International Journal of
Corporate Social Responsibility

ORIGINAL ARTICLE Open Access

When and where does it pay to be green? – A look into socially responsible investing and the cost of equity capital

Yanbing Wang[1,2*], Michael S. Delgado[3] and Jin Xu[4]

Abstract

We investigate the circumstances under which socially responsible investing (SRI) enhances firm long-term financial performance, and therefore provides incentives for firms to self-regulate their environmental performance. Aggregating portfolios across SRI mutual funds, we estimate the effect of SRI investment with environmental screening criteria on firm cost of equity capital. We find that accounting for interactions between firm and non-shareholder stakeholders, and potential agency costs associated with certain environmental activities of the firm, SRI can facilitate the alignment of firms' environmental and financial goals. We also find that an industry group's environmental performance and diversity influence the extent to which a firm in that group can benefit from SRI investment.

Keywords Socially responsible investing, Corporate environmental performance, Corporate social responsibility , Environmental, social, corporate governance, Environmental self-regulation

Introduction

The recent few decades have seen public firms placing an increasing emphasis on their social and environmental responsibility. Firms take initiatives to protect the environment, improve relationships with employees and communities, and promote social justice. Inevitably, firm activities towards social and environmental responsibility involve commitment of financial resources and beyond. In terms of firm environmental activities, for instance, voluntary pollution abatement activities may incur costs associated with technological changes in the production or waste management process, investment in renewable energy, and the opportunity cost associated with investing in other projects that may increase shareholder wealth. Hence, there has been an ongoing debate over whether "it pays to be green". For public firms, this can boil down to whether firm environmental responsibility harms shareholder value due to the related costs, or whether a firm can maintain shareholder value while achieving environmental goals.

The stance one would take on such a debate depends on the time horizon over which the relation between firm environmental performance and financial performance is viewed. Projects integrating environmental values may only realize significant financial gains over a longer time horizon, and possibly at the expense of short-term gains (Khanna & Damon, 1999; Eccles et al., 2014; Kecskes et al., 2014), for instance, firm efforts in managing and mitigating climate risk (Flammer, 2021). There is rich empirical evidence on the short-term value-relevance of firm environmental responsibility, often based on event studies on stock price response to information regarding firm environmental performance (e.g. Klassen & McLaughlin, 1996; Lyon & Shimshack, 2012; Wang et al.,

*Correspondence:
Yanbing Wang
yanbing.wang@agroscope.admin.ch
[1] Economic Modeling and Policy Analysis Group, Agroscope, Tänikon, Switzerland
[2] Agricultural Economics and Policy Group, ETH Zürich, Zürich, Switzerland
[3] Department of Agricultural Economics, Purdue University, West Lafayette, IN, USA
[4] Pamplin College of Business, Virginia Tech, VA, Blacksburg, USA

2019). The transient stock price changes, however, do not capture effects of a firm's long-standing environmental activities that accrue to its social and environmental profile[1]. Evidence from existing studies on why firms voluntarily and consistently engage in environmental abatement activities, as well as the long-term financial implications of such activities, is still sparse (e.g. Friede et al., 2015; Margolis et al., 2007; Margolis & Walsh, 2003).

In this study, we investigate the long-term financial outcome of firm environmental responsibility. We examine, *ceteris paribus*, whether an environmentally responsible firm benefits from a lower cost of equity capital. We focus on a particular channel which may link firm environmental performance to financial performance: socially responsible investing (SRI)[2]. We test whether and under what circumstances do investments from SRI mutual funds with environmental screening criteria impact firm cost of equity capital, and further explore industry-level heterogeneity.

Our study contributes to the literature that examines the long-term financial outcomes of firm socially and environmentally responsible behavior (e.g., Ambec & Lanoie, 2008; Clarkson et al., 2008; Dhaliwal et al., 2011; El Ghoul et al., 2011; Kim, 2019). Instead of following the previous studies to search for an overall relation between environmental performance and the financial outcomes (whether "it pays to be green"), we focus on SRI mutual funds as a specific channel through which good environmental performance may lead to favorable financial outcomes in the long run, i.e., a lower cost of equity capital. We examine whether and under what circumstances (i.e., firm-stakeholder relations and industry characteristics) SRI impacts firm cost of equity capital, which translates into an incentive for firms to improve environmental performance over longer time horizons. We find that accounting for interactions between firms and non-shareholder stakeholders and potential agency costs in firm environmentally activities, the eligibility for SRI investment reduces firm cost of equity capital. Moreover, the effect of SRI investment on cost of equity is heterogeneous across industries, depending on industry group environmental performance and diversity. Our study takes a further step in understanding incentives created in financial markets that motivate firm environmental self-regulation, which is an important supplement to existing mandatory environmental regulations.

Background and related literature

Socially responsible investing (SRI)

We consider SRI as a potential channel through which firm environmental performance may link to financial performance. SRI is an investment discipline that applies environmental, social, and corporate governance (ESG) criteria to investment decisions in order to generate a positive social impact while achieving long-term financial returns[3]. Compared to investors that only aim for (short-term) earnings regardless of the social and environmental impact of the securities in which they invest, SRI investors aim for both financial performance and the advancement of ESG practices in the long run via their investments. To do this, SRI investors incorporate ESG considerations in portfolio construction and analysis, and/or file shareholder resolutions to prompt attention to ESG-related issues[4]. Moreover, SRI investors' focus on long-term returns may facilitate achieving ESG goals over long-term horizons on the firm's side (Eccles et al., 2014; Kecskes et al., 2014).

SRI has been quickly growing worldwide. In the United States, as of the end of 2019, at least $17.1 trillion was invested according to SRI strategies. This figure amounts to more than one out of every three dollars under professional management. By contrast, in 1995 the size of SRI was only $639 billion. According to the United States Forum for Sustainable and Responsible Investment (USSIF), SRI comprises three major segments. Registered investment companies, including mutual funds, variable annuity funds, ETFs and closed-end funds that apply ESG criteria in investment decisions, is the largest segment, managing $3.10 trillion of ESG assets in 2020. Alternative investment funds include private equity and venture capital funds, hedge funds, and real estate investment

[1] For example, while a firm's announcement of achieving LEED certification for its office buildings may induce a significant stock market reaction, maintaining the LEED credentials continuously over a long period of time may contribute to the environmental profile of the firm as being energy-efficient. However, this long-term effect cannot be captured in the stock market reaction to a single announcement.

[2] SRI is also commonly known as sustainable investing.

[3] The concept of ESG is closely related to corporate social responsibility (CSR), which is widely referred to in the literature. CSR refers to the strategies and policies incorporated into firm business practices to ensure that firm actions leave a positive social and environmental impact, with the objective of increasing long-term profits, shareholder wealth, and stakeholder support. An important intersection of CSR and ESG is that they both require a long-term perspective. The key difference between CSR and ESG is the party that they initially concern, i.e., firms and investors, respectively. SRI investors screen on the ESG performance of firms, but in the context of our study, CSR can be considered equivalent to ESG because the screening on ESG performance by SRI investors reflects their perspective on the outcome of firm CSR.

[4] Many SRI mutual funds engage in shareholder advocacy, which means they may file or co-file shareholder resolutions on ESG issues or engage in dialogs on ESG issues with firms in their portfolio. Dimson et al. (2015) provide examples of ESG issues addressed by shareholder resolutions. We do not focus our analyses on these shareholder resolutions; instead, we study whether the screening strategies of SRI investors may influence firm environmental behavior through an impact on the cost of equity capital.

trusts or other property funds that considered ESG criteria. These funds managed total assets of $716 billion in 2020. Lastly, community investments include community development banks, credit unions, loan and venture funds. Community investing assets in 2020 was $266 billion (USSIF 2021).

In terms of regulations on SRI investors in the United States, in particular on registered investment companies, there have not been specific guidelines or requirements from the regulator Securities and Exchange Commission (SEC) as of 2021. However, the SEC has been taking continuous action with respect to ESG-related investment, for instance, issuing risk alerts on potential misconducts of registered investment companies and other fund managers on the claims they made about ESG-related products (SEC, 2021).

Among the SRI investors, mutual funds comprise one of the fastest growing groups. In 1995 there were 55 SRI mutual fund products incorporating ESG criteria, managing assets of $12 billion in the United States. From 2018 to 2020, the number of mutual fund products grew from 636 to 718, with assets increasing from $2.58 trillion to around $3 trillion (USSIF 2021)[5]. Despite the absence of formal regulation, SRI mutual funds registered with the USSIF disclose their screening strategies. In the Appendix we provide information on the environmental screening strategies of SRI mutual funds that concern our study.

Along with the rapid growth of SRI investing is the potentially increasing impact of SRI investment on firm financial performance and environmental behavior[6]. By conventional wisdom, shown in a theoretical model by Heinkel et al. (2001), the screening process of SRI investments may alter firm risk sharing opportunities, which in turn have a stock price effect (discussed below). It is an empirical issue to what extent SRI investment is able to influence firm financial performance and therefore create incentives for firms to self-regulate environmental externalities.

Cost of equity capital as a measure of firm performance

Cost of equity capital is the expected return a firm needs to offer in compensation for the risks incurred from holding the firm's stock. It is a critical component of firm valuation, and plays an important role in firm financing and operations decisions (Dhaliwal et al., 2011). If investors associate high risk with a firm project, they will require a higher expected rate of return from the firm to compensate for the risks, as opposed to a project with low risk. Firm cost of equity capital provides a benchmark for measuring the relative risks associated with firm projects. With a lower cost of equity capital, a firm can more easily undertake new projects because of the lower expected return it needs to pay investors (i.e., a higher share price)[7].

Although the effect of a lower cost of equity capital varies by the firm's other financial characteristics, In the Appendix we use two numerical examples to show how a reduction in cost of equity capital might influence firm financial performance.

Related literature

The traditional perspective on firm social and environmental responsibility is that it comes at a cost to the profitability of a firm, which is against the interest of firm stakeholders (Friedman, 1970). Yet, this view has been challenged by a number of subsequent theories that demonstrate how firm social and environmental responsibility can generate benefits that offset the costs. For example, the stakeholder theory and its extensions illustrate how firm social and environmental responsibility facilitates the establishment of long-term relationships of a firm with its stakeholders, on which the success of the business depends (Freeman, 1984; Jones, 1995). Kitzmueller & Shimshack (2012) summarize several theoretical explanations for corporate social responsibility (CSR); under certain mechanisms, shareholder value maximization itself could be the motivation behind CSR. In particular, investors with preference for environmental and social responsibility internalize the negative externalities (e.g., pollution) associated with firm production, which they reflect in the analysis of their portfolio as well as interventions with firm ESG behavior (Heal, 2005; Revelli 2017; Dam 2015; Mccahery 2016; Hart 2017).

Findings in the literature on the (short-term) stock market response to firm environment-related behavior provide important insights into the value-relevance of firm environmental performance (e.g, Klassen and McLaughlin, 1996; Lyon and Shimshack, 2012; Wang et al., 2019). The financial outcomes associated with environmental information therefore incentivize a firm to adjust its behavior in order to improve environmental performance. The underlying activities in these studies usually focus on improving the favor of a particular set of stakeholders, which likely translate into near-term gains or losses; the long-term relationship between firm environmental and financial performance, on the other

[5] From 2019, the USSIF reports assets managed by investment companies, including mutual funds and ETFs, altogether.

[6] For a survey of the history and development of SRI, SRI fund performance, as well as the value relevance of firm social and environmental responsibility, see Renneboog et al. (2008).

[7] This is different from the transient price effect resulting from the stock market responding to new information. A change in the cost of equity capital has an effect on the long-term average stock price.

hand, reflect firm interaction with a broad range of stakeholders (Barnett, 2007). By introducing the concept of "stakeholder influence capacity", Barnett (2007) argues that CSR impacts firm financial performance through its influence on stakeholder relations. In other words, the relation between firm social and environmental performance and financial performance can depend on a firm's ability to use socially and environmentally responsible activities to improve stakeholder relations in a profitable way (Mackey 2007; Hart 2017).

