Corporate social responsibility and financial markets

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Chapter 2

Corporate Social Responsibility and Financial Performance

2.1 Introduction

The relationship between corporate social responsibility and corporate financial performance has been studied intensively with mixed results. In a survey of 95 empirical studies conducted between 1972-2001, Margolis and Walsh (2001, p.10), report that: "When treated as an independent variable, corporate social performance is found to have a positive relationship to financial performance in 42 studies (53%), no relationship in 19 studies (24%), a negative relationship in 4 studies (5%), and a mixed relationship in 15 studies (19%)." In general, when the empirical literature assesses the link between social responsibility and financial performance the conclusion is that the evidence is mixed. We show that this confusion is created by a paradox that is due to differences in the behavior of distinct financial performance measures.

There exist many definitions and views[1] of corporate social responsibility. However, far fewer attempts have been made to analyze corporate social responsibility in an economic framework. In this chapter, we link corporate social responsibility to basic resource allocation theory, and adopt the definition of Heal (2005, p.393): "corporate social responsibility involves taking actions which reduce the extent of externalized costs or avoid distributional conflicts". We formalize this concept in an

This chapter is an adapted version of Dam (2006a)

[1] See for definitions and views on corporate social responsibility, for example, McGuire et al. (1988); Caroll (1999); Baron (2001); McWilliams and Siegel (2001); Heal (2005); McWilliams et al. (2006); Morrison Paul and Siegel (2006).

economic model to analyze the relationship of social responsibility with financial performance.

When the relationship between social responsibility and financial performance is examined, it is often implicitly assumed that financial performance measures can be used interchangeably. Indeed, without externalities, most financial performance measures can be expected to generate similar conclusions. With externalities, however, changes in financial performance measures must be interpreted differently. For example, the internalization of externalized costs has a strictly negative effect on accounting profits. Lower profits have a negative effect on the stock market value of the firm. Yet, if the internalization of external effects is valued by (socially responsible) stockholders, there is also a positive effect on stock market value. Consequently, accounting profit and stock market prices cannot be expected to change in a similar way. Partial equilibrium analysis cannot reveal these opposing effects. In this type of analysis, the financial return process and the generation of external effects are exogenous.[2] Therefore, we formulate an economic model that links socially responsible investment and corporate social responsibility in a general equilibrium framework. Our model illustrates that when externalities are internalized, various financial performance measures capture different effects, which may then yield paradoxical findings.

We introduce a Diamond (1967)-like general equilibrium stock market model with both heterogeneous consumers and heterogeneous producers. We assume that besides production of market-traded goods, firms generate an externality, for example environmental damage. The traditional way of dealing with externalities is through some form of intervention, e.g. imposing a Pigouvian tax on the generator of the externality (Pigou, 1920; Baumol, 1972). In contrast, socially responsible firms internalize the externalities voluntarily. Such constrained business conduct implies a cost. However, there are also potential benefits to corporate social responsibility, since some stakeholders appreciate socially responsible behavior. Consumers might be willing to pay a higher price for "green" products, or employees might be willing to accept a lower wage in exchange for "safer" working conditions. These are examples of hedonic pricing mechanisms (see Rosen, 1974). When consumers and/or employees fully bear the costs of corporate social responsibility, there are no consequences for financial performance in a competitive equilibrium.

[2] The model by (Heinkel et al., 2001) with *green screening* in the portfolio selection process is worth mentioning here. This model is similar to the asymmetric information model by Merton (1987), where "screening" is due to the fact that some investors do not know about the existence of certain securities. However, these studies analyze a partial equilibrium model and therefore focus on (socially responsible) investing.

Hence, to study potential differences in financial performance, we only need to consider the shareholders' hedonic pricing mechanism associated with corporate social responsibility, namely socially responsible investment.

In 2005, about one out of every ten dollars under professional management in the United States was involved in socially responsible investing.[3] Socially responsible investors acknowledge that, as owners of the firm, they are also responsible for the generation of the externality. Effectively, such investors view the externality as their property, which affects their demand for shares. Consequently, corporate social responsibility has an effect on the market value of the firm. We find that a social planner's solution coincides with the competitive stock market allocation, given that firms maximize market value. This finding can be related to the argument made by Coase (1960), that externalities can be resolved when property rights are well-defined. The result is also in accordance with the basic argument made by Jensen (2002), that the single objective of a firm should be to maximize its market value. Maximizing value is not the same as maximizing profits and this result explains many of the various empirical findings of studies on the relationship between social responsibility and financial performance.

We re-evaluate the existing empirical literature of the last three decades. Three measures of financial performance are commonly used: 1. the Market-to-Book ratio; 2. accounting profit ratios, such as Return on Assets; 3. stock market returns. We observe which financial performance measure is used in 68 empirical studies. We group the studies accordingly and investigate the observed relationship between financial performance and corporate social responsibility. We find that the empirical results are in line with the predictions of our general equilibrium model. In addition, in light of our findings, the existing empirical evidence is no longer mixed.

The remainder of this chapter is organized as follows. In the next section we present the model. We derive the socially optimal allocation and introduce financial markets. We compare the market equilibrium with the socially optimal solution. In Section 2.3 we examine the consequences of socially responsible behavior for three different financial performance measures. In Section 2.4 we relate our results to the existing empirical literature. Finally, we summarize and conclude in Section 2.5.

[3] Social Investment Forum, 2005 Report on Socially Responsible Investing Trends in the United States.

2.2 The model

The basic set-up is the general equilibrium stock market model of Diamond (1967). We consider n firms and we assume that the production by firm i can be written as a decomposable function of capital intensity k_i and a random vector θ reflecting the state of nature, as in Diamond (1967). The output of firm i when state θ occurs is given by:

$$y_i(k_i, \theta) = g_i(\theta) f_i(k_i), \tag{2.1}$$

with $f_i'(k_i) > 0$, $f_i''(k_i) < 0$. We assume that $f_i(k_i)$ is homogeneous of degree α_i with respect to k_i. Modeled as a decomposable production function, output is scaled by the state of nature, but output patterns are not affected by different choices of inputs. The firm also generates an economic bad, labeled social damage D^i, which we may think of as environmental pollution. For simplicity, but without losing the general argument, we assume it is proportional to $f(\cdot)$:

$$D^i = D^i(f_i(k_i)) = D_i f_i(k_i). \tag{2.2}$$

Note that D^i is total social damage and D_i is damage proportional to expected production. Social damage D^i is produced with certainty, so it is state independent.[4] It is a quite natural assumption that capital intensity is related to environmental damage. One can also give an alternative interpretation to Eq. (2.2) in terms of *social* damage to employees. If a firm hires more employees, it can reduce the work load per employee and therefore work-related stress, so that more men on the job increases health and safety conditions.[5] A larger number of employees reduces capital intensity so that there is a correlation between total social damage and capital intensity. We assume that each firm produces the same good and the same bad. This perfect substitutability allows us to interpret goods as cash flows.

