Why Investors Value Information on Firms' Social Performance*

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Abstract

Responsible investors build their portfolios according to environmental, social and governance criteria that do not usually enter the valuation of a firm. To this end, they collect information about the social performance of the firm they intend to invest in. Mainstream investors are indifferent to the firm's social record. This paper examines the conditions under which mainstream investors are willing to purchase information about the firms' social performance. I show that responsible investment can create a speculative opportunity on the capital market because firms are valued below (over) their book value when they have a poor (good) social record. If investors trade only once, such an opportunity vanishes. The equilibrium share price reflects the social information privately held by responsible investors. In this context, mainstream investors are not better off informed than uninformed. If investors trade over two periods, then the speculative opportunity exists and mainstream investors best profit from it when they are socially informed. An inter–temporal asset pricing model, where both responsible and mainstream investors with rational expectations coexist, allows deriving such a rationale for the mainstream investors' interest in social information.

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1 Introduction

Firms impact society beyond their productive activity. They pollute or care about reducing their carbon footprint, they employ low–paid labor in poor countries or care about the working conditions offered by their subcontractors. Responsible investors try to flag these behaviors. In some cases, they even try to actively alter the companies' behavior. They do so even when the environmental, social or governance stand of the flagged firms barely impacts the companies' financial performance. Yet, the economic theory remains unclear about the mechanisms by which financial markets encompass the presence of responsible investors.

The present paper examines one possible mechanism, namely the diffusion of information related to the firms' performance in the environmental, social and governance sectors (hereafter "ESG" criteria). It investigates the conditions under which mainstream investors, who are indifferent to this kind of performance, gain by being informed about it. A priori, it makes good business sense to purchase information about a firm's ESG action that eventually feeds back to the firms' financial performance. Does it also make good business sense to purchase social information related to a performance that does not show in the firm's accounting data?[1] To tackle this issue, one needs to understand the interplay between 1) investors who build responsible portfolios according to their concern for a firm's impact on society and 2) mainstream investors who are indifferent to this impact.

An important argument of the paper is that the market positioning of responsible investors is not a straightforward translation of the ESG information they have. Therefore, mainstream investors need to purchase social information in order to anticipate this market positioning and possibly profit from it.

[1] Accounting data somewhat correspond to the firm's book value, i.e. its net asset value as stated in the fundamental (and purely financially driven) analysis of the firm.

Obviously, the mere negative screening by ethic funds does not imply a change in the underlying logic of investment. Ethic funds look to invest in financially outperforming firms, only within a reduced choice set. This logic does not deviate from the mainstream logic of investment. Departing from the negative screening, other responsible investors account for the firms' social performance as an important component of the firms' value. This positive stand alters the responsible investors' logic of investment.[2] This is not a problem per se if mainstream investors know the new underlying logic of investment of their responsible peers. It becomes an issue when the characteristics of the positive screening are uncertain and blur the pricing mechanism on financial markets.

It is argued here that learning about what responsible investors care about helps anticipating their market positioning. In a context where the behavior of responsible investors is an additional source of risk that does not straightforwardly enter the market pricing of firms' stocks, learning about the firm's social performance is valuable. Indeed, mainstream investors can predict their responsible peers' holdings by purchasing information on the firms' social performance.

The relevance of this argument is best illustrated when one considers the literature on responsible investment. Currently, the economic literature distinguishes two broad forms of responsible investment.[3] First, some investors select their portfolio assets according to their values. Ethical funds that shun stocks of tobacco, alcohol or gambling companies correspond to such value-driven investors.[4] They are willing to sacrifice profit against the non–pecuniary benefit of investing in responsible firms. Second, some investors believe that firms with excellent records on environmental and/or social matters also generate higher financial returns. This belief relies on two assumptions: 1) the firms' social practices affect its future cash flows, 2) stock prices do not reflect all the value

[2] Also referred to as "positive screening" or "best in class" or "best effort" approaches.
[3] See Derwall et al. (2010) for a recent survey.
[4] See Hong and Kacperczyk (2009).

relevant information related to the firms' social practices.[5]

This last assumption is currently challenged by the integration of social information into the traditional financial accounting of firms' performance. Towards the end of 2009, Bloomberg clients were given access to all publicly available ESG data from 2,000 to 3,000 companies. 'The idea is to gather the data and commoditize the data so that financial analysts can opt to use it. Eleven percent of assets under management are socially responsible. Now the other 89 percent will get a chance to see this data,' said Emil Efthimides, manager of Environmental, Social and Governance Data Project at Bloomberg.[6] Yet, the reason for which mainstream investors should use this available information remains obscure. Building on the existing literature, the present paper argues that mainstream investors can better anticipate their responsible peers' positioning if they use this social information and possibly profit from it.

The interplay of investors is captured within an asset pricing model. Mainstream and responsible investors coexist, have rational expectations and are risk averse. Investors decide whether to invest in a firm that generates profits and an externality.[7] All investors are equally informed about the firm's future profits. They may be informed about the firm's externality. If so, they become "socially informed". Responsible investors are directly affected by the externality (it enters their utility function). Mainstream investors are indifferent to it.

The analysis focuses on the appeal to mainstream investors of being socially informed. In equilibrium, investors' demands and the firm's share price are determined simultaneously. Each investor maximizes his expected utility of

[5] See Edmans (2009).

[6] See `http://blogs.hbr.org/leadinggreen/2009/05/is-esg-data-going-mainstream.html`.

[7] The externality corresponds to the firm's "social" or "ESG" performance. The firm does not fully appropriate the costs or benefits of this performance. For instance, Heinz' killing dolphins while fishing for tuna was a clear side effect of the company's activity until the mid nineties. The social costs of tuna fishing exceeded the private costs until Heinz decided to change its tuna sources from the eastern to the western Pacific, where the dolphin bycatch is much less.

trade given his knowledge of the share price.[8] The latter is set so that the total demand equates to the total supply of the firm's shares. In the first step of the analysis, investors trade only once. In the second step, investors are active in the market for two consecutive dates.

The first setup with a single trading date illustrates why mainstream investors are not willing to pay for information on a probabilistic event 1) they are indifferent to, 2) that does not affect the only performance of the firm they are interested in, i.e. the firm's financial performance. The social information held by responsible investors impacts the market valuation of the firm. The equilibrium share price reflects both the firm's financial performance and its externality.[9] The firm's externality impacts the share price more when the relative number of responsible investors increases. No noise blurs the mapping from investors' information to the equilibrium share price. Mainstream investors extract the information related to the externality from the share price and trade accordingly. The single–trade setup with responsible investors illustrates the result of Grossman and Stiglitz (1980): there is no incentive to gather additional information if the sufficient statistics of all private signals can be inferred from the equilibrium price for free.

In the setup with two trading rounds, noise is introduced into the model for the equilibrium price of the first trading round to not be fully revealing. The risk aversion of responsible investors is now their private knowledge. Therefore, the positioning of responsible investors is a source of uncertainty in the market. Prior to the first round, investors can purchase a social report from a social rating agency. The report is a noisy version of a social signal that all responsible investors get for free between the two dates of trade. This setup provides two

[8] An investor's expected utility is the satisfaction he hopes to derive from holding or selling shares, before trade actually occurs.

[9] This is not saying that the equilibrium share price of a firm reflects the total cost (or benefit) to society of the externality the firm generates. The equilibrium price is efficient from the perspective of utility–maximizing responsible investors and not necessarily efficient from a welfare–maximizing perspective.

important results.

First, mainstream investors set their date 1 demand in order to profit from a price change between trading dates. The difference in prices follows the dissemination of a social signal among responsible investors prior to the second trade. Informed mainstream investors refine their first demand according to their better anticipation of the weight attached to the social information in the date 2 equilibrium price. It is shown that informed mainstream investors have a greater unconditional expected utility than uninformed mainstream investors.

Second, uninformed mainstream investors always benefit from a lesser sensitivity to social information of *both* the equilibrium prices. This effect can be achieved if the relative share of uninformed and mainstream investment increases. In contrast to this, informed mainstream investors benefit from a lesser sensitivity to social information of *the date 1* equilibrium price, if and only if their private expectation of the sensitivity to the social information of the date 2 equilibrium price falls within a certain interval of intermediate values. In other words, the advantage of being informed is greater when the presence of uninformed mainstream investors 1) makes the foreknowledge of the effect of the firm's externality on the date 2 price worth it, 2) yet does not make the trading too risky because of a too–large price adjustment between the trading dates.

