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Corporate Social Responsibility and Investment Efficiency

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Abstract Using a sample of 21,030 US firm-year observations that represents more than 3000 individual firms over the 1998–2012 period, we investigate the relationship between Corporate Social Responsibility (CSR) and investment efficiency. We provide strong and robust evidence that high CSR involvement decreases investment inefficiency and consequently increases investment efficiency. This result is consistent with our expectations that high CSR firms enjoy low information asymmetry and high stakeholder solidarity (stakeholder theory). Moreover, our findings suggest that CSR components that are directly related to firms' primary stakeholders (e.g. employee relations, product characteristics, environment, and diversity) are more relevant in reducing investment inefficiency compared with those related to secondary stakeholders (e.g. human rights and community involvement). Finally, additional results show that the effect of CSR on investment efficiency is more pronounced during the subprime crisis. Taken together, our results highlight the important role that CSR plays in shaping firms' investment behaviour and efficiency.

Keywords Corporate social responsibility · Corporate governance · Investment efficiency · Stakeholders theory

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Introduction

Over the last 40 years, the growing debate on the financial implications of Corporate Social Responsibility (CSR) has been far from resolved. While some scholars argue that high CSR involvement is associated with higher firm performance and higher firm value (e.g. Jo and Harjoto 2011, 2012), lower financial risk (e.g. Bouslah et al. 2013), lower information asymmetry (e.g. Cho et al. 2013), easy access to finance (e.g. Cheng et al. 2014), and lower cost of equity (e.g. El Ghoul et al. 2011), others argue that CSR activities are a source of conflict between different stakeholders (e.g. Krüger 2015), reduce a firm's resources because of unnecessary costs (e.g. Vance 1975), and that they are more likely to create a competitive disadvantage compared with less socially responsible firms (e.g. Aupperle et al. 1985).

There are two opposite points of view, often reflecting the financial implications associated with high CSR activities. On the one hand, approaching CSR as a source of conflict between different stakeholders dates back to Friedman (1970). The author criticises the increasing interest of academics and practitioners in the CSR field and advances his well-known claim that 'the only responsibility of business is to increase profit'. Extensions of this point of view have often served as a theoretical background to support the negative association between CSR's degree of involvement and firm value. For instance, Preston and O'Bannon (1997) discuss the managerial opportunism hypothesis and argue that some private managerial goals might lead to a firm's resources being wasted through overinvestment in CSR. CSR is thus a manifestation of managerial agency problems inside the firm (e.g. Bénabou and Tirole 2010). Furthermore, through their

trade-off hypothesis, Preston and O'Bannon (1997) argue that investing in social and environmental activities is likely to reduce a company's resources, which creates a competitive disadvantage and negatively affects a firm's value. On the other hand, the opposite point of view—the value-enhancing view—argues that by serving the implicit claims of their stakeholders (stakeholder theory), high CSR companies enhance their reputation, gain employee loyalty, and benefit from customers' support. Social activities will therefore result in a positive impact on the companies' financial performance. Furthermore, good management theory (Waddock and Graves 1997) suggests that managerial and strategic skills that lead to high social performance are the same as those that may also help companies in achieving high financial performance. High social performance is the channel through which firms will achieve their objectives in terms of value maximisation.

In this paper, we provide new evidence that enriches the debate on the financial implications of high CSR involvement. We then investigate the relationship between CSR and a firm's capital allocation. More precisely, we study whether and how CSR affects investment efficiency, which is one of the fundamental questions of finance literature. We argue that if the value-enhancing view of CSR dominates, high CSR firms should be associated with high investment efficiency. In contrast, if the agency view of CSR dominates, high CSR involvement is more likely to decrease investment efficiency.

Using a large sample of 21,030 firm-year observations, representing more than 3000 individual US firms between 1998 and 2012, and after controlling for previous determinants of investment efficiency as well as industry and year fixed effects, we provide strong evidence that high CSR involvement increases investment efficiency. This result is in harmony with the value-enhancing view of CSR and confirms that social and environmental involvements play a fundamental role in improving firm value. Our main result is robust to a battery of sensitivity tests, including alternative measures of CSR, alternative measures of investment efficiency, alternative estimations and standard errors, and several approaches to addressing endogeneity and self-selection bias.

In an additional set of tests, we try to identify which individual components of CSR matter the most in improving investment efficiency. We show that dimensions which are linked to primary stakeholders (e.g. employee relations, product characteristics, environment, and diversity) significantly improve investment efficiency, unlike dimensions associated with secondary stakeholders (e.g. human rights and community involvement), which show no significant effect on investment efficiency.

Previous studies have suggested that high CSR firms benefit from employee solidarity and customers' loyalty in times of financial crisis (Benlemlih and Girerd-Potin 2014). We therefore investigate this view and examine whether CSR had an additional effect on investment efficiency during the subprime crisis. Our findings suggest that the relationship between CSR and investment efficiency is consistent for periods in and out of crisis. They also suggest that CSR involvement has an additional positive effect on investment efficiency during financial distress.

Finally, we explore the relationship between CSR and investment efficiency in extreme cases. While extremely high CSR involvement might be due to managers' tendency to overinvest in CSR (e.g. Benlemlih 2015; Krüger 2015), extremely low CSR involvement is likely to signal a poor ability to manage the complexity of environmental and social requirements (e.g. Kytle and Ruggie 2005). In these cases, CSR is expected not to affect (or to negatively affect) investment efficiency. Our results confirm this expectation and show that extremely low CSR and extremely high CSR firms do not enjoy a high level of investment efficiency.

Our study contributes to the literature in several ways. First, to the best of our knowledge, this is the first attempt to investigate the relationship between CSR and investment efficiency. The debate on the financial implications of firms' social involvement is far from being resolved, we believe that our work sheds further light on this unresolved puzzle. Second, while previous studies show that financial reporting quality (e.g. Biddle et al. 2009), government intervention (e.g. Chen et al. 2011b), and state and foreign ownership (e.g. Chen et al. 2014) are significant determinants of investment efficiency, our work enriches the literature and shows that CSR is also a significant determinant of investment efficiency. Finally, we build upon the work of Clarkson (1995) and Hillman and Keim (2001) by confirming that primary stakeholders are vital for firms' performance. Our work shows that among the individual components of CSR only those related to primary stakeholders significantly increase investment efficiency.

The rest of this article is structured as follows. In the next section, we review some previous studies on the determinants of investment efficiency before introducing the main hypothesis of our work. In the third section, we show our data and research design. We then present the main results of the study and the robustness tests. "Conclusion" section concludes.

Literature Background and Hypotheses

Determinants of Investment Efficiency

Under the Modigliani and Miller (1958) paradigm, investment opportunities are the only driver of a firm's

investment. All positive net present value (NPV) should be accomplished. The theory argues that firms are likely to obtain financing for all positive NPV projects and to continue to invest until the marginal benefit of investment equals the marginal cost (e.g. Hayashi 1982). In practice, firms may face some financing constraints that limit managers' ability to carry out all positive NPV projects (e.g. Hubbard 1998). Previous literature has shown that capital market frictions may lead to a deviation from firms' optimal investment (Chen et al. 2014), which in turn results in an overinvestment or an underinvestment. The overinvestment phenomenon occurs when managers choose to invest inefficiently by making bad project selections in order to expropriate some firms' existing resources. Conversely, the underinvestment phenomenon occurs when firms facing financing constraints withdraw from positive NPV projects due to the high cost of raising capital (e.g. Biddle et al. 2009). Scholars have widely discussed a variety of frictions and distortional forces that prevent an optimal level of investment (Stein 2003). More precisely, previous empirical and theoretical works have emphasised two types of friction that are the most decisive in investment efficiency, namely information asymmetry and agency problems.

According to Myers (1984) and Myers and Majluf (1984), information asymmetry between managers and shareholders can affect the cost of raising funds and project selection. When managers have private information that securities are overvalued, they would like to issue new securities. Shareholders are aware of this information asymmetry and consequently discount new issuances of securities. Managers may refuse to raise funds at a discount price, even though that means renouncing good investment opportunities. Information asymmetry will then prevent efficient investment and lead to underinvestment. In addition to this theoretical aspect, many other studies have provided supportive empirical evidence for this argument (e.g. Lang et al. 1996).

In contrast to this information asymmetry view, which indicates that managers act in the shareholders' interest, the agency view argues that managers are self-interested (Chen et al. 2014). They tend to maximise their welfare by choosing investment opportunities that are not systematically in the interest of shareholders (Jensen and Meckling 1976). Agency problems are likely to increase investment inefficiency due to poor project selection. On the other hand, investors anticipate potential resource expropriation, which may increase the cost of raising funds. For instance, Jensen (1986) predicts that empire building induces managers with free cash flow to overinvest; this is especially true when managers are not monitored by shareholders. Blanchard et al. (1994), and Lang et al. (1991), empirically investigate the agency view and confirm that it is a principal source of investment inefficiency.

In this paper, we rely on studies that confirm that high CSR firms are shown to be associated with less information asymmetry (e.g. Cho et al. 2013; Dhaliwal et al. 2011) and less agency conflict (e.g. Renneboog et al. 2014; Krüger 2015). We thus discuss in the next section how high CSR involvement enhances investment efficiency.

Hypotheses

CSR may be associated with investment efficiency in different ways. We discuss two main channels through which high CSR companies may be associated with high investment efficiency, namely low information asymmetry and better management practices due to stakeholders' consideration (stakeholders' theory).

A Responsible Firm's Information Asymmetry and Investment Efficiency

Prior studies have widely shown that extra-financial information helps reduce information asymmetry and provide a more accurate picture regarding a firm's performance. This explains the emergence of numerous voluntary reporting standards that provide relevant information about companies' CSR practices and standardise their disclosure.[1] In their study of the relationship between CSR and information quality as reflected by earnings management, Chih et al. (2008) use 1,653 companies in 46 countries and employ three earnings management measures: earnings smoothing, earnings aggressiveness, and earnings loss and decrease avoidance. The authors show that CSR mitigates earning smoothing and earnings loss (earnings decrease) avoidance, while CSR increases earnings aggressiveness. Their results are consistent with Cui et al. (2012), who show an inverse relationship between CSR performance and information asymmetry: CSR negatively affects information asymmetry within a firm. By investigating whether companies exhibiting high CSR reduce earnings management and disclose more transparent and reliable information to investors, Cho et al. (2013) and Kim et al. (2012) show robust evidence that high CSR firms are less likely to engage in earnings management or manipulate real operating activities. Finally, Dhaliwal et al. (2011) empirically show that high CSR firms disclose more

[1] In 2014, the plenary of the European Parliament adopted a directive on extra-financial information disclosure that concerns large companies and groups. The companies concerned will have the obligation of disclosing information on policies, risks, and outcomes as regards environmental-, social-, and employee-related aspects, respect for human rights, anti-corruption and bribery issues, and diversity in their board of directors. These new extra-financial information disclosure rules will be applied to some large companies with more than 500 employees.

information about their financial and extra-financial activities than low CSR firms. By doing so, high CSR companies are likely to reflect a positive image about their attitude towards investors and stakeholders. Dhaliwal et al. (2011) conclude that CSR-related information can serve as a substitute for financial information, especially when it comes to reducing information asymmetry between companies and their non-financial stakeholders.[2] If high CSR companies are associated with more information quality, more transparency, and less earnings management, this should be reflected in the efficiency of their investment: high CSR firms are likely to be associated with more investment efficiency because of the low information asymmetry they enjoy.

