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Managers' green investment disclosures and investors' reaction [☆]

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ABSTRACT

Although managers' green investments have no impact on future cash flows in our experimental markets, investors respond favorably when managers make and disclose an investment and highlight the societal benefits rather than the cost to the company. Managers anticipate investors' reaction and therefore often disclose their investment and the associated societal benefits. Managers and other shareholders benefit from investors' reaction, but the investment cost always exceeds this benefit, demonstrating that managers make green investments because they value the societal benefits. Collectively, our findings show that both investors and managers tradeoff wealth for societal benefits and help explain managers' corporate social responsibility disclosures.

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1. Introduction

Although not required, most large companies now issue reports on corporate social responsibility (CSR) performance.¹ This voluntary disclosure of CSR activities is likely driven at least in part by a desire to communicate CSR information to investors. If CSR activities affect the company's future earnings and cash flows, investors will find related disclosures useful for their valuation decisions. However, it is possible that investors react to CSR disclosures for another reason as well. If investors value the societal benefits associated with CSR activities, they may respond positively to disclosures that the company has engaged in such activities independent of how they expect the activities to affect future earnings and cash flows. We conduct an experiment to test whether investors respond to managers' disclosure of their CSR investment independent of the effect on the company's future cash flows. In addition, we examine whether managers anticipate investors' response when making their disclosure decisions. Finally, we examine whether managers' CSR investment

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¹ Although most CSR disclosures are voluntary, domestic U.S. public companies are required to disclose any material risks resulting from the legislative, regulatory, business, market, or physical impact of climate change (SEC, 2010. Commission Guidance Regarding Disclosure Related to Climate Change).

decisions are driven only by investors' expected response or also by their preferences for the societal benefits associated with their CSR investments.

Understanding how investors' respond to CSR disclosure is important because this can help explain managers' voluntary CSR disclosure practices. For example, knowing that investors value the societal benefits of CSR activities would help explain why managers' CSR disclosures tend to focus on such benefits. Also, knowing whether investors' reaction to CSR disclosures goes beyond the expected effect of CSR activities on the company's future cash flows could help explain the rapid growth in Socially Responsible Investment (SRI) funds (Social Investment Forum Foundation, 2012). More broadly, a more complete understanding of investors' reaction to CSR disclosure can inform standard setters who are considering whether CSR disclosures should be required, what information should be disclosed, and whether such disclosures should be audited.² Finally, understanding why managers invest in CSR activities helps inform the ongoing debate regarding whether all CSR activities must be shareholder value maximizing (Friedman, 1970; Karnani, 2010) or whether some such activities sacrifice profits in the social interest (Benabou and Tirole, 2010; Reinhart et al., 2008; Kolstad, 2007).

We examine a particular type of CSR activity, green investment to reduce carbon emissions, in an experimental market setting. There are several critical features of our setting that allow us to isolate the effects necessary to answer our research questions. First, in our experimental setting, the impact of a manager's green investment is fully reflected in the company's current earnings, and as such there can be no further impact on the company's future cash flows. This ensures that any observed investor reaction to disclosure of the green investment is not based on investors' expectations regarding how the investment will affect future earnings. Second, we ensure that both investors and managers in our experiment know that the financial cost to the company of a green investment always exceeds the financial benefit, i.e., the investment is always unprofitable. Thus, any green investment a manager makes always lowers shareholder value, and therefore any positive investor response to the disclosure of a green investment must reflect the investors' desire to reward the manager for engaging in an activity that the investors value.

We find that potential investors' standardized bids for the company are higher when managers disclose their green investments than when they do not, providing evidence that investors value the societal benefits associated with the investment. We also provide some evidence that investors respond more positively when managers' disclosures focus on the societal benefits of their investment rather than on the cost to the company. In addition, managers anticipate investors' reaction and thus overwhelmingly disclose their investment and tend to focus their disclosure on the societal benefits of the investment rather than on the cost to the company. Finally, despite investors' positive response to a disclosed green investment, both managers and current shareholders nevertheless bear a cost when the manager makes a green investment. Thus, managers' investment decisions must reflect the value they place on the associated societal benefits in addition to any expected investor response.

Our findings contribute to the CSR literature in several ways. First, our finding that investors' positive response to disclosures of a green investment are based at least in part on the societal benefits associated with the investments helps us better understand the rapid increase in SRI funds (Social Investment Forum Foundation, 2012). Second, our results offer insights into how and why managers disclose their CSR activities to investors. Third, our study helps inform standard setters who are considering possible CSR disclosure requirements. Finally, our study demonstrates the advantages of using experiments to examine important CSR issues that are difficult to study effectively using archival data.

In Sections 2 and 3 we provide background information and present our hypotheses. We describe our experiment in Section 4 and report our results in Section 5. The paper concludes with a discussion of our results and their implications in Section 6.

2. Background

The KPMG International Survey of CSR (2013) reports that 93 percent of the 250 largest global companies and 86 percent of the 100 largest US companies now engage in some type of voluntary CSR disclosure. If CSR activities affect the company's future earnings and cash flows, disclosing such activities will be useful for investors' valuation decisions. There are several ways that CSR performance could affect a company's future earnings. For example, being more socially responsible could add customers, increase sales, or increase pricing power (Lev et al., 2010), attract or motivate employees (Balakrishnan et al., 2011; Bhattacharya et al., 2008), lower the cost of equity capital (Dhaliwal et al., 2011) or reduce the risk of governmental regulation (Paine, 2000). Based on such arguments, researchers have often focused on establishing a positive association between CSR and measures of financial performance. Margolis et al. (2009) conduct a meta-analysis of 251 such studies over the last 40 years and conclude that "the overall effect is positive but small...and the results for the 106 studies for the past decade are even smaller." Of the 251 studies, 59% reported a non-significant result, 28% found a positive result, 2% a negative result, and the remaining 10% did not report sample size or significance.

² In addition to the traditional standard setters such as the SEC, FASB, and IASB, a number of other organizations have established or are working on establishing guidelines regarding sustainability reporting. Some notable examples include the Global Reporting Initiative (GRI), the International Integrated Reporting Council (IIRC) and the Sustainability Accounting Standards Board (SASB).

Although the prior research does not completely resolve whether companies' CSR performance is associated with their future financial performance, investors' reactions to CSR disclosures are likely to be at least partially based on their expectations about the effect on financial performance. However, investors could also react to CSR disclosures because they value the societal benefits associated with CSR activities. Such a reaction would be difficult to isolate using archival data because it occurs simultaneously with any reaction based on expectations of how CSR activities affect earnings. We overcome this problem by using an experimental setting in which the impact of the CSR activity is fully incorporated into current earnings. This ensures that any investor reaction is not due to expectations regarding the impact of CSR activities on future cash flows.

3. Development of hypotheses

A positive response by investors to disclosed CSR activities could reflect their desire to reward company managers for taking an action they value. The recent rapid growth in SRI funds is consistent with an expanding group of investors rewarding companies for being socially responsible.³ Such behavior is consistent with the social norm of reciprocity, in which a kind act is reciprocated with a similarly kind act in return (Rabin, 1993). Reciprocity has been documented in many settings including labor markets and other experimental games. In labor market settings, prior studies show that in incomplete contract environments, employers often offer a "gift" of a wage greater than the market-clearing level and workers reciprocate with a "gift" of greater effort than the minimum enforceable amount (Akerlof, 1982; Fehr et al., 1993, 1997; Hannan et al., 2002; Hannan, 2005; Kuang and Moser, 2009, 2011).⁴ Another widely studied experimental setting documenting reciprocity is the "trust game" (Berg et al., 1995), in which a first mover is given a sum of money and decides how much of it to give to an anonymous counterparty. Any money given is increased by a multiplier, and then the counterparty decides how much of this new amount to give back to the first mover and how much to keep for him/herself. The first mover in this setting typically transfers a significant portion of their money to the counterparty, and the counterparty reciprocates this action by returning a significant amount of the new multiplied amount to the first mover.