The remaining of the paper is organized as follows. Section 2 details the different approaches to responsible investment and states the chosen approach adopted in this paper. Section 3 describes the model. In section 4, investors only trade once and static results are derived. In section 5, the model is enriched of a second trading round and some noise is introduced in order to blur equilibrium prices. Section 6 concludes.

2 The Approaches to Responsible Investment

Asset management companies and their clients show an increasing interest in responsible investment (hereafter RI). As an illustrating figure, about 200 mutual funds with social screens held 179 billions of dollars in 2005. This segment of SRI assets has increased 15-fold since 1995.[10] The boom in RI calls for a better understanding of how the social concern of some investors translates into a specific positioning on capital markets. The present paper formally disentangles the different rationales for RI and assesses the impact of RI on the market valuation of investment opportunities.

There are two main sources of social information: self–reporting of ESG related practices by the firms and social rating agencies. Currently, the information production sector concentrates fast. In 2009, two leading providers of financial information acquired well–established social rating agencies: RiskMetrics acquired Innovest and KLD Research & Analytics while Thomson Reuters acquired Asset4. Therefore, more and more social information is made available to investors, responsible or mainstream. The present paper does not tackle the measurement problem of corporate ESG practices. Nor does it question the relevance of either criterium of social performance. Rather, it provides a new rationale for the usage of such information by investors.

Deviating from Landier and Nair's typology, I stress three broad reasons to invest in a responsible way and therefore to acquire information on the social performance of firms. The first and most obvious one is correlation. The information about the firms' externality reveals something (either good or bad) about the management of the firm and its future financial performance. Shareholders are likely to exploit such information in order to optimize the value of their portfolio.

[10] Socially responsible investment represents 11% of the 25.1 trillion US dollars in total assets under management in the United States. This figure drops to 1% of all assets under management in France. See the Social Investment Forum figures at `http://www.socialinvest.org/resources/sriguide/srifacts.cfm`

The second motive is proximity. Responsible investors try to avoid the disutility of being involved in irresponsible firms while maximizing their utility of being associated with responsible ones. Investment funds adopt the proximity rationale either because they are under regulatory pressure or as part of a differentiation strategy or both. For instance, the Seventh National Pension Fund of Sweden (AP7) strictly excludes from its portfolio firms that do not meet certain ethical and environmental requirements as stated by the Swedish Government.[11] AP7 bases its investment decisions on the social information it purchases from two different sources: Ethix SRI Advisors and GES. Interestingly enough, AP7 took a 5 % ownership stake in GES when the screening company almost disappeared, leaving Ethix SRI Advisors as the sole provider of social information.[12] AP7 reduces its proximity with "irresponsible" companies. Such a reduction requires sound information about the externalities generated by firms.

The third motive is activism. It differs from proximity in as much as activist investors want to alter the firms' course of action (e.g. by increasing its cost of raising capital via concerted share selling). The present paper focuses on proximity. It argues and shows that mainstream investors may be interested in purchasing information about the firm's ESG performance because it gives them the foreknowledge of the responsible investors' likely behavior. I deliberately leave aside the correlation that can exist between a firm's social impact and its financial performance. If such a correlation exists, traditional rating agencies should already account for it (e.g. when they grade a firm's management of risks).

[11] AP7 is responsible for 2.5 % of the pensionable income in Sweden – i.e. roughly seven billion US dollars – and manages the premium pension system. In contrast with the other Swedish pension funds, AP7 trustees can withdraw their assets from the funds. Therefore, AP7 directly competes with other asset managers.

[12] For more on this, see Hamilton (2010).

3 The Model

Based on the above description of what SRI covers and the list of motives to acquire social information for responsible investors, I draw two assumptions. First, the preference for social responsibility enters the utility function of responsible investors in an additive way. Second, responsible investors are always socially informed.

The second assumption may seem rather ad hoc at first. Yet, the managers of responsible funds need to assure that their clients' portfolio reflects the latter's taste for high social performance, whether managers share this taste or not. At the very least, social and environmental criteria need to be "ticked off" by fund managers, regardless of the latter's use of this kind of information.[13]

3.1 The agents of the economy

Investors can purchase shares of a company whose asset generates random profits f.[14] The firm's productive activity also generates a random externality e.[15] In short, the productive activity of the firm impacts a broad fraction of the society and information on this impact does not enter the traditional assessment of the firm's value.[16]

There are three categories $j \in \{nru, nri, ri\}$ of risk averse investors with constant absolute risk aversion γ who may be interested in purchasing x_j shares of the firm.[17] Investors of category j are in proportion μ_j. Two features delimit the categories: an investor's idiosyncratic taste for social responsibility, and his level of information about the firm's externality. A proportion $\mu_{nr} = \mu_{nri} + \mu_{nru}$ of all investors are not affected by the externality. A proportion μ_{ri} of

[13] See Henningsson (2008).

[14] See the appendix for a recapitulation of all notations.

[15] e is also referred to as the firm's "social performance" or its "level" of externality.

[16] Either because the society is not perfectly aware of this by–product or because it is not easy to communicate about it. The stochastic feature of the externality captures among other things the random timing at which an ongoing debate among experts becomes a public issue.

[17] More generally, the risk aversion of two different investors may differ. This is not, however, the focus of the static analysis in the single trading round model.

all investors are responsible and the externality directly enters their utility function. Among mainstream investors, a proportion μ_{nri} is informed about e. All responsible investors are assumed to be privately informed about the social impact of the firm.[18]

3.2 The information structure

An informed investor receives a private signal β that is correlated with the level of the firm's externality e. The social signal satisfies the following identity:

$$\beta \equiv e + \epsilon_e.$$

In addition, all investors know about the extent to which the responsible investors are affected by the social externality.

Two different concerns could be modeled: a "proximity" concern and an "absolute" one. Proximity captures the fact that a responsible investor does not wish to be involved in companies whose practices do not reflect his own values. An "absolutely" responsible investor would wish bad externalities to disappear, whether he has some stakes in the companies that generate them or not. I will be focusing on the proximity motive that drives the demand of responsible investors. Parameter θ scales the importance of the social performance when responsible investors trade.[19]

All random variables are normally distributed as follows:

$$\begin{bmatrix} f \\ e \\ \epsilon_e \end{bmatrix} \sim N\left(\begin{bmatrix} \phi \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma^2 & 0 & 0 \\ 0 & \sigma_e^2 & 0 \\ 0 & 0 & \sigma_{ne}^2 \end{bmatrix} \right)$$

Information on the firm's profitability does not provide information on how important the firm's externality can be. The reverse is also true: information

[18] See section 2 for a discussion of this assumption.

[19] For instance, $\theta = 50\%$ in Macif Gestion. This implies that asset managers there account for 50% the firms' ESG performance in taking their portfolio decisions.

on the firm's externality does not help predicting the firm's liquidation value.[20]

Denote Ω_j the information set of investor j when he purchases x_j shares of the firm. Investors nru, nri, and ri have the respective information sets: $\Omega_{nru} = \{\phi, P\}$, $\Omega_{nri} = \{\phi, \beta, P\}$, and $\Omega_{ri} = \{\phi, \beta, P\}$, where P denotes the equilibrium price of the firm's shares.

3.3 Investors' decisions and definition of an equilibrium

Investor j has a negative exponential utility function for his final payoffs $\pi_j(x_j)$ given by: $U(\pi_j(x_j)) = -\exp(-\gamma\pi_j(x_j))$. The exponential utility allows to derive closed form expressions for the investors' demand and preserves the constant absolute risk aversion. Given his information set, an investor j sets his equilibrium demand schedule x_j in order to maximize his expected utility $E[U(\pi_j(x_j))|\Omega_j]$.