From a stakeholder perspective, the literature provides empirical evidence on the circumstances under which a firm might behave in a socially and environmentally responsible way, and ways that social and environmental performance can influence financial performance. Stakeholders of a firm play an important role in shaping firm environmental behavior. As is summarized in Kitzmueller & Shimshack (2012) p. 58, socially and environmentally responsible firm behavior may arise in a "stakeholder interaction" context, translated from preferences of stakeholders. When a firm faces pressure from different groups of stakeholders that are interested in firm social and environmental responsibility, not taking into account of these interests subjects the firm to risks that affect firm performance. Hence a firm may choose to incorporate social and environmental responsibility in its business processes and products in order to mitigate these risks. Empirical evidence of the sources of external stakeholder pressures suggests that the regulatory environment, political environment, and interests of local communities in social and environmental issues influence firm behavior in these aspects (Henriques & Sadorsky, 1996; Anton et al., 2004; Frondel et al., 2008; Albuquerque et al., 2019; Dimson et al., 2015). In terms of internal stakeholders, pressure and preference from active shareholders, management, employees, and the board of directors can affect a firm's tendency to respond to social and environmental issues (Ervin et al., 2013; Frondel et al., 2008; Kassinis & Vafeas, 2002; Wu, 2009; Mackey 2007).

Firm behavior with respect to social and environmental responsibility also depends on industry characteristics. Several studies indicate that firms operating in industries/sectors where the profitability is relatively more sensitive to stakeholder relations are more likely to take socially and environmentally responsible actions, and this likelihood is also influenced by the behavior of competitors in similar industries (Henriques & Sadorsky, 1996; Frondel et al., 2008; Eccles et al., 2014). As such, the links between firm social and environmental behavior and financial outcomes are likely heterogeneous and contingent, and therefore warrant further investigation into when and under what circumstances it pays for firms to be environmentally responsible.

Recent research provides theoretical and empirical evidence on how firm socially and environmentally responsible behavior can influence firm financial performance via firm-investor interactions (e.g., Albuquerque et al., 2019; Bushnell et al., 2013; Flammer, 2015). By analyzing the financial performance of firms following shareholder resolutions raised by asset managers of a large institutional investor, Dimson et al. (2015) show that firms that successfully address the ESG issues in the shareholder resolutions experience improved financial and operating performance. Hong & Kacperczyk, (2009) provide evidence that firms in "sin" industries (i.e., alcohol, tobacco, and gaming) need to offer higher expected returns due to limited investments from norm-constrained institutional investors. Overall, these findings are consistent with the theoretical evidence that SRI investing can motivate changes in firm social and environmental behavior (e.g., Heinkel et al., 2001; Mackey 2007; Dam 2015; Hart 2017). Furthermore, in studies that also focus on the cost of capital as a financial outcome, El Ghoul et al. (2011) and Chava (2014) find a negative relation between firm social and environmental performance and the cost of equity financing. Nonetheless, several other studies that uses portfolio analysis provide mixed empirical evidence on the relationship between investment that incorporates social/environmental screening and firm stock performance (Edmans, 2011; Eccles et al., 2014; Mollet & Ziegler, 2014).

Our study is closely related to the literature on the financial impact of firm social/ environmental responsibility. We provide a new angle to assess the extent to which investor-firm interactions can create financial incentives for firms to voluntarily improve environmental performance. Instead of studying one particular investor (Dimson et al., 2015) or considering all institutional investors as norm-constrained investors (Hong & Kacperczyk, 2009; Chava, 2014), we focus on SRI mutual funds with explicit environmental screening criteria as a specific channel, and identify the impact of SRI investments on firm cost of equity capital. Moreover, instead of searching for an overall relation between firm environmental performance and cost of equity capital (El Ghoul et al., 2011; Chava, 2014), we take into account the potential heterogeneity in the effect of SRI investing on firm cost of equity capital across industries by addressing the industry heterogeneity of the effect of SRI screening.

Theoretical framework and hypothesis development

Theoretical framework on the price effect of SRI

Heinkel et al. (2001) develop a theoretical framework to demonstrate the price effect of SRI investing. Excluded by SRI investors from their portfolios, polluting firms face relatively limited risk sharing opportunities compared to clean firms. Polluting firms therefore need to offer higher expected returns to (neutral) investors that still hold their shares. That is, SRI screening increases the cost of equity capital of polluting firms. When the price effect of SRI screening is large enough, there is an incentive for polluting firms to improve environmental performance to comply with SRI criteria. A number of subsequent studies on the price effect of firm social and environmental responsibility also apply variations of this framework (e.g., El Ghoul et al., 2011; Hong and Kacperczyk, 2009). We provide the key results derived from the theoretical framework in the Appendix and summarize the implications here (see Eq. (6)). First, the price effect of SRI investing depends on the fraction of SRI investors: an increase in the number of green investors in the economy lowers the demand for shares of the polluting firms, which reduces their share prices (i.e., increases their cost of equity capital), leading more polluting firms to reform. Second, the number of firms that choose to reform decreases as the cost of reform increases. Third, the number of reformers decreases as the risk tolerance of investors and the number of clean firms in the economy increases.

From an empirical perspective, while the equilibrium characterized in Heinkel et al. (2001) demonstrate the basic logic behind the price effect of SRI investing through changing firms' risk sharing opportunities, it may miss several realities, particularly in terms of heterogeneity in investor preference and the starting point of firm environmental performance (Mackey 2007; Dam 2015). First, as is discussed in Heinkel et al. (2001), the effect of SRI investment on firm environmental behavior is compromised if not all SRI investors apply the same screening criteria, which reduces the risk sharing impact. According to the USSIF, this appears to be the case in reality. Neutral investors that do not value firm ESG performance may perceive this screening variability among SRI investors as a form of noise trading, which complicates the price effect of SRI screening (Vanwalleghem, 2013). Besides, the cost of technology reform in order to comply with SRI screening varies; in particular, industries that are relatively more polluting overall face a higher cost of reform than cleaner industries. That is, the cost of reform is likely to vary across industries. As such, we expect in equilibrium, the fraction of firms that comply to SRI screening criteria, and more importantly, the price effect of SRI investment, to vary across industries.

Empirical hypotheses

Building on the theoretical framework in Heinkel et al. (2001) and the literature on the relation between firm environmental performance and financial performance we review in Background and related literature section, we develop our hypotheses on the impact of SRI screening strategies on firm cost of equity capital.

> **Hypothesis 1:** SRI investment reduces a firm's cost of equity capital.

We expect that on average, the status of receiving SRI investment reduces firm cost of equity capital, i.e., compared to a firm that does not pass SRI screening, the cost of equity capital for a firm that passes the screening is reduced through the risk sharing opportunities offered by SRI mutual funds. Taking into account the possible dependency of the financial outcomes of firm environmental responsibility on firm-stakeholder relationship revealed from previous literature, and the difference in the cost of complying to SRI screening across industries, under the main hypothesis we further develop the following two sub-hypotheses.

> **Hypothesis 1a:** The effect of SRI investment on firm cost of equity capital depends on firm-stakeholder relationship.
>
> **Hypothesis 1b:** The effect of SRI investment on firm cost of equity capital depends on industry characteristics.

Empirical strategy and identification

Econometric framework

To test our hypotheses, we estimate a treatment effect model with the cost of equity capital as the outcome, and whether a firm is included in any SRI fund's portfolio as the treatment. Let Y^0_{ijt} denote the potential cost of equity capital for firm i in industry j when the firm is not invested by any SRI funds at time t, and let Y^1_{ijt} denote the potential cost of equity capital when the firm is invested by at least one SRI fund. Then, $Y^1_{ijt} - Y^0_{ijt}$ is the treatment effect of SRI investment. Let X_{ijt} be a set of observable firm characteristics that influence a firm's cost of equity capital, then Y^0_{ijt} and Y^1_{ijt} can be decomposed into the mean given firm characteristics, $\mu_0(X_{ijt})$ and $\mu_1(X_{ijt})$, and the deviation from the mean, U^0_{ijt} and U^1_{ijt}:

$$\begin{aligned} Y^0_{ijt} &= \mu_0(X_{ijt}) + U^0_{ijt}, \\ Y^1_{ijt} &= \mu_1(X_{ijt}) + U^1_{ijt}. \end{aligned} \tag{1}$$

Our goal is to learn about the effect of the treatment, D, on the cost of equity capital. We define the treated group as the firm-year observations that receive SRI investment, and the control group as those that do not. Define $D_{ijt-1} = 1$ if a firm is invested by SRI funds (treated) at time $t-1$, and $D_{ijt-1} = 0$ otherwise. Since each firm is observed only in one state, either invested or not invested by SRI funds, the observed outcome, Y_{ijt}, is $Y_{ijt} = D_{ijt-1}Y^1_{ijt} + (1 - D_{ijt-1})Y^0_{ijt}$. Substituting Eq. (1) into this expression, we get

$$\begin{aligned} Y_{ijt} =& Y^0_{ijt} + (Y^1_{ijt} - Y^0_{ijt})D_{ijt-1} \\ =& \mu_0 + (\mu_1 - \mu_0 + U^1_{ijt} - U^0_{ijt})D_{ijt-1} + U^0_{ijt}. \end{aligned} \tag{2}$$

Assuming a linear in parameters function for $\mu_l, l = \{0, 1\}$ and adding fixed effects, Eq. (2) implies the regression:

$$Y_{ijt} = X_{ijt}\beta^0 + [X_{ijt}(\beta^1 - \beta^0) + (U^1_{ijt} - U^0_{ijt})]D_{ijt-1} + \tau_t + \phi_j + U^0_{ijt}. \tag{3}$$

That is, we define the cost of equity capital as a function of time-varying firm characteristics X_{ijt}, and state-specific coefficients β^l for $l = \{0, 1\}$. In addition, we account for an unobservable year-specific effect τ_t, an unobservable time-invariant effect at the industry level ϕ_j, and state-specific time-varying unobservables U^l_{ijt} [8].

In the base model we assume a common unobservable effect and that D_{ijt-1} is conditionally exogenous, i.e. $U^1_{ijt} = U^0_{ijt} = U_{ijt}$, and $D_{ijt-1} \perp U_{ijt} | X_{ijt}, \tau_t, \phi_j$. Our parameter of interest $\gamma \equiv E[Y^1_{ijt} - Y^0_{ijt}] = E[X_{ijt}(\beta^1 - \beta^0)]$, is the average treatment effect of SRI investment on firm cost of equity capital. A negative estimate of γ indicates that on average, SRI investment decreases firm cost of equity capital, which is in line with our main hypothesis. Identification of γ relies on adequately controlling for the factors that lead to variation in the cost of equity capital, so that conditional on the control variables, firm cost of equity capital only varies through the receipt of SRI investment. We include industry fixed effects to control for the variation in cost of equity capital due to industry-specific and time-invariant characteristics, and year fixed effects to control for changes over time, such as economic shocks or the evolution of investor (equilibrium) preferences, that affect firm cost of equity capital.

As a robustness check of the results from our baseline regressions, we estimate the effect of SRI investment on cost of equity capital in a difference-in-differences model. This model allows us to compare the average change in cost of equity capital after a firm receives SRI investment to the change for a firm that never receives SRI investment. For this analysis, we use a subset of firms that are either never included in the portfolios of SRI mutual funds in our sample, or are included in the portfolio after the start of our study period.

