The Effect of Punishing “Over-Contributors” on Overall Welfare: Some Experimental Evidence

A Thesis
SUBMITTED TO THE FACULTY OF
UNIVERSITY OF MINNESOTA
BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF SCIENCE

Terry Hurley, Advisor

July 2015

Acknowledgements

Many thanks are due to my thesis committee: my advisor Terry Hurley, Jay Coggins, and Claire Hill. I am also deeply indebted to Sarah Wilmer for her help and patience.

Dedication

This thesis is dedicated to the memory of Stephen R. Hickerson, who taught me to approach economics as a language and to always view doctrine with a healthy dose of skepticism.

Abstract

A public goods environment was constructed to simulate a dilemma in which corporate managers choose between acts of corporate social responsibility and acts of profitability. An experiment was conducted to determine the effect of a penalty for contributing above a specific level. The penalty has significant effects, encouraging free riding and suppressing contributions at all levels, even though most contributions would not have triggered the penalty.

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Chapter I. INTRODUCTION.

There is a growing trend in legal scholarship toward a belief that over-regulation of corporation stunts corporate morality. This belief, developed extensively by Lawrence E. Mitchell in his widely cited *Cooperation and Constraint in the Modern Corporation: An Inquiry into the Causes of Corporate Immorality*, 73 Tex. L. Rev. 477 (1995), argues that extensive regulation of corporate behavior reduces corporate social responsibility.

This argument has two elements. The first of which is the general requirement under law that corporate actors act in the best interests of their shareholders. This, according to Mitchell and others, translates to primarily mean profit maximization (a traditional assumption of neoclassical economic theory). Mitchell suggests that this duty restricts the role of corporate actors and discourages social responsibility when such responsibility would reduce profits.

Mitchell also claims that strict regulation for corporations regarding such things as product safety, treatment of the environment, and working conditions reduces the morality of the corporate actor, much in the same way that strict rules ("constraints") can limit a child's moral development (Piaget 1965).

I propose to test the effect of rule-based regulation on corporate actors' self-regulation with an experiment in behavioral economics.

A. Research problem.

Do fiduciary duties constrain corporate social responsibility? Mitchell (1995) posits that they do. Specifically, he writes that corporate managers' fiduciary duty of loyalty, which includes the duty to act in shareholders' best interests, is widely interpreted as a duty to maximize corporate profits. Given the choice between a more profitable action and a more socially responsible action, corporate managers will choose the more profitable action because they are bound by fiduciary duties to do so. Mitchell concludes by stating that he has no way to prove that corporate managers will act more morally in the absence of shareholder litigation threat: "I believe that if corporate actors are left to their own devices in the society we currently have and have an awareness that society expects them to behave in a corporate context as complete members of that society, corporate actors on balance will behave well."

The problem, then, is to test Mitchell's assertion. A "real world" experiment would involve a change to state law that reduces the standards to which shareholders hold corporate managers. A legislative change like that seems unlikely, and in any event is not a viable option for academic research. Some states have enacted constituency legislation (which allows corporate managers to consider the interests of broad constituencies well beyond their shareholders), but even those states have not gone so far as to alter the basic directive to corporate managers to maximize shareholder profits. Perhaps a laboratory experiment, using a game theoretic model designed to simulate corporate managers' decision-making, can shed light on the issue.

B. Need for the research.

1. *Increasing Corporate Social Responsibility*

This paper borrows the definition of corporate social responsibility (CSR) from McWilliams and Siegel (2001), describing it as "actions that appear to further some social good, beyond the interests of the firm and that which is required by law." In other words, CSR is what can happen when firms make choices between a private benefit and a public benefit. For many of these choices, the potential public benefit greatly outweighs the private benefit and therefore increases social welfare. This is often the case where there negative externalities arise from a profitable action, or, inversely, when positive externalities arise from an unprofitable action.

Corporate social responsibility (defined in more detail in Section I.D below) describes the choice of a firm to sacrifice a private benefit for a public benefit, such as incurring higher input costs to purchase more environmentally friendly components. The public benefits can potentially vastly outweigh the private costs.

In those cases, the potential social benefit of this research is clear: exploring this tension between public and private benefit will inform policymakers on how best to structure corporate fiduciary duties such that they can maximize social welfare. Improving policy can potentially lead to diverse and substantial social benefits.

This paper will not definitively answer the questions of whether or exactly how we should tinker with fiduciary duties for corporate managers. These questions are difficult and multi-faceted. *See* Section I.E, below. Nonetheless, policy choices can and should consider these issues.

2. Increasing Efficient Provision of Public Goods, Specifically and Generally

This paper could have a specific effect on social welfare if its results contribute to and guide policy on corporate fiduciary duties. CSR may have some comparative advantages as a way to provide public goods over government and nonprofit sectors. Besley and Gatach (2007) argue that in the case of perfect government, CSR can provide public goods at the same level as individual voluntary contribution, but if government is imperfect, CSR can provide public goods at an even higher level. They write:

> [P]rivate contributions to reduce public bads may not be very effective. NGO's may use resources to lobby or curtail the bad activities, but may not have a technology to directly reduce the quantity of a public bad. However, this is not the case for many instances of CSR where the corporation may itself be the perpetrator of the bad.

If CSR can be harnessed to provide public goods (or equivalently, to reduce public bads), policymakers may be able to increase social welfare.

This paper could also have a more general effect as it informs the broader body of economics knowledge. This experiment will contribute to the literature on public goods games, also known as the voluntary contribution mechanism. It appears that no one has studied the effects of penalizing underperformance in a public goods game. If such a penalty does have an effect, broad applications could exist. Public goods games are used to model a variety of situations in which public goods are provided by private contributions, including climate change (Hasson 2009), environmental technology "green markets" (Kotchen 2006), and labor unions (Martin et al. 1991). Adding or removing penalties (as appropriate to the results of this experiment) could be a useful way adjust the parameters of real-life public goods games and thereby encourage the provision of public goods in circumstances well beyond corporate decision making.

C. Nominal definitions.

1. Corporate Social Responsibility

This paper borrows the definition of corporate social responsibility (CSR) from McWilliams and Siegel (2001), describing it as "actions that appear to further some social good, beyond the interests of the firm and that which is required by law." In other words, CSR is what can happen when firms make choices between a private benefit and a public benefit. For many of these choices, the potential public benefit greatly outweighs the private benefit and therefore increases social welfare. This is often the case where negative externalities arise from a profitable action, or, inversely, when positive externalities arise from an unprofitable action. CSR that reduces social welfare is also conceivable, if ill-advised. A direct wealth transfer with no significant transaction costs might have no net social welfare change, and a direct wealth transfer with significant transaction costs may reduce social welfare.

2. Fiduciary Duties

Under case law in Delaware (where most American corporations are incorporated), corporate decision-makers, as officers of a firm, owe that firm fiduciary duties of care and loyalty. *Gantler v. Stephens*, 965 A.2d 695 (Del. 2009). The duty of loyalty requires fiduciaries to act in the best interests of the corporation, and that includes a duty not to waste corporate resources. A corporate officer in breach of fiduciary duties risks being sued by the corporation's shareholders in a derivative suit. Even if the suit is unsuccessful, or if the firm's insurance indemnifies the officer, the experience is not a welcome one. The defendant could be fired, suffer reputational harm, and be compelled to participate in the legal process, for example by sitting for a deposition.

D. Context.

Mitchell (1995) argues that a tension exists between a desire to grant corporate managers broad discretion on one hand and a desire to ensure their loyalty to the corporation on the other. The fiduciary duty of loyalty to the corporation resolves this tension by requiring corporate managers to act in the best interests of the corporation. Lorsch & MacIver (1989) conclude that corporate managers, despite feeling moral obligations to serve broad constituencies (such as employees, creditors, customers, the public, etc.) believe that their legal duty is to the shareholders.

The "interests of the corporation" (that managers must consider) have been broadened somewhat. For example, Wolfe (1993) describes early legal battles over the legitimacy of corporate donations to not-for-profit institutions and the provision of extraordinary benefits to employees. These battles resulted in judicial and legislative actions that increase the constituencies corporate managers may consider when making decisions to some degree, although there are limits.

Mitchell (1995) believes that corporate managers will behave more responsibly and morally if certain legal constraints on their conduct are removed. Why does he believe this? "A complete answer to this question is beyond the scope of this Article (and perhaps my abilities), for it requires the development and defense of a theory of human nature and substantive goods."

Chapter II. THEORY.

A. Overview.

This section begins with a discussion of public goods games, social dilemma in which subjects make decisions about whether to make contributions toward a public good or keep resources for themselves. Public goods game experiments provide researchers with a mechanism by which they can test ideas about how to encourage private provision of public goods in spite of individual incentives to free ride off others' efforts.

Next, this section discusses various experiments in public goods environments, including several factors that are known to affect contributions to the public good. Although economic theory predicts that all subjects will free ride, experiments in a laboratory setting have shown repeatedly that many subjects do not free ride, at least at first.

This section then explores the payoff structure of a public goods game, including the effect of tweaking various parameters and the difference between linear public goods environments and provision point public goods environments.

Finally, the section explores the phenomenon of strategic corporate social responsibility and observes a link between executive compensation and corporate performance.

B. Literature.

1. The theoretical basis of public goods games

The public goods game, like the prisoner's dilemma game, represents a social dilemma situation in which subjects make decisions and the outcome for each is dependent on the decisions of others. Subjects can achieve the highest possible outcome for the collective by cooperating. However, each individual subject has an incentive not to cooperate, while reaping the benefits of others' cooperation (or "free ride") (Volk 2011).

Also thought of as the "*N*-person prisoner's dilemma" (Santos 2008), in the simplest form, each subject is given an endowment w, and makes a decision between cooperating (contributing a cost c to the "group exchange") or defecting (contributing nothing). The aggregate contribution is multiplied by an enhancement factor r and is then equally distributed among all N members of the group.

Hence, defectors get the same benefit as the contributors at no cost (*id.*). Public goods games are interesting dilemmas where $r < N$, meaning that the amount subject i contributes (c_i) will be less than i's share of the return. In other words, the marginal per capita return for each unit of contribution c_i is less than one. If the game were constructed such that $r \geq N$, every contribution would have a certain, profitable return, and full contribution ($c_i = w_i$) would be a strictly dominant strategy for all players.