I look for a linear equilibrium with rational expectations in which investor j's demand for shares is a linear function of his private information. Investor j maximizes over x_j

$$E[-\exp(-\gamma\pi_j(x_j))|\Omega_j] = -\exp(-\gamma(E[\pi_j(x_j)|\Omega_j] - \frac{\gamma}{2}Var[\pi_j(x_j)|\Omega_j])). \quad (1)$$

Investor j's problem can be rewritten as[21]

$$\max_{x_j} E[\pi_j(x_j)|\Omega_j] - \frac{\gamma}{2}Var[\pi_j(x_j)|\Omega_j].$$

Mainstream investors The final payoff of mainstream investors $j = nri, nru$ who purchase $x_{j=nri,nru}$ shares of the firm is given by: $\pi_{j=nri,nru} = x_{j=nri,nru}(f-$

[20] This does not imply that the firm's externality is independent from the firm's productivity. Indeed, the level of the firm's externality is likely to be correlated to the level of the firm's investment. The latter will crucially depend upon the firm's cost of capital, i.e. the firm's share price in equilibrium.

[21] Linearity preserves the normality of investor j's interim wealth, conditional on his information Ω_j. For a normally distributed random variable e we have that: $E[\exp(e)] = \exp(E[e] + \frac{Var[e]}{2})$.

P). Uninformed investors buy x_{nru} shares in order to solve the following problem:

$$\max_{x_{nru}} E[x_{nru}(f-P)|\phi,P] - \frac{\gamma}{2}Var[x_{nru}(f-P)|\Omega_{nru}]. \tag{2}$$

Informed investors buy x_{nri} shares in order to solve

$$\max_{x_{nri}} E[x_{nri}(f-P)|\phi,\beta,P] - \frac{\gamma}{2}Var[x_{nri}(f-P)|\Omega_{nri}]. \tag{3}$$

Responsible investors The final payoff of responsible investors ri who purchase x_{ri} shares of the firm is given by: $\pi_{ri} = x_{ri}(f - P + \theta e)$.[22] The linearity of the investors final payoff implies two important things. First, responsible investors can translate the private disutility (utility) they suffer (enjoy) from the firm's bad (good) externality into monetary losses (gains) and integrate them in their final payoffs. Responsible investors are able to translate into a market value the firm's externality. To this end, θ is similar to an exchange rate. Second, responsible investors have the same risk aversion vis à vis the level of the externality and the financial proceeds of their investment.
Responsible investors buy x_{ri} shares in order to solve

$$\max_{x_{ri}} E[x_{ri}(f-P+\theta e)|\phi,\theta,\beta,P] - \frac{\gamma}{2}Var[x_{ri}(f-P+\theta e)|\Omega_{ri}]. \tag{4}$$

The definition of an equilibrium with rational expectations writes

Definition 1. *A rational expectations equilibrium entails a pricing rule $P(x)$, a total order flow x and individual demands for the firm's shares $x_{j\in\{nru,nri,ri\}}$ such that:*

i) Profit maximization: $x_j \in arg\max E[U(\pi_j)|\Omega_j]$.

ii) Total order flow: $x = \mu_{nru}x_{nru} + \mu_{nri}x_{nri} + \mu_{ri}x_{ri}$.

[22] The absolute concern for social responsibility could be modeled by rewriting the final payoffs of concerned investors as: $\pi_r = x_r(f - P + \theta) + \theta_a e$.

iii) Market price P set such that $x(P) = 1$.[23]

4 One Round of Trade

In a first step of the analysis, investors trade once. At $t = 1$, they post their demand for the firm's shares. When the market closes, they earn the returns of their shares and their utility realizes.

The equilibrium price equates the total demand stemming from all investors to the unitary supply of the firm's shares. It is a linear function of the private information held by the investors. More precisely, an equilibrium price will be given by $P = \phi + \lambda_\beta \beta + c$ (where parameters λ_β and c are derived in equilibrium). All investors correctly anticipate how the price is computed in equilibrium. In this context, how does information on the firm's externality, privately held by some investors, affect the equilibrium price of the firm's shares and the equilibrium demand of each type of investor?

4.1 The equilibrium demands

Recall that responsible investors are assumed to be informed. The first order conditions in $x_{j\in\{nru,nri,ri\}}$ of problems $(4)-(7)$ allow us to derive the optimal demand schedule of each investor j:

$$x_{nru} = \frac{E[f|\Omega_{nru}] - P}{\gamma Var[f|\Omega_{nru}]}, \tag{5}$$

$$x_{nri} = \frac{E[f|\Omega_{nri}] - P}{\gamma Var[f|\Omega_{nri}]}, \tag{6}$$

$$x_{ri} = \frac{E[f + \theta e|\Omega_{ri}] - P}{\gamma Var[f + \theta e|\Omega_{ri}]}. \tag{7}$$

Lemma 1 below summarizes the equilibrium features of the individual demands for shares of each type of investor.

[23] The certain supply of shares is normalized to unity.

Lemma 1. *An equilibrium with rational expectations on the market for the firm's shares entails individual demands x_j's that write*

$$x_{nru} = x_{nri} = \frac{\phi - P}{\gamma\sigma^2},$$

$$x_{ri} = \frac{\phi + \theta\rho_{e\beta}\beta - P}{\gamma(\sigma^2 + \theta^2\rho_{e\beta}\sigma^2_{ne})},$$

where $\rho_{e\beta} = \frac{\sigma^2_e}{\sigma^2_e + \sigma^2_{ne}}$ is the square of the correlation coefficient between the externality level e and the signal β.

Unsurprisingly, all demands are decreasing in the firm's share price. Informed and uninformed mainstream investors set the same equilibrium demand. They are essentially interested in the expected profits of their investment. The equilibrium demand of responsible investors has a responsible component which writes $\theta\rho_{e\beta}\ \beta$. It is scaled by the proximity parameter θ.

Responsible investors weigh a "traditional" financial risk and a social risk when they purchase the firm's shares, given their proximity θ to the firm's social performance. For any given level of risk aversion γ, their valuation of the firm involves a greater subjective variance than the valuation of the firm by mainstream investors. Using the vocabulary of the capital asset pricing model (CAPM), responsible investors account for a higher systematic risk (the "beta") than mainstream investors. The firm's beta now reflects a social risk $\theta^2(Var[e|\Omega_r])$ that increases as the precision of the social signal decreases. Therefore, mainstream and responsible investors ask for a different risk premium when they purchase shares.

Corollary 1. *The demand of mainstream investors is more responsive to variations of the firm's expected profitability than the demand of responsible investors:*

$$\frac{\partial x_{nr}}{\partial(E[f|\Omega_{nr}] - P)} = \frac{1}{\gamma\sigma^2} > \frac{1}{\gamma(\sigma^2 + \theta^2\rho_{e\beta}\sigma^2_{ne})} = \frac{\partial x_r}{\partial(E[f|\Omega_r] - P)}.$$

The higher responsiveness of mainstream investors is due to their mono–concern for the strictly financial proceeds of their investment. The bi–concern

of responsible investors, for financial proceeds on the one hand and social responsibility on the other, make their demand less elastic to the variations of the financial risk premium. An expected positive social performance ($\beta > 0$) compensates responsible investors for a lower expected financial performance.

4.2 The equilibrium price

The total supply of the firm's shares is normalized to one. In equilibrium, the price reflects the firm's externality because responsible investors manifest a specific concern for it.

Proposition 1. *There exists a unique fully revealing rational expectations equilibrium in the market for the firm's shares.*[24] *The equilibrium share price writes*

$$P = \phi + \beta \frac{\mu_r \sigma^2 \theta \rho_{e\beta}}{\mu_{nr} \theta^2 \rho_{e\beta} \sigma_{ne}^2 + \sigma^2} - \frac{\gamma \sigma^2 (\sigma^2 + \theta^2 \rho_{e\beta} \sigma_{ne}^2)}{\mu_{nr} \theta^2 \rho_{e\beta} \sigma_{ne}^2 + \sigma^2}. \tag{8}$$

Mainstream investors are not better off when they are socially informed than when they are not.

The preference for social responsibility impacts the price as the proximity motive partly drives the responsible investment. There is no problem of signal extraction and the equilibrium price fully reveals the social information β that helps responsible investors matching their portfolio to their concern. Compared to a situation without SRI, responsible firms are overvalued and irresponsible ones are undervalued. Whether informed or not, all investors rationally anticipate this pricing mechanism. There is no specific trading opportunity related to socially responsible investment.

