] We then run a modified version of Eq. (1) employing up to six years after the cartel breakup:

$$y_{it} = \alpha + \beta_1 Collusion_{it} + \sum_{\tau=1}^{6} \beta_2^{t+\tau} Post\ Collusion_{it}(t+\tau) + \Omega' Z_{it} + \phi_i + \mu_{jt} + \epsilon_{it} \quad (2)$$

In Table 4, we present the results of estimating Eq. (2). Similar to the results we show in Tables 2 and 3, the coefficients associated with the *Collusion* dummy are not statistically significant in any column. The evidence shows that *CSR Strengths* (columns 1–3) increase after the cartel breakup; i.e., the coefficients associated with the *Post Collusion*$_{it}(t+1)$ dummy are positive and statistically significant. Note that the difference between the coefficients for *Collusion* and *Post Collusion*$_{it}(t+1)$ is statistically significant at 5% level (columns 1–2). Moreover, the coefficients associated with *Post Collusion*$_{it}(t+2)$ to *Post Collusion*$_{it}(t+6)$ are statistically significant. Interestingly, the magnitude of the coeffi-

[8] We use observations of cartel firms until year 6 to show a broader picture of the CSR dynamics.

cients increase monotonically up to year 4 and then decrease until year 6 (the dummy *Post Collusion*$_{it}(t+6)$ is similar in magnitude to *Post Collusion*$_{it}(t+1)$). The evidence that *CSR Strengths* increase monotonically in the years immediately following the collusion period up to year t+4 (peak), is consistent with the fact that most firms are prosecuted around four years after a cartel breakup.

It is important to highlight that the results for *CSR Strengths* (and *CSR Score*) are robust to alternative specifications. In fact, in column (3) we use a multivariate regression to show, more precisely, that the parallel trend assumption holds (Fig. 2 shows the complete CSR dynamics before and after the cartel dissolution for the three CSR dimensions). We now use three dummies (*Collusion Breakup* $(t=-2)$, *Collusion Breakup* $(t=-1)$ and *Collusion Breakup* $(t=0)$) that also capture the CSR dynamics in the two years before the breakup of the cartel and the year of the price fixing scheme dissolution. We find that in the last years of the collusive period cartel firms and control firms share similar CSR patterns (pre-treatment trends).

Consistent with the evidence we showed before, the results in columns 4–6 indicate that *CSR Concerns* do not change around cartel breakups. Importantly, we find that *CSR Score* follows the same dynamics as *CSR Strengths* showing that the increase in *CSR Score* is largely explained by new positive *CSR* investments - not by a reduction in *CSR Concerns*.

5.4. CSR and enforcement actions

It is still important to analyze whether the changes in CSR policies in price fixing firms take place before or after the official announcement of an antitrust indictment. Hence, we divide the *Post Collusion* years into three periods based on the timing of the cartel breakup, the time when an official antitrust investigation was first known by the public and the exact date of the final fine announcement. Instead of using only the *Post Collusion* dummy variable, we create dummy variables for each subperiod during the years following collusion. *Post Collusion – Before Notice*$_{it}$, is a dummy variable that takes the value of 1 for the years after the collusion period and before the first notice of official investigation for cartel firms; and 0 otherwise. Note that *Post Collusion – Before Notice*$_{it}$ takes the value of 0 for all control firms. *Post Collusion – After Notice*$_{it}$, is a dummy variable that takes the value of 1 for cartel firms in the years after the collusion period and after the first notice of an official price fixing investigation for cartel firms, but before the official fine announcement; and 0 otherwise. *Note that Post Collusion – After Notice*$_{it}$ takes the value of 0 for control firms. *Post Collusion – After Fine*$_{it}$, is a dummy variable that takes the value of 1 for cartel firms in the years after the collusion period and after the fine announcement up to year 5 of the post-collusion years; and 0 otherwise. Note that *Post Collusion – After Fine*$_{it}$ takes the value of 0 for control firms.

We run a modified version of Eq. (1):

$$y_{it} = \alpha + \beta_1 Collusion_{it} + \beta_2 Post\ Collusion - Before\ Notice_{it} + \beta_3 Post\ Collusion - After\ Notice_{it} + \beta_4 Post\ Collusion - After\ Fine_{it} + \Omega' Z_{it} + \phi_i + \mu_{jt} + \epsilon_{it} \quad (3)$$

In Table 5 we present the results of estimating Eq. (3). We find that colluding firms increase their CSR efforts immediately after the first notice of an official antitrust investigation. In columns (1)-(3) and (7)-(9) the coefficients for the *Post Collusion – After Notice* dummy are positive and statistically significant. Note that the difference in coefficients for the *Collusion* and *Post Collusion – After Notice* dummies is statistically significant at the 5% level in all the columns. Moreover, the estimated coefficients associated with *Post Collusion – After Notice* and the *Post Collusion – After Fine* (which is also statically significant) are quantitative similar and

