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Disclosure, investment and regulation

Per Östberg

Department of Finance and Management Science, Norwegian School of Economics and Business Administration, Helleveien 30, N-5045 Bergen, Norway

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Abstract

This paper provides a framework to analyze voluntary and mandatory disclosure. Since improved disclosure reduces the entrepreneur's ability to extract private benefits, it secures funding for new investments, but also provides existing claimholders with a windfall gain. As a result, the entrepreneur may choose to forgo investment in favor of extracting more private benefits. A mandatory disclosure standard reduces inefficient extraction and increases investment efficiency. Although the optimal standard is higher than the entrepreneur's optimal choice, it can be less than complete in order not to deter investment. The model also shows that better legal shareholder protection goes together with higher disclosure standards and that harmonization of disclosure standards may be detrimental.

JEL classification: G28; G38

Keywords: Disclosure; Regulation; Corporate governance

1. Introduction

There is extensive evidence that increases in disclosure leads to greater shareholder value. For instance, Miller (1999) finds an abnormal return of 1.15% to the announcement of a US listing. Even though there are significant returns to increasing disclosure Doidge et al. (2004) report that only one in ten large firms choose to increase their disclosure level by cross-listing their shares on a US market. These findings suggest that the increase in disclosure is in the interest of shareholders, but not in the interest of those controlling the firm. If firms are exposed to an agency

E-mail address: per.ostberg@nhh.no.

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problem that is mitigated by disclosure, then why is it that regulators in environments with weak disclosure standards do not all impose the standards found in strong disclosure environments?

To address this question, we provide a general model of voluntary and mandatory disclosure that is applicable to various disclosure decisions, such as going public, cross-listing on a foreign exchange, or imposing a minimum disclosure requirement. Using this framework we analyze the disclosure choice of an entrepreneur. Given the entrepreneur's disclosure decision, we are able derive the optimal level of disclosure regulation. We show that, complete disclosure may not be optimal. If the firm is exposed to both a moral hazard problem and a debt overhang, then the optimal disclosure level may be partial in order to foster investment efficiency.

In our setting the disclosure level determines the verifiability of the firm's assets and therefore reduces the insider's moral hazard problem. So the entrepreneur can use disclosure to credibly commit not to expropriate investors and thereby raise financing for investment. Due to the presence of existing claimholders, adhering to a higher disclosure level also comes with a cost: it reduces the insider's ability to expropriate all investors, thereby giving existing claimholders a windfall gain. When an increase in disclosure is necessary to attract financing the entrepreneur faces a trade-off between the windfall gain provided to existing outsiders and the added value of the investment. In effect the existing claimholders act as a debt overhang on investment and some positive NPV investments may not be undertaken. If the size of the existing outsiders claim is sufficiently large, then the entrepreneur prefers to select an as low disclosure level as possible. Essentially, the entrepreneur compares the cost of consuming through private benefits to the cost of consuming through security benefits. In this setting there are two benefits of implementing a mandatory standard. First, implementing a mandatory disclosure standard reduces the amount of costly expropriation. Secondly, even though the existing claimholders represent a debt overhang a mandatory standard increases investment efficiency. Intuitively, since the mandatory standard applies irrespective if the entrepreneur invests, it reduces the benefit from abstaining and thereby makes investing relatively more attractive to the insider. Nonetheless, due to the debt overhang, the optimal disclosure standard may be less than complete in order to foster investment. In fact, the best partial standard depends on firm characteristics implying that a disclosure standard suitable for one firm may not suit a firm with different characteristics. So harmonization of disclosure standards may be sub-optimal. The regulator's trade-off implies that the greater the shareholder protection the more likely the social planner is to implement complete disclosure. Intuitively, stronger shareholder protection increases—by assumption—the deadweight loss of extraction which increases the social planner's returns from increasing the disclosure level. This implies that economies with better shareholder protection also have higher mandatory disclosure standards.

There is ample evidence concerning the effect of firm disclosure on stock prices.[1] Doidge et al. (2004) find that exchange-listed firms that choose to cross-list their shares are worth up to 37% more than firms that choose not to cross-list. These papers broadly support the view that the firm is exposed to a moral hazard problem that is mitigated by adopting stricter disclosure requirements and that complying to stricter disclosure standards is not in the interest of the insiders of the firm.

There is less evidence on the effect of an increase in mandatory disclosure standards. Bushee and Leuz (2005) find that imposition of additional disclosure requirements on firms listed on the OTCBB (Over the Counter Bulletin Board) implied that many firms delisted corroborating

[1] Karolyi (1998) contains a survey of the literature.

that disclosure is associated with significant costs. In our theory the reduction in private benefit extraction that an increase in the disclosure standard implies may result in firms delisting. Greenstone et al. (2006) document positive and significant returns from increasing mandatory disclosure requirements through the 1964 Securities Acts Amendments. Our theory predicts that moderate standards yield positive price increases due to a reduction in rent seeking by insiders and increases in investment efficiency. Unfortunately their paper does not consider the effects on investment efficiency and they only consider a single change in the disclosure standard.

Our theory has a number of testable implications that to date have not been explored fully by the empirical literature. First, the model predicts that a moderate mandatory standard maximizes investment efficiency. A complete standard or no standard implies less positive NPV investments are undertaken. Second, the social planner's trade-off implies that the greater the desire for shareholder protection, the more likely the social planner is to implement complete disclosure.

This paper is related to both the traditional disclosure literature which models disclosure as information transmission (e.g., Verrecchia, 1983) and the growing incomplete contracting literature in law and finance. The present incomplete contract model emphasizes the impact of disclosure on the verifiability (as in the sense of Hart, 1995) of the firms' revenues.[2] More precisely, we assume that the disclosure level determines the probability that the realized cash flow is verifiable, thereby limiting the extent to which investors can be expropriated. Intuitively, when a firm discloses the existence of a certain asset (or the value of that asset) this asset becomes verifiable in a court of law. An example of how disclosure may affect the verifiability of the firms assets is the treatment of hidden reserves. Code law allows firms to keep some hidden reserves which effectively implies that it is less likely that this cash is verifiable in a court of law.[3] The asymmetric information literature on disclosure implicitly assumes that cash flows are verifiable while we relax that assumption in a setting with symmetric information.

Boot and Thakor (2001) consider the types of information that a firm should voluntarily disclose. They find that information disclosure may strengthen or weaken private information production incentives depending on whether the information substitutes or complements information possessed by investors. Substitute information disclosure reduces financial innovation incentives while complementary and to-be-processed information has an ambiguous effect on financial innovation. They additionally conclude that there might be a role for mandatory disclosure if there is a conflict of interest between shareholders and investors. Admati and Pfleiderer (2000) argue that there is a role for mandatory disclosure when firm values are correlated, disclosing information is costly and information asymmetries between firms and investors reduce firm values. In essence, firms do not internalize the positive effect that their disclosure has on other firms. Fishman and Hagerty (1990) show that in a setting in which agents cannot disclose all of their information imposing a mandatory standard that reduces discretion may improve informativeness. Fishman and Hagerty (1995) shows that disclosure of information is a commitment to trade aggressively and thereby discourages competition. All of the above papers are related in the sense that they consider disclosure, but they consider disclosure to be related to asymmetric information and they do not consider the effect of disclosure on firm investment decisions.

The corporate governance literature pioneered by La Porta et al. (1997, 1998) documents that countries with weak legal protection of minority shareholders have less developed and narrower capital markets. The importance of disclosure for capital markets is highlighted in a recent study

[2] Common to both approaches is that disclosure helps investors to avoid losing money.

[3] When Daimler Chrysler listed on the NYSE a profit under German code-law was turned into a sizeable loss due to common law treatment of hidden reserves.

by La Porta et al. (2006) that find that disclosure and liability rules are more important than public enforcement for stock market development. Within the corporate governance literature, there are a number of related contributions. Shleifer and Wolfenzon (2002) who consider the effect of the legal environment on the size of the capital markets and the decision to go public by entrepreneurs. Another related paper is that of Durnev and Kim (2005) who also consider the governance choices of firms. These papers consider the firm to be subject to a moral hazard problem, but abstract from existing claimholders. The absence of existing claimholders implies that more regulation is always beneficial.