Our experimental setting shares some features with the gift-exchange and trust games described above in that our managers are similar to the employers in the gift-exchange studies and to the first movers in the trust game studies, while our investors are similar to the workers in the gift-exchange studies and the counterparty in the trust game studies. However, our setting differs from the previous settings in important ways. First, while the manager's green investment in our study is similar to the employer's gift and first mover's transfer in the previous studies, it differs in that, unlike in the previous studies, the manager's green investment does *not* financially benefit the investors directly. Therefore, in our setting any reciprocal motivation on the part of investors must operate through the value they place on the societal benefits of the green investment rather than on any potential personal financial gain. Second, managers who make a green investment in our setting affect both their own wealth and the wealth of another current shareholder. In the other settings, when employers (first movers) offer a gift (transfer), they only reduce their own wealth. Third, in prior studies, the employee (second mover) could directly reciprocate the employer's (first mover's) behavior, but in our market setting, it is less clear that any individual investor can directly reciprocate the manager's behavior because only the winning bidder can ultimately do so.

The differences described above make reciprocation by investors less likely in our setting than in previous reciprocity studies. Nevertheless, there are still reasons to expect that investors will react positively when managers disclose their green investment. Martin (2009) found that investors in a market setting similar to ours were willing to bear part, but not all, of the cost of a green investment made by the sole owner of a company. Elfenbein and McManus (2010) used data from eBay auctions to show that customers were more likely to buy, and pay higher prices for, items for which the seller had committed to donate a portion of the sales proceeds to charity than identical items for which the seller had not made such a commitment. Again, the higher prices paid by customers reduced, but did not fully offset, the cost to the company of the charitable contribution. Finally, Balakrishnan et al. (2011) provide evidence that employer charitable giving can help motivate employee effort that benefits the employer, but, again, many employers only recovered part of the cost of their charitable donations. Thus, our first hypothesis is:

Hypothesis 1(H1). Holding the distribution of possible cash flows constant, investors will respond more positively to disclosure of a green investment than to no report about green investing.

As hypothesized above, we expect investors who value the societal benefits of green investments to reciprocate the manager's behavior by paying higher prices when managers disclose that they made a green investment. However, investor reaction is also expected to vary depending on how managers frame their green investment disclosure. Different framing of equivalent information has been shown to influence individuals' judgments in many different settings (see Levin et al., 1998

³ Social Investment Forum Foundation (2012) estimates that \$3.74 trillion of the \$33.3 trillion being professionally managed in the US in 2012 was invested using criteria based on social responsibility, and the amounts invested using such criteria grew 22% from 2009 to 2012 such that by 2012 over 720 investment funds incorporating socially responsible criteria were available.

⁴ See Fehr et al. (2009) for a review of this literature.

for a review of the framing literature). If investors' reciprocal response reflects the value they place on the societal benefits of a green investment, they are likely to respond more favorably to reports that focus on the societal benefits of the investment rather than on the cost of the investment to the company. Thus, our second hypothesis is:

Hypothesis 2 (H2). Investors will react more positively to disclosures that focus on the societal benefits of green investments than to disclosures that focus on the costs to the company of such investments.

Since disclosures of CSR activities are largely voluntary, managers can decide what, if anything, they wish to disclose about such activities. Managers likely decide what to disclose based on their expectations regarding investors' reaction. However, in our experimental setting the impact of the green investment is fully incorporated into the company's current earnings, and thus managers' disclosure decisions must be based on expectations of investors' response to non-economic information in the disclosure. If investors respond as predicted in H1 and H2, managers would likely either anticipate or learn which forms of disclosure yield the most positive investor response. Thus, our third and fourth hypotheses are:

Hypothesis 3 (H3). Managers who make a green investment will more often disclose to investors that they have done so rather than make no report.

Hypothesis 4 (H4). Managers' disclosures of their green investment will more often focus on the societal benefits of the investment than on the cost to the company.

Because in our setting any green investment is always unprofitable, the manager and the other current shareholder will always bear a cost when the manager makes a green investment unless investors reciprocate sufficiently to offset the full cost of the unprofitable investment. If managers are repeatedly willing to bear a personal cost and to impose a cost on the other current shareholders, this suggests that their green investments do not reflect a naive belief that investors will fully compensate them for the cost of the investment. Rather, managers' green investments must reflect the personal value they place on the societal benefits of such investments.

4. Experiment

4.1. Overview

We conducted our experimental markets using z-tree software (Fischbacher, 2007) in a networked computer lab. We recruited 90 volunteer participants from the lab participant pool of approximately 1,300 individuals. Our participants were 55% male and averaged 21 years of age. Three experimental sessions with 30 participants each were conducted. Each session consisted of 20 independent periods and lasted approximately 90 minutes. At the conclusion of each session, one of the 20 periods was randomly selected and participants were paid their \$5 participation fee plus their earnings for the randomly selected period. Participants' earnings depended on the decisions that they and other participants made during the experiment (details provided below).

In each of the three sessions, participants were randomly assigned to one of three roles: (1) a manager who was a shareholder in the company, (2) another current shareholder in the company, or (3) one of three potential investors in the company, and these roles were constant throughout the experiment. We distinguish between "potential investors" and "current shareholders" in our setting and measure investor reaction based on the price set by the potential investors. Although our other current shareholders do not play a role in setting the market price, we included them in our design to reflect the fact that, like our managers, they also bear a direct financial cost when managers make an unprofitable green investment.

Each period, one manager was randomly matched with one current shareholder and three potential investors, creating a group of 5 participants. There were 6 such groups of 5 in each of our 3 experimental sessions, resulting in a total of 18 groups. Thus, our 90 participants consisted of 18 managers (one per group), 18 current shareholders (one per group) and 54 potential investors (three per group). With 20 periods in each session, this resulted in 360 observations (investment and reporting decisions) from managers (18 managers \times 20 periods) and 360 observations (winning bids) from the potential investors (one winning bid for each of the 18 groups of three investors \times 20 periods). Because managers, current shareholders, and potential investors were randomly re-matched into new 5-member groups each period, they never knew with whom they were matched at any point in their experimental session. Therefore, participants knew that all decisions were anonymous and neither managers nor investors could form reputations.⁵

At the start of each period, the manager and the other current shareholder each owned one-half of the company. This ownership structure captures forces that are important in actual corporate settings. Specifically, this structure provides managers with (1) a personal financial deterrent against investing in the unprofitable green project, (2) a deterrent against investing in the unprofitable green project because of a fiduciary responsibility to the other current shareholder, and (3) an

⁵ Participants knew that their decisions were anonymous to each other and also to the experimenters because their decisions were only tracked by participant number.

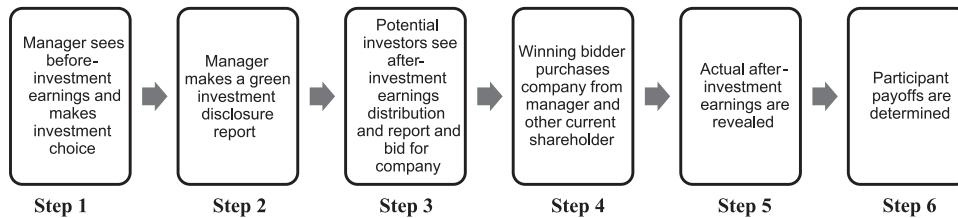


Fig. 1. Steps in the experiment.

Table 1
Managers' reporting choices.

Exact screen wording for reporting options when the manager chose to make a green investment:^a

1. No report
2. A portion of this period's earnings have been invested to reduce carbon emissions.
3. \$ ___ of this period's earnings have been invested to reduce carbon emissions.
4. \$ ___ of this period's earnings have been invested to reduce carbon emissions at a cost to the company of \$ ___.
5. A portion of this period's earnings have been invested to reduce carbon emissions at a cost to the company of \$ ___.