Table 5
CSR in Colluding Firms - Official Investigation and Fine Announcement. This table presents the results of CSR performance of cartel firms during collusion years and post collusion period divided in three subperiods. The dependent variable is CSR performance measured as: *Strengths, Concerns* and *Score.* In all the regressions we use as control firms those (non-colluding) firms that are similar according to H-P (Hoberg and Phillips, 2010) and operate in the same industry (4-digit SIC code) as the colluding firms. *Collusion (C)* takes the value of 1 for cartel firms during collusion years, and 0 otherwise. Instead of using the dummy variable, *Post Collusion,*we create three dummy variables for each subperiod after the collusion years. *Post Collusion – Before Notice*$_{it}$, is a dummy variable that takes the value of 1 for the years after the collusion period until the first notice of investigation by the DOJ for cartel firms. *Post Collusion – Before Notice*$_{it}$ takes the value of 0 for control firms. *Post Collusion – After Notice*$_{it}$, is a dummy variable that takes the value of 1 for the years after the collusion period and after the first notice of investigation by the DOJ for cartel firms, but before the fine announcement. *Post Collusion – After Notice*$_{it}$ takes the value of 0 for control firms. *Post Collusion – After Fine*$_{it}$, is a dummy variable that takes the value of 1 for the years after the collusion period and after the fine announcement for cartel firms until year 5 of the post collusion years. *Post Collusion – After Fine*$_{it}$ takes the value of 0 for control firms. The set of control variables comprises *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout, Cash to Assets* and *Cash Flow Volatility*. In all the columns we include industry-year and firm fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at firm level. Statistical significance at the 10%, 5% and 1% levels are denoted by *, ** and ***, respectively.

CSR:	Strengths			Concerns			Score		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Collusion (C)	.009	.009		.006	.007		.003	.002	
	(.011)	(.011)		(.005)	(.005)		(.013)	(.013)	
Post Collusion-Before Notice (PCBN)	.008	.007	.005	.013	.014	.012	-.005	-.007	-.007
	(.010)	(.010)	(.009)	(.010)	(.009)	(.009)	(.014)	(.014)	(.013)
Post Collusion-After Notice (PCAN)	.036	.033	.029	.002	.003	-.0008	.034	.030	.030
	(.018)**	(.018)*	(.015)**	(.007)	(.007)	(.006)	(.020)*	(.020)	(.016)*
Post Collusion-After Fine (PCAF)	.039	.039	.035	.008	.009	.005	.031	.031	.030
	(.012)***	(.012)***	(.009)***	(.006)	(.006)	(.005)	(.012)***	(.011)***	(.008)***
Control Variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry-Year F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4489	4489	4489	4489	4489	4489	4489	4489	4489
R^2	.811	.814	.813	.787	.789	.788	.756	.76	.76
PCBN-C	−0.001	−0.002		0.007	0.007		−0.008	−0.009	
PCAN-C	0.027**	0.024**		−0.004	−0.004		0.031**	0.028**	
PCAF-C	0.030***	0.030***		0.002	0.002		0.028***	0.029***	
PCAF-PCAN	0.003	0.006	0.006	0.006	0.006	0.006	−0.003	0.001	0.000

Table 6
CSR in Colluding Firms - Main Cartel Member. This table presents the results of CSR performance of the main cartel member during and after the collusion years. The dependent variable is CSR performance measured as: *Strengths, Concerns* and *Score*. In all the regressions we use as control firms those (non-colluding) firms that are similar according to H-P (Hoberg and Phillips, 2010) and operate in the same industry (4-digit SIC code) as the colluding firms. We identify main cartel firms in terms of *Sales* and *Enterprise Value* (*EV*), which are the colluding firms with the largest size before the cartel breaks up. *Collusion (C)* takes the value of 1 for cartel firms during collusion years, and 0 otherwise. *Post Collusion (PC)* takes the value of 1 for cartel firms during the 5 years after the cartel breakup, and 0 otherwise. The set of control variables comprises *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout, Cash to Assets* and *Cash Flow Volatility*. In all the columns we include industry-year and firm fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at firm level. Statistical significance at the 10%, 5% and 1% levels are denoted by *, ** and ***, respectively.

CSR:	Strengths				Concerns				Score			
	Sales		EV		Sales		EV		Sales		EV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Main Cartel Member	-.004	-.001	-.006	-.003	.032	.033	.032	.032	-.037	-.034	-.038	-.035
	(.021)	(.019)	(.021)	(.019)	(.009)***	(.009)***	(.009)***	(.009)***	(.022)*	(.021)*	(.022)*	(.021)*
Collusion (C)	.006		.007		.0006		.0006		.005		.006	
	(.011)		(.011)		(.004)		(.004)		(.013)		(.013)	
Post Collusion (PC)	.016	.013	.011	.008	.002	.001	.001	.0007	.014	.011	.010	.007
	(.011)	(.007)*	(.010)	(.006)	(.005)	(.004)	(.005)	(.004)	(.012)	(.008)	(.011)	(.007)
Post Collusion×Main Cartel Member	.041	.041	.050	.049	-.002	-.002	-.0008	-.0008	.044	.044	.050	.050
	(.013)***	(.013)***	(.012)***	(.012)***	(.008)	(.008)	(.007)	(.007)	(.013)***	(.013)***	(.012)***	(.013)***
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489	4489
R^2	.815	.815	.816	.816	.791	.791	.791	.791	.762	.762	.763	.763

statistically indistinguishable from each other. Hence, our evidence suggests that colluding firms modify and improve their CSR performance as soon as they learn about official antitrust inquiries; probably as way to reduce the negative hit of the investigations and potential fines. Notably, the effect of cartel enforcement actions on the CSR initiatives of price fixing firms persists even after the imposition of the official fine.