In a slightly more sophisticated version of the public goods game, each subject has an endowment, from which the subject may contribute any amount (as opposed to all or nothing) to a group exchange representing a public good that returns an enhanced (multiplied by *r*) payoff divided among all the subjects. In some framings, the group exchange is called the "public exchange," and any part of the endowment not contributed to the public exchange is deposited in the subject's own "individual exchange," which is then paid out to the subject with no multiplier. One can interpret the amount contributed as a measure of cooperative behavior in this scenario more acutely than in the all-or-nothing contribution scenario (Denant-Boemont 2007). The payoff to each subject *i* is given by:

$$\pi_i = w_i - c_i + r\left(\sum_{j=1}^{N} c_j\right)$$

The enhancement factor *r* is what makes the group exchange a public *good* because the group exchange can return substantially more than the fixed amount set for the individual exchange (Marwell 1981). In other words, although low or no contribution may be a dominant strategy, high or full contribution is Pareto-superior (Isaac 1989).

No matter what strategies other subjects use, subject *i*'s best response is to contribute nothing because subject *i*'s return to c_i will always be less than c_i when $\frac{r}{N} < 1$.[1] The dominant strategy for each subject *i*, then, is

$$c_i^* = 0$$

And that is also therefore the Nash equilibrium. An underlying assumption of microeconomics is that subjects act rationally to maximize their own self-interested utility (Nicholson 2005). If that holds in a public goods game, they will each contribute nothing. However, this assumption tends to be unreliable.

[1] This is always the case in a public goods game. In cases where when $\frac{r}{N} > 1$, public and private interests are aligned and there is no dilemma.

2. Basic public goods game experiment features

There has been a considerable amount of experimental research on public goods environments. Isaac and Walker (1987a) and Ledyard (1995) provide excellent surveys of the literature, and Zelmer (2003) offers a meta-analysis of a variety of public goods experiments.

Experiments involving public goods games show that many subjects make nonzero contributions, their direct incentives notwithstanding (Ledyard 1995, Zelmer 2003). Seminal public goods experiments showed a wide range of strategies in single rounds, with approximately 30% contributing nothing, 20% fully contributing, and 50% making partial contributions (Isaac 1984; Isaac 1985).

Experiments involving repeated treatments have shown that contribution levels decrease over time. Although initial contribution levels are substantial, they generally decrease over time until contribution levels converge near zero (Denant-Boemont 2007 citing Isaac et al. 1985; Andreoni 1988; Isaac and Walker 1998a; Ledyard 1995).

This convergent behavior may appear to be the result of strategic behavior or of learning. That is, according to the strategy hypothesis, some subjects may have engaged in a strategy of early high contributions to encourage other subjects to make high contributions, and after seeing low participation, modified their own contributions. The learning hypothesis suggests that subjects did not understand that contributing nothing was a dominant strategy, and after a few rounds the subjects learned that contributing nothing benefitted them more than contributing something. Andreoni (1988) addressed these hypotheses by parsing out the potential effects of strategies and learning and found them lacking. Specifically, he compared contributions from subjects who stayed in the same group through ten rounds against contributions from subjects who were randomly reassigned to new groups after each of ten rounds, as strategy would be useless in the latter. He also, after ten rounds, instructed some groups to start again and play another ten rounds. For those groups that did so and stayed within the same groups, their round 11 contributions were largely the same as their round 1 contributions, which suggests that the decay toward zero contributions is not the result of learning, either.

3. *Payoff structure in public goods games*

Several experiments have tested the effects of altering the enhancement factor *r* applied to the total contributions before distributing it among subjects. Experimenters rarely set $r = 1$ (Zelmer 2003), which reflects the nature of externalities as something other than zero-sum games. Many experiments set $r = 1.2$ (Isaac et al 1989).

Experiments show that subjects in high payoff conditions (environments with high *r* values) contribute more than individuals in low payoff conditions. This is true for initial contributions (Zelmer 2003), and it is also true for total contributions in repeated treatments (Isaac et al. 1989).

A subject's marginal per capita return (*MPCR*) on the subject's contribution is a function of both the enhancement factor *r* and the group size *N*. Specifically, the function is usually given by:

$$MPCR(r,N) = \frac{r}{N}$$

Although the model discussed so far involves continuous returns to any subject's contributions, some experimenters, including Marwell and Ames (1981) and Dawes et al. (1986), have created more discrete public goods environments using provision points. That is, subjects in a group must contribute some minimum amount to earn a payoff from a public account. If that minimum is not reached, the public good is considered "not provided," and the subjects receive either nothing or very little from the public account. On the other hand, if the group does reach the provision point, the public good is provided, and the group receives a sizeable return on its investment in the public account. A unique feature of provision points is that if a subject believes that the other group members' contributions will total just below the provision point, that subject will see a very high return from contributing to the public account.

4. *Marketing CSR*

Some firms engage in CSR conduct and make sure that consumers know it. Baron (2001) calls this strategic corporate social responsibility: attempts to increase profits by attracting socially responsible consumers. Bagnoli and Watts (2003) provide numerous examples of this phenomenon, including cause-related marketing (that is, donating a portion of profits or otherwise linking charitable donations to sales levels) and lump-sum corporate donations to "worthy" causes or "green" activities, which implicitly link the contribution to sales of the company's products, such as support for public radio/television, health research, etc.

This kind of CSR is strategic because it is calculated to increase profits.[2] That is, consumers have to be willing to pay for the firm's voluntary increase in its marginal costs. But if they are in fact willing to pay, and willing to pay a premium higher than the firm's marginal costs, the firm's increased marginal costs can ultimately increase profits. In Bagnoli (2003)'s model of strategic CSR, private provision of a public good becomes a by-product of product-market competition between firms.

5. *Corporate managers' compensation*

Compensation for corporate managers correlates strongly with firm performance, as measured by the firm's annual returns. In a survey of executive compensation spanning the years 1980-1994, Hall and Liebman (1998) discovered a "strong link" between executive compensation and firm performance. They attribute virtually all of the sensitivity between pay and performance to changes in the value of executive stock and stock option holdings.

C. Model.

To model the circumstances of a corporate manager's social responsibility dilemma, this experiment creates a fairly standard public goods game environment with one modification: a penalty for underperformance designed to model the cost of shareholder litigation.

The Penalty Condition represents the current state of fiduciary duty law, where corporate managers face negative consequences for the firm's underperformance. The

[2] Another way to view this strategic CSR is in the form of corporate managers trying to avoid negative externalities of the magnitude that might induce a successful boycott (Putnam 1993).

Regular Condition removes the penalty for underperformance to simulate a scenario in which corporate managers are insulated from liability for engaging the firm in acts that increase social welfare at the expense of profits. The Regular Condition is closer to typical public goods games and the Penalty Condition represents a departure from the traditional model. But the question to be tested is whether a departure from the current state of fiduciary duty law would positively affect aggregate social welfare, so in a sense, the Penalty Condition is the control condition and the Regular Condition is the variable condition.

The independent variable, then, is the presence or absence of the penalty for underperformance, to determine whether fiduciary duties affect corporate social responsibility. The presence or absence more accurately represents a change to the environment than a change to a systemic or design variable (Ledyard 1995). The dependent variable to be measured is subjects' contributions, which represent sacrificing private profits for the greater public good. If the independent variable has a significant negative effect on the dependent variable, the experiment will indicate that fiduciary duties do constrain corporate social responsibility.

1. *Regular condition*

This paper first describes the Regular Condition, which is simpler, and builds from there to establish the Penalty Condition. As in a typical public goods game, each subject i in the Regular Condition begins with an endowment w_i and must choose to make a contribution c_i in the range of $[0, w_i]$. All N subjects' contributions are added together, multiplied by an enhancement factor r, and then distributed evenly among all subjects.

The payoff function for subject *i* in the Regular Condition is therefore given by

$$\pi_i(c_i) = w_i - c_i + \frac{r}{N}\left(\sum_{j=1}^{N} c_j\right)$$

As in typical public goods games, all players receive the same benefit from the total contributions, regardless of whether they themselves contributed. Here, this represents one corporate manager's expenditures to increase social welfare benefiting another corporate manager who desires an increase in social welfare. For example, a corporate manager who cares about protecting the environment will be pleased by another firm's actions that benefit the environment beyond that other firm's legal obligations to do so.

The enhancement factor *r* must be less than the number of subjects *N* to create a dilemma. The reverse condition, $r > N$, could represent socially responsible actions that are also profitable. In the latter circumstance, corporate managers could choose actions that are both socially responsible and privately profitable, so fiduciary breach would not be implicated because shareholders could not point to a failure to maximize profits.

Thus the amount each subject *i* contributes (c_i) will be less than *i*'s share of the return. In other words, the marginal per capita return for each unit of contribution c_i is less than one. For each subject, contributing any amount is a strategy dominated by contributing less. Mathematically, this aspect of marginal per capita return is given by:

$$c_i \cdot \left(\frac{r}{N}\right) < c_i$$

Game theory predicts a Nash equilibrium in each round where all subjects contribute nothing ($c_i = 0$). The Pareto-optimal outcome occurs when all subjects contribute their entire endowments ($c_i = w_i$). The experimental literature shows that, notwithstanding the theoretical Nash equilibrium, aggregate contribution levels regularly fall between nothing and everything $(0 < c_i < w_i)$, with some subjects contributing nothing and others contributing at varying levels (Zelmer 2003).

Each session consists of ten rounds with the same group members. This experiment employs multiple rounds to simulate a corporate management environment because business continues over time. If the goal is to simulate an ongoing business environment, limiting the game to a single round seems inappropriate. Further, Mitchell (1995) argued that fiduciary duties constrain corporate moral development. Expanding the game to multiple rounds allows an opportunity for subjects to develop. Also, shareholder litigation often follows annual or quarterly reporting that reveals performance (whether above or below expectations), and that reporting happens on a discrete but ongoing basis.

2. Penalty condition

The Penalty condition builds upon the Regular Condition's public goods game by adding a penalty for underperformance. That is, the subject incurs a penalty for contributing more than a given threshold. This paper designates that threshold *b* (for "breach") and the penalty *p*. This simulates a circumstance in which a subject plays the role of a corporate manager whose shareholders will sue for breach of fiduciary duty if the corporate manager earns profits ($w_i - c_i$) below a specified level. A simple way to state this is that there will be a penalty if $c_i > b$.

The penalty can alternatively be thought of as a modification to the marginal cost of contributing a token. Ordinarily, for any given subject, contributing a single token to the public account has a marginal cost of 1 token. However, contributing the *b*th token costs the subject 1 + *p*. All other tokens below or above the *b*th token still have a marginal cost of 1 token.

The payoff function for subject *i* in the Penalty Condition is therefore given by the pair of functions

$$\pi_i(c_i \geq b) = w_i - c_i + \frac{r}{N}\left(\sum_{j=1}^{N} c_j\right)$$

(this is functionally identical to the Regular Condition described above) and

$$\pi_i(c_i < b) = w_i - c_i + \frac{r}{N}\left(\sum_{j=1}^{N} c_j\right) - p$$

Another way to write this function, in a single equation uses a nested function $f(c_i)$, which represents the penalty *p* of being sued for fiduciary breach, is given by

$$\pi_i(c_i) = w_i - c_i + \frac{r}{N}\left(\sum_{j=1}^{N} c_j\right) - f(w_i, c_i)$$

where $f(c_i) = 0$ if $(w_i - c_i) > b$ and $f(c_i) = p$ if $(w_i - c_i) \leq b$.