There are m consumers and consumer j has individual preferences for the good and the bad which are represented by a utility function $U^j(c_j, d_j)$, where c_j is consumption and d_j is damage due to production, $U_c^j = \frac{\partial U^j}{\partial c_j} > 0, U_{cc}^j = \frac{\partial^2 U^j}{\partial c_j^2} < 0, U_d^j =$

[4] Adding uncertainty to the amount of generated damage requires keeping account of several covariances and variances to calculate the aggregate risk associated with a certain investment, but does not alter the core of the analysis.

[5] In a market equilibrium, the dual equivalent of a reduced workload can be interpreted as a "fair wage"

$\frac{\partial U^j}{\partial d_j} < 0, U^j_{dd} = \frac{\partial^2 U^j}{\partial d_j^2} < 0$. A consumer wants to maximize expected utility:

$$V^j = E[U^j(c_j, d_j)]. \tag{2.3}$$

We make some restrictive assumptions on technology and preferences, which do not influence the results, but allow for explicit solutions and expositional convenience. We assume constant absolute risk aversion (CARA) preferences and a constant marginal rate of substitution between consumption and damage. We assume $g_i(\theta) \sim \mathcal{N}(1, \sigma_i^2)$ and we consider the simple case where covariances between the $g_i(\theta)$'s equal zero.[6]

There are some intriguing issues in modeling preferences over social damage which arise in this way. For example, the environment is a public good, which means that the relationship between private and public consumption is not one-to-one. In addition, the generated social damage need not be a physical product. In order to avoid blurring the analysis with free-rider effects, underprovision, or other secondary problems related to externalities, we treat the bad as a divisible, privately owned product. Alternatively, we can simply interpret the bad component as disutility that consumers get from consumption of a good that is produced in a damaging manner. This approach is similar to models of vertical differentiation, where goods have a quality dimension (see, for instance, Tirole, 1988, p.296-298).

In the next section, we first derive the socially optimal allocation which serves as a benchmark. Next, in section 2.2.2, we calculate the stock market equilibrium.

2.2.1 A centrally planned economy

We examine a centrally planned economy, in which a social planner tries to find a Pareto optimal allocation in terms of expected utility V_j. As in Diamond (1967) the planner has full control over the allocation of the production factors, but has limited control over the allocation of output. Hence, we consider a social planner with somewhat limited powers. The reason is that a planner with full control can in principle determine an allocation identical to that which is achieved by a competitive economy with a complete set of contingent commodity markets (see Arrow and Debreu, 1954). In contrast, we look at a limited set of markets; we do not allow for insurance markets, etc. We therefore assume that the cost elements that

[6] The effects of covariances on prices and portfolio selection are well known and do not affect our analysis qualitatively. Generally, covariances play an important role in asset pricing, but for our purpose we only require a risk premium. See, for example, Cochrane (2001).

restrict the set of markets also limit a social planner in the same way. Accordingly, we choose the planner's powers in such a way that the competitive economy with a stock market can *in principle* generate the same allocation as the social planner. More precisely, the planner has to come up with a distribution of production before the state of nature is known, so instructions are given to firms before production is completed. Firm i is instructed to deliver a fraction β_{ij} of its output to individual j, independent of the state of nature. This implies that the total consumption and damage of individual j is equal to:

$$c_j = \sum_{i=1}^{n} \beta_{ij} y_i(k_i, \theta), \tag{2.4}$$

$$d_j = \sum_{i=1}^{n} \beta_{ij} D_i f_i(k_i). \tag{2.5}$$

Total consumption should equal total output. This gives a restriction on the β_{ij}'s:

$$\sum_{j=1}^{m} \beta_{ij} = 1. \tag{2.6}$$

We impose a constraint on the available capital:

$$\sum_{i=1}^{n} k_i = \bar{k}. \tag{2.7}$$

A Pareto optimal allocation is then found by maximizing the utility of the first consumer $E[U^1(c_1, d_1)]$ subject to $m-1$ constraints on the expected utility of the other consumers $E[U^j(c_j, d_j)] = \bar{V}^j$, where the $\bar{V}_j$'s are reservation levels of expected utility of consumers $j = 2, .., m$. We derive a simple allocation rule:

$$\frac{f_1'(k_1)}{f_i'(k_i)} = \frac{E[U_c^1 g_i(\theta)] + D_i E[U_d^1]}{E[U_c^1 g_1(\theta)] + D_1 E[U_d^1]}, i = 2, 3, .., n. \tag{2.8}$$

(For the derivation see the Appendix.) This expression equates the marginal rate of transformation with the expected marginal rates of substitution. This result is similar to Diamond (1967). We see that the marginal rates of substitution are simply adjusted for social damage.

2.2.2 Stock market economy

We introduce stocks, bonds, and production factor markets. Firms hire production factors and reward these with payments independent of the state of nature, while stockholders are the residual claimants. The internalization of externalized costs does not necessarily require socially responsible investors. There might be other stakeholders that value socially responsible behavior. The subsequent analysis of corporate behavior will be similar to a setting with responsible investment if we consider consumers that are willing to pay more for "green" products or employees that are willing to receive a lower wage for better working conditions instead. Corporate social responsibility can induce vertical product differentiation in the consumer good market (see, e.g. Heal, 2003; Nyborg et al., 2006) and create compensating wage differentials in the labor market, which can be seen as hedonic pricing mechanisms (See Rosen, 1974). If the cost of corporate social responsibility is channeled through either the final goods market and/or the labor market, there are no consequences for financial performance in a competitive equilibrium. Since we are interested in potential differences in financial performance, the rest of this analysis considers a hedonic pricing mechanism in the stock market in the form of socially responsible investing.

We first describe the portfolio selection process of consumers. Then we introduce two types of corporate behavior and characterize the market equilibrium. In section 2.3 we argue that these corporate goals can be linked to social responsibility. We study the implications of the two types of corporate behavior for three widely used financial performance measures, namely the Market-to-Book ratio, Return on Assets, and stock market returns.

