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Information Disclosure When There is Fundamental Disagreement

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Abstract

This paper develops a theory of information disclosure with disagreement, and then examines its implications for financial and non-financial firms. Managers of firms are voluntarily communicating objective and subjective information, and prior beliefs about the strategy to maximize project value are rational but heterogeneous, creating the possibility of fundamental disagreement. Four main sets of results are derived. First, not all firms disclose (subjective) information about strategy that can potentially increase disagreement with investors. Second, more valuable firms, and those whose strategies investors are more likely to agree with, voluntarily disclose less information in equilibrium. Third, information disclosure has real consequences because it interacts with corporate governance. Fourth, banks optimally disclose less strategic information than non-financial firms, and mandatory information disclosure may make banks more fragile, which exposes a potential tension between information transparency and greater fragility in banking. Improvements in corporate governance will lead banks to voluntarily disclose less strategic information and become less fragile.

Keywords: information disclosure, disagreement, subjective information

JEL Classifications: G21, G30

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INFORMATION DISCLOSURE WHEN THERE IS FUNDAMENTAL DISAGREEMENT

by

Anjan V. Thakor[†]

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Abstract

This paper develops a theory of information disclosure with disagreement, and then examines its implications for financial and non-financial firms. Managers of firms are voluntarily communicating objective and subjective information, and prior beliefs about the strategy to maximize project value are rational but heterogeneous, creating the possibility of fundamental disagreement. Four main sets of results are derived. First, not all firms disclose (subjective) information about strategy that can potentially increase disagreement with investors. Second, more valuable firms, and those whose strategies investors are more likely to agree with, voluntarily disclose *less* information in equilibrium. Third, information disclosure has real consequences because it interacts with corporate governance. Fourth, banks optimally disclose less strategic information than non-financial firms, and mandatory information disclosure may make banks more fragile, which exposes a potential tension between information transparency and greater fragility in banking. Improvements in corporate governance will lead banks to voluntarily disclose less strategic information and become less fragile.

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INFORMATION DISCLOSURE WITH FUNDAMENTAL DISAGREEMENT

"For as the interposition of a rivulet, however small, will occasion the line of the phalanx to fluctuate, so any trifling disagreement will be the cause of seditions."

Aristotle in *Aristotle's Politics: A Treatise on Government*

1. INTRODUCTION

Firms − both financial and non-financial− frequently voluntarily disclose information about their strategies. These disclosures are sometimes in the narrative section of the company's annual report and sometimes in communications with the press or analysts.[1] Such information ─ like corporate/managerial vision (e.g. Van den Steen (2005)) ─ is inherently qualitative and subjective in nature, and therefore associated with multiple interpretations related to whether these strategies are best for the firm (see, for example, Santema, Hoekert, van de Rijt and Van Oijen (2005)). For example, whereas most western companies see emerging markets as a major component of their growth strategy, Maas (2008) reports Lars Sorensen, CEO of Denmark's pharmaceutical firm Novo Nordisk, as expressing disagreement that this was best for his firm. He communicated his company's growth strategy as being focused on developed markets: "… going to see our main growth in the U.K., in the U.S., central Europe and Australia, as these countries use considerable resources to deal with inflammatory diseases".

There is also considerable heterogeneity in the amount of such disclosure (see Broberg, Tagesson and Collin (2009), and Santema, Hoekert, van de Rijt and van Oijen (2005)). For example, a firm may announce that it plans to raise additional equity to expand its operations. However, the firm has considerable discretion over the extent to which it explains *how* it plans to expand. Will it expand by increasing the geography over which it operates? Will it expand by buying smaller competitors? Will it

[1] There is substantial in communication between the CEO and analysts that occurs outside of the written communication in the Annual Report. In the Annual Report, this communication typically appears in Section 7 (Management's Discussion and Analysis of Financial Conditions and Results of Operations) and in Section 7a (Quantitative and Qualitative Disclosures about Market Risk). See Kogan, Routledge, Sagi and Smith (2009) for empirical evidence that such disclosures are informative for predicting the firm's future stock return volatility.

expand by investing in process technology that lowers its manufacturing cost, enables selling its product at a lower price and thereby increases demand? Will it expand by investing more in product innovation? These are details of strategy that the firm could choose to disclose or withhold, and different agents may have different opinions about which strategy is value-maximizing for the firm.