Selection issues

While each SRI fund determines in which firms to invest, the set of SRI eligible firms is not likely to be random. In other words, a firm may self-select into being eligible for SRI based on an array of intrinsic and extrinsic factors. Some of these factors may be common within industries or geographical regions. Industry characteristics may drive a firm's environmental behavior, since undertaking environmentally responsible activities may be more beneficial or less costly for a firm in certain industries than others. Bagnoli & Watts (2003) show in a theoretical framework that in competition for socially responsible consumers, the level of environmental and social responsibility provided by a firm depends on the market competitiveness of an industry. Empirical evidence also shows that for a firm that sells final goods to consumers, environmental responsibility may be a product differentiation strategy to attract customers that care about the environment (Henriques & Sadorsky, 1996; Anton et al., 2004; Eccles et al., 2014). The industry fixed effects in Eq. (3) capture many types of selection issues that we believe exist at the industry level. Firm environmental behavior also depends on the environmental preferences of the community members and regulators in the geographic region in which a firm is located. We use a state fixed effect to account for the spatial variation in the regulatory pressure on a firm to behave environmentally responsibly. Moreover, firm financial characteristics, which determine the affordability of environmental activities to a firm, influences the firm's decision to undertake environmentally responsible activities. If by conditioning on firm characteristics and the fixed effects, $U^1_{ijt} = U^0_{ijt} = U_{ijt}$ and $D_{ijt-1} \perp U_{ijt}$, then we can identify γ.

To the extent that there still exist idiosyncratic and time-varying unobservables that are not captured by the fixed effects, for example, if the unobservables lead

[8] An alternative specification would include firm-specific fixed effects. However, using firm-specific fixed effects precludes us from including and interacting the industry group-level characteristics with SRI investment. As we discuss in this section, our set of control variables that vary at the firm level and our inclusion of the year- and industry-level fixed effects captures the relevant factors that influence firm cost of equity capital. To the extent that there exists firm-specific unobservables beyond the firm-specific control variables we include in the model, we develop an instrumental variables strategy (see the next subsection) to ensure that we obtain consistent estimates. The instrumental variables approach addresses time-varying firm-level unobservables, in addition to the time-invariant firm-level unobservables that would be controlled for via firm-level fixed effects.

to distinct cost of equity capital between SRI eligible and SRI ineligible firms without SRI investment, i.e. $Cov(D_{ijt-1}, U_{ijt}) \neq 0$ after controlling for X_{ijt} and the fixed effects, the estimate of γ may still be biased. The concept of stakeholder influence capacity (Barnett, 2007) and its role in determining the financial outcomes of CSR may be a potential source of time-varying unobservables at the firm level. According to Barnett (2007), a firm achieves the financial outcomes of CSR activities through its ability to use CSR to improve stakeholder relationships. These relationships could be dynamic in light of, for example, the intensity of media scrutiny of the firm, which changes over time. In the case that the unobserved stakeholder influence capacity is correlated with cost of equity capital through channels other than SRI investment, while also correlated with firm eligibility for SRI investment, then we cannot use the fixed effects to capture this (unobservable) variability in cost of equity capital. For example, by studying events of conflicts and cooperation with stakeholders of public firms in gold mining, Henisz et al. (2014) find that greater stakeholder support leads to higher firm valuation. If some of the stakeholders events influence firm eligibility of SRI investment, for example, events concerning environmental compliance, then we are faced with selection bias in the sense that firms that are eligible for SRI investments are those faced with less stringent environmental regulations. Although this relationship may be more relevant to industries that transform natural resources to shareholder wealth (Henisz et al., 2014), since the level of shareholder cooperation is dynamic, an industry fixed effect may be insufficient to identify the effect of SRI investment.

To address the issue of a non-random sample due to selection bias, we use a set of instrumental variables to predict the propensity that a firm behaves environmentally responsibly, which qualifies the firm for SRI investment, before estimating the impact of SRI investment on cost of equity capital. Formally, define D^*_{ijt} as a latent variable that generates D_{ijt} according to a threshold crossing rule:

$$D_{ijt} = \mathbf{1}[D^*_{ijt} > 0], \tag{4}$$

where $\mathbf{1}[A]$ is an indicator function ($\mathbf{1}[A] = 1$ if A is true; 0 otherwise). Specifically, define

$$D^*_{ijt} = \mu_{D_{ijt}}(Z_{ijt}) - V_{ijt}, \tag{5}$$

where Z_{ijt} is a vector of firm and industry specific, time-varying characteristics that influence the firm's decision to become eligible for SRI, and $\mu_{D_{ijt}}(Z_{ijt}) - V_{ijt}$ can be interpreted as the net benefit for a firm with characteristics (Z_{ijt}, V_{ijt}). Identification requires that some element Z^k_{ijt} in Z_{ijt} is excluded from X_{ijt}, so that by varying Z^k_{ijt}, we can recover the probability that a firm is eligible to receive treatment without affecting the outcome.

Our first instrumental variable is the ratio of independent directors over the total number of directors. It is excluded from X_{ijt} as a firm's board composition is not likely to directly influence firm financial performance. Although some may argue that shareholders may be willing to accept lower returns from firms with better corporate governance, of which board independence is an aspect, several studies that examine the relation between firm corporate governance and financial performance do not find evidence of a significant correlation between board independence and firm performance which include the cost of equity capital (Ashbaugh et al., 2004; Pham et al., 2011; Lima & Sanvicente, 2013). In particular, Ashbaugh et al. (2004) find that the majority of the governance attributes considered in their study, including board independence, are significantly associated with market risk (market beta), and no significant relation exists between governance attributes and financial performance when beta is controlled for. A conclusion follows that board independence affects cost of equity capital only through the effect on market risk. Since we control for beta in our analysis, the potential correlation between board independence and cost of equity capital would be subsumed in beta.

The motivation underlying this instrument is twofold. First, while the external factors may influence firm behavior with respect to the environment, they are unlikely to have a homogeneous effect because these factors may take effect through the board of directors, which vary in philosophies and styles, and therefore attitude towards stakeholder interests[9]. To what extent a firm takes account of the interests of its stakeholders and fulfills their demands depends on firm engagement with the stakeholders. As is argued by Kassinis & Vafeas (2002) and Kock et al. (2012), stakeholders have greater influence over the board when the board is composed of fewer insiders (employees of and individuals affiliated with the firm), because non-affiliated directors are more likely to address stakeholder interests. We therefore use the fraction of independent directors – non-affiliated directors who are independent of management and tend to be friendly to stakeholders – over the total number of directors to measure firm responsiveness to pressure from external stakeholders.

Second, as is argued in several studies (e.g., Barnea and Rubin, 2010; Barnett, 2007), certain socially responsible activities, such as those that are purely altruistic or out of the manager's personal benefits, do not substantially contribute to improving stakeholder relationships,

[9] For example, in the face of conflicts with stakeholders, some firms may take effort to resolve the conflicts, while some may choose to ignore it.

and therefore do not improve firm financial performance. These activities are especially likely to occur when the manager makes environmental decisions without going through the board. Therefore, these activities create agency problems since they benefit the manager or society, but not shareholders (Jensen & Meckling, 1976)[10]. Barnett (2007) argues that when agency problems confound with CSR, it may create a downward bias in the estimate of the financial outcome of CSR (i.e., an upward bias in the effect on cost of equity capital). (Krüger 2015) provide further empirical evidence that CSR that reflect agency problems harm shareholder wealth. Given the evidence from Byrd & Hickman (1992) that independent directors can monitor management decisions on the behalf of shareholders, and therefore mitigate the agency problem, we use the fraction of independent directors as an instrument to account for the potential downward bias in the estimate of the financial benefit of SRI investment due to agency costs associated with firm environmental behaviors. Data for this instrumental variable are from the Institutional Shareholder Services (ISS) database.

Our second instrumental variable addresses the case that social and environmental preference may translate into actions that influence corporate strategy regarding environmental performance (Kitzmueller & Shimshack, 2012). The variable is constructed as the number of Sierra Club members in the state in which a firm is headquartered per 1,000 residents of the state. Sierra Club is a nation-wide environmental organization in the United States which promotes green policies in areas such as green energy and climate change by lobbying politicians. Membership of the Sierra Club is argued to represent the environmental preferences of the population of a state, or the marginal value the state residents place on environmental quality, which influences the pressure of behaving environmentally responsibly received by a firm in that state (Maxwell et al., 2000; Delmas & Montes-Sancho, 2010)[11]. This instrument is correlated with firm cost of equity capital only through SRI investment, which satisfies the exclusion restriction for instrumental variables[12].

Industry heterogeneity

In addition to controlling for industry-level variation in the cost of equity capital, we also expect that the effect of SRI investment may vary across industries. Several studies indicate that the motivation for undertaking environmentally responsible activities and the costs and benefits vary across industries, which may in turn lead to a heterogeneous financial impact (e.g., King 2001; Eccles et al., 2014; Lyon and Maxwell, 2011). In particular, industry environmental performance and closeness to final consumers are two important factors relevant to the financial outcomes of firm environmental responsibility. Since polluting industries may have stronger incentives pursue environmental responsibility, it is important to correct for industry type and industry-level environmental performance (Lyon & Maxwell, 2011; Bénabou & Tirole, 2010; Dam 2015). The effect of SRI investment on the cost of equity capital may therefore depend on the industry's environmental performance.

In terms of closeness to final consumers, Anton et al. (2004) find that for industries that deliver final goods or services to consumers and individual customers, environmental responsibility is positively related to firm financial performance. Dimson et al. (2015) find that SRI fund managers' engagement with firm environmental and governance issues are especially concentrated in certain industries, such as manufacturing and advertising-intensive industries, and the financial impact of such engagement also varies across industries. Since an increasing number of consumers are willing to pay higher prices for goods and services with environmental features (Kitzmueller & Shimshack, 2012), environmental activities in these industries are likely considered as value-relevant by both SRI and neutral investors. When neutral investors do not require a risk premium for trading firms in these industries, the firms benefit from a reduction in the cost of equity capital through SRI investment (Vanwalleghem, 2013). On the other hand, the clients of the intermediary industries (i.e., the downstream industries) are

[10] Agency problems arise when there exists conflict of interest between the agent (the manager) and the principals (the shareholders), i.e. the manager does not act in a way to maximize shareholder value. The associated costs are agency costs. Ferrell et al. (2014) provides a review of the agency view of corporate social responsibility.

[11] While one may argue that a firm may face pressure of environmental responsibility from both within and outside of the state where it is headquartered, our instrument is still relevant. Specifically, our identification is through the portion of pressure within the state that influence corporate strategy and environmental performance.

[12] Apart from selection bias, if the effects of SRI, $U^1_{ijt} - U^0_{ijt}$, are heterogeneous among firms invested and not invested by SRI funds, and firms make their decision of whether to be eligible for SRI based on partial or full knowledge of their gains from being invested by SRI funds, i.e. $Cov(D_{ijt-1}, U^1_{ijt} - U^0_{ijt}) \neq 0$, it is possible that the firms that choose to be eligible for SRI are the ones that would benefit more from the investment than the ones that do not choose to be eligible (Heckman et al., 2006). We do not find evidence that firms select on unobservable gains in receiving SRI investment. A detailed discussion and the results of the tests are reported in the Appendix.

likely not willing to pay for the price premium associated with environmental responsibility if the premium cannot be passed along to final consumers; in this case, environmental activities are seen as an unnecessary cost.

Since there is variation in the scope of industries within the industry groups, the effect of SRI investment may also vary in industry diversity. For less diversified industry groups such as Chemicals, Construction, and Automobiles and Trucks, there more likely exists a homogeneous effect of SRI investment[13]. However, for other industry groups such as Retail, Wholesale, and Business Services, the sub-industry groups are highly diversified, it is possible that SRI investment has a positive effect on the cost of equity capital of certain sub-industries, and a negative effect on that of other sub-industries[14].

To explore the potentially heterogeneous effect of SRI investment on the cost of equity capital of firms across different industry groups, we estimate a model with interactions of SRI investment and the three industry group characteristics discussed above – industry group diversity, environmental performance, and closeness to final consumer. We account for industry group diversity with the number of sub-industry groups in each industry group. For industry environmental characteristics, we construct an index of environmental concerns relative to environmental strength for each industry group. Data for this index are from the MSCI ESG STATS dataset (previously KLD STATS). We group the firms by the Fama-French 48 industries, and construct the index as the ratio of number of environmental concerns in four categories – Regulatory Compliance, Toxic Spills & Releases, Climate Change, and Other Concerns – to environmental strengths in four respective categories - Environmental Opportunities, Waste Management, Climate Change, and Other Strength – among firms in each industry group over the available time period[15]. We calculate the fraction of intermediate industries in each industry group based on four-digit SIC codes to measure an industry group's closeness to final consumers.