Stakeholder Theory and Investment Efficiency

The association between CSR and investment efficiency also finds consistent support in the stakeholder theory. Indeed, Cornell and Shapiro (1987) argue that failing to meet stakeholders' expectations (Freeman 1984) is more likely to generate market fears, which in turn will result in the loss of profit opportunities for the firm. When responding to the implicit claims of stakeholders, a firm increases its financial performance; this is more likely due to good investment efficiency. Investment efficiency is likely to be the channel through which high CSR companies, which consider their stakeholders' expectation, increase their financial performance. Waddock and Graves (1997) provide additional support for this claim by considering the implications of good management theory as an extension of stakeholder theory. Waddock and Graves (1997) assume that managerial and strategic skills that lead to high social performance are also those that enhance financial performance. The level of resources that will be devoted to CSR activities in the short term depends mainly on the accessibility of resources not required for other purposes. CSR activities are undertaken only if their benefits exceed their costs. Although firms wish to follow the principles of sustainable investment, their actual CSR decisions depend mainly on the resources available, particularly given that firms' social and environmental involvements are associated with the objective of enhancing companies' competitive advantages.[3] Accordingly, our first and main hypothesis is as follows:

H1 High CSR performance is positively related to investment efficiency.

CSR is, by definition, a multidimensional construct (Carroll 1979). The use of an aggregate CSR score might mask the effect of each CSR dimension on investment efficiency. Attig (2011) and Galema et al. (2008) argue that differences in the results of some CSR studies may be due to the use of overall CSR measures. In our study's context, it is likely expected that only stakeholders that have a direct effect on a firm's activities will enhance the firm's investment efficiency. Prior studies (e.g. Carroll 1979; Hillman and Keim 2001) distinguish between primary and secondary stakeholders. Primary stakeholders (e.g. employee relations, product characteristics, environment, and diversity) are individuals or entities that benefit or are directly impacted by a firm's operations and activities. These primary stakeholders include shareholders, employees, customers, and the natural environment (Starik, 1995). This is consistent with Hillman and Keim's (2001) classification, which suggests that primary stakeholder groups are typically comprised of shareholders and investors, employees, customers, and suppliers. Clarkson (1995) argues that a firm's survival and profitability mainly depend upon its ability to create, maintain, and distribute wealth or sufficient value to ensure that primary stakeholders continue as part of the company's stakeholder system (Hillman and Keim 2001). In contrast to these primary stakeholders, secondary stakeholders (e.g. human rights and community) are those that have an indirect effect on a firm's operations and activities or are indirectly affected by the firm's activities. For instance, secondary stakeholders might include residents who live near a company and thus who may benefit from its donations to the community. These secondary stakeholders are less interesting for investment efficiency and, unlike primary stakeholders, are not likely to affect investment decisions. Investing in relationships with the primary stakeholders may be considered as a strategy for increasing competitive advantage (Attig et al. 2014) and consequently enhancing investment efficiency. This is consistent with our second hypothesis:

H2 Investment efficiency is positively related to CSR dimensions that present most firms' primary stakeholder interests.

Next, we deepen the study of the relationship between CSR and investment efficiency by examining whether CSR

[2] Several other studies provide similar results regarding the negative effect of CSR on information asymmetry and earnings management. For instance, Hong and Kacperczyk (2009) provide similar findings by analysing sin companies; Cohen et al. (2011) show that investors expressed an interest in increasing their use of non-financial information in the future, and Dhaliwal et al. (2012) demonstrate that the benefits associated with high CSR disclosure exceed the reduction of information asymmetry and generate a reduction in the cost of equity.

[3] The mechanism through which CSR increases firms' competitive advantages are multiple, namely, firm's image, firm's reputation, segmentation, and long-term cost saving.

affects investment efficiency in extreme cases. On the one hand, low CSR companies are unable to manage the complexity of environmental and social requirements and are consequently more likely to be less efficient. On the other hand, Godfrey (2005) argues that corporate philanthropy may be a source of interest conflicts between managers and shareholders. Godfrey (2005) explains the existence of an optimal level of philanthropy that should not be exceeded by managers because additional philanthropy expenditures will not generate any additional benefit. Ye and Zhang (2011) show similar results: CSR (as measured by the ratio of charitable giving to sales) reduces the cost of debt financing when a firm's CSR score is lower than a specific level; exceeding this threshold, CSR increases the cost of debt financing. Barnea and Rubin (2010) generalise this concept by showing that when a firm overinvests in all CSR components, this may lead to negative effects on a firm's financial performance. Benlemlih (2015) investigate some monitoring mechanisms and empirically show that firms are likely to reduce the maturity of their debt in order to avoid the CSR overinvestment phenomenon. In our context, we expect that if managers overinvest in CSR, this should affect the relationship between CSR and investment efficiency. A very high level of CSR may be due, inter alia, to some agency problems. In this case, we expect that CSR will not play a positive role in increasing investment efficiency. This is consistent with our last hypothesis:

H3 Very high CSR firms and very low CSR firms are weakly associated with investment efficiency.

Data and Research Design

Sample Selection

To empirically investigate the relationship between CSR and investment inefficiency, our sample is drawn from two main databases: *Compustat*, which provides financial information, and *MSCI ESG STATS* (formerly known as *KLD STATS*), which we use to obtain CSR data. To construct our sample, we begin by considering all firms from *Compustat* with non-missing financial information for the period between 1991 and 2012. We then retain observations with sufficient available data to construct our dependent variable (investment inefficiency), and control variables data. Following prior research, we exclude financial firms (Standard Industrial Classification (SIC) codes between 6000 and 6999) from our sample because they have different investment behaviour due to regulation. Next, we match our *Compustat* sample with *MSCI ESG STATS*, which evaluates each firm along 13 CSR areas based on annual reports, public information, global media publications, government documents, academic journals, and business surveys. Our final sample contains 21,030 observations representing more than 3000 US individual firms between 1998 and 2012. Table 1 presents the sample composition by year and by industry (using the two-digit SIC codes). The sample distribution by year shows that the number of firms in our study is fairly distributed around 300 firms between 1998 and 2000, and around 500 between 2001 and 2002. The number of firms increases dramatically to between 1600 and 2100 firms per year between 2003 and 2012. The rise in the number of firms per year is largely due to increased sample coverage over time by *MSCI ESG STATS*. Indeed, in the 1991–2000 period the CSR coverage consisted of the S&P 500 and the Domini Social Index. The Russell 1000 Index was added in 2001, the Large Cap Social Index in 2002, and finally both the Russell 2000 Index and the Broad Market Social Index in 2003 (Attig et al. 2014).

The sample distribution by industry is based on the first two digits of the SIC code. Table 1 shows that manufacturing industries have the largest number of observations, with 10,388 observations and about 50 % of our sample. The sample distribution by industry also shows that other industries, such as service industries and transportation, have an important number of observations and a good representation in our sample.

Regression Variables

CSR Data

Our original sample is drawn from *MSCI ESG STATS*, a database compiled by MSCI ESG Research and its predecessor, KLD Research & Analytics Inc. Since its founding in 1988, KLD has been providing research, analysis, and consulting services related to environmental, social, and governance practices. Its rating is considered as a standard in CSR and has been widely used by researchers (e.g. Bae et al. 2011; Bouslah et al. 2013; Hillman and Keim 2001; Krüger 2015; Servaes and Tamayo 2013; Sharfman 1996). The KLD rating consists of 13 CSR dimensions, grouped into two major categories: seven qualitative issue areas and six controversial business issues. The seven qualitative issue areas include: community, diversity, employee relations, environment, product characteristics, human rights, and corporate governance. The six controversial business areas include: alcohol, gambling, firearms, military, nuclear power, and tobacco. The qualitative issue areas include positive and negative ratings (strengths and concerns) with a binary system (0/1) for every concern and strength, as illustrated in Appendix 1. We calculate an overall CSR score based on six different CSR areas, namely community, diversity, employee relations, environment, human rights, and product characteristics. For

Table 1 Sample breakdown by year and industry

Year	*N*	%	Industry	Two-digit SIC	*N*	%
1998	261	1.24	Agriculture forestry and fisheries	<10	70	0.33
1999	284	1.34	Mineral industries	10–14	1188	5.63
2000	307	1.45	Construction industries	15–17	262	1.24
2001	552	2.61	Manufacturing	20–39	10,388	49.19
2002	612	2.90	Transportation communications	40–49	2555	12.10
2003	1636	7.75	Wholesale trade	50–51	693	3.28
2004	1778	8.42	Retail trade	52–59	1820	8.62
2005	1789	8.47	Service industries	>70	3954	18.72
2006	1835	8.69	Unclassified		188	0.89
2007	1879	8.90	Total		21,118	100
2008	1979	9.37				
2009	2054	9.73				
2010	2095	9.92				
2011	2027	9.60				
2012	2030	9.61				
Total	21,118	100				

This table presents the year and industry (according to the two-digit Standard Industrial Classification) distributions for the 21,118 industry-year observations that comprise the sample between 1998 and 2012. Financial firms (SIC codes 6000–6999) are excluded

each qualitative area, we calculate a score that is equal to the number of strengths minus the number of concerns. We then sum the qualitative areas' scores to obtain our overall CSR score (CSR_NET).[4] This approach is widely used in the CSR literature (e.g. Benlemlih 2015; El Ghoul et al. 2011).[5] More detailed variable definitions are provided in Appendices 1 and 2.

Dependent Variables

Investment efficiency, by definition, measures the ability of the company to undertake all those projects with positive net present value (Gomariz and Ballesta 2014). While previous literature does not show any direct proxy for the investment efficiency of the company, Biddle et al. (2009) and Chen et al. (2011a) present some of the first attempts to predict the normal level of investment. The authors then estimate the deviation from this expected optimal investment (reflected in the error term of the investment model) to assess the magnitude of inefficiency. In both studies, the investment level in the following year is estimated as a function of growth opportunities in the current year (measured by sales growth) as:

$$\text{Investment}_{i,t} = \beta_0 + \beta_1 \text{Sales growth}_{i,t-1} + \varepsilon_{i,t}, \quad (1)$$

where $\text{Investment}_{i,t}$ is the total investment of firm i in year t, defined as the net increase in tangible and intangible assets and scaled by lagged total assets; $\text{Sales growth}_{i,t-1}$ is the rate of change in sales of firm i from $t-2$ to year t.

We estimate investment model (2) cross-sectionally for each year and industry. Industry classification is based on the two-digit SIC codes. The residuals from the regression model reflect the deviation from the expected investment level. We use these residuals as our main proxy for firm investment inefficiency (*INV_INEFF*). A negative association between CSR scores and the dependent variable (the residual from the investment model) indicates that CSR reduces investment inefficiency and consequently increases investment efficiency.

On the other hand, a positive residual means that the firm is making investments at a higher level than expected according to the growth opportunities (as measured by sales growth). These positive residuals represent the over-investment phenomenon. In contrast, a negative residual suggests that real investment is less than the expected

[4] As in Servaes and Tamayo (2013), we do not believe that corporate governance is a part of CSR. Corporate governance concerns the mechanisms that allow shareholders to reward and exert control on agents. CSR deals with the social and environmental objectives of the company and stakeholders other than shareholders. We thus follow Servaes and Tamayo (2013) by the excluding corporate governance component when constructing our overall CSR score. However, our results remain unchanged when we include the corporate governance area in the calculation of our overall CSR measure.

[5] Previous literature shows alternative methods for creating a single CSR score. For example, Cai el al. (2015) calculate a CSR index by dividing the net of strengths and concerns by the total maximum possible number of strengths and concerns. In unreported results we calculate the overall CSR score using this alternative approach and re-run our main analysis. Our findings fully confirm the preliminary results and suggest that our results are not driven by the choice of the CSR measure.

investment level, which is likely to represent the underinvestment scenario.

