Communication of Soft Information: Reputation and 
Imperfect Enforcement of Reporting Quality*

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Abstract

Entrepreneurs report unverifiable soft information to investors. The credibility of soft information depends on the entrepreneur’s reputation. In equilibrium, high-talent entrepreneurs, who are better at developing profitable projects in the future and therefore have stronger reputation concerns, signal their talents by producing honest reports on current projects. We show how probabilistic third-party enforcement of reporting quality changes some firms’ reporting strategies, which again spill over to the financing costs of firms not directly affected by improved enforcement. In some cases, improved enforcement of reporting quality can reduce firms’ reputation concerns and result in less efficient communication of information.

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1 Introduction

Information from an entrepreneur to investors, such as sales forecasts or progress reports of investment projects, contains soft information, which is hard to verify. The credibility of the reports depends on the sender’s reputation.\(^1\)

Consider for instance an entrepreneur managing a biotechnology project. As the project progresses, the entrepreneur produces reports and investors update their beliefs on how likely the project succeeds. If it turns out that the project is less promising than initially thought, the project may be liquidated and some of the investments are saved. However, since the entrepreneur and investors often have different incentives, the credibility of progress reports is an important issue. Even after the outcome of a research project is known, it might be difficult to assess whether the progress reports were truthful. In our setting, an entrepreneur’s reputation in the financial market is shaped by previous progress reports and outcomes of completed projects. We show that, in equilibrium, high-talent entrepreneurs, who are better at discovering and developing profitable projects, signal their talents by producing honest reports on current projects. Entrepreneurs are willing to take short-term losses associated with making an honest report on bad current projects if they are compensated by obtaining better reputation and less expensive financing in the future. Future financing costs are most important for high-talent entrepreneurs, and we examine an equilibrium where only high-talent entrepreneurs make honest reports on current projects.

To capture the fact that soft information is hard to verify and that entrepreneurs are concerned about their reputations, we introduce a two-period cheap-talk model with the following main features. The entrepreneurs are heterogeneous and characterized by their different talents, which in our setting is their probabilities of finding good investment projects. Talent is constant over time and private information of the entrepreneur. At the beginning of each period, the entrepreneur approaches potential creditors for financing.\(^2\) After a project is financed, the entrepreneur privately observes whether the project has a high or low probability of success. Consequently, at this stage, the model contains two types of private information: entrepreneur talent and the current project’s probability of success. A project with a high probability

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\(^1\)See Jennings (1987) for an early examination of how credibility of earnings forecasts varies across firms. Ng et al. (2013) discuss the more recent literature on credibility of reporting of nonverifiable information.

\(^2\)By considering an entrepreneurial firm we abstract from managerial contracts between owners and managers. See Bergstrasser and Philippon (2006) and Goldman and Slezak (2006) for discussions of how compensation of managers influences managers’ reporting of information.
of success is worth continuing, but one with low probability of success should be liquidated. The entrepreneur reports the probability of success to creditors. However, since information on success probability is unverifiable, nothing (apart from reputation concerns) prevents the entrepreneur from misreporting it. The outcome of a project, on the other hand, is verifiable and contractible. The financial market uses the report and the project outcome to update their beliefs about the entrepreneur.

If the entrepreneur privately observes that the project has a low probability of success, he faces the temptation to misreport in order to continue the project. On the other hand, if he reports truthfully, he builds a reputation for being honest which will be associated with high talent in equilibrium.

Low-talent entrepreneurs are less likely to succeed and repay debt in the future, and consequently they are less concerned about building their reputation in order to reduce interest rates. In equilibrium, high-talent entrepreneurs signal their talent by making truthful reports on current projects. This implies that reports on *current* projects signal information about the entrepreneurs’ talent.

Firstly, we adapt the model of Choi et al. (2010), which considers preannouncing new products to our setting where an entrepreneur reports soft information to lenders. We derive the following results: i) Reputation concerns induce high-talent entrepreneurs to report *truthfully*, while low-talent entrepreneurs misreport bad projects. ii) Because financial markets have coarse information about individual entrepreneurs, they categorize entrepreneurs into different groups based on observable characteristics and past reporting. Individual entrepreneurs’ reporting strategies spill over onto comparable entrepreneurs’ financing costs. We investigate the spillover effects from one entrepreneur’s reporting strategy on other entrepreneurs’ financing costs.

Secondly, we introduce probabilistic enforcement of reporting quality. Misreporting is detected and penalized with a positive probability. Misreporting is detected by both standard corporate governance actors like investors, the SEC, and auditors, and also nontraditional actors like employees, the media, and industry regulators (Dyck et al. (2010)). In order to increase the detection probability, legal regulation in several countries has recently been strengthened in order to improve quality and credibility of reports. We contribute to the literature by in-

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3In addition to reducing interest rates, reputation can also determine the amount of funds available to the entrepreneur. This is a straightforward extension of our model in which highly reputed entrepreneurs benefit from lower interest rates as well as from running larger projects. In this way our results carry over to a model of staged financing, where the entrepreneur obtains the next round of financing depending on progress reports. See for instance Cornelli and Yosha (2003) for a discussion of staged financing and reporting incentives.
vestigating how reputation concerns and public enforcement of reporting quality jointly induce entrepreneurs to report honestly. We show that better enforcement of reporting quality has an ambiguous effect on entrepreneurs’ reputations and financing costs. For instance, better enforcement will induce a larger set of entrepreneur types to report honestly about bad projects, which implies that honest reporting yields a smaller boost to reputation. More generally, we investigate how improved enforcement changes some firm types’ reporting strategies, and how firm types not directly influenced by improved enforcement face higher or lower financing costs. Furthermore, we show that better enforcement may reduce the disciplinary effect of reputation concerns. In some cases improved enforcement probability crowds out reputation concerns, which again implies less honest reporting and possibly less financing to talented entrepreneurs starting their second project. Thus, economic surplus might decrease by better enforcement.

1.1 Related literature

The main branch of the disclosure literature considers a firm that chooses between either truthfully disclosing private information or not making a disclosure. This literature started with Grossman and Hart (1980), Grossman (1981), and Milgrom (1981), who developed a "full-disclosure theorem" in a setting where all informed agents know their types perfectly and disclosure is costless. Javanovic (1982) and Verrecchia (1983) showed how costly reporting prevents unraveling and full disclosure, and Dye (1985) showed how uncertainty regarding whether the agent is informed also prevents full-disclosure. Recently this literature has been further developed by Beyer and Dye (2012) to incorporate reputation concerns and by Guttman et al. (2014) to consider multiple signals. The assumption that a firm choosing to report must report truthfully can be justified in settings where misreporting is detected with a high probability and penalized. A smaller branch of the disclosure literature considers the possibility that enforcement is weak and firms are tempted to misreport information. This literature builds on Crawford and Sobel (1982) and examines how "cheap talk" can be made credible when lying is not penalized and receivers and senders have (partly) conflicting objectives. This approach is developed in the accounting literature by Gigler (1994) and Newman and Sansing (1993) who discuss announcements in a cheap-talk setting with two recipients (investors and

4Related game-theory literature examines how senders in a cheap-talk game can build a reputation for being of a particular type (Sobel (1985), Benabou and Laroque (1992), and Morris (2001)). In these papers one sender type is assumed to be honest or have the same incentives as the receiver. We depart from this approach by allowing all sender types to have misaligned incentives with the receiver (i.e. all entrepreneur types want to continue projects).
competitors). They show that the existence of a second receiver of information may facilitate informative communication even though misreporting is not penalized. We also adopt a cheap-talk game framework; however, we investigate how senders’ reputation concerns can induce honest reporting and extend the model to allow for probabilistic detection and punishment of cheating.

Stocken (2000) is the first paper to study how reputation concerns can discipline firms’ reporting of accounting information when misreporting is costless (cheap-talk) and outside verification of information is impossible.\(^5\) Since Stocken assumes that all firms are ex ante identical and draw new projects from the same probability distribution, there is no updating or learning about firm type over time. In contrast, we allow entrepreneurs to have different talents to discover good projects (entrepreneurs draw projects from different probability distributions) and examine how an entrepreneur’s reporting strategy, together with realized project outcomes, reveals information about the entrepreneur’s talent. This modelling approach builds on Choi et al. (2010) which examines the credibility of firms’ product pre-announcements in a similar repeated cheap-talk model as studied here. Although reputation concerns induce honest product pre-announcements in the same way as reputation concerns induce honest reporting in this paper, the set of questions asked here are different and we introduce probabilistic public enforcement of reporting quality and study the interaction of enforcement and reputation concerns.

A growing literature examines how enforcement and mandatory reporting relates to funding costs and market liquidity (Lambert et al. (2007)). We introduce an explicit model of probabilistic enforcement (similar to Ellingsen and Kristiansen (2011)) to examine how better enforcement changes firms’ financing costs and how the quality of enforcement interacts with firms’ reputation concerns. Better enforcement induces more firm types to make honest reports which in turn has heterogenous effects on firms’ financing costs. Similar to Gao (2010), we shed light on empirical studies reporting mixed results on the connection between firm financing costs and disclosure quality (Healy and Palepu (2001)) by highlighting the heterogenous effects depending on firm types.

The rest of the paper proceeds as follows. Section 2 introduces the two-period cheap-talk model. Section 3 examines the partially informative equilibrium. Since this Section builds on...
Choi et al. (2010) we have relegated parts of the formal analysis to Appendix A. Section 4 discusses probabilistic enforcement of reporting quality. Section 5 discusses some of our key assumptions. Section 6 draws conclusions. All proofs are in Appendix A.