Lastly, we think this is an important result as we find that those CSR investments that price fixing firms initiate during the antitrust-related investigations become relatively permanent over time.

6. Cross-Sectional analysis

In this section, we present the results of three cross-sectional tests to further explore specific circumstances that drive CSR dynamics following cartel breakups. First, we show that large and more visible cartel participants are more likely to use CSR strategies following a cartel breakup. Second, we provide evidence that indicates that colluding firms in more competitive markets invest more in CSR initiatives in the post collusion years. Finally, we show that not all colluding firms are able to favor major CSR improvements in the post collusion periods, given their limited cash flows from operations and liquidity.

6.1. CSR and main cartel member

In this subsection we analyze whether larger and more visible cartel members - in particular - increase their CSR initiatives in the collusion and post-collusion period. We use the following empirical model to test whether firms with more potential downside from cartel scandals engage in more CSR activities during or after collusion:

$$y_{it} = \alpha + \beta_1 Collusion_{it} + \beta_2 Post\ Collusion_{it} + \beta_3 Post\ Collusion_{it} \times Main\ Cartel\ Member_i + \beta_4 Main\ Cartel\ Member_i + \Omega' Z_{it} + \phi_i + \mu_{jt} + \epsilon_{it} \quad (4)$$

In Eq. (4) all variables and fixed effects are defined as in Eq. (1), while *Main Cartel Member* is a dummy variable that takes the value of 1 for the firm in a given cartel with the largest level of sales the year before the breakup of the price-fixing scheme. Alternatively, we define *Main Cartel Member* as a dummy variable that takes the value of 1 for the firm in a given cartel with the highest enterprise value (EV) the year before the cartel dissolution.

In Table 6, we present the results of estimating Eq. (4). The variable of interest is the interaction term *Post Collusion* × *Main Cartel Member*, which is positive and statistically significant for both definitions of *Main Cartel Member*. We interpret these findings as indications that players with more potential downside from cartel scandals have more incentives to engage in positive CSR initiatives (*CSR Strengths*) following cartel breakups.

6.2. CSR and competition

In this subsection we analyze whether cartel firms are more likely to engage in CSR post-collusion, in cases when they face higher competitive pressures. Firms that are more exposed to product market threats might especially engage in new CSR initiatives to limit downsides associated with the revelation of the corporate misconduct. We expect that cartel firms increase their *CSR Strengths* as a mechanism to reduce the negative effect of the revelation of illegal fixing price scandals, in more competitive markets.

We use a new measure that captures the concept of "product-market fluidity", developed by Hoberg et al. (2014), to analyze whether firms in more competitive markets invest more in CSR post cartel breakup. The "product-market fluidity" measure uses textual analysis of product descriptions found in SEC 10-K forms to estimate the intensity of a firm's product-market threats. A higher product-market fluidity measure means that a firm's competitive environment changes frequently, so it faces stronger competitive pressure. We use product market fluidity to measure the competitive pressure faced by firms in our sample.[9] We split our sample of

[9] Ferrés et al. (2021) suggest that the measure of product market fluidity has low variability within firms. For that reason, we take the average for each firm across the years to have one observation per firm. By doing so, we have more observations to perform our test and we can split the sample in half.

Table 7
CSR in Colluding Firms - Product Market Competition. This table presents the results of CSR performance of cartel firms during and after the collusion years, depending on the product market competition. We split the sample into firms with high and low product market fluidity to measure the competitive pressure faced by firms (Hoberg et al., 2014). The dependent variable is CSR performance measured as: *Strengths, Concerns* and *Score*. In all the regressions we use as control firms those (non-colluding) firms that are similar according to H-P (Hoberg and Phillips, 2010) and operate in the same industry (4-digit SIC code) as the colluding firms. *Collusion (C)* takes the value of 1 for cartel firms during collusion years, and 0 otherwise. *Post Collusion (PC)* takes the value of 1 for cartel firms during the 5 years after the cartel breakup, and 0 otherwise. The set of control variables comprises *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout, Cash to Assets* and*Cash Flow Volatility*. In all the columns we include industry-year and firm fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at firm level. Statistical significance at the 10%, 5% and 1% levels are denoted by *, ** and ***, respectively.

CSR:	Strengths		Concerns		Score	
	Fluidity		Fluidity		Fluidity	
	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
Collusion (C)	.009	.007	.008	.004	.0007	.003
	(.012)	(.021)	(.007)	(.007)	(.016)	(.022)
Post Collusion (PC)	.026	.077	.007	.013	.020	.063
	(.010)***	(.030)**	(.009)	(.008)	(.013)	(.030)**
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year F.E	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2278	2211	2278	2211	2278	2211
R^2	.832	.819	.828	.766	.787	.765
PC-C	0.017*	0.070***	−0.001	0.009	0.019*	0.060***

cartel firms into observations with above-median fluidity (stronger competitive pressure) and below-median fluidity (weaker competitive pressure) and re-run Eq. (1).