We also follow Chen et al. (2011b, 2014), and McLean et al. (2012), among others, by using several alternative measures of investment efficiency in the robustness tests section. In particular, we use a ratio of investment efficiency (I) measured by the sum of yearly growth in property, plants, and equipment, plus growth in inventory, plus research and development (R&D) expenditure, deflated by the lagged book value of assets. We also use the capital expenditure ratio (CAPX_RAT) measured by capital expenditure deflated by the lagged book value of assets. We finally analyse a third investment efficiency proxy measured as capital expenditure plus R&D deflated by the lagged book value of assets. The coefficients of CSR in models using these alternative measures of investment efficiency are expected to be positive, as all of them are direct proxies of investment efficiency. Thereby a high level of the investment efficiency ratio reflects a high level of a firm's investment efficiency.

Control Variables

Motivated by prior research (e.g. Biddle et al. 2009; Chen et al. 2011b, 2014; Gomariz and Ballesta 2014; McLean et al. 2012), we include several control variables to better isolate the effect of CSR on investment efficiency. These control variables improve comparability with prior studies and reduce the possibility that investment efficiency is a function of correlated omitted variables. As a proxy for firm size (***SIZE***), we use the natural logarithm of dollar value of total book value of assets; Cash flow sensitivity (***S_CASH***) is measured as the standard deviation of cash and short-term investments from year $t-3$ to year 3; age (***LN_AGE***) is measured as the natural logarithm value of the number of years between fiscal year and *Compustat* listing year; tangibility (TANG) is calculated as the ratio of tangible fixed assets to total assets; return on assets volatility (S_ROA) is the standard deviation of return on assets from year $t-4$ to year t; to measure growth opportunities we include Tobin's Q (TOB_Q) as the market value of equity minus the book value of equity plus the book value of assets, all scaled by the book value of assets; to control for the financial solvency of the firm, we employ an index of financial constraints (F_CONS) developed by Hadlock and Pierce (2010) as: $-0.0737*\text{SIZE} + 0.043*\text{SIZE}^2 - 0.040*\text{AGE}$; we include a dummy variable (***LOSS***) that takes the value of one if net income before extraordinary items is negative, and zero otherwise; we also include the ratio of cash flow to total assets (CASH_AT); and a firm's leverage (LEV) as the ratio of the book value of total liabilities and debt scaled by the book value of total assets.

Finally, to address potential year- and industry-specific effects, two dummy variables are included in all the analysis: ***YEAR*** and ***INDUSTRY***. Industry fixed effects are based on the two-digit SIC codes.

Model Specification

The model we suggest to test the effect of CSR on investment efficiency is as follows:

$$\begin{aligned}\text{INV\_INEFF}_{i,t} = {} & \beta_0 + \beta_1\text{CSR}_{i,t} + \beta_2\text{SIZE}_{i,t} + \beta_3\text{S\_CASH}_{i,t} \\ & + \beta_4\text{LN\_AGE}_{i,t} + \beta_5\text{TANG}_{i,t} + \beta_6\text{S\_ROA}_{i,t} \\ & + \beta_7\text{TOB\_Q}_{i,t} + \beta_8\text{F\_CONS}_{i,t} + \beta_9\text{LOSS}_{i,t} \\ & + \beta_{10}\text{CASH\_AT}_{i,t} + \beta_{11}\text{LEV}_{i,t} \\ & + \sum \beta_j \text{Industry dummies} \\ & + \sum \beta_k \text{Year dummies} + \varepsilon_{i,t} \qquad (2)\end{aligned}$$

where $\text{INV\_INEFF}_{i,t}$ is the residuals from the investment model. It represents the estimate deviation from the expected optimal investment and reflects the magnitude of investment inefficiency. $\beta_0$is the time invariant intercept; βs are the slope coefficients of the respective factors; CSR represents social responsibility scores, measured by the overall CSR score (CSR_NET) as well as by individual components of CSR: human rights (HUM_NET), employee relations(EMPL_NET), diversity (DIV_NET), community (COM_NET), product characteristics (PRO_NET), and environment (ENV_NET). Since our main hypothesis predicts that CSR reduces investment inefficiency and improves investment efficiency, we expect β_1 to be negative and statistically significant. The rest are the control variables discussed above that may influence investment efficiency: size (SIZE), standard deviation of cash (S_CASH), age (LN_AGE), tangibility (TANG), return on assets volatility (S_ROA), Tobin's Q (TOB_Q), an index of financial constraints (F_CONS), presence of losses (LOSS), cash flow from operations (CASH_AT), and leverage (LEV). All refer to firm i in year t, and $\varepsilon_{i,t}$ is the respective disturbance term.

We include industry dummy variables to control for industry fixed effects, which may affect the relationship between firms' investment efficiency and social performance scores. Industry dummy variables are based on the first two digits of the SIC code. We also include dummy variables for each year in our sample period (i.e. year fixed effects) to control for changing economic conditions.

We use ordinary least squares (OLS) specifications with robust standard errors adjusted for both heteroscedasticity and clustering of observations. More precisely, we use Petersen's (2009) one-way cluster-robust standard errors approach at the firm level. This technique is shown by Petersen (2009) to be the preferred method for estimating standard errors in corporate finance applications using panel data.

Table 2 Descriptive statistics

	N	Mean	Median	SD	Min	Max
Panel A. Descriptive statistics for corporate social responsibility scores						
CSR_NET	21,118	−0.226	0.000	2.325	−9.000	18.000
HUM_NET	21,118	−0.046	0.000	0.262	−3.000	2.000
EMPL_NET	21,118	−0.114	0.000	0.939	−4.000	7.000
DIV_NET	21,118	0.017	0.000	1.352	−3.000	7.000
COM_NET	21,118	0.065	0.000	0.488	−2.000	4.000
PRO_NET	21,118	−0.140	0.000	0.579	−4.000	2.000
ENV_NET	21,118	−0.008	0.000	0.799	−5.000	5.000
CSR_STR	21,118	1.326	0.000	2.289	0.000	21.000
CSR_CON	21,118	1.552	1.000	1.653	0.000	14.000
Panel B Descriptive statistics for the dependent variables						
INV_INEFF	21,118	0.000	−0.022	0.428	−7.202	20.396
I	13,057	0.083	0.036	0.139	−0.010	3.225
CAPX_RAT	21,118	0.064	0.038	0.094	−0.029	4.694
CAPX_XRD	13,057	0.130	0.091	0.143	0.000	2.805
Panel C Descriptive statistics for the control variables						
SIZE	21,118	7.105	6.973	1.676	0.926	13.590
S_CASH	21,118	86.149	39.409	102.837	5.440	326.603
LN_AGE	21,118	2.921	2.890	0.701	0.693	3.989
TANG	21,118	0.295	0.313	0.345	−5.750	0.993
S_ROA	21,118	0.089	0.038	0.346	0.000	40.005
TOB_Q	21,118	2.082	1.602	1.548	0.347	39.119
F_CONS	21,118	0.836	0.725	0.856	−1.582	5.073
LOSS	21,118	0.223	0.000	0.416	0.000	1.000
CASH_AT	21,118	0.191	0.109	0.210	0.000	0.996
LEV	21,030	0.222	0.192	0.223	0.000	3.676
Panel D Descriptive statistics for the instrumental variables						
CSR_IND	21,118	−0.226	−0.160	0.793	−6.000	6.000
CSR_INI	21,118	−0.221	0.000	1.815	−9.000	10.000

This table presents the descriptive statistics for the 21,118 industry-year observations between 1998 and 2012. Financial firms (SIC codes 6000–6999) are excluded. Panel A presents the number of observations, the mean, the median, the standard deviation, the minimum, and the maximum of the corporate social responsibility data. Panel B presents the number of observations, the mean, the median, the standard deviation, the minimum, and the maximum of the dependent variables. Panel C shows the number of observations, the mean, the median, the standard deviation, the minimum, and the maximum of the control variables. Panel D presents the number of observations, the mean, the median, the standard deviation, the minimum, and the maximum of the instrumental variables. Appendices 1 and 2 outline the definitions of all the variables above

Descriptive Statistics

Panel A of Table 2 shows the descriptive statistics for the CSR data (the overall CSR score and individual components of CSR). All the scores present a median equal to 0 (except for the CSR number of concerns CSR_CON, for which the median equals −1). This suggests that the distribution of CSR scores is relatively balanced with positive and negative values. Furthermore, the overall CSR score ranges from −9 for the least socially responsible firm to +18 for the most socially responsible firm.

Panel B of Table 2 shows the descriptive statistics for the dependent variables of the study. By construction, investment inefficiency (INV_INEFF) has a mean value of 0, ranging from −7.2 to 20.39. The median value of investment inefficiency is −0.022, which suggests that the residuals from the investment model are more frequently negative, although to a smaller magnitude. Panel B also shows the descriptive statistics for the alternative measure of investment efficiency. The figures are not too far from those of Chen et al. (2014) in an international context.

Table 3 Pearson correlation coefficients between the variables

	INV_INEFF	CSR_NET	SIZE	S_CASH	LN_AGE	TANG	S_ROA	TOB_Q	F_CONS	LOSS	CASH_AT
INV_INEFF	1.000										
CSR_NET	**−0.019**	1.000									
SIZE	**−0.059**	**0.218**	1.000								
S_CASH	**−0.020**	**0.222**	**0.400**	1.000							
LN_AGE	**−0.100**	**0.123**	**0.434**	**0.136**	1.000						
TANG	**0.117**	**−0.028**	**−0.344**	**−0.052**	**−0.095**	1.000					
S_ROA	**0.045**	**−0.033**	**−0.145**	**−0.021**	**−0.098**	0.010	1.000				
TOB_Q	**0.118**	**0.085**	**−0.257**	0.012	**−0.217**	**0.136**	**0.094**	1.000			
F_CONS	**−0.011**	**0.166**	**0.774**	**0.413**	**−0.182**	**−0.286**	**−0.073**	**−0.095**	1.000		
LOSS	**−0.030**	**−0.078**	**−0.244**	**−0.046**	**−0.195**	**−0.033**	**0.144**	0.003	**−0.108**	1.000	
CASH_AT	**0.124**	**0.021**	**−0.454**	**0.015**	**−0.320**	**0.430**	**0.154**	**0.406**	**−0.230**	**0.265**	1.000

This table presents the Pearson pair-wise correlation coefficients between the dependent variables, the overall corporate social responsibility score, and the control variables for the 21,118 firm-year observations between 1998 and 2012. Financial firms (SIC codes 6000–6999) were excluded from the analysis. Appendices 1 and 2 provide the definitions for the corporate social responsibility data as well as the regression variables. Correlation coefficients in boldface are significant at least at the 5 % level

Panel C of Table 2 presents the descriptive statistics for the control variables. It globally shows values consistent with prior research (Biddle et al. 2009).

Table 3 presents the Pearson pair-wise correlation coefficients between all the variables from our analysis. As expected, we find that our overall CSR score (CSR_NET) is negatively associated with investment inefficiency. We also find that investment inefficiency is highly related to our explanatory variables, providing insurance about the relevance of our variables. Additionally, we do not find a high correlation between all the explanatory variables, indicating that our regressions do not suffer from any multicollinearity concerns.