2 A model

We construct a two-period cheap-talk model. In each period, the entrepreneur has a project that requires investment $I$ and no own funds. We assume that projects are financed by standard debt and that the entrepreneur holds equity. This capital structure is common for young firms.

Competing creditors offer debt contracts which describe how much the entrepreneur must repay in order to borrow $I$. The contract includes a covenant that allows for efficient liquidation. More specifically, the project can be liquidated if new information reveals that the project is bad and yields negative net present value if continued.

A project has two feasible final outcomes. A successful project is worth $V$, whereas a failure is worth $0$. After the investment is made, but before the project is completed, a project can be liquidated. In this case, the creditors get the liquidation value $L$, where $L \leq I$.

Projects differ in their probabilities of success. A good project ($G$) succeeds with probability $p_G$, whereas a bad project ($B$) succeeds with probability $p_B$ ($< p_G$). We assume $p_B V < L < p_G V$ which implies that a bad project should be liquidated while a good project should be continued. A good project has positive net present value; $p_G V > I$.

Let $\theta \in [0, 1]$ be the entrepreneur’s type. In each period an entrepreneur of type $\theta$ draws a $G$ project with probability $\theta$ and a $B$ project with probability $1 - \theta$. The distribution of the entrepreneur types is given by distribution function $F(\cdot)$. The entrepreneur knows his own type, $\theta$, while creditors know only the distribution of $\theta$. The entrepreneur observes whether he has a good or bad project after the investment decision and before the liquidation decision is made. After observing the success probability of the project, he chooses whether to report project quality truthfully or misreport it to the creditors. Depending on the reported information, the creditors decide whether to continue or liquidate the project. The timeline of each project is summarized in Figure 1.

FIGURE 1 ABOUT HERE

There is uncertainty about the final outcome of both $B$ and $G$ projects. Consequently, it is infeasible to distinguish bad luck from deliberate misreporting by comparing the reported
information with the project outcome. In an extension of the model, there is probabilistic enforcement and misreporting is detected and penalized with a positive probability (see Section 4).

To simplify the analysis, we make the following assumptions:

**Assumption 1** (All entrepreneurs types will report honestly on G projects)

\[
p_G \left( V - \frac{I}{\mu} \right) + p_G \left[ p_G \left( V - \frac{I}{\mu_2(S)} \right) + (1 - p_G) \left( V - \frac{I}{\mu_2(F)} \right) \right] > p_G V - I
\]  
(1)

Probability \( \overline{\mu}_1 \) denotes the expected probability of success in period 1, \( \mu_2(S) \) denotes the expected probability of success in period 2 conditional on success in period 1 and \( \mu_2(F) \) denotes the expected probability of success in period 2 conditional on failure in period 1. In a competitive credit market an entrepreneur has to repay \( I \) in case of success. All probabilities are calculated by using Bayes’ rule and assuming that there is no informative reporting on project qualities (either no reporting or all report the same project quality independent of the true quality);\(^6\)

\[
\overline{\mu}_1 = \int_0^1 \left[ p_B + \theta (p_G - p_B) \right] dF(\theta),
\]  
(2)

\[
\mu_2(S) = \frac{\int_0^1 \left[ p_B + \theta (p_G - p_B) \right]^2 dF(\theta)}{\int_0^1 p_B + \theta (p_G - p_B) dF(\theta)},
\]

\[
\mu_2(F) = \frac{\int_0^1 \left[ \theta (1 - p_G) + (1 - \theta) (1 - p_B) \right] \left[ p_B + \theta (p_G - p_B) \right] dF(\theta)}{\int_0^1 \theta (1 - p_G) + (1 - \theta) (1 - p_B) dF(\theta)}.
\]

We will later see that Assumption 1 implies that the entrepreneur’s gain from completing a G project in the first period (represented by the left hand side of the inequality) exceeds a possible reputation gain from reporting B (while having a G project) in the first period in order to reduce second-period borrowing cost (the right hand side of the inequality). Note that the assumption holds if the value of a successful project \( V \) is sufficiently large compared to the investment \( I \). The assumption simplifies the analysis by letting us focus on possible misreporting of B projects and rules out misreporting of G projects.

**Assumption 2** (There exists an interval of highly talented entrepreneur types who report

\(^6\)Note that \( p_G > \mu_2(S) > \mu_2(F) > p_B \) since a success in the first period implies a positive updating of expected entrepreneur quality \( \theta \) before the second period starts, while a failure in the first period implies a negative updating of entrepreneur quality.
honestly on B projects)

\[ (p_G V - I) - \left[ p_B \left( V - \frac{I}{\mu_1} \right) + p_G \left( V - p_B \frac{I}{\mu_2} (S) - (1 - p_B) \frac{I}{\mu_2} (F) \right) \right] > 0. \] (3)

Assumption 2 ensures that (in equilibrium) the most talented entrepreneur types always will gain more in the second period than the loss from liquidation of a B project in the first period.

To focus on the interaction of borrower reputation and soft information, the model abstracts from long-term contracting. The lenders cannot commit to provide financing on other terms than market terms when the second project starts. We also assume that the potential profit from the first project is consumed before the entrepreneur starts the second project. The only intertemporal linkage is the information about the report and outcome of the first project.

3 Analysis

We are searching for an equilibrium in which the entrepreneur balances short-term gains from misreporting (avoiding liquidation) against long-term gains associated with a higher reputation and lower financing costs in the future. To understand the forces leading to this equilibrium, let us briefly consider alternative outcomes. If a negative report did not lead to liquidation of the current project, all entrepreneur types would have produced reports that lead to the highest possible reputation; consequently, since all types make identical reports, they are all uninformative. Furthermore, note that if all entrepreneurs benefit equally from improved reputation, either all or none of the entrepreneurs will report honestly. To make reports informative about entrepreneur types, some entrepreneur types must benefit more than others. In our model, the high-quality entrepreneurs benefit more than low-quality entrepreneurs, because they are more likely to repay debt and therefore benefit more from having low interest rates.

The game we are considering is a game of incomplete information where creditors’ beliefs about the entrepreneur type (reputation) are derived by Bayes’ rule whenever possible. We are searching for a perfect Bayesian equilibrium (PBE) where all players’ strategies are sequentially optimal given their beliefs.\(^7\)

\(^7\)As in any model of cheap talk, we always have a babbling equilibrium, in which the cheap talk has no
We analyze how reputation is formed in equilibrium and how the concern over reputation affects cheap talk. As usual, we proceed by using backward induction to derive the informative equilibrium.

3.1 Second investment project

The second investment project constitutes the last interaction with creditors. As a result, the entrepreneur does not have any reputational concerns and will simply seek to maximize his current profit. Note that if the project is liquidated, the creditor captures the liquidation value \( L \), and the entrepreneur gets zero. On the other hand, if the project is continued and succeeds, the entrepreneur repays the loan and keeps the residual. Consequently, all entrepreneur types have incentives to report \( G \) in order to continue the project, which again renders second-period reports uninformative.

The relevant history for creditors at the start of the second period is \( h_2 = (m_1, r_1) \), where \( m_1 \in \{G, B\} \) (Good or Bad) and \( r_1 \in \{S, F\} \) (Success or Failure) are the reported quality and the realized outcome of the first project, respectively. Note that if the entrepreneur reports \( B \) in the first period, the project is liquidated and no final outcome is realized. In this case, the relevant history for creditors in the second project is \( h_2 = (B) \). Hence there are three possible histories at the start of the second project; \( h_2 \in \{(G, S), (G, F), (B)\} \). Since only \( G \) projects will be continued we can simplify the notation; \( h_2 \in \{S, F, B\} \). As a result, at the beginning of the second period, creditors will have history-dependent beliefs \( \mu_2(h_2) \) about the second project’s success probability.

As the entrepreneur never reports negative information about the second project, the second project will never be liquidated. Thus in order to break even creditors must require

\[
D_2(\mu_2) = \frac{I}{\mu_2(h_2)}
\]

in repayment if the project succeeds. If the project fails, creditors receive nothing. Unless stated otherwise we assume that for all possible \( h_2 \), the entrepreneur can obtain financing in the second period, \( V \geq I/\mu_2(h_2) \).\(^8\) The repayment depends on creditors’ beliefs about the success probabilities of the project \( (\mu_2) \). The face value of debt, \( D_2(\mu_2) \), is decreasing in the meaning and is rationally ignored by the receiver.

\(^8\)In Section 4 we examine the case where imperfect public enforcement of reporting quality may make some entrepreneurs unable to obtain financing in the second period.
entrepreneur’s reputation.

Given the creditors’ beliefs $\mu_2$, the expected profit for an entrepreneur of type $\theta$ is:

$$\pi_2(\theta) = [p_B + \theta (p_G - p_B)] [V - D_2(\mu_2)].$$

(4)

Note that entrepreneurs with high $\theta$ are more likely to have a successful project and repay debt, $D_2(\mu_2)$. Thus, high-$\theta$ entrepreneurs benefit most from improving reputation $\mu_2$, and thereby reducing $D_2(\mu_2)$.

**Lemma 1** The second-period profit satisfies the Spence-Mirrlees single crossing property;

$$\frac{\partial^2 \pi_2(\theta)}{\partial \theta \partial \mu_2} > 0.$$  

(5)

This property allows us to establish a partially informative equilibrium where some types report honestly in the first period.