Given that subjective information potentially generates disagreement even among agents who observe the same information signal, why do companies sometimes disclose subjective information about strategy and sometimes prefer not to? And will more valuable firms disclose more or less information? Will firms disclose more or less information when the likelihood of investors agreeing with the chosen strategy is higher? This represents the first set of questions studied in this paper. Further, how do financial firms like banks differ from non-financial firms when it comes to information disclosure of this sort? What is the implication of this for the transparency and fragility of financial institutions? This is the second set of questions studied in this paper, and the related analysis has implications for bank regulatory policy. In particular, in light of the recent global financial crisis, numerous proposals have been made about the pros and cons of requiring banks ─ especially those considered systemically important ─ to reveal more information about their strategies and the associated risks (e.g., McConnell (2012)). The analysis presented in this paper has relevance for that discussion.

These issues are analyzed in three layers. The first layer examines information disclosure with potential disagreement among two risk-averse contracting parties in a general setting where one agent controls the choice of action in production and the other agent controls the provision of costly input (like capital or observable effort) to make production possible. The question is whether the agent choosing the action reveals this choice to the agent providing the productive input. The second layer specializes this general model to one in which there is a firm that is deciding whether to disclose information about a strategy choice prior to an equity issue to raise financing for a project. Included in this is an analysis of the interaction between strategic information disclosure and corporate governance. The third layer provides a further a specialization of the model to examine disclosure issues for financial firms like banks, and provide a comparison to non-banks.

The main results are as follows. First, not all firms disclose (subjective) information about strategy that can potentially increase disagreement with investors. The inherently subjective nature of strategy makes it prone to different interpretations by agents with heterogeneous beliefs (which are rational in the sense of Kurz (1994a,b)) and this could generate different opinions about the optimal course of action. This difference of opinion, when it occurs, is costly to the firm because investors will either lower their valuation of the firm or simply refuse to provide financing to even a "good" project if they believe the firm is adopting the wrong strategy for the project. This generates a cost associated with information disclosure. However, not disclosing information about strategy is costly too, because it increases the cost of external financing to the firm. It is this tradeoff between the cost of not being able to sometimes invest in the project and the higher cost of external financing that determines which firms in the cross-section disclose information about strategy and which firms do not.

Second, on the issue of which firms disclose *information* and which do not, the result is counterintuitive ─ when the firm's intrinsic value is higher or agreement with the providers of productive inputs (like investors) is more likely, the firm discloses *less* information.

Third, somewhat surprisingly, improvements in corporate governance lead to *less* voluntary disclosure of information about strategy.

Fourth, banks engage in less strategic information disclosure than non-financial firms because such disclosure exacerbates the bank's liquidity risk. A key feature that distinguishes banks is that they have short-maturity debt that is subject to withdrawal on demand, whereas non-financial firms do not face such withdrawal risk. One way that the bank can mitigate this withdrawal risk is by raising equity to replace lost debt financing in the event of a liquidity shock. However, if the bank has disclosed its strategy and investors disagree that it is the right strategy, then such funding may be unavailable, forcing liquidation. Thus, voluntary disclosure of strategic information can diminish the bank's ability to attenuate liquidity risk by seeking external financing. The bank's optimal disclosure choice rests on the tradeoff between the rock of liquidity risk that accompanies disclosure and the hard place of a higher cost

of funding due to the lack of transparency that accompanies non-disclosure.[2] This also has implications for mandatory regulatory information disclosure because it suggests that, when it comes to disclosure of strategic information, there is a tension between transparency and stability.

In a nutshell, the intended marginal contribution of this paper is a theory of optimal disclosure policy for non-financial and financial firms when agents may disagree. The disclosure studied here is that of subjective information that differs from hard, objective information ─ like earnings announcements ─ that the information disclosure literature has focused on (see, for example, Boyer, Cohen and Walther (2010)). With objective information, the interpretation of the information is indisputable ─ two agents confronted with the same information will always agree on what it means and the decision it implies to maximize a given objective function. By contrast, greater disclosure of subjective information may lead to greater disagreement over what decision maximizes a given objective function. A key insight of the analysis is that, in contrast with objective information disclosure, the communication of information in the face of disagreement has ramifications for control rights over productive decision, so the manager prefers not to disclose unless it becomes too expensive to withhold information. Consequently, the result in models of asymmetric (but objective) information that firms voluntarily disclose in equilibrium all they know (see Milgrom (1981)) if none of their disclosed information goes to product-market competitors (see, for example, Feltham and Xie (1992)) is shown not to hold. This sharp delineation between asymmetric information and disagreement can be understood as follows. With asymmetric information, disclosing more information reduces information gaps between the firm and investors, which improves liquidity and lowers the cost of capital. *Conditional* on obtaining financing, greater disclosure has that effect with disagreement as well. However, disagreement involves a cost of disclosure that asymmetric information does not ─ the probability of obtaining financing goes down as the firm discloses more.