The most closely related paper is Doidge et al. (2004) which illustrates an insider's decision to cross-list the firm's shares. In their model the entrepreneur faces a trade-off between the ability to extract private benefits of control and the ability to fund future growth opportunities. In contrast to this paper, their model does not consider a regulator. Introducing a social planner in their setting results in a trivial outcome because imposing a higher level of corporate governance never has any downside. Additionally, their model considers exclusively cross-listing while this paper is more general in the sense that it is applicable to other increases in verifiability such as IPOs.

Other related theoretical literature includes Modigliani and Perotti (2000), but in our model the entrepreneur is given the option to commit not to expropriate the investors by complying with disclosure rules. Bergman and Nicolaievsky (2002) examine charters of Mexican firms and find that private firms more often enhance the protection of minority shareholders than public firms. They explain this result in a theoretical model in which providing extensive legal protection may lead to "overinclusion" which requires renegotiation. Publicly held firms have higher renegotiation costs and hence insiders in a public firm provides lower minority protection than private firms with low renegotiation costs.

Holmström and Kaplan (2003) argue that the greatest risk now facing the US corporate governance system is the possibility of overregulation. This is very much in line with the conclusions of this paper, since some regulation is beneficial because it reduces wasteful expropriation and increases investment efficiency, but regulation beyond a certain point may be sub-optimal.

The crucial assumption of our model is the existence of claimholders at the time the disclosure level is chosen. There is ample empirical motivation for this assumption. According to Field and Sheehan (2004) 83% of all firms going public have an outside blockholder. In addition, most firms have other significant stakeholders who have relative to new investors senior claims, such as wages, trade credits and other creditor liabilities. Additionally, Dyck and Zingales (2004) point out that the government has a residual claim in all firms through the firm's corporate tax liabilities. These tax claims exist before any contract is written with the firm and cannot be renegotiated.

It is also well known that venture capitalists use other mechanisms to motivate entrepreneurs and protect themselves from expropriation. They require seats on the board, the ability to veto decisions within the firm and they give financing in stages to ensure that the entrepreneur fulfills his obligations. When a venture capitalist exits his investment the mechanisms employed by the venture capitalist needs to be replaced. For many firms stock market disclosure rules serve this purpose.

The paper is organized as follows. Section 2 outlines the model. Section 3 examines the entrepreneur's choice of disclosure level. Section 4 analyzes the disclosure choice of a social planner. Section 5 discusses robustness issues such as renegotiation, incentive contracts and seniority. Section 6 describes the empirical implications of the model and discusses how these might be tested. Section 7 concludes.

2. Model

Consider a firm run by an entrepreneur that has assets in place that generate a random cash flow. With probability θ the firm succeeds and is worth X. With probability $(1-\theta)$ the firm fails and is worth zero. Besides the entrepreneur, there are existing outside investors who hold a claim $\beta \in (0, 1)$ on the expected cash flow. Importantly, we assume that their claim is senior, i.e., they hold debt.[4] The model has three dates, there is no discounting, and all agents are risk-neutral.

At date $t = 1$ the entrepreneur can choose a disclosure level $\lambda \in [0, 1]$ to which the firm will adhere. The disclosure level λ determines the probability with which the entire cash flow X is verifiable. The lack of disclosure level prior to $t = 1$ is merely a normalization. For our results it suffices to assume that the disclosure level prior to $t = 1$ is less than complete.

At date $t = 2$ the entrepreneur has the possibility to undertake an investment at financial cost F. The investment increases the success probability from θ to $\theta + \Delta$. The important implication of this formalization is that the investment return cannot be separated from the return generated by the assets in place. The entrepreneur is cash-constrained and has to raise F on the competitive capital market. Additionally, the entrepreneur may only issue claims that are junior to the existing outsiders' claim. As a result, the entrepreneur has to raise F by selling a part of his stake. Thus, the new investors purchase a claim $\alpha \in [0, 1-\beta]$. The entrepreneur retains control over the firm, irrespective of the fraction of cash flow rights that he retains. We denote his stake by $\gamma \in [0, \beta]$. The sum of all stakeholders' claims must sum up to unity which implies $\beta + \alpha + \gamma = 1$.

At date $t = 3$ the cash flow X realizes with probability θ or probability $\theta + \Delta$ (depending on whether the investment was undertaken). The cash flow is not verifiable with probability $(1-\lambda)$ in which case the entrepreneur decides how much of the cash flow to expropriate. Otherwise, X is paid out to investors and entrepreneur in accordance with the size of their respective stakes β, α and γ. We assume that diversion involves a constant marginal deadweight loss. For each dollar the entrepreneur diverts, he receives $(1-\phi)$ dollars in private benefits where $\phi \in [0, 1]$ denotes the expropriation cost. Moreover, the entrepreneur cannot target specific claims when extracting private benefits. That is, expropriation dilutes his and all investors' claims equally. Private benefit extraction should be broadly interpreted as any action that does not maximize the outside investors claim, such as underprovision of effort or consumption of various perquisites (Jensen and Meckling, 1976).

The model explores the interaction between two agency problems, the possibility to divert corporate resources and the debt overhang. Obviously, the latter relies on the assumption that existing outsiders hold a senior claim. The seniority of the existing outsiders' claim should be interpreted as a composite claim (of all senior claims) that the entrepreneur entered into prior to choosing the disclosure level and that is difficult or impossible to renegotiate. As mentioned in the introduction, there are various examples of such claims. In a later section, we explore the robustness of our results with respect to the seniority assumption.

3. Voluntary disclosure

To determine the entrepreneur's optimal disclosure choice, we solve the model backwards. We derive the conditions under which the entrepreneur diverts revenues and then the conditions under which he undertakes the investment. Finally, we determine the disclosure choice.

[4] Since we have a binary outcome we can assume that β represents a debt claim.

Suppose some disclosure level λ has been chosen at $t = 1$ and the firm succeeds. This outcome is feasible irrespective of whether or not the investment is undertaken, as the investment merely increases the success probability from θ to $\theta + \Delta$. With probability λ the revenues are verifiable, preventing any diversion. With the complementary probability $(1 - \lambda)$ the cash flow is not verifiable, and the entrepreneur has full discretion over the resource allocation. When diverting a fraction $d \in [0, 1]$ the entrepreneur's payoff is

$$\Pi = \big[(1 - d)\gamma + d(1 - \phi)\big]X. \tag{1}$$

Since his marginal cost γ and his marginal benefit $(1 - \phi)$ of diversion are both constant, the entrepreneur expropriates the entire cash flow if $(1 - \phi) > \gamma$, and nothing if $(1 - \phi) < \gamma$.[5]

The entrepreneur's incentives to expropriate ex post depend on the chosen disclosure level. A higher disclosure level reduces the size of the stake that the new investors require to fund the investment. While the disclosure level affects the entrepreneur's remaining stake, it has no impact on the size of the existing claims β.

When investing, the reduction in the entrepreneur's stake can create a time consistency problem because the expropriation cost borne by the entrepreneur decreases with the issue. Since the new investors anticipate the entrepreneur's diversion decision, they require compensation, i.e., a larger stake, if the entrepreneur has incentives to expropriate at $t = 3$. Thus, the entrepreneur does not gain from expropriating the new investors. By contrast, the possibility to divert from the existing outsiders may be valuable.

Lemma 1. *For $\beta \leqslant \phi$, the entrepreneur never diverts any revenues in equilibrium.*

Intuitively, if the expropriation cost exceeds the fraction owned by existing outsiders, the entrepreneur never wants to divert ex ante. This also holds ex post, if his stake after the issue still exceeds the marginal benefit of diversion $(1 - \phi < \gamma = 1 - \alpha - \beta)$. Conversely, if the issue is large, the entrepreneur prefers to expropriate ex post, even though he would gain ex ante from forgoing the opportunity to divert. Disclosure allows the entrepreneur to resolve the time consistency problem: By choosing full disclosure $(\lambda = 1)$ the entrepreneur commits himself not to divert.