We present the results from the fluidity sample splits in Table 7. We find evidence that *CSR Strengths* increase in the post collusion periods, especially for firms facing stronger competitive pressure (high fluidity). While both relevant coefficients are positive and statistically significant, the coefficient for *Post Collusion* for the high fluidity subsample is three times the magnitude of the coefficient for *Post Collusion* in the low fluidity subsample. In addition, only cartel firms operating in highly competitive markets increase their overall *CSR Score*. In sum, these results support the notion that colluding firms are more likely to increase CSR following cartel breakups in more competitive industries.

6.3. CSR and corporate liquidity

If positive CSR plays a role in mitigating the costs of fraud revelation, one would expect all cartel firms to engage in new CSR initiatives around the time when they face an official antitrust investigation. However, as CSR is costly we conjecture that some cartel firms might not have available resources to improve their *CSR Strengths/Score* to offset the costs of fraud revelation. We split the sample of cartel firms into firms with above and below the median in terms of cash (and equivalents) and cash flows from operations, and we estimate Eq. (1) for the two subsamples. Even though the split is made for cartel firms only, for each subsample of cartel firms we employ the same control group as in our baseline regression.

In Table 8 we show that firms with high level of cash or cash flow from operations (columns 2 and 8) improve their *CSR Strengths* during the post collusion period. Note that the coefficients associated with *Post Collusion* for cartel firms with more available resources are positive and statistically significant. Moreover, the difference between the coefficients associated with *Post Collusion* and *Collusion* is statistically significant at conventional levels. Importantly, only those cartel firms with high liquidity levels and cash from operations boost their overall *CSR Score*. For firms with low cash or cash flows, we only find evidence of smaller changes in *CSR Strengths* during *Post Collusion* (column 1). Lastly, we find no meaningful evidence of changes in *CSR Concerns*, which suggests that firms with more available resources concentrate their efforts on raising their *CSR Strengths* in order to compensate for the costs associated with the corporate misconduct.

Table 8
CSR in Colluding Firms - Corporate Liquidity. This table presents the results of CSR performance of cartel firm during and after the collusion years, depending on the corporate liquidity. We split the sample into firms with below-median and above-median in terms of *Cash and Equivalents* and *Cash Flow* (from operating activities), both scaled by total assets. The dependent variable is CSR performance measured as: *Strengths, Concerns* and *Score*. In all the regressions we use as control firms those (non-colluding) firms that are similar according to H-P (Hoberg and Phillips, 2010) and operate in the same industry (4-digit SIC code) as the colluding firms. *Collusion (C)* takes the value of 1 for cartel firms during collusion years, and 0 otherwise. *Post Collusion (PC)* takes the value of 1 for cartel firms during the 5 years after the cartel breakup, and 0 otherwise. The set of control variables comprises *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout, Cash to Assets* and *Cash Flow Volatility*. In all the columns we include industry-year and firm fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at firm level. Statistical significance at the 10%, 5% and 1% levels are denoted by *, ** and ***, respectively.

CSR:	Strengths		Concerns		Score		Strengths		Concerns		Score	
	Cash						Cash Flow					
	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)	Low (7)	High (8)	Low (9)	High (10)	Low (11)	High (12)
Collusion (C)	.004	.006	.009	.006	-.005	-.0002	.011	-.003	.009	.010	.002	-.013
	(.012)	(.015)	(.006)*	(.007)	(.013)	(.018)	(.015)	(.013)	(.006)	(.006)	(.017)	(.015)
Post Collusion (PC)	.021	.039	.008	.005	.013	.034	.019	.041	.003	.011	.017	.030
	(.011)*	(.016)**	(.005)	(.008)	(.012)	(.017)**	(.016)	(.015)***	(.006)	(.009)	(.017)	(.016)*
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4158	4155	4158	4155	4158	4155	3734	3719	3734	3719	3734	3719
R^2	.811	.808	.791	.78	.769	.758	.795	.806	.755	.766	.748	.75
PC-C	0.017**	0.033***	−0.001	−0.001	0.018**	0.034***	0.008	0.044***	−0.006	0.001	0.015	0.043***

Table 9
CSR in Colluding Firms - Fines. This table presents the association between the timing of CSR performance of cartel firms and the corporate fine. We split the sample into firms that paid high and low fines imposed by antitrust authorities. The dependent variable is CSR performance measured as: *Strengths*, *Concerns* and *Score*. In all the regressions we use as control firms those (non-colluding) firms that are similar according to H-P (Hoberg and Phillips, 2010) and operate in the same industry (4-digit SIC code) as the colluding firms. *Collusion (C)* takes the value of 1 for cartel firms during collusion years, and 0 otherwise. *Post Collusion* $t+\tau$ ($PC_{t+\tau}$) takes the value of 1 for cartel firms in the year τ after the cartel breakup, and 0 otherwise. The set of control variables comprises *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout, Cash to Assets* and*Cash Flow Volatility*. In all the columns we include industry-year and firm fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are adjusted for heteroscedasticity and clustered at firm level. Statistical significance at the 10%, 5% and 1% levels are denoted by *, ** and ***, respectively.