Exact screen wording for reporting options when the manager chose not to make a green investment:

1. No report
2. No amount of this period's earnings have been invested to reduce carbon emissions.

^a \$ ___ shown in reports represents the actual dollar amount of green investment or the actual dollar amount of the cost to the company as indicated in the report.

incentive to invest in the unprofitable green project because half of the cost of the investment can be shifted to the other current shareholder.

Managers decided whether to make a green investment and what to disclose about their investment choice to potential investors. Potential investors then placed bids to purchase the company. Both managers and potential investors knew that any amount of green investment that was made had a real societal benefit in reducing carbon emissions because they knew that the full amount of any green investment would be donated by the researchers to Carbonfund.org, a real non-profit environmental organization that invests contributions in renewable energy and reforestation projects that reduce the amount of greenhouse gases in the environment.⁶ After the experiment was completed, the actual dollar amount of the green investment made by managers for the randomly selected payment period was contributed to Carbonfund.org.

4.2. Detailed experimental procedures

A time-line of the steps in each period of each experimental session is provided in Fig. 1. As shown in Step 1, each period managers learned the amount of earnings for the company before they made any green investment (hereafter referred to as the "before-investment earnings") and then decided whether to invest a portion of those earnings to reduce carbon emissions. Possible green investment amounts ranged from \$0 to \$20 in \$1 increments.

The company's before-investment earnings for each period were drawn from a uniform distribution ranging from \$25 to \$35 in two stages. In the first stage, a distribution with a smaller \$5 range was randomly drawn from the uniformly distributed larger \$10 range (\$25–\$35). We refer to this smaller \$5 range as the "before-investment earnings range." In the second stage, the before-investment earnings amount (i.e., a single specific earnings amount) was randomly drawn from the uniformly distributed smaller \$5 before-investment earnings range. This specific amount is the before-investment earnings amount that managers saw before making their green investment decision. As described in more detail later, the company's before-investment earnings were selected using this two-stage process to limit the inferences potential investors could make regarding whether a green investment had been made.

Because any amount of green investment reduced the company's energy costs, the net cost of the green investment to the company was always less than the amount contributed to Carbonfund.org. (hereafter referred to as the societal benefit associated with the investment).⁷ In other words, every \$1 of green investment the manager made to reduce carbon emissions resulted in a net cost to the company of \$0.50. This design feature reflects the fact that in many cases green

⁶ See www.carbonfund.org for additional information

⁷ We recognize that not all individuals view the reduction in carbon emissions caused by a manager's green investment as resulting in the same amount of societal benefit, or even any societal benefit at all. However, describing the amount of the green investment as the "societal benefit" is justified because unless participants valued the effect on society there would be no reason to ever make an investment. That is, managers' expected payoffs in the experiment were always higher when they did not make an investment. For this reason and to facilitate exposition, we refer to the amount of a manager's green investment as the societal benefit.

Table 2

Calculation of payoffs.

Manager's payoff

Because the manager initially owned one-half of the company, s/he receives one-half of the selling price of the company, which is equal to 50% of the highest bid made by any of the three potential investors and the participation fee. Thus, the manager's total payoff is:

Payoff = 50% of the selling price of the company + the \$5 participation fee.

Potential investors' payoff

If a potential investor purchased the company, s/he earns the amount of the actual after-investment earnings as the liquidating dividend minus the amount s/he paid for the company. In addition, the investor receives the participation fee plus the initial endowment minus the repayment of one-half of the endowment. Thus, the total payoff is:

Payoff = the liquidating dividend for the company – the purchase price of the company + \$5 participation fee + 15 (the \$30 endowment – \$15 repayment).

If a potential investor did not purchase the company, s/he receives the \$5 participation fee and retains one-half of the original endowment. Thus, the total payoff is:

Payoff = \$5 participation fee + 15 (the \$30 endowment – \$15 repayment).

Current shareholder's payoff

Because the current shareholder initially owned one-half of the company, s/he receives one-half of the selling price of the company, which is equal to 50% of the highest bid made by any of the three potential investors and the participation fee. Thus, the current shareholder's total payoff is:

Payoff = 50% of the selling price of the company + the \$5 participation fee.

investments have both societal benefits and financial benefits for the company and that in some cases the benefits to society exceed the costs to the company.

As shown in Step 2, after managers made their investment decision, they decided what information to disclose about their decision to the potential investors and the other current shareholder. Managers chose one of the reporting options shown in Table 1 depending on whether they chose to make a green investment. If they made a green investment, they could (1) send no report, (2) disclose that they made an investment to reduce carbon emissions without any amounts, (3) disclose that they made an investment to reduce carbon emissions along with the amount of the investment, (4) disclose that they made an investment to reduce carbon emissions along with both the amount of investment and the related cost to the company, or (5) disclose that they made an investment to reduce carbon emissions along with only the net cost to the company. If they did not make a green investment, they could (1) send no report, or (2) send a report indicating that they did not make an investment to reduce carbon emissions. Table 1 provides the exact wording used on the computer screens for each type of report. The computer program ensured that any report the manager made to the investors was truthful.⁸

Any disclosure managers chose to make was provided to the potential investors, along with the \$5 range of possible after-investment earnings. This \$5 range of after-investment cash flows was obtained by subtracting the cost to the company of any green investment the manager made from the \$5 before-investment range described above.⁹

As shown in Step 3, after receiving the \$5.00 range of equally likely after-investment company earnings and any report that the manager chose to provide, each potential investor submitted a bid indicating the price s/he was willing to pay for the entire company. At the start of each period, each potential investor received a \$30.00 endowment amount, which along with the \$5.00 participation fee could be used to purchase the company. The potential investor making the highest bid purchased the company from the manager and current shareholder. In the event of a tie, the computer randomly determined which potential investor making a highest bid purchased the company. At the conclusion of each period, potential investors were required to repay \$15 of their \$30 endowment.¹⁰

⁸ As in much of the prior disclosure literature (Verrecchia, 1983; King and Wallin, 1995; Forsythe et al., 1999), we assumed there was an anti-fraud provision that prevented false reporting. That is, managers in our experiment could only truthfully report whether they invested to reduce carbon emissions, and if they chose to report the amount of their investment or the cost to the company of their investment, these amounts had to be reported truthfully as well. We required truthful reporting to ensure a clean test of investors' reaction to the content of the reports. We did not allow blatantly dishonest reporting (e.g., reporting that a green investment was made when none actually was) for two reasons: (1) investors' reactions to the reports would have been confounded by their concerns regarding the credibility (versus the content) of the report, and (2) we were concerned that the amount of dishonest reporting and investors' expectations of such reporting would be higher in the experiment than in actual corporate settings where there would be consequences if the lies were exposed. We note that our managers still had considerable leeway in what information they chose to disclose, ranging from disclosing no information to full information about their green investments and the cost to the company.

⁹ For example, assume that the \$5 before-investment range was \$27–\$32. If the manager made a green investment of \$2 that cost the company \$1, the after-investment earnings range shown to potential investors would be \$26–\$31.

¹⁰ Investors were required to repay \$15 (one-half of the initial \$30 endowment) in order to keep the expected payoffs for the participants in different roles roughly comparable. The following assumptions were made when calculating the expected payoffs: (1) potential investors are risk neutral, (2) \$0 green investment, (3) expected value of liquidating dividend = \$30 (midpoint of the \$25–\$35 range). As shown in the Appendix, these assumptions yield an expected payoff of \$20 for all participants.

As shown in Step 4, the potential investor making the highest bid purchased the company from the manager and current shareholder. Because the amount paid by the potential investor who purchased the company is shared evenly by the manager and the other current shareholder as 50% owners, potential investors knew that their bidding decisions would affect the wealth of both the manager and the other current shareholder.