By contrast, if the fraction held by the existing outsiders exceeds the expropriation cost $(\beta > \phi)$ there is always a conflict of interest between existing outsiders and the entrepreneur. Moreover, the entrepreneur does not want to avoid this conflict by choosing full disclosure. Subsequently, we restrict attention to this constellation.

Assumption 1. $\beta > \phi$.

This assumption ensures that the entrepreneur prefers to divert even though he has to compensate the new investors.

Consider the entrepreneur's issue and invest decision at date $t = 2$ for some given disclosure level λ. Since the project has a positive NPV, the entrepreneur always invests if he has raised the financing. He prefers to invest if

$$(\Delta + \theta)\big[\lambda(1 - \alpha - \beta) + (1 - \lambda)(1 - \phi)\big]X > \theta\big[\lambda(1 - \beta) + (1 - \lambda)(1 - \phi)\big]X. \tag{2}$$

[5] This is a result of the constant cost of diversion. An increasing marginal cost could yield an interior solution, as in Burkart et al. (1998), but would not affect the qualitative results.

Rearranging this inequality yields

$$\Delta\big[\lambda(1-\beta)+(1-\lambda)(1-\phi)\big]X > (\Delta+\theta)\lambda\alpha X. \tag{3}$$

This condition compares the entrepreneur's benefit and cost from undertaking the investment. The benefit depends on the disclosure level. When the revenues are verifiable, the entrepreneur has to share the expected investment return with the existing outsiders. Otherwise, he can extract the entire expected investment return as private benefits. The cost is simply that new investors receive a share of the entire firm in return for financing the investment. As will become clear later, condition (3) is not a binding constraint in equilibrium.

Given that markets are competitive, the new investor's participation constraint is

$$\alpha = \frac{F}{\lambda(\Delta+\theta)X}. \tag{4}$$

In addition, the entrepreneur can at most sell his entire stake $(1-\beta)$. Hence, the investment is only feasible if $(1-\beta) \geqslant \alpha = F/(\lambda(\Delta+\theta)X)$. Rearranging this condition allows us to express the participation constraint in terms of a lower bound on the disclosure level

$$\lambda \geqslant \lambda_{\min} \equiv \frac{F}{(1-\beta)(\Delta+\theta)X}. \tag{5}$$

Thus, unless the entrepreneur chooses $\lambda > \lambda_{\min}$, the investment is not feasible because the new investors cannot break even. Additionally, unless $1 \geqslant \lambda_{\min}$ the firm is not feasible since there is no disclosure level such that investors break even. Formally, the following assumption implies that the firm is feasible

Assumption 2. $(1-\beta)(\Delta+\theta)X \geqslant F$.

The above assumption ensures that the firm is profitable enough to allow new investors to recover their investment if the entrepreneur commits to no expropriation. Which disclosure level $\lambda \geqslant \lambda_{\min}$ does the entrepreneur choose at $t=1$, given he intends to issue and invest at $t=2$? His expected payoff from doing so is

$$\Pi = (\Delta+\theta)\big[\lambda(1-\alpha-\beta)+(1-\lambda)(1-\phi)\big]X.$$

Taking the new investors' participation constraint into account, the entrepreneur maximizes

$$\Pi = (\Delta+\theta)\big[\lambda(\phi-\beta)+(1-\phi)\big]X - F$$

subject to the constraint

$$\lambda \geqslant \lambda_{\min}.$$

Since $\beta > \phi$ (Assumption 1), the entrepreneur's payoff decreases with the disclosure level and the constraint binds. Note that as long as the investment is of positive NPV the entrepreneur always invests after issuing equity. The intuition for this is that once a disclosure level is set the entrepreneur has already borne the cost of undertaking the investment (the reduction in expropriation) and since the entrepreneur's expropriation income depends on the final cash flow he gains from undertaking the investment.[6]

[6] Formally, the payoff from investing once equity has been issued is $(\Delta+\theta)[\lambda\gamma+(1-\lambda)(1-\phi)]X$ while the payoff from not investing is $(\theta X+F)[\lambda\gamma+(1-\lambda)(1-\phi)]$. Hence, the entrepreneur invests as long as $\Delta X > F$.

Selecting the minimum possible disclosure level implies that the entrepreneur sells his entire stake to the new investors ($(1-\beta)=\alpha$). This extreme result is due to the assumption that the entrepreneur retains control irrespective of the size of his stake. Below we discuss how the entrepreneur's choice is affected if control requires some minimum stake.

Intuitively, the choice of the disclosure level involves a trade-off between granting existing outsiders a windfall gain and expropriation cost. On the one hand, a higher disclosure level increases the transfer to existing outside claimholders, thereby aggravating the debt overhang problem. On the other hand, it reduces the likelihood that revenues are not verifiable and hence the expected expropriation cost. Since the fraction held by the existing outsiders exceeds the expropriation cost, the trade-off has a corner solution. That is, the entrepreneur minimizes the transfer to the existing outsiders by choosing the minimum feasible disclosure level $\lambda_{\min}$.

Clearly, if the entrepreneur does not plan to invest, he does not have to satisfy the participation constraint. In this case, his objective function is given by

$$\Pi = \theta\big[\lambda(\phi-\beta)+(1-\phi)\big]X$$

which also strictly decreases with λ. Thus, the entrepreneur chooses not to disclose at all ($\lambda=0$) when he does not undertake the investment.

Recall that the zero disclosure level prior to date $t=1$ is a normalization. Thus, the result that the entrepreneur chooses $\lambda=0$ when abstaining from investing should be interpreted as no increase in the disclosure level.

Comparing the payoffs associated with $\lambda=\lambda_{\min}$ and with $\lambda=0$ illustrates that the entrepreneur chooses to issue and invest if

$$(\Delta+\theta)\big[\lambda_{\min}(\phi-\beta)+(1-\phi)\big]X - F \geqslant \theta\big[(1-\phi)\big]X$$

or equivalently, if

$$\Delta X \geqslant \Delta\beta X + F. \tag{6}$$

The entrepreneur undertakes the investment if the expected total return exceeds the sum of the transfer to existing outsiders and the investment cost. Clearly, the investment decision is always efficient in the absence of the debt overhang problem ($\beta=0$). For future reference, we denote by C_1 the total expected return ΔX for which the above condition holds with strict equality. This lower bound on the investment return is equal to

$$C_1 = \frac{F}{(1-\beta)}. \tag{7}$$

Proposition 1. *If the debt overhang binds ($\Delta(1-\beta)X < F$) the entrepreneur abstains from investment and does not disclose anything, i.e. selects $\lambda^E=0$. If $\Delta(1-\beta)X \geqslant F$ the entrepreneur selects $\lambda^E=\lambda_{\min}$ and undertakes the investment.*

The proposition predicts that firms with a significant amount of existing outside claimholders choose not to increase their disclosure levels. That is, efficient investments may be forgone because the existing outsiders' claim is too large, just like in Myers (1977). Doidge et al. (2005) find that the probability of a firm cross-listing is inversely related to the difference between control and cash flow rights. In our context, a high β implies control with little cash flow rights and all other things equal, more likely that the firm does not cross-list. As is shown in the section on seniority the crucial assumption for the investment distortion is the seniority of existing

claimholders and so the model predicts that it might not be the lack of cash flow rights per se which precludes firms from cross-listing but rather the size of senior claims.

The value of the existing claimholders stake is increased by $\beta\lambda_{\min}(\Delta+\theta)X$. We have given existing claimholders seniority to avoid their claim being diluted, but we could relax the assumption of seniority (i.e. assume that they hold equity) and assume that their interest is protected by an anti-dilution provision. In which case stock prices would increase with an increase in the disclosure level (as documented by Miller, 1999 and others).