In this environment, too, the amount each subject *i* contributes (c_i) will be less than *i*'s share of the return. So once again, the marginal per capita return for each unit of contribution c_i is less than one. For each subject *i*, regardless of what any other subject decides, contributing any amount is a strategy dominated by contributing less.

The difference is that in this environment, high-contributing subjects will realize an even lower return than in the Regular Condition. A high-contributing subject's payoff function could theoretically be negative, if

$$p > c_i \cdot \left(\frac{r}{N}\right)$$

As before, game theory predicts a Nash equilibrium where all subjects contribute nothing ($c_i = 0$). However, the Pareto-optimal outcome no longer necessarily occurs when all subjects contribute their entire endowments ($c_i = w_i$). The social utility function is given by:

$$\sum_{j=1}^{N} \pi_j(c_j) = \sum_{j=1}^{N} \left(w_j + (r-1) \cdot c_j - f(w_j, c_j)\right)$$

Therefore if contributions are symmetrical, the social utility function is given by:

$$\sum_{j=1}^{N} \pi_j(c_j) = N \cdot \left(w_j + (r-1) \cdot c_j - f(w_j, c_j)\right)$$

One can see that if the penalty *p* (which, recall, is subtracted if w_i drops below the breach threshold *b*) is large enough relative to the enhancement factor *r*, it can offset the gains from the marginal contribution that triggers it. In fact, if *p* is quite large, it can conceivably cancel out marginal contributions all the way to 100% (where $c_i = w_i$). When *p* is that large, the Pareto-optimal outcome will be found just short of *b*, because up to that point, higher contributions increase aggregate payoffs.

I considered provision points but declined to incorporate them into the model because they do not reflect the situation faced by a corporate manager. For some public goods, such as organization members hiring a lobbyist to represent their collective interest (Dawes et al. 1986), the public good cannot be provided unless a minimum aggregate contribution is reached. However, in the situation I wish to model, there is no minimum amount of aggregate corporate social responsibility that must be achieved for corporate managers to feel satisfaction for doing good. Rather, the returns from corporate social responsibility are more or less linear. For example, generating any lower amount of pollution is more desirable than generating a higher amount of pollution, and the desirability basically scales with the amount reduced. I also excluded provision points because Dawes et al. (1986) suggested that with provision points, there might be effects from a subject thinking that his or her contribution is the "critical" contribution.

The penalty is a function of contributions only, and returns from the public account do not affect it. Returns from the public account represent achievements of social responsibility, which create what Andreoni (1989) calls a "warm glow" for the subject. However, returns from the public account do not satisfy the fiduciary impetus to generate profits for shareholders, and therefore they do not prevent a penalty for breach.

Another way to think about the penalty condition is in terms of marginal cost of contributing one token to the public account. That is, in a given round, the gross marginal cost of each of the first $b - 1$ tokens (as well as all the tokens between $b + 1$ and w) a subject contributes to the public account is one token.[3] However, the marginal cost of the bth token is $1 + p$. That is, 1 for the token itself and p for the penalty.

[3] The net marginal cost would have to account for the marginal per capita return from the public account for each token a subject contributes, which is $\frac{r}{N}$.

D. Hypotheses.

There are several ways to measure the effect of the penalty on contributions. For the first three hypotheses, each subject's average contribution (over ten rounds) will be compared across the Regular and Penalty Conditions.

H_1: (overall-null): In a public goods environment, a penalty for "over-contributing" to the public good will not affect overall individual contribution levels.

H_2: (overall-reduction): In a public goods environment, a penalty for "over-contributing" to the public good will decrease overall individual contribution levels.

H_3: (overall-increase): In a public goods environment, a penalty for "over-contributing" to the public good will increase overall individual contribution levels.

The next set of hypotheses compare individual contributions on a round-by-round basis. That is, the Regular Condition subjects' contributions in the first round will be compared against the Penalty Condition subjects' contributions in the first round, and the same for the second round, and so on. Although I list only three hypotheses in this category, each of them will apply to each of the ten rounds, so they could also be listed as thirty separate hypotheses. Instead of that, I will apply each of the three to each of the ten rounds.

H_4: (oneround-null): In a public goods environment, a penalty for "over-contributing" to the public good will not affect individual contribution levels in each round.

H_5: (oneround-reduction): In a public goods environment, a penalty for "over-contributing" to the public good will decrease individual contribution levels in each round.

H_6: (oneround-increase): In a public goods environment, a penalty for "over-contributing" to the public good will increase individual contribution levels in each round.

For the next set, I will compare contributions of zero against non-zero contributions. Contributing zero is the dominant strategy, and the literature shows that although contributions generally start above zero, they tend to decay toward zero. Comparing zero contributions against non-zero contributions may reflect the speed at which a subject's contributions decay toward zero, depending on the presence of the penalty.

H_7: (nonzero-null): In a public goods environment, a penalty for "over-contributing" to the public good will not affect the number of individual non-zero contributions in each round.

H_8: (nonzero-reduction): In a public goods environment, a penalty for "over-contributing" to the public good will decrease number of individual non-zero contributions in each round.

H_9: (nonzero-increase): In a public goods environment, a penalty for "over-contributing" to the public good will increase number of individual non-zero contributions in each round.

For the final set of hypotheses, I will compare contributions above the level at which subjects incur a penalty. If contributions in the Penalty Condition are similar to those in the Regular Condition, but cluster below the breach level, that may tell us something different about the effect of the penalty from what we might learn simply from contribution levels.

H_{10}: (abovebreachlevel-null): In a public goods environment, a penalty for "over-contributing" to the public good will not affect the number of individual above-breach-level contributions in each round.

H_{11}: (abovebreachlevel-reduction): In a public goods environment, a penalty for "over-contributing" to the public good will decrease number of individual above-breach-level contributions in each round.

H_{12}: (abovebreachlevel-increase): In a public goods environment, a penalty for "over-contributing" to the public good will increase number of individual above-breach-level contributions in each round.

Mitchell (1995) expects that removing the breach threshold will increase contributions because its presence constrains subjects (standing in for corporate managers) from developing their institutional morality. He expects that the breach threshold creates a psychological barrier to high levels of contribution.

However, I expected that the presence or absence of a breach threshold will have no significant effect on individual or group contributions because executive compensation is so strongly correlated with firm performance. I expected that personal compensation would influence contribution levels strongly enough to obscure any effect from the presence of a penalty.

E. Scope of the study.

This study attempts to explore the effect, if any, of fiduciary duties on corporate managers' propensity to choose social responsibility over private profits. It assumes that corporate managers would personally benefit from using corporate resources for social responsibility (perhaps by feeling that they have done the right thing—Andreoni's "warm glow"), that using too many corporate resources for social responsibility risks inviting shareholder litigation which would be unpleasant for the corporate manager, and that a change to fiduciary duty law could prevent such litigation.

The study is limited by these assumptions. To the extent that they are incorrect, the results of the experiment cannot be generalized to the broader policy question.

The study makes no normative claims as to whether corporate fiduciary duties ought to be altered by legislation or any other means, regardless of the outcome of the experiment.

Chapter III. METHODS.

This experiment created a public goods game environment, employing common parameters and features of public goods games. However, this experiment imposed a penalty for contributing “too much” in one of two conditions.

A. Design.

1. Subjects and setting

The experiment took place in a university classroom. I planned to have six sessions of twenty subjects each, for a total of 120 subjects, but unfortunately, my recruiting efforts were not as successful as I had hoped, so I ended up with 60 subjects. Three sessions were conducted on Friday, February 13, 2015 and the two others were conducted on Saturday, February 14, 2015. Each session had between two and four groups of five subjects each.

As the subjects arrived, they were asked to sit wherever they pleased. If the number of subjects was not a multiple of five, an auction was held to pay enough students to leave the room until a multiple of five remained. I distributed packets to the subjects containing various documents. One of the documents assigned the subject to a group of five. The subjects were assigned randomly except that some effort was made to ensure that subjects sitting next to one another were not in the same group, to prevent distortions from some subjects knowing the contributions of other group members.[4] This also ensured that the subjects could make decisions anonymously from other group members.

Subjects were handed packets that assigned them to random groups. Each packet contained a consent form, instructions, a sheet of “tear strips” to use to submit decisions to the monitors, a record sheet, and a receipt.[5]

Communication between participants was strictly prohibited and subjects were not given information that allows them to identify the other members in their group before, during, or after the experiment. In fact, to prevent subjects from inferring group affiliations by the order in which subjects received their payoff information, contribution tear sheets were returned to the subjects in a different order after each round.

In each iteration of the game, monitors collected atear strip from each subject and entered the decisions into the computer. I then recorded the total contributions for the relevant group and the individual subject’s payoff on the tear strip and returned the forms to the subjects.

A computer was stationed at the front of the room. The computer was programmed to automatically calculate payoffs as soon as contributions were entered. This allowed me to enter my data in real time as the experiment proceeded and reduced the risk of error in calculating the returns for each subject in each round.

[4] I also expect that any subjects that already knew each other would have sat together, and that this would eliminate any effects from preexisting friendships. Some of the corporate managers this experiment attempts to model probably socialize with one another, but I leave the effects of friendship on cooperation to other researchers.

[5] The actual consent form, instructions, tear strip sheet, record sheet, and receipt are attached as Appendix A.

No subjects were used in more than one session to prevent contamination from order effects, that is, to reduce the chance that subjects will be experienced and the effects of that experience on the subjects' decisions. However, subjects that accepted a payment not to participate (to achieve even groups of five) were allowed to return to participate in a later session.

2. *Decision mechanism and parameters*

The environment reflects the two public goods games described above in Chapter II, Section C, with the following parameters for each of ten rounds:

w_i = 10

$r = 2$

N = 5

b = 6 (where applicable)

p = 2 (where applicable)

So each subject receives an endowment of ten tokens, any portion of which they can either keep privately or contribute to a group account. Using contribution levels of 0–10 should yield more precise results than an all-or-nothing contribution decision. Asking subjects to choose between contributing everything and contributing nothing really only captures whether a subject is on one side of the preponderance line or the other side. A binary decision like that fails to show how far from the line the subject is. Allowing subjects to choose within a range of 0–10 yields greater sensitivity to the effects of the independent variable (which in this experiment is actually a change to the environment). Further, allowing a range of choices more accurately represents the situation this experiment attempts to model because corporate managers do not face the choice between spending their firms' total profits on CSR and spending nothing at all.