To address the endogeneity of SRI investment and its interactions with the industry characteristics, we use a control function approach by first regressing the SRI investment indicator on firm characteristics and the two instrumental variables, then including the error term from the first stage in the estimation of the effect of SRI investment on firm cost of equity capital.

[13] These industry groups have 7, 6, and 15 sub-industry groups, respectively.

[14] For example, the Wholesale industry group covers 41 wholesale businesses from groceries to metals and minerals, for which the effect of SRI may vary largely, and the numbers of sub-industry groups for Business Services and Retail are 44 and 64, respectively.

[15] While MSCI ESG STATS reports annual firm-level indicators of environmental concerns and strengths in aspects such as environmental reporting, waste management, and climate change, the universe of firms changes over time, and does not fully overlap with our sample. We therefore do not measure environmental concerns at the firm level, but rather aggregate to the industry group level.

Data

We compile information on publicly traded firms in the following categories: investments from SRI mutual funds, cost of equity capital, and firm characteristics that affect cost of equity capital.

Investments from SRI mutual funds We obtain a list of SRI mutual funds with environmental screenings from websites of the USSIF, SocialFunds, and Bloomberg, and collect information on 65 portfolios from Bloomberg (Table 6 list the funds and their inception dates whenever available). These mutual funds are equity funds that can be access by both individual and institutional investors. We focus on socially responsible mutual funds because their investments compose a considerable amount of all SRI investment (29 percent by assets under management), and their screening strategies are publicly disclosed and relatively more standardized compared to other investment instruments. For each firm-year observation, we sum over the investments from each mutual fund (measured by positions held) to obtain the total investment from SRI mutual funds in firm i during year t.

Based on the sign (positive or zero) of the SRI investment from mutual funds received by firm i in year t, we divide the firms in our sample into four groups – those that receive SRI investment throughout the whole sample period (referred to as "SRI Firms"), those that receive no SRI investment throughout the sample period ("nonSRI Firms"), those that receive SRI investment continuously from a certain year through the end of the sample period ("ΔSRI Firms"), and others that receive SRI investment intermittently over the sample period ("Other"). Table 1 presents the number of firms in each group and the summary statistics of SRI investment in each group. Our sample consists of 1,434 SRI firms, 224 nonSRI firms, 982 ΔSRI firms, and 340 Other firms. Among the groups of firms with positive SRI investment, i.e. SRI, ΔSRI, and Other firms, group SRI has a higher mean SRI investment than the other two groups, and all three groups have higher mean SRI investment than the median, displaying right-skewness. We plot the market value of SRI investment over time from the mutual funds in our sample and the distributions of the mean fraction of SRI investment in SRI, ΔSRI, and Other firms in Figs. 1 and 2 the Appendix.

Cost of equity capital Our measure of cost of equity capital is constructed following the ex-ante approach in Gebhardt et al. (2001), in which the implied cost of

Table 1 Summary statistics of SRI investment and cost of equity capital

		SRI Investment (%)			Risk Premium (%)		
Group	**Num. Firms**	**Mean**	**Std.Dev.**	**Median**	**Mean**	**Std.Dev.**	**Median**
nonSRI	224	0.000	0.000	0.000	5.548	5.321	4.564
Other	340	0.102	0.508	0.003	4.953	4.023	4.476
ΔSRI	982	0.052	0.215	0.004	4.695	3.399	4.403
SRI	1,434	0.234	0.943	0.045	4.397	3.255	4.159

equity capital of a firm is the internal rate of return that equates the current stock price to the present value of all expected future free cash flows to equity (i.e. dividends) of the firm based on all the information available at time *t*. This approach avoids using realized returns and a particular asset pricing model to estimate expected returns, an approach commonly adopted in portfolio analysis, which may provide biased estimates (Gebhardt et al., 2001; Hann et al., 2013). Details of how the implied cost of equity capital is computed can be found in the Appendix, where we also provide two examples to demonstrate how reduction in cost of equity capital might influence firm financial performance.

To examine the effect of SRI investment on firm cost of equity capital net of the rate of return to risk-free investments, following Gebhardt et al. (2001), Hann et al. (2013), and Chava (2014), we subtract the 10-year treasury bond yield from the calculated cost of equity capital to obtain the firm equity risk premium. We obtain data on these variables from I/B/E/S, CRSP, and Compustat.

Table 1 presents descriptive statistics of firm equity risk premium. Firms differ in mean risk premium across groups, with the group nonSRI having the highest risk premium and the group SRI the lowest. Two-sample *t*-tests show that the means are pairwise statistically different at the 1 percent level except for the group Other and the group nonSRI, the difference between which is not statistically significant. The mean equity risk premium in our whole sample is about 4.7 percent, while the mean cost of equity capital (before subtracting the risk free rate) is about 8.2 percent.

Other firm characteristics Various risk and firm characteristics may influence a firm's cost of equity capital, including firm size (measures information availability), financial leverage, book-to-market ratio, market beta (measures market volatility), analyst earnings forecast dispersion (measures earnings variability), long-term growth forecast, and past returns. We obtain these data from Compustat and I/B/E/S.

The universe of firms in our sample comprises all public firms in the United States included in Compustat, CRSP, and I/B/E/S between 2004 and 2015. We obtain an unbalanced panel of 2980 firms that have data available to construct each of the variables discussed above.

Figure 3 presents the timeline of the data on our key variables, SRI investment and equity risk premium, as well as other firm characteristics variables. Following Gebhardt et al. (2001) and Hann et al. (2013), we use long-term growth forecast, analyst earnings forecast dispersion, forecast earnings per share, and stock price per share as of the third Thursday of June each year. We use data on the other control variables from the most recent quarterly report prior to June each year, and data on SRI investment from December of the previous year.

Table 2 shows descriptive statistics of the continuous variables. Statistics of the ratio of SRI investment show that the skewness of the distribution is driven by the very large outliers at the right tail. We report the correlations between the continuous variables in the Appendix. Table 7 shows that the highest correlation among the covariates, 0.4, is between the natural log of book-to-market ratio and leverage ratio.

To ensure the comparability of the treatment samples, for each variable, we perform balance and overlap tests to assess the similarity in the distributions of the variable across treatment groups. We find that the covariates are well-balanced. Detailed discussions of the metrics we use and the test results are reported in the Appendix.

Results and discussion

Baseline and instrumental variables regressions

In our baseline analysis, we estimate fixed effects models of firm equity risk premium regressed on SRI investment and other control variables, treating SRI investment as a binary variable that equals to 1 if a firm receives SRI

Table 2 Descriptive statistics of continuous variables for the full sample of 20,500 observations

Variables	Mean	Std.Dev.	Minimum	Maximum	Median
Risk premium (%)	4.603	3.490	-4.147	28.527	4.286
log(Market cap (in MM))	7.536	1.574	2.482	13.483	7.396
Leverage	0.218	0.211	0.000	0.986	0.165
log(Book-to-market)	-0.876	0.744	-8.580	2.833	-0.812
log(Dispersion)	-2.881	1.060	-4.605	7.840	-2.996
Long-term growth	0.182	0.780	-1.999	60.000	0.130
Beta	1.239	0.749	-2.092	12.514	1.131
Return (%)	1.523	1.825	-14.801	24.859	1.314
SRI ratio (%)	0.147	0.706	0.000	53.317	0.017

investment in a given year, and 0 otherwise. We include industry, year, and state fixed effects. Column 1 of Table 3 shows the results. The coefficient on SRI investment is statistically insignificant in Model FE, indicating that on average, receiving SRI investment does not affect firm cost of equity capital when we control for year, industry, and state fixed effects.

For the difference-in-differences estimation in the robustness check, we use firms in the nonSRI group as the control group, and firms in the ΔSRI group as the treated group. We present the results from this model in the Appendix, since results are largely consistent with those from the baseline regressions.

As we discuss in Selection issues section, time-varying unobservables correlated with both cost of equity capital and firm eligibility for SRI investment may lead to non-random treatment assignment and bias the

Table 3 Results of baseline and IV regressions

	FE	IV (1)		IV (2)	
		First Stage	Second Stage	First Stage	Second Stage
Market Cap	−0.030***	0.426***	-0.016	0.426***	-0.017
	(0.011)	(0.079)	(0.013)	(0.079)	(0.013)
Leverage	2.565***	-0.349	2.537***	-0.359	2.539***
	(0.104)	(0.323)	(0.105)	(0.323)	(0.105)
Book-to-Market	1.436***	0.160**	1.433***	0.161**	1.433***
	(0.028)	(0.080)	(0.028)	(0.080)	(0.028)
Dispersion	0.370***	0.017	0.367***	0.017	0.367***
	(0.017)	(0.041)	(0.017)	(0.041)	(0.017)
Long-term Growth	−0.057***	0.032	−0.055***	0.033	−0.055***
	(0.021)	(0.073)	(0.021)	(0.073)	(0.021)
Beta	0.397***	-0.017	0.395***	-0.025	0.395***
	(0.026)	(0.056)	(0.027)	(0.057)	(0.026)
Return	0.044***	−0.067***	0.038***	−0.068***	0.038***
	(0.012)	(0.023)	(0.012)	(0.023)	(0.012)
SRI	0.071		−0.574**		−0.530*
	(0.073)		(0.280)		(0.279)
Affiliation		0.971***		0.953***	
		(0.171)		(0.171)	
Sierra Club				0.270	
				(0.173)	
Year FE	Yes		Yes		Yes
Industry FE	Yes		Yes		Yes
State FE	Yes		Yes		Yes
Observations	12,134	12,134	12,134	12,134	12,134
R^2	0.653		0.651		0.651
Adjusted R^2	0.650		0.648		0.648
F—Statistic		228.78		232.19	

Column 1 reports results of the fixed effect regressions; Column 2 and Column 4 report results of the first-stage correlated random effects probit regression of SRI investment on the instrumental variables and firm characteristics; Column 3 and Column 5 report results of the second-stage regressions using the predicted propensity from the correlated random effects probit models as instrumental variables. Standard errors are in parentheses. *, **, *** denote statistical significance at the 10%, 5%, and the 1% levels, respectively

estimates. We next estimate the effect of SRI investment on firm cost of equity capital using the instrumental variables to address such issues. The instruments are the ratio of independent board directors at the firm level (Affiliation), and the fraction of Sierra Club members at the state level (Sierra Club). In the first stage, we estimate a correlated random effects probit model using director affiliation alone, or both directer affiliation and Sierra Club membership, along with firm characteristics to predict the propensity that a firm receives SRI investment[16]. Column 2 and Column 4 of Table 3 show the respective results. The negative coefficient of past return indicate that for our sample, firms with relatively lower past returns are more likely to receive SRI investment. This may be due to that the screening strategies of SRI funds, which do not solely focus on near-term firm financial performance, but also emphasize on firm ESG performance. In particular, as we discuss in Introduction section, under such strategies, it is more admissible that firms allocate resources to address environmental issues, even if it is costly in the short-run. Likelihood ratio tests show that both instruments are relevant[17]. We also report the weak instruments *F*-test statistic for each model in Table 3, and in all cases the test statistic is large, indicating the instruments are not weak (Stock & Yogo, 2002). In the second stage, we use the predicted propensity as an instrumental variable to estimate the average treatment effect of SRI investment.

Column 3 and Column 5 of Table 3 present the results of the instrumental variable regressions using director affiliation, and directer affiliation along with Sierra Club membership, as instruments, respectively. While the fixed effects models indicate that SRI investment does not have a statistically significant effect on firm cost of equity capital with the present sample, results from the second stage instrumental variable regressions show a negative and significant effect: accounting for agency problems and external pressure in firm environmental behavior, firms that receive SRI investment on average benefit from an reduction of 0.53 to 0.57 percent in the cost of equity capital, which is a non-trivial effect considering the examples we show in Data section.