For all firms that satisfy the above condition (6), the optimal disclosure level λ^E increases with investment cost F and the size of the existing outsiders' stake β, but decreases with the profitability of the investment ΔX and of the assets in place θX. Another implication of the result $\lambda^E = \lambda_{\min}$ is that the entrepreneur prefers to use internal funds to finance the investment. Intuitively, the less funds the new investors have to contribute the lower the necessary disclosure level, which in turn allows the entrepreneur to divert the revenues more often. (A formal proof is given in Appendix A.)

Taken together, these results imply that the relationship between firm size and disclosure level is ambiguous due to opposing effects. On the one hand, less profitable firms choose higher disclosure levels. So, if economic growth implies ceteris paribus a decrease in return to capital, the model predicts that voluntary disclosure levels increase with the maturity of the economy (firms). On the other hand, larger and older firms typically have more retained earnings which eases the financing constraint, thereby reducing the required disclosure level. Another prediction is that larger firms tend to have more existing claimholders (β) and therefore have to opt for higher disclosure levels. While the relation between size and disclosure level is in general indeterminate, the implication for cash-constrained growth firms is clear cut: Growing firms without cash have to increase their disclosure level to finance their investments. Hence, a prediction of the model is that finance junkies need to select higher disclosure levels than cash cows.

As mentioned above, the entrepreneur sells his entire stake when he sets $\lambda^E = \lambda_{\min}$. If control would require some minimum stake $\underline{\gamma}$, the entrepreneur has to choose a higher disclosure level to simultaneously satisfy the new investors' participation constraint and the control constraint. Clearly, this renders the investment option less attractive, and ceteris paribus less entrepreneurs would find it profitable to invest.

The above analysis assumes that the entrepreneur can choose any disclosure level in the unit interval. This can be interpreted as a legal system allowing the entrepreneur numerous (infinite) choices with respect to the amount of revenues that he can pledge to outside investors. Such an abundant menu of options is only available in a sophisticated legal system characterized by highly developed institutions, functioning courts, liability standards and various opt-out provisions. Arguably, lesser developed institutions do not provide such rich menus. In particular, the amount of returns that corporate insiders can credibly pledge to outside investors is limited in countries with a weak legal system.

To determine the entrepreneur's decision in situations when every disclosure level within the unit interval is not available we need to determine the maximum disclosure level for which the entrepreneur is willing to invest given that he has the option to abstain To achieve this, we replace $\lambda = 0$ into the LHS of Eq. (2) and rearrange which yields

$$\lambda_{\max}^{\text{out}} \leqslant \frac{\Delta(1-\phi)X - F}{(\Delta+\theta)(\beta-\phi)X}. \tag{8}$$

This yields an upper bound on the disclosure level that is consistent with the entrepreneur undertaking the investment. Higher disclosure levels increase the likelihood that the cash flow is

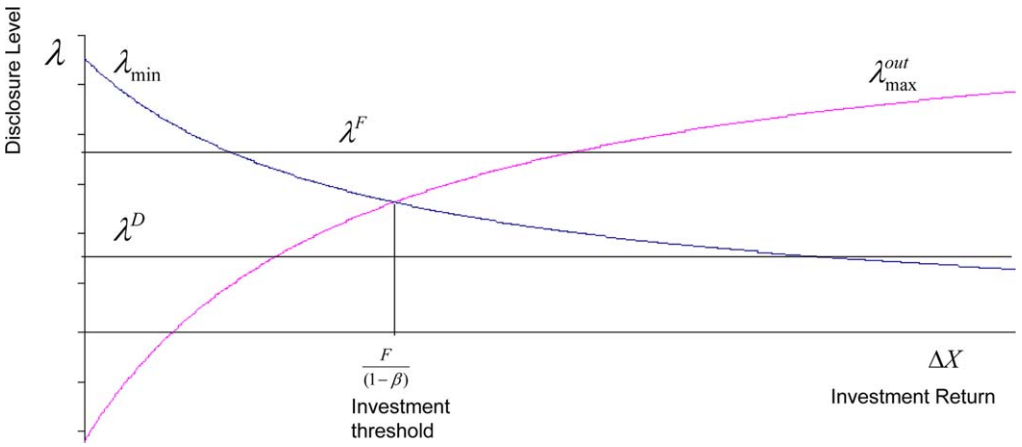

Fig. 1. The entrepreneur's disclosure decision. The graph is plotted for parameter values $\beta = 0.8$, $\phi = 0.3$, $\theta = 0.3$, $X = 60$, $F = 4$ and Δ ranging from 0 to 1.

verifiable and thereby the transfer to existing outsiders. For $\lambda > \lambda_{\max}^{\text{out}}$ the debt overhang is so severe that the entrepreneur prefers not to issue and invest. Later we are going to consider a mandatory standard and this is going to affect the payoff from abstaining and therefore change entrepreneur's willingness to undertake the investment. So when there is an available disclosure level such that $\lambda \in (\lambda_{\min}, \lambda_{\max}^{\text{out}})$ then the entrepreneur prefers to invest rather than abstain.[7]

In our framework, a weak legal system can be modeled as an upper bound λ^D on the disclosure level available to an entrepreneur. Given this restriction, only entrepreneurs with very profitable investments ($\lambda^E < \lambda^D$) are able to fund their investment. Consider now the possibility of overcoming the weak domestic institutions by means of cross-listing on a foreign stock exchange with $\lambda^F > \lambda^D$.

Figure 1 illustrates both the minimum disclosure level that ensures that new investors break even ($\lambda_{\min}$) and the condition that ensures that the entrepreneur prefers to undertake the investment ($\lambda_{\max}^{\text{out}}$). If $\Delta X < C_1$ then we know that the entrepreneur abstains from the investment and selects $\lambda^E = 0$. As long as $\Delta X > C_1$, then we know that $\lambda_{\min} < \lambda_{\max}^{\text{out}}$ and we consider that part of Fig. 1 from now on. The two horizontal lines in Fig. 1 depict the maximum domestic disclosure standard λ^D, and the standard required by the foreign stock exchange λ^F. If neither λ^D or λ^F belong to $[\lambda_{\min}, \lambda_{\max}^{\text{out}}]$ then there is no disclosure level such that the investment is feasible and the entrepreneur abstains. If $\lambda_{\min} < \lambda^D < \lambda_{\max}^{\text{out}}$ then the entrepreneur's investment is so profitable that he can finance the investment using the domestic disclosure level and he selects $\lambda^E = \lambda^D$ and invests. If $\lambda^D < \lambda_{\min} < \lambda^F < \lambda_{\max}^{\text{out}}$ then the domestic disclosure standard is not sufficient to ensure that investors break even and the entrepreneur chooses to cross-list on the foreign exchange in order to invest.

A number of predictions emerge from this analysis of the entrepreneur's decision to cross-list. First, among the firms that undertake the investment, those with a lower return, or equivalently higher funding requirement, cross-list. Second, the value of the outsiders' stake increases with the disclosure level. Third, a lower domestic disclosure level induces more firms to cross-list. Fourth, in countries with weak shareholder protection (low ϕ) more firms are likely to face a

[7] Not surprisingly $\lambda_{\max}^{\text{out}} \geqslant \lambda_{\min}$ as long as $\Delta X \geqslant C_1$.

conflict of interest between insiders and outsiders, and therefore require disclosure to fund their investment. Hence, we expect an inverse relationship between shareholder protection and the number of firms that cross-list.

Several recent empirical studies analyze the decision to cross-list. Blass and Yafeh (2001) find that Israeli firms choosing to go public on NASDAQ as opposed to the Tel Aviv Stock Exchange are in general more R&D intensive. This fits well with the model's first prediction that firms with ample investment opportunities, but little funds choose to cross-list their shares. Doidge et al. (2004) report that firms which cross-list have a 16.5 percent higher Tobin's Q than those which do not cross-list. Reese and Weisbach (2002) document that firms from French Civil Law countries are more likely to cross-list on an exchange than firms from English Common Law countries. This finding corroborates the prediction that firms from weak legal environments are more likely to cross-list.