As shown in Step 5, after the winning bid was determined, potential investors learned which specific amount from the \$5.00 distribution of equally likely after-investment earnings was the actual after-investment earnings amount. This amount was paid as a liquidating dividend to the potential investor who purchased the company.

Finally, as shown in Step 6, participants' payoffs for the period were determined as specified in Table 2. Because managers initially owned one-half of the company, they received 50% of selling price of the company (i.e., the winning bid) plus their \$5 participation fee. Potential investors' payoffs depended on whether they purchased the company. Potential investors who purchased the company received the liquidating dividend (i.e., the actual company earnings) minus the price they paid to buy the company plus their \$5 participation fee plus \$15 (\$30 endowment minus \$15 repayment). Potential investors who did not purchase the company received their \$5 participation fee plus \$15 (\$30 endowment minus \$15 repayment). Because current shareholders initially owned one-half of the company, they received 50% of the selling price of the company plus their \$5 participation fee. The six steps described above were repeated for each of the 20 periods in each of the three experimental sessions.

After all periods were completed, participants responded to a post-experiment questionnaire, a volunteer participant drew a number from a container holding the numbers 1 through 20 to determine the payment period, and participants received their participation fee and their payoff amount for this randomly selected period.

4.3. Procedures to limit investor inferences

Two features of the experimental procedures described above were designed specifically to limit investors' inferences about whether a green investment was made or the amount or cost of any investment. First, the managers knew the underlying \$10 distribution from which the smaller \$5 before-investment earnings ranges were selected, but the potential investors were never provided any information about this larger initial distribution. Using a fairly wide range of randomly selected smaller distributions drawn from the larger distribution ensured that there was significant variation in the distributions potential investors encountered across periods.¹¹ Had the same distribution been used each period, repeated observations may have allowed potential investors to infer the distribution and therefore infer whether the manager had made a green investment. In addition, had potential investors known that the underlying range was from \$25 to \$35, they would have been able to infer the amount of any green investment for some randomly drawn smaller distributions because the after-investment distribution could have included an amount below \$25. For example, a green investment with a cost to the company of \$2 could have resulted in a range of \$23–\$28 being shown to potential investors, allowing the investors to infer that the manager had made a green investment with a cost to the company of at least \$2.

Second, managers making a green investment knew that their investment reduced the company's energy cost by an amount equal to 50% of their investment, but this exact percent of cost reduction was not known by the potential investors.¹² If potential investors had been provided with this exact percentage (i.e., 50%), they would have been able to infer with certainty either the amount of the investment (i.e., the societal benefit) or the net cost to the company whenever the manager chose to disclose either one of these in their reports. For example, if the manager's report disclosed that the green investment was \$2, potential investors would have been able to infer with certainty that the net cost to the company was \$1. Likewise, if the manager's report disclosed that the cost to the company was \$1, potential investors would have been able to infer with certainty that the amount of the green investment was \$2. Because we are interested in potential investors' reaction to the specific information that managers choose to disclose, it was important that investors not be able to infer information about managers' green investment decisions beyond that disclosed by the managers.

We took the steps described above to limit investors' inferences about the manager's green investment decision even though any report the manager provided to investors was irrelevant for how wealth-maximizing investors would value the company because their bids would be based exclusively on the after-investment distribution of cash flows. However, because our hypotheses assume that some potential investors value the societal benefits of green investments, it was important that they could not infer information about the manager's investments beyond that disclosed by the managers. Although our procedures severely limited any inferences investors could make about the manager's green investment, we cannot be certain that investors did not infer any information about the manager's investment as they gained experience in the market after multiple periods. However, if investors did infer any information regarding a manager's green investment beyond that disclosed by the manager, this works against finding differences in investors' bidding behavior across different disclosures.

¹¹ In each period of each session, a separate randomly determined \$5 before-investment earnings distribution was randomly drawn from the underlying range of \$25–\$35 for each of the six managers. Then a separate before-investment actual earnings amount was drawn randomly from this randomly determined \$5 before-investment earnings distribution. With 20 periods in each session, this resulted in a total of 120 randomly determined \$5 before-investment distributions and randomly determined before-investment actual earnings amounts (6 managers × 20 periods). These 120 separate \$5 before-investment distributions and before investment actual earnings amounts were used in each of the three experimental sessions to limit any differences across experimental sessions.

¹² This reflects the asymmetric information regarding the net cost of green investments between managers and potential investors.

5. Results

5.1. Overview

Our first two hypotheses relate to investors' reactions to managers' disclosures. In order to test these hypotheses, it is necessary to first show that some managers made green investments and that there was variation in what managers disclosed to potential investors about their investments. As explained earlier, our experimental design yields 360 group-level responses (i.e., 18 groups \times 20 periods). Panels A and B of Table 3 report the frequency and percentage of green investments by amount of green investment (Panel A) and frequency and percentage of report type (Panel B).

Recall that in our setting wealth maximizing managers would never make a green investment unless they expected investors to fully compensate them for the personal cost they bear to make the investment. Neoclassical economic theory also predicts that managers' disclosures will not affect wealth maximizing potential investors' behavior, and thus managers will be indifferent as to what they disclose to investors. Panel A of Table 3 shows that managers made a green investment 50% of the time (180 out of 360 cases). Panel B of Table 3 shows that, while there is variation in report type, managers made some report types more often than others, which suggests that they expect that potential investors value the societal benefits of green investing and thus may react more positively to some report types than others. We discuss managers' behavior in more detail later in conjunction with the tests of our H3 and H4.

5.2. Test of H1

Table 4 reports descriptive statistics by type of report managers made to investors. For each broad report type group, Panel A of Table 4 shows the frequency of such reports, the average before-investment earnings range, the managers' average green investment amount, the average net cost of the investment to the company (i.e., the investment amount

Table 3
Managers' green investment and reporting decisions.

Panel A: Frequency and percent of managers' Green Investment Amounts			Panel B: Frequency and percent of managers' reports			
	Green investment amount ^a	Frequency ^b	% of total investment decisions		Frequency ^b	% of total reports
No Green Investment			No Green Investment (50% of 360 cases)			
Green Investment	\$0	180	50.0%	No Report	32	17.8%
	\$1	60	16.7%	No Green Investment ^c	148	82.2%
	\$2	33	9.2%	All No Green Investment	180	100%
	\$3	13	3.6%	Green Investment (50% of 360 cases)		
	\$4	6	1.7%	<u>Green Investment not Disclosed</u>		
	\$5	13	3.6%	No Report	25	13.9%
	\$6	4	1.1%	<u>Disclosed Green Investment</u>		
	\$7	4	1.1%	Green Investment ^d	56	31.1%
	\$8	1	0.3%	Green Investment Amount ^e	31	17.2%
	\$9	1	0.3%	Green Investment Amount and Cost ^f	35	19.4%
	\$10	8	2.2%	Green Investment and Cost ^g	33	18.3%
	\$12	1	0.3%	Subtotal – Disclosed Green Investment	155	86.1%
	\$14	1	0.3%	All Green Investment	180	100%
	\$15	3	0.8%			
	\$18	2	0.6%			
	\$20	30	8.3%			
Subtotal – Green Investment		180	50.0%			
Total		360	100%			

^a Possible investment amounts ranged from \$0 to \$20 in one dollar increments.

^b Frequency equals the total number of times managers made the specified amount of green investment (Panel A) or the number of times managers provided the specified type of report (Panel B).

^c No Green Investment=a report stating "No amount of this period's earnings have been invested to reduce carbon emissions."

^d Green Investment=a report stating "A portion of this period's earnings have been invested to reduce carbon emissions."

^e Green Investment Amount=a report stating "\$ ___ of this period's earnings have been invested to reduce carbon emissions."