Portfolio selection

A consumer has initial wealth W_j, which consists of initial shareholdings and production factors. Assets are indexed by $i = 1, ..., n$ and generate payoffs R_i and damage D^i. The consumer receives these cash and pollution flows in proportion to his shareholdings in firm i. Asset i can be bought at price p_i. Consumers can also buy bonds and the price of a bond is the numeraire. One unit of a bond is a commitment to pay a fixed amount of r units of consumption. As such, this asset is risk-free and non-polluting. The consumer receives fixed payments both for his initial inputs and for the amount of bonds he holds. Let b_j be the total amount of bonds plus the real capital endowments of consumer j. An investor chooses a portfolio to maximize expected utility:

$$\max_{\omega_{ij}} E[U^j(c_j, d_j)]$$

subject to

$$\begin{aligned} c_j = rb_j + \sum_{i=1}^{n} \omega_{ij} R_i, \\ d_j = \sum_{i=1}^{n} \omega_{ij} D^i, \\ W_j = b_j + \sum_{i=1}^{n} \omega_{ij} p_i, \end{aligned}$$

where ω_{ij} is the number of shares consumer j holds in firm i, and the last equation is the budget constraint. With normally distributed payoffs, the solution to this problem takes the form of a pricing equation:

$$p_i = \frac{E[R_i]}{r} - \frac{1}{r}\left(\delta \text{cov}[c_j, R_i] + \lambda_j D^i\right), \tag{2.9}$$

where $\delta = -\frac{E[U^j_{cc}]}{E[U^j_c]}$ is the coefficient of absolute risk aversion, and $\lambda_j = -\frac{E[U^j_d]}{E[U^j_c]}$ the implicit subjective conversion price, or the subjective marginal rate of substitution, of social damage to consumption of consumer j (for a derivation see the appendix). We can express Eq. (2.9) in returns and rearrange to find a familiar form:

$$\frac{E[R_i]}{p_i} = r + \frac{\lambda_j}{p_i} D^i + \delta \text{cov}[c_j, \frac{R_i}{p_i}]. \tag{2.10}$$

This equation is a modified Capital Asset Pricing Model (CAPM) equation, with a term added to the intercept which can be interpreted as a "social damage premium". We can also interpret the equation as a two-factor model. With social damage, an asset's return, and specifically Jensen's alpha, depends on other characteristics than financial risk. In the specific context of financial markets, we can give a general interpretation to these non-financial characteristics: D^i represents any liability or negatively valued characteristics of the firm, or any subjective ethical concerns of investors, that cannot be directly observed in financial statements. For instance, shareholders might want the firm to avoid potential environmental scandals or consumer boycotts.[7]

Let $\mu_i = E[R_i]$ and $\sigma^2_{R_i} = \text{Var}[R_i]$. With CARA preferences and a constant marginal rate of substitution between consumption and damage the pricing equation for consumer j , Eq. (2.9),becomes:

$$p_i = \frac{1}{r}[\mu_i - \delta\omega_{ij}\sigma^2_{R_i} - \lambda_j D^i], \tag{2.11}$$

which can be inverted into a demand function for shares:

$$\omega_{ij} = [\mu_i - p_i r - \lambda_j D^i]\frac{1}{\sigma^2_{R_i}\delta}. \tag{2.12}$$

A consumer with a stronger preference for environmental quality (high λ_j) will hold less of the share if the firm pollutes more. Furthermore, greater risk lowers demand proportional to the risk aversion of investors.

Define $\bar{\lambda} = (1/m)\sum_{j=1}^{m}\lambda_j$ as the average rate of substitution between consumption and damage and normalize the number of shares and consumers to one. In equilibrium the stock market value M_i of firm i is:

$$M_i = p_i = \frac{1}{r}[\mu_i - \delta{\sigma_{R_i}}^2 - \bar{\lambda}D^i]. \tag{2.13}$$

This result is related to the partial equilibrium models by Heinkel et al. (2001) and Merton (1987) in the special case of no shortselling. If shortselling is not allowed, the demand for shares, Eq. (2.12), cannot become negative. Then, for very polluting firms (i.e. high D^i), Eq. (2.12) is a binding constraint for some j. In this case environmental screening takes place, since some stocks are omitted from the portfolio. If shortselling is not allowed and we have a dichotomous distribution of consumers' preferences (consumers with either a high λ_j or $\lambda_j = 0$), we get the model with environmental screening of Heinkel et al. (2001). Similarly, we have the Merton model of incomplete information if we interpret damage D^i as the "shadow cost of not knowing about security i" (Merton, 1987, p. 491). Both environmental screening and asymmetric information lower the market value of polluting and "unknown" firms.[8]

[7] An example of how consumer boycotts can drive firms to engage in corporate social responsibility in a symmetric information equilibrium is given by Innes (2006).

[8] In our model, we include shortselling since we want to obtain an explicit expression for p_i without specifying the functional form of λ_j. As in the case of no shortselling, higher environmental damage (weakly) lowers the market value of the firm when shortselling is allowed. Therefore, the choice of whether or not to allow for shortselling has no qualitative consequences for the comparative static effects.

Corporate behavior

The firm rewards production factors with r, irrespective of the state of nature. Hence, this payment is equivalent to a risk-free rate. Profits are given by:

$$R_i = g_i(\theta) f_i(k_i) - rk_i. \tag{2.14}$$

Define the market value of the firm as the stock market value plus the capital stock, $M_i + k_i$. Expected profits and the variance of profits are:

$$\mu_i = E[R_i] = f_i(k_i) - rk_i, \tag{2.15}$$

$$\sigma_{R_i}{}^2 = \mathrm{Var}[R_i] = \sigma_i^2 f_i^2(k_i). \tag{2.16}$$

The firm can either maximize profits or maximize market value. [9]

Market Equilibrium

We now highlight the distinction between value maximization and profit maximization which our model generates. Using Eq. (2.2), Eq. (2.13), and Eq. (2.15)-(2.16) we find the value of the firm in equilibrium as:

$$\begin{aligned} M_i + k_i &= \tfrac{1}{r}[f_i(k_i) - rk_i - \delta\sigma_i^2 f_i^2(k_i) - \bar{\lambda} D_i f_i(k_i)] + k_i \\ &= \tfrac{1}{r}[f_i(k_i) - \delta\sigma_i^2 f_i^2(k_i) - \bar{\lambda} D_i f_i(k_i)]. \end{aligned} \tag{2.17}$$

Without agency problems, taxes, and transaction costs, the value of the firm only depends on output and not on the financing structure (as shown by Modigliani and Miller, 1958).