Zelmer's (2003) meta-analysis of public goods games found that the median marginal per capita return in the experiments covered was 0.404. With no compelling reason to deviate from the previous experiments, this experiment is parameterized such that found that $\frac{r}{N} = \frac{2}{5} = 0.4$.

In the Regular Condition, each subject *i*'s payoff function is given by:

$$\pi_i(c_i) = (10 - c_i) + \frac{2}{5}\sum_{j=1}^{5} c_j$$

Each subject maximizes the subject's own payoff by contributing zero tokens, but maximizes the total payoff (to the group) by contributing all ten tokens. Thus the experiment presents the classic social dilemma: the highest possible outcome for the group can be achieved by cooperating, but each individual group member benefits most from not cooperating.

As described above, the Nash equilibrium in the model is zero contributions, regardless of parameters. The Pareto optimum occurs when every subject contributes the maximum ($c_i = 10$).

In the Penalty Condition, each subject *i*'s payoff function is given by:

$$\pi_i(c_i \geq 6) = (10 - c_i) + \frac{2}{5}\sum_{j=1}^{5} c_j - 2$$

(incurring a penalty) and

$$\pi_i(c_i < 6) = (10 - c_i) + \frac{2}{5}\sum_{j=1}^{5} c_j$$

(not incurring a penalty).

Again, each subject's payoff is maximized by contributing zero tokens, but maximizing the total payoff (to the group) requires every subject to contribute all ten tokens. The Nash equilibrium in is condition is also zero contributions.

Looking at the penalty as a modification to marginal cost, these parameters make it so that contributing the 6th token costs the subject 3 tokens, while all other tokens below or above the 6th token still have a marginal cost of 1 token.

Under these parameters, if given subject contributes 5 tokens, the group will be better off in the aggregate than if that subject contributes 6 tokens, and the group will achieve the same total welfare as if that subject contributes 7 tokens (although distribution will differ). However, if a subject contributes 8 tokens, the group's aggregate payoff climbs again, and upward again for the 9th and 10th token. The Pareto optimum therefore occurs when every subject contributes the maximum ($c_i = 10$).

3. *Instructions and record-keeping*

Subjects received a packet of documents that included written instructions explaining the experimental task in detail. I read the instructions aloud to the subjects and asked them to follow along. I then encouraged them to ask questions. In most sessions, the subjects had 1–3 questions.

The written instructions explained the rules of the game, directed the subjects in the use of the included investment decision forms and the record sheet, provided a sample payoff table, and explained how payoffs in the game would translate into actual earnings.[6]

The instructions noted that group contributions are aggregated, doubled, and split evenly among the five members of each group, but subjects were not explicitly told the marginal per capita return of their contributions.

The investment decision forms ("tear strips") included in the packet were a means for subjects to submit their contributions and receive feedback on their payoffs for each round. The tear strips were numbered both by round (1–10) and by a subject identifier (e.g. B-1) so that they could be used as both investment decision forms and earnings report forms. The packet also included a record sheet on which the subjects could calculate their earnings for each round. The record sheet was laid out as a work sheet such that the subjects could input their individual contribution, the total group contribution, and their individual payoff for each round, and easily compute their share of the group returns and whether or not they incurred a penalty in that round (in applicable sessions).

After each round, subjects were only told the total contribution of the public good for their own group. Subjects were not told the specific contributions of other individuals or the aggregate contributions for the other groups so that individual subjects would not be influenced by what other groups (or specific individuals in their own group) were doing. This information control may not be the most realistic way to model the behavior of corporate managers, who can probably see how other specific firms or even other

[6] The instructions for Regular and Penalty Conditions are attached in Appendix A.

industries are conducting their business. However, for this experiment I decided to keep it simple so I would have a better chance to isolate the effect of the penalty and not get a lot of noise from information effects.

Subjects were instructed that one round would be selected at random to determine their earnings. The round was randomly selected at the end when a monitor blindly chose one of ten numbered poker chips from a coffee can.

At the end of each session, the subjects were asked to calculate their earnings using the following formula: $\$10.00 + \$.40(\pi_i)$, where *i* is the randomly selected round. Subjects were asked to round up their earnings to the nearest quarter because it was administratively easier to make change if no smaller denominations were needed.

After the subjects completed their receipt, they were called to the front of the room one by one to receive their payment. All subjects were paid their experimental earnings privately to maintain their anonymity.

B. Sample.

Subjects were University of Minnesota undergraduate students recruited from introductory-level undergraduate economics and applied economics courses (macroeconomics and microeconomics). I do not expect that the subjects have undergone advanced economics training because of the low level of the courses from which they were recruited, so the contribution-reducing effect of economics training found by Marwell and Ames (1981) should not be present.

I personally visited most of the classes from which students were recruited and read from a script. I then answered any questions they had, almost all of which were logistical (location, time, etc.). I collected email addresses from interested students (or, in larger classes, provided my email address and had them email me) and assigned them one of their preferred time slots.[7] I then sent a reminder email to each of the subjects the day before their respective sessions.

University students are a common pool from which experimenters draw subjects. Ball and Cech (1996), and more recently Fréchette (2011), found that this common pool makes a good proxy for professionals, including corporate managers, because in general, the results of economic experiments are similar regardless of whether the subjects are business professionals or college students.

C. Measurement.

Measurement is fairly straightforward in this experiment, because the subjects are asked to make quantitative contributions to a public account and keep the remainder. No opinions or other scalable data were collected.

In advance of the actual experiment sessions, I conducted a trial run with a group of economics students. The trial run consisted of two rounds, one in the Regular Condition and one in the Penalty Condition. Afterward, I discussed the experiment at length with the subjects, particularly the instructions. Their feedback was useful both for modifying the instructions for clarity and fine-tuning the mechanics of administering the experiment, such as collecting and distributing contribution sheets.

[7] The actual recruitment script and sign-up sheets I used are attached in Appendix A.

D. Analysis.

Because there is a single binary independent variable (Regular Condition versus Penalty Condition) and a single quantitative dependent variable, the Mann–Whitney rank-sum u-test is appropriate. Mann–Whitney can be used when observations from both groups are independent from each other (which is the case here, because the different conditions are applied in different sessions), the data are ordinal, and under the null hypothesis, the distributions of the Regular Condition and the Penalty Condition are the same. That is, if the presence of the penalty does not have an effect on contribution levels, median contributions should be equal in both groups.

The Mann–Whitney test can be applied to each subject's average contributions over all ten rounds and to each subject's contributions in any given round. By converting the data into a binary of zero and non-zero contributions and calculating average numbers of zero contributions per subject, Mann–Whitney can also be used to determine whether a difference in free riding between the Regular and Penalty Conditions is significant. Finally, it can be used to detect a significant difference between contributions above the level that would incur a penalty in either condition.

E. Validity.

15 subjects were recruited for a session under the control group rules, allowing for three groups of five each. 45 subjects were recruited for the penalty group: 15 subjects in one session (allowing three groups of five) and 10 subjects in each of three additional sessions (allowing two groups of five per session).

All of the subjects received the same instructions, were overseen by the same experimenter, were all students from introductory-level undergraduate economics courses, and participated in the experiment in a similar physical environment (a university classroom). The only change between conditions that should affect outcomes at all is the change to the economic environment that imposes a penalty or not. Accordingly, the dependent variable (the environment change) should be the only factor causing a change in the dependent variable (contributions to the public account).

The experiment should also be externally valid, as it has both facial validity and content validity.

Using a public goods game to measure corporate social responsibility should be facially valid. As detailed above, corporate managers' compensation generally correlates to performance of the company, and deciding to pursue actions that increase social responsibility (and personal satisfaction) but decrease profits appears to be quite similar to the dilemma faced by a subject in a public goods game. Similarly, the penalty for over-contribution should closely model being sued for a breach of fiduciary duties. It seems unlikely that a corporate manager would be sued for using a small amount of corporate resources for the greater good, but when the resources used become large, that may attract attention from shareholders and their attorneys.

The experiment has content validity to the extent that the subjects, a sample of university students, adequately represent the population of corporate managers when faced with the same incentives. This squares with the research surveyed by Ball and Cech

(1996) and Fréchette (2011), who found that the results of experiments with business professionals are similar to experiments with college students.

However, the experiment model is not a perfect map of a business environment, and there may be a meaningful difference between corporate social responsibility, which may imbue the actor with Andreoni's "warm glow" of altruism, and a subject in a public goods game whose cooperation helps other similarly situated subjects. The latter may cooperate strategically, to encourage other subjects to cooperate.

F. Methodological assumptions.

This experiment's parameters reflect several assumptions. The first is that it maps the point at which a corporate manager would be sued for fiduciary breach at just over half of manager's endowment. The endowment reflects something like that manager's discretionary budget. Setting $b = 6$ means that using over half of the resources at the manager's discretion will result in some chance for negative consequences that is not present if the manager makes a lower contribution. If b is unrealistically high, contribution levels may be inflated, and vice versa.

A second assumption is the value of the harm from contributing above the breach level. Setting $p = 2$ is designed to deter contributions above the breach level, but also to reflect the reality of uncertainty. Although the experience of being sued (or fired) for fiduciary breach may warrant a higher penalty in the model, there is always some level of uncertainty about whether the lawsuit (or termination) will actually happen. Accordingly, p represents an expected value. The environment might be more realistic if p were higher but also a stochastic term; however, this complicates the model and potentially introduces additional confusion among subjects. If *p* is unrealistically high, above-breach-level contributions will be biased downward, and vice versa (assuming that a larger penalty would deter contributions at a level that would incur the penalty, which seems like a safe assumption).

Finally, setting *r* at 2 implies that corporate resources, when paid to shareholders, are only half as valuable as some other possible use. This assumes that the CSR in which corporate managers are likely to engage is twice as valuable as using the same resources as private profits. If *r* is incorrect or unrealistic, it should not adversely affect the results of this experiment because *r* is the same in both conditions. If *r* is too high, it should bias contributions upward in both conditions, and, if anything, make the experiment more sensitive to the effects of the penalty.

Chapter IV. FINDINGS.

It appears that imposing a penalty for over-contribution does deter contributions, whether measured by overall contributions or by contributions in individual rounds (although the latter is much less clear). Relatedly, the penalty appears to encourage complete free riding and discourage making contributions above the breach level.

A. Results of application of method.

Before the sessions began, I gave instructions and conducted two test rounds of the Penalty Condition on students in a graduate-level microeconomics class in the Applied Economics program. These test rounds and the discussion that followed helped me refine the instructions to the subjects so that they were clearer and more accurate. I also used this experience to make clarifying edits to the tear strips and record sheets.