[2] In this paper, the higher cost of funding due to lower disclosure arises from disagreement. It may also arise from a reduction in liquidity due to the greater asymmetric information that accompanies lower disclosure. Balakrishnan, Billings, Kelly and Ljungqvist (2011) have documented that firms actively influence their information environments through their disclosure policies, and that greater (voluntary) disclosure affects the liquidity of these firms' shares.

There are also other differences relative to models of objective information disclosure that are discussed in the next section.

I believe disagreement is a first-order phenomenon and firms take it seriously in formulating corporate strategy. For example, the Compaq-HP merger generated considerable disagreement among HP shareholders and between shareholders and HP executives. The disagreement almost resulted in the merger being cancelled, and it was consummated mainly because a large institutional investor in HP eventually decided to support the merger. Another example is provided by beer manufacturer Carlsberg, as reported by Bloomberg (March 8, 2010). Investors had publicly expressed their concern that the company might adopt a strategy of growth through acquisitions which they disagreed with. In response to this disagreement over the company's growth strategy, Carlsberg recently announced that it would forgo any acquisition plans and focus instead on organic growth.

The rest is organized as follows. Section 2 reviews the related literature. Section 3 contains the first layer of the analysis and establishes the general disclosure result with disagreement. The model of corporate strategy disclosure (second layer) is developed and analyzed in Section 4. This is continued in Section 5 which examines impact of corporate governance. Section 6 looks at optimal disclosure policy in banks (the third layer of the analysis). Section 7 concludes. All proofs are in the Appendix.

2. RELATED LITERATURE

One stand of the literature that this paper is related to is that on information disclosure. This literature traces it origins back to the seminal Representation Theorem of Grossman (1981) and Milgrom (1981): if the sender's preferences are monotonic in the receiver's action, then the sender reveals its type in every sequential equilibrium with verifiable messages (Milgrom (1981)). [3] This monotonicity condition for full disclosure was relaxed by Seidman and Winter (1997) who generalized Milgrom's

[3] Milgrom (1981) shows that a firm with "good news" will wish to disclose it to separate itself from the pool, and the absence of disclosure will generate the most pessimistic inference by the uninformed, inducing even firms with "bad news" to disclose (See also Grossman (1981)). On the voluntary full-disclosure incentives of firms, see also Boot and Thakor (2001), Ross (1979), and Verrecchia (2001)

(1981) result with more general sender preferences where the ideal action for a sender varies with its type. The main implication of this is that, in equilibrium, firms will voluntarily disclose all they know.

Because firms are observed to not voluntarily disclose all they know, a large literature has emerged in which various papers relax one more of the conditions for the Representation theorem to hold and show that partial disclosure may occur in equilibrium (e.g., Fishman and Hagerty (2003), Hughes and Pae (2004), Jung and Kwon (1988), Jorgensen and Kirschenheiter (2003), and Newman and Sausing (1993)). Beyer, Cohen, Lys, and Walther (2010) extensively review this literature, including the empirical contributions, whereas Core's (2001) review is focused on the empirical papers.

A notable strand of this literature introduces either exogenous or endogenous costs of disclosure. Papers that employ exogenous costs invoke exogenous frictions—the incapability of managers to communicate all dimensions of their private information, the existence of communication costs, the prevalence of incentive frictions, and so on (e.g. Dye (1985a), and Healy and Palepu (2001)). Papers that provide an explanation based on endogenous costs of disclosure rely on the "proprietary costs" of signaling that arise endogenously from the "two-audience-signaling" problem, namely that disclosing information to investors also reveals it to competitors, which can adversely affect cash flows (e.g. Bhattacharya and Ritter (1983), Dye (1985b), Darrough and Stoughton (1990), Feltham and Xie (1992)), and Wagenhofer (1990)). These papers show that there may be no-disclosure or partial-disclosure equilibria in which information disclosure incentives depend on the likelihood of invention; for example, in Bhattacharya and Ritter (1983), a firm with a higher Poisson intensity of invention in a Research and Development race—and hence more valuable—reveals part of its knowledge via signaling. In contrast to most of this literature, an interesting paper by Gigler (1994) shows that product-market proprietary costs actually *encourage* voluntary disclosures by firms by engendering capital-market credibility for such disclosures, even in the absence of direct verification.[4] The differences between this literature and this paper are discussed in Section 4.