All proofs are in the Appendix.

Lemma 2.1. *Maximizing the market value of the firm is different from maximizing profits. More specifically, if a firm maximizes its market value, it chooses k_i such that in equilibrium:*

$$f_i'(k_i) = \frac{r}{1 - \delta\sigma_i^2 f_i(k_i) - \bar{\lambda} D_i}. \tag{2.18}$$

In contrast, if a firm maximizes pure profits subject to the socially preferred fixed risk level, then it chooses k_i such that in equilibrium:

$$f_i'(k_i) = \frac{r}{1 - \delta\sigma_i^2 f_i(k_i)}. \tag{2.19}$$

[9] These derivations are in the appendix and we turn directly to the market equilibrium.

Lemma 2.2. *The socially optimal allocation, characterized by Eq. (2.8), is attained in a competitive economy by maximizing the value of the firm.*

These results also hold for a general utility function U, production function f and distribution function $g(\theta)$.

The socially optimal solution is attained by maximizing firm value, not by maximizing profits, which corresponds to the argument made by Michael Jensen: "value is created when a firm produces an output or set of outputs that are valued by its customers at more than the value of the inputs it consumes (as valued by their suppliers) in such production" (Jensen, 2002, p.239). Consequently, Jensen argues, firms should have one objective, namely to maximize the value of the firm. The argument is often interpreted as "firms should maximize profits", the statement put forward by Milton Friedman (1970), who claimed that "The social responsibility of business is to increase its profits".[10] However, if a firm creates several outputs, of which some are negatively valued, maximizing the long-term value of the firm is no longer the same as maximizing profits. Even if the negatively valued output is, in principle, marketable, by free disposal it will have a price equal to zero, which favors pure profits. Hence, there is a difference between pure profit maximization and firm value maximization.

Friedman argues that firms are taxing consumers through reduced profits by engaging in corporate social responsibility and that consumers can spend on social responsibility programs themselves if they want to. However, pollution due to production can also be considered as a form of taxation. From an efficiency point of view it might be better to prevent environmental damage, rather than cleaning it up later.

2.3 Implications

We now explore the implications of a firm's choice to operate in a socially responsible way on financial performance. The bulk of empirical studies basically adopt the

[10] Several arguments can be made to support this claim. If social damage is incorporated through consumption behavior on the consumption goods market, Friedman is right. However, this mechanism assumes that consumers have perfect information about all production processes in the supply chain of intermediate goods, on top of information about the production process of the resulting final good. In practice, this is almost impossible to keep track of (for an interesting story of a scholar who tried to do this for a T-shirt, see Rivoli, 2005). This makes it less likely that all the social damage generated by each firm in the supply chain is incorporated in the price of the final good. Therefore, we argue, that information asymmetries and resulting externalities are more likely to be present in the consumer goods market compared to the stock market, since shareholders as owners of the firm are more directly involved in the production process. Consequently, maximizing profits is no longer the same as maximizing firm value.

intuition of the partial equilibrium result of Eq. (2.13), namely that in equilibrium there is a trade-off between stock-market returns and corporate social responsibility. Next, the financial performance of socially responsible firms is compared to the financial performance of irresponsible firms, using some financial performance measure. It is implicitly assumed that any choice of financial performance measure will reveal the trade-off.

We present three general equilibrium results that show that for comparison purposes between socially responsible and irresponsible firms, it matters what kind of financial performance measure is used. We choose to discuss the properties of three measures that are widely used in the empirical literature. These three are Market-to-Book (or Tobin's Q), Return on Assets (i.e. accounting profit ratios), and stock market returns.

To keep the analysis simple, we focus on extreme cases and consider two types of corporate behavior. The first type of corporate behavior is market value maximization. Since maximizing market value yields the social optimum, we label it as socially responsible behavior. The second type of corporate behavior is pure profit maximization without internalization of external effects. We call this irresponsible behavior. This is in line with the definition of corporate social responsibility proposed by Heal (2005).

According to (2.18) a socially responsible firm (SR) sets its capital intensity k^{SR} such that:

$$f'^{SR}(k^{SR}) = \frac{r}{1 - \delta\sigma^2_{R_{SR}} - \bar{\lambda}D^{SR}} \tag{2.20}$$

An irresponsible firm (IR) sets its capital intensity k^{IR} such that:

$$f'^{IR}(k^{IR}) = \frac{r}{1 - \delta\sigma^2_{R_{IR}}} \tag{2.21}$$

Where $\sigma^2_{R_{SR}} := \sigma^2_{SR} f^{SR}(k^{SR})$ and $\sigma^2_{R_{IR}} := \sigma^2_{IR} f^{IR}(k^{IR})$. The difference between the two expressions is that the irresponsible firm does not consider the social damage $\bar{\lambda}D^{IR}$. The irresponsible firm uses a cost of capital that is too low from a social viewpoint, i.e. it takes into account the risk-free rate plus a risk premium, but not the pollution premium. Note that the choice of being socially responsible or socially irresponsible is exogenous in our model. There is no economic mechanism that forces firms to be socially responsible.[11]

[11] If shareholders disagree with the policy of a firm, they can either sell the stocks (Exit) or try to influ-

Proposition 2.1. *Define the Market-to-Book ratio as total market value divided by installed capital,* $(M+k)/k$*. Then:*

1. *the Market-to-Book ratio of a socially responsible firm is always larger than the Market-to-Book ratio of an irresponsible firm with the same degree of homogeneity, irrespective of the level of damage per output;*

2. *the Market-to-Book ratio of socially responsible firms is constant with respect to damage per output'.*

Note that the result even holds if firm risk levels differ, since the market value is determined by the appropriate discount rate. A responsible firm is maximizing market value, so it will install capital until the unique optimal Market-to-Book value is obtained.

Proposition 2.2. *Define the Return on Assets (ROA) ratio as profits divided by installed capital,* π/k*. To adjust for risk levels we assume that* $\sigma^2_{R_{SR}} = \sigma^2_{R_{IR}} = \sigma^2$*. Then:*

1. *the ROA of a socially responsible firm is always larger than the ROA of an irresponsible firm with the same degree of homogeneity;*

2. *the ROA of irresponsible firms is constant with respect to damage per output* D_i*, but for socially responsible firms it is increasing in damage per output* D_i*.*

If each firm is assumed to have the same corporate goal, namely to maximize profits, then observing a higher ROA would indeed imply superior financial performance. However, socially responsible firms do not maximize profits and based on a simple comparison of ROA we would label irresponsible firms as inefficient. According to conventional microeconomic theory, relatively higher *average* profits should induce additional investments, since maximum profits have not yet been attained. With social damage, however, socially responsible investors appreciate the internalization of externalities. This alternative corporate goal compromises profit maximization. A better way to measure inefficiency is by applying stochastic frontier analysis as proposed by Hughes et al. (1996). This type of analysis can take into account distinct corporate goals and, as such, measure "true" inefficiency.