### 3.2 First investment project

Let $m_1(v_1; \theta)$ denote the message of a type $\theta$ entrepreneur when he knows that the first project is of quality $v_1 \in \{G, B\}$. As is typical in any cheap-talk game, we have a so-called babbling equilibrium in which the cheap talk has no meaning and is rationally ignored by the receiver. Here, we are interested in the existence of informative equilibrium in which the message sent by the entrepreneur can convey meaningful information and thus affect the creditor’s liquidation decision in the first period.

Our first step is to characterize an informative equilibrium.

**Lemma 2** In any informative equilibrium, there exists a threshold type $\hat{\theta}$ such that any type higher than $\hat{\theta}$ reveals the project quality truthfully whereas any type less than $\hat{\theta}$ always report the project quality as $G$;

$$m_1(v_1; \theta) = v_1 \text{ for } \theta \geq \hat{\theta}$$

$$m_1(v_1; \theta) = G \text{ for } \theta < \hat{\theta}.$$

(6)

In other words, all entrepreneurs with $G$ projects report truthfully. If an entrepreneur has a $B$ project, then there is a cut-off such that types $\theta > \hat{\theta}$ truthfully report $B$, whereas types

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9 Note that $\frac{\partial^2 \pi_2(\theta)}{\partial \theta \partial \mu_2} = - (p_G - p_B) \frac{\partial D_2(\mu_2)}{\partial \mu_2} > 0.$
\( \theta < \hat{\theta} \) report \( G \) in order to induce the creditors to continue the project. We will provide a condition which ensures that the threshold \( \hat{\theta} \) is unique.

The threshold property described in Lemma 2 enables us to describe how creditors use entrepreneurs’ reports to update their belief about success probabilities. We denote creditors’ beliefs by \( \mu_1(m_1; \hat{\theta}) \) when the entrepreneur is expected to adopt the cut-off rule of \( \hat{\theta} \), where \( m_1 \in \{ G, B \} \) is the report about the first project. By applying Bayes’ rule, we can derive creditors’ beliefs based on the report:

\[
\begin{align*}
\mu_1(B; \hat{\theta}) &= p_B \\
\mu_1(G; \hat{\theta}) &= \frac{\text{Pr(success in first project and report G)}}{\text{Pr(report G)}} \\
&= \frac{\int_{\hat{\theta}}^{\theta} [p_B + \theta (p_G - p_B)] dF(\theta) + \int_{\hat{\theta}}^{1} p_G \theta dF(\theta)}{\int_{\hat{\theta}}^{1} \theta dF(\theta)}.
\end{align*}
\]

Notice that if all entrepreneur types misreport when they have a \( B \) project, then there is no information associated with reporting \( G \) and \( \mu_1(G; \hat{\theta} = 1) = \overline{\mu}_1 \), where \( \overline{\mu}_1 \) is the success probability in the absence of informative cheap talk (see equation (2)).

Since a project is continued only when the entrepreneur reports \( G \), the probability of continuing the first project is given by

\[
\text{Pr}(G; \hat{\theta}) = 1 - \int_{\hat{\theta}}^{1} (1 - \theta) dF(\theta)
\]

where the integral represents the probability for a \( B \) report from an entrepreneur with \( \theta \in \left[ \hat{\theta}, 1 \right] \). The face value of the first loan, \( D_1 \left( \mu_1 \left( G; \hat{\theta} \right) \right) \), is given by the break-even constraint of the creditor:

\[
D_1 \left( \mu_1 \left( G; \hat{\theta} \right) \right) \mu_1 \left( G; \hat{\theta} \right) \text{Pr}(G; \hat{\theta}) + \left( 1 - \text{Pr}(G; \hat{\theta}) \right) L = I, \tag{8}
\]

or, alternatively, by

\[
D_1 \left( \mu_1 \left( G; \hat{\theta} \right) \right) = \frac{I - \left( 1 - \text{Pr}(G; \hat{\theta}) \right) L}{\mu_1 \left( G; \hat{\theta} \right) \text{Pr}(G; \hat{\theta})}. \tag{9}
\]

Before the second project is financed, creditors will update their beliefs about an entrepreneur’s success probability based on \( h_2 \). The beliefs depend on the reported probability of success \( (m_1) \), the realized outcome of the first project \( (r_1) \), and the threshold \( \hat{\theta} \);
In Appendix B we use Bayes’ rule to derive the creditors beliefs; $\mu_2(B; \hat{\theta})$ (report $B$), $\mu_2(S; \hat{\theta})$ (report $G$ and success in first project), and $\mu_2(F; \hat{\theta})$ (report $G$ and failure in first project).

For later use, let $\mu_2(F; \hat{\theta} = 1) = \mu_2(F)$ and $\mu_2(S; \hat{\theta} = 1) = \mu_2(S)$ denote the probabilities of success in the absence of informative cheap talk (i.e., all entrepreneur types report $G$ when they have a $B$ project).

So far, we have constructed the creditor’s beliefs and the related face value of debt in both periods ($D_1$ and $D_2$), given the entrepreneur’s communication strategy. Now, we examine the communication strategy and describe the equilibrium threshold, $\mathring{\theta}$, for honest reporting of $B$ projects. For this purpose, let $\Pi \left( m_1; (\theta, v_1); \hat{\theta} \right)$ denote the entrepreneur’s overall expected profit if he announces project quality $m_1 \in \{G, B\}$ when his type is $\theta$, the actual project quality in the first period is $v_1 \in \{G, B\}$, and the threshold value is $\hat{\theta}$.

Profit of an entrepreneur $\theta$ reporting $G$ and having a $G$ project:

$$\Pi \left( G; (\theta, G); \hat{\theta} \right) = p_G \left[ V - D_1 \left( \mu_1 \left( G; \hat{\theta} \right) \right) \right] + p_G \pi_2 \left( \theta, \mu_2(S; \hat{\theta}) \right) + (1 - p_G) \pi_2 \left( \theta, \mu_2(F; \hat{\theta}) \right) \tag{10}$$

The first and second lines represent the expected profit from the first and second projects, respectively. Recall that $\pi_2(.)$ is defined by equation (4).

Profit of an entrepreneur $\theta$ reporting $G$ and having a $B$ project:

$$\Pi \left( G; (\theta, B); \hat{\theta} \right) = p_B \left[ V - D_1 \left( \mu_1 \left( G; \hat{\theta} \right) \right) \right] + p_B \pi_2 \left( \theta, \mu_2(S; \hat{\theta}) \right) + (1 - p_B) \pi_2 \left( \theta, \mu_2(F; \hat{\theta}) \right)$$

Profit of an entrepreneur reporting $B$ and having a $B$ project:

$$\Pi \left( B; (\theta, B); \hat{\theta} \right) = \pi_2 \left( \theta, \mu_2(B; \hat{\theta}) \right)$$

The total profit function only includes profit from the second project (because reporting $B$ implies that the first project is liquidated).

Profit of an entrepreneur reporting $B$ and having a $G$ project:

$$\Pi \left( B; (\theta, G); \hat{\theta} \right) = \pi_2 \left( \theta, \mu_2(G; \hat{\theta}) \right).$$
Now, we will consider the different entrepreneur types’ incentives to report the quality of the first project truthfully. We have already, in Lemma 2, established that Assumption 1 ensures that all entrepreneur types will report honestly on G projects.

Next, consider an entrepreneur with a B project. He has incentive to tell the truth (report B) if and only if the payoffs from honestly reporting B exceed the payoffs from reporting G:

$$\Delta(\theta; \hat{\theta}) = \Pi\left(B; (\theta, B); \hat{\theta}\right) - \Pi\left(G; (\theta, B); \hat{\theta}\right) \geq 0$$

Define $\Psi(\hat{\theta})$ as the type $\theta$ that is indifferent between reporting B and G given that creditors expect that the threshold is $\hat{\theta}$

$$\Psi(\hat{\theta}) \equiv \theta \text{ such that } \Pi\left(B; (\theta, B); \hat{\theta}\right) = \Pi\left(G; (\theta, B); \hat{\theta}\right)$$

The equilibrium reporting strategy is consistent with creditors beliefs if and only if $\Psi(\hat{\theta}) = \hat{\theta}$. Let the fixed point satisfying $\Psi(\hat{\theta}) = \hat{\theta}$ be denoted by $\theta^*$. Since high-$\theta$ entrepreneurs benefit more from reducing the face value of debt in the second period than do low-$\theta$ entrepreneurs, an equilibrium must imply that high-$\theta$ entrepreneurs have stronger incentives to build good reputations by being truthful.

Proposition 1 describes the threshold equilibrium. We build on Choi et al. (2010) and extend the analysis to a setting where there final outcome is uncertain even after the firm has obtained private information about the outcome. Otherwise, the outcome would perfectly reveal whether the firm has misreported or not.

**Proposition 1** There exists a threshold equilibrium with cut-off $\theta^* \in (0, 1)$ and the following properties:

(a) In the first period, an entrepreneur whose type exceeds the cut-off point $\theta^*$ reports truthfully.
(b) In the first period, an entrepreneur whose type is below the cut-off point $\theta^*$ always reports that the project is good.
(c) Reporting in the second period does not convey any meaning.