Empirical Evidence

CSR and Investment Inefficiency

Table 4 reports the results of estimating Eq. (2) using OLS, with standard errors corrected for heteroscedasticity and clustered at the firm level. In Model 1, we regress investment inefficiency (INV_INEFF)—our main proxy for investment efficiency—on the overall CSR score (*CSR_NET*) without taking into account the control variables. We find support for our hypothesis, claiming a negative relationship between CSR and investment inefficiency: the estimated coefficient of CSR_NET is negative and statistically significant (at the 1 % level), indicating that an increase in the overall CSR score leads to lower investment inefficiency. This first result is confirmed in Model 2, which regresses investment inefficiency (INV_INEFF)—our main proxy for investment efficiency—on the overall CSR score (*CSR_NET*) and a set of controls. The estimated coefficient on CSR_NET is negative and statistically significant (at the 1 % level), indicating that an increase in CSR rating leads to a lower level of investment inefficiency and consequently a high level of investment efficiency. This result is consistent with the expectation of our first hypothesis: CSR firms are shown to be associated with less information asymmetry, more transparency, high management quality, and less earnings management, which positively affects the efficiency of their investment. Taken together, our evidence suggesting that CSR improves investment efficiency, providing strong support for the view that high CSR involvement enhances a firm's competitiveness and is far from creating a firm's competitive disadvantages (e.g. Preston and O'Bannon 1997; Waddock and Graves 1997).

Turning to the control variables, we document several significant relations. The estimated coefficient on SIZE is positive and statistically significant. Large firms have fewer growth opportunities and tend to reduce investment activities, which explain why a firm's size is associated with high investment inefficiency. A firm's age (LN_AGE) loads negatively and is statistically significant. The longer the firm has been listed, the more likely it is to be in the mature stage of the business life cycle, suggesting more experience and increased investment efficiency. Tangibility (TANG) has a positive and significant coefficient, showing that a higher volume of tangible assets leads to lower investment efficiency. Firms with higher investment opportunities as measured by a higher Tobin's Q (TOB_Q) are associated with a high level of investment, which may lead to the overinvestment phenomenon. This explains the positive coefficient on Tobin's Q. Firms that exhibit high financial constraints (F_CONS) are more likely to face investment inefficiency: high financial constraints increase investment efficiency. Regarding free cash flow

Table 4 Corporate social responsibility and investment inefficiency

	Main analysis		Analysis by sub-periods				Overinvestment	Underinvestment
	Simple (1)	Main (2)	1998–2000 (3)	2001–2004 (4)	2005–2008 (5)	2009–2012 (6)	Main (7)	Main (8)
CSR_NET	−0.004***	−0.004***	0.000	−0.004*	−0.007***	−0.002**	−0.001	−0.001***
	(−4.36)	(−4.57)	(−0.13)	(−1.72)	(−3.76)	(−1.98)	(−0.62)	(−3.00)
SIZE		0.094***	0.057*	0.061***	0.136***	0.101***	0.120***	0.011*
		(8.29)	(1.79)	(3.00)	(5.30)	(5.52)	(5.76)	(1.65)
S_CASH		0.000**	0.000	0.000	0.000	0.000*	0.000**	0.000**
		(1.98)	(1.07)	(0.99)	(1.43)	(1.69)	(2.09)	(−2.08)
LN_AGE		−0.175***	−0.087**	−0.122***	−0.236***	−0.180***	−0.256***	0.009
		(−9.68)	(−1.95)	(−3.95)	(−6.07)	(−6.41)	(−7.98)	(0.77)
TANG		0.060***	0.026	−0.003	0.059*	0.106***	−0.036	0.053***
		(3.76)	(0.65)	(−0.08)	(1.89)	(4.43)	(−1.01)	(4.72)
S_ROA		0.045	0.059	0.032	0.007	0.382**	0.387**	−0.016
		(1.24)	(0.29)	(0.93)	(0.73)	(2.05)	(2.41)	(−1.30)
TOB_Q		0.027***	0.010	0.040***	0.031***	0.014**	0.021***	−0.009***
		(5.64)	(1.62)	(3.02)	(4.16)	(1.98)	(2.61)	(−4.53)
F_CONS		−0.152***	−0.080	−0.106***	−0.220***	−0.157***	−0.213***	−0.002
		(−8.15)	(−1.61)	(−3.04)	(−5.31)	(−5.76)	(−6.31)	(−0.17)
LOSS		−0.051***	−0.028	−0.063***	−0.004	−0.087***	0.239***	−0.067***
		(−4.68)	(−0.93)	(−2.57)	(−0.18)	(−6.41)	(6.38)	(−16.19)
CASH_AT		0.221***	−0.023	0.265***	0.248***	0.145***	0.451***	−0.089***
		(5.60)	(−0.17)	(2.90)	(3.38)	(3.29)	(5.54)	(−8.78)
LEV		−0.113***	−0.180***	−0.208***	−0.192***	−0.004	−0.156***	−0.065**
		(−4.14)	(−2.51)	(−3.58)	(−3.23)	(−0.13)	(−3.05)	(−2.38)
INTERC	0.001	−0.015	−0.037	0.055	−0.109	−0.109**	0.172**	−0.111***
	(0.11)	(−0.44)	(−0.34)	(0.80)	(−1.51)	(−1.98)	(2.37)	(−5.96)
Ind. FE.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	No	No	No	No	Yes	Yes
Adj.R^2/R^2	0.01	0.05	0.11	0.07	0.05	0.07	0.16	0.23
Observations	21,118	21,030	851	4558	7452	8169	8125	12,799

This table presents the results from regressing the proxy of investment inefficiency on the overall CSR score and other control variables over the 1998–2012 period for the 21,030 firm-year observations in the sample. Models 1 and 2 regress investment inefficiency (measured as the residuals from a simple investment model) on the overall CSR score and control variables for the entire sample period. Models 3–6 replicate Model 2 after dividing the total sample period into four sub-periods. Model 7 regresses investment overinvestment (measured as the positive residuals from the investment model) on the overall CSR score and control variables for the entire sample period. Model 8 regresses investment underinvestment (measured as the negative residuals from the investment model) on the overall CSR score and control variables for the entire sample period. The control variables are size (SIZE), cash volatility (S_CASH), age (LN_AGE), tangibility (TANG), return on asset volatility (S_ROA), financial constraints (F_CONS), loss (LOSS), cash to total assets (CASH_AT), and leverage (LEV). All the models include industry and year fixed effects. Unreported industry controls are based on the two-digit Standard Industrial Classification codes. Appendices 1 and 2 outline the definitions for all the regression variables. Financial firms (SIC codes 6000–6999) are excluded from the analysis. Robust *t*-statistics corrected for clustering at the firm level are presented in parentheses

***, **, and * denote statistical significance at the 1, 5, and 10 % levels, respectively

(CASH_AT), larger operating cash flows provide firms with more financial resources for investment. High operating cash flow may lead to overinvestment activities (agency problems). A positive coefficient on operating cash flow provides support for this expectation: high operating cash flow increases investment inefficiency. A firm with higher leverage (LEV) pays more interest and is less likely to obtain additional debt financing, both of which constrain its ability to invest. Furthermore, debt holders play a monitoring role in avoiding inefficient investment (Jensen 1986). This explains the negative coefficient on leverage: highly leveraged firms are associated with low investment inefficiency. Finally, higher cash volatility (S_CASH) increases investment inefficiency, whereas the presence of

losses (LOSS) leads to less investment inefficiency. Taken together, the findings from the control variables are highly consistent with previous studies (e.g. Biddle et al. 2009; Chen et al. 2011b; Gomariz and Ballesta 2014).

Models 3 through 6 from Table 4 examine the stability of the CSR–investment efficiency relationship over time. We thus re-estimate our baseline model (Model 2) after splitting the total sample into four sub-samples. The only sub-period that shows no significant effect of CSR on investment efficiency is the first sub-period between 1998 and 2000. This is more likely due to the low number covered by *MSCI ESG STATS* during this period. The three other analysed sub-periods show that the coefficient on the overall CSR score loads negatively and is statistically significant, providing strong support for the main analysis. We conclude that the link between the overall CSR score and investment efficiency is consistent over time.

The last two models in Table 4 distinguish between two alternative scenarios of investment inefficiency, overinvestment, and underinvestment, represented by positive and negative residuals in the investment efficiency model. We consider the positive deviations (positive residual) with regard to expected investment as the dependent variable in Model 7. In Model 8, the dependent variable is the negative deviations with regard to expected investment. We find that in an overinvestment situation, CSR has no effect on investment efficiency. More precisely, in firms where investment is higher than expected, CSR is not effective in reducing the investment level. In contrast to this first result, in an underinvestment scenario CSR has a significant effect on investment efficiency. The coefficient loads negatively and is statistically significant, supporting the idea that CSR decreases investment inefficiency related to underinvestment situations: CSR contributes to increasing investment level.

The Components of CSR and Investment Inefficiency

In order to validate our second hypothesis, we extend our analysis to examine the link between investment efficiency and different dimensions of corporate social performance. Previous literature (e.g. Bouslah et al. 2013; Galema et al. 2008) suggests that aggregating dimensions of CSR may hide confounding effects among the individual dimensions of social responsibility. It is thereby relevant to study the dimensions of CSR that matter the most in increasing a firm's investment efficiency. In Table 5, we replicate the baseline model of our main analysis (Table 4, Model 2) by substituting the overall CSR score with the following six attributes of the CSR rating: human rights (*HUM_NET)* in Model 1, employee relations (*EMPL_NET)* in Model 2, product characteristics (*PRO_NET)* in Model 3, environment (*ENV_NET)* in Model 4, diversity (*DIV_NET)* in Model 5, and community (*COM_NET)* in Model 6. The results from this analysis provide strong support for our earlier findings. They are also consistent with our expectation in the second hypothesis. On the one hand, four out of the six individual components of CSR significantly increase investment efficiency, namely employee relations, product characteristics, environment, and diversity, in Models 2, 3, 4, and 5, respectively. CSR dimensions related to the firm's primary stakeholders are relevant and lead to more investment efficiency. On the other hand, CSR dimensions that are not directly related to a firm's primary stakeholders do not matter for investment efficiency. More precisely, the human rights and community sub-dimensions do not significantly affect the investment efficiency proxy (Models 1 and 6, respectively).

Taken together, the sub-dimension analyses are, to a large degree, consistent with the expectations of our second hypothesis (H2). As such, they also provide large support for the findings of Hillman and Keim (2001). CSR components that are directly related to firms' primary stakeholders (employee relations, product characteristics, environment, and diversity) are the dimensions that are the most relevant for investment efficiency. Improving relationships with firm's primary stakeholders is considered as a strategy that enhances a company's competitive advantage (Attig et al. 2014) and consequently improves the efficiency of its investments. In contrast, CSR components that are not directly related to firms' primary stakeholders do not have any internal benefit for the firm. Increasing philanthropy activities (community score) and improving human rights practices help the company enhance its reputation as being a socially responsible firm, but such activities are less interesting for investment efficiency and do not have any effect on investment decisions.

Robustness Checks

To examine the validity of our results suggesting a positive association between CSR and investment efficiency, we run additional robustness tests. These tests evaluate the sensitivity of our results to alternative measures of CSR, alternative measures of investment efficiency, alternative estimations and standard errors, several approaches to address endogeneity, and self-selection bias.