4. Disclosure regulation

In this section we introduce a social planner who imposes a mandatory disclosure standard λ^M, say through the choice of disclosure requirements in company law. Within our framework such a mandatory standard prevents the entrepreneur from selecting any disclosure level $\lambda^E < \lambda^M$. Other than choosing λ^M, the social planner (regulator) has by assumption no influence over private party contracting, notably he cannot affect the claims of the existing outsiders nor the expropriation cost. We further assume that Assumption 1 ($\beta > \phi$) continues to hold.

The regulator sets the disclosure level such as to maximize total expected revenues net of any expropriation cost. From the analysis above, it follows that the socially optimal disclosure level entails a trade-off between investment efficiency and expropriation cost. While a higher disclosure level reduces the expected expropriation cost, the social planner may not want to require full disclosure because this may discourage investment.

To derive the socially optimal disclosure standard we need to compare the social welfare of two different outcomes; the social welfare obtained when disclosure is compatible with investment and the social welfare obtained when disclosure discourages investment. To this end we repeat the analytical steps of the previous section and determine how the entrepreneur reacts to the minimum standard. Thereafter we derive the socially optimal disclosure choice for a given investment behavior.

The entrepreneur's resource allocation decision at $t = 3$ is independent of the disclosure level. For any imposed λ^M, he expropriates the entire cash flow when cash flow is not verifiable because of Assumption 1. At $t = 2$ the entrepreneur issues and invests for a given disclosure level if condition (3) is satisfied. Replacing the investor participation constraint (4) in condition (3) yields the upper bound on the disclosure level

$$\lambda_{\max} = \frac{\Delta(1-\phi)X - F}{\Delta(\beta-\phi)X} \tag{9}$$

that is compatible with investment. Note that, Eq. (9) is greater than condition (8) which guarantees investment in the absence of a mandatory standard. The mandatory standard reduces RHS of (3) since the standard limits how low a disclosure level the entrepreneur can select if he plans to abstain.

Given that the regulator wants to preserve the entrepreneur's incentives to invest, maximizing social welfare solves

$$\max_{\lambda}(\Delta+\theta)\big[\lambda\gamma + (1-\lambda)(1-\phi) + \lambda\beta + \lambda\alpha\big]X - F$$

subject to the constraints

$$\lambda \leqslant \lambda_{\max}, \quad \lambda \geqslant \lambda_{\min}.$$

Clearly, the social objective function increases with λ and the social planner selects $\lambda^* = \lambda_{\max}$.

Consider now the outcome in which mandatory disclosure discourages investment. In this case, the regulator obviously wants to minimize the expropriation cost and maximizes

$$\theta\big[\lambda(1-\beta) + (1-\lambda)(1-\phi) + \lambda\beta\big]X$$

by setting $\lambda^* = 1$. That is, if the social planner abstracts from the impact that the mandatory disclosure standard may have on investment efficiency, his only concern is the expropriation cost.

Having derived the socially optimal disclosure standard for the outcome with and without investment, we now examine the effects of a mandatory disclosure standard on investment efficiency and social welfare.

The introduction of a mandatory standard has two potential effects on investment efficiency. First, since it increases the value of the existing outsiders claim it aggravates the debt overhang and thereby reduces investment efficiency. Second, since it reduces the value from abstaining it may increase investment efficiency. Introducing a complete mandatory disclosure standard does not distort the entrepreneur's incentives to undertake the investment vis-à-vis allowing the entrepreneur to select any disclosure level.

Remark 1. The entrepreneur has the same investment incentives under a complete disclosure requirement ($\lambda^M = 1$) as in absence of a mandatory standard ($\lambda^M = 0$).

Inserting $\lambda = 1$ into (2) illustrates that even though the introduction of a complete standard implies a higher disclosure standard in case of investment ($1 > \lambda_{\min}$) it also implies a higher disclosure level in case the entrepreneur chooses to abstain ($1 > 0$). This large reduction in the entrepreneur's payoff from abstaining is what ensures that investment incentives are the same under complete disclosure as if the entrepreneur is allowed to select any standard ($\lambda^M = 0$). Intuitively, the above remark also implies that $\lambda_{\max} = 1$ when $\Delta(1-\beta)X = F$ (condition (6)) since the entrepreneur has the same incentives to invest under complete disclosure as in the absence of a standard. This also implies that $\lambda_{\max} < 1$ if $\Delta(1-\beta)X < F$.[8]

Although complete disclosure entails no loss in investment efficiency relative to the absence of a mandatory standard, a lower mandatory standard can improve investment efficiency. In a regime with mandatory disclosure, investment is feasible if the new investor's participation constraint (condition (5)) and the entrepreneur's incentive constraint (condition (9)) are simultaneously satisfied, i.e., $\lambda_{\min} \leqslant \lambda^M \leqslant \lambda_{\max}$. Inserting the definitions for $\lambda_{\min}$ and $\lambda_{\max}$ and rearranging yields

$$\Delta X > \frac{F}{\theta + \Delta}\left[\frac{\Delta}{1-\beta} + \frac{\theta}{1-\phi}\right]. \tag{10}$$

The investment is feasible if its expected return exceeds the sum of investment costs, transfers to existing outsiders and forgone diversion benefits. Besides letting existing outsiders participate in

[8] This is inconsistent with (6), but the mandatory standard alters the investment decision and (6) is not the relevant investment condition any longer.

the investment returns, mandatory disclosure also limits diversion of assets in place. This latter effect reduces the opportunity costs of investing, i.e., of pledging part of these assets to new investors. Therefore, the investment feasibility condition depends on the assets in place and is less stringent than in the absence of a mandatory standard (condition (6)) where the entrepreneur always has the option to divert the entire return by abstaining from voluntary disclosure (and investment).[9]

The two conditions coincide when there are no assets in place ($\theta = 0$). Assets in place have two opposing effects on investment efficiency. Firstly, they can be pledged to new investors which implies that the minimum disclosure required to satisfy investors is reduced and this increases investment efficiency. Secondly, assets in place imply that abstaining from investment has value and this reduces the entrepreneur's investment incentives. In fact the optimal partial standard ($\lambda_{\max}$) reduces the value from abstaining completely so only the first effect remains which implies that the presence of assets in place increases investment efficiency under a mandatory standard. The two conditions also coincide for the special case when $\phi = \beta$ since forgone diversion benefits and the transfer of investment returns to existing outsiders cancel.

For future reference, we denote by C_2 the total expected investment return for which condition (10) holds with equality. This lower bound on the investment return is equal to

$$C_2 = \frac{F}{(\theta + \Delta)}\left[\frac{\Delta}{1-\beta} + \frac{\theta}{1-\phi}\right] \tag{11}$$

and smaller than C_1.

Proposition 2. *When the debt overhang binds but the investment is still feasible (i.e. $\Delta X \in (C_2, C_1)$), the introduction of the mandatory disclosure standard ($\lambda^{M*} = \lambda_{\max} < 1$) increases investment efficiency. Otherwise ($\Delta X \notin (C_2, C_1)$), mandatory disclosure does not affect investment.*

Disclosure standards that satisfy the entrepreneur's incentive constraint (condition (9)) ensure that all investments in the interval (C_2, C_1) are undertaken that are passed up in the absence of a mandatory standard. To ensure investment, the mandatory standard must, however, be less than complete. That is, condition (9) binds for λ values smaller than 1. Although a mandatory standard $\lambda^{M*} = \lambda_{\max}$ increases investment efficiency, the regulator may nonetheless prefer complete disclosure due to the expropriation cost. More precisely, for $\Delta X \in (C_2, C_1)$ the social planner faces a trade-off: Setting $\lambda^M = \lambda_{\max} < 1$ ensures investment but leads to expropriation costs, whereas setting $\lambda^M = 1$ eliminates any deadweight loss but prevents investment. To establish the optimal disclosure level when ΔX is in the range (C_2, C_1), we compare the social welfare of the two options.[10]

When preserving the entrepreneur's investment incentives ($\lambda^M \leqslant \lambda_{\max}$), the highest possible social welfare is

$$(\Delta + \theta)\big[(1-\phi) + \lambda_{\max}\phi\big]X - F.$$

[9] From $1 > \beta > \phi$ it follows that $1 < \left[\frac{\Delta}{\theta+\Delta}\frac{1}{1-\beta} + \frac{\theta}{\theta+\Delta}\frac{1}{1-\phi}\right] < \left[\frac{\theta+\Delta}{\theta+\Delta}\frac{1}{1-\beta}\right]$.