CSR:	Strengths		Concerns		Score	
	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
Collusion (C)	.006	.011	-.005	.023	.011	-.012
	(.013)	(.019)	(.005)	(.008)***	(.013)	(.022)
Post Collusion $t+1$ (PC_{t+1})	.038	.017	-.005	.020	.043	-.003
	(.020)*	(.020)	(.006)	(.010)**	(.021)**	(.022)
Post Collusion $t+2$ (PC_{t+2})	.033	.024	-.002	.020	.036	.005
	(.016)**	(.021)	(.007)	(.010)*	(.017)**	(.022)
Post Collusion $t+3$ (PC_{t+3})	.031	.043	.005	.022	.026	.021
	(.016)*	(.021)**	(.007)	(.011)**	(.018)	(.023)
Post Collusion $t+4$ (PC_{t+4})	.012	.075	-.004	.026	.017	.049
	(.015)	(.021)***	(.006)	(.011)**	(.016)	(.021)**
Post Collusion $t+5$ (PC_{t+5})	.023	.061	-.003	.015	.026	.046
	(.013)*	(.024)***	(.007)	(.012)	(.015)*	(.028)*
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year F.E	Yes	Yes	Yes	Yes	Yes	Yes
Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4256	4057	4256	4057	4256	4057
R^2	.816	.807	.791	.779	.767	.763
$PC_{t+1} - C$	0.032**	0.006	0.000	−0.003	0.032**	0.009
$PC_{t+2} - C$	0.027**	0.013	0.003	−0.003	0.025**	0.017*
$PC_{t+3} - C$	0.025**	0.032***	0.010	−0.001	0.015	0.033***
$PC_{t+4} - C$	0.006	0.064***	0.001	0.003	0.006	0.061***
$PC_{t+5} - C$	0.017*	0.050**	0.002	−0.008	0.015	0.058**

7. The implications of CSR

In this section we explore specific implications of the CSR investments on the fines obtained by the cartel firms and on the product market performance of colluding firms after a cartel breakup.

7.1. CSR and the size of the fines

In this subsection, we analyze the link between positive CSR actions and the size of the official fines that price fixing firms obtain. To test the association between the timing of CSR investments and the official fines, we split the sample of cartel firms into firms with zero and positive fines, and we estimate Eq. (2) for the two subsamples.[10] Even though fines are pertinent to cartel firms only, we include the same control group as in our baseline regression. Thus, for each subsample of cartel firms we employ the same control firms.

We are interested in analyzing the association between the new CSR initiatives of price fixing firms and the size of the corporate fines. As we show in subsection 5.4 (Table 5) the CSR efforts of price fixing firms initiate before the fine announcement and persist after the imposition of the fine. In this subsection, we test whether the timing of the new CSR initiatives are associated with the size of corporate fines. More specifically, we test whether price fixing firms obtain reduced corporate fines in cases in which those new CSR improvements occur early on in the investigatory process. Hence, we believe that is important to test whether the dynamics of the new CSR efforts (and not only the intensity of the CSR efforts) has an heterogeneous impact on the fines. While we admit a caveat of our empirical procedure - that we perform the sample split based on endogenous variable (size of the fine) - we think this empirical test provides illustrative evidence about the impact of CSR on cartel enforcement actions and fines.

In Table 9, we report the results of our test on the link between the timing of the CSR initiatives in price fixing firms and the magnitude of the official fine. Our evidence shows that firms that increase their *CSR Strengths* and *CSR Score* right around the time when they become subject to an official antitrust enforcement action obtain smaller corporate fines. On the other hand, the evidence shows that firms that increase their *CSR Strengths* and *CSR Score* later in the investigatory process obtain higher corporate fines. While Hong et al. (2019) suggest that socially responsible firms receive more lenient settlements from prosecutors (in general), our analysis shows more granular results that signal the importance of "anticipatory" CSR investments in firms that are tainted by corporate misconduct. Our evidence points out that only firms that engage in a first round of CSR investments that normally coincides with the early stages of an antitrust investigations receive lower official fines. However, firms that increase their CSR initiatives later as the official antitrust investigations advances, receive larger official fines. Our evidence shows that the CSR investments of colluding firms have positive implications in terms of the magnitude of the corporate fines - only if those new CSR initiatives are timely executed.

7.2. CSR and product market performance

In this subsection, we analyze whether CSR has a positive impact on the product market performance of colluding firms after a cartel breakup. Intuitively, price fixing firms might boost CSR initiatives to sustain their sales in the post collusion years. We think this is an important test as colluding firms are likely to undergo negative product market dynamics following cartel breakups. We study the impact of CSR on sales growth and on the market share performance of the cartel firms during the post collusion period,

[10] We consider all the fines paid by U.S. firms around the world.