Figure 2 illustrates the equilibrium outcome in period 1:

**FIGURE 2 ABOUT HERE**

The equilibrium reporting strategy implies that the credibility of a B report is higher than the credibility of a G report which is reported by entrepreneurs with G projects and by low-
quality entrepreneurs ($\theta < \theta^*$) with B projects. This is consistent with empirical findings showing that the market response is larger for bad news than good news (Jennings (1987), Williams (1996), and Rogers and Stocken (2005)).

The relationship between managerial ability and reporting quality is examined by Demerjian et al. (2013). In line with Proposition 1, they find that ability of the manager is positively correlated with earnings quality.\footnote{Demerjian et al. (2013) do not examine the relationship between earning management and manager ability but "leave a direct examination of the interaction between managerial ability and earning management to future work."}

We have so far established the existence of an informative equilibrium, but cannot rule out the possibility of multiple informative equilibria. The next corollary provides a sufficient condition that guarantees a unique threshold equilibrium.

**Corollary 1** The threshold equilibrium described in Proposition 1 is unique if

\[
\left. \frac{\partial \Delta(\theta; \theta^*)}{\partial \theta} \right|_{\theta = \theta^*} > \left. - \frac{\partial \Delta(\theta; \theta^*)}{\partial \theta^*} \right|_{\theta = \theta^*} \tag{12}
\]

We can interpret the above condition in the following way. The LHS of the inequality $\partial \Delta(\theta; \theta^*)/\partial \theta$ can be considered the direct effect of being a higher type on the incentives to tell the truth (i.e., reveal bad news) while $\partial \Delta(\theta; \theta^*)/\partial \theta^*$ can be considered as an indirect effect of an increase in the threshold value on the incentives to reveal bad news. Note that $\partial \Delta(\theta; \theta^*)/\partial \theta$ is always positive. Thus, if $\partial \Delta(\theta; \theta^*)/\partial \theta^*$ is also positive, the condition is automatically satisfied. If $\partial \Delta(\theta; \theta^*)/\partial \theta^*$ turns out to be negative, the condition is satisfied as long as the direct effect dominates the indirect effect in terms of the absolute values.\footnote{We have applied some standard distributions functions and in all of our examples we obtained a unique $\theta$.} To do comparative statics in the next subsection we assume that condition (12) holds and the equilibrium is unique.

### 3.3 Investment opportunities and soft information

So far, we have considered the case where the first and the second projects are of the same size. In this subsection, we examine how the credibility of soft information changes as the investment size varies over time (we do not allow the size of the investment to depend on entrepreneur type).
Growth opportunities create two kinds of gains for the entrepreneur. In addition to the obvious gain from having larger investment opportunities in the second period, there is a benefit from increased disciplinary effect of reputation on reporting behavior in the first period.

Let the second project be described by $I_2 = \lambda I_1$, $V_2 = \lambda V_1$, and $L_2 = \lambda L_1$, where $\lambda > 0$ and the subscript refers to the project being considered. Thus, all project characteristics of the second project are equal to those in the first project with a scale factor of $\lambda$. The higher the value of $\lambda$, the more the entrepreneur is concerned about his financing terms in period two compared to period one.

**Proposition 2 (More types are honest when future investments increase)** The cut-off $\theta^*$ is decreasing in the scale of second period investment opportunities, $\lambda$.

Proposition 2 shows that more entrepreneur types report truthfully and that soft information is more credible in growth industries (large $\lambda$) than in mature industries with smaller investment opportunities (low $\lambda$). Figure 3 illustrates the impact of increased investment opportunities on the equilibrium outcome:

**FIGURE 3 ABOUT HERE**

As investment opportunities improve, the entrepreneur’s reputation concerns and borrowing costs will change. Proposition 3 describes how the borrowing costs in period 1 and 2 change due to higher credibility of soft information. Borrowing cost is defined as the face value of debt divided by loan amount (i.e. $D_1/I_1$ and $D_2/I_2$ for the first and second project).

**Proposition 3 (Borrowing costs and industry growth)**

*Borrowing costs in the first period:* Borrowing costs decrease as investment opportunities improve in the second period (higher $\lambda$).

*Borrowing costs in the second period:*

(a) An entrepreneur reporting $B$ in the first period faces higher borrowing costs in the second period.

(b) An entrepreneur reporting $G$ and succeeding with his first project faces lower borrowing costs in the second period.

(c) An entrepreneur reporting $G$ and failing with his first project faces lower borrowing costs in the second period.
Proposition 3 (first period) follows from the observation that improved investment opportunities induce more entrepreneur types to report honestly and liquidate their B projects. Since more efficient liquidation increases the expected repayment of debt, face value of debt is reduced.

Proposition 3 (second period) shows how various outcomes in period 1 leads to different borrowing costs in period 2. It is particularly interesting to note that increased reputation concerns leads to higher borrowing costs for entrepreneurs reporting B in period 1. This is because a B report becomes a weaker signal about entrepreneur quality ($\theta$) when more entrepreneur types report honestly about B projects. The average quality of entrepreneurs reporting B decreases when more entrepreneurs become honest which again explains why they face higher borrowing costs in period 2.\footnote{If $\theta^*$ decreases due to stronger reputation concerns, then the interval $[\theta^*, 1]$ increases and the average entrepreneur on the interval, $E[\theta | \theta \geq \theta^*]$, has a smaller probability of success. This explains why this group of entrepreneurs faces higher interest rates in period 2 as more entrepreneur types report honestly in period 1.}

Figure 4 illustrates how a creditor’s beliefs about the probability of success of the second project depend on the outcome of the first project, the report of the first project, and the cut-off rule $\theta^*$.\footnote{Notice that, in equilibrium, $\theta^*$ must satisfy $\mu_2(G, F; \theta^*) < \mu_2(B; \theta^*)$. To produce the figure we assumed that $\theta$ is uniformly distributed on $[0, 1]$, $p_G = \frac{2}{3}$, and $p_B = \frac{1}{3}$.}

Improved credibility of soft information (lower $\theta^*$) increases the impact of new soft information on market values of debt claims. Consider an entrepreneur which has just reported on prospects of his first project. Creditors update their beliefs about the expected value of their claims. The claim is either worth $L_1$ (liquidation value) or $D_1(\mu_1(G; \theta^*))$ (continuation value). The face value of debt, $D_1(\mu_1(G; \theta^*))$, is determined by the break-even constraint of lenders (equation (8)). We consider the difference between these two values as the volatility of the value of debt claims, $\Delta P$:

$$\Delta P = D_1(\mu_1(G; \theta^*)) - L_1.$$ 

The following corollary shows that in growth industries, the increased credibility of soft information makes the pricing of debt claims more volatile.
Proposition 4 Entrepreneurs in growth industries (high $\lambda$) have higher credibility of reported soft information and more volatile pricing of debt claims (higher $\Delta P$) than entrepreneurs in mature industries (low $\lambda$).

Improved reporting quality of soft information leads to swifter updating of project values and more volatile pricing of debt claims. Needless to say, there are other industry differences that may complement the credibility effect. For instance, there might be more important soft information to be reported in growth industries.

4 Probabilistic enforcement

So far we have assumed no public enforcement of reporting quality and hence misleading statements about investment projects are never verified and penalized. However, misreporting can in some cases be revealed by SEC, auditors, investors, media, or workers acting as whistleblowers (Skinner (1994), Leuz et al. (2003), Dyck et al. (2010), and Laux and Stocken (2012)). Given that misreporting can be verified, courts penalize the entrepreneur.

We assume that misreporting is detected and verified with probability $\phi \in [0, 1]$ after the entrepreneur has irreversibly made the liquidation/continuation decision.\(^{14}\) Put differently, at the time it is verified that the project is bad, the second-hand value of assets are too low compared to the continuation value to make liquidation of the project profit maximizing. Furthermore, we assume that misreporting is detected before the final outcome of the project is observed.\(^{15}\) If misreporting is verified by courts, the entrepreneur must pay a fine $\gamma > 0$. The entrepreneur has no own funds and needs to spend proceeds from a successful project to pay the fine. If the project fails, he will no be able to pay the fine.\(^{16}\)

The probability of verifying misreporting depends on to what extent it possible to produce evidence for misreporting in courts and the standard of proof applied by courts ("beyond a reasonable doubt" or "preponderance of the evidence").

Note that in the second period, an entrepreneur will always have incentives to misreport on a $B$ project: If he produces an honest report on the $B$ project, the project will be liquidated

\(^{14}\)See Ellingsen and Kristiansen (2011) for a discussion of probabilistic enforcement in financial markets when the entrepreneur can illegally divert funds. The enforcement technology is similar to what we assume in this paper.

\(^{15}\)None of our results will change if misreporting is verified after the project is completed. The entrepreneur will acquire the same reputation whenever misreporting is verified.

\(^{16}\)Our model predictions will not significantly change if we allowed creditors to receive a fraction of $\gamma$. 

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and the entrepreneur receives nothing. On the other hand, if the entrepreneur cheats and continues a $B$ project, there is a positive probability for success and positive profit. If cheating is verified and penalized, he is protected by limited liability (unless $\gamma$ contains non-pecuniary punishment). Hence probabilistic enforcement cannot prevent cheating in the second period. In the first period, verified cheating has a negative impact on reputation which together with the punishment $\gamma$ makes cheating less attractive and thereby reduces the set of entrepreneur types which cheats.