Since our instrumental variables account for the pressure from external stakeholders (environmental groups), the propensity that a firm addresses stakeholder interests, and the agency costs associated with firm environmental behavior, the results from the instrumental variable regressions bear the following implications. First, the extent to which a firm may benefit from SRI investment in the form of a reduction in the cost of equity capital depends on the relationships between the firm and its stakeholders. In other words, while SRI investing may be a channel through which environmentally responsible firms achieve financial benefits, the benefit is contingent on firm interaction with the myriad groups of stakeholders other than shareholders. Second, SRI investors take into account the agency costs associated with certain voluntary environmental activities, as represented by a potential upward bias in the effect of SRI investment on firm cost of equity capital in our baseline models. Therefore, the achievement of financial benefits from environmentally responsible activities that ultimately benefit shareholders depends on effective corporate governance. In other words, good corporate governance facilitates the alignment of firm long-term environmental goals and the goal of shareholder value maximization. This is consistent with the findings in e.g, Ferrell et al. (2014) that firms with fewer agency problems are more likely to engage in social and environmental responsibility, which should enhance shareholder value; the findings in Kecskes et al. (2014) that corporate social responsibility can create shareholder value when long-term investors properly monitor a firm's manager; and the findings in Wang et al. (2019) that instead of valuing environmental performance alone, investors value firm ESG performance as a whole.

Industry Heterogeneity in the Effect of SRI Investment

We examine the heterogeneous effect of SRI investment on the cost of equity capital of firms across different industry groups by interacting SRI investment and three industry group characteristics – industry group diversity, environmental performance, and closeness to final consumer. For ease of interpreting the coefficient estimates of these interactions, we scale each of the three characteristics to have mean of zero and standard deviation of one. We use a control function approach to correct for the endogenous SRI investment as well as its interaction with the industry group characteristics. In doing so, we first estimate the likelihood of receiving SRI investment in a linear probability model with both instrumental variables, the ratio of independent directors and Sierra Club membership, then include the error term from this model in the second stage estimation. Table 4 presents the results of the second stage estimation[18].

[16] The underlying assumption here is that there is a positive correlation between the likelihood that a firm becomes eligible for SRI investment and the likelihood that the firm receives SRI investment.

[17] While Sierra Club is not statistically significant in Column 4, it is significant when entered the model as the only instrument. Moreover, the likelihood ratio test shows it is relevant and the weak instrument test shows it is not a weak instrument.

[18] We note that the coefficient estimates of the control variables in this model are different from those in Table 3 because we include industry characteristics at the firm level instead of industry fixed effects in the baseline and instrumental variable models.

Table 4 Influencing factors of heterogeneous effect of SRI investment

	Coefficient	Std. Error
Market Cap	−0.0104	(0.015)
Leverage	0.849***	(0.100)
Book-to-Market	1.437***	(0.030)
Dispersion	0.500***	(0.018)
Long-term Growth	−0.054**	(0.024)
Beta	0.442***	(0.026)
Return	0.043***	(0.014)
SRI	0.138	(0.390)
Environmental Concern	−0.269***	(0.076)
Intermediate	−0.179**	(0.081)
Diversity	−0.041	(0.074)
SRI×Environmental Concern	0.250***	(0.078)
SRI×Intermediate	0.050	(0.082)
SRI×Diversity	0.127*	(0.076)
$\hat{u}$	0.003	(0.394)
Year FE	Yes	
Observations	12,134	
R^2	0.541	
Adjusted R^2	0.540	
F Statistic	549.520***	

Effect of SRI investment accounting for industry characteristics. Column 1 reports coefficient estimates, and Column 2 reports the standard errors. "Diversity" is the number of sub-industry groups in each of the 48 industry groups, "Environmental Concern" is the ratio of average environmental concerns to environmental strengths in each industry group, and "Intermediate" is the fraction of sub-industry groups that are composed of intermediate industries. All industry level variables are scaled to have mean of 0 and standard deviation of 1. *, **, *** denote statistical significance at the 10%, 5%, and the 1% levels, respectively

Table 4 shows that for a firm in an industry group with average environmental performance, closeness to final consumer, and industry diversity, SRI investment does not have a statistically significant effect on the cost of equity capital. For an industry group with environmental concern (relative to environmental strength) that is one standard deviation above the mean value, SRI investment has a positive and significant effect on the cost of equity capital of 0.25 percent. In other words, firms in industries with relatively poor environmental performance does not benefit from SRI investment in terms of reduced cost of equity capital. This effect is likely due to the higher compensation for polluting industries to be labeled socially responsible (Bénabou & Tirole, 2010; Dam 2015), as well the premium requested from neutral investors which offsets the potential benefit of SRI investment in such industries (Vanwalleghem, 2013). For an industry group with number of subgroups one standard deviation higher than the mean value, receiving SRI investment increases the cost of equity capital by 0.13 percent. One possible explanation is that within these industry groups, SRI investment has qualitatively different effects on the cost of equity capital of firms in the sub-groups, with the aggregate effect being positive[19].

Returning to our hypotheses, results from our analysis show that while on average receiving SRI investment does not significantly reduce firm cost of equity capital, the effect of SRI investment on firm cost of equity capital is contingent on firm interactions with stakeholders and firm governance, and is heterogeneous across industry groups. Comparing our instrumental variable to the baseline regressions, we find that the absence of addressing endogeneity of firm eligibility of SRI investment would mask the significant effect of SRI on firm cost of equity capital on firms with good governance. As such, our study contributes to the understanding of long-term relationship between firm environmental performance and financial performance by addressing the question of "when and where does it pay to be green", instead of an overall answer to "whether it pays to be green". Our findings bear important implications both for firm managerial decisions in terms of engagement in social/environmental responsibility and the expected response from equity markets, and for policymakers in the potential of leveraging the incentives from financial markets for firm environmental self-regulation to supplement mandatory regulations.

Our study has several limitations. First, while there is a variety of SRI investors who apply ESG criteria in their investment decisions, information on both the screening strategies and the specific portfolios is only publicly available for a subset of them, i.e., mutual funds. Therefore, information on the asset allocation decisions on all SRI investors would provide a more comprehensive portrait of how firms' compliance with SRI investors' screening criteria impact their cost of equity capital. Nonetheless, since SRI mutual funds are a substantial component of SRI investment, understanding their impact still provides important insights into the financial outcomes of firm environmental responsibility. Second, our study uses environmental screening of SRI mutual funds as a proxy of good firm environmental performance. This relies on the assumption that SRI fund managers indeed distinguish firm environmental performance in making their investment decisions. We acknowledge the possibility that some funds may not fully incorporate the screening criteria they disclose. Regulations that ensure funds adhere to their

[19] As a robustness check, we also estimate a model with SRI investment interacted with industry group dummies, and calculate the net effect of SRI investment for each industry group. We then regress these effects on the industry characteristics (at the industry level), and the results are consistent with what we find in Table 4. While the correction term $\hat{u}$ does not show statistical significance in Table 4, the term is statistically significant when we remove the interaction terms of SRI investment and industry group characteristics. This shows evidence that SRI investment is not random, and the endogeneity is to an extent at the industry level.

stated screening strategies can therefore enhance the effect of SRI investing in promoting firm environmental responsibility. Furthermore, SRI investors may apply different stringency in their environmental screening, which reflects different environmental performance of firms that pass the screening. Yet the levels of stringency of SRI screening is not quantifiable. For future research, a framework to differentiate the stringency of SRI screening would provide more granularity in the understanding of the effects of firm environmental performance on financial performance.

Conclusion

With the continuously growing attention on environmental responsibility from both firms and investors, it is important to understand the extent to which the interests from the two parties can be aligned, such that the equity market indeed creates incentives for firms to environmentally self-regulate. In this paper we examine, by applying environmental criteria, whether and under what circumstances SRI investment impacts firm financial performance, paying special attention to firm-stakeholder interactions and the potential heterogeneity in the effect of SRI investing on firm cost of equity capital across industries. Our findings shed light on the time horizon over and the circumstances under which firms' environmental performance generates a long-term effect on the financial performance, and therefore motivates firms to self-regulate environmental externalities.

Accounting for external stakeholder pressure and the firm-stakeholder interactions between the firm and stakeholders regarding firm environmental performance, we find a negative effect of SRI investment on firm cost of equity capital. These findings indicate that the ability of a firm to maintain sound relationships with its stakeholders and manage agency problems influences the financial benefit the firm may achieve through SRI investment. Investigating into the effect of SRI investment on different industry groups, we find that the effect is largely heterogeneous across industries. In particular, industry groups that are relatively less diverse and those with relatively less environmental concerns are especially likely to benefit from SRI investment.

Our findings bear important implications regarding the financial outcomes of firm environmental responsibility and the incentives for firm environmental self-regulation from the equity markets. First, the financial benefit of environmental responsibility in the form of reduced cost of equity capital is not uniform across industries. While SRI investors hold diversified portfolios of various industries in order to achieve goals in both financial performance and social and environmental impact, SRI investment may be effective in creating a financial incentive for environmental self-regulation only in certain industries. Second, our results indicate that SRI investors are able to discern agency problems associated with certain firm environmental activities, and SRI investment generates a greater reduction in the cost of equity capital in a firm that undertakes environmental activities in the absence of agency problems. In other words, SRI investment may facilitate the alignment of environmental and financial goals of a firm by monitoring the agency problems. Third, our results indicate that the screening criteria of SRI investors in firm environmental performance alone may not be sufficient to incentivize firm environmental responsibility; instead, applying screening criteria in corporate governance performance on top of environmental performance may enable SRI investing to more effectively motivate firm environmental self-regulation. While this is the case for some of the SRI mutual funds in our sample, other funds screen only on as single aspect of firm ESG performance. Thus incorporating a holistic set of criteria may allow SRI screening to better connect to firm environmental performance.

Appendix

Price effect of SRI

Heinkel et al. (2001) develop a theoretical model to demonstrate the price effect of limited risk sharing due to the exclusion of polluting firms by green investors. The model assumes a one-period economy with I utility-maximizing investors and N share-price-maximizing firms. There are two types of investors and three types of firms: I_g green investors and I_n neutral investors differ in their tolerance of environmental damage and both have constant absolute risk aversion utility with risk tolerance parameter τ; N_C acceptable firms satisfy green investors' investing criteria, N_U unacceptable firms are excluded by green investors, and N_R reformed firms can choose to achieve acceptability of green investors at a fixed cost K. Each type C firm uses a clean technology and generates a cash flow that follows $N\left(\mu_C, \sigma_C^2\right)$, and each type U or type R firm uses a polluting technology and generates a cash flow that follows $N\left(\mu_P, \sigma_P^2\right)$. In equilibrium, the number of unacceptable firms that choose to reform will be zero or will adjust until the increase in the share price of the reformed firms just compensates the cost of reform, that is, $P_R = P_U + K$. The number of reformed firms is given by

$$N_R = max\left\{0, \frac{I_g}{I}\left(N - N_C - KI\tau\frac{\sigma_C^2}{\phi}\right)\right\}, \tag{6}$$

where $\phi = \sigma_C^2\sigma_P^2 - \sigma_{CP}^2$.

Equation (6) reveals several motivating equilibrium relations relevant to our analysis. First, the number of

reformed firms increases with the fraction of green investors. This implies that the price effect of SRI investing depends on the fraction of SRI investors: an increase in the number of green investors further lowers the demand for shares of the polluting firms, which reduces their share prices (i.e., increases their cost of equity capital), leading more polluting firms to reform. Evidence presented in the introduction indicates that SRI investment has been rapidly growing over the past two decades. Second, the number of firms that choose to reform decreases as the cost of reform, K, increases. Third, the number of reformers decreases as the risk tolerance of investors and the number of clean firms in the economy increases.

SRI screening strategies

SRI investors that incorporate environmental values form their portfolios by screening firm environmental performance. As of June 2015, 113 SRI mutual funds registered with the USSIF involve equity investment. The screening party could be the internal research department within the fund, a third-party agency, or a combination of the two. Besides the primary research, the funds usually utilize external resources such as a database that provides firm ESG performance information. In other words, SRI mutual funds trade on both public and private information on firm ESG performance.