^f Green Investment Amount and Cost=a report stating "\$ ___ of this period's earnings have been invested to reduce carbon emissions at a cost to the company of \$___."

^g Green Investment and Cost=a report stating "A portion of this period's earnings have been invested to reduce carbon emissions at a cost to the company of \$___."

Table 4

Descriptive statistics.

Panel A: Descriptive statistics by broad category of report types

Report Type ^a	Frequency ^b	(1) Average Before-investment Earnings Range ^c	(2) Average Green Investment ^d	(3) Average Cost of Investment to Company ^e	(4) Average After-investment Earnings Range (1 minus 3) ^f
No Green Investment	148	\$27.42–\$32.42	\$0.00	\$0.00	\$27.42–\$32.42
All No Reports	56	\$27.48–\$32.48	\$4.57	\$2.29	\$25.19–\$30.19
All Disclosed Green Investment	154	\$27.65–\$32.65	\$5.40	\$2.70	\$24.95–\$29.45
Total	358 ^g	\$27.53–\$32.53	\$3.04	\$1.52	\$26.01–\$31.01

Panel B: Descriptive statistics by specific report types

Report Type ^a	Frequency ^b	(1) Average Before-investment Earnings Range ^c	(2) Average Green Investment ^d	(3) Average Cost of Investment to Company ^e	(4) Average After-investment Earnings Range (1 minus 3) ^f
No Reports					
No Report – No Green Investment	32	\$27.69–\$32.69	\$0.00	\$0.00	\$27.69–\$32.69
No Report – Green Investment	24	\$27.20–\$32.20	\$10.66	\$5.33	\$21.87–\$26.87
All No Reports	56	\$27.48–\$32.48	\$4.57	\$2.29	\$25.19–\$30.19
Disclosed Green Investment					
Green Investment Only	56	\$27.36–\$32.36	\$7.91	\$3.96	\$23.40–\$28.40
Green Investment Amount	31	\$27.98–\$32.98	\$3.35	\$1.68	\$26.30–\$31.30
Green Investment Amount and Cost	34	\$27.92–\$32.92	\$3.82	\$1.91	\$26.01–\$31.01
Green Investment Cost	33	\$27.55–\$32.55	\$4.70	\$2.35	\$25.20–\$30.20
All Disclosed Green Investment	154	\$27.65–\$32.65	\$5.40	\$2.70	\$24.95–\$29.45

Panel C: Calculation of standardized winning bid by specific report types

Report Type ^a	Frequency ^b	(1) Average Winning Bid ^h	(2) Average Lowest Possible Earnings ⁱ	(3) Standardized Winning Bid (1 minus 2) ^j
No Reports				
No Report – No Green Investment	32	\$28.89	\$27.69	\$1.21
No Report – Green Investment	24	\$23.72	\$21.87	\$1.85
All No Reports	56	\$26.67	\$25.19	\$1.48
Disclosed Green Investment				
Green Investment Only	56	\$25.58	\$23.40	\$2.18
Green Investment Amount	31	\$28.51	\$26.30	\$2.21
Green Investment Amount and Cost	34	\$28.19	\$26.01	\$2.18
Green Investment Cost	33	\$26.70	\$25.20	\$1.49
All Disclosed Green Investment	154	\$26.99	\$24.95	\$2.03

^a See notes c–g of Table 3 for details of the specific information contained in each report type.^b Frequency equals the total number of times managers provided the specific type of report.^c Average before-investment earnings range=the average of the \$5 ranges that were randomly drawn from the uniformly distributed larger range of \$25–\$35 (see section 4.2).^d Average green investment=the average amount managers chose to invest in reducing carbon emissions.^e Average cost of investment to company=the average net cost to the company of the green investment, where the net cost equals the amount of the green investment less a 50% energy cost savings.^f Average after investment earnings range=average before-investment earnings range (column 1) minus the cost of the investment to the company (column 3).^g The total number of reports is 358 because two outliers were removed (see footnote 10).^h Average winning bid=the average of the highest bids that potential investors made for the company.ⁱ Average lowest possible earnings=the lowest amount in the average after-investment earnings range.^j Average standardized winning bid=the average winning bid standardized by subtracting the average lowest possible earnings (column 2) from the winning bid (column 1) to remove all possible effects of cash flows on the winning bid.

Table 5

Statistical tests.

Panel A: H1Model: Standardized winning Bid^a = $\alpha_1 + \alpha_2$ Reported Green Investment + ϵ

	Coefficient	t-Value	p-Value ^e
Constant	1.48	5.62	< 0.01
Reported Green Investment ^b	0.55	1.79	0.04
Number of observations	210		

Panel B: H2Model 1: Standardized Winning Bid^a = $\alpha_1 + \alpha_2$ Cost of Green Investment + ϵ

	Coefficient	t-Value	p-Value ^e
Constant	2.18	6.09	< 0.01
Cost of Green Investment ^c	0.69	1.68	0.05
Number of observations	89		

Model 2: Standardized Winning Bid^a = $\alpha_1 + \alpha_2$ Cost of Green Investment + ϵ

	Coefficient	t-Value	p-Value ^e
Constant	2.21	7.32	< 0.01
Cost of Green Investment ^c	0.03	0.07	0.47
Number of observations	65		

Panel C: Investor reaction to amount of Green InvestmentModel: Standardized Winning Bid^a = $\alpha_1 + \alpha_2$ Amount of Investment + ϵ

	Coefficient	t-Value	p-Value ^e
Constant	1.81	7.88	< 0.01
Amount of Investment ^d	0.11	1.69	0.05
Number of observations	65		

^a Standardized Winning Bid is the winning bid standardized by subtracting the average lowest possible earnings from the winning bid to remove all possible effects of cash flows on the winning bid.

^b Reported Green Investment equals one if the report disclosed that a green investment was made and zero if there was no report.

^c Cost of Green Investment equals one if the report does not include information about the cost of the green investment, and zero if the report includes the cost of the green investment.

^d Amount of Investment equals the reported amount of the green investment.

^e p-Values are estimated using Huber-White corrected standard errors clustered by participant.

reduced by the 50% cost savings), and the average after-investment earnings range. Panel B of Table 4 presents the same information as Panel A broken out by specific report type for all no reports and all reports that disclosed a green investment. Panel C of Table 4 reports the average winning bid, the average lowest possible earnings (from the last column of Panel B), and the standardized winning bid for the same reports shown in Panel B.

The standardized winning bid shown in the last column in Panel C of Table 4 is our primary dependent variable for testing H1 and H2. We standardize the investor's winning bid by subtracting the lowest value in the \$5 distribution of the after-investment cash flows to isolate any incremental effect of different green investment reports on investors' winning bids separate from the economic impact of differing cash flows. Two items could cause the cash flows that investors see before making their bids to differ for the different types of reports: 1) differences in the random draw of possible earnings, and 2) different amounts of green investment. Our standardized winning bid removes the effect of both such differences in cash flows, and therefore it provides a clean measure of how investors' winning bids are influenced by different reports beyond any economic effect due to differing cash flows. As such, our standardized winning bid allows us to isolate whether investors value the societal benefits of managers' green investments.