All investors have the same interest ex ante in becoming informed about the social performance of the firm because they are equally informed about the

[24] If the respective shares of responsible and mainstream investors and the investors' risk aversion are common knowledge when investors take their portfolio decision, then the fully revealing equilibrium in the financial market is guaranteed to be unique, in the class of linear equilibria. See Muendler 2007.

firm's book value f.[25] If each investor j receives an individual and noisy signal ϕ_j on f, then each investor has a different appetency for the social information β ex ante. Indeed, each investor j's capacity to retrieve the true book to market value from the equilibrium share price depends upon his signal's precision. In this respect, the social signal β could compensate for a not so precise signal ϕ_j and help investor j better assessing f.

The equilibrium price reflects both the firm's expected financial and social performance, ϕ and β. When they acquire shares, mainstream investors pay a social premium if responsible investors expect a positive social performance ($\beta > 0$). They enjoy a social discount if responsible investors expect a negative social performance ($\beta < 0$). How does the equilibrium price vary when the proportion of responsible investors increases? A marginal increase of an optimistic ($\beta > 0$) responsible demand marginally increases the equilibrium price. A marginal increase of a pessimistic ($\beta < 0$) responsible demand marginally decreases the equilibrium price if and only if the social concern is high enough. This formally writes

Corollary 2. *The sensitivity of the equilibrium price to the share of responsible investment writes*

$$\frac{\partial P}{\partial \mu_r} = \frac{\sigma^2(\sigma^2 + \theta^2 \rho_{e\beta} \sigma_{ne}^2)}{(\mu_{nr} \theta^2 \rho_{e\beta} \sigma_{ne}^2 + \sigma^2)^2} \left(\gamma + \mu_{nr} \beta \theta \rho_{e\beta} \right).$$

For $\beta \geq 0$, $\frac{\partial P}{\partial \mu_r} \geq 0$.
For $\beta < 0$, $\frac{\partial P}{\partial \mu_r} \leq 0$ *if and only if* $\frac{\gamma}{-\mu_{nr} \rho_{e\beta} \beta} \leq \theta$.

Corollary 2 shows that the marginal power of stigmatization of an increasing proportion of responsible investment is lower than its marginal power of promotion. Stigmatization refers here to the social discount reflected by the share price of a socially under–performing firm ($\beta < 0$); promotion refers to the

[25] "Same" is a little strained in as much as responsible investors have a priori a greater interest in learning about the firm's social performance than mainstream investors. However, the strategic value of the social information is the same to all investors: it enables each of them to disentangle the social variations from the financial variations of the equilibrium price.

social premium reflected by the share price of a socially over–performing firm ($\beta > 0$).

Corollary 3. *In equilibrium, the marginal variation of the responsible (mainstream) demand following a change of the social signal is proportional to the relative number of mainstream (responsible) investors*

$$\left|\frac{\partial x_r}{\partial \beta}\right| = \frac{\mu_{nr}\theta\rho_{e\beta}(\sigma^2 + \theta^2\rho_{e\beta}\sigma_{ne}^2)}{\gamma(\mu_{nr}\theta^2\rho_{e\beta}\sigma_{ne}^2 + \sigma^2)}$$

$$\left|\frac{\partial x_{nr}}{\partial \beta}\right| = \frac{\mu_r\theta\rho_{e\beta}}{\gamma(\mu_{nr}\theta^2\rho_{e\beta}\sigma_{ne}^2 + \sigma^2)}.$$

Are these market–based mechanisms large enough for the financial market to encompass at all the specific concern of responsible investors? In terms of volumes, corollary 3 casts doubt on the ultimate efficiency of SRI. At the margin, SRI makes a difference on the financial market 1) the larger the responsible investors' social concern, 2) the more they are (or equivalently the larger their assets under management), 3) the better their social information. For instance, the French responsible funds Macif Gestion account for 50% the social criteria when they value an investment opportunity. This represents a very high concern θ. However, their assets under management are a mere 1.9 billion s, i.e. a drop in the oceanic financial market.

A firm that behaves responsibly produces a public good for which responsible investors are willing to pay, thus up to their concern θ. When more responsible investors enter the financial market, the extra demand for responsible shares tends to inflate the share price. The decrease in mainstream demand slows down the inflation but does not counterbalance it. The extra utility derived from investing in responsible firms cannot infinitely compensate for the disutility of paying an increasing social premium. At some point, responsible investors themselves decrease their equilibrium demand: $\frac{\partial^2 x_r}{\partial\beta\partial\mu_r} \leq 0$.

5 Two Rounds of Trade

In section 4, the equilibrium share price is fully revealing because there is no exogenous noise – such as a random supply of shares. Assume now that investors are active for two trading dates, 1 and 2. Prior to the first round of trade, some investors purchase a report ν from a social rating agency. This report is a noisy version of the social signal β given by:

$$\nu \equiv \beta + \epsilon_\nu$$

with $\epsilon_\nu \sim N(0, \sigma^2_{n\nu})$, a noise independent from all the other random variables.

The first round of trade occurs. Only the clients of the rating agency have an idea of the level of the firm's externality. Prior to the second round of trade, the signal β is revealed to all responsible investors for free. The second round of trade occurs at t=2. Payoffs realize at t=3.

The risk aversion γ_{ri} of responsible investors takes a low value γ_l or a high value γ_h (with $\gamma_l < \gamma_h$) with equal probability $\frac{1}{2}$. Importantly, γ_{ri} is unknown to mainstream investors. All mainstream investors have the same risk aversion γ that is common knowledge.

Let P_1 and P_2 and x^1_j and x^2_j denote the equilibrium price and investor j's demand at the successive dates 1 and 2. As in section 4, I look for equilibrium share prices that are linear functions of the private information held by the investors. More precisely:

$$\begin{aligned} P_1 &= \lambda_\phi \phi + \lambda_\nu(\gamma_{ri})\nu + c_1 \\ P_2 &= \phi + \lambda_\beta(\gamma_{ri})\beta + c_2. \end{aligned}$$

All investors expect the social information to impact the share's price. However, the random risk aversion of responsible investors makes it impossible to

uninformed investors to disentangle the respective effects of the risk aversion and the social information on the market positioning of responsible investors. Therefore, purchasing the date 1 social report is potentially valuable to mainstream investors who would better anticipate the impact (downward or upward) of responsible investment on the date 2 equilibrium price. This is true provided the price equations are linearly independent.

5.1 The equilibrium demands and prices

The equilibrium demands are computed by backward induction, following the steps exposed by Grundy and McNichols (1989).

At t=2, investor j computes the difference between i) his date 3 expectations of the firm's book value f and the firm's social performance e (if j is responsible), and ii) the market price P_2 at t=2. This difference is investor j's market opportunity. Given his date 1 holding, he sets his date 2 demand in order to solve the following problem

$$\max_{x_j^2} E\Big[-\exp[-\gamma_j(x_j^2\ (f+\iota\theta e - P_2) + x_j^1\ (P_2 - P_1))]|\Omega_j^2\Big] \tag{9}$$

where $\iota = 1$ if investor j is responsible and 0 otherwise.

At t=2, the equilibrium investor j's holding writes:

$$x_j^2 = \frac{E[f+\iota\theta e|\Omega_j^2] - P_2}{\gamma_j Var[f+\iota\theta e|\Omega_j^2]}. \tag{10}$$

The aggressiveness with which investor j exploits his market opportunity is determined by his risk aversion γ_j and the precision of his information Ω_j^2 at that date.