Alternative Measures of CSR

In Table 6, we analyse the effect of alternative measures of CSR on investment efficiency. We first use aggregate CSR strengths and concerns (Models 1 and 2). Strike et al. (2006) argue that CSR should be decomposed into positive and negative aspects (strengths and concerns). Companies

Table 5 Corporate social responsibility and investment inefficiency: individual components

	HUM_NET (1)	EMPL_NET (2)	PRO_NET (3)	ENV_NET (4)	DIV_NET (5)	COM_NET (6)
CSR_IND	−0.005	−0.004*	−0.011***	−0.009***	−0.006***	−0.002
	(−0.81)	(−1.75)	(−3.30)	(−4.78)	(−2.84)	(−0.59)
SIZE	0.092***	0.092***	0.092***	0.093***	0.093***	0.092***
	(8.13)	(8.11)	(8.16)	(8.21)	(8.26)	(8.13)
S_CASH	0.000	0.000*	0.000	0.000*	0.000*	0.000
	(1.48)	(1.64)	(1.31)	(1.69)	(1.85)	(1.56)
LN_AGE	−0.176***	−0.175***	−0.178***	−0.177***	−0.174***	−0.175***
	(−9.71)	(−9.67)	(−9.80)	(−9.77)	(−9.55)	(−9.68)
TANG	0.060***	0.061***	0.061***	0.060***	0.059***	0.060***
	(3.76)	(3.82)	(3.80)	(3.73)	(3.68)	(3.76)
S_ROA	0.045	0.045	0.045	0.045	0.045	0.045
	(1.24)	(1.24)	(1.24)	(1.24)	(1.24)	(1.24)
TOB_Q	0.026***	0.026***	0.026***	0.026***	0.026***	0.026***
	(5.52)	(5.55)	(5.54)	(5.57)	(5.61)	(5.52)
F_CONS	−0.152***	−0.151***	−0.154***	−0.154***	−0.150***	−0.152***
	(−8.14)	(−8.08)	(−8.24)	(−8.21)	(−8.03)	(−8.11)
LOSS	−0.050***	−0.050***	−0.050***	−0.050***	−0.050***	−0.050***
	(−4.63)	(−4.67)	(−4.65)	(−4.67)	(−4.58)	(−4.63)
CASH_AT	0.219***	0.218***	0.219***	0.220***	0.221***	0.219***
	(5.55)	(5.54)	(5.56)	(5.58)	(5.61)	(5.55)
LEV	−0.111***	−0.111***	−0.110***	−0.112***	−0.114***	−0.111***
	(−4.06)	(−4.06)	(−4.02)	(−4.09)	(−4.16)	(−4.07)
INTERC	0.001	0.001	0.004	−0.007	−0.019	−0.001
	(0.03)	(0.03)	(0.13)	(−0.21)	(−0.57)	(−0.03)
Ind. FE.	Yes	Yes	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R^2/R^2	0.049	0.049	0.049	0.049	0.049	0.049
Observations	21,030	21,030	21,030	21,030	21,030	21,030

This table presents the results from regressing the proxy of investment inefficiency on individual components of the CSR score and other control variables over the 1998–2012 period for the 21,030 firm-year observations in the sample. The individual components of CSR are human rights score (Model 1), employee relations score (Model 2), product characteristics score (Model 3), environment score (Model 4), diversity score (Model 5), and community score (Model 6). The control variables are size (SIZE), cash volatility (S_CASH), age (LN_AGE), tangibility (TANG), return on asset volatility (S_ROA), financial constraints (F_CONS), loss (LOSS), cash to total assets (CASH_AT), and leverage (LEV). All the models include industry and year fixed effects. Unreported industry controls are based on the two-digit Standard Industrial Classification codes. Appendices 1 and 2 outline the definitions for all the regression variables. Financial firms (SIC codes 6000–6999) are excluded from the analysis. Robust t-statistics corrected for clustering at the firm level are presented in parentheses

***, **, and * denote statistical significance at the 1, 5, and 10 % levels, respectively

are more likely to operate both responsibly and irresponsibly; it is thereby relevant to distinguish between these two components of CSR. We expect that CSR strengths increase investment efficiency, while CSR concerns reduce investment efficiency. Model 1 shows that the coefficient on CSR_ALTE loads negatively and is statistically significant, providing evidence that CSR strengths significantly reduce investment inefficiency. In Model 2, CSR_ALTE loads positively and is statistically significant, suggesting that companies that face CSR concerns are more likely to exhibit higher investment inefficiency. Results from both models are in line with our expectations and confirm results from our main analysis.

We further follow Girerd-Potin et al. (2014) by operating a Principal Component Analysis (PCA) on the six subcriterions of CSR analysed previously. A PCA helps to summarise the information contained in the CSR components in fewer dimensions and extracts relevant and

Table 6 Corporate social responsibility and investment inefficiency: alternative measures of CSR

	CSR strengths and concerns		CSR scores from a principal component analysis		
	CSR_STR (1)	CSR_CON (2)	CSR_PCA_1 (3)	CSR_PCA_2 (4)	CSR_PCA_3 (5)
CSR_ALTE	−0.004***	0.004**	−0.006***	−0.005**	−0.006***
	(−3.04)	(2.28)	(−3.05)	(−2.10)	(−2.99)
SIZE	0.093***	0.093***	0.094***	0.092***	0.093***
	(8.18)	(8.23)	(8.27)	(8.12)	(8.15)
S_CASH	0.000**	0.000	0.000*	0.000*	0.000
	(1.98)	(1.29)	(1.91)	(1.63)	(1.54)
LN_AGE	−0.172***	−0.179***	−0.173***	−0.176***	−0.177***
	(−9.44)	(−9.95)	(−9.53)	(−9.73)	(−9.73)
TANG	0.060***	0.060***	0.059***	0.061***	0.059***
	(3.75)	(3.77)	(3.68)	(3.82)	(3.72)
S_ROA	0.045	0.045	0.045	0.045	0.045
	(1.24)	(1.24)	(1.24)	(1.24)	(1.24)
TOB_Q	0.027***	0.026***	0.026***	0.026***	0.026***
	(5.63)	(5.53)	(5.62)	(5.55)	(5.53)
F_CONS	−0.148***	−0.156***	−0.150***	−0.152***	−0.154***
	(−7.87)	(−8.39)	(−8.02)	(−8.14)	(−8.17)
LOSS	−0.050***	−0.051***	−0.050***	−0.051***	−0.050***
	(−4.59)	(−4.68)	(−4.60)	(−4.68)	(−4.64)
CASH_AT	0.221***	0.219***	0.221***	0.218***	0.220***
	(5.60)	(5.55)	(5.62)	(5.54)	(5.57)
LEV	−0.114***	−0.110***	−0.114***	−0.111***	−0.112***
	(−4.14)	(−4.00)	(−4.17)	(−4.05)	(−4.08)
INTERC	−0.018	0.004	−0.021	0.003	−0.004
	(−0.52)	(0.13)	(−0.61)	(0.10)	(−0.11)
Ind. FE.	Yes	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	Yes	Yes	Yes
Adj.R^2/R^2	0.049	0.049	0.049	0.049	0.049
Observations	21,030	21,030	21,030	21,030	21,030

This table presents the results from regressing the proxy of investment inefficiency on alternative measures of CSR (CSR_ALTE) and other control variables over the 1998–2012 period for the 21,030 firm-year observations of the sample. The alternative measures of CSR are the total number of strengths from the six individual qualitative issue areas (Model 1), the total number of concerns from the six individual qualitative issue areas (Model 2), and the three principal factors from the principal component analysis (Models 3, 4, and 5, respectively). The control variables are size (SIZE), cash volatility (S_CASH), age (LN_AGE), tangibility (TANG), return on asset volatility (S_ROA), financial constraints (F_CONS), loss (LOSS), cash to total assets (CASH_AT), and leverage (LEV). All the models include industry and year fixed effects. Unreported industry controls are based on the two-digit Standard Industrial Classification codes. Appendices 1 and 2 outline the definitions for all the regression variables. Financial firms (SIC codes 6000–6999) are excluded from the analysis. Robust t-statistics corrected for clustering at the firm level are presented in parentheses

***, **, and * denote statistical significance at the 1, 5, and 10 % levels, respectively

independent ones. We finally consider three principal factors from this PCA and use them as proxies for CSR involvement in our regressions. Models 3–5 show that CSR rating as measured by factors from the PCA are negative and statistically significant. This is consistent with our previous results as well as with our expectations: high CSR involvement increases a firm's investment efficiency.

Alternative Measures of Investment Efficiency

We next test the robustness of our main results to the use of three alternative measures of investment efficiency. We follow Chen et al. (2014) and McLean et al. (2012), among others, and measure investment efficiency by the sum of yearly growth in property, plants, and equipment, plus

growth in inventory, plus R&D expenditure, deflated by the lagged book value of assets (I in Models 1, 4, and 7); the capital expenditure ratio measured by capital expenditure deflated by the lagged book value of assets (CAPX_RAT in Models 2, 5, and 8); and capital expenditure plus R&D expenditure deflated by the lagged book value of assets (CAPX_XRD in Models 3, 6, and 9). These are direct proxies for investment efficiency; we then expect a positive association between them and the overall CSR score. In Table 7, we show that the overall CSR score significantly increases investment efficiency as measured by the three alternative dependent variables discussed above (Models 1–3). We also show that aggregate CSR strengths significantly increase investment efficiency (Models 4–6), while aggregate CSR concerns reduce it (Models 7–9).

Alternative Estimation Methods

In this section, we verify the robustness of our results using alternative econometric specifications and standard errors. These alternative estimations help ensure that our main inference does not suffer from any cross-sectional or serial dependence. Table 8 reports the results from regressing investment efficiency proxy (investment inefficiency) on the overall CSR score and control variables using a White procedure to correct the heteroscedasticity of the standard errors (Model 1), a generalised linear model estimation (Model 2), a quantile regression procedure (Model 3), bootstrapping techniques using 50 random resamples of the 20,030 firm-year observations observed in our initial sample (Model 4), and a Newey–West test to correct autocorrelation among the residuals (Model 5). Importantly, the estimated coefficient on *CSR_NET* loads significantly negatively on investment inefficiency in all these regressions, indicating that our main evidence on the positive association between CSR and investment efficiency is unaffected by the use of different estimation methods.

Endogeneity

In this section, we perform several tests to address the issue of potential endogeneity which could bias our results. To mitigate concerns of endogeneity, we use several approaches and report our findings in the next section.

First, in Table 9, Panel A we perform an instrumental variable (IV) estimation procedure consisting of two-step regression. In the first step, we regress the overall CSR score on two instruments and control variables from the baseline model. In the second step, we regress the investment efficiency proxy on the predicted value of the overall CSR score and control variables. As instruments, we use the initial level of a firm's CSR score (CSR_INI, Attig et al. 2013), and the industry-year average of overall CSR scores (CSR_IND, El Ghoul et al. 2011). These two instruments are likely to be exogenous to the contemporaneous overall CSR score. From the first stage regression (Table 9, Model 1), we notice that larger firms with high cash holdings and high growth opportunities enjoy high CSR scores. We also find that the coefficients on the two instruments (CSR_INI and CSR_IND) load positively and are statistically significant. From the second stage regression estimated according to the 2SLS, LIML, and GMM approaches (Models 2, 3, and 4, respectively), it is clear that the coefficients on CSR load negatively and are statistically significant at the 1 % level. Models from the second stage regression consistently show that the impact of the predicted value of overall CSR score negatively affects investment inefficiency, reinforcing our earlier OLS findings.

Second, Panel B in Table 9 shows results from a Heckman (1979) selection approach that corrects for self-selection bias. The main objective of this analysis is to for a control firms' choice to increase their social involvement. In the first step, we estimate a probit model that regresses a dummy variable which takes the value of 1 if the company has a positive overall CSR score and 0 otherwise on the two instruments discussed previously (CSR_INI and CSR_IND) and control variables from the baseline model. In the second stage regression, we consider the investment efficiency proxy as the dependent variable, the overall CSR score as the interest variable, and we include control variables as well as a self-selection parameter (measured as the inverse Mills ratio) estimated from the first-stage regression.

Heckman's (1979) two-stage self-selection model continues to suggest that high CSR involvement increases investment efficiency.