H1 predicts that investors will respond more positively to disclosure of a green investment than to no report regarding the manager's green investing decision. We test H1 by comparing the standardized winning bid for cases in which the manager reported that they made a green investment versus cases in which they made no report (see Panel C of Table 4).¹³

¹³ We use all cases in which managers made no report ($n=56$ in Panel C of Table 4) for this test because when potential investors received no report they did not know whether the manager had or had not made a green investment. In addition we removed two outliers from our data, which dropped the total number of observations from 360 to 358. The observations we removed were both more than 6 standard deviations away from the mean standardized winning bid, with the most extreme one being more than 9 standard deviations away. Because these two outliers arise from potential investors' bids they only affect our standardized winning bid measure, and therefore are only removed for tests of H1 and H2. Using standard deviation cutoffs of 5, 4, or

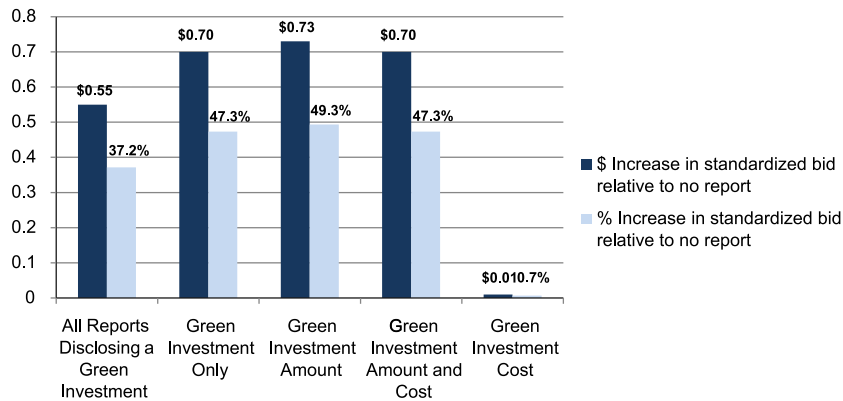


Fig. 2. Average increase in the standardized winning bid for reports that disclosed green investments relative to no report.

For our test of H1 and all subsequent analyses involving standardized winning bids, we use the Huber-White method to estimate robust standard errors after adjusting for non-independence caused by repeated measures (Huber 1967; White 1982). As shown in Panel A of Table 5, consistent with H1, the standardized winning bid was significantly higher ($t=1.79$, $p=0.04$) when managers disclosed that they made a green investment (mean standardized winning bid=\$2.03 from Table 4) than when managers made no report (mean standardized winning bid=\$1.48 from Table 4).¹⁴ This result indicates that investors value the societal benefits of green investment and therefore reward managers for disclosing that they made such an investment.

Although investors' actual bidding behavior in the experiment provides the most direct support for our interpretation that investors bid more because of the societal benefits associated with a disclosed green investment, this interpretation is also consistent with investors' responses to our post experiment questionnaire. Potential investors' average rating of their willingness to contribute to environmental causes was 3.55 on a scale with endpoints of 0 (Not Willing) and 6 (Very High Willingness), and a midpoint of 3 (Moderate Willingness).¹⁵

5.3. Test of H2

H2 predicts that investors will react more positively to disclosures that focus on the societal benefits of green investments than those that focus on the cost to the company. We used two comparisons of standardized winning bids to test this hypothesis. First, we compared the standardized winning bids for Green Investment Only reports to the standardized winning bids for Green Investment and Cost reports and then we compared the standardized winning bids for Green Investment Amount reports to the standardized winning bids for Green Investment Amount and Cost reports. We used these comparisons because the only difference between the two report types in each comparison is the inclusion of cost information.

For the first comparison, Model 1 in Panel B of Table 5 shows that, consistent with H2, the standardized winning bids are significantly higher ($t=1.68$, $p=0.05$) when managers' disclosure focused on the societal benefit ($n=56$, mean standardized winning bid=\$2.18 from Panel C of Table 4) than when they also reported the specific cost to the company ($n=33$, mean standardized winning bid=\$1.49 from Panel C of Table 4). However, for the second comparison, Model 2 in Panel B of Table 5 shows that there is no significant difference ($t=0.07$, $p=0.47$) when managers' disclosure focused on the societal benefit ($n=31$, mean standardized winning bid=\$2.21 from Panel C of Table 4) than when they also reported the specific cost to the company ($n=34$, mean standardized winning bid=\$2.18 from Panel C of Table 4).

The second comparison above suggests that investors may not always react less positively when cost information is disclosed. Although we did not anticipate this result, a possible explanation is that the disclosed cost information in the second comparison made salient the reduction in energy costs associated with the green investment. That is, although any green investment always had a net cost to the company in our setting, the amount of the societal benefit was twice as high as the net cost to the company, and this was made salient when the report included information about both the amount of the societal benefit and the cost to the company. This may explain why the second comparison did not support H2, while the first did.

(footnote continued)

3 rather than 6 does not change any of our statistical inferences except that a standard deviation cutoff of 4 or 5 results in removing one additional data point, which moves the result for our test of H1 to marginal significance ($p=0.065$).

¹⁴ Because this and all subsequent hypotheses make directional predictions, all reported p-values are one-tailed unless otherwise specified.

¹⁵ In addition to the mean reported above we note that 81.5% of the potential investors rated their willingness to contribute to environmental causes to be within the narrow range of 3 to 5 on the scale from 0 to 6.

Although wealth maximizing potential investors should ignore any disclosure regarding green investment in our setting, the results for H1 and H2 reported above show that they respond differently to different types of reports. Fig. 2 summarizes these results. The first column of the figure corresponds to the results for H1, showing that, on average, the standardized winning bid was \$0.55 and 37.2% higher when managers disclosed that a green investment was made versus when they made no report. The last four columns of Fig. 2 correspond to the results for H2, showing that there is a positive difference in the standardized winning bids between No Report and the Green Investment Only (\$0.70 and 47.3%), Green Investment Amount (\$0.73 and 49.3%) and Green Investment Amount and Cost (\$0.70 and 47.3%) reports, but virtually no difference in the standardized winning bids (0.01 and 0.7%) between the Green Investment Cost report and No Report.

The results for H1 and H2 reported above show that potential investors bid more when the green investment is disclosed and when the disclosure focuses on the societal benefits of the green investment. Investors' higher bids in response to these disclosures reduce the cost of the green investment to the manager and the other current shareholder. However, despite this reduction in cost, the manager and the current shareholder nevertheless still bear a significant financial cost when the manager made a green investment. That is, even though investors responded more favorably to such disclosures, a regression model with the joint payoff for the manager and current shareholder as the dependent variable and amount of the green investment as an independent variable shows that the joint payoff was negatively affected ($t = -23.64$, $p < 0.001$; not tabulated) by the amount of green investment.¹⁶ Moreover, this result holds separately for each report type (all t 's > 3.88 , p 's < 0.01 ; not tabulated) and for both the first and the second half of the experiment (both t 's > 16.06 , p 's < 0.01 ; not tabulated).¹⁷ These results provide evidence that, although investors' bids are higher when managers disclosed that they made a green investment, managers and current shareholders still bore a significant financial cost regardless of the type of report that managers made regarding their investment decision. In summary, investors shared only part of the costs of managers' unprofitable green investment, with the remaining cost being borne by the manager and other current shareholder.

5.4. Test of H3

Before testing H3, we note that, as shown in Panel A of Table 3, managers made a green investment 50% of the time (180 out of 360 cases). Most investments were for lower amounts, i.e., \$1.00 (16.7%) or \$2.00 (9.2%), but the next highest percentage was for the maximum possible amount of \$20.00 (8.3%). For the 180 cases in which an investment was made, the average investment was \$6.17, which represents 21% of the company's expected earnings of \$30. Seventeen of the 18 managers (94.4%) made a green investment, with 5 managers making more than 15 investments, 4 making 11 to 15, 3 making 6 to 10, and 5 making 5 or less.