Similar to the analysis in Section 3.2 without enforcement ($\phi = 0$), we will now describe an analogous threshold-strategy for probabilistic enforcement, $\phi > 0$. We denote the threshold $\theta^E$. To find the equilibrium threshold $\theta^*E$, we need to examine how the reputation of an entrepreneur depends on reporting, project outcomes, and enforcement actions $a \in \{e, n\}$ where $e$ means that misreporting is verified while $n$ means that no misreporting is verified.

First-period success probabilities: The formulas for the success probabilities, $\mu_1(B; \hat{\theta}^E)$ and $\mu_1(G; \hat{\theta}^E)$, are the same as in Section 3 for a given threshold $\hat{\theta}^E$ (see equation (7)).

Second-period success probabilities: Given a $B$ report on the first project and threshold $\hat{\theta}^E$, the success probability of a second project is the same as before; $\mu_2(B; \hat{\theta}^E)$ (see equation (25)). The other history-dependent success probabilities are changed due to public enforcement. The conditional success probabilities must take into account that some misreporting is verified and penalized. The success probability for an entrepreneur with a successful first-period project and no enforcement action taken is denoted $\mu_2(S, n; \hat{\theta}^E)$: Similarly, let $\mu_2(F, n; \hat{\theta}^E)$ denote the success probability of an entrepreneur who failed in the first period. The success probability of an entrepreneur who has been penalized for misreporting in period 1 is denoted $\mu_2(e; \hat{\theta}^E)$.

The probabilities are given in Appendix B.

Let $\Pi^E(m_1; (\theta, v_1); \hat{\theta})$ denote the entrepreneur’s expected profit (for both periods) if he announces project quality $m_1 \in \{G, B\}$ when his type is $\theta$, the actual project quality in the first period is $v_1 \in \{G, B\}$, cheating is detected and punished with probability $\phi$, and the entrepreneur adopts the cut-off $\hat{\theta}$.

Expected profit given that a $\theta$-entrepreneur reports $G$ and has a $G$ project (honest):

$$\Pi^E(G; (\theta, G); \hat{\theta}) = p_G \left[ V - D_1 \left( \mu_1 \left( G; \hat{\theta} \right) \right) \right]$$
$$+ p_G \pi_2 \left( \theta, \mu_2(S, n; \hat{\theta}) \right) + (1 - p_G) \pi_2 \left( \theta, \mu_2(F, n; \hat{\theta}) \right)$$

$^{17}$Note that if it verified that the project is $B$, there is no additional information in whether the project fails or succeeds (i.e. observation $B$ is a sufficient statistic).
Expected profit given that a $\theta$-entrepreneur reports G but has a B project (cheating):

$$
\Pi^E \left( G; (\theta, B); \hat{\theta} \right) = p_B \left[ V - D_1 \left( \mu_1 \left( G; \hat{\theta} \right) \right) - \phi \gamma \right]
+ (1 - \phi) \left[ p_B \pi_2 \left( \theta, \mu_2(S, n; \hat{\theta}) \right) + (1 - p_B) \pi_2 \left( \theta, \mu_2(F, n; \hat{\theta}) \right) \right]
+ \phi \pi_2 \left( \theta, \mu_2(e; \hat{\theta}) \right)
$$

Note that in the first term we take into account that (if a B project succeeds) the entrepreneur has to pay a fine $\gamma$ with probability $\phi$. The last term reflects that verified cheating implies tarnished reputation, $\mu_2(e; \hat{\theta})$, and reduced expected profit in the second period. Expected profit given that a $\theta$-entrepreneur reports B and has a B project (honest):

$$
\Pi^E \left( B; (\theta, B); \hat{\theta} \right) = \pi_2 \left( \theta, \mu_2(B; \hat{\theta}) \right)
$$

In this case the first project is liquidated. For completeness, we also describe the expected profit given that a $\theta$-entrepreneur reports B and has a G project.\footnote{As in Section 3.2. misreporting about a G-project will never happen in equilibrium.}

$$
\Pi^E \left( B; (\theta, G); \hat{\theta} \right) = \pi_2 \left( \theta, \mu_2(B; \hat{\theta}) \right)
$$

As in Section 3.2 we will now derive a threshold equilibrium with probabilistic enforcement. Since the procedure is similar, we keep the analysis brief.

Let the threshold value $\theta^{*E}$ be defined by the indifference condition

$$
\Pi^E \left( B; (\theta^{*E}, B); \theta^{*E} \right) = \Pi^E \left( G; (\theta^{*E}, B); \theta^{*E} \right)
$$

which ensures that a $\theta^{*E}$-entrepreneur is indifferent between cheating and making honest report when he has a B project (see equation (11) and the following discussion in the absence of enforcement). Parallel to condition (12), we make the following assumption to ensure uniqueness of an informative equilibrium:

$$
\frac{\partial \Delta(\theta; \theta^{*E})}{\partial \theta} \Big|_{\theta^{*E}} > - \frac{\partial \Delta(\theta; \theta^{*E})}{\partial \theta^{*E}} \Big|_{\theta^{*E}}
$$

Note that if $\phi = 0$, the threshold is as before, i.e. $\theta^{*E} = \theta^{*}$. Let $\theta^{*E}(\phi)$ be the threshold
rule supported by enforcement probability $\phi$. It is straightforward to show that an increase in $\phi$ makes it less attractive to misreport (if verified the entrepreneur has to pay $\gamma$ and in addition his reputation is tarnished since it is revealed that his type is below $\theta^{*E}$). Consequently, $d\theta^{*E}/d\phi < 0$.

First observe that more honest reporting and more efficient liquidation/continuation decisions reduce financing costs in period 1 (lower $D_1$). Since investors compete, all the efficiency gains from better reporting is captured by the entrepreneurs.

The second-period effect of better enforcement on financing costs depends on reporting and project outcomes in the first period. This is because better enforcement implies that boundaries between entrepreneurs with different first-period outcomes and reports change. Correspondingly, investors interpret first-period history differently when enforcement is improved. Consider, for instance, entrepreneurs reporting B in the first period. This group will expand since more types will make honest reports when enforcement improves. Furthermore, since the marginal entrepreneurs entering the group have lower success probabilities than the average type in the group (the marginal type, $\theta^{*E}$, is below the average type, $E[\theta|\theta > \theta^{*E}]$), better enforcement makes honest reporting a less favorable signal. Proposition 5 describes the spillover effects that better enforcement will create on various groups of entrepreneurs in the second period.

**Proposition 5** (Changes in borrowing costs as enforcement improves)

*First period:* Borrowing costs decrease for all entrepreneur types.

*Second period:*

(a) An entrepreneur reporting B in the first period faces higher borrowing costs in the second period.

(b) An entrepreneur reporting G and succeeding with the first project faces lower borrowing costs in the second period.

(c) An entrepreneur reporting G and failing with his first project faces lower borrowing costs in the second period.

(d) An entrepreneur penalized for misreporting in the first period faces higher borrowing costs in the second period.

Recall that borrowing costs are defined as $\frac{D_1}{I_1}$ and $\frac{D_2}{I_2}$ for period 1 and 2. Better enforcement makes first-period reports more credible in the same way as increased reputation concerns. Hence better enforcement makes pricing of debt claims in the first period more dependent on interim progress reports and, consequently, prices of a debt claim will move more when reports
are released. Parallel to Proposition 2, better enforcement implies higher credibility of reported information and consequently financial claims are more dependent on firm-specific reported information and less dependent on general market conditions. This is in line with empirical studies (Morck et al. (2000)) finding that in more developed financial markets with better investor protection, prices are less driven by general market conditions and more dependent on firm-specific reported information. See also Greenstone et al. (2006), which finds that market prices responded more strongly to new information reported from firms traded over the counter after the 1964 Security Acts Amendments strengthened mandatory disclosure requirements for these firms.

4.1 Better enforcement may crowd out reputation concerns

In this part we show that better enforcement can make an informative reporting equilibrium unsustainable and thereby prevent informative reporting of soft information. Improved legal enforcement (misreporting is more likely detected and penalized) can undermine entrepreneurs’ reputational concerns which again can lead to less credible reporting.

To illustrate the potential negative effects from better enforcement, we extend the model such that access to credit in the second period depends on the reputation acquired by the entrepreneur in the first period. First, assume that if all entrepreneur types are honest the reputation obtained after a B report, \( \mu_2(B; 0) \), implies that the second project has negative net value;

\[
\mu_2(B; 0) < \frac{I_2}{V_2}. \tag{18}
\]

Recall that if all agents are honest, an honest report about a B project does not signal that the entrepreneur is above a certain talent threshold \( (\theta^{E_2} = 0) \).

Because \( d\mu_2(B; \theta^{E_2})/d\theta^{E_2} > 0 \) (being honest boost your reputation more if only the most talented entrepreneurs are honest) it follows that there is a unique \( \overline{\theta} \) satisfying \( \mu_2(B; \overline{\theta}) = I_2/V_2 \).\(^{19}\) Hence an informative equilibrium must entail \( \overline{\theta} < \theta^{E_2} \). Otherwise, honest report about a B project implies that the second project cannot be financed and there will be no gains associated with being honest.