Third, we employ the propensity score matching (PSM) procedure proposed by Rosenbaum and Rubin (1983). PSM consists of matching observations of firms based on the probability of increasing their overall CSR score. The effect of the overall CSR score on investment efficiency is then studied on the matched sample. To implement PSM we construct a CSR dummy variable that takes the value of 1 if the company has a positive overall CSR score and 0 otherwise. We then estimate a probit model where we regress the CSR dummy on the instruments from the previous section and all controls. We use the score estimated to match each observation with a CSR dummy that equals 1 to an observation with a CSR dummy that equals 0. To do so, we employ four different matching techniques: one-to-

Table 7 Corporate social responsibility and investment inefficiency: alternative measures of investment inefficiency

Dep. variables	The overall CSR score			CSR strengths			CSR concerns		
	I (1)	CAPX_RAT (2)	CAPX_XRD (3)	I (4)	CAPX_RAT (5)	CAPX_XRD (6)	I (7)	*CAPX_RAT* (8)	*CAPX_XRD* (9)
CSR_NET	0.001***	0.001***	0.002***						
	(2.87)	(2.54)	(3.35)						
CSR_STR				0.002***	0.001*	0.002***			
				(2.90)	(1.81)	(3.65)			
CSR_CON							−0.001	−0.001*	−0.001
							(−0.83)	(−1.88)	(−0.73)
SIZE	−0.033***	0.012***	−0.018***	−0.030***	0.013***	−0.017***	−0.031***	0.012***	−0.017***
	(−6.05)	(4.72)	(−3.21)	(−5.61)	(4.66)	(−2.99)	(−5.53)	(4.84)	(−2.89)
S_CASH	0.000	0.000*	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(−1.32)	(1.62)	(−0.19)	(−1.19)	(−0.52)	(−0.58)	(−1.56)	(−0.85)	(−1.03)
LN_AGE	0.026***	−0.034***	−0.004	0.024***	−0.033***	−0.006	0.028***	−0.031***	−0.002
	(3.28)	(−7.75)	(−0.42)	(3.49)	(−7.22)	(−0.18)	(3.01)	(−7.69)	(−0.74)
TANG	−0.087***	0.085***	−0.019	−0.087***	0.085***	−0.019	−0.086***	0.085***	−0.018
	(−7.04)	(14.74)	(−1.43)	(−7.04)	(14.78)	(−1.39)	(−7.08)	(14.77)	(−1.45)
S_ROA	0.049**	0.002	0.053***	0.048**	0.002	0.052**	0.049**	0.003	0.053**
	(2.07)	(1.00)	(2.12)	(2.06)	(1.02)	(2.11)	(2.06)	(1.01)	(2.11)
TOB_Q	0.015***	0.007***	0.021***	0.015***	0.007***	0.021***	0.015***	0.007***	0.021***
	(8.11)	(10.16)	(10.39)	(8.27)	(10.36)	(10.53)	(8.19)	(10.23)	(10.43)
F_CONS	0.045***	−0.023***	0.022**	0.042***	−0.022***	0.019***	0.045***	−0.020***	0.024**
	(5.25)	(−4.89)	(2.34)	(5.54)	(−4.27)	(2.69)	(5.04)	(−4.79)	(2.10)
LOSS	0.048***	−0.004*	0.046***	0.048***	−0.004*	0.045***	0.048***	−0.004*	0.046***
	(12.59)	(−1.89)	(10.75)	(12.79)	(−1.71)	(10.88)	(12.67)	(−1.83)	(10.78)
CASH_AT	0.210***	−0.094***	0.134***	0.213***	−0.091***	0.137***	0.213***	−0.091***	0.138***
	(16.56)	(−15.99)	(9.51)	(15.97)	(−15.71)	(9.32)	(15.98)	(−15.71)	(9.32)
LEV	−0.087***	0.074***	−0.029*	−0.088***	0.074***	−0.029*	−0.089***	0.073***	−0.030*
	(−5.30)	(10.01)	(−1.67)	(−5.40)	(10.01)	(−1.75)	(−5.32)	(10.10)	(−1.66)
INTERC	0.120***	0.070***	0.225***	0.117***	0.064***	0.225****	0.107***	0.060***	0.212***
	(5.26)	(7.04)	(4.11)	(4.61)	(5.87)	(3.96)	(4.31)	(5.75)	(3.78)
Ind. FE.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R^2/R^2	0.47	0.35	0.38	0.47	0.35	0.38	0.47	0.35	0.38
Observations	12,992	21,030	12,992	12,992	21,030	12,992	12,992	21,030	12,992

This table presents the results from regressing alternative proxies of investment inefficiency on the CSR scores (the overall CSR score, the total number of strengths, and the total number of concerns) and other control variables over the 1998–2012 period for the 21,030 firm-year observations of the sample. As alternative measures of investment inefficiency, we use the measures of investment efficiency developed by Chen et al. (2014), namely the sum of yearly growth in property, plants, and equipment, plus growth in inventory, plus R&D expenditure, deflated by lagged book value of assets (I in Models 1, 4, and 7), capital expenditure deflated by lagged book value of assets (CAPX_RAT in Models, 2, 5, and 8), and capital expenditure plus R&D deflated by lagged book value of assets (CAPX_XRD in Models 3, 6, and 9). The control variables are size (SIZE), cash volatility (S_CASH), age (LN_AGE), tangibility (TANG), return on asset volatility (S_ROA), financial constraints (F_CONS), loss (LOSS), cash to total assets (CASH_AT), and leverage (LEV). All the models include industry and year fixed effects. Unreported industry controls are based on the two-digit Standard Industrial Classification codes. Appendices 1 and 2 outline the definitions for all the regression variables. Financial firms (SIC codes 6000–6999) are excluded from the analysis. Robust t-statistics corrected for clustering at the firm level are presented in parentheses

***, **, and * denote statistical significance at the 1, 5, and 10 % levels, respectively

one matching without replacement (Model 1), one-to-one matching with replacement (Model 2), the nearest neighbour with n = 2 (Model 3), and the nearest neighbour with n = 5 (Model 4).

In all matched samples (Models 1–4 in Table 10), we continue to find a negative and statistically significant coefficient on the overall CSR score: High CSR involvement is associated with high investment efficiency.

Table 8 Corporate social responsibility and investment inefficiency: alternative estimations and standard errors

	White (1)	GLM (2)	Quantile (3)	Bootstrap (4)	Newey–West (5)
CSR_NET	−0.004***	−0.004***	−0.002***	−0.004***	−0.004***
	(−4.65)	(−4.58)	(−5.80)	(−4.78)	(−4.93)
SIZE	0.097***	0.094***	0.011***	0.094***	0.094***
	(8.61)	(8.30)	(6.23)	(7.53)	(8.37)
S_CASH	0.000***	0.000***	0.000	0.000**	0.000**
	(−3.89)	(1.98)	(0.32)	(2.04)	(2.26)
LN_AGE	−0.166***	−0.175***	−0.026***	−0.175***	−0.175***
	(−9.48)	(−9.70)	(−9.88)	(−8.19)	(−9.71)
TANG	0.062***	0.060***	0.036***	0.060***	0.060***
	(4.15)	(3.77)	(10.59)	(3.83)	(3.92)
S_ROA	0.046	0.045	−0.002	0.045	0.045
	(1.24)	(1.24)	(−1.44)	(0.66)	(1.24)
TOB_Q	0.027***	0.027***	0.015***	0.027***	0.027***
	(5.63)	(5.65)	(29.67)	(6.28)	(5.55)
F_CONS	−0.140***	−0.152***	−0.019***	−0.152***	−0.152***
	(−7.94)	(−8.17)	(−5.93)	(−7.26)	(−8.27)
LOSS	−0.048***	−0.051***	−0.080***	−0.051***	−0.051***
	(−4.48)	(−4.68)	(−45.38)	(−4.02)	(−4.71)
CASH_AT	0.245***	0.221***	0.004***	0.221***	0.221***
	(5.79)	(5.61)	(0.83)	(5.61)	(5.52)
LEV	−0.115***	−0.113***	−0.011**	−0.113***	−0.113***
	(−4.16)	(−4.14)	(−2.19)	(−3.96)	(−4.10)
INTERC	−0.074**	−0.088**	0.002	−0.088	−0.088**
	(−1.99)	(−2.21)	(0.15)	(−2.57)	(−2.32)
Ind. FE.	Yes	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	Yes	Yes	Yes
Adj.R^2/R^2	0.049	0.049	0.049	0.049	0.049
Observations	21,030	21,030	21,030	21,030	21,030

This table presents the results from regressing the proxy of investment inefficiency on the overall CSR score and other control variables over the 1998–2012 period for the 21,030 firm-year observations of the sample. The control variables are size (SIZE), cash volatility (S_CASH), age (LN_AGE), tangibility (TANG), return on asset volatility (S_ROA), financial constraints (F_CONS), loss (LOSS), cash to total assets (CASH_AT), and leverage (LEV). We show results from heteroscedasticity-consistent standard errors based on a White procedure (Model 1), a Generalised Linear Model (Model 2), a quantile regression (Model 3), standard errors based on bootstrapping techniques (50 random resamples) (Model 4), and a Newey–West estimation procedure (Model 5). All models include industry and year fixed effects. Unreported industry controls are based on the two-digit code of the Standard Industrial Classification. Appendices 1 and 2 outline the definitions for all the regression variables. Financial firms (SIC codes 6000–6999) are excluded from the analysis. Robust t-statistics corrected for clustering at the firm level are presented in parentheses

***, **, and * denote statistical significance at the 1, 5, and 10 % levels, respectively

CSR and Investment Inefficiency: The Crisis Period[6]

Following Benlemlih and Girerd-Potin (2014), we enlarge the framework of our study by investigating the relationship between CSR and investment efficiency during a financial crisis. Social and environmental weaknesses are closely observed by the market during times of financial instability and may enforce the CSR–investment efficiency

[6] We follow Benlemlih and Girerd-Potin (2014) by considering the definition of the National Bureau of Economic Research, which defines recession as a significant decline in economic activity that lasts more than a few months and that is visible in different macroeconomic variables. According to the National Bureau of Economic Research, the recession cycle period in the subprime crisis endured between December 2007 and June 2009.