Given the frequency of green investments and the financial disincentive to make such investments, it is unlikely that the large number of investments were random errors. Moreover, managers' responses to a post experiment question indicate that those who made green investments did so because they value the societal benefits. Managers rated their willingness to contribute to environmental causes on a 7 point scale with endpoints of 0 (Not Willing) and 6 (Very High Willingness), and a midpoint of 3 (Moderate Willingness). A logistic regression with investment as an indicator dependent variable coded as 1 (0) when a manager made (did not make) an investment and the response to this question as the independent variable shows that managers with higher responses were more likely to make an investment ($z = 1.58$, $p = 0.055$).¹⁸

H3 predicts that managers who make a green investment will disclose that they have done so. Given that our earlier results show that investors respond differently to different types of disclosures, we expect managers to anticipate this and make their disclosure decisions accordingly. As shown in Panel B of Table 3, consistent with H3, managers disclosed their green investment in 155 of the 180 cases (86.1%). This proportion of disclosed cases (86.1%) is significantly greater ($z = 28.02$, $p < 0.001$) than the proportion of cases not disclosed (13.9%).¹⁹

Managers' responses to post experiment questions provide further evidence that they considered investors' reaction when making their disclosure decisions. Managers rated how they expected investors to react to a report that a green investment was made and to no report on separate scales with endpoints of 0 (Very Unfavorably) and 6 (Very Favorably), and a midpoint of 3 (Neither Favorably or Unfavorably). The average response for a report that a green investment was made

¹⁶ The manager's and the current shareholder's payoffs were combined because each owned 50% of the company, and therefore each received the same payoff (see Table 2).

¹⁷ We included the before-investment earnings range as a control variable in these regressions to control for the fact that different earnings draws likely affected investors' bids and therefore both managers' and other current shareholders' payoffs.

¹⁸ A study by Martin (2015) provides further evidence that managers' green investments are intentional. In a setting similar to ours, he finds that, when choosing between making an unprofitable green investment versus a more profitable non-green investment, managers chose the green investment 47.2% of the time, whereas when choosing between an unprofitable non-green investment and a more profitable green investment, managers chose the non-green investment only 6.5% of the time. These asymmetric choices indicate that managers' green-investment choices were conscious choices, not errors. The similarity in percentages of green investments in Martin's study (47.2%) and ours (50%) also increases our confidence that our managers' choices are intentional.

¹⁹ We also used a more conservative test that compares the proportion of cases that disclosed the green investment (86.1%) to 80%, the expected proportion of such reports if managers chose their reports randomly (i.e., if they made 20% of each of the five possible types of reports, four of which disclosed green investment). The results of this more conservative test also provide evidence that the proportion of cases in which the green investment was disclosed was significantly greater than would be expected if choices were random ($z = 2.05$, $p = 0.02$).

(3.11) is significantly greater ($t=3.83$, $p < 0.001$) than for no report (1.89), suggesting that, on average, managers expected investors to react favorably to a report that a green investment was made, but unfavorably to no report.²⁰

5.5. Test of H4

H4 predicts that managers who disclose their green investment will focus their disclosure on the societal benefits of their investment more often than on the cost to the company. We test H4 by examining the types of reports that managers made to investors. We used the same two comparisons of report types to test H4 as we used earlier to test H2. First, we compared Green Investment Only ($n=56$) to Green Investment and Cost ($n=33$) and then we compared Green Investment Amount ($n=31$) to Green Investment Amount and Cost ($n=35$). The only difference between the two report types in each comparison is cost information. We compared the proportion of the first type of report (reports that focused on the societal benefits without the cost) to the proportion of the second type of report (reports that included cost information).

Consistent with H4, the first comparison shows that there were significantly more ($z=2.44$, $p < 0.01$) reports that focused on the societal benefits ($56/89=62.9\%$) of the green investment than those that also disclosed specific information about the cost to the company ($33/89=37.1\%$). However, for the second comparison, the proportion of reports for the two report types ($31/66=47.0\%$ and $35/66=53.0\%$) is not significantly different ($z=0.492$).²¹

As for H2, there is an explanation for why the second comparison does not support H4. When cost information is disclosed along with the amount of the societal benefit, the reduction in energy costs from the green investment is made salient, and some managers may have tried to highlight this positive aspect of their investment. As shown earlier when testing H2, disclosing both the societal benefits and the associated cost did not hurt managers because investors reacted as favorably to such reports as to reports that disclosed only the societal benefits.

5.6. Additional analysis

5.6.1. Amount of Green Investment

Our results for H1 show that investors value knowing that a green investment was made, but do not address investors' response to the *amount* of the investment. Therefore, we examined whether the standardized winning bids increased as the *disclosed* amount of investment increased. Panel C of Table 5 shows that the standardized winning bids increased by approximately \$0.11 for each \$1.00 of disclosed investment amount ($t=1.69$, $p=0.05$). Thus, not only are the standardized winning bids higher when an investment is disclosed, they also increase as the disclosed investment amount increases.

However, our data also suggest that managers may not have expected investors to react favorably to all *amounts* of green investment. Specifically, when managers made a green investment of \$10 or less ($n=143$), they disclosed the amount of the investment 44.8% of the time, but when managers made a green investment of more than \$10 ($n=37$), they only disclosed the amount of the investment 5.4% of the time. Consistent with this observation, Panel B of Table 4 shows that the "Average Green Investment" amounts in column 2 are larger for managers who invested and did not disclose the amount of their investment (No Report=\$10.66 and Green Investment Only=\$7.91, combined average=\$8.74) than for managers who invested and disclosed the amount of their investment (Green Investment Amount=\$3.35 and Green Investment Amount and Cost=\$3.82, combined average=\$3.60).²² This suggests that managers were concerned that potential investors may view very high amounts of unprofitable green investment unfavorably. While managers rarely disclosed the amount of their investment greater than \$10, they nevertheless still disclosed that they made such an investment most of the time ($67.6\%=25/37$).²³ We cannot directly test how potential investors reacted to such high investment amounts because managers rarely disclosed them.

Further evidence that managers were concerned that very high investment amounts might be viewed less favorably by investors comes from their responses to a post experiment question asking them to rate how they expected investors to respond to all possible amounts of green investment (\$0 through \$20 in one dollar increments) on a seven point scale with endpoints of 0 (Very Unfavorably) and 6 (Very Favorably) and a midpoint of 3 (neither favorable or unfavorable). Managers rated amounts of \$5 and below as favorable (mean=4.22) but rated all amounts above \$5 as unfavorable (mean=1.43), indicating that they believed that investors would react favorably to smaller investment amounts and unfavorably to high investment amounts. Managers' average ratings decreased monotonically for amounts from \$0 to \$20, with the switch from favorable to unfavorable ratings occurring at a \$6 investment.

²⁰ In another post experiment question, managers rated the extent to which their reporting choice was influenced by potential investor reaction on a scale with endpoints of 0 (No Influence) and 6 (Very High Influence), and a midpoint of 3 (Moderate Influence). The average response of 3.56 (83.3% of responses were 3 or above) suggests that managers' expectations about investor reaction had a greater than moderate effect on their reporting choice.

²¹ To test for trends in our data, we conducted separate tests of our hypotheses using only data from the first ten periods and only data from the last ten periods and find that all previously reported statistical inferences hold for both the first and the second half of our experiment.

²² The average amount invested by managers who did not disclose any amounts (\$8.74) is significantly larger ($t=3.01$, $p < 0.01$) than the amount invested by managers who disclosed the amount of their investment (\$3.60).

²³ We use \$10 as the cutoff for very high green investments because this is the midpoint of possible investments, which ranged from zero to \$20. An investment above \$10 represented more than one-third of the company's expected earnings of \$30. The results are similar for cutoffs of \$5 (41.6% of managers disclosed investments of \$5 and below while 25.5% of managers disclosed investments greater than \$5) or \$15 (43.9% of managers disclosed investments of \$15 and below while 3.1% of managers disclosed investments greater than \$15).