Proposition 2.3. *Define stock market returns as* π/M*. To adjust for risk levels we assume that* $\sigma^2_{R_{SR}} = \sigma^2_{R_{IR}} = \sigma^2$*. Then:*

ence firm policy at shareholder meetings (Voice). As we assume that the individual investor is small, the latter is not an option.

1. *whether the risk-adjusted stock market returns are higher for socially responsible firms or irresponsible firms is ambiguous;*

2. *socially responsible firms have lower stock market returns compared to irresponsible firms with the same damage per output D_i technology .*

This result is not driven by differences in α_i since it holds when all firms have the same degree of homogeneity; $\alpha_i = \alpha$. A set of firms that have the same damage per output can be interpreted as an industry. So we find that socially responsible firms have lower stock market returns compared to irresponsible firms that are in the same industry. If we compare socially responsible firms to irresponsible firms at an aggregate level, i.e. we do not correct for industry type, then it is ambiguous whether stock market returns are higher or lower for socially responsible firms. The intuition is that corporate social responsibility relates to the internalization of external effects, not just the extent to which it creates external effects. A more polluting industry has to compensate more for its pollution if it wants to be labeled socially responsible. Unless we identify what drives firms to engage in corporate social responsibility - e.g. polluting industries are relatively more involved in pursuing social responsibility- we are unable to make precise statements concerning the stock market returns of socially responsible firms.

Note that all of the results hold without imposing assumptions on the operational relationship between productivity and social damage. Whether or not more damaging technologies are more productive is irrelevant to our analysis.

2.4 Empirical evidence

The empirical findings on the relation between corporate social responsibility and corporate financial performance appear to be contradicting. However, using our model we show that in fact this is not the case. We relate our propositions to the findings in the empirical literature, paying attention to what type of performance measure is used. For this purpose, we consulted two widely cited surveys on the link between corporate social responsibility and corporate financial performance, namely Margolis and Walsh (2001) and Orlitzky et al. (2003). We classify the studies according to the financial performance measure used and relate the empirical findings to our propositions. Therefore, we only look at studies that use Market-to-Book, Return on Assets[12] or stock market returns. This results in a survey of 68

[12] We also included in this category measures that are equivalent accounting profit measures, e.g. Return on Equity (ROE), Return on Investment (ROI) and Return on Sales (ROS).

Table 2.1. Studies using Market-to-Book

Authors	**Relationship**	**Strength of result**
B. Brown and Perry (1994)	positive	strong
Dowell et al. (2000)	positive	strong
Fombrun and Shanley (1990)	positive	strong
King and Lenox (2001)	positive	strong
Hamilton (1995)	positive	strong

Studies using Market-to-Book (Tobin's Q) find a positive relation between corporate social responsibility and corporate financial performance.

studies.

2.4.1 Studies using Market-to-Book

Table 2.1 shows that all five studies that have used the Market-to-Book index find a strong and positive relationship between corporate social responsibility and Market-to-Book. This is in line with Proposition 2.1. We quote King and Lenox (2001, p.106):

> We find evidence of a real association between lower pollution and higher financial performance. We also show that a firm's environmental performance relative to its industry is associated with higher financial performance. We cannot show conclusively, however, that a firm's choice to operate in cleaner industries is associated with better financial performance (..).

This is precisely what Proposition 2.1 predicts, namely that Market-to-Book is constant across industries for socially responsible firms and relatively lower for irresponsible firms, independent of the environmental performance of the industry. Heal also comes to this conclusion and mentions: "One robust result seems to be that superior environmental performance is correlated with high values for Tobin's Q" (Heal, 2005, p. 402).

2.4.2 Studies using Return on Assets

In Table 2.2 we present 36 studies that use Return on Assets or a comparable accounting profit measure. First note that not one study finds a strictly negative relationship. Furthermore, 17 out of 18 studies, that are classified as presenting either strong or moderate evidence, find a positive relationship which is in line with

Table 2.2. Studies using Return on Assets or equivalent measure

Authors	**Relationship**	**Strength of result**
Berman et al. (1999)	Positive	Strong
B. Brown and Perry (1994)	Positive	Strong
Dooley and Lerner (1994)	Positive	Strong
Judge Jr. and Douglas (1998)	Positive	Strong
Preston and OBannon (1997)	Positive	Strong
Simerly (1995)	Positive	Strong
Waddock and Graves (1997)	Positive	Strong
Graves and Waddock (1994)	Positive	Moderate
Graves and Waddock (2000)	Positive	Moderate
Hart and Ahuja (1996)	Positive	Moderate
Heinze (1976)	Positive	Moderate
Herremans et al. (1993)	Positive	Moderate
McGuire et al. (1988)	Positive	Moderate
Russo and Fouts (1997)	Positive	Moderate
Spencer and Taylor (1987)	Positive	Moderate
Turban and Greening (1997)	Positive	Moderate
Abbott and Monsen (1979)	Positive	Weak
Anderson and Frankle (1980)	Positive	Weak
Bowman (1978)	Positive	Weak
Bragdon Jr. and Marlin (1972)	Positive	Weak
Griffin and Mahon (1997)	Positive	Weak
Marcus and Goodman (1986)	Positive	Weak
Parket and Eilbirt (1975)	Positive	Weak
Pava and Krausz (1995)	Positive	Weak
Wokutch and Spencer (1987)	Positive	Weak
Preston (1978)	Positive	N/A
Greening (1995)	Positive	N/A
Johnson and Greening (1999)	No Effect/Positive	Moderate
Cochran and Wood (1984)	No Effect/Mixed	Weak
Patten (1991)	No Effect	Strong
Aupperle et al. (1985)	No Effect	Weak
Chen and Metcalf (1980)	No Effect	Weak
Freedman and Jaggi (1982)	No Effect	Weak
Ingram and Frazier (1980)	No Effect	Weak
O'Neill et al. (1989)	No Effect	Weak
Rockness et al. (1986)	No Effect	Weak

Studies using accounting profit ratios (ROA/ROE/ROI/ROS) find merely positive relations between corporate social responsibility and corporate financial performance.