Lemma 2. *The equilibrium date 2 demands are similar to the equilibrium demands derived in the setup with a unique trading date.*

All mainstream investors have the same date 2 equilibrium demand for the firm's shares

$$x_{nr}^2 = \frac{\phi - P_2}{\gamma\sigma^2}.$$

All responsible investors have the same date 2 equilibrium demand for the firm's shares

$$x_r^2 = \frac{\phi + \theta\rho_{e\beta}\beta - P_2}{\gamma_{ri}(\sigma^2 + \theta^2\rho_{e\beta}\sigma_{ne}^2)}.$$

At t=1, investor j's problem is to set his demand given his anticipation of the future relations between his demand x_j^2, the price P_2, and the available signal β at t=2. At t=1, investor j maximizes the date 2 expected gains of equation 9, given his date 1 information set Ω_j^1. Formally, his problem at date 1 writes

$$\max_{x_j^1} E\Big[- \exp\Big[- \frac{(E[f + \iota\theta e|\Omega_j^2] - P_2)^2}{2Var[f + \iota\theta e \ - \ P_2|\Omega_j^2]} - \gamma_j \, x_j^1 \, (P_2 - P_1)\Big]|\Omega_j^1\Big]. \qquad (11)$$

The computation of the optimal demands at t=1 is tedious and is relegated to the Appendix. It writes

$$x_j^1 = \frac{E[\tilde{P}_2] - P_1}{\gamma_j \, G_j} \ - \ \frac{g_j(\phi + \iota\theta E[\tilde{e}] - E[\tilde{P}_2])}{\gamma_j \, G_j} \qquad (12)$$

where:

- $\tilde{e} = e|\Omega_j^1$, $\tilde{P}_2 = P_2|\Omega_j^1$,
- G_j and g_j are conditional variances and covariances of the date 2 equilibrium price P_2 (detailed in Appendix).

The date 1 equilibrium demand of investor j is set to profit from a change in prices between the trading dates 1 and 2 (first component of the sum 12). The difference in prices follows the dissemination of the signal β among responsible investors prior to the second trade. The aggressiveness with which investor j bets on this difference in prices is curbed by his aversion to risk of financial and possibly social losses at date 3 (second component of the sum 12). The anticipation of both the price variation and the expected returns from investing in the firm crucially depends upon the information set of investor j at date 1.

The date 1 and date 2 equilibrium demands allow to compute the equilibrium weights λ_ν and λ_β attached to the social information held by investors.

Proposition 2. *For a realization γ_{ri} of the responsible investors' risk aversion, a linear equilibrium with rational expectations is described by the following sequence of prices*

$$\begin{aligned} P_2 &= \phi + \frac{\mu_r \theta \rho_{e\beta} \gamma \sigma^2}{\mu_{nr}\gamma_{ri}(\sigma^2 + \theta^2 \rho_{e\beta}\sigma^2_{ne}) + \mu_r \gamma \sigma^2}\, \beta \\ &- \frac{\gamma\sigma^2\, \gamma_{ri}(\sigma^2 + \theta^2 \rho_{e\beta}\sigma^2_{ne})}{\mu_{nr}\gamma_{ri}(\sigma^2 + \theta^2 \rho_{e\beta}\sigma^2_{ne}) + \mu_r \gamma \sigma^2} \end{aligned}$$

$$P_1 = \lambda_\phi\, \phi + \lambda_\nu\, \nu + c_1.^{26}$$

The volatility of the difference in prices between the two trading dates 1 and 2 writes

$$Var[P_2 - P_1] = \lambda^2_\nu \sigma^2_{n\nu} + \lambda^2_\beta \sigma^2_\beta (1 + 2\frac{\lambda_\nu}{\lambda_\beta} + (\frac{\lambda_\nu}{\lambda_\beta})^2).$$

The volatility of the price swing decreases when both the social report ν and the intermediate signal β become more precise.

5.1.1 The value of being "responsibly" informed

Below is computed the unconditional expected utility $E[U(\pi_j)]$ of a mainstream investor $j = nri\ , nru$, i.e. before the latter reads the social agency's report ν he might have scheduled to receive.[27]

$$\begin{aligned} E[U(\pi_{nri})] &= -\sqrt{Var[E[\tilde{P}_2] - P_1]\Big[\frac{1}{Var[E[\tilde{P}_2] - P_1]} + \frac{2}{G_{nri}}\Big]^{-1}} \\ &\times \exp\Big[-\frac{1}{2}(\phi - E[\tilde{P}_2])^2\Big(\frac{1}{Var[\tilde{f} - \tilde{P}_2]} - \frac{g^2_{nri}}{G^2_{nri}}\Big[\frac{1}{Var[E[\tilde{P}_2] - P_1]} + \frac{2}{G_{nri}}\Big]^{-1}\Big)\Big] \end{aligned}$$

[26] The equilibrium weights in price P_1 are detailed in the Appendix.
[27] The steps of the computation are detailed in the appendix.

$$
\begin{aligned}
E[U(\pi_{nru})] &= -\sqrt{Var[E[\tilde{P}_2]-P_1]\Big[\frac{1}{Var[E[\tilde{P}_2]-P_1]}+\frac{2}{G_{nru}}\Big]^{-1}} \\
&\times \exp\Big[-\frac{1}{2}(\phi-E[\tilde{P}_2])^2\Big(\frac{1}{Var[\tilde{f}-\tilde{P}_2]}-\frac{g_{nru}^2}{G_{nru}^2}\Big[\frac{1}{Var[E[\tilde{P}_2]-P_1]}+\frac{2}{G_{nru}}\Big]^{-1}\Big)\Big]
\end{aligned}
$$

Before receiving any piece of social information, mainstream investors try to best anticipate two things. First, they bet on the variation in prices between the two trading dates. Informed mainstream investors better forecast the premium (discount) that socially responsible investors are willing to pay (ask in order to buy) to finance socially (non)responsible firms at date 2. This increases their unconditional expected utility. Second, they speculate on the date 3 financial proceeds f of their shares. The social report is here of no help in guessing the strictly financial performance of the firm. The pricing error of informed mainstream investors is smaller, which in turn reduces their unconditional expected utility. However, this decrease is of a second order compared to the expected speculative gains.

Proposition 3. *Prior to paying the price of the social report ν, mainstream investors who learn its content at date 1 have a greater unconditional expected utility than those who do not.*

The unconditional expected utility of a mainstream investor j is an increasing function of the pricing error $Var[f-P_2|\Omega_{nrj}^1]$. Indeed, large pricing errors allow the investors to enjoy a large discount (premium) when they buy (sell) the firms' shares.

The unconditional expected utility of a mainstream investor j is a decreasing function of the volatility of the difference in prices between the two trading dates, i.e. $\frac{\partial E[U(\pi_j)]}{\partial Var[E[\tilde{P}_2]-P_1]}<0$. Informed mainstream investors mistake less than uninformed mainstream investors when they anticipate the price swing between the trading dates 1 and 2. Therefore, $Var[E[P_2|\Omega_{nri}^1]-P_1]<Var[E[P_2|\Omega_{nru}^1]-P_1]$.

A greater proportion of uninformed trading in the first period reduces P_1's sensitivity to the social report privately held by investors of type ri and nri. This affects the appeal of being informed in two ways. First, it reinforces the individual benefit of an investor nri of better anticipating the variation of the social discount/premium between the two trading dates. Second, it makes the trading of the firm's shares less risky for uninformed investors, while it has an ambiguous effect for informed investors. This non-monotonic effect of a greater share of uninformed investment, μ_{nru}, is formalized below

Proposition 4. *Given an increase in the share of uninformed investment (μ_{nru} $\nearrow$)*

- *uninformed investors nru always benefit from being relatively more numerous;*
- *informed investors nri benefit from being relatively less numerous if and only if their expectation of the date 2 sensitivity to the social information β falls within the interval $[\lambda_\beta \rho^0_{\beta\nu}, \lambda_\beta \rho^1_{\beta\nu}]$.*

(Proof in the Appendix.)

The advantage of being informed is greater when the presence of uninformed and mainstream investors 1) makes the foreknowledge of the price effect of the firm's social performance worth it, 2) yet does not make the trading too risky because of a too large readjustment of the social discount/premium entailed by the equilibrium price between the two trading dates (i.e. when λ_ν differs too much from λ_β).

6 Conclusion

The present paper acknowledges the existence of a growing mass of responsible investors and focuses on the proximity motive that drives the latter's holdings' decision. It asks and answers the two following questions: how do the markets for firms' shares incorporate the social information privately held by responsible investors? Under which circumstances this information is worth purchasing by mainstream investors?

In the setup with a single round of market trade, information related to the social performance of firms has no anticipatory value to mainstream investors. Absent further noise on the financial market, the equilibrium share price fully reveals the signal about

the firm's social impact held by responsible investors. The latter are less responsive to the variations of the firms' financial profits than mainstream investors.