Table 10
CSR in Colluding Firms - Sales and Market Share. This table presents the impact of the CSR performance after the collusion years on sales growth and market share. The dependent variables are the sales growth and market share. *Sales Growth*$_{it}$ is the percentage change in firm's sales in year *t* with respect to year *t-1*. *Mkt Share*$_{it}$ is the market participation (4-digit SIC code) in terms of sales of firm *i* in year *t*. We employ the entire Compustat universe to calculate the market share. CSR performance is measured as: *Strengths, Concerns* and *Score*. In all the regressions we use as control firms those (non-colluding) firms that are similar according to H-P (Hoberg and Phillips, 2010) and operate in the same industry (4-digit SIC code) and with similar products as the colluding firms. *Collusion (C)* takes the value of 1 for cartel firms during collusion years, and 0 otherwise. *Post Collusion (PC)* takes the value of 1 for cartel firms during the 5 years after the cartel breakup, and 0 otherwise. The set of control variables comprises *Size, ROA, Leverage, Tangibility, Market-to-Book* ratio, *Dividend Payout, Cash to Assets* and *Cash Flow Volatility*. In all the columns we include year fixed effects. Also, we include firm and industry fixed depending on the specification. All variables are defined in Appendix A. Standard errors (in parentheses) are adjusted for heteroscedasticity and double clustered at firm and year level (two ways). Statistical significance at the 10%, 5% and 1% levels are denoted by *, ** and ***, respectively.

CSR:	Strengths		Concerns		Score	
Dependent variable:	*Sales Growth* (1)	*Mkt Share* (2)	*Sales Growth* (3)	*Mkt Share* (4)	*Sales Growth* (5)	*Mkt Share* (6)
Collusion (C)	-.063	-.018	-.051	-.017	-.062	-.018
	(.051)	(.010)*	(.051)	(.009)*	(.050)	(.009)*
Post Collusion (PC)	-.119	-.004	-.096	.001	-.105	-.001
	(.060)**	(.010)	(.056)*	(.010)	(.060)*	(.009)
CSR	-.211	-.022	-.425	.081	-.051	-.034
	(.354)	(.027)	(.673)	(.034)**	(.342)	(.020)*
Post Collusion ×*CSR*	.565	.130	.832	.069	.448	.128
	(.258)**	(.054)**	(.526)	(.170)	(.316)	(.062)**
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E	No	Yes	No	Yes	No	Yes
Industry-Year F.E	Yes	No	Yes	No	Yes	No
Firm F.E	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4469	4489	4469	4489	4469	4489
R^2	.32	.963	.32	.963	.32	.963

using the following model:

$$y_{it} = \alpha + \beta_1 Collusion_{it} + \beta_2 Post\ Collusion_{it} + \beta_3 Post\ Collusion_{it} \times CSR_{it} + \beta_4 CSR_{it} + \Omega' Z_{it} + \phi_i + \mu_{jt} + \epsilon_{it} \quad (5)$$

In this specification we use CSR_{it} (*Strengths, Concerns and Score*) as independent variables to test the influence of CSR on a firm's sales and industry market share. *Sales Growth*$_{it}$ is the percentage change in the firm's sales in the current year (*t*) with respect to the previous year (*t-1*). *Mkt Share*$_{it}$ is the firm's market participation (in its 4-digit SIC industry) in year *t*. We employ the entire Compustat universe to calculate market shares. In Eq. (5) all other variables are defined as in Eq. (1). When considering *Sales Growth*$_{it}$ as dependent variable, we include firm and industry-year fixed effects to control for any shock in the industry in a given year that might affect sales of cartel firms and the control group simultaneously.[11] According to Gormley and Matsa (2014) including industry-year fixed effects helps to control for any industry-specific shocks (unobserved) and also eases the interpretation of the effect on the dependent variable as it is now "industry-adjusted". Hence, the positive effect that we expect from CSR efforts on sales growth is relative to the performance of the industry in a given year. For the case of *Mkt Share*$_t$ we include firm and year fixed effects since the market share of each firm is calculated within industry.

In Table 10, we present evidence linking *CSR* activities with colluding firms' product market performance after cartel breakups. In columns (1) and (2) we find that cartel firms with high *CSR Strengths* exhibit better performance in the post collusion years - in terms of sales growth and market shares. The coefficient associated with the interaction term *PostCollusion* × *CSR* is positive and statistically significant. However, the coefficient associated with *Post Collusion* is statistically significant only for sales growth (although for market share it has negative sign, as expected). Moreover, we find that firms with a higher *CSR Score* also have positive sales and market share dynamics in the post collusion periods (see columns 5–6). Interestingly, in unreported tests we analyze the impact of CSR on gross margins and markups and we do not find any meaningful result, which suggests that CSR efforts are not likely to help the overall profitability of the price fixing firms; rather the CSR investments seem to be instrumental in maintaining the sales levels of the colluding firms. Overall, our results suggest that firms increase CSR efforts after the dissolution of the price-fixing scheme as a way to reduce the downside associated with the corporate misconduct that could affect their sales.

8. Conclusion

To the best of our knowledge, our paper is the first empirical study to specifically analyze the timing and the stability of the new CSR dynamics in firms tainted with the revelation of corporate misconduct. Different from other kinds of corporate misconduct, in the setting of cartel investigations it is possible to identify the periods when price fixing fraud occurred, the time when the antitrust investigations became known by the public and the exact date of the official fine announcement. We use this crucial information about collusion periods, official investigations and fine announcements to precisely pin down the timing of CSR changes in price fixing firms.

We show that price fixing firms are likely to initiate new CSR efforts that coincide with the official antitrust investigations. While colluding firms do not modify their CSR policies during collusion, we show that colluding firms engage in more and new CSR investments after cartels break up. Our evidence, specifically, shows an increase in CSR in price fixing firms that coincides with the timing of the regulatory investigations and that those CSR initiatives persist following the antitrust enforcement actions and the imposition of fines. Remarkably, cartel firms with higher liquidity levels are able to engage in major new CSR initiatives to offset the negative implication of the corporate misconduct.