Suppose there is a threshold equilibrium where \( \theta^{E_2} \in [\overline{\theta}, 1) \) and according to Lemma 1 all

\(^{19}\) Recall that an honest report on a B project implies that the entrepreneur belongs to the \([\theta^*, 1]\)-group, which again implies that the expected type on \([\theta^*, 1]\) is increasing in \( \theta^* \).
better entrepreneur types than $\theta^{E^*}$ are honest. Directly from the definition of $\theta^{E^*}$ it follows that $d \theta^{E^*}/d \phi < 0$ (it is less attractive to cheat when the expected punishment increases) and consequently,

$$\frac{d \mu_2(B; \theta^{E^*})}{d \phi} = \frac{d \mu_2(B; \theta^{E^*})}{d \phi} \frac{d \theta^{E^*}}{d \phi} < 0.$$ 

Hence there must exist an enforcement probability $\phi^n$ such that honest reporting of a B project implies no financing of the second project.$^{20}$ In this case reputation concerns do not discipline any of the entrepreneur types with B projects and all types cheat when reporting about B projects. Put differently, for any potential threshold $\theta \in [\bar{\theta}, 1)$ we have

$$\Pi^E \left( B; \left( \hat{\theta}, B \right); \hat{\theta} \right) > \Pi^E \left( G; \left( \hat{\theta}, B \right); \hat{\theta} \right)$$

and hence there is no threshold $\hat{\theta}$ that makes an entrepreneur indifferent between being honest and cheating. Since all potential informative equilibria are threshold equilibria (Lemma 1) there exists no informative equilibrium when $\phi$ is sufficiently large. If a B report is observed of investors in a non-informative equilibrium (report B is off the equilibrium path), it will be ignored (as in a babbling equilibrium) and the investors will only update their beliefs based on realized outcomes of the first project.

Can introduction of probabilistic enforcement reduce total surplus? To answer we compare the surplus in an equilibrium outcome with partial informative reporting and no enforcement to the equilibrium outcome where enforcement crowds out reputation concerns. In the first equilibrium the reputation is shaped by the outcome of the first project and the report while in the second equilibrium reputation is shaped by project outcome and possible enforcement actions.

Gains from partial informative reporting: B projects owned by $\theta \in [\theta^*, 1]$ entrepreneurs are efficiently liquidated after a honest report.

The expected gain from liquidation compared to continuation is

$$p(B \text{ reported}; \theta^*) \left( L_1 - p_B V_1 \right).$$

$p(B \text{ reported}; \theta^*)$ is the probability of a B report in an informative cheap-talk equilibrium with

$^{20}$We assume that $\gamma$ is sufficiently large to induce honest reporting if $\phi = 1$. 

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threshold $\theta^*$;
\[
p(B \text{ reported}; \theta^*) = \int_{\theta^*}^{1} (1 - \theta) dF(\theta)
\]

$L_1 - p_B V_1$ is the gain compared to no liquidation. All entrepreneur types obtain credit for their second project.

Gains from probabilistic enforcement: If the enforcement probability is $\phi^n$ (or larger) then the entrepreneur will never liquidate a B project in the first period. The gains from enforcement appear in the second period; If enforcement actions in the first period reveals that the entrepreneur has a B project, the entrepreneur will have reputation $\mu_2(B)$ in the second period which makes it impossible to obtain financing (condition (18)). To illustrate the potential harmful equilibrium effect of better enforcement, it suffices to consider the case where entrepreneurs that failed on their first projects (B or G projects which fail) are able to obtain funding in the second project; \(^{21}\)

\[
\mu_2(F) > \frac{I_2}{V_2}.
\]

The expected gain from preventing financing is

\[
\phi^n \ p(B) \ (\mu_2(B) \ V_2 - I_2)
\]

where $p(B)$ is the probability of having a B project in the first period,

\[
p(B) = \int_{0}^{1} (1 - \theta) dF(\theta).
\]

Because the entrepreneurs on average have negative net-value projects in the second period, the expected gain from preventing access to financing is $I_2 - \mu_2(B) V_2$.

By comparing the net gain from enforcement (equation (22)) with the net gain from partial informative reporting and liquidation (equation (20)), we have the following proposition.

**Proposition 6** Suppose enforcement level increases from 0 to $\phi^n$.
(a) No informative reporting equilibrium exists, and all period-1 projects are continued.

\(^{21}\)Note that $\mu_2(F) > \mu_2(B)$ so this assumption is consistent with condition (18).
(b) Net surplus generated from increasing the enforcement level to $\phi^*$ is negative if

$$p(B \text{ reported}; \theta^*) (L_1 - p_B V_1) > \phi^* p(B) (I_2 - \mu_2(B) V_2),$$

The possibility that better enforcement may induce more misreporting is also highlighted in Laux and Stocken (2012). They consider a very different setting with overoptimistic and wealthy entrepreneurs. In contrast, we examine how better enforcement reduces the reputation gain from honest reporting which again makes it impossible to obtain financing in later rounds and, consequently, no firm will report honestly in equilibrium.

5 Discussion

Can a combination of external debt and external equity financing ensure honest reporting and efficient liquidation decisions? First consider the case where there is only one project (not a sequence of new projects) and the project is fully funded by equity. The entrepreneur will maximize profit by making honest reports and efficient liquidation decisions. Since the outside investors hold the same claim on the firm as the entrepreneur, the outside investors’ profit is also maximized in equilibrium. However, in a situation where a sequence of projects needs to be financed and there are reputation concerns, equity claims do not necessarily provide efficient liquidation incentives. The entrepreneur might be willing to make decisions that reduce the profit of the first project, if he is compensated by better reputation and has to sell a smaller fraction of the second project to investors to finance the second project. Furthermore, since the strength of the entrepreneur’s reputation concerns is unobservable and depends on entrepreneur type ($\theta$), it will generally be a nontrivial task to design a capital structure which provides the right reporting and liquidation incentives.\footnote{However, note that if we assume that all current and future projects are financed at date 0 by issuing equity, then the entrepreneur’s liquidation/continuation incentives will again be efficient.}

Can liquidation values exceeding face value of debt ($D_1 < L$) change the entrepreneurs’ reporting behavior?\footnote{“Liquidation” can be interpreted as reallocating some of the initial investment to a different use, which reduces the return on the investment but keep the return above face value of debt.} Although we did not take this possibility into account in our formal analysis, our main insight will prevail as long as the entrepreneur expects to gain more from continuation than liquidation, i.e., $p_B (V - D_1) > L - D_1$. Note, however, that since the entrepreneur keeps the difference between liquidation value and the face value of debt, the entrepre-
neur is to some extent rewarded for making honest reports, and this will decrease the threshold $\theta^*$ and make more entrepreneur types report honestly.

6 Concluding remarks

It is common practice for firms to report on information that cannot be verified ex post. Investors may think that information is misrepresented but find it impossible to verify in court that a firm deliberately misled investors. We develop a simple model in which entrepreneurs report soft information, and we examine the credibility of such information when firms need to approach a credit market repeatedly for financing of new projects. We show that a firm’s reporting strategy reveals information about current projects as well as information on the characteristics or talent of the entrepreneur. A talented entrepreneur who happens to have a poor project can insure himself against acquiring a bad reputation by truthfully reporting that the project is poor. Market characteristics like industry growth influence credibility of reported soft information, and determine how creditors use soft information on current projects to update beliefs on long-term prospects of entrepreneurs.

We extend our analysis to allow for probabilistic enforcement of reporting quality. As expected, better enforcement induces more entrepreneur types to report honestly, which leads to lower financing costs on current projects. The effects of better enforcement on financing costs of later projects is ambiguous. Although better enforcement leads to more efficient liquidation decisions, which reduces financing costs, there are potential negative effects of better enforcement on high-talent entrepreneurs. Better enforcement implies that a larger group of entrepreneurs make honest reports and, consequently, the reporting strategy produces a less precise signal about entrepreneur talent, which again influences future financing costs. Finally, we show that better enforcement can remove the disciplinary effect of reputation concerns, reducing the amount of credible information reported and thereby reducing economic surplus by lowering investments in profitable projects.
Appendix A

Proof of Lemma 2: Let us first consider an entrepreneur with a $G$ project in the first period. If he reports $B$ instead of $G$, the project is liquidated and the entrepreneur’s possible gain from the first project is lost. The entrepreneur compares the loss from liquidating the first project with the possible gains from a better reputation in the second period. To see that the loss from liquidating a $G$ project in the first period will always exceed the possible reputation gain (for any possible equilibrium), let us consider the entrepreneur that will gain most from improved reputation, namely type $\theta = 1$. This is the entrepreneur who always has a $G$ project in the second period and is most likely to repay debt in the second period. The highest possible reputation gain from reporting $B$ is obtained if all entrepreneurs types report $G$ apart from type $\theta = 1$. In this case, a $B$ report reveals precisely that the type is $\theta = 1$. Furthermore, note that if only type $\theta = 1$ reports honestly, the expected success probability in the first period is $\bar{\mu}$, the same as given uninformative reporting ($\theta = 1$ has measure 0). The maximum reputation gain from reporting $B$ instead of honestly reporting $G$ will never be sufficient to compensate the entrepreneur for liquidating a $G$ project in the first period, if the following condition is satisfied

$$p_G \left( V - \frac{I}{\bar{\mu}} \right) + p_G \left[ p_G \left( V - \frac{I}{\mu_2(S)} \right) + (1 - p_G) \left( V - \frac{I}{\mu_2(F)} \right) \right] > p_G V - I$$

which is the same condition as Assumption 1. Note that on the LHS is the expected gain from reporting $G$ and continuing the first project (first parenthesis) and obtaining reputation $\mu_2(S)$ or $\mu_2(F)$ depending on success or failure of the first project. The second parenthesis represents the expected gain from the second project. On the RHS is the expected gain if $B$ is reported, the first project is liquidated, and the second project is financed after it is revealed that the entrepreneur type is $\theta = 1$.