In the setup with two rounds of trade, information related to the social performance of firms is valuable to mainstream investors. Informed mainstream investors refine their first demand according to their better anticipation of the weight attached to the social information in the date 2 equilibrium price. Furthermore, the advantage of being informed is greater when the presence of uninformed and mainstream investors 1) makes the foreknowledge of the responsible investors' reaction to the social signal (received prior to the second trading date) worth it, 2) yet does not make the trading too risky because of a too large readjustment of the social discount/premium entailed by the equilibrium price between the two trading dates.

The Fisher separation theorem states that the firms' objective is the maximization of its present value, regardless of the preferences of its investors. According to Fisher, the management of the firm can choose between productive opportunities independently of the firm's owners preferences. After the redistribution of the firm's financial proceeds, the owners can maximize their utility according to their own preferences. Responsible investment questions this separation. It recognizes that markets for the firm's externalities are missing, especially in the social and governance fields. If so, responsible investors cannot correct these externalities outside the firm. They ought to "internalize" their preferences, either through managerial choices that reflect them, or through their choice of portfolio that will impact the firm's cost of capital. As it stands though, the present paper questions the social information diffusion as an efficient tool to correct such market failures.

Social rating agencies define and apply non–financial criteria to assess the social performance of companies. They produce grades and ratings out of them that help responsible investors choosing their portfolio. Notably, the production of social information (usually supplied as annual grades and qualitative reports) is prone to rapid and deep changes. The sector concentrates fast and increasingly diversifies its offer in order to cope with the investors' demand for a more frequently issued (at least at a monthly rate) corporate information. These two trends may surprise given the lack of unanimity over the definition of a "good" corporate social performance. They raise the question of how desirable a publicly enforced certification of RI could be. They certainly make the production of social corporate information a very interesting field

for future research.

TECHNICAL APPENDIX

Figure 1: Table of notations

Notations recapped	
Information and signals	
f	Firm's random book value. Distributed along $N(\varphi,\sigma^2)$.
e	Firm's random externality. Distributed along $N(0,\sigma_e^2)$.
θ	Private signal on e.
v	Report on θ. Privately sold to investors by a social rating agency.
$\varepsilon_e,\varepsilon_{nv}$	Respective noises attached to signal θ and v. Distributed along $N(0,\sigma_{ne}^2)$ and $N(0,\sigma_{nv}^2)$.
$\rho_{e\theta}$	Square of the correlation coefficient between variables e and θ.
Attributes	
γ	Investors' risk aversion (one round of trade).
γ_l, γ_h	Responsible investors' risk aversion (two rounds of trade).
ϑ	Responsible investors' concern for the firm's externality.
μ_j	Share of investors j=*nru, nri, ri* within the population of investors.
Ω_j^t	Information set of investor j, at date t=1,2.
Actions and payoffs	
x_j^t	Investor j's demand for the firm's shares at date t=1,2.
$\pi_j(x_j^t)$	Payoffs of investor j, given his date t demand x_j^t.
$E[U(\pi_j(x_j^t))\|\Omega_j^t]$	Expected utility of investor j conditional on his date t information.

A Computation of Equilibrium Demands

Date 1 equilibrium demands

I first solve for the date 1 maximization problem 11 of an informed and non responsible investor given the equilibrium date 2 demand derived in equation 10. The problem writes

$$\max_{x^1_{nri}} E\Big[-\exp\Big[-\frac{(E[f|\Omega^2_{nri}]-P_2)^2}{2Var[f-P_2|\Omega^2_{nri}]} - \gamma\, x^1_{nri}\,(P_2-P_1)\Big]|\Omega^1_{nri}\Big].$$

At date 1, there are two unknown variables in the above maximization problem: the price at date 2 and the financial liquidation value of the firm. They are denoted below $\tilde{P}_2$ and $\tilde{f}$ (with $\tilde{P}_2 = P_2|\Omega^1_{nri} = P_2|P_1,\nu$ and $\tilde{f} = f|\Omega^1_{nri} = P_2|P_1,\nu$) and are random at date 1. Both are normally distributed conditional on the investor's information set Ω^1_{nri}. Consider the following change of variables

$$x = -\gamma\, x^1_{nri}\,(\tilde{P}_2 - P_1),$$

$$y = \frac{E[f|\Omega^2_{nri}] - \tilde{P}_2}{\sqrt{2Var[\tilde{f}-\tilde{P}_2]}}.$$

x and y are normally distributed with means $\bar{x}$, $\bar{y}$ and variances σ_x^2, σ_y^2 that write

$$\bar{x} = -\gamma\, x^1_{nri}\,(E[\tilde{P}_2]-P_1)\ ,\ \sigma_x^2 = (\gamma\, x^1_{nri})^2 Var[\tilde{P}_2],$$

$$\bar{y} = \frac{E[f] - E[\tilde{P}_2]}{\sqrt{2Var[\tilde{f} - \tilde{P}_2]}}\ ,\ \sigma_y^2 = \frac{Var[E[f|\Omega_{nri}^2] - \tilde{P}_2]}{2Var[\tilde{f} - \tilde{P}_2]},$$

$$Cov(x,y) = \frac{-\gamma\ x_{nri}^1\ Cov(E[f|\Omega_{nri}^2] - \tilde{P}_2\ ,\ \tilde{P}_2)}{\sqrt{2Var[\tilde{f} - \tilde{P}_2]}}.$$

One can then apply the following lemma (see the technical appendix in Cespa and Foucault)

Lemma 3. *If x has a normal distribution with mean $\bar{x}$ and variance σ_x^2 and y has a normal distribution with mean $\bar{y}$ and variance σ_y^2, then*

$$E[\exp(x - y^2)] = \frac{1}{\sqrt{1 + 2\sigma_y^2}} \exp\Big(\bar{x} + \frac{\sigma_x^2}{2} - \frac{(\bar{y} + Cov(x,y))^2}{1 + 2\sigma_y^2}\Big).$$

An informed and non responsible investor therefore sets his date 1 demand in order to maximize the following rewritten problem 11

$$\begin{aligned}\max_{x_{nri}^1} \quad & \sqrt{\frac{Var[\tilde{f} - \tilde{P}_2]}{Var[\tilde{f} - \tilde{P}_2] + Var[E[f|\Omega_{nri}^2] - \tilde{P}_2]}} \\ \times \quad & \exp\Big[- \gamma x_{nri}^1 [E[\tilde{P}_2] - P_1] + (\gamma x_{nri}^1)^2 \frac{Var[\tilde{P}_2]}{2} \\ - \quad & \frac{(\phi - E[\tilde{P}_2] - \gamma x_{nri}^1 Cov(E[f|\Omega_{nri}^2] - \tilde{P}_2\ ,\ \tilde{P}_2))^2}{2(Var[\tilde{f} - \tilde{P}_2] + Var[E[f|\Omega_{nri}^2] - P_2])}\Big].\end{aligned}$$

The first order condition gives the equilibrium demand of an informed and non responsible investor:

$$x_{nri}^1 = \frac{E[\tilde{P}_2] - P_1}{\gamma\ G_{nri}}\ -\ \frac{g_{nri}(\phi - E[\tilde{P}_2])}{\gamma\ G_{nri}}$$

with $G_{nri} = Var[\tilde{P}_2] - \frac{Cov(E[f|\Omega_{nri}^2] - \tilde{P}_2\ ,\ \tilde{P}_2)^2}{Var[\tilde{f} - \tilde{P}_2] + Var[E[f|\Omega_{nri}^2] - \tilde{P}_2]}$
and $g_{nri} = \frac{Cov(E[f|\Omega_{nri}^2] - \tilde{P}_2\ ,\ \tilde{P}_2)}{Var[\tilde{f} - \tilde{P}_2] + Var[E[f|\Omega_{nri}^2] - \tilde{P}_2]}$.

The computation of the date 1 equilibrium demand of the mainstream and uninformed investors follows the same steps described above. Yet, these investors base their expectation of the equilibrium date 2 price on their sole knowledge of the equilibrium date 1 price and not the social report ν they did not purchase.