For the experiment itself, I conducted one session of the control treatment and three sessions of the variable treatment, for a total of 60 participants. The experiment typically lasted between 45–50 minutes and overall, participants' earnings averaged $15.38 (standard deviation of $1.01, maximum of $17.25, minimum of $12.50). The Penalty Condition earnings averaged $15.58 (standard deviation of $0.62, maximum of $16.50, minimum of $14.50); the Regular Condition earnings averaged $15.31 (standard deviation of $1.11, maximum of $17.25, minimum of $12.50).

I had hoped for 120 subjects, but I was only able to recruit 60 subjects. I decided to include 15 of those subjects in the Regular Condition and 45 in the Penalty Condition. I chose to do so because the Regular Condition has been tested extensively already, and it will be easier to see whether my admitted small sample of Regular Condition subjects is representative of other subjects under similar conditions than to do the same with the Penalty Condition subjects, because to my knowledge, this is the only public goods experiment to impose a penalty for "over-contributing."

There was a minor aberration in one session of the Penalty Condition. Due to a bug in the payoff calculation software, above-breach-level contributions were not penalized in Rounds 2 through 4. When the error was discovered, the correction was announced to the subjects, who were also told that any penalties they should have incurred, but were not calculated in those rounds would not be counted when calculating their cash earnings. Notwithstanding, the effect of this appears to be minimal. Only four subjects made above-breach-level contributions during those rounds. Subject C-2 contributed all 10 tokens consistently in all ten rounds, so C-2 apparently was not deterred by the penalty. Subjects A-2 and C-4 made contributions above the breach level in round 2 or 3, but had already reduced their contributions to below breach level by round 4. In fact, A-2 contributed 10 tokens in round 7, indicating a clear willingness to incur the penalty in that round. Subject C-5 similarly reduced contributions to below the breach level in round 5, but also made an above-breach-level contribution (8 tokens) in round 7. The bug was corrected and did not disrupt any other sessions. If there was an effect on contributions, it more likely came from publicly reaffirming the effect of the penalty to the entire group than from the erroneously inflating payoffs to specific subjects.

B. Descriptive analysis.

1. *Subjects' average and median contributions*

Table 1 lists the average percentage of the endowment contributed to the public good in each round.[8] For example, in the Regular Condition, the average subject contributed 40% of that subject's endowment in the first round, 50.67% in the second round, and so on.

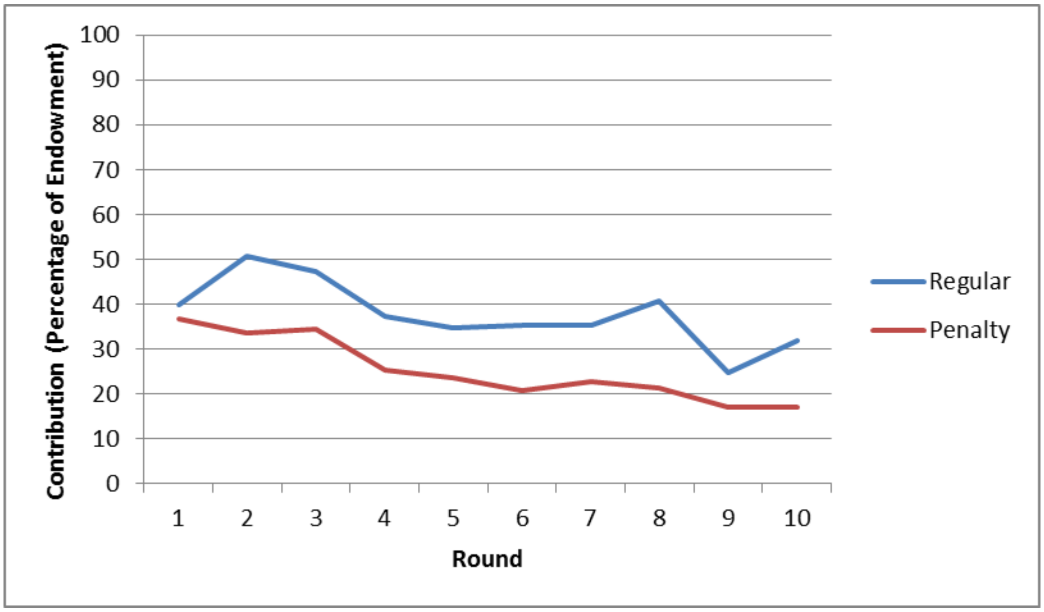
Table I
Percent of Endowment Contributed to the Public Good Per Round

	Round									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Regular	40.00	50.67	47.33	37.33	34.67	35.33	35.33	40.67	24.67	32.00
Penalty	36.89	33.56	34.44	25.33	23.56	20.67	22.67	21.33	17.11	17.11
Difference	3.11	17.11	12.89	12.00	11.11	14.67	12.67	19.33	7.56	14.89

Figure I graphs the same information and plainly shows that, in each round, average contributions in the Penalty Condition were lower than average contributions in the Regular Condition. It follows that overall average contributions were lower in the Penalty Condition than in the Regular Condition.

[8] Raw data is attached as Appendix B.

Figure I
Percent of Endowment Contributed to the Public Good Per Round



Average contributions in the Regular Condition conform to the pattern of earlier experiments, with cooperation in round 1 of 40 percent, decaying to 24.67 percent in round 9 before ticking back up to 32 percent in round 10. The overall average contributions in the Regular Condition were 37.8%, with a standard deviation of .179. Compare this to Zelmer's (2003) meta-analysis, in which the weighted-mean group size was 6.6, the weighted-mean number of rounds was 10.6, and the weighted-mean average contribution was 37.7% of the subject's endowment.

For a specific example, compare these results to Andreoni (1995a), in which he divided subjects into groups of five and had them play ten rounds of a public goods game with a marginal per capita return of 0.5. There, Regular Condition subjects contributed 56.0% of their endowments in round one, decaying to 26.5% by round ten. Andreoni (1995b) saw initial contributions of 47.5% decay to 20.9% in round ten.

Average contributions in the Penalty Condition are noticeably lower. By round 4 the subjects are contributing less than 30% and by round 5 they contribute less than 20%. The overall average contributions in the Penalty Condition were almost exactly a third lower than the Regular Condition at 25.3%, with a standard deviation of .168.

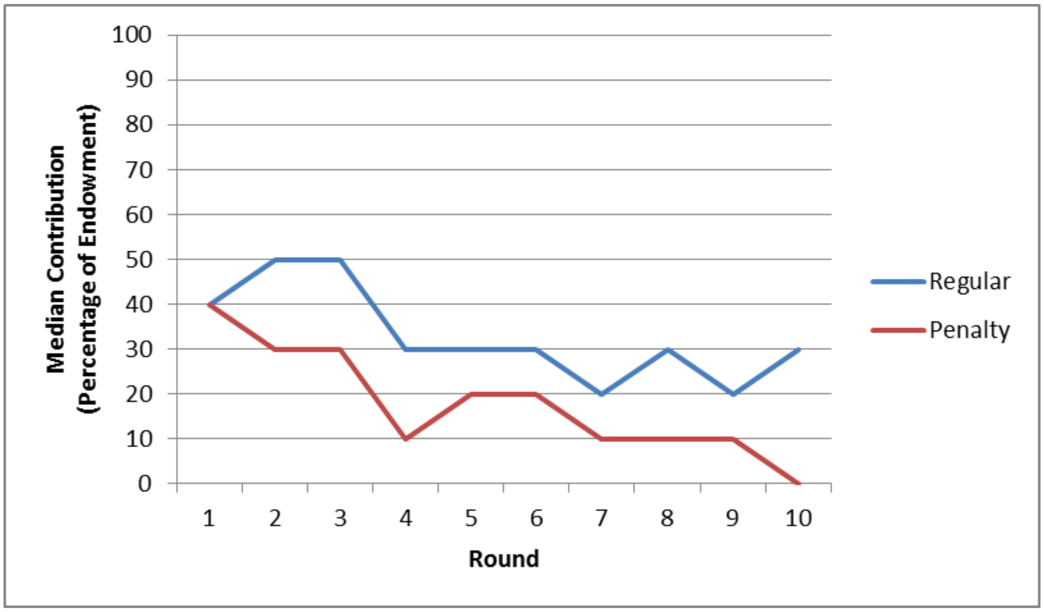
Medians contributions tell a similar story. As depicted in Table II, median contributions are the same in the first round, but for each subsequent round, median contributions in the Penalty Condition are lower than median contributions in the Regular Condition.

Table II
Median Contribution to the Public Good Per Round

	Round									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Regular	**40.00**	**50.00**	**50.00**	**30.00**	**30.00**	**30.00**	**20.00**	**30.00**	**20.00**	**30.00**
Penalty	**40.00**	**30.00**	**30.00**	**10.00**	**20.00**	**20.00**	**10.00**	**10.00**	**10.00**	**0.00**
Difference	**0.00**	**20.00**	**20.00**	**20.00**	**10.00**	**10.00**	**10.00**	**20.00**	**10.00**	**30.00**

Figure II graphs the same information and illustrates the difference in median contributions across conditions.

Figure II
Median Contribution to the Public Good Per Round



2. *Subjects' free riding*

Throughout the public goods game literature, the number of subjects free riding (contributing zero to the public good) increases over repeated treatments. That pattern appears here under both conditions, with both conditions showing a general trend toward increasing free riding over the course of the treatment. Table III shows the percentage of subjects contributing zero in each round.