[10] We are grateful to an anonymous referee for suggesting this.

For $\Delta X \in (C_2, C_1)$, full disclosure discourages investment and social welfare simplifies to θX. Thus, the regulator prefers partial disclosure ($\lambda_{\max} < 1$) to complete disclosure if

$$\Delta X - F > (\Delta + \theta)(1 - \lambda_{\max})\phi X. \tag{12}$$

Comparing the NPV of the investment ($\Delta X - F$) with the expected expropriation cost ($(\Delta+\theta) \times (1-\lambda_{\max})\phi X$), the social planner is more likely to choose partial disclosure when the investment is more profitable. Additionally, when $\lambda_{\max}$ is closer to complete disclosure, the expropriation cost is smaller, and hence the social planner is more likely to select partial disclosure.

Replacing $\lambda_{\max}$ (Eq. (9)) in the above condition yields a lower bound on the expected investment return for which the regulator prefers partial to complete disclosure. This minimum return is

$$\Delta X > C_3 \equiv \frac{(\Delta + \theta)\phi + \Delta(\beta - \phi)}{(\Delta + \theta)(1 - \beta)\phi + \Delta(\beta - \phi)} F. \tag{13}$$

Given Assumption 1 ($\beta > \phi$), it is easy to verify that $C_3 < C_1$ holds. Whether C_3 exceeds C_2 or not depends on the parameters ϕ, Δ, and θ.

Obviously, the regulator favors investment when its return is relatively large compared to the return from the assets in place. That is, C_2 always exceeds C_3 when $\Delta > \theta$. By contrast, the ranking of C_2 and C_3 depends on the expropriation cost ϕ when the assets in place are more relevant for the payoff than the investment ($\Delta < \theta$).

Lemma 2. *For $\Delta < \theta$ and $\phi \in \left(\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}, \beta\right)$, it always holds that $C_3 > C_2$.*

Proof. See Appendix B.

The above lemma illustrates that when assets in place are important and the expropriation cost is significant the regulator may prefer to curtail investment.

Figure 2 illustrates the optimal disclosure standard as a function of the investment return for $\Delta < \theta$. There are five different cases depending on the relative size of C_1, C_2 and C_3. For

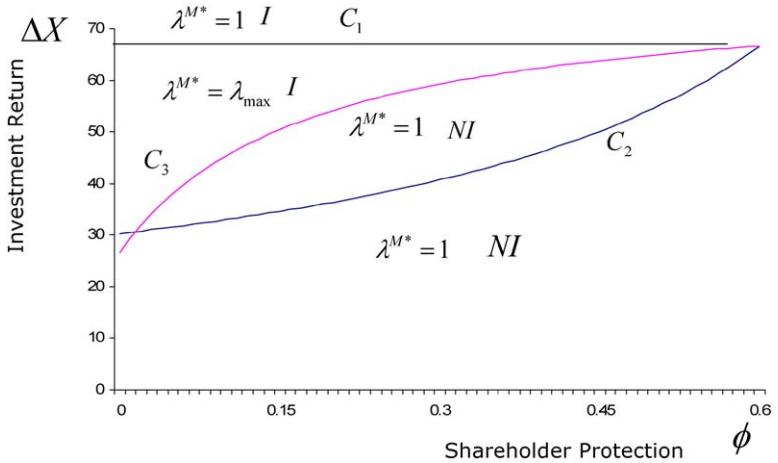

Fig. 2. Disclosure regulation. Regions for which there is investment are denoted by I and regions with no investment are denoted by NI. The graph is plotted for parameter values $\beta = 0.6$. $\Delta = 0.075$, $\theta = 0.75$ and $F = 2$.

$\Delta X > C_1$, the social planner does not face a trade-off since the entrepreneur undertakes the investment even if $\lambda^{M*} = 1$. For $\Delta X < C_2$ there is no disclosure level such that the investment is feasible. Again, social welfare is maximized by eliminating all expropriation cost by setting $\lambda^{M*} = 1$. When investment is of intermediate profitability, the regulator faces a trade-off between investment return and expropriation cost. For $C_3 > \Delta X > C_2$, investment is feasible for $\lambda \leqslant \lambda_{\max}$, but the return does not offset the expected expropriation cost. Hence, the social planner prefers $\lambda^{M*} = 1$. For $\Delta X > C_3 > C_2$ the expropriation cost associated with $\lambda_{\max} < 1$ is outweighed by the investment return. This also holds for $\Delta X > C_2 > C_3$ where the binding constraint on investment is condition (10), rather than the regulator's trade-off between investment and expropriation cost.

Proposition 3. *The optimal mandatory disclosure standard λ^{M*} may be complete or partial, but always exceeds the voluntary disclosure level λ^{E}.*

The above discussion shows that regulation provides an improvement over voluntary disclosure (private contracting) by reducing the expropriation cost and increasing investment efficiency. Despite the efficiency gain, this is, however, not a Pareto improvement since the entrepreneur is worse off than in the absence of a mandatory standard. His share of the investment return is smaller than his forgone expropriation benefits. So the introduction of a mandatory standard provides existing claimholders with a windfall and their claims increase in value which is corroborated by Greenstone et al. (2006) that document positive and significant returns from an increase in the mandatory disclosure requirements.

Moreover, too stringent disclosure requirements may be undesirable. The reason is that complete disclosure solves the expropriation problem but aggravates the debt overhang problem. Hence, some socially desirable investments are not undertaken unless disclosure is partial ($C_3 < \Delta X < C_1$). This is a statement about the second best outcomes: In the presence of two agency problems, solving one completely is typically not optimal from a social point of view.

Proposition 3 also has implications for the harmonization of disclosure standards. The convergence of disclosure rules may be undesirable when (the representative) firms are heterogeneous across economies. More precisely, consider two economies A and B, each populated by many identical firms. In both countries, firms have an investment return such that the optimal disclosure standard is partial ($\lambda_{\max} < 1$), but $\lambda^{A}_{\max} < \lambda^{B}_{\max}$ (as $\Delta X^{A} < \Delta X^{B}$).

From Lemma 2 it follows that social welfare in country A (B) is maximized by setting $\lambda^{M*A} = \lambda^{A}_{\max}$ ($\lambda^{M*B} = \lambda^{B}_{\max}$). On the one hand, if country A adopts $\lambda^{B}_{\max}$, socially desirable investments are prevented due to a too stringent disclosure requirement. On the other hand, if the social planner in country B implements $\lambda^{A}_{\max}$ there is an inefficiently high level of expropriation. Thus convergence can be sub-optimal unless economies have a comparable composition of firms.

Following the suggestion of La Porta et al. (2000) to interpret expropriation cost as an inverse measure of legal shareholder protection, we can relate optimal disclosure levels to the quality of investor protection.

Proposition 4. *Ceteris paribus, weak shareholder protection (small ϕ values) implies a lower mandatory disclosure standard.*

As shown above, the social planner faces a trade-off between investment and expropriation cost when investment profitability is intermediate ($\Delta X \in (C_2, C_1)$). As C_3 is increasing in the expropriation cost ϕ (condition (13)), the region in which the social planner selects $\lambda_{\max} < 1$ is

decreasing in ϕ. Intuitively, better shareholder protection (higher ϕ values) renders expropriation more costly and therefore complete disclosure more attractive. Strong legal protection goes together with high mandatory disclosure standards which is consistent with the observation that developed economies have better shareholder protection and higher mandatory disclosure levels.