Proposition 2.2. Overall, 27 out of 36 studies find a positive relationship and the studies that are classified as presenting weak evidence find no relationship. Note that most of these studies date back to the 1970s and 1980s when data availability was probably a problem.

There is additional evidence that supports Proposition 2.2. Spencer and Taylor (1987) note that the relationship is valid at the industry level. This indicates that differences in ROA are not solely due to differences in damaging technologies. This evidence is supported by Griffin and Mahon (1997), who look at a single industry and find a positive relationship between ROA and corporate social responsibility, and also by Dooley and Lerner (1994), who use as an indicator a firm's ROA relative to the industry average ROA and find the predicted positive relationship.

2.4.3 Studies using stock market returns

Table 2.3 gives an overview of studies that have used stock market returns as a financial performance measure. We grouped these studies into comparative and event studies.

For the comparative studies (top half of Table 2.3) the findings differ considerably and the majority of the studies finds mixed effects or no effect, which is in line with Proposition 2.3. Moreover, according to Proposition 2.3, we should observe a negative relationship if we look at differences in stock market returns within one industry. Newgren et al. (1985) look at financial performance relative to average industry performance and indeed find a negative relationship.[13]

Event studies (bottom half of Table 2.3) present a less conflicting picture as they compare the returns of a firm to the firm itself. However, the problem with event studies is that it may be unclear whether or not the "event" is actually providing new information to investors. If this is not the case, then this action will not significantly affect the stock price.

In line with Proposition 2.3, most event studies find the expected negative relationship, however, three studies find a positive relationship, of which two are on the withdrawal of international firms from South-Africa in the 1980s.

2.4.4 Summary of empirical findings

Table 2.4 shows that the alleged paradoxical empirical findings are in line with our propositions and that these findings should in fact be interpreted as showing strong evidence on the relation between social responsibility and financial performance. If

[13] In fact Newgren et al. (1985) look at the Price/Earnings index relative to the industry Price/Earnings index and find a positive relationship between this indicator and corporate social responsibility. Note however, that the Price/Earnings index is inversely related to stock market return, which in a steady state is equal to the Earnings/Price index. Therefore we label this result as negative to make it comparable to the other studies.

Table 2.3. Studies using stock market returns

a) Average Return Studies

Authors	Relationship	Strength of result
Freedman and Stagliano (1991)	Positive	Strong/Moderate
McGuire et al. (1988)	Positive	Moderate
Ingram (1978)	Positive	Moderate
B. Brown (1998)	Positive	Moderate
Vance (1975)	Negative	Strong
Newgren et al. (1985)	Negative	Moderate
Guerard Jr. (1997b)	Mixed	Moderate
Davidson III and Worrell (1992)	Mixed	Weak
B. Brown (1997)	No effect/Positive	Weak
Hamilton et al. (1993)	No effect	Moderate
Alexander and Buchholz (1978)	No effect	Weak
Guerard Jr. (1997a)	No effect	N/A
Chen and Metcalf (1980)	No effect	Weak

b) Event Studies

Authors	Relationship*	Strength of result
Blacconiere and Northcut (1997)	Negative	Moderate
Blacconiere and Patten (1994)	Negative	Moderate
Klassen and McLaughlin (1996)	Negative	Moderate
Shane and Spicer (1983)	Negative	Moderate
Stevens (1984)	Negative	Moderate
Posnikoff (1997)	Negative**	Moderate
Belkaoui (1976)	Negative	Weak
Meznar et al. (1994)	Positive**	Strong
P. Wright and Ferris (1997)	Positive**	Moderate
Boyle et al. (1997)	Positive	Moderate
Diltz (1995)	Mixed	Weak
Freedman and Jaggi (1986)	No effect	Moderate
Patten (1990)	No effect	Weak
Pava and Krausz (1995)	No effect	Weak

Studies using stock market returns find an ambiguous relation between corporate social responsibility and corporate financial performance.
*Other than the usage of the researchers, the results are given the interpretation "negative", if news on increased social responsibility increases the stock price significantly in the event window. In the context of our model, a correction of the stock price results in lower stock market returns for these firms, given that operating profits are not affected by the news. This way, our interpretation makes it possible to compare event studies with studies that use average stock market returns.
**These are studies on the effect of announcing withdrawal from South-Africa, with conflicting results.

we distinguish between the different performance indicators we find that there are clear associations between financial indicators and corporate social responsibility.

Table 2.4. Overview of empirical findings

Financial performance indicator	Number of studies	Positive relation	Negative relation	Mixed relation	No relation
Market-to-Book	5	5 (100%)	0 (0%)	0 (0 %)	0 (0 %)
Return on Assets	36	27 (75%)	0 (0%)	0 (0%)	9 (25%)
stock market returns*	27	7 (26%)	9 (33%)	3 (11%)	8 (30%)
Total	68	39 (57%)	9 (13%)	3 (5%)	17 (25%)

Overview of the results of the studies on the relation between corporate social responsibility and corporate financial performance, classified by financial performance measure.
*We give an interpretation to the results of event studies that is in line with our model.

2.5 Conclusion

In this chapter, we introduce a general equilibrium stock market model to study the effects of corporate social responsibility on financial performance. We assume that a significant part of investor behavior is affected by the non-financial characteristics of the firm. We show that one cannot use financial performance measures interchangeably to develop an understanding of the relationship between corporate social responsibility and corporate financial performance. With externalities, different financial performance measures capture different effects. As such, one should be cautious when interpreting empirical results.

We analyze the impact of socially responsible behavior on three widely used financial indicators, namely the Market-to-Book ratio, Return on Assets and stock market returns. We show that for the Market-to-Book ratio as well as for Return on Assets we expect a positive relationship with social responsibility. In contrast, for stock market returns the relationship is ambiguous at the aggregate level and negative at the industry level.

We review the existing empirical literature of the past three decades on the relationship between corporate social responsibility and corporate financial performance in the light of our findings. In general, when the empirical literature assesses the link between corporate social responsibility and financial performance the conclusion is that the relationship is not very clear. Our analysis shows that there are in fact strong linkages between corporate social responsibility and financial performance. The linkages are intuitive: engaging in corporate social responsibility compromises pure profits, but it potentially leads to maximum firm value.