5.6.2. No Green Investment

Our analysis so far has focused on the 50% of cases in which the manager made a green investment. We now consider the other 50% of cases in which the manager chose not to invest. Managers may not have invested in these cases because, although potential investors' bids lowered the cost of any green investment, their winning bids never fully offset the cost of the investment. Thus, managers not willing to bear the personal cost or to impose a cost on the current shareholder would not make a green investment. Panel B of Table 3 shows that in 148 of the 180 such cases (82.2%) the managers disclosed that they did not make a green investment, while in the remaining 32 cases they made no report. Moreover, there is moderate evidence that potential investors reacted more favorably ($t=1.73$, $p=0.09$, two-tailed; not tabulated) when managers disclosed that no green investment had been made ($n=148$, mean standardized winning bid=\$1.99, not tabulated) than when they made no report ($n=56$, mean standardized winning bid=\$1.48). We were initially surprised by these results because we expected managers who did not invest to make no report to investors as appears to be the case in actual field settings. However, in hindsight these results are not surprising given our setting.

In actual field settings, investors typically cannot determine whether companies' green investments are profitable or unprofitable. Thus, managers would not usually needlessly report that they did not make any green investments. In contrast, in our experiment managers knew that investors knew that any green investment was always unprofitable. Although this was a critical design feature for examining our research questions, it could have introduced a negative investor reaction to green investing not present in field settings, and as such may explain why managers reported that they did not make an investment.²⁴

While the potential negative investor reaction described above could explain the results for cases in which managers **did not** make an unprofitable green investment, it works against confirming our hypotheses which relate to cases in which managers **did** make an unprofitable green investment. First, a negative investor reaction to unprofitable green investments works against our finding that potential investors responded more favorably to disclosure of an unprofitable green investment than to no report (H1). Second, faced with a potential negative investor reaction, managers who made an unprofitable green investment would be less likely to disclose that they had done so, which works against our finding that managers who made an unprofitable green investment largely disclosed that they had done so (H3).

We note one final aspect of our results. Potential investors reacted less favorably to no report than to disclosure that a green investment was made and to disclosure that no green investment was made. This suggests that resolving uncertainty or being forthcoming about whether a green investment was made could help explain potential investors' more favorable reaction to reports that the manager made a green investment versus no report (H1). However, the results for the first test of H2 are inconsistent with this interpretation. This test compared reports disclosing only that a green investment was made (with no amount) to reports disclosing that a green investment was made and the net cost of the investment to the company. Both reports inform potential investors that an unprofitable investment was made, but the second report also informs potential investors of the net cost to the company. As reported earlier, investors responded more positively to reports disclosing only that a green investment was made (mean standardized winning bid=\$2.18) than to reports disclosing both that a green investment was made and the net cost to the company of the green investment (mean standardized winning bid=\$1.49). Thus, the report that resolves more uncertainty and is more forthcoming received a *less* favorable response, which is the opposite of what would be expected if uncertainty resolution were driving potential investors' bidding behavior.

6. Discussion and conclusions

Investors may use CSR disclosures to help predict future earnings and cash flows. However, investors could also respond to such disclosures because they value the societal benefits associated with CSR activities. It is difficult to separate these effects using field data because they occur simultaneously. We overcome this problem by designing an experiment in which CSR disclosures have no predictive value for future earnings or cash flows, which allows us to isolate investors' reactions that reflect the value they place on the societal benefits.

We find that potential investors respond more positively to voluntary disclosure of a green investment than to no report. We also find some evidence that investors respond more positively when managers focus their disclosures on the societal benefits of their investment than on the cost to the company. Because any disclosures regarding the green investment are irrelevant for firm value in our setting, these findings violate the assumption that investors value companies only on the risk-adjusted present value of future cash flows. Although our experiment was not designed to test the stability of the value premium we find for green investment disclosure, we believe that such a value premium is likely to persist as long as a portion of investors value the societal benefits of CSR. That is, if the value premium is based on investors' preferences for the societal benefits of CSR and such preferences remain relatively stable, the value premium is not likely to result in market bubbles or crashes.

²⁴ Our post experiment questionnaire provides additional evidence supporting our argument that managers expected that potential investors would respond more favorably to a report that no green investment was made than to no report. Managers rated how they expected investors to react to a report that no green investment was made and to no report on separate scales with endpoints of 0 (Very Unfavorably) to 6 (Very Favorably), and a midpoint of 3 (Neither Favorably or Unfavorably). The average response for a report that no green investment was made (4.44) is significantly greater ($t=5.25$, $p < 0.001$) than for no report (1.89), indicating that, on average, managers expected investors to react favorably to a report that no investment was made and unfavorably to no report.

Our results also demonstrate that managers anticipate investors' reaction and thus overwhelmingly disclose their green investments and tend to focus their disclosure on the societal benefits of the investment rather than on the cost to the company. Although managers generally disclose that they made a green investment, they disclose the *amount* of their investment less often when they invested very large amounts, presumably because they are concerned that investors may view such large investment amounts unfavorably. However, managers disclose the amount of their lower investment amounts more often and investors respond more positively as the amount of such investments increase.

Our results suggest that managers can craft disclosures of unprofitable investments that benefit society in ways that encourage investors to help lower the costs of such investments to the company. This helps explain why company managers tend to disclose the benefits of their CSR investments to society or to the company, while often remaining silent about or downplaying the costs to the company. Our results also contribute to the broader CSR literature by providing evidence that managers may sometimes overinvest in CSR activities. Such overinvestment is viewed as an agency problem by those who believe that managers should only be socially responsible when this maximizes shareholder value. However, for those who believe that managers should be socially responsible even when this could hurt the bottom line, our results will be welcomed because they suggest that managers may sometimes act in society's interest even when this lowers their personal wealth and the wealth of other shareholders.

In addition to the benefits discussed earlier, using an experiment also helped control for many other confounding effects present in the field. For example, corporate managers could use the uncertain future benefits of current CSR investments to justify unprofitable CSR investments. By making all costs and benefits certain and limiting them to the current period, we are able to rule out such alternative explanations for managers' investments and investors' reaction. Similarly, some corporate managers could invest in CSR projects because the personal reputational benefits in their community or among special interest groups exceed the financial costs they bear. Because our managers' investment decisions are anonymous, such external reputational benefits cannot explain their unprofitable CSR investments.

Because the participants in our experiment were not practicing corporate managers or sophisticated investors and the financial stakes were not as large as those in the field, we cannot be sure that our results would generalize to field settings. However, there are no obvious reasons why corporate managers would have weaker preferences for societal benefits than the participants in our experiments. In fact, corporate managers may have stronger preference given that they have access to more resources and may feel an obligation to a broader group of stakeholders than just current shareholders (Moser and Martin, 2012). Our participants had no such external pressure to make green investments. Regarding our investor participants, the prevalence of socially responsible investment funds suggests that many actual institutional and individual investors value companies' CSR activities. Regarding the size of the financial stakes, prior studies show that the results of experiments using smaller financial stakes generalize fairly well to settings with larger stakes (Kachelmeier and Shehata, 1992, see also Camerer, 2011 and Falk and Heckman, 2009 for general discussions of the generalizability of experiments to the field).

Despite years of study and philosophical debate regarding CSR, we understand very little about how managers make such decisions, what information they voluntarily disclose about those decisions, and how investors react to such disclosures. Given the lack of archival data to test such questions as directly as we could in our experiment, we hope that our study spurs future studies using experiments, archival data, or other approaches to extend our findings.

Appendix. Expected payoff for participants

Assumptions: (1) potential investors are risk neutral, (2) \$0 green investment, (3) expected value of liquidating dividend = \$30 (midpoint of the \$25–\$35 range).

Potential Investors' payoff

Potential investor who purchased the company for its expected value

Expected value of the liquidating dividend (\$30)–purchase price for the company (\$30)+\$5 participation fee+the \$30 endowment–\$15 (one half of the endowment)=\$20

Potential investor who did not purchase the company

\$5 participation fee+the \$30 endowment–\$15 (one half of the endowment)=\$20

Manager's payoff

50% of the selling price for the company (\$15)+\$5 participation fee=\$20

Current Shareholder's payoff

50% of the selling price for the company (\$15)+\$5 participation fee=\$20

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