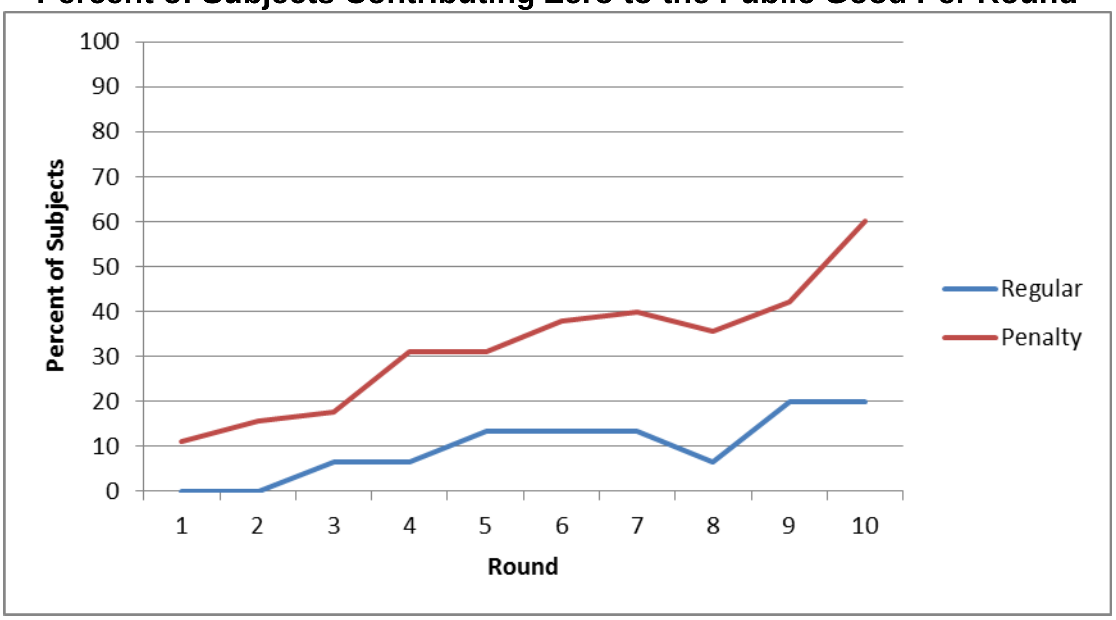
Table III
Percent of Subjects Contributing Zero to the Public Good Per Round

	Round									
	1	2	3	4	5	6	7	8	9	10
Regular	0.0	0.0	6.7	6.7	13.3	13.3	13.3	6.7	20.0	20.0
Penalty	11.1	15.6	17.8	31.1	31.1	37.8	40.0	35.6	42.2	60.0
Difference	-11.1	-15.6	-11.1	-24.4	-17.8	-24.4	-26.7	-28.9	-22.2	-40.0

By round 3, over 30% of the Penalty Condition subjects free ride, which is a higher rate than the Regular Condition subjects reach in any one round. By the end of the experiment, a majority of Penalty Condition subjects free ride.

Figure III shows the same information and once again shows a consistent difference between the two conditions: the percentage of subjects contributing zero in the Penalty Condition is higher than the percentage of subjects contributing zero in the Regular Condition and that this is true across all ten rounds. It follows that the overall percentage of subjects contributing zero in a round is higher in the Penalty Condition than in the Regular Condition.

Figure III
Percent of Subjects Contributing Zero to the Public Good Per Round



Contributions of zero, a.k.a. free riding, are visibly higher in the Penalty Condition. By round 4 more than 30% are free riding, which is more than any round in the Regular Condition. By the end of the experiment, more than half of the subjects in the penalty condition were free riding. In fact, in round 10, subjects in the Penalty Condition were three times as likely to free ride as their counterparts in the Regular Condition.

3. *Subjects' contributions above the "breach" level*

Average contributions and free riding are fairly standard measurements of public goods experiment outcomes, but this experiment is unique in applying a penalty for contributing above a specified level. Accordingly, it might also be interesting to see whether the penalty had a significant effect on contributions above the level that would incur such a penalty. Table IV shows the percentage of subjects in each condition that contributed more than 6 tokens (the level that incurs a penalty under the Penalty Condition) in a given round of the treatment.

Table IV
Percent of Subjects Contributing Above the "Breach" Level to the Public Good (Thus Incurring a Penalty If Applicable) Per Round

	Round									
	1	2	3	4	5	6	7	8	9	10
Regular	20.00	33.33	40.00	26.67	33.33	20.00	26.67	33.33	6.67	20.00
Penalty	8.89	11.11	13.33	13.33	4.44	2.22	8.89	6.67	4.44	8.89
Difference	11.11	22.22	26.67	13.33	28.89	17.78	17.78	26.67	2.22	11.11

Indeed, we see that in every round, the percentage of subjects contributing 6 or more tokens is higher in the Regular Condition than in the Penalty Condition. The breach level may have created an anchor value of sorts for subjects in the Penalty Condition. However, for subjects in the Regular Condition, there was no significance to this number.

Figure IV
Percent of Subjects Contributing Above the "Breach" Level to the Public Good (Thus Incurring a Penalty If Applicable) Per Round

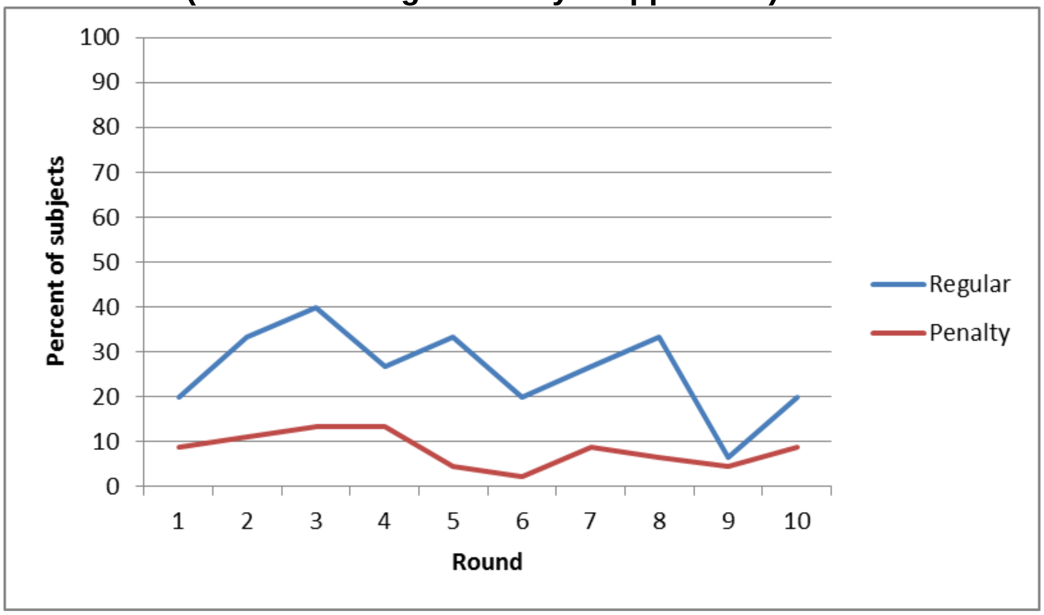


Figure IV provides a visual analysis of above-breach-level contributions. Interestingly, contributions at these levels do not clearly decay over the course of the experiment in either condition (although overall they appear to trend downward, they do so very slightly).

C. Tests of hypotheses.

1. Subjects' average contributions

The first three hypotheses proposed in this paper[9] relate to subjects' contribution levels. As Table I and Figure I show, subjects in the Penalty Condition contribute less in every round (and therefore, overall) than subjects in the Regular Condition, so hypothesis H_3 (the penalty will increase contributions) can be immediately rejected. However, it is

[9] See section II.D.

not immediately clear that H_2 (penalty will decrease contributions) prevails until we can reject H_1 (overall-null).

To do that, I compare conditions by analyzing the average contributions of each subject across all ten rounds of the experiment, following Andreoni (1996) and others in applying the Mann-Whitney rank-sum U-test. The results, shown in Table V, show that the null can be rejected with a high degree of certainty.

Table V
Significance of the Difference Between Groups by Average Contribution Per Subject

Null	Average Contributions
Sig.	0.016
Reject null at p < .05 ?	Yes
Reject null at p < .10 ?	Yes

2. *Subjects' per-round contributions*

The second set of three hypotheses proposed in this paper are directed toward contribution levels in individual rounds. Again, Table I and Figure I show that subjects in the Penalty Condition contribute less in every round than subjects in the Regular Condition, so hypothesis H_6 (oneround-increase) can also be immediately rejected. But again, H_4 (oneround-null) must be rejected before concluding that H_5 (oneround-reduction) was correct.

Applying Mann-Whitney to each round, it appears that the null can be rejected in some rounds at the .05 level, but this is not the case in all rounds. Table VI shows the rounds in which the null can be rejected at the .05 and .10 levels.

Table VI
Significance Levels for Per-Round Contribution Difference among Groups

Round	1	2	3	4	5	6	7	8	9	10
Sig.	0.334	0.012	0.068	0.052	0.071	0.030	0.078	0.011	0.115	0.014
Reject null at p < .05 ?	No	Yes	No	No	No	Yes	No	Yes	No	Yes
Reject null at p < .10 ?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

Perhaps with additional treatments, these significance levels could be increased. Interestingly, by far the least significant difference between the two conditions appears in the first round. This suggests that the presence of the penalty does not suppress initial contributions, but rather that the penalty accelerates the decay toward zero.

3. *Subjects' free riding*

The third set of three hypotheses addresses contribution levels of zero. Table III and Figure III show that a higher percentage of subjects in the Penalty Condition contributes zero in every round than subjects in the Regular Condition do, so hypothesis H_9 (nonzero-increase) can also be immediately rejected. As before, H_7 (nonzero-null) must be rejected before concluding that H_8 (oneround-reduction) was correct.

Applying Mann-Whitney to each subjects' average number of zero-level contributions across all ten rounds, it appears that the null can be rejected at the .05 level.

Table VII shows that the null can be rejected at the .05 and .10 levels. In fact, the penalty's effect on free riding is even significant at the .01 level.

Table VII
Significance of the Difference Between Groups by Average Number of Non-Zero Contributions Per Subject

Null	Non-zero Contributions
Sig.	0.002
Reject null at p < .05 ?	Yes
Reject null at p < .10 ?	Yes

4. *Subjects' contributions above the "breach" level*

The final set of hypotheses deals with contributions above the level that would incur a penalty for contributing too much. Table IV and Figure IV show that a lower percentage of subjects in the Penalty Condition contributes zero in every round than subjects in the Regular Condition do, so hypothesis H_{12} (abovebreachlevel-increase) can be immediately rejected. As before, H_{11} (abovebreachlevel-reduction) can only be adopted after rejecting H_{10} (abovebreachlevel-null).

Applying Mann-Whitney to each subjects' average number of above-breach-level contributions across all ten rounds, it appears that the null cannot be rejected at the .05 level. Table VIII shows that the null cannot be rejected at the .05 level, although it can be rejected at the 10 level. Accordingly, this result is merely suggestive.

Table VIII
Significance of the Difference Between Groups by Average Number of Penalty-Incurring Contributions Per Subject

Null	Penalty-incurring Contributions
Sig.	0.083
Reject null at p < .05 ?	No
Reject null at p < .10 ?	Yes

Chapter V. DISCUSSION.

A. Discussion of results of application of method.

The sample size was somewhat disappointing. Nonetheless, it turned out to be large enough to generate statistically significant results, as described below.

The unofficial treatments conducted on the graduate-level applied economics class paid off. The feedback from that class led to refinements to the instructions that appear to have made them significantly clearer. After reading the instructions aloud in each session, I asked the subjects whether they had any questions. Although subjects asked questions in most sessions, subjects did not repeatedly ask the same questions across sessions. This suggests that there was not a particularly confusing aspect to the instructions.