Table 9 Corporate social responsibility and investment inefficiency: addressing endogeneity

	Panel A. Instrumental Variable Approach				Panel B. Heckman Selection Approach	
	First stage	Second stage			Selection equation	Outcome equation
		2SLS	LIML	GMM		
	(1)	(2)	(3)	(4)	(5)	(6)
CSR_NET		−0.006***	−0.006***	−0.006***		−0.004***
		(−3.31)	(−3.31)	(−2.81)		(−2.58)
CSR_INI	0.652***				−0.039***	
	(27.69)				(−6.19)	
CSR_IND	0.788***				−0.093***	
	(17.21)				(−4.04)	
SIZE	0.301***	0.095***	0.095***	0.094***	0.019	0.068***
	(3.99)	(8.40)	(8.40)	(8.20)	(0.70)	(8.07)
S_CASH	0.000***	0.000**	0.000**	0.000***	0.000***	0.000
	(4.69)	(2.22)	(2.22)	(2.18)	(3.77)	(0.59)
LN_AGE	−0.116	−0.175***	−0.175***	−0.175***	0.137***	−0.133***
	(−1.01)	(−9.68)	(−9.68)	(−9.65)	(3.35)	(−10.02)
TANG	0.003	0.060***	0.060***	0.059***	0.105**	0.058***
	(0.03)	(3.77)	(3.77)	(3.58)	(2.08)	(3.41)
S_ROA	0.014	0.045	0.045	0.045	0.023	0.139***
	(0.87)	(1.24)	(1.24)	(1.24)	(0.94)	(9.80)
TOB_Q	0.068***	0.027***	0.027***	0.027***	0.014*	0.023***
	(5.23)	(5.68)	(5.68)	(5.63)	(1.84)	(9.60)
F_CONS	−0.132	−0.153***	−0.153***	−0.152***	0.155***	−0.113***
	(−0.80)	(−8.18)	(−8.18)	(−8.05)	(3.11)	(−7.24)
LOSS	−0.080**	−0.051***	−0.051***	−0.051***	−0.003	−0.070***
	(−2.01)	(−4.70)	(−4.70)	(−4.68)	(−0.12)	(−8.39)
CASH_AT	0.364***	0.221***	0.221***	0.222***	0.053	0.150***
	(2.72)	(5.63)	(5.63)	(5.70)	(0.76)	(6.69)
LEV	−0.178	−0.114***	−0.114***	−0.115***	0.043	−0.120***
	(−1.06)	(−4.19)	(−4.19)	(−4.15)	(0.60)	(−5.19)
INTERC	−1.396***	−0.098**	−0.098**	−0.042	−0.081	−0.007
	(−3.44)	(−2.38)	(−2.38)	(−0.26)	(−0.33)	(−0.08)
INV_MILLS						−0.113
						(−1.32)
Ind. FE.	Yes	Yes	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R^2/R^2	0.436	0.049	0.049	0.049		5.05
Observations	21,030	21,030	21,030	21,030	21,030	21,030

This table presents the results of two main approaches to correct for endogeneity. Panel A shows results from Instrumental Variable (IV) regressions that control for the endogeneity of CSR. We employ two instruments: (1) the initial level of a firm's CSR score (CSR_INI), and (2) the industry-year average of the overall CSR score (CSR_IND). Model 1 shows the first stage regression (where the dependent variable is the overall CSR score). Models 2–4 present the results from the second stage regressions (2SLS, LIML, GMM). Panel B presents the results of Heckman's two-step treatment effect model used to correct the self-selection in CSR. The selection (CSR score) equation uses the CSR Dummy as the dependent variable, which takes the value of 1 if the firm has a positive overall CSR score and 0 otherwise. We employ two instruments: (1) the initial level of a firm's CSR score (CSR_INI), and (2) the industry average of the overall CSR score (CSR_IND). The outcome equation regresses our main measure of investment inefficiency (measured as the residuals from a simple investment model) on the overall CSR score and the control variables. The outcome equation also controls the inverse Mills ratio (INV_MILLS) estimated from the selection equation. The control variables are size (SIZE), cash volatility (S_CASH), age (LN_AGE), tangibility (TANG), return on asset volatility (S_ROA), financial constraints (F_CONS), loss (LOSS), cash to total assets (CASH_AT), and leverage (LEV). All the models include industry and year fixed effects. Unreported industry controls are based on the two-digit Standard Industrial Classification codes. Appendices 1 and 2 outline the definitions for all the regression variables. Financial firms (SIC codes 6000–6999) are excluded from the analysis. Robust t-statistics corrected for clustering at the firm level are presented in parentheses

***, **, and * denote statistical significance at the 1, 5, and 10 % levels, respectively

Table 10 Corporate social responsibility and investment inefficiency: addressing endogeneity

	PSM: 1–1 matching without replacement (1)	PSM: 1–1 matching with replacement (2)	PSM: nearest neighbour ($n = 2$) (3)	PSM: nearest neighbour ($n = 5$) (4)
CSR_NET	−0.003**	−0.004**	−0.005***	−0.005***
	(−2.23)	(−2.09)	(−3.67)	(−4.67)
SIZE	0.088***	0.068***	0.090***	0.097***
	(6.09)	(4.47)	(7.05)	(7.03)
S_CASH	0.000	0.000**	0.000***	0.000*
	(1.39)	(2.14)	(2.94)	(1.80)
LN_AGE	−0.162***	−0.152***	−0.177***	−0.182***
	(−6.25)	(−5.87)	(−8.13)	(−8.04)
TANG	0.060***	0.051***	0.055***	0.055***
	(2.91)	(2.28)	(2.86)	(3.08)
S_ROA	0.013	0.034	0.034	0.037
	(0.97)	(0.80)	(0.95)	(1.07)
TOB_Q	0.027***	0.022***	0.027***	0.027***
	(5.13)	(3.45)	(5.17)	(5.84)
F_CONS	−0.146***	−0.123***	−0.154***	−0.160***
	(−5.54)	(−4.68)	(−6.96)	(−6.72)
LOSS	−0.068***	−0.073***	−0.063***	−0.053***
	(−5.33)	(−5.22)	(−5.31)	(−4.57)
CASH_AT	0.206***	0.127***	0.146***	0.235***
	(4.56)	(2.56)	(3.75)	(5.07)
LEV	−0.095**	−0.076***	−0.098***	−0.118***
	(−2.29)	(−2.52)	(−3.90)	(−3.79)
INTERC	−0.069	0.066	−0.015	−0.085***
	(−1.56)	(1.34)	(−0.39)	(−2.07)
Ind. FE.	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	Yes	Yes
Adj.R^2/R^2	0.06	0.048	0.054	0.049
Observations	10,494	7908	11,394	15,908

This table presents the results from regressing the proxy of investment inefficiency (measured as the residuals from a simple investment model) on the overall CSR score and other control variables over the 1998–2012 period for the matched sample from a Propensity Score Matching (PSM) approach. The propensity scores are computed from a probit model. The dependent variable is a dummy that takes the value of 1 if the firm has a positive overall CSR score and 0 otherwise. The independent variables are the control from our main effect model and two instrumental variables: (1) the initial level of a firm's CSR score (CSR_INI), and (2) the industry-year average of the overall CSR score (CSR_IND). We employ four propensity matching methods: 1–1 matching without replacement (Model 1), 1–1 matching with replacement (Model 2), nearest neighbour ($n = 2$) (Model 3), and nearest neighbour ($n = 5$) (Model 4). The control variables are size (SIZE), cash volatility (S_CASH), age (LN_AGE), tangibility (TANG), return on asset volatility (S_ROA), financial constraints (F_CONS), loss (LOSS), cash to total assets (CASH_AT), and leverage (LEV). All the models include industry and year fixed effects. Unreported industry controls are based on the two–digit Standard Industrial Classification codes. Appendices 1 and 2 outline the definitions for all the regression variables. Financial firms (SIC codes 6000–6999) are excluded from the analysis. Robust t-statistics corrected for clustering at the firm level are presented in parentheses

***, **, and * denote statistical significance at the 1, 5, and 10 % levels, respectively

relationship. Indeed, high CSR firms enjoy high loyalty from their stakeholders, attract high-quality employees, benefit from a good relationship with the players in the market, and have a good image and reputation. All of these advantages are more likely to benefit companies during times of financial distress. We thus expect that the relationship between CSR and investment efficiency is more pronounced.

The results from Table 11 show that CSR has a greater positive effect on investment efficiency during a financial crisis. The coefficient on the overall CSR score during times of financial distress is −0.011 (Model 2) as opposed to −0.002 in out-of-crisis periods (Model 3). In Model 4, we include an interaction term to check whether this difference in the CSR effect on investment efficiency is statistically significant. Results from this

Table 11 Corporate social responsibility and investment inefficiency: the crisis period

	Total period (1)	Crisis period (2)	Out-of-crisis period (3)	Total period with interaction term (4)
CSR_NET	−0.004***	−0.011***	−0.002**	−0.003***
	(−4.57)	(−4.42)	(−1.98)	(−3.08)
CRISIS				0.009
				(0.77)
CSR_NET*CRISIS				−0.004**
				(−1.95)
SIZE	0.094***	0.102***	0.098***	0.097***
	(8.29)	(3.61)	(7.64)	(8.62)
S_CASH	0.000**	0.000	0.000***	0.000***
	(1.98)	(−1.47)	(−3.74)	(−3.84)
LN_AGE	−0.175***	−0.149***	−0.170***	−0.166***
	(−9.68)	(−3.16)	(−9.03)	(−9.54)
TANG	0.060***	0.055	0.070***	0.062***
	(3.76)	(1.37)	(3.92)	(3.86)
S_ROA	0.045	0.000	0.143	0.046
	(1.24)	(−0.02)	(1.82)	(1.25)
TOB_Q	0.027***	0.043***	0.024***	0.027***
	(5.64)	(3.77)	(4.45)	(5.80)
F_CONS	−0.152***	−0.127***	−0.145***	−0.140***
	(−8.15)	(−2.82)	(−7.34)	(−7.85)
LOSS	−0.051***	−0.005	−0.064***	−0.048***
	(−4.68)	(−0.16)	(−5.63)	(−4.46)
CASH_AT	0.221***	0.145**	0.256***	0.245***
	(5.60)	(1.99)	(5.47)	(6.01)
LEV	−0.113***	−0.258***	−0.071***	−0.115***
	(−4.14)	(−2.91)	(−3.00)	(−4.22)
INTERC	−0.015	−0.190**	−0.076*	−0.074**
	(−0.44)	(−1.97)	(−1.65)	(−1.95)
Ind. FE.	Yes	Yes	Yes	Yes
Year FE.	Yes	NO	Yes	Yes
Adj.R^2/R^2	0.05	0.047	0.057	0.051
Observations	21,030	3843	17,187	21,030

This table presents the results from regressing the proxy of investment inefficiency (measured as the residuals from a simple investment model) on the overall CSR score and other control variables during the crisis/out-of-crisis periods. The sample includes 21,030 firm-year observations between 1998 and 2012. Model 1 shows the baseline model, Model 2 shows the relationship between CSR and investment inefficiency in the period of the subprime crisis, Model 3 studies the out-of-crisis period, and Model 4 includes an interaction term to investigate if there is an additional effect of CSR on investment inefficiency in a time of crisis. The control variables are size (SIZE), cash volatility (S_CASH), age (LN_AGE), tangibility (TANG), return on asset volatility (S_ROA), financial constraints (F_CONS), loss (LOSS), cash to total assets (CASH_AT), and leverage (LEV). All the models include industry and year fixed effects. Unreported industry controls are based on the two-digit Standard Industrial Classification codes. Appendices 1 and 2 outline the definitions for all the regression variables. Financial firms (SIC codes 6000–6999) are excluded from the analysis. Robust t-statistics corrected for clustering at the firm level are presented in parentheses

***, **, and * denote statistical significance at the 1, 5, and 10 % levels, respectively

model show that this additional effect of the overall CSR score on investment efficiency during the subprime crisis is statistically significant. High CSR companies really enjoy the benefit of their high social and environmental involvement: CSR helps attenuate the negative effects of financial crises and reduces the impact of firm-specific shocks by increasing the efficiency of the operated investments.