Next let us consider the case where the entrepreneur has a $B$ project in the first period. Again, for the message to be informative, the liquidation decision by the creditor should be responsive to the messages; that is, the creditor liquidates the project if and only if the message is $B$. Now consider a putative equilibrium in which the creditor’s first period response to the entrepreneur’s message is given by $a_1(G) = \text{Continue}$ and $a_1(B) = \text{Liquidate}$. In such an equilibrium, let the posterior beliefs for creditors at the beginning of the second period be

\[24\text{Note that in an informative equilibrium, a negative report must entail liquidation.}\]
given by $\mu_2(h_2)$, where $h_2 \in \{S, F, B\}$ and $S$ and $F$ imply that the entrepreneur has reported $G$ and continued a project that succeeds or fails, respectively. Let us define $\Pi(B, B, \theta)$ and $\Pi(G, B, \theta)$ to be the expected value of reporting $B$ and $G$ for the entrepreneur of type $\theta$ when the true signal is $B$. Suppose that there is an entrepreneur of type $\hat{\theta}$ who uses a mixed strategy between $B$ and $G$ when he has the signal $B$. This implies that the type $\hat{\theta}$ entrepreneur is indifferent between sending $B$ and $G$ signals, that is,

$$\Pi(B, B, \hat{\theta}) = \left[ p_B + \hat{\theta} (p_G - p_B) \right] (V - D_2(B))$$

$$= p_B[V - D_1] + [p_B + \hat{\theta} (p_G - p_B)][p_B (V - D_2(S)) + (1 - p_B) (V - D_2(F))]$$

$$= \Pi(G, B, \hat{\theta})$$

The LHS of the equation above is the expected value of reporting $B$ truthfully while the RHS is the expected value of lying for type $\hat{\theta}$. It can be easily seen that $\Pi(B, B, \theta)$ is steeper than $\Pi(G, B, \theta)$ as a function of $\theta$, which implies that any type higher than $\hat{\theta}$ strictly prefers to report $B$ truthfully while all types less than $\hat{\theta}$ strictly prefer to lie and report $G$. Thus, any equilibrium should be of threshold type.

**Proof of Proposition 1:** For the equilibrium to be informative, the fixed point $\theta^*$ needs to be in the interval $[0, 1)$, with a lower fixed point $\theta^*$ corresponding to a more informative equilibrium. A sufficient condition for $\theta^* < 1$ is that $\Psi(1) < 1$. Since high-$\theta$ types have the strongest incentives to acquire a high reputation by imitating the absolute highest type, $\theta = 1$, it suffices to see that

$$\Pi \left( B; (\theta = 1, B) ; \hat{\theta} = 1 \right) - \Pi \left( G; (\theta = 1, B) ; \hat{\theta} = 1 \right) > 0.$$  

(23)

By continuity, the inequality holds for $\theta$ sufficiently close to 1. The intuition is that if creditors believe that only the best type of entrepreneur ($\hat{\theta} = 1$) tells the truth, then other types are willing to report a $B$ project truthfully to imitate the best type and hence $\theta^*$ must be strictly below 1. To show Proposition 1 we first derive Lemma A and Lemma B.

**Lemma A** $\Psi(1) < 1$

**Proof:** Lemma 1 follows from Assumption 2 and the definition of the profit functions (10) and inequality (23). To simplify the notation let

$$\Delta (\theta, \theta^*) = \Pi \left( B; (\theta, B) ; \theta^* \right) - \Pi \left( G; (\theta, B) ; \theta^* \right)$$

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$\Psi(\theta^*)$ satisfies $\Delta(\Psi(\theta^*), \theta^*) = 0$. Notice that $\frac{\partial \Delta(\theta, \theta^*)}{\partial \theta} > 0$; i.e., high-$\theta$ entrepreneurs benefit more from reducing the face value of debt in the second period than do low-$\theta$ entrepreneurs.

From:

$$\Delta(\theta = 1, \theta^* = 1) = \Pi(B; (\theta = 1, B); \theta^* = 1) - \Pi(G; (\theta = 1, B); \theta^* = 1) > 0,$$

we obtain:

$$[p_G V - I] - \left[p_B \left(V - \frac{I}{\mu_1}\right) + p_G \left(V - p_B \frac{I}{\mu_2(S)} - (1 - p_B) \frac{I}{\mu_2(F)}\right)\right] > 0,$$

which by Assumption 2 is satisfied.

**Lemma B** $\Psi(0) > 0$.

**Proof:** If all entrepreneur types are expected to tell the truth, i.e., $\theta^* = 0$, then type $\theta = 0$ optimally chooses to lie:

$$\Delta(\theta = 0, \theta^* = 0) = \Pi(B; (\theta = 0, B); \theta^* = 0) - \Pi(G; (\theta = 0, B); \theta^* = 0)
\begin{align*}
&= \left[p_B \left(V - \frac{I}{\mu_2(B; \theta^* = 0)}\right)\right] \\
&\quad - \left[p_B \left(V - \frac{I - (1 - E[\theta]) L}{p_G E[\theta]}\right) + p_B \left(V - \frac{I}{\mu_2(G)}\right)\right] \\
&< 0,
\end{align*}$$

where $\mu_2(G) \equiv \mu_2(G, S; \theta^* = 0) = \mu_2(G, F; \theta^* = 0) > \mu_2(B; \theta^* = 0)$ and $E[\theta] = \int_0^1 \theta dF(\theta)$.

If all entrepreneur types are expected to tell the truth ($\hat{\theta} = 0$), the outcome of the project (success or failure) does not affect the entrepreneur’s reputation. The reports are sufficient statistics and creditors will disregard project outcome when they update beliefs (reputation). Reporting $G$ and having an unsuccessful project is attributed to bad luck and never to misreporting about the project. However, in this case, the entrepreneurs would be tempted to misreport the quality of $B$ projects. Consequently, there is no equilibrium where all entrepreneurs report truthfully, i.e. $\Psi(0) > 0$.

Figure A illustrates the threshold equilibrium.

**FIGURE A ABOUT HERE**

Note that the informative equilibrium represented by $\theta^*$ is a solution to the equation $\Omega(\theta) = 0$, where $\Omega(\theta) = \Psi(\theta) - \theta$. Lemmas A and B establish that $\Omega(0) = \Psi(0) > 0$ and $\Omega(1) =$
By the intermediate value theorem, Lemmas A and B thus establish that there exists an informative equilibrium, that is, there is a solution to \( \Omega(\theta^*) = 0 \) with \( \theta^* \in (0, 1) \).

**Proof of Corollary 1:** We need to prove that the cut-off \( \theta^* \) is unique if \( \frac{\partial \Omega(\theta)}{\partial \theta} \bigg|_{\theta=\theta^*} > -\frac{\partial \Delta(\theta; \theta^*)}{\partial \theta} \bigg|_{\theta=\theta^*} \). We prove this by contradiction. On the contrary, let us assume that there are (at least) two solutions to \( \Omega(\theta) = \Psi(\theta) - \theta = 0 \). Let \( \theta_1^* \) and \( \theta_2^* \) be the lowest two solutions. By definition, \( \Psi(\theta_i^*) \) satisfies \( \Delta(\Psi(\theta_i^*), \theta_i^*) = 0 \), where \( i = 1, 2 \). From the implicit function theorem, we have

\[
\Psi'(\theta_i^*) = -\frac{\partial \Delta(\theta; \theta_i^*)}{\partial \theta} \bigg|_{\theta=\theta_i^*} < 1
\]

under the condition we have. This in turn implies that \( \Omega'(\theta_i^*) = \Psi'(\theta_i^*) - 1 < 0 \), where \( i = 1, 2 \). Since we have \( \Omega(0) > 0 \), \( \Omega(\theta) \) should cut through the zero line from above at \( \theta_1^* \), that is, \( \Omega'(\theta_1^*) < 0 \). Then at the adjacent solution \( \theta_2^* \), \( \Omega(\theta) \) should cut through the zero line from below, that is, \( \Omega'(\theta_2^*) > 0 \), which is a contradiction to \( \Omega'(\theta_i^*) = \Psi'(\theta_i^*) - 1 < 0 \), for all \( i = 1, 2 \). This proves that we have a unique equilibrium under the condition we have specified. ( \( \Psi(\hat{\theta}) \) crosses the 45\(^0\)-line in Figure A only once).

**Proof of Proposition 2:** Consider the truth-telling condition (the entrepreneur has a \( B \) project in the first period) when the second project is scaled up by a factor \( \lambda \) compared with the first project:

\[
\left\{ (p_B + \theta (p_G - p_B)) \left( \lambda V_1 - \frac{\lambda I_1}{\mu_2 (B; \theta^*)} \right) \right\} 
- p_B \left( V_1 - \frac{I_1}{\mu_1 (G; \theta^*)} - \frac{1 - \Pr(G; \theta^*)}{\mu_2 (G; \theta^*)} \right) - (p_B + \theta (p_G - p_B)) \left( \lambda V_1 - p_B \frac{\lambda I_1}{\mu_2 (G, S; \theta^*)} - (1 - p_B) \frac{\lambda I_1}{\mu_2 (G, F; \theta^*)} \right).
\]

The expression is positive (negative) if \( \lambda > 1 \) (\( \lambda < 1 \)).