[4] That is, product-market proprietary costs play the role of dissipative signaling costs in assuring the incentive compatibility of signaling (disclosure) to the capital market.

There is also an interesting contrast of the analysis here with cheap-talk models (e.g., Crawford and Sobel (1982)). In these models, when there is no direct cost of misreporting, managers make whatever disclosures lead investors to value the firm closest to managerial objectives. Thus, such disclosures are uninformative and in equilibrium it does not matter what managers communicate (e.g., Stocken (2000)). However, if talk is cheap but the manager's incentives are only partially misaligned with those investors, then managers can convey information even with cheap talk. In these models too there is a divergence of opinion on the right strategy. But, in the contrast to the main result here, these papers predict *less* communication where there is a greater divergence of opinion (e.g., Fischer and Stocken (2001), and Baldenius, Melumad and Meng (2010)).[5]

Two papers are most closely related to this paper. One is Suijs (2007), which maintains all the conditions of the Representation Theorem except the investors' uniform-response condition, and shows that when managers are uncertain about how investors will respond to disclosures, partial disclosure equilibria may obtain. Such investor heterogeneity has also been modeled elsewhere with the assumption that investors have varying levels of sophistication in processing information (e.g., Boot and Thakor (2001), Dye (1998), and Fishman and Hagerty (2003)). Suijs (2007) shows that when a partial-disclosure equilibrium exists, only average information is disclosed, as firms avoid disclosing both very favorable and very unfavorable information. Although Suijs (2007) also deals with objective information (about returns), in contrast to the subjective information here, one similarity between his paper and mine is the uncertainty about how investors will respond to the disclosure. However, a key difference is the result in my paper that it is the relatively highly-valued firms that eschew disclosure in equilibrium.

Another related paper is Ferreira and Rezende (2007) which also examines voluntary disclosure of corporate strategies. However, it does not focus on disagreement, and examines a different set of issues. It models the cost of disclosure as the difficulty of subsequently changing course, and the benefit as the stronger incentives it creates for the firm's partners to undertake strategy-specific investments.

[5] For example, Baldenius, Melumad and Meng (2010) examine the optimal Board composition of monitoring versus advisory types within a cheap-talk framework. They find that as the CEO's bias (and hence potential disagreement with the Board) increases, the CEO submits more and more noisy signals about his information to the Board.

With respect to the implications of the analysis for banks, this paper is related to Thakor (2012) who develops a model in which potential disagreement is an essential part of financial innovation. In this paper, the argument is that potential disagreement is an essential part of strategic information disclosure. Although not examined here, the analysis raises questions about the design of capital requirements for banks (e.g. Acharya, Mehran and Thakor (2011)).

Because disagreement arises in the model due to heterogeneous beliefs, the literature on heterogeneous priors is also relevant. While rational agents must use Bayes's rule to update their prior beliefs, economic theory does not address how priors themselves arise; these are taken as primitives, along with preferences and endowments. In this sense, we follow Kreps (1990, p.370) who argues that, given this, the assumption of homogeneous priors has "little basis in philosophy or logic".[6] Our approach is also consistent with Kurz's (1994a,b) theory of "rational beliefs". Rational beliefs are those that cannot be invalidated by historical data. When the underlying state variables based on which agents are revising beliefs are governed by stationary distributions, the usual convergence argument holds and rational beliefs converge to rational expectations.[7] However, when the environment is non-stationary, there can be an infinite number of beliefs that can be rational. Thus, in a non-stationary environment, rational beliefs need not coincide with rational expectations. In other words, there is nothing radical about heterogeneous prior beliefs. Morris (1995) shows that such a specification is consistent with Beyesian rationality.

With rational beliefs, disagreement may persist even with exchange of information related to beliefs. As Kreps (1990) has pointed out, rational agents will *not* revise their beliefs merely because they learn that other agents have different prior beliefs (see also Van den Steen (2001)). Beliefs revision will

[6] We know from the "no trade" theorem that there is no trade in markets with common prior beliefs (see Milgrom and Stokey (1982)). Rational agents will not trade with each other based on differences in information alone. This creates a "trading motivation" for differences in beliefs, but differences in prior beliefs do not always suffice to generate trade (Morris (1994)), i.e., the no-trade theorem may still hold. However, as Morris (1994) shows, some differences in prior beliefs do lead to trade, and the volume of trade in financial markets is too large to be explained without belief motives.