Going into the details of the computation of $E[\tilde{P}_2]^j$ and $Var[\tilde{P}_2]^j$ (with $j = nru, nri$), one finds

$$
\begin{aligned}
E[\tilde{P}_2]^{nri} &= \phi + c_2 + \frac{\lambda_\beta}{\lambda_\nu}\rho_{\beta\nu}\nu \\
Var[\tilde{P}_2]^{nri} &= \lambda_\beta^2 \rho_{\beta\nu}\sigma_{n\nu}^2 \\
E[\tilde{P}_2]^{nru} &= \phi + \bar{c_2} + \frac{Cov[P_2,P_1]^{nru}}{Var[P_1]^{nru}}(P_1 - E[P_1]^{nru}) \\
Var[\tilde{P}_2]^{nru} &= \sigma_\beta^2(\bar{\lambda_\beta} + Var[\lambda_\beta]) - \frac{Cov[P_2,P_1]^{2nru}}{Var[P_1]^{nru}}
\end{aligned}
$$

where $\bar{x} = E[x]$, $x = \lambda_\beta, c_2$. More precisely,

$$
\bar{\lambda_\beta} = \frac{\mu_r\theta\rho_{e\beta}\gamma\sigma^2}{2}\Big(\frac{1}{\mu_{nr}\gamma_h(\sigma^2+\theta^2\rho_{e\beta}\sigma_{ne}^2)+\mu_r\gamma\sigma^2} + \frac{1}{\mu_{nr}\gamma_l(\sigma^2+\theta^2\rho_{e\beta}\sigma_{ne}^2)+\mu_r\gamma\sigma^2}\Big)
$$

and

$$
\bar{c_2} = -\frac{1}{2}\Big(\frac{\gamma\sigma^2\ \gamma_l(\sigma^2+\theta^2\rho_{e\beta}\sigma_{ne}^2)}{\mu_{nr}\gamma_l(\sigma^2+\theta^2\rho_{e\beta}\sigma_{ne}^2)+\mu_r\gamma\sigma^2} + \frac{\gamma\sigma^2\ \gamma_h(\sigma^2+\theta^2\rho_{e\beta}\sigma_{ne}^2)}{\mu_{nr}\gamma_h(\sigma^2+\theta^2\rho_{e\beta}\sigma_{ne}^2)+\mu_r\gamma\sigma^2}\Big).
$$

From the investors' date 1 equilibrium demands, we retrieve the equilibrium price P_1 by solving for the market clearing condition that writes

$$
\mu_{nru}x_{nru}^1 + \mu_{nri}x_{nri}^1 + \mu_r x_r^1 = 1.
$$

Replacing the demands one finds

$$
\begin{aligned}
P_1 &= \phi\ \frac{\frac{\mu_{nru}}{\gamma G_{nru}} + \frac{\mu_{nri}}{\gamma G_{nri}} + \frac{\mu_r}{\gamma_k G_r}}{\frac{\mu_{nru}}{\gamma G_{nru}}(1 - \frac{g_{nru}Cov[P_2,P_1]^{nru}}{Var[P_1]^{nru}}) + \frac{\mu_{nri}}{\gamma G_{nri}} + \frac{\mu_r}{\gamma_k G_r}} \\
&+ \nu\ \frac{\frac{\mu_{nri}}{\gamma G_{nri}}\lambda_\beta\rho_{\beta\nu}(1-g_{nri}) + \frac{\mu_r}{\gamma_k G_r}(\lambda_\beta\rho_{\beta\nu} - g_r(\theta\rho_{e\nu} - \lambda_\beta\rho_{\beta\nu}))}{\frac{\mu_{nru}}{\gamma G_{nru}}(1 - \frac{g_{nru}Cov[P_2,P_1]^{nru}}{Var[P_1]^{nru}}) + \frac{\mu_{nri}}{\gamma G_{nri}} + \frac{\mu_r}{\gamma_k G_r}} \\
&+ \frac{c_2\Big[\frac{\mu_{nri}}{\gamma G_{nri}}(1+g_{nri}) + \frac{\mu_r}{\gamma_k G_r}(1+g_r)\Big] + \frac{\mu_{nru}}{\gamma G_{nru}}(1+g_{nru})\Big[\bar{c_2} - E[P_1]^{nru}\frac{Cov[P_2,P_2]^{nru}}{Var[P_1]^{nru}}\Big]}{\frac{\mu_{nru}}{\gamma G_{nru}}(1 - \frac{g_{nru}Cov[P_2,P_1]^{nru}}{Var[P_1]^{nru}}) + \frac{\mu_{nri}}{\gamma G_{nri}} + \frac{\mu_r}{\gamma_k G_r}}.
\end{aligned}
$$

B Proof of Proposition 3

Given the previous computation of the equilibrium date 1 demands, we replace x_j^1 in the expression for the mainstream investors' expected utility conditional on his date 1 information set

$$
E\Big[-\exp\Big[-(\frac{(\phi - E[\tilde{P}_2])^2}{2Var[f-P_2|\Omega_j^2]} - \frac{g_j(\phi - E[\tilde{P}_2])}{G_j}(E[\tilde{P}_2] - P_1) + \frac{(E[\tilde{P}_2]-P_1)^2}{G_j})\Big]|\Omega_j^1\Big].
$$

Setting $x = E[\tilde{P}_2] - P_1$, we can use the following lemma

Lemma 4. *Let x be a normally distributed random variable with mean zero and vari-*

ance σ^2 and let $W = c + bx + Ax^2$ where c, b and A are scalars. Then:

$$E[-\exp(-aW)] = -(\sigma^2(\frac{1}{\sigma^2} + 2aA)^{-1})^{0.5} \exp\Big(- a(c - \frac{1}{2}ab^2(\sigma^{-2} + 2aA)^{-1})\Big)$$

where

$$\begin{aligned} c &= \frac{(\phi - E[\tilde{P}_2])^2}{2Var[\tilde{f} - \tilde{P}_2]} \\ b &= -\frac{g_j(\phi - E[\tilde{P}_2])}{G_j} \\ A &= \frac{1}{G_j}. \end{aligned}$$

The unconditional expected utility of a mainstream investor j can then be retrieved as

$$\begin{aligned} E[U(\pi_j(x_j))] &= E[-\exp(-W)] \\ &= -\sqrt{Var[E[\tilde{P}_2] - P_1]\Big[\frac{1}{Var[E[\tilde{P}_2] - P_1]} + \frac{2}{G_j}\Big]^{-1}} \\ &\times \exp\Big[- \frac{1}{2}(\frac{(\phi - E[\tilde{P}_2])^2}{Var[\tilde{f} - \tilde{P}_2]} - \frac{g_j^2(\phi - E[\tilde{P}_2])^2}{G_j^2}\Big[\frac{1}{Var[E[\tilde{P}_2] - P_1]} + \frac{2}{G_j}\Big]^{-1})\Big] \\ &= -\sqrt{Var[E[\tilde{P}_2] - P_1]\Big[\frac{1}{Var[E[\tilde{P}_2] - P_1]} + \frac{2}{G_j}\Big]^{-1}} \\ &\times \exp\Big[- \frac{1}{2}(\phi - E[\tilde{P}_2])^2\Big(\frac{1}{Var[\tilde{f} - \tilde{P}_2]} - \frac{g_j^2}{G_j^2}\Big[\frac{1}{Var[E[\tilde{P}_2] - P_1]} + \frac{2}{G_j}\Big]^{-1}\Big)\Big] \end{aligned}$$

C Proof of Proposition 4

Variation of $E[U(\pi_j(x_j))]$ with respect to $Var[E[P_2|\Omega_j^1] - P_1]$

Consider the above expected unconditional utility as the product of two functions of $Var[E[P_2|\Omega_j^1] - P_1]$, $f(.)$ and $g(.)$. The partial derivative of $E[U(\pi_j(x_j))]$ with respect to $Var[E[P_2|\Omega_j^1] - P_1]$ then writes

$$\frac{\partial f(Var[E[P_2|\Omega_j^1] - P_1])}{\partial Var[E[P_2|\Omega_j^1] - P_1]}\, g(.) \;+\; f(.)\, \frac{\partial g(Var[E[P_2|\Omega_j^1] - P_1])}{\partial Var[E[P_2|\Omega_j^1] - P_1]} = f'g + fg'.$$