B. Discussion of descriptive analysis.

The descriptive analysis is strikingly clear. In terms of absolute contribution levels, subjects in the Regular Condition contribute more overall, and in each round, than subjects in the Penalty Condition. This suggests that the presence of the penalty is lowering contribution levels, although with just this analysis, it could be due to a clustering below the breach point that brings down the average contributions. That is, it is possible that subjects are starting out with lower contributions and converging toward zero at the same rate, as if the Penalty Condition subjects have a head start.

The subjects' median contributions show the same level of initial contribution, but lower contributions in the Penalty Condition thereafter. The median contributions show more clearly that the presence of the penalty has an effect on contributions that are well below the level that would trigger the penalty, because none of the median contributions would have triggered the penalty, yet the difference between median contributions in the Regular and Penalty Conditions (depicted in Figure II) is clear.

Relatedly, Penalty Condition subjects are more likely to completely free ride (by contributing nothing) than Regular Condition subjects, both overall and even in each round. But again, this could be because of the Penalty Condition subjects' high marginal cost of contributing above the breach level, which gives those subjects the "head start" mentioned in the preceding paragraph. However, average initial contributions are fairly similar across conditions. Further, looking at the data in Figure III, it appears that the number of zero contributions increases at a much faster rate in the Penalty Condition than in the Regular Condition. This seems to contradict the "head start" hypothesis, suggesting instead that the presence of the penalty affects contributions on an ongoing basis, even past the point where it would no longer apply in the Regular Condition. That is, whatever causes contributions to converge toward zero is apparently enhanced by the presence of the penalty.

That is not to say that the penalty only affects below-breach contributions. Figure IV shows quite clearly that above-breach level contributions happen two-to-four times more frequently in each round in the Regular Condition than in the Penalty Condition. This indicates that subjects appreciate and are sensitive to the high marginal cost of contributing above the breach level and that they are lowering their contributions accordingly.

However, that sensitivity alone does not provide a satisfactory explanation of the more-rapid decay toward zero shown by subjects in the Penalty Condition. If it did, the zero-contribution rate would increase in parallel. Therefore, it appears that the mere presence of the penalty lowers contribution rates even for subjects who, in the Regular Condition, would have contributed below the breach level.

Andreoni (1995a) tested the old assumption that subjects contribute too much because they are confused about the rules of the game. Interestingly, the Penalty Condition subjects' contributions were more closely in line with the theoretical prediction and dominant strategy of contributing zero. However, their rules were slightly more complicated, which suggests that the Regular Condition subjects' increased cooperation was not the result of confusion.

C. Discussion of tests of hypothesis.

The difference in overall contributions between the two conditions is quite significant, and counsel strongly in favor of rejecting the null hypothesis. This indicates that the penalty is very likely the cause of the overall reduction in contributions in comparison to the Regular Condition. If the experiment modeled corporate managers' incentives correctly, this suggests that fiduciary duties may indeed constrain corporate managers from acting in social optimal ways.

Round by round, the differences were less significant (see Table VI), though Penalty Condition subjects contributed significantly less in four rounds at the .05 level, and eight out of ten rounds at the .10 level. Interestingly, the only two rounds with $p > .10$ were the first round and the ninth round. In the latter, the Regular Condition subjects saw a sudden, unusual dip in contribution levels that brought them closer to the Penalty Condition levels. Setting aside the ninth round as a random oddity, it is notable that contributions in the first round showed the least significant difference across conditions. Throughout the literature, contribution levels reliably decrease over time, so the highest contribution levels should be observed at the beginning of the experiment. I expected that that was when the penalty's effect would have been highest because it would have discouraged high initial contributions. To the contrary, the penalty had the least significant effect in the first round, and had more significant effects later in the experiment. This indicates that the penalty is affecting more than just above-breach-level contributions, and that in fact it is lowering contribution levels that would have been below breach level without the penalty.

The difference between zero and non-zero contributions across conditions is extremely significant—easily passing muster even at the .01 level. This, along with the data in Table III and Figure III, indicates that a penalty has a substantial effect on reducing contribution levels, even when those contribution levels are not close to the penalty-incurring breach level. In this experiment, contributions of 5 or less were not penalized, yet subjects in the Penalty Condition were far more likely to contribute zero in a given round than subjects in the Regular Condition are. This cannot be mere sensitivity to the increased marginal cost of the sixth token contributed, because that should not cause a subject to contribute so much less than the breach level that the subject reaches zero. For example, a subject that would have contributed 6 in the Regular Condition might contribute 4 or 5 in the Penalty Condition to get a similar marginal return. Rather, this is evidence that the penalty affects even contributions that would have been below breach level, regardless of condition.

On the other hand, Table VIII shows that the difference in above-breach contributions in the Regular Condition versus the Penalty Condition is suggestive, but not conclusive (it is significant at the .10 level but not the .05 level). This tells us that there are probably subjects for whom the penalty took the form of an increased marginal cost of the sixth token and adjusted their contributions downward accordingly.

This combination of effects on above-breach contribution levels and on zero contribution levels suggests that there may be two effects: one of marginal cost, and another, harder to pin down effect: the penalty lowers contribution levels even from subjects who, in the absence of the penalty, would have contributed an amount below the breach level in the Regular Condition.

D. Post-hoc analysis.

The error in the first session of the Penalty Condition, in which subjects were mistakenly not penalized in rounds 2 through 4, does not seem to have contaminated the data in that session. In that session, subjects contributed, on average, 29.0% of their endowments, compared to 28.8%, 32.7%, and 41.9% contributions in subsequent sessions. The average contribution for all non-error sessions was 34.5%. Under a Mann–Whitney u-test, the difference between the first session average per-subject contributions and all other Penalty Condition average per-subject contributions is not significant, with a *p* value of .656.

Chapter VI. CONCLUSION.

This study has attempted to answer the question of whether corporate social responsibility is being curtailed by fiduciary duties. In an attempt to answer that question, two public goods environments were constructed: one traditional and one featuring a penalty for contributions above a certain level. Sixty university students were recruited to participate in an experiment to test the effect of the change in incentives on overall contributions.

The penalty, a surrogate for the negative consequences that may flow from a corporate manager’s breach of fiduciary duties, has an apparent, substantial, and significant effect on individual and aggregate contribution levels. This may mean that the fiduciary duties placed on corporate managers really are reducing corporate social responsibility, and quite possibly reducing overall welfare.

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APPENDIX A

DETAILS OF EXPERIMENTAL PROCEDURES

Instructions [Regular]

This is an experiment in group and individual decision making. Please do not talk with one another for the duration of the experiment. If you have any questions, please raise your hand.

You have been randomly assigned to a group of 5 individuals. You will remain with this same group throughout the experiment. Your identity and individual choices will **not** be revealed to the other members of your group or participants in this experiment.

The experiment proceeds in 10 rounds. For each round,

1. Each person in your group receives 10 "chips."
2. You decide privately how many of the 10 chips to contribute to a public account. The remainder of the 10 chips will stay in a private account. You record your contributions on the provided record sheet and tear sheet for the current round. When you are done, you hand that tear sheet to a monitor.
3. The monitor returns your tear sheet after writing in the total contribution to the public account for your group and your earnings from the public account.
4. Record your earnings on your record sheet:
    a. Your private account earnings are equal to the remainder (10 minus your contribution). For example, if you contribute 4 chips to the public account, you earn 6 chips from keeping them in your private account ($10_{\text{starting}} - 4_{\text{contribution}} = 6$ chips).
    b. However, if contribute more than 5 chips to the public account, your private account earnings will be reduced by 2 chips. For example, if you contribute 7 chips to the public account, you lose two chips from your private account, which then earns only 1 chip ($10_{\text{starting}} - 7_{\text{contribution}} - 2_{\text{penalty}} = 1$ chip).
    c. Your public account earnings are calculated by doubling the total public contributions from all your group members and then dividing by 5, so that the earnings from the public account are equally distributed to all members of the group, regardless of how much you contributed or other members of your group contributed. For example, if the sum of public contributions for your group is 25 chips, this value is doubled to 50 chips. These 50 chips are then shared equally, so each individual in your group earns 10 chips.
    d. Your total earnings for the round are the sum of your private and public account earnings.
    e. A payoff table is enclosed to help you estimate the results of your contribution.

We offer a simple payoff table to make it easy for you to calculate your total earnings from the group and private accounts.

<u>PAYOFF TABLE – Your earnings from different combinations of contributions</u>

Your contribution \ Group contribution	0	5	10	15	20	25	30	35	40	45	50
0	10	12	14	16	18	20	22	24	26		
1	9	11	13	15	17	19	21	23	25	27	
2	8	10	12	14	16	18	20	22	24	26	
3	7	9	11	13	15	17	19	21	23	25	
4	6	8	10	12	14	16	18	20	22	24	
5	5	7	9	11	13	15	17	19	21	23	25
6		6	8	10	12	14	16	18	20	22	24
7		5	7	9	11	13	15	17	19	21	23
8		4	6	8	10	12	14	16	18	20	22
9		3	5	7	9	11	13	15	17	19	21
10			4	6	8	10	12	14	16	18	20

Suppose you have contributed 3 chips to the group account and that the total number of chips in the group account is 20, then your payoff would be 15. As a second example, suppose you contribute 6 chips and the total group contribution is 35 then your payoff is 18. Group contributions are shown in multiples of five for simplicity, but other intervals are possible.

After the 10 rounds are completed, we will draw one round at random. Your cash earnings for the experiment will be $10 plus $0.40 times number of chips you earned in the randomly selected round. Record this amount on the provided receipt along with the other requested information. Place this receipt and other materials for the experiment back into your folder and wait for your name to be called so you can be paid.

ARE THERE ANY QUESTIONS BEFORE WE BEGIN?

<u>Instructions</u> [Penalty]

This is an experiment in group and individual decision making. Please do not talk with one another for the duration of the experiment. If you have any questions, please raise your hand.

You have been randomly assigned to a group of 5 individuals. You will remain with this same group throughout the experiment. Your identity and individual choices will **not** be revealed to the other members of your group or participants in this experiment.

The experiment proceeds in 10 rounds. For each round,

5. Each person in your group receives 10 "chips."
6. You decide privately how many of the 10 chips to contribute to a public account. The remainder of the 10 chips will stay in a private account. You record your contributions on the provided record sheet and tear sheet for the current round. When you are done, you hand that tear sheet to a monitor.
7. The monitor returns your tear sheet after writing in the total contribution to the public account for your group and your earnings from the public account.
8. Record your earnings on your record sheet:
   a. Your private account earnings are equal to the remainder (10 minus your contribution). For example, if you contribute 4 chips to the public account, you earn 6 chips from keeping them in your private account ($10_{starting} - 4_{contribution} = 6$ chips).
   b. However, if contribute more than 5 chips to the public account, your private account earnings will be reduced by 2 chips. For example, if you contribute 7 chips to the public account, you lose two chips from your private account, which then earns only 1 chip ($10_{starting} - 7_{contribution} - 2_{penalty} = 1$ chip).
   c. Your public account earnings are calculated by doubling the total public contributions from all your group members and then dividing by 5, so that the earnings from the public account are equally distributed to all members of the group, regardless of how much you contributed or other members of your group contributed. For example, if the sum of public contributions for your group is 25 chips, this value is doubled to 50 chips. These 50 chips are then shared equally, so each individual in your group earns 10 chips.
   d. Your total earnings for the round are the sum of your private and public account earnings.
   e. A payoff table is enclosed to help you estimate the results of your contribution.