Our model is simple yet general. There are many specific issues that can be studied in the area of corporate social responsibility. For example, it is often suggested that only the firms that *"do well"* also *"do good"*, and not vice versa. Alongside causal issues, strategic motivations are sometimes given to explain the reasons for socially responsible behavior. These types of analysis are valid and valuable in and of themselves. However, incorporating these issues will not change our general equilibrium results. Recall that the choice of being socially responsible is exogenous in the model, the model is static, and we only require market clearing. Our findings must hold in equilibrium, irrespective of whether there are direct or indirect operational benefits to behave in a socially responsible way, such as product differentiation, eco-efficiency, preempting future regulations, improved brand equity, or improved customer relationships.

Our analysis opens up various areas for further research. First, our model provides more specific and theoretically supported testable hypotheses for empirical work. Second, the model can be extended to allow for strategic motivations. Our model cannot provide an understanding of why some firms choose to behave socially responsible and others do not, as this choice is exogenous in the model. Finally, we can consider a dynamic version of the model. In a static model it is not possible to analyze the long term considerations that are often associated with corporate social responsibility. We leave this for future research.

2.A Appendix

Derivation of the social planner's solution

We rewrite the constraint given by Eq. (2.6) so that $\beta_{i1} = 1 - \sum_{j=2}^{m} \beta_{ij}$. Then using Eq. (2.4) and Eq. (2.5), substitute for consumption and damage, and for β_{i1}, and form the Lagrangean:

$$E\left[U^1\left(\sum_{i=1}^{n}(1-\sum_{j=2}^{m}\beta_{ij})y_i(k_i,\theta),\sum_{i=1}^{n}(1-\sum_{j=2}^{m}\beta_{ij})D_i f_i(k_i)\right)\right]$$
$$+\sum_{j=2}^{m}\nu_j\left(E\left[U^j\left(\sum_{i=1}^{n}\beta_{ij}y_i(k_i,\theta),\sum_{i=1}^{n}\beta_{ij}D_i f_i(k_i)\right)\right]-\bar{V}_j\right)+\mu\left(\bar{k}-\sum_{i=1}^{n}k_i\right) \tag{2.A.1}$$

where μ is the Lagrange multiplier. Maximizing with respect to the β_{ij}'s and k_i's gives the following first-order necessary conditions:

$$-\left(E[U_c^1 y_i(k_i,\theta)]+D_i E[U_d^1 f_i(k_i)]\right)$$
$$+\nu_j\left(E[U_c^j y_i(k_i,\theta)]+D_i E[U_d^j f_i(k_i)]\right)=0$$
$$i=1,2,..,n;j=2,3,..,m \tag{2.A.2}$$

$$(1-\sum_{j=2}^{m}\beta_{ij})\left(E[U_c^1 y_i'(k_i,\theta)]+D_i E[U_d^1 f_i'(k_i)]\right)$$
$$+\sum_{j=2}^{m}\nu_j\beta_{ij}\left(E[U_c^j y_i'(k_i,\theta)]+D_i E[U_d^j f_i'(k_i)]\right)=\mu$$
$$i=1,2,..,n \tag{2.A.3}$$

Since production is decomposable we have

$$\begin{aligned} E[U_c^j y_i(k_i,\theta)] &= f_i(k_i)E[U_c^j g_i(\theta)] \\ E[U_c^j y_i'(k_i,\theta)] &= f_i'(k_i)E[U_c^j g_i(\theta)] \end{aligned}$$

Substitute these two equations in Eq. (2.A.2) and Eq. (2.A.3) and combine these two first-order conditions by substituting for the Lagrange multiplier ν_j. If Eq. (2.A.2) holds, the summation terms in Eq. (2.A.3) drop out and we get

$$f_i'(k_i)\left(E[U_c^1 g_i(\theta)] + D_i E[U_d^1]\right) = \mu$$

Substituting for μ we get Eq. (2.8):

$$\frac{f_1'(k_1)}{f_i'(k_i)} = \frac{E[U_c^1 g_i(\theta)] + D_i E[U_d^1]}{E[U_c^1 g_1(\theta)] + D_1 E[U_d^1]}, i = 2, 3, .., m$$

Derivation of the pricing equation

Set up the Lagrangean:

$$E[U^j(rb_j + \sum_{i=1}^{n} \omega_{ij} R_i, \sum_{i=1}^{n} \omega_{ij} D^i)] + \kappa(W_j - b_j - \sum_{i=1}^{n} \omega_{ij} p_i)$$

where κ is the Lagrange multiplier. Taking the derivative yields the first-order condition for a maximum:

$$E[U_c^j R_i] + E[U_d^j] D^i - p_i \kappa = 0 \tag{2.A.4}$$

Taking the derivative with respect to b_j yields an expression for the Lagrange multiplier κ:

$$\kappa = E[U_c^j r] = E[U_c^j] r \tag{2.A.5}$$

since bonds pay with certainty. Consequently, we get the pricing equation:

$$p_i = \frac{1}{E[U_c^j] r}\left(E[U_c^j R_i] + E[U_d^j] D^i\right) \tag{2.A.6}$$

Use $E[xy] = E[x]E[y] + \text{cov}[x, y]$ to get:

$$\begin{aligned} p_i = & \quad \frac{1}{E[U_c^j] r}\left(E[U_c^j] E[R_i] + \text{cov}[U_c^j, R_i] + E[U_d^j] D^i\right) && (2.A.7) \\ = & \quad \frac{E[R_i]}{r} + \frac{E[U_{cc}^j]}{E[U_c^j]} \frac{\text{cov}[c_j, R_i]}{r} + \frac{E[U_d^j]}{E[U_c^j]} \frac{D^i}{r} && (2.A.8) \end{aligned}$$

where the last result is obtained by noting that if two random variables x and z are jointly normally distributed, then $\text{cov}[g(x), z] = E[g'(x)]\text{cov}[x, z]$ due to a Lemma by Cochrane (2001, p. 164). Consequently, we obtain the pricing equation (2.9).