5. Robustness

5.1. Renegotiation

In this model, the entrepreneur selects an inefficiently low disclosure level due to the existing outsiders' claim. Clearly, this inefficiency could be alleviated if the existing outside claimholders were willing to reduce the size of their stake. Nonetheless, the possibility of renegotiation does not always eliminate costly expropriation as it may require too much "debt forgiveness."

Since the entrepreneur selects an inefficient disclosure level as long as $\beta > \phi$, the outsiders have to reduce their claim from β to β' where $\beta' \leqslant \phi$ to induce the entrepreneur to select $\lambda = 1$. In what circumstances would existing claimholders have incentives to accept such a β'? As the entrepreneur selects $\lambda_{\min}$ if the existing outsiders do not reduce the size of their claim, the expected value of their claim is $\beta\lambda_{\min}(\theta + \Delta)X$. The highest stake the outsiders can retain without triggering expropriation is ϕ. So if $\lambda_{\min}\beta > 1 \times \phi$, the existing claimholders have no incentive to reduce their stake in order to achieve congruency. This is equivalent to

$$\lambda_{\min}\beta > \phi \quad \Rightarrow \quad \frac{F}{(\Delta+\theta)}\frac{\beta}{(1-\beta)\phi} > X.$$

The condition implies an upper bound on the profitability of the firm (investment and assets in place) such that the existing outsiders prefer not to reduce their claim. In Section 4 it was shown that the investment is feasible, provided that condition (10) is satisfied ($\lambda_{\max} > \lambda_{\min}$). The above upper bound is compatible with (10) if

$$\frac{\beta}{\phi} > 1 + \frac{(1-\beta)}{(1-\phi)}\frac{\theta}{\Delta}.$$

The above inequality always holds if ϕ is sufficiently small relative to β. Intuitively, if the expropriation cost ϕ is small compared to β, it is very costly for the existing outsiders to achieve congruent interest.

5.2. Incentive contracts

In this section we show by example that a wage/incentive contract is not a perfect substitute for the disclosure device. The disclosure device can finance some investments when interests between the entrepreneur and existing claimholders are not aligned. In comparison a wage contract requires alignment of interests in order to finance the investment. This implies that a wage contract is not a perfect substitute for the disclosure device. We assume that a regulator has the possibility to give the entrepreneur a wage contract which is paid out of the firm's returns.

Clearly, wages are more efficient in providing incentives rather than allowing expropriation since wages do not involve a deadweight loss. However, if the investment requires excessive funding, it may not be possible to simultaneously align interests and to satisfy the new investors' participation constraint. Subsequently, we provide an example where the disclosure device can finance an investment that is not feasible under a wage contract. For simplicity we abstract from the possibility of using both devices simultaneously.

The most effective wage contract is to only pay the entrepreneur if the entire cash flow X is given to investors. Since the payoff of the project is binary, the optimal contract is to pay the entrepreneur δX (in addition to his remaining equity stake γ) if the cash flow is X. In addition, we assume that the entrepreneur's wage is senior to all other claims. This implies that the wage dilutes the claims of old and new investors alike. Furthermore, the wage is agreed upon before equity is issued to new outsiders.

To ensure that the investment is undertaken, an incentive contract makes sure that the new investors' participation constraint is satisfied and that the entrepreneur's interests are congruent with those of the investors. Otherwise the entrepreneur would steal all the cash flow. The entrepreneur prefers not to divert at date $t = 3$ if the wage δ satisfies the following condition

$$\delta X + (1 - \alpha - \beta)(1 - \delta)X > (1 - \phi)X, \quad \phi > (1 - \delta)(\alpha + \beta).$$

Since ϕ is positive this condition always holds if $\delta = 1$. Intuitively, alignment of interest can always be achieved if all other stakeholders reduce their claims in favor of the entrepreneur. However, this may not be compatible with the new investors' participation constraint. Replacing $\alpha = F/((1 - \delta)(\Delta + \theta)X)$ in $\phi > (1 - \delta)(\alpha + \beta)$ and rearranging yields

$$(\Delta + \theta)\big(\phi - (1 - \delta)\beta\big) > \frac{F}{X}.$$

Thus, if $F/X \geqslant (\Delta + \theta)\phi$ there exists no wage such that both conditions are satisfied. Consider the example where $\phi = F/((\Delta + \theta)X)$. In this case, we know that an incentive contract cannot ensure investment, but is investment feasible with the disclosure device?

Using $\phi = F/((\theta + \Delta)X)$ and assumption 1 ($\beta > \phi$) implies

$$\beta > \phi = \frac{F}{(\theta + \Delta)X}.$$

Combining the above condition with the entrepreneur's investment condition (6) implies the disclosure device can finance investments that a wage contract cannot if

$$\Delta X > \Delta(\beta - \phi)X + \frac{\Delta}{\theta + \Delta}F + F.$$

If a regulator selects the disclosure level then the investment decision may be different. From Proposition 2 we know that the investment condition is unaltered if a complete standard is implemented. This means the above condition applies.

If on the other hand, a partial standard is implemented then the appropriate investment condition is (10). Appendix C shows that condition (10) may be satisfied for $\phi = F/((\Delta + \theta)X)$.

The above examples imply that an incentive contract is not a perfect substitute for disclosure rules. Although an incentive contract may solve the debt overhang problem, it may not be compatible with investment due to the entrepreneur's time consistency problem.

5.3. Seniority

This section discusses the robustness of the results when the assumption that existing outsiders hold a senior claim, i.e., debt, is relaxed. Everything remains the same as in the basic model, except that the existing outsiders are now assumed to hold equity (β is an equity claim). This implies that the entrepreneur and existing outsiders have their stakes diluted if the investment is undertaken. So after issuing α shares to new investors, the entrepreneur owns $(1 - \beta)(1 - \alpha)$ of shares and the existing outsiders hold $\beta(1 - \alpha)$.

Applying the same procedure as in Sections 3 and 4 we solve the model backwards. When the revenues are not verifiable, the entrepreneur continues to divert all revenues. The entrepreneur also continues to select the minimum disclosure level. The removal of seniority implies that the entrepreneur can sell claims on the entire cash flow. So α is now bounded by 1 rather than $(1-\beta)$. This makes it easier to satisfy the new investors' participation constraint and the entrepreneur's incentive constraint. The lower bound on the disclosure level is

$$\lambda_{\min} = \frac{F}{(\theta + \Delta)X}$$

and the upper bound is

$$\lambda_{\max} = \frac{\Delta(1-\phi)X - (1-\beta)F}{\Delta(\beta-\phi)X}.$$

Thus, investment is feasible if $(\lambda_{\max} > \lambda_{\min})$

$$\Delta X > \frac{F}{(1-\phi)(\theta+\Delta)}\big[\Delta(1-\phi) + \theta(1-\beta)\big].$$

The above inequality is less stringent than C_2 (Eq. (11)) because the debt overhang is eliminated. Just like in Section 3, we have to compare the entrepreneur's best possible payoff from abstaining with his best possible payoff if he invests. We find that the entrepreneur undertakes the investment if $\Delta X > F$ which implies that there is no debt overhang and no investment distortion. Additionally, being able to issue securities of equal seniority implies that the maximum disclosure level compatible with investment $(\lambda_{\max})$ is never less than 1 for all investments with a positive NPV $(\Delta X \geqslant F)$. Hence, the social planner never faces a trade-off and always selects complete disclosure.

Replacing the existing outsiders' debt claim with an equity stake does not alter the result of a divergence between the voluntary disclosure level and the socially optimal disclosure standard. However, the debt overhang problem never binds in this setting since the existing outsiders' equity claim can always be diluted. Furthermore, the minimum possible disclosure level now implies that the new investors own the entire firm $(\alpha = 1)$. Obviously, this results in the existing outsider's equity stake having no value. (The assumption that existing outsiders hold senior claims avoids this degenerate outcome.) Given that the debt overhang problem ceases to exist, the introduction of a mandatory disclosure standard does not increase investment efficiency nor does the regulator face a trade-off between investment and expropriation cost.