Environmental screening by SRI mutual funds apply four types of strategies: *Positive Investment* (the fund seeks investments with positive impact in a certain area); *Restricted/Exclusionary Investment* (the fund seeks to avoid investments in performers with poor performance in a certain area); *Combination* of positive and restricted/exclusionary strategies; *No Screens* (the fund does not screen investments). Environmental screening is done in the following areas:

- **Climate/Clean Technology** Focus on risk and opportunities related to climate change and greenhouse gas emissions, or on businesses dedicated to environmentally sustainable technologies, efficient use of natural resources, or clean energy generation, infrastructure and storage.
- **Pollution/Toxics** Consideration of toxicity of products and operations and/or pollution management and mitigation, including recycling, waste management, and water purification.
- **Environment/Other** Focus on environmental issues outside of criteria specified above[20].

[20] According to the screening methodologies provided by some of the funds, the area "Other" covers issues such as resource conservation, recycling, waste reduction, product and process innovation, and involvement in the nuclear power industry.

Table 5 Summary of the distribution of SRI screening strategies in our sample

	Climate/Clean Technology	Pollution/ Toxics	Environment/ Other
Positive	45	44	58
Restricted	2	5	7
Combined	44	41	41
No Screens	22	23	7
Total	113*	113	113

Note: 11 funds have a formal policy restricting investment in fossil fuels

Table 5 shows the distributions of environmental screening strategies of the mutual funds registered with the USSIF among different areas.

Table 6 presents the list of SRI funds in our sample, for which we are able to acquire portfolio information.

Time trend and distribution of SRI investment

Figure 1a shows the market value of SRI investment from the mutual funds in our sample by year. There is an overall increasing trend of SRI investment over time, with a significant drop in 2008, at which time the financial crisis took place. The market value of SRI investment rebounded in 2009 and has been growing at an increasing rate. The trend in the SRI mutual funds in our sample is consistent with the information from the USSIF on SRI investment as a whole. Figure 1b shows the mean and median ratio of SRI investment (in percentage) in our sample firms over time. The mean ratio displays a similar trend to that of the market value, though after the rebound in 2009 it did not exceed the values prior to the financial crisis. The median ratio displays a consistently increasing trend through the sample period. The different trends in the mean and median fraction of SRI investment surrounding the 2008 crisis indicate that there had been large declines in the fraction of SRI investment in some but not all firms in our sample over that period. We also find in the data an increasing trend in the number of firms that receive SRI investment. This may be because SRI mutual funds have been diversifying their portfolios over time, or that the new funds founded in the later years have different screening criteria than those founded earlier, and therefore have a very different set of firms in their portfolios.

Since both Fig. 1a and b display different trends prior to and after the 2008 financial crisis, in Fig. 2a we present the distributions of the mean fraction of SRI investment in SRI, ΔSRI, and Other firms in the two periods separately. In Fig. 2b we plot only the 688 firms that have observations throughout the sample period.

Table 6 List of SRI funds

Ticker	Fund name	Inception date
ACNKX	AMER CENT NT CORE EQUITY-INS	
APPLX	Appleseed Fund	December 8, 2006
AQBLX	LKCM AQUINAS SMALL-CAP FUND	
AQEGX	LKCM AQUINAS GROWTH FUND	
AQEIX	LKCM AQUINAS VALUE FUND	January 3, 1994
BAC6220	CAN SUSTAINAB NTH AMERICA-C	
BCAIX	Boston Common International Fund	December 29, 2010
BCAMX	Boston Common Large Cap Core Equity Fund	April 30, 2012
BNIEX	UBS Global Sustainable Equity Fund	June 30, 1997
BSRIAUS	BROWN ADVISORY US FL EQ-AUS	
CAEIX	Calvert Global Energy Solutions Fund I	May 31, 2007
CEIAX	Calvert Equity Income Fund A	
CFWAX	Calvert Global Water Fund A	September 30, 2008
CIOAX	CALVERT INTERNATIONAL OPPORTUNITIES	May 31, 2007
CLVAX	CALVERT LARGE CAP VALUE-A	
CVMAX	Calvert Emerging Markets Equity Fund A	October 29, 2012
CWVGX	Calvert International Equity Fund A	July 2, 1992
DFSIX	DFA US SUSTAINABILITY CORE I	March 12, 2008
DFUEX	DFA US SOCIAL CORE EQUITY 2	October 1, 2007
DIUSAFD	DNB USA	
DOMIX	Domini International Social Equity Fund – Investor shares	December 27, 2006
DRTHX	DREYFUS 3RD CENTURY FUND-Z	March 29, 1972
DSI	ISHARES MSCI KLD 400 SOCIAL	November 14, 2006
EGOAX	WFA LARGE CAP CORE FUND-A	December 17, 2007
EPVNX	Epiphany FFV Fund N	
ETGLX	Eventide Gilead Fund	July 8, 2008
ETHENAM	ETHOS-EQU NORTH AMER(RPF)-EX	
ETHNAEQ	NEI ETHCL AM MULTI-STRAT-AFE	
FLRUX	Flex-funds Total Return Utilities	June 21, 1995
FMILX	FIDELITY NEW MILLENNIUM FUND	December 28, 1992
FOGRX	TRIBUTARY GROW OPP-INST	April 1, 1998
HECO	HUNTINGTON ECOLOGICAL STRATE	June 18, 2012
IGIAX	Integrity Growth & Income Fund	January 3, 1995
KLD	ISHARES MSCI USA ESG SELECT	
KLPAUSA	KLP AKSJEUSA INDEKS USD	
LFUSGLA	LUX FLEX-US GLOBAL LEADERS-A	
MGNDX	PRAXIS GROWTH INDX FD-A	May 1, 2007
MMSCX	PRAXIS SMALL CAP FUND-A	May 1, 2007
MPLAX	Praxis International Index A	December 31, 2010
MPLIX	Praxis International Index Fund - Institutional	December 31, 2010
MVIAX	PRAXIS VALUE INDEX FD-A	May 2, 2001
NALFX	New Alternatives Fund	September 3, 1982
NCGFX	New Covenant Growth Fund	July 1, 1999
OETIUSA	OHMAN ETISK INDEX USA	
PAFSX	Parnassus Asia Fund	
PAGAX	ESG MANAGERS GROWTH PRTF-A	
PARNX	PARNASSUS FUND	December 31, 1984
PGPAX	ESG MGRS GRTH AND INCOME-A	
PGRNX	Pax World Global Environmental Markets Fund - Individual Investor	March 27, 2008

Table 6 (continued)

Ticker	Fund name	Inception date
PMPAX	ESG MANAGERS BALANCED PRTF-A	
PORTX	Portfolio 21	September 30, 1999
PXINX	Pax MSCI International ESG Index Fund - Individual Investor	March 31, 2014
SARUSAB	JSS SUSTAINABLE EQUITY-USA P	
SCECX	STEWARD SMALL-MID CAP EN-INS	April 3, 2006
SEECX	STEWARD LRG CAP ENH INDX-IS	October 1, 2004
SNABFBI	SNS-RESPNSBL INDEX EQ N-BFBI	
SPEGX	ALGER GREEN FUND-A	December 4, 2000
SRIAX	GABELLI SRI FUND INC-A	
TAAGX	TIMOTHY PLAN AGGRESS GRWTH-A	October 4, 2000
TDVFX	TOWLE DEEP VALUE FUND	October 31, 2011
TPDAX	TIMOTHY PLAN DEF STRAT-A	November 4, 2009
UIMP	UBS ETF MSCI NORTH AMER. SRI	
VCSRX	VALIC II-SOCAILLY RESPONSIBL	
VFTSX	VANGUARD FTSE SOC INDX-INV	May 31, 2000
VNBSRIV	NB NVIT SOC RESP-I	

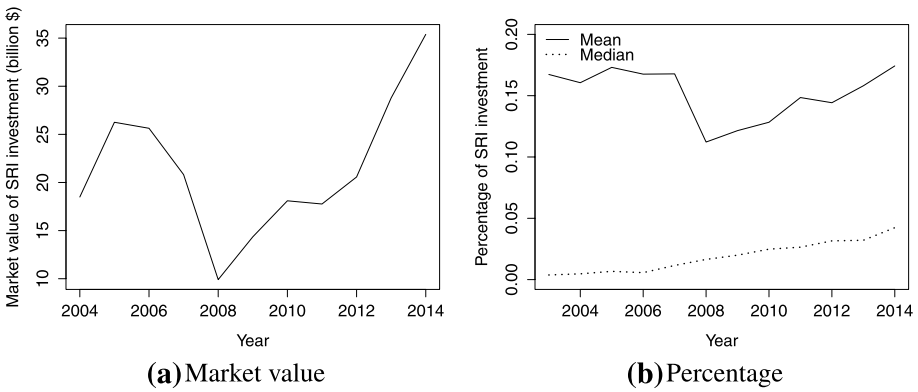


Fig. 1 Time trend of total SRI investment in SRI, ΔSRI, and Other firms

Since all four densities are heavily right-skewed, we present only up to 0.4 percent of SRI investment, where the density is close to zero. Figure 2a shows that the distributions of the ratio of SRI investment are very different in the two periods, with the pre-2008 distribution having a higher mean and lower median than that of the post-2008 period. Figure 2b shows that for firms that are in the sample throughout the sample period, the distributions differ in the same way: the pre-2008 distribution has a higher mean and lower median than that of the post-2008 period.

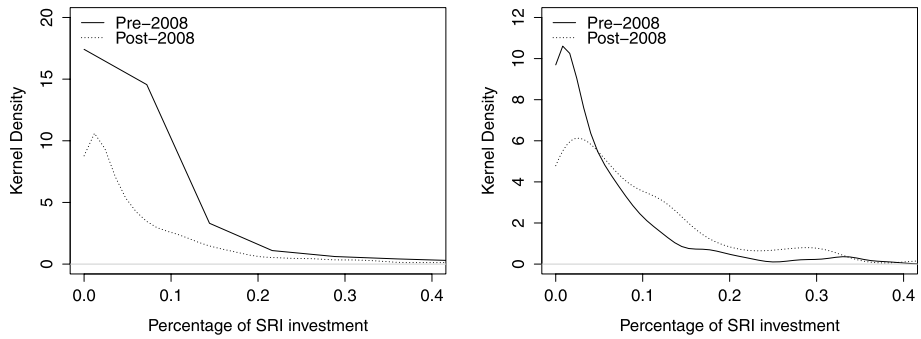
Constructing implied cost of equity capital

To calculate the implied cost of equity capital, assuming a flat term-structure of discount rates,

$$P_t = \sum_{k=1}^{\infty} \frac{E_t(D_{t+k})}{(1+r_e)^k}, \tag{7}$$

where P_t is the stock price of a firm at time t, $E_t(D_{t+k})$ is the expected future dividends (per share) k periods ahead of t, or the free cash flow to equity at time $t+k$, given all the information available at time t, and r_e is the cost of equity capital conditional on the information set at time t.

The measure of cost of capital in Gebhardt et al. (2001) is based on the residual income valuation model and assumes that firm earnings and book value are forecast in consistence with "clean surplus" accounting. According to the model, the stock price of a firm at time t can be rewritten as



(a) All SRI, ΔSRI, and Other firms **(b)** Firms with full observations

Fig. 2 Distribution of SRI investment in SRI, ΔSRI, and Other firms in periods pre-and-post-2008

$$\begin{aligned} P_t =& B_t + \sum_{k=1}^{\infty} \frac{E_t[NI_{t+k} - r_e B_{t+k-1}]}{(1+r_e)^k} \\ =& B_t + \sum_{k=1}^{\infty} \frac{E_t[(ROE_{t+k} - r_e) B_{t+k-1}]}{(1+r_e)^k}, \end{aligned} \tag{8}$$

where B_t is the book value of equity (per share) at time t, NI_{t+k} is the net income (per share) at time $t+k$, and ROE_{t+k} is the return on equity at time $t+k$. To obtain a finite-horizon estimate of cost of capital, Gebhardt et al. (2001) assume that individual firm ROE reverts to its industry median over a specified horizon T, and the terminal value beyond time T is estimated by calculating the present value of time T residual income as a perpetuity:

$$P_t = B_t + \sum_{k=1}^{T} \frac{FROE_{t+k} - r_e}{(1+r_e)^k} B_{t+k-1} + \frac{FROE_{t+T} - r_e}{r_e (1+r_e)^T} B_{t+T-1}, \tag{9}$$

where $FROE_{t+k}$ is the forecast ROE at time $t+k$, $B_{t+k} = B_{t+k-1} + FEPS_{t+k} - FDPS_{t+k}$, and $FDPS_{t+k}$ is the forecast dividend per share at time $t+k$. We use a forecasting horizon of 12 years ($T = 12$).