We offer a simple payoff table to make it easy for you to calculate your total earnings from the group and private accounts.

<u>PAYOFF TABLE – Your earnings from different combinations of contributions</u>

Your contribution \ Group contribution	0	5	10	15	20	25	30	35	40	45	50
0	10	12	14	16	18	20	22	24	26		
1	9	11	13	15	17	19	21	23	25	27	
2	8	10	12	14	16	18	20	22	24	26	
3	7	9	11	13	15	17	19	21	23	25	
4	6	8	10	12	14	16	18	20	22	24	
5	5	7	9	11	13	15	17	19	21	23	25
6		6	8	10	12	14	16	18	20	22	24
7		5	7	9	11	13	15	17	19	21	23
8		4	6	8	10	12	14	16	18	20	22
9		3	5	7	9	11	13	15	17	19	21
10			4	6	8	10	12	14	16	18	20

Suppose you have contributed 3 chips to the group account and that the total number of chips in the group account is 20, then your payoff would be 15. As a second example, suppose you contribute 6 chips and the total group contribution is 35 then your payoff is 18. Group contributions are shown in multiples of five for simplicity, but other intervals are possible.

After the 10 rounds are completed, we will draw one round at random. Your cash earnings for the experiment will be $10 plus $0.40 times number of chips you earned in the randomly selected round. Record this amount on the provided receipt along with the other requested information. Place this receipt and other materials for the experiment back into your folder and wait for your name to be called so you can be paid.

ARE THERE ANY QUESTIONS BEFORE WE BEGIN?

RECORD SHEET [Regular]

			CONTRIBUTIONS				EARNINGS				
Period	**Starting Chips**	**–**	**Public Account Contribution**	**=**	**Private Account Remainder**		**Private Account Remainder**	**+**	**Public Account Earnings**	**=**	**Total for This Round**
1	10	–		=				+		=	
2	10	–		=				+		=	
3	10	–		=				+		=	
4	10	–		=				+		=	
5	10	–		=				+		=	
6	10	–		=				+		=	
7	10	–		=				+		=	
8	10	–		=				+		=	
9	10	–		=				+		=	
10	10	–		=				+		=	

RECORD SHEET [Penalty]

			CONTRIBUTIONS				EARNINGS						
Period	**Starting Chips**	**–**	**Public Account Contribution**	**=**	**Private Account Remainder**		**Private Account Remainder**	**–**	**Penalty (2 if Contribution is > 5)**	**+**	**Public Account Earnings**	**=**	**Total for This Round**
1	10	–		=				–		+		=	
2	10	–		=				–		+		=	
3	10	–		=				–		+		=	
4	10	–		=				–		+		=	
5	10	–		=				–		+		=	
6	10	–		=				–		+		=	
7	10	–		=				–		+		=	
8	10	–		=				–		+		=	
9	10	–		=				–		+		=	
10	10	–		=				–		+		=	

TEAR STRIPS

A-1	Round 1	Your public account contribution: ____	Total group contributions :	Your payout:
A-1	Round 2	Your public account contribution: ____	Total group contributions :	Your payout:
A-1	Round 3	Your public account contribution: ____	Total group contributions :	Your payout:
A-1	Round 4	Your public account contribution: ____	Total group contributions :	Your payout:
A-1	Round 5	Your public account contribution: ____	Total group contributions :	Your payout:
A-1	Round 6	Your public account contribution: ____	Total group contributions :	Your payout:
A-1	Round 7	Your public account contribution: ____	Total group contributions :	Your payout:
A-1	Round 8	Your public account contribution: ____	Total group contributions :	Your payout:
A-1	Round 9	Your public account contribution: ____	Total group contributions :	Your payout:
A-1	Round 10	Your public account contribution: ____	Total group contributions :	Your payout:

FLYER

We are looking for volunteers to participate in an economics experiment on Investment Decision Making. The experiment will take about 50 minutes. ***You will be paid for your participation***. At a minimum, you will earn **$10**, but with good decision making and a little bit of luck you could earn almost **$20**. The experiment will be held in four sessions **this Saturday**, February 14th in Blegen Hall at the following times: 9:30 A.M., 10:45 A.M., and 12:00 P.M. If you are interested in participating please email me your preferred time(s) at biesa002@umn.edu. I will send you a reminder email with confirmation and additional information. ***There is limited space in each session, so please sign up early!*** If you have any questions, you can email or call me at 612-598-4917. Thanks, Zach Biesanz

Sign-up sheet for participation in economic experiment about investment decisions [Sample]

I request your participation in my economic experiment as part of my thesis research. The experiment will take place in four runs on **Friday, February 13**. You can expect to earn at least $10 and a maximum of $20 during the 50-minute session. Your payoff will depend partly on the choices you make and partly on chance. The experiment will be entirely anonymous. Please indicate your willingness to participate by writing your name and email below. You can only participate once. I appreciate your willingness to participate. Feel free to contact me with questions you might have about the experiment and how the results are being used in the future at biesa002@umn.edu or 612-598-4917. Thank you, Zach Biesanz

Friday, 9:35 a.m.

(other times available on additional pages)

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APPENDIX B

RAW DATA

Session	Subject	Condition	Round										Average
			1	2	3	4	5	6	7	8	9	10	
1	A1	Regular	5	7	7	2	7	8	6	7	3	5	5.7
1	A2	Regular	4	4	5	3	2	2	2	2	1	1	2.6
1	A3	Regular	3	5	5	4	7	5	5	5	3	6	4.8
1	A4	Regular	5	4	2	3	2	3	4	2	2	4	3.1
1	A5	Regular	6	10	6	7	6	6	7	7	6	6	6.7
1	B1	Regular	2	5	4	3	4	5	2	3	2	3	3.3
1	B2	Regular	2	2	2	2	2	1	2	2	0	2	1.7
1	B3	Regular	6	8	7	8	3	3	9	3	5	3	5.5
1	B4	Regular	5	7	9	7	6	7	4	5	4	5	5.9
1	B5	Regular	6	6	7	6	6	5	8	7	5	0	5.6
1	C1	Regular	2	3	0	1	0	0	1	10	0	0	1.7
1	C2	Regular	4	4	4	4	3	4	0	0	1	0	2.4
1	C3	Regular	5	3	3	0	0	0	1	1	1	2	1.6
1	C4	Regular	2	3	3	4	1	3	2	1	0	1	2
1	C5	Regular	3	5	7	2	3	1	0	6	4	10	4.1
2	A1	Penalty	4	4	4	0	2	3	4	4	3	4	3.2
2	A2	Penalty	5	9	5	1	0	0	10	5	3	4	4.2
2	A3	Penalty	3	4	2	1	5	3	2	1	1	0	2.2
2	A4	Penalty	4	4	5	1	5	4	4	4	4	0	3.5
2	A5	Penalty	2	3	2	4	2	2	3	3	2	2	2.5
2	B1	Penalty	3	5	4	5	2	1	1	1	2	1	2.5
2	B2	Penalty	4	3	1	2	0	0	3	0	0	0	1.3
2	B3	Penalty	4	5	1	2	0	3	3	3	0	0	2.1
2	B4	Penalty	3	0	2	0	1	1	1	0	3	0	1.1
2	B5	Penalty	0	0	0	0	0	5	0	0	0	10	1.5
2	C1	Penalty	4	3	2	0	0	0	0	0	0	0	0.9
2	C2	Penalty	10	10	10	10	10	10	10	10	10	10	10
2	C3	Penalty	4	1	2	0	0	0	0	0	0	0	0.7
2	C4	Penalty	5	1	10	1	3	5	5	1	2	0	3.3
2	C5	Penalty	4	5	4	6	5	4	8	3	4	2	4.5
3	A1	Penalty	2	0	3	3	2	0	1	4	0	0	1.5
3	A2	Penalty	4	2	8	8	3	4	5	1	1	1	3.7
3	A3	Penalty	3	2	6	0	1	5	0	1	1	5	2.4

3	A4	Penalty	2	0	0	1	1	2	0	0	0	4	1
3	A5	Penalty	0	0	0	1	0	0	0	2	0	2	0.5
3	B1	Penalty	5	4	5	4	5	3	4	3	5	4	4.2
3	B2	Penalty	4	10	4	0	0	0	0	0	0	0	1.8
3	B3	Penalty	4	4	5	3	2	0	1	5	3	7	3.4
3	B4	Penalty	3	4	3	4	0	5	1	3	2	3	2.8
3	B5	Penalty	3	1	0	0	2	2	0	0	0	0	0.8
4	A1	Penalty	2	4	5	0	1	0	3	0	0	0	1.5
4	A2	Penalty	2	1	0	0	3	0	0	0	0	0	0.6
4	A3	Penalty	4	0	5	4	0	5	2	1	0	0	2.1
4	A4	Penalty	3	3	2	1	5	2	0	1	2	0	1.9
4	A5	Penalty	3	4	1	0	5	0	1	0	2	0	1.6
4	C1	Penalty	0	3	2	3	5	2	0	1	2	0	1.8
4	C2	Penalty	5	1	0	6	0	1	0	5	1	0	1.9
4	C3	Penalty	2	2	0	0	0	0	0	8	0	0	1.2
4	C4	Penalty	0	4	10	10	3	0	0	0	0	0	2.7
4	C5	Penalty	7	4	3	4	10	5	4	2	3	4	4.6
5	B1	Penalty	5	7	2	3	5	4	0	1	1	0	2.8
5	B2	Penalty	10	10	10	0	0	0	5	10	0	0	4.5
5	B3	Penalty	4	4	5	3	1	2	0	0	0	0	1.9
5	B4	Penalty	3	2	3	1	4	0	2	0	2	0	1.7
5	B5	Penalty	0	0	0	0	0	0	0	0	0	0	0
5	D1	Penalty	10	5	3	10	1	2	2	4	3	0	4
5	D2	Penalty	4	3	5	4	4	2	5	4	7	10	4.8
5	D3	Penalty	4	3	1	5	4	0	7	2	5	3	3.4
5	D4	Penalty	4	2	5	1	2	4	0	3	3	1	2.5
5	D5	Penalty	5	5	5	2	2	2	5	0	0	0	2.6