We contribute to the existing literature on CSR as we show that price fixing firms expand their positive CSR initiatives as they become part of an official price-fixing investigation and that those anticipatory CSR actions work as a mechanism to limit the potential costs of fraud revelation. Colluding firms tend to increase their CSR activities to receive lower fines, but also to sustain their CSR

[11] Since we have overlapping observations to calculate the growth of sales, standard errors are double clustered at firm and year level (two ways).

investments after knowing the official fine. The fact that price fixing firms maintain their CSR projects following the imposition of the corporate fines suggests that the objectives of those CSR investments go beyond a mere reduction of the antitrust-related penalties. In particular, we find that cartel firms that invest in CSR following a cartel breakup undergo a less pronounced reduction in sales during the post collusion years.

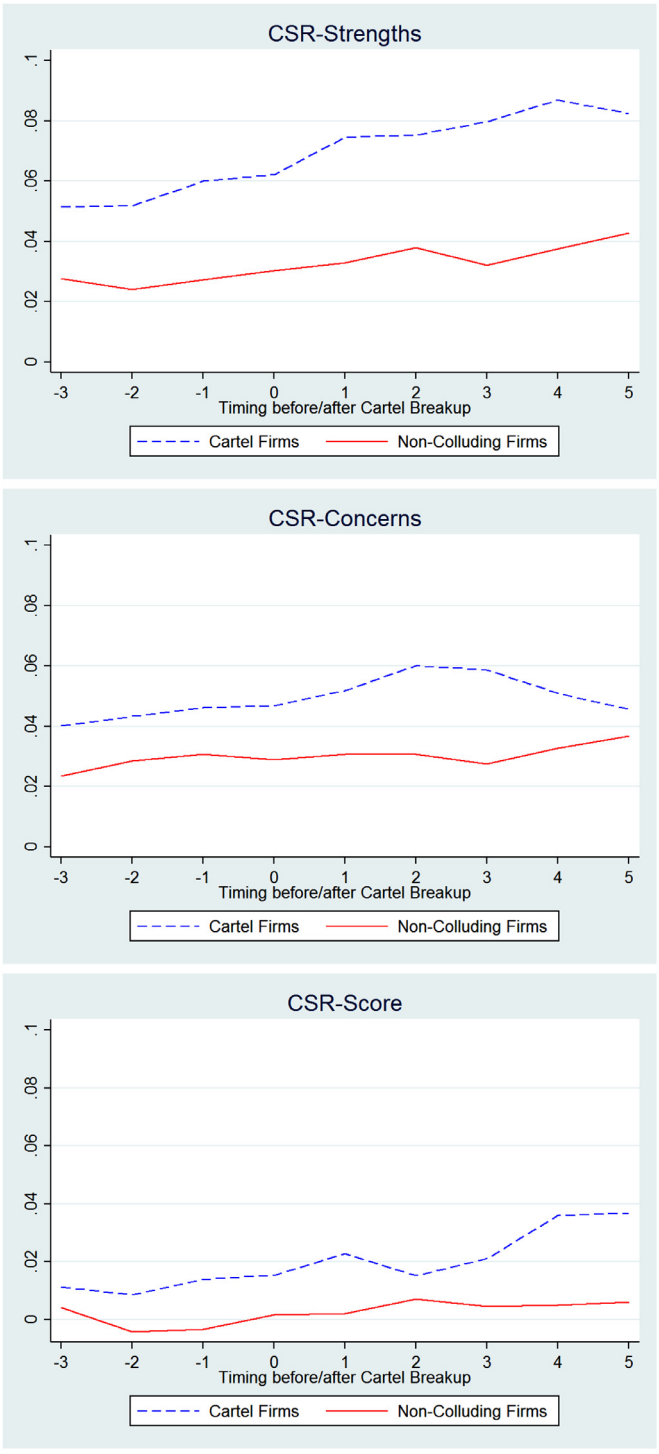

Fig. 1. CSR - Parallel Trends. These figures present the results of analyzing the timing of the CSR dynamics of cartel and control firms (non-colluding firms) before and after the cartel breakup. The dependent variable is the average CSR performance (*Strengths*, *Concerns* and *Score*) of the two groups. The *Cartel Firms* are the colluding firms that appear in the PIC data. The *Non-Colluding Firms* are the control firms in the same industry (4-digit SIC code) as the colluding firms and similar in terms of product similarity according to the H-P measure (Hoberg and Phillips, 2010).