Table 12 Corporate social responsibility and investment inefficiency: extreme cases

	1st–5th (1)	5th–95th (2)	95th–100th (3)	1st–10th (4)	10th–90th (5)	90th–100th (6)
CSR_NET	−0.003	−0.005***	0.002	−0.003	−0.008***	−0.003
	(−0.33)	(−3.14)	(0.92)	(−0.62)	(−2.99)	(−1.48)
SIZE	−0.027	0.105***	−0.038*	−0.007	0.115***	−0.011
	(−1.30)	(8.77)	(−1.65)	(−0.35)	(8.84)	(−0.35)
S_CASH	0.000	0.000***	0.000	0.000	0.000***	0.000
	(0.02)	(−3.37)	(0.79)	(0.91)	(−3.01)	(−1.11)
LN_AGE	0.003	−0.180***	0.050	−0.021	−0.195***	−0.010
	(0.11)	(−9.54)	(1.26)	(−0.88)	(−9.43)	(−0.23)
TANG	−0.034	0.063***	0.049	0.009	0.067***	−0.010
	(−0.64)	(3.73)	(1.28)	(0.26)	(3.66)	(−0.25)
S_ROA	0.120	0.045	0.054	0.131	0.045	0.250**
	(0.92)	(1.24)	(0.54)	(1.24)	(1.23)	(2.21)
TOB_Q	−0.017	0.029***	−0.003	0.002	0.030***	0.021***
	(−0.90)	(5.97)	(−0.40)	(0.23)	(5.61)	(2.58)
F_CONS	0.023	−0.155***	0.045	−0.010	−0.173***	0.023
	(0.88)	(−7.82)	(1.44)	(−0.38)	(−7.83)	(0.59)
LOSS	−0.093***	−0.047***	−0.080***	−0.077***	−0.048***	−0.058*
	(−5.67)	(−4.14)	(−3.35)	(−4.20)	(−3.90)	(−1.64)
CASH_AT	0.028	0.245***	0.073	−0.020	0.256***	0.081
	(0.38)	(5.85)	(1.62)	(−0.31)	(5.74)	(1.56)
LEV	−0.076	−0.123***	−0.023	−0.059	−0.131***	−0.044
	(−1.25)	(−4.25)	(−0.30)	(−1.23)	(−4.23)	(−0.74)
INTERC	0.275**	−0.082**	0.104	0.148*	−0.100**	0.135
	(2.35)	(−2.06)	(1.44)	(1.69)	(−2.32)	(1.15)
Ind. FE.	Yes	Yes	Yes	Yes	Yes	Yes
Year FE.	Yes	Yes	Yes	Yes	Yes	Yes
Adj.R^2/R^2	0.125	0.051	0.151	0.078	0.053	0.085
Observations	781	19,401	848	1774	17,298	1,958

This table presents the results from studying extreme cases of the relationship between CSR and investment inefficiency. Models 1–3 consider 5 and 95 % as a threshold for the extreme cases, while Models 4–6 consider 10 and 90 % as the threshold for the extreme cases. The models regress investment inefficiency (measured as the residuals from a simple investment model) on the overall CSR score and control variables The control variables are size (SIZE), cash volatility (S_CASH), age (LN_AGE), tangibility (TANG), return on asset volatility (S_ROA), financial constraints (F_CONS), loss (LOSS), cash to total assets (CASH_AT), and leverage (LEV). All the models include industry and year fixed effects. Unreported industry controls are based on the two-digit Standard Industrial Classification codes. Appendices 1 and 2 outline the definitions for all the regression variables. Financial firms (SIC codes 6000–6999) are excluded from the analysis. Robust t-statistics corrected for clustering at the firm level are presented in parentheses

***, **, and * denote statistical significance at the 1, 5, and 10 % levels, respectively

CSR and Investment Inefficiency: The Extreme Cases

The last empirical section of this study investigates the relationship between CSR and investment efficiency through extreme cases. Indeed, based on the overinvestment argument, we expect that very low and very high CSR firms are more likely to not be associated with investment efficiency. On the one hand, low CSR companies are not able to manage the complexity of environmental and social requirements and consequently are more likely to be less efficient. On the other hand, a very high level of CSR may be due to managers' tendency to overinvest in CSR and entrench themselves as being socially responsible managers. A very high level of CSR is expected to have no effect (or to negatively affect) investment efficiency. Results from Table 12 provide strong support for this analysis. In the first three models, where very low CSR firms and very high CSR firms are determined as the extreme 5 % of the distribution, it is

clear that CSR does not affect investment efficiency. Nevertheless, when the CSR level is between the fifth and the ninety-fifth percentile we continue to find that high CSR increases investment efficiency. This is consistent with our expectation in Hypothesis 3 (H3). Models 4 through 6 show that this result is robust and holds even when considering extreme CSR levels, as measured by 10 % of the distribution in our sample.

Conclusion

In this study, we provide one of the first attempts to investigate the relationship between CSR and investment efficiency. Using a large sample of more than 3000 individual firms representing 21,030 firm-year observations over the 1998–2012 period, we find statistically significant evidence that CSR is positively related to investment efficiency. We believe that our evidence is mainly due to the low level of information asymmetry that high CSR firms enjoy, as well as their good management practices. Our findings are robust when using alternative measures of CSR, alternative measures of investment efficiency, alternative estimations and standard errors, and several approaches to address endogeneity and self-selection bias. Moreover, among the individual components of CSR, we show that dimensions which are linked to primary stakeholders (e.g. employee relations, product characteristics, environment, and diversity) are the dimensions that play the most important role in improving investment efficiency. Additional results suggest that CSR had an additional effect on investment efficiency during the subprime crisis. High CSR firms benefit from employee solidarity and customer loyalty in financial crises, which enhance the efficiency of their investment. In a final set of tests, our findings indicate that extremely low CSR and extremely high CSR firms do not enjoy a high level of investment efficiency.

Our study's results support the theory that CSR investments may be considered as an effective way to improve investment efficiency. Corporate managers are highly encouraged to improve their practices with their primary stakeholders. Such improvements will likely result in reflecting a better image of the company, gaining employee loyalty, and enhancing customer support. This may result in an increase in investment efficiency, especially in times of financial stability, which in turn leads to high financial performance.

When studying the relationship between CSR and investment efficiency, we argue that high CSR commitment helps increase investment efficiency; however, good investment efficiency is generally associated with better financial performance, which may result in more resources being available for the pursuit of CSR goals. With the regression analysis, we cannot confirm a causal relationship between CSR and investment efficiency. Future research may extend the framework of the relationship between CSR and investment efficiency by examining the direction of causation between these two variables by using appropriate methodologies (e.g. Granger causality tests).

Appendix 1: Qualitative Issue Area Definitions

We use six qualitative issue areas from KLD: community, diversity, employee relations, environment, product characteristics, and human rights. Each area has several strengths and concerns, as illustrated below. We calculate a score for each area equal to the number of strengths minus the number of concerns. The overall CSR score is equal to the sum of all areas' scores.

Dimension	Strengths	Concerns
Community	Charitable giving	Investment controversies
	Innovative giving	Negative economic impacts
	Non-US charitable giving	Indigenous peoples relations
	Support for housing	Tax disputes
	Support for education	Other concerns
	Indigenous peoples Relations	
	Volunteer programmes	
	Other strengths	
Diversity	CEO's Identity promotion	Controversies (e.g. fines)
	Board of directors	Non-representation
	Women and minority contracting	Other concerns
	Employment of the disabled	
	Gay and lesbian policies other strengths	

Dimension	Strengths	Concerns
Employee relations	Union relations	Union relations
	No-layoff policy	Health and safety concerns
	Cash profit sharing	Workforce reductions
	Employee involvement	Retirement benefits concerns
	Retirement benefits Strengths	Other concerns
	Health and safety strengths	
	Other strengths	
Environment	Beneficial products and services	Hazardous waste
	Pollution prevention	Regulatory problems
	Recycling	Ozone-depleting Chemicals
	Clean energy	Substantial emissions
	Communications	Agricultural chemicals
	Property, plants, and equipment	Climate change
	Management systems	Other concerns
	Other strengths	
Product characteristics	Quality	Product safety
	R&D/innovation	Marketing/contracting Concerns
	Benefits for the economically disadvantaged	Antitrust
	Other strengths	Other concerns
Human rights	Positive record in South Africa	South Africa concerns
	Indigenous peoples relations strengths	Northern Ireland concerns
	Labour rights strengths	Burma concerns
	Other strengths	Mexico concerns
		Labour Rights Concerns
		Indigenous peoples relations concerns other concerns

Appendix 2: Variable Definitions and Data Sources

Variables	Definition	Source
Panel A. Dependent variables		
INV_INEFF	Investment inefficiency is measured as the residual from a simple investment model (Biddle et al. 2009) that predicts the level of investment based on growth opportunities (measured by sales growth). Deviations from the model, as reflected in the error terms of the investment model, represent the investment inefficiency $Investment_{i,t} = \beta_0 + \beta_1 Sales\,Growth_{i,t-1} + n_{I,t}$ Investment $_{i,t}$ is the total investment of firm i in year t, defined as the net increase in tangible and intangible assets and scaled by lagged total assets. $Sales\ Growth_{i,t-1}$ is the rate of change in sales from year $t-2$ to year $t-1$ of firm i. The estimation of the model is made cross-sectionally for each year and industry	Authors' calculations based on ***COMPUSTAT***data
I	A proxy for investment efficiency equals the sum of yearly growth in property, plants, and equipment, plus growth in inventory, plus R&D expenditure, deflated by the lagged book value of assets (Chen et al. 2014)	As above
CAPX_RAT	A proxy for investment efficiency equals capital expenditure deflated by the lagged book value of assets (Chen et al. 2014)	As above
CAPX_XRD	A proxy for investment efficiency equals capital expenditure plus R&D deflated by the lagged book value of assets (Chen et al. 2014)	
Panel B. CSR variables		
HUM_NET	The human rights score equals the number of strengths minus the number of concerns in the human right issues area	Authors' calculations based on ***MSCI ESG STATS*** data

Variables	Definition	Source
EMPL_NET	The employee relations score equals the number of strengths minus the number of concerns in the employee relations qualitative issues area	As above
DIV_NET	The diversity score equals the number of strengths minus the number of concerns in the diversity qualitative issues area	As above
COM_NET	The community score equals the number of strengths minus the number of concerns in the community qualitative issues area	As above
PRO_NET	The product score equals the number of strengths minus the number of concerns in the product qualitative issues area	As above
ENV_NET	The environment score equals the number of strengths minus the number of concerns in the environment qualitative issues area	As above
CSR_NET	The overall CSR score equals the sum of the human rights, employee relations, diversity, community, product characteristics, and environment qualitative issues areas' scores	As above
CSR_STR	The total number of strengths of the human rights, employee relations, diversity, community, product characteristics, and environment qualitative issues areas	As above
CSR_CON	The total number of concerns of the human rights, employee relations, diversity, community, product characteristics, and environment qualitative issues areas	As above
Panel C. Control variables		
SIZE	Natural logarithm of the dollar value of the total book value assets	Authors' calculations based on ***COMPUSTAT*** data
S_CASH	Standard deviation of cash and short-term investments from $t-3$ to t	As above
LN_AGE	Logarithmic value number of the years between the fiscal year and the Compustat listing year	As above
TANG	The ratio of tangible fixed assets to total assets	As above
S_ROA	Standard deviation of return on assets (ROA) from $t-4$ to t	As above
TOB_Q	Market value of equity minus book value of equity plus the book value of assets, all scaled by book value of assets	As above
F_CONS	An index of financial constraints developed by Hadlock and Pierce (2010) as: $-0.0737 * \text{SIZE} + 0.043 * \text{SIZE}^2 - 0.040 * \text{AGE}$.	As above
LOSS	A dummy that takes the value of one if net income before extraordinary items is negative, and zero otherwise	As above
CASH_AT	The ratio of cash flow to total assets	COMPUSTAT data
LEV	The ratio of the book value of total liabilities and debt scaled by book value of total assets	As above
CRISE	A dummy variable that takes a value of 1 for years 2007 and 2008 and 0 otherwise	
INDUSTRY FE	A dummy that takes a value of 1 if the firm is active in one of the two-digit Standard Industrial Classification codes and otherwise	
Panel D. Instrumental variables		
CSR_IND	The industry-year average of the overall CSR score	Authors' calculations based on ***MSCI ESG STATS*** data
CSR_INI	The firm-level initial value of the overall CSR score	KLD STATS data

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