With

$$\begin{aligned} f(Var[E[P_2|\Omega_j^1] - P_1]) &= -\sqrt{Var[E[\tilde{P}_2] - P_1]\Big[\frac{1}{Var[E[\tilde{P}_2] - P_1]} + \frac{2}{G_j}\Big]^{-1}} \\ g(Var[E[P_2|\Omega_j^1] - P_1]) &= \exp\Big[- \frac{1}{2}(\phi - E[\tilde{P}_2])^2\Big(\frac{1}{Var[\tilde{f} - \tilde{P}_2]} - \frac{g_j^2}{G_j^2}\Big[\frac{1}{Var[E[\tilde{P}_2] - P_1]} + \frac{2}{G_j}\Big]^{-1}\Big)\Big]. \end{aligned}$$

After some computations, one finds that

$$\begin{aligned}
f'g &= -\frac{1}{2}\Big[\frac{1}{Var[E[\tilde{P}_2]-P_1]}+\frac{2}{G_j}\Big]^{-\frac{1}{2}}\Big(1+\frac{1}{Var[E[\tilde{P}_2]-P_1]}\Big[\frac{1}{Var[E[\tilde{P}_2]-P_1]}+\frac{2}{G_j}\Big]^{-1}\Big)^{-\frac{1}{2}} \\
&\times \exp\Big[-\frac{1}{2}(\phi-E[\tilde{P}_2])^2\Big(\frac{1}{Var[\tilde{f}-\tilde{P}_2]}-\frac{g_j^2}{G_j^2}\Big[\frac{1}{Var[E[\tilde{P}_2]-P_1]}+\frac{2}{G_j}\Big]^{-1}\Big)\Big] \\
fg' &= -\sqrt{Var[E[\tilde{P}_2]-P_1]\Big[\frac{1}{Var[E[\tilde{P}_2]-P_1]}+\frac{2}{G_j}\Big]^{-1}} \\
&\times \frac{1}{2}(\phi-E[\tilde{P}_2])^2\frac{g_j^2}{G_j^2}\frac{1}{Var[E[\tilde{P}_2]-P_1]}\Big[\frac{1}{Var[E[\tilde{P}_2]-P_1]}+\frac{2}{G_j}\Big]^{-2} \\
&\times \exp\Big[-\frac{1}{2}(\phi-E[\tilde{P}_2])^2\Big(\frac{1}{Var[\tilde{f}-\tilde{P}_2]}-\frac{g_j^2}{G_j^2}\Big[\frac{1}{Var[E[\tilde{P}_2]-P_1]}+\frac{2}{G_j}\Big]^{-1}\Big)\Big].
\end{aligned}$$

Since both terms of the derivative are negative, then the partial derivative of $E[U(\pi_j(x_j))]$ with respect to $Var[E[P_2|\Omega_j^1]-P_1]$ is also negative. Therefore, the expected unconditional utility of a mainstream investor j – whether informed or not – is a decreasing function of the volatility of the difference in prices between the two trading dates.

Variation of $E[U(\pi_j(x_j))]$ with respect to μ_{nru}

The partial derivative of the date 1 equilibrium price's sensitivity to social information with respect to the share of uninformed mainstream investment is first derived

$$\begin{aligned}
\frac{\partial\lambda_\nu}{\partial\mu_{nru}} &= -\frac{1-g_{nru}\frac{Cov(P_2,P_1)^{nru}}{Var[P_1]^{nru}}}{\gamma G_{nru}} \\
&\times \frac{\frac{\mu_{nri}}{\gamma G_{nri}}\lambda_\beta\rho_{\beta\nu}(1-g_{nri})+\frac{\mu_r}{\gamma_k G_r}(\lambda_\beta\rho_{\beta\nu}-g_r(\theta\rho_{e\nu}-\lambda_\beta\rho_{\beta\nu}))}{\Big(\frac{\mu_{nru}}{\gamma G_{nru}}(1-\frac{g_{nru}Cov[P_2,P_1]^{nru}}{Var[P_1]^{nru}})+\frac{\mu_{nri}}{\gamma G_{nri}}+\frac{\mu_r}{\gamma_k G_r}\Big)^2}
\end{aligned}$$

This partial derivative is negative provided that $\theta\leq\bar{\theta}$, with $\bar{\theta}$ such that $\frac{\mu_{nri}}{\gamma G_{nri}}\lambda_\beta\rho_{\beta\nu}(1-g_{nri})+\frac{\mu_r}{\gamma_k G_r}(\lambda_\beta\rho_{\beta\nu}-g_r(\theta\rho_{e\nu}-\lambda_\beta\rho_{\beta\nu}))=0$. Furthermore,

$$\begin{aligned}
Var[E[P_2|\Omega_{nru}]-P_1] &= \Big(\frac{Cov(P_2,P_1)^{nru}}{Var[P_1]^{nru}}\Big)^2 Var[P_1-E[P_1]^{nru}]+\lambda_\nu^2\sigma_\nu^2 \\
&+ 2\lambda_\nu\Big(\frac{Cov(P_2,P_1)^{nru}}{Var[P_1]^{nru}}\Big)Cov[\nu,P_1-E[P_1]^{nru}] \\
Var[E[P_2|\Omega_{nri}]-P_1] &= \Big(\frac{\lambda_\beta}{\lambda_\nu}\rho_{\beta\nu}-\lambda_\nu\Big)^2\sigma_\nu^2.
\end{aligned}$$

$Var[E[P_2|\Omega_{nru}]-P_1]$ is monotonically increasing in λ_ν. Therefore, $Var[E[P_2|\Omega_{nru}]-P_1]$ is monotonically decreasing in μ_{nru}, provided $\theta\leq\bar{\theta}$.

By contrast, $Var[E[P_2|\Omega_{nri}]-P_1]$ is not a monotonic function of λ_ν. It is decreasing if $\lambda_\beta\rho_{\beta\nu}\in[0,\lambda_\beta\rho^0_{\beta\nu}]\cup[\lambda_\beta\rho^1_{\beta\nu},1]$ and increasing if $\lambda_\beta\rho_{\beta\nu}\in[\lambda_\beta\rho^0_{\beta\nu},\lambda_\beta\rho^1_{\beta\nu}]$. $\lambda_\beta\rho^0_{\beta\nu}$ and $\lambda_\beta\rho^1_{\beta\nu}$ are the two positive roots of the following polynomial equation

$$\lambda_\nu^2-\lambda_\beta\rho_{\beta\nu}=0.$$

If the expected social discount/premium of the date 2 equilibrium price is very low or very large (in absolute terms), then informed investors are ex ante better off when the share of uninformed mainstream investment decreases, ceteris paribus. If the expected social discount/premium of the date 2 equilibrium price falls within a range of intermediate values, then informed investors are ex ante better off when the share of uninformed mainstream investment increases, ceteris paribus.

Provided that $\theta \leq \bar{\theta}$, then λ_ν is a decreasing function of the proportion of uninformed mainstream investment μ_{nru}. As the share of uninformed mainstream investment, μ_{nru}, becomes more prevalent, the date 1 equilibrium price's sensitivity to the expected social performance of the firm, λ_ν, decreases. It can further be shown that $\frac{\partial Var[E[P_2|\Omega^1_{nru}]-P_1]}{\partial \lambda_\nu} > 0$, implying that when the price's sensitivity to the social performance of the firm increases, so does the variance of the difference in prices. Therefore, uninformed mainstream investors are always better off when their weight on the market for the firm's shares increases.

By contrast, $Var[E[P_2|\Omega^1_{nri}] - P_1]$ is not monotonic in λ_ν. More precisely, if $\lambda_\beta \rho_{\beta\nu} \in [0, \lambda_\beta \rho^0_{\beta\nu}] \cup [\lambda_\beta \rho^1_{\beta\nu}, 1]$, then $\frac{\partial Var[E[P_2|\Omega^1_{nri}]-P_1]}{\partial \lambda_\nu} < 0$ and informed and mainstream investors are better off when the proportion of uninformed and mainstream trading decreases ceteris paribus. If $\lambda_\beta \rho_{\beta\nu} \in [\lambda_\beta \rho^0_{\beta\nu}, \lambda_\beta \rho^1_{\beta\nu}]$, then $\frac{\partial Var[E[P_2|\Omega^1_{nri}]-P_1]}{\partial \lambda_\nu} > 0$ and informed and mainstream investors are better off when the proportion of uninformed and mainstream trading increases ceteris paribus.

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