6. Empirical implications

For the entrepreneur's disclosure decision it is important that the existing claimholders hold senior claims. If the existing claimholders were not senior then the entrepreneur would never abstain from investment (there would be no debt overhang). So a prediction of the model is that firms with more senior claims are more likely to abstain (i.e. not cross-list) from investment. This could be tested by comparing the amount of senior claims that cross-listing firms have in comparison to firms that do not cross-list.

Most of the empirical work on disclosure focuses on stock price reactions to voluntary disclosure decisions. One exception is Greenstone et al. (2006). That paper considers the stock price reaction of an increase in mandatory disclosure requirements. Our theory predicts that there are two reasons for a positive price increase when a moderate disclosure standard is introduced, the

reduction in costly expropriation and an increase in investment efficiency. So the first testable prediction is that the introduction of a moderate mandatory standard implies more investments are undertaken. The second implication is that an increase in the mandatory standard from a moderate level to a more complete standard is going to imply less investment. The ideal testing procedure would examine a range of changes in the mandatory standard and then measure the impact of these on firm investment. The theory additionally predicts that there is only an improvement in investment efficiency in those firms with senior claimholders.

Another testable implication is that when the cost of expropriation is large, the optimal mandatory standard is more likely to be complete. So in economies with greater costs of expropriation, we also expect greater mandatory disclosure standards. This can be tested in a cross-country setting.

7. Conclusion

This paper analyzes voluntary and mandatory disclosure. The disclosure level is assumed to determine the probability that the firm's returns are verifiable. The model developed in the paper shows that if the entrepreneur has issued debt (or other senior claims) prior to his disclosure choice, he may not want to increase disclosure even though it is social welfare enhancing.

Specifically, the debt claim and the possibility to expropriate outsiders results in a trade-off. Increasing the disclosure level aggravates the debt overhang while alleviating the agency problem caused by expropriation. If the debt overhang dominates then the entrepreneur has incentives to set an as low disclosure level as possible. Hence, the model is able to explain why so relatively few firms cross-list given the positive stock price reaction.

In our setting a mandatory standard is beneficial since it reduces the amount of costly expropriation. Additionally, it may improve investment efficiency by reducing the entrepreneur's possibility to expropriate and hence the benefit of abstaining from investment. The regulator implements partial disclosure when the investment is relatively valuable. Thus, the model provides a rational for disclosure regulation and even though the social planner implements higher disclosure than the entrepreneur it may be less than complete. Partial disclosure implies that the optimal disclosure standard depends on firm characteristics and if there is firm heterogeneity then disclosure harmonization is detrimental.

The social planner may curtail feasible investments if they entail significant expropriation costs. So, economies with stronger shareholder protection (higher expropriation costs) should have higher mandatory disclosure requirements.

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Appendix A. With assets in place

Assume the firm has liquid assets in place that can be diverted at $t = 3$ in the same way as the investment return, provided the project succeeded. Given Assumption 1, the entrepreneur selects the lowest feasible disclosure level. Given the liquid assets are distributed with probability λ, the new investors' participation constraint implies the following lower bound on disclosure

$$\lambda_{\min}^{D} \geqslant \frac{F}{(1-\beta)[(\Delta+\theta)X + A]}.$$

Relative to the case without liquid assets in place, the minimum disclosure level is lower as the new investors also get part of these assets.

Suppose now that these liquid assets can be used to fund part of the investment. Again, the entrepreneur selects the minimum disclosure level that satisfy the new investors' participation constraint. Given that the liquid assets (retained earnings) are used to finance the investment, the entrepreneur needs to raise on the market $\max(F - A, 0)$. The disclosure level that satisfy the new investors' participation constraint when they invest $\max(F - A, 0)$ is

$$\lambda_{\min}^{R} \geqslant \frac{\max(F - A, 0)}{(1-\beta)(\theta+\Delta)X}.$$

To assess whether the entrepreneur wants to invest retained earnings, we compare the payoffs under the two alternative modes of financing. Assuming that $F > A$, the entrepreneur prefers to invest A if

$$\begin{aligned}\Pi(\lambda_{\min}^{R}) &= (\theta+\Delta)\big[\lambda_{\min}^{R}(\phi-\beta) + (1-\phi)\big]X - (F - A)\\ &\geqslant \lambda_{\min}^{D}(\phi-\beta)\big[(\theta+\Delta)X + A\big] + (1-\phi)\big[(\theta+\Delta)X + A\big] - F = \Pi\big(\lambda_{\min}^{D}\big).\end{aligned}$$

Substituting the above definition of the minimum disclosure levels and rearranging yields

$$A\beta\frac{(1-\phi)}{(1-\beta)} \geqslant 0.$$

Hence, the entrepreneur strictly prefers to invest all retained earnings. Clearly, this also applies for $F \leqslant A$, as investment does not require disclosure.

Appendix B

First we will show that $C_1 > C_3 > C_2$ in the range $\phi \in (\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}, \beta)$.

Recall that

$$C_3 = \frac{(\Delta+\theta)\phi + \Delta(\beta-\phi)}{(\Delta+\theta)(1-\beta)\phi + \Delta(\beta-\phi)}F, \qquad C_2 = \frac{F}{(\theta+\Delta)}\left[\frac{\Delta}{1-\beta} + \frac{\theta}{1-\phi}\right] \quad \text{and}$$

$$C_1 = \frac{F}{(1-\beta)}.$$

Note that $\partial C_2/\partial\phi > 0$, $\partial C_3/\partial\phi > 0$ and $C_3(\phi=\beta) = C_2(\phi=\beta) = C_1$ therefore $C_1 > C_2$ and $C_1 > C_3$, $\forall\phi \in [0, \beta)$. Define

$$A = C_3 - C_2 = \frac{(\Delta+\theta)\phi + \Delta(\beta-\phi)}{(\Delta+\theta)(1-\beta)\phi + \Delta(\beta-\phi)}F - \frac{F}{(\theta+\Delta)}\left[\frac{\Delta}{1-\beta} + \frac{\theta}{1-\phi}\right].$$

Rearranging and setting $A = 0$ yields $(\beta - \phi)(\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2} - \phi) = 0$ which is quadratic in ϕ. This means that $C_2 = C_3$ if $\phi = \beta$ or $\phi = \frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}$. Notice that $\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2} < \beta$ as long as $\theta > \Delta$. Since $\partial^2 A/\partial\phi^2 = 2 > 0$ we know that A has a maximum. Additionally, since A has two solutions, one on each side of the interval $(\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}, \beta)$ we know that A is positive on the interval. Hence, $C_1 > C_3 > C_2$, $\forall\phi \in (\frac{\beta\Delta^2}{\theta^2(1-\beta)+\beta\Delta^2}, \beta)$.

Appendix C

For $\lambda_{\max} > \lambda_{\min}$ when $\phi = \frac{F}{(\Delta+\theta)X}$ requires that

$$(\theta + \Delta)\Delta X^2 - \left(\Delta + \frac{\Delta}{1-\beta} + \theta\right)FX + \frac{\Delta F^2}{(\Delta+\theta)(1-\beta)} > 0.$$

The roots are given by $c_{1,2} = \frac{-b \pm \sqrt{D}}{2a}$ and in our case $a = (\theta + \Delta)\Delta$, $b = -(\Delta + \frac{\Delta}{1-\beta} + \theta)F$, $c = \frac{\Delta F^2}{(\Delta+\theta)(1-\beta)}$. Simple calculations shows that

$$D = F^2\left[\Delta^2\frac{\beta^2}{(1-\beta)^2} + \theta(2\Delta + \frac{2\Delta}{1-\beta} + \theta)\right] > 0$$

which implies that $c_{1,2}$ are both real roots. Since $-b > 0$, $2a > 0$ and $4ac > 0$ both roots are positive.

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