Although the benefit of a reduction in cost of equity capital to a firm varies by the firm's financial characteristics, we use two numerical examples to show how a 0.25 percent reduction in cost of equity capital might influence firm financial performance.

Example 1 Firm A has a current share price (P_t) of \$32.68, current book value (B_t) of \$27.27 million and next year's forecast ROE ($FROE_{t+1}$) of 7.7 percent. Applying Eq. (9), the ex ante cost of equity capital of Firm A is 8.24 percent. If the stock market instead believes Firm A's cost of equity capital is 7.99 percent, the firm would be priced at \$34.28 per share, over \$1.6 higher than the original price (a 4.9 percent increase).

Example 2 Firm B is solely financed with equity, and is evaluating an investment of \$24 million in a new environmental project which is expected to generate annual cash flows of \$3.5 million starting at year 4 for 10 years. If the firm's equity risk premium is 4.7 percent, the net present value of the project would be $\$ - 0.11$ million, and the firm would forgo this project. If the firm's equity risk premium is 4.45 percent instead, the project would produce a positive net present value of \$0.36 million. In other words, a reduction in the cost of equity capital allows a firm to undertake more projects with positive net present value.

Correlations between continuous variables

Table 7 shows the correlations between the continuous variables. The signs on the simple correlation between the risk premium and the financial characteristics are consistent with the literature, and there is a positive correlation between the risk premium and SRI ratio.

Time line of variables

In Fig. 3 we present the timeline along which we collect data for our key variables:, SRI investment and equity risk premium, as well as other firm characteristics variables. Following Gebhardt et al. (2001) and Hann et al. (2013), we collect firm long-term growth forecast, analyst earnings forecast dispersion, forecast earnings per share, and stock price per share as of the third Thursday of June each year. Data on other firm characteristics are from the most recent quarterly

Table 7 Correlations between continuous variables

	Risk.pr	Mkt.cap	Lev.	BM	Disp.	Ltg	Beta	Ret.	SRI
Risk premium	1								
Market cap	-0.11	1							
Leverage	0.30	-0.01	1						
Book-to-market	0.38	-0.28	0.40	1					
Dispersion	0.36	0.12	0.25	0.18	1				
Long-term growth	0.01	-0.05	-0.02	-0.02	0.01	1			
Beta	0.13	-0.17	-0.03	0.04	0.08	0.05	1		
Return	-0.18	0.06	-0.24	-0.39	-0.07	0.03	0.17	1	
SRI ratio	0.03	0.03	0.00	-0.01	0.06	-0.01	0.01	-0.03	1

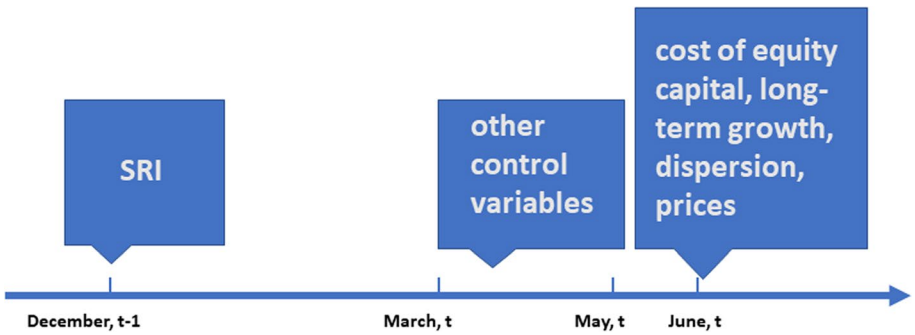


Fig. 3 Time line of SRI, cost of equity capital, and other variables

report prior to June each year, and data on SRI investment are collected from December of the previous year.

Assessing balance and overlap of the treated and control groups

Identification of the treatment effect requires that firms receiving SRI investment are comparable to those that do not. We assess the comparability of the two groups by examining the similarity between the distributions of covariates for the treated and control samples, i.e. whether the samples are well-balanced, and whether there is sufficient overlap in the distributions of covariates between the two samples. We perform the assessment using three metrics: the normalized difference, the log ratio of the standard deviations, and the fraction of observations in the tails of the opposing distributions (Imbens and Rubin, 2015, p. 352).

Balance and overlap assessment results Table 8 presents the results of the balance and overlap assessment. Results show that the distributions of most of the covariates are similar across the treated/control samples, with the normalized mean difference less than 0.1 for all but market capitalization, book-to-market ratio, and analysts' forecast dispersion. For these three variables, there is not a large fraction of observations in the tails of one treatment group that lie within the opposing distribution. The log ratio of the standard deviations of the treated and control groups are not very large for any covariates. Hence the two groups are comparable, making it less likely that imbalance in covariates introduces biases into our estimates.

Difference-in-differences estimation

As a robustness check for our baseline model, we estimate a difference-in-differences model, which allows us to compare the average change in cost of equity capital after a firm receives SRI investment to the change for a firm that never receives SRI investment. Specifically, we set firms in the nonSRI group as the control group, and firms in the ΔSRI group as the treated group. The difference-in-differences approach has the advantage of removing bias due to systematic differences between the treatment groups, as well as bias due to time-invariant effects. Table 9 shows results from the difference-in-differences estimation. Firms in the treated group have significantly lower cost of equity capital than those in the control group, represented by a negative sign of the coefficient on ΔSRI. However, consistent

Table 8 Balance and overlap assessment of treatment groups

	Mean Treated	SD Treated	Mean Control	SD Control	Normalized Diff	Log Ratio SD	Tails Treated	Tails Control
Risk premium	4.653	3.348	4.398	4.016	0.069	-0.182	0.025	0.079
Market cap	7.845	1.509	6.270	1.145	1.176	0.276	0.224	0.168
Leverage	0.214	0.201	0.235	0.244	-0.094	-0.193	0.136	0.247
Book-to-Market	-0.901	0.744	-0.776	0.733	-0.170	0.014	0.043	0.060
Dispersion	-2.842	1.051	-3.041	1.082	0.186	-0.029	0.118	0.170
Long-term growth	0.175	0.811	0.212	0.636	-0.052	0.244	0.049	0.063
Beta	1.226	0.696	1.293	0.931	-0.080	-0.291	0.015	0.106
Return	0.014	0.017	0.016	0.024	-0.084	-0.347	0.016	0.119

Columns 2-9 report results from the balance and overlap assessment of the treated and control samples: columns 6-7 report the normalized difference and the log ratio of the standard deviation, metrics for assessing the balance; and columns 8-9 report the fraction of observations in the tails of the opposing distribution, metrics for assessing the overlap

with estimates from the baseline model, the estimated treatment effect of SRI on cost of equity capital is statistically insignificant.

Testing for selection on unobservable gains in SRI investment

In the case that $Cov(D_{ijt-1}, U^1_{ijt} - U^0_{ijt}) \neq 0$, the treatment effect of SRI investment varies over firms and time through $U^1_{ijt} - U^0_{ijt}$, the unobservable change in cost of capital, after controlling for X_{ijt-1}, and thus it can not be summarized in a single parameter, i.e. γ in our model in Eq. (3) (Heckman et al., 2006). For example, a firm that has a negative environmental reputation due to environmentally irresponsible activities (which may have affected the firm's profit) may benefit more than other firms from improving its environmental performance. Another possible reason for firms to sort on the unobserved gain is the difference among the firms' current shareholders in terms of how active they are in influencing firm social and environmental behaviors. A firm with more active shareholders that pressure the firm for social and environmental responsibility may benefit more from engaging in environmentally responsible activities, and therefore qualifying itself for SRI, than a firm whose current shareholders do not actively exercise their rights to influence the firm's social and environmental behavior.

To assess whether the average treatment effect we identify can be summarized by a single homogeneous parameter, we test whether there exists selection on unobservable gains of receiving SRI investment, i.e. whether $Cov(D_{ijt-1}, U^1_{ijt} - U^0_{ijt}) \neq 0$, using the following model specification:

$$Y_{ijt} = X_{ijt-1}\beta^0 + X_{ijt-1}(\beta^1 - \beta^0)P(Z_{ijt}) + \sum_{s=1}^{3} \eta_s P(Z_{ijt})^s + \tau_t + \phi_j + U^0_{ijt}, \quad (10)$$

where $P(Z_{ijt})$ is the propensity score from the first stage instrumental variable regression. As is shown in Heckman & Vytlacil (1999), Heckman et al. (2006), and Carneiro et al. (2011), evidence of nonlinearity of Y_{ijt} in $P(Z_{ijt})$ indicates selection on unobservable gains, in which case the average treatment effect would be heterogeneous across firms; evidence of linearity of Y_{ijt} in $P(Z_{ijt})$

Table 9 Results of difference-in-differences estimation

Market Cap	−0.180***
	(0.031)
Leverage	3.171***
	(0.194)
Book-to-Market	1.143***
	(0.056)
Dispersion	0.792***
	(0.035)
Long-term Growth	0.086*
	(0.050)
Beta	0.361***
	(0.048)
Return	1.583
	(1.910)
SRI	0.138
	(0.086)
ΔSRI	−0.880***
	(0.132)
Year FE	Yes
Industry FE	Yes
State FE	Yes
Observations	7,678
R^2	0.443
Adjusted R^2	0.435
F Statistic	52.843***

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

Table 10 Test of selection on unobservable gains

	(1)	(2)
Market cap	0.023	0.120
	(0.385)	(0.371)
Leverage	9.878***	9.688***
	(1.446)	(1.423)
Book-to-market	−0.484	−0.413
	(0.417)	(0.411)
Dispersion	2.720***	2.636***
	(0.217)	(0.215)
Long-term growth	3.139	3.231*
	(1.923)	(1.949)
Beta	−0.485	−0.474
	(0.296)	(0.296)
Return	23.598	23.276
	(16.008)	(15.815)
p_1	1.017	
	(10.959)	
p_1^2	−5.173	
	(15.910)	
p_1^3	0.866	
	(7.198)	
p_2		−4.245
		(10.697)
p_2^2		3.643
		(15.560)
p_2^3		−3.293
		(7.054)
Observations	12,006	12,006
R^2	0.535	0.535
Adjusted R^2	0.532	0.532
Residual SE	2.145	2.146
F Statistic	185.642***	185.468***

Columns 2-3 report coefficient estimates and standard errors (in parentheses) from the regressions in Eq. (10) using director affiliation, and director affiliation and Sierra Club Membership as the instrument, respectively. Estimates of the interaction terms $X_{ijt-1}P(Z_{ijt})$ are unreported. *, **, *** denote statistical significance at the 10%, 5%, and the 1% levels, respectively

indicates that the marginal effect of SRI investment on cost of equity capital is constant after controlling for X_{ijt-1}. Therefore, we test for selection on unobservable gains using a test of joint significance of $\eta_s, s = 1, 2, 3$ in Eq. (10). Table 10 presents the results. The coefficients on the higher-order polynomials of the propensity score are not significant for both sets of instruments, and F-tests of the joint significance of these coefficients fail to reject the null hypothesis that they are jointly different from zero. Hence, we do not find evidence that firms select into qualifying for SRI investment based on unobservable gains.