Proof of Lemma 2.1

Derivation of market value maximization

We assumed a decomposable production function, so the effect of the state of nature is multiplicative. As a price taker, the firm recognizes that its value will change in proportion to output. In general, when the input level and market value equal $\hat{k}_i$ and $\hat{M}_i$, the firm calculates the market value given an alternative input level k_i as:

$$M_i = \frac{f_i(k_i)}{f_i(\hat{k}_i)}(\hat{M}_i + \hat{k}_i) - k_i.$$

The firm chooses its input level such that the derivative of the market value with respect to k_i equals zero, which at the equilibrium input level where $\hat{k}_i = k_i$ yields:

$$\frac{f_i'(k_i)}{f_i(k_i)}(M_i + k_i) = 1. \tag{2.A.9}$$

Substituting the expression for the market value of the firm Eq. (2.17) in Eq. (2.A.9) we see that in general equilibrium:

$$\frac{f_i'(k_i)}{f_i(k_i)}\frac{1}{r}[f_i(k_i) - \delta\sigma_i^2 f_i^2(k_i) - \bar{\lambda} D_i f_i(k_i)] = 1$$

which simplifies to

$$f_i'(k_i)[1 - \delta\sigma_i^2 f_i(k_i) - \bar{\lambda} D_i] = r. \tag{2.A.10}$$

Derivation of pure profit maximization

A pure profit maximizing firm faces the following problem:

$$\max_{k_i} E[\pi_i] \text{ subject to } \operatorname{cov}(\pi_i, R^m) = \bar{\rho}$$

where R^m is the market return and $\bar{\rho}$ a fixed risk level. The restriction is on the covariance of profits with respect to market return, since the firm acknowledges that only systematic risk is priced. Rewrite, substitute, and set up the Lagrangean:

$$f_i(k_i) - rk_i - \xi(f(k_i)\operatorname{cov}(g_i(\theta), R^m) - \bar{\rho})$$

Here, ξ is the Lagrange multiplier. Maximizing with respect to k_i yields the following first-order condition:

$$f'(k_i)(1 - \xi \mathrm{cov}(g_i(\theta), R^m)) = r$$

Covariances between the $g_i(\theta)$'s are assumed equal to zero, so that in equilibrium we have $\mathrm{cov}(g_i(\theta), R^m)) = \sigma_i^2 f_i(k_i)$. To find the equilibrium solution we directly substitute consumers' risk attitude δ for the shadow cost of risk ξ:

$$f_i'(k_i)[1 - \delta\sigma_i^2 f(k_i)] = r$$

Rewrite and we obtain Eq. (2.19).

Proof of Lemma 2.2

Note that (2.8) must also hold for a risk free, non-polluting technology. Then we can substitute $f_1' = r$ in the numerator of the left hand side of Eq. (2.8). Rewrite $E[U_c^1 g_i(\theta)] + D_i E[U_d^1] = E[U_c^1](1 - \beta_{i1}\delta\sigma_i^2 f_i(k_i) - \lambda_1 D_i)$. For the risk free technology ($i = 1$) the numerator of the right hand side of Eq. (2.8) is equal to $E[U_c^1]$. Substituting these expressions in Eq. (2.8) and averaging over all consumers, noting that $\sum_{j=1}^m \beta_{ij} = 1$, we see that Eq. (2.18) is equal to the social planner's solution Eq. (2.8). ■

Proof of Proposition 2.1

First note that if $f_i(k_i)$ is homogeneous of degree α then $\frac{f_i'(k_i)k_i}{f_i(k_i)} = \alpha$. Substituting Eq. (2.20) in Eq. (2.17) we find that the total market value of a socially responsible firm is equal to $M^{SR} + k^{SR} = k^{SR}\alpha^{-1}$, so the Market-to-Book ratio is equal to $(M^{SR} + k^{SR})/k^{SR} = \alpha^{-1}$ which does not depend on the level of social damage. Substituting Eq. (2.21) in Eq. (2.17) we find that the total market value of the irresponsible firm is equal to $(M^{IR} + k^{IR})/k^{IR} = \alpha^{-1}\left(1 - \frac{\bar{\lambda}}{r} f'(k) D_{IR}\right) < \alpha^{-1} = (M^{SR} + k^{SR})/k^{SR}$. ■

Proof of Proposition 2.2

Again, note that if $f_i(k_i)$ is homogeneous of degree alpha then $\frac{f_i'(k_i)k_i}{f_i(k_i)} = \alpha$. Using the definition of profits we have ROA $= \pi_i/k_i = f_i(k_i)/k_i - rk_i/k_i = f_i'(k_i)/\alpha - r$.

Substituting for $f_i'(k_i)$ using Eq. (2.21) we see that for the irresponsible firm

$$\mathrm{ROA}^{IR} = \frac{r}{\alpha(1-\delta\sigma^2_{R_{IR}})} - r$$

which does not depend on damage per output D_i. For socially responsible firms we substitute for $f_i'(k_i)$ using Eq. (2.20) and find that

$$\mathrm{ROA}^{SR} = \frac{r}{\alpha(1-\delta\sigma^2_{R_{SR}} - \bar{\lambda}D^{SR})} - r$$

which is increasing in damage per output D_i. Looking at the difference we see that

$$\mathrm{ROA}^{SR} - \mathrm{ROA}^{IR} = \frac{r}{\alpha(1-\delta\sigma^2_{R_{SR}} - \bar{\lambda}D^{SR})} - \frac{r}{\alpha(1-\delta\sigma^2_{R_{IR}})} > 0$$

given that risk is identical $\sigma^2_{R_{SR}} = \sigma^2_{R_{IR}} = \sigma^2$. ∎

Proof of Proposition 2.3

First we observe that $\pi/M = \frac{\pi/k}{M/k} = \frac{\mathrm{ROA}}{\text{Market-to-Book}-1}$. We assume that the risk levels are identical $\sigma^2_{R_{SR}} = \sigma^2_{R_{IR}} = \sigma^2$. Using the expression for ROA and Market-to-Book, we can express the stock market returns of the socially responsible firm as

$$\frac{\pi^{SR}}{M^{SR}} = \frac{A + r\alpha\bar{\lambda}D_{SR}}{B-(1-\alpha)\bar{\lambda}D_{SR}},$$

and the stock market returns of the irresponsible firm as

$$\frac{\pi^{IR}}{M^{IR}} = \frac{A}{B-\bar{\lambda}D_{IR}},$$

with $A = r\left(1-\alpha(1-\delta\sigma^2)\right)$ and $B = (1-\alpha)(1-\delta\sigma^2)$. Note that both are increasing in damage per unit of output. The sign of the difference of these two equations depends on the combination of D_{SR} and D_{IR}. Stock market returns of the irresponsible (IR) and responsible (SR) firm are identical if:

$$D_{SR} = D_{IR}\frac{1-\alpha(1-\delta\sigma^2)}{1-\alpha(1+\bar{\lambda}D_{IR})}.$$

If D_{SR} exceeds the right-hand side of this equation, the socially responsible firm has a higher stock market return, otherwise lower. We see that if $D_{SR} = D_{IR}$, that is, if we compare within a single industry, stock market returns are lower for socially responsible firms. ■