The first line in the expression corresponds to the expected profit associated with reporting \( B \), while the next two lines correspond to the expected profit associated with reporting \( G \). Entrepreneur \( \theta = \theta^* \) (who is indifferent about issuing a \( G \) or a \( B \) report) will strictly favor a truthful \( B \) report if \( \lambda \) increases. This follows from \( \frac{p_B}{p_2(G, S; \theta^*)} + \frac{1}{\mu_2(G, S; \theta^*)} > \frac{1}{\mu_2(B; \theta^*)} \); the average reputation associated with reporting \( G \) is lower than the reputation acquired by reporting \( B \).
**Proof of Proposition 3:** First period: Recall that \( D_1 (\mu_1 (G; \theta^*)) \) is defined by the break-even constraint of creditors:

\[
D_1 (\mu_1 (G; \theta^*)) \mu_1 (G; \theta^*) \Pr(G; \theta^*) + [1 - \Pr(G; \theta^*)] L_1 = I_1.
\]

Recall from Proposition 2 that \( \frac{d\theta^*}{d\lambda} < 0 \) if \( \theta^* \in (0, 1) \). As a reduction in \( \theta^* \) implies that more \( B \) projects are efficiently liquidated, the face value of debt decreases with a reduction in \( \theta^* \).

Second period: Again use that \( \frac{d\theta^*}{d\lambda} < 0 \) if \( \theta^* \in (0, 1) \) and note that

(a) \( \frac{dD_2((B);\theta^*)}{d\lambda} = \frac{1}{\mu_2((B);\theta^*)} \) and that differentiation yields \( \frac{d\mu_2((B);\theta^*)}{d\theta^*} > 0 \) which again leads to

(b) \( \frac{dD_2((G,S);\theta^*)}{d\lambda} = \frac{1}{\mu_2((G,S);\theta^*)} \) and that differentiation yields \( \frac{d\mu_2((G,S);\theta^*)}{d\theta^*} < 0 \) which leads to

(c) \( \frac{dD_2((F);\theta^*)}{d\lambda} = \frac{1}{\mu_2((F);\theta^*)} \) and that differentiation yields \( \frac{d\mu_2((F);\theta^*)}{d\theta^*} < 0 \) which leads to

Proposition 3 follows.

**Proof of Proposition 4:** We need to show

\[
\frac{d(D_1 (\mu_1 (G; \theta^*)) \mu_1 (G; \theta^*))}{d\theta^*} d\theta^* > 0. \tag{24}
\]

From Proposition 2 we have that \( \frac{d\theta^*}{d\lambda} < 0 \) if \( \theta^* \in (0, 1) \). By the break-even constraint of the creditors (equation (8)) we have

\[
D_1 (\mu_1 (G; \theta^*)) \mu_1 (G; \theta^*) = \frac{I_1 - L_1}{\Pr(G; \theta^*^*)} + L_1,
\]

where

\[
\Pr(G; \theta^*) = 1 - \int_{\theta^*}^{1} (1 - \theta) dF(\theta)
\]

Observe that \( \Pr(G; \theta^*) \) is increasing in \( \theta^* \) and, consequently, \( D_1 (\mu_1 (G; \theta^*)) \mu_1 (G; \theta^*) \) is decreasing in \( \theta^* \). Inequality (24) follows.

**Proof of Proposition 5:** Apart from (d) the proof is parallel to the proof of Proposition 3 and not included. Part (d) follows from the fact that the expected type of an entrepreneur which misreport \( (E [\theta | \theta \leq \theta^{E^*}] ) \) drops as \( \theta^{E^*} \) decreases.
Appendix B

This appendix derives the creditors updated beliefs about an entrepreneur’s success probability before the second project is financed. The beliefs depend on the reported probability of success \( (m_1) \), the realized outcome of the first project \( (r_1) \), and the threshold \( \hat{\theta} \); \( \mu_2 (h_2; \hat{\theta}) = \mu_2 (m_1, r_1; \hat{\theta}) \). Creditors’ beliefs, if the first project is stopped and liquidated (i.e., \( B \) is reported), are as follows:

\[
\mu_2(B; \hat{\theta}) = \frac{\Pr(\text{report } B \text{ in first project and success in second project})}{\Pr(\text{report } B \text{ in first project})} \tag{25}
\]

\[
= \frac{\int_{\hat{\theta}}^{1} (p_B + \theta (p_G - p_B)) (1 - \theta) dF(\theta)}{\int_{\hat{\theta}}^{1} (1 - \theta) dF(\theta)}.
\]

If the first project is reported to be \( G \) and the project is a success, beliefs are as follows:

\[
\mu_2(S; \hat{\theta}) = \frac{\Pr(\text{success in first project and success in second project})}{\Pr(\text{success in first project})} \tag{26}
\]

\[
= \frac{\int_{0}^{\hat{\theta}} [p_B + \theta (p_G - p_B)]^2 dF(\theta) + \int_{\hat{\theta}}^{1} \theta p_G [p_B + \theta (p_G - p_B)] dF(\theta)}{\int_{0}^{\hat{\theta}} [p_B + \theta (p_G - p_B)] dF(\theta) + \int_{\hat{\theta}}^{1} \theta p_G dF(\theta)}.
\]

On the other hand, if the first project is reported to be \( G \) and the project is a failure, beliefs are as follows:

\[
\mu_2(F; \hat{\theta}) = \frac{\Pr(\text{failure in first project and success in second project})}{\Pr(\text{failure in first project})} \tag{27}
\]

\[
= \frac{\int_{0}^{\hat{\theta}} [\theta (1 - p_G) + (1 - \theta) (1 - p_B)] [p_B + \theta (p_G - p_B)] dF(\theta)}{\int_{0}^{\hat{\theta}} [\theta (1 - p_G) + (1 - \theta) (1 - p_B)] dF(\theta) + \int_{\hat{\theta}}^{1} \theta (1 - p_G) dF(\theta)}.
\]
Appendix C

This appendix describes the conditional probabilities with probabilistic enforcement.

i) Given that the first project is reported to be $G$, no enforcement actions are taken, and the project is a success, beliefs are as follows:

$$
\mu_2(S, n; \hat{\theta}) = \frac{\Pr(\text{success in first project, no enforcement, success in second project})}{\Pr(\text{success in first project})} \\
= \frac{\int_{0}^{\hat{\theta}} \left[ \theta p_G + (1 - \theta) (1 - \phi) p_B \right] \left[ \theta p_G + (1 - \theta) p_B \right] dF(\theta) + \int_{\hat{\theta}}^{1} \theta p_G \left[ p_B + \theta (p_G - p_B) \right] dF(\theta)}{\int_{0}^{\hat{\theta}} \left[ \theta p_G + (1 - \theta) (1 - \phi) p_B \right] dF(\theta) + \int_{\hat{\theta}}^{1} \theta p_G dF(\theta)}
$$

ii) Given that the first project is reported to be $G$, no enforcement actions are taken, and the project is a failure, beliefs are as follows:

$$
\mu_2(F, n; \hat{\theta}) = \frac{\Pr(\text{failure in first project, no enforcement action, success in second project})}{\Pr(\text{failure in first project, no enforcement action})} \\
= \frac{\int_{0}^{\hat{\theta}} \left[ \theta (1 - p_G) + (1 - \theta) (1 - \phi) (1 - p_B) \right] \left[ p_B + \theta (p_G - p_B) \right] dF(\theta) + \int_{\hat{\theta}}^{1} \theta (1 - p_G) \left[ p_B + \theta (p_G - p_B) \right] dF(\theta)}{\int_{0}^{\hat{\theta}} \left[ \theta (1 - p_G) + (1 - \theta) (1 - \phi) (1 - p_B) \right] dF(\theta) + \int_{\hat{\theta}}^{1} \theta (1 - p_G) dF(\theta)}
$$

iii) If enforcement actions uncover that a B project is reported as $G$, then beliefs are independent of outcome and are given by:

$$
\mu_2(F, e; \hat{\theta}) = \mu_2(S, e; \hat{\theta}) = \mu_2(e; \hat{\theta}) = \frac{\Pr(\text{enforcement action, success in second project})}{\Pr(\text{enforcement action})} \\
= \frac{\int_{0}^{\hat{\theta}} (1 - \theta) \phi \left[ p_B + \theta (p_G - p_B) \right] dF(\theta)}{\int_{0}^{\hat{\theta}} (1 - \theta) \phi dF(\theta)} = \frac{\int_{0}^{\hat{\theta}} (1 - \theta) \left[ p_B + \theta (p_G - p_B) \right] dF(\theta)}{\int_{0}^{\hat{\theta}} (1 - \theta) dF(\theta)}
$$
References


FIGURES

Figure 1:

Stage 0
Creditors decide whether to finance a project.

Nature draws with probability $\theta$ a good project and with probability $1-\theta$ a bad project.

Figure 2:

$\theta = 0$  
$Always \ report \ G$  
$\theta^*$  
$Truthful \ report$  
$\theta = 1$

Figure 2: Reporting strategies

Figure 3

$\theta = 0$  
$Always \ report \ G$  
$\theta^*$  
$Truthful \ report$  
$\theta = 1$

Figure 3: Investment opportunities and the entrepreneur’s reporting strategy.
Figure A: Illustration of Lemma A ($\Psi(1) < 1$) and Lemma B ($0 < \Psi(0)$) and the fixed point, $\theta^*$. 