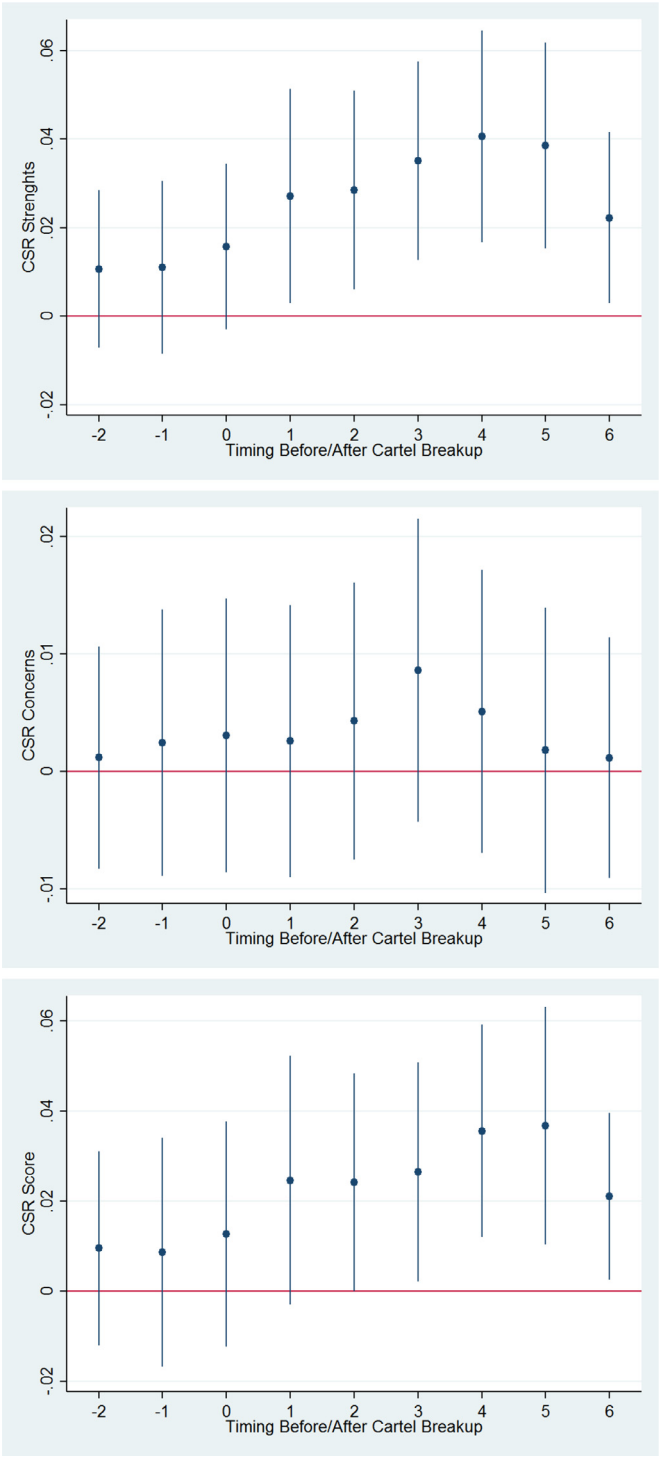

Fig. 2. CSR - Timing. These figures present the results of analyzing the timing of CSR performance before and after the break up of the cartel. The dependent variable is CSR performance measured as: *Strengths*, *Concerns* and *Score*. The figures present the coefficients (and 95% confidence interval) associated with *Post Collusion* $t+\tau$ ($PC_{t+\tau}$) that we obtain from the following regression: $y_{it} = \alpha + \sum_{\tau=-2}^{6} \beta_2^{t+\tau} Post\ Collusion_{it}(t+\tau) + \Omega' Z_{it} + \phi_i + \mu_{jt} + \epsilon_{it}$ The *Cartel Firms* are the colluding firms that appear in the PIC data. The *Non-Colluding Firms* are the control firms in the same industry (4-digit SIC code) as the colluding firms and similar in terms of product similarity according to the H-P measure (Hoberg and Phillips, 2010). *Post Collusion* $t+\tau$ ($PC_{t+\tau}$) takes the value of 1 for cartel firms in the year τ before/after the cartel breakup, and 0 otherwise. The set of control variables comprises *Size*, *ROA*, *Leverage*, *Tangibility*, *Market-to-Book* ratio, *Dividend Payout*, *Cash to Assets* and *Cash Flow Volatility*.

Appendix A

- *Collusion:* Dummy variable that takes the value of 1 for cartel firms during collusion years, and 0 otherwise.
- *Cash Flow Volatility:* Standard deviation of Profitability over the prior 3-year period.
- *Cash to Assets:* The ratio of cash and equivalents to the book value of total assets.
- *Dividend Payout:* The ratio of dividends paid plus common and preferred stock purchased divided by the book value of assets.
- *Leverage:* The ratio of the sum of total long-term debt plus total debt in current liabilities scaled by the book value of total assets.
- *Market Share:* Market participation (4-digit SIC code) in terms of sales of firm *i* in year *t*. We employ the entire Compustat universe to calculate the market share.
- *Market-to-Book* ratio: The ratio of the sum of the total book value of debt plus market value of equity divided by the book value of total assets.
- *Post Collusion:* Dummy variable that takes the value of 1 for cartel firms during the 5 years after the cartel breakup, and 0 otherwise.
- *ROA:* The ratio of operating income before depreciation divided by the book value of assets.
- *Sales Growth*: Percentage change in firm's sales in year *t* with respect to year *t-1*.
- *Size:* Natural Logarithm of the book value of total assets.
- *Tangibility:* The ratio of the book value of Net Property Plant and Equipment divided by the book value of total assets.

CRediT authorship contribution statement

Daniel Ferrés: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Project administration. **Francisco Marcet:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Project administration.

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