Abbreviations

SRI Socially responsible investing
CSR Corporate social responsibility
ESG Environmental, social, corporate governance

Acknowledgements
We thank Trudy Cameron, Ben Gramig, Neha Khanna, Junjie Wu, and participants at the SHaPE Brownbag seminars at Purdue University, the 2016 WEAI Annual Conference, the 2016 AAEA Annual Meeting, and the pERE seminar at the University of Illinois at Urbana-Champagne for helpful feedback.

Authors' contributions
All authors contributed to conceptualization of the study; Wang co-designed the empirical models, performed the analyses, and wrote the manuscript; Delgado co-designed the empirical models and wrote parts of the manuscript; Xu co-designed the empirical models and wrote parts of the manuscript. The authors read and approved the final manuscript.

Funding
The authors declare no external funding associated with this study.

Availability of data and materials
Data are acquired from the respective databases listed in the Data section via Wharton Research Data Services, and the list of SRI funds are listed in the Appendix.

Declarations

Competing interests
The authors declare that they have no competing interests.

Received: 9 November 2021 Accepted: 14 January 2023
Published online: 11 February 2023

References

Albuquerque, R., Koskinen, Y., & Zhang, C. (2019). Corporate social responsibility and firm risk: Theory and empirical evidence. *Management Science, 65*(10), 4451–4469.
Ambec, S., & Lanoie, P. (2008). Does it pay to be green? A systematic overview. *Academy of Management Perspectives, 22*(4), 45–62.
Anton, W. R. Q., Deltas, G., & Khanna, M. (2004). Incentives for environmental self-regulation and implications for environmental performance. *Journal of Environmental Economics and Management, 48*(1), 632–654.
Ashbaugh, H., Collins, D. W., & LaFond, R. (2004). *Corporate governance and the cost of equity capital* (vol. 26, p. 2006). Emory: University of Iowa. Retrieved January.
Bagnoli, M., & Watts, S. G. (2003). Selling to socially responsible consumers: Competition and the private provision of public goods. *Journal of Economics & Management Strategy, 12*(3), 419–445.
Barnea, A., & Rubin, A. (2010). Corporate social responsibility as a conflict between shareholders. *Journal of Business Ethics, 97*(1), 71–86.
Barnett, M. L. (2007). Stakeholder influence capacity and the variability of financial returns to corporate social responsibility. *Academy of Management Review, 32*(3), 794–816.
Bénabou, R., & Tirole, J. (2010). Individual and corporate social responsibility. *Economica, 77*(305), 1–19.
Bushnell, J. B., Chong, H., & Mansur, E. T. (2013). Profiting from regulation: evidence from the European carbon market. *American Economic Journal: Economic Policy, 5*(4), 78–106.
Byrd, J. W., & Hickman, K. A. (1992). Do outside directors monitor managers? Evidence from tender offer bids. *Journal of Financial Economics, 32*(2), 195–221.
Carneiro, P., Heckman, J. J., & Vytlacil, E. J. (2011). Estimating marginal returns to education. *American Economic Review, 101*, 2754–2781.
Chava, S. (2014). Environmental externalities and cost of capital. *Management Science, 60*(9), 2223–2247.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: an empirical analysis. *Accounting, Organizations and Society, 33*(4), 303–327.
Dam, L., & Scholtens, B. (2015). Toward a theory of responsible investing: On the economic foundations of corporate social responsibility. *Resource and Energy Economics, 41*, 103–121.
Delmas, M. A., & Montes-Sancho, M. J. (2010). Voluntary agreements to improve environmental quality: symbolic and substantive cooperation. *Strategic Management Journal, 31*(6), 575–601.
Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: the initiation of corporate social responsibility reporting. *The Accounting Review, 86*(1), 59–100.
Dimson, E., Karakaş, O., & Li, X. (2015). Active ownership. *Review of Financial Studies, 28*(12), 3225–3268.
Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management Science, 60*(11), 2835–2857.
Edmans, A. (2011). Does the stock market fully value intangibles? Employee satisfaction and equity prices. *Journal of Financial Economics, 101*(3), 621–640.
El Ghoul, S., Guedhami, O., Kwok, C. C., & Mishra, D. R. (2011). Does corporate social responsibility affect the cost of capital? *Journal of Banking & Finance, 35*(9), 2388–2406.
Ervin, D., Wu, J., Khanna, M., Jones, C., & Wirkkala, T. (2013). Motivations and barriers to corporate environmental management. *Business Strategy and the Environment, 22*(6), 390–409.
Ferrell, A., Liang, H., & Renneboog, L. (2014). Socially responsible firms. (No. d0e94017-b378-4134-9e56-2c85dfae342b). Tilburg University, School of Economics and Management.
Flammer, C. (2015). Does corporate social responsibility lead to superior financial performance? a regression discontinuity approach. *Management Science, 61*(11), 2549–2568.
Flammer, C., Toffel, M. W., & Viswanathan, K. (2021). Shareholder activism and firms' voluntary disclosure of climate change risks. *Strategic Management Journal, 42*(10), 1850–1879.
Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach*. Boston: Pitman.
Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment, 5*(4), 210–233.
Friedman, M. (1970). The social responsibility of business is to increase its profits. *The New York Times Magazine*, September 13.
Frondel, M., Horbach, J., & Rennings, K. (2008). What triggers environmental management and innovation? *Empirical evidence for Germany. Ecological Economics, 66*(1), 153–160.
Gebhardt, W. R., Lee, C., & Swaminathan, B. (2001). Toward an implied cost of capital. *Journal of Accounting Research, 39*(1), 135–176.
Hann, R. N., Ogneva, M., & Ozbas, O. (2013). Corporate diversification and the cost of capital. *The Journal of Finance, 68*(5), 1961–1999.
Hart, O. and Zingales, L. (2017). Companies should maximize shareholder welfare not market value. ECGI-Finance Working Paper, (521).
Heal, G. (2005). Corporate social responsibility: An economic and financial framework. *The Geneva papers on risk and insurance-Issues and practice, 30*(3), 387–409.
Heckman, J. J., Urzua, S., & Vytlacil, E. (2006). Understanding instrumental variables in models with essential heterogeneity. *The Review of Economics and Statistics, 88*(3), 389–432.
Heckman, J. J., & Vytlacil, E. J. (1999). Local instrumental variables and latent variable models for identifying and bounding treatment effects. *Proceedings of the national Academy of Sciences, 96*(8), 4730–4734.
Heinkel, R., Kraus, A., & Zechner, J. (2001). The effect of green investment on corporate behavior. *Journal of Financial and Quantitative Analysis, 36*(4), 431–449.
Henisz, W. J., Dorobantu, S., & Nartey, L. J. (2014). Spinning gold: the financial returns to stakeholder engagement. *Strategic Management Journal, 35*(12), 1727–1748.
Henriques, I., & Sadorsky, P. (1996). The determinants of an environmentally responsive firm: an empirical approach. *Journal of Environmental Economics and Management, 30*(3), 381–395.
Hong, H., & Kacperczyk, M. (2009). The price of sin: the effects of social norms on markets. *Journal of Financial Economics, 93*(1), 15–36.
Imbens, G. W., & Rubin, D. B. (2015). *Causal Inference for Statistics, Social, and Biomedical Sciences*. Cambridge University Press.
Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305–360.
Jones, T. M. (1995). Instrumental stakeholder theory: a synthesis of ethics and economics. *Academy of Management Review, 20*(2), 404–437.
Kassinis, G., & Vafeas, N. (2002). Corporate boards and outside stakeholders as determinants of environmental litigation. *Strategic Management Journal, 23*(5), 399–415.
Kecskes, A., Mansi, S., & Nguyen, P.-A. (2014). Does corporate investment in stakeholder capital create value for shareholders? The importance of long-term investors. Working Paper, York University.
Khanna, M., & Damon, L. A. (1999). EPA's voluntary 33/50 program: impact on toxic releases and economic performance of firms. *Journal of Environmental Economics and Management, 37*(1), 1–25.
Kim, I., Wan, H., Wang, B., and Yang, T. (2019). Institutional investors and corporate environmental, social, and governance policies: Evidence from toxics release data. Management Science, 65(10):4901–4926.
King, A. A. and Lenox, M. J. (2001). Does it really pay to be green? An empirical study of firm environmental and financial performance. Journal of Industrial Ecology, 5(1):105–116.
Kitzmueller, M., & Shimshack, J. (2012). Economic perspectives on corporate social responsibility. *Journal of Economic Literature, 50*(1), 51–84.
Klassen, R. D., & McLaughlin, C. P. (1996). The impact of environmental management on firm performance. *Management Science, 42*(8), 1199–1214.
Kock, C. J., Santaló, J., & Diestre, L. (2012). Corporate governance and the environment: what type of governance creates greener companies? *Journal of Management Studies, 49*(3), 492–514.
Krüger, P. (2015). Corporate goodness and shareholder wealth. Journal of financial economics, 115(2):304–329.
Lima, B. F., & Sanvicente, A. Z. (2013). Quality of corporate governance and cost of equity in brazil. *Journal of Applied Corporate Finance, 25*(1), 72–80.
Lyon, T. P., & Maxwell, J. W. (2011). Greenwash: corporate environmental disclosure under threat of audit. *Journal of Economics & Management Strategy, 20*(1), 3–41.
Lyon, T. P., & Shimshack, J. P. (2012). Environmental disclosure: evidence from Newsweek's green companies rankings. *Business & Society,* 1–44. https://doi.org/10.1177/0007650312439701
Mackey, A., Mackey, T. B., and Barney, J. B. (2007). Corporate social responsibility and firm performance: Investor preferences and corporate strategies. Academy of management review, 32(3):817–835.
Margolis, J. D., Elfenbein, H. A., & Walsh, J. P. (2007). *Does it pay to be good? A meta-analysis and redirection of research on the relationship between corporate social and financial performance.* Boston, MA: Harvard Business School, Harvard University. Working Paper.
Margolis, J. D., & Walsh, J. P. (2003). Misery loves companies: rethinking social initiatives by business. *Administrative Science Quarterly, 48*(2), 268–305.
Maxwell, J. W., Lyon, T. P., & Hackett, S. C. (2000). Self-regulation and social welfare: the political economy of corporate environmentalism. *Journal of Law and Economics, 43*(2), 583–618.
McCahery, J. A., Sautner, Z., and Starks, L. T. (2016). Behind the scenes: The corporate governance preferences of institutional investors. The Journal of Finance, 71(6):2905–2932.
Mollet, J. C., & Ziegler, A. (2014). Socially responsible investing and stock performance: new empirical evidence for the US and European stock markets. *Review of Financial Economics, 23*(4), 208–216.
Pham, P. K., Suchard, J.-A., & Zein, J. (2011). Corporate governance and alternative performance measures: evidence from australian firms. *Australian Journal of Management, 36*(3), 371–386.
Renneboog, L., Horst, J. T., & Zhang, C. (2008). Socially responsible investments: institutional aspects, performance, and investor behavior. *Journal of Banking & Finance, 32*(9), 1723–1742.
Revelli, C. (2017). Socially responsible investing (sri): From mainstream to margin? *Research in International Business and Finance, 39*, 711–717.
SEC (2021). SEC responseto climate and ESG risks and opportunities. US Securities and Exchange Commission. https://www.sec.gov/sec-response-climate-and-esg-risks-and-opportunities. Accessed Dec 2021.

Stock, J. H. and Yogo, M. (2002). Testing for weak instruments in linear IV regression.
USSIF (2021). Sustainable investing basics. US Forum for Sustainable and Responsible Investment. https://www.ussif.org/sribasics. Accessed Dec 2021.
Vanwalleghem, D. (2013). The real effects of socially responsible investing: Disagreement on the doing well while doing good hypothesis and the cost of capital. J Bus Ethics, 7(3), 1-36.
Wang, Y., Delgado, M. S., Khanna, N., & Bogan, V. L. (2019). Good news for environmental self-regulation? finding the right link. *Journal of Environmental Economics and Management, 94*, 217–235.
Wu, J. (2009). Environmental compliance: the good, the bad, and the super green. *Journal of Environmental Management, 90*(11), 3363–3381.

Publisher's Note