[7] As Kurz (2006) points out, the rational beliefs of *all* agents may be "wrong" in the sense that none of them coincide with rational expectations.

occur only when *new* information about payoffs is revealed, *not* when different prior beliefs are revealed.[8] Because both the disagreeing parties view their own beliefs as *rational* neither can convince the other that it has "better" prior beliefs.[9] Another reason why disagreement persists, and may even get stronger when more common information is presented, could be related to the factors highlighted by Andreoni and Mylavanov (2012). They develop a model and then present supporting experimental evidence that, even for people observing the same data, opinion polarization ─wherein people draw opposite conclusions─ emerges when one-dimensional opinions are formed from two-dimensional information. Contrary to the theory, however, disagreement *persists* despite sufficient information provision, as people overweight their own information relative to information gleaned from the actions of others.

The idea of disagreement based on multiple heterogeneous beliefs has been used to examine a variety of issues, including the theory of the firm (Van den Steen (2010)), formalizing the notion of leadership and managerial vision (Van den Steen (2005)), the firm's choice of debt versus equity financing (Dittmar and Thakor (2007)), the entrepreneur's choice of private versus public ownership (Boot, Gopalan and Thakor (2006, 2008)), optimal capital structure (Boot and Thakor (2011)), and "endogenous optimism" (Van den Steen (2004)).

3. DISCLOSURE WITH DISAGREEMENT

This section establishes the general disclosure result with disagreement.

Suppose there are two agents, A and B, who can enter into a partnership to produce a risky output *x*. Agent A owns the productive technology and can choose an action $S \in \{S_1, S_2\}$ to maximize the output from the production. If the "correct" action is chosen, then the probability density function of the output is $f_G(\cdot)$ with cumulative distribution function F_G. If the "wrong" action is chosen, the probability

[8] Thus, in this model, there is no value in the manager attempting to learn something by examining the market's reaction to a disclosure, as in Dye and Sridharan (2002), or extracting investment-relevant information from the stock price as in the price-feedback model of Boot and Thakor (1997). The market's anticipated reaction influences whether the firm chooses to disclose its strategy, but *not* its choice of strategy.

[9] Models of rational but heterogeneous priors also differ from models of "private values", typically used in the auctions literature. Those are models of payoff-relevant asymmetric information in which bidding behavior is predicated on the information one has about the private valuations of other bidders, so the equilibrium price differs based on how much bidders know. In our model, investors know exactly what the beliefs of the manager are subsequent to disclosure, but this affects only the availability of finance, not its price.

density function of the output is $f_B(\cdot)$ with cumulative distribution function F_B. F_G first-order-stochastically dominates (FOSD) F_B. The utility function of each agent over wealth w is $u(w)$, with $u(w) > 0$ if $w > 0$, $u(w) < 0$ if $w < 0$, $u(0) = 0$, $u' > 0$, and $u'' < 0$.

Agent A needs agent B to provide a productive input I, without which production cannot commence. In exchange for providing I, agent B must be given a share α of the output *x* that generates an expected utility at least equal to his reservation utility of $u(I) = \bar{u}$. If agent A does not engage agent B to commence production, agent A's expected utility is 0. It will be assumed that $\int u(x) f_G(x)dx > \bar{u}$, and $\int x f_B(x)dx = 0$, so $\int u(cx) f_B(x)dx < 0$ for any $c \in (0,1]$.

The sequence of events is as follows. First, agent A randomly draws a prior belief about which action is correct. The probability that agent A will believe S_1 is the correct action is $q \in (0,1)$ and the probability he will believe S_2 is the correct action is $(1-q) \in (0,1)$. It is clear that agent A will strictly prefer to choose the action he believes is correct, since the wrong action yields him a negative expected utility, which is lower than with autarky. Second, agent A makes a disclosure decision $\delta \in \{n, d\}$. If $\delta = n$, then agent B is invited to contribute *I* without agent A disclosing which action $S \in \{S_1, S_2\}$ has been chosen. In this case, agent B is offered a share $\alpha_n \in [0,1]$ of the output *x* to provide the input *I*. If $\delta = d$, it means that agent A discloses to agent B what action has been chosen. There is no misrepresentation.[10] In this case, agent B is offered a share $\alpha_d \in [0,1]$ of the output *x*. Both α_n and α_d are endogenous. After observing the disclosure and the offer, agent B randomly draws a prior belief about which action is correct.[11] With either $\delta = n$ or $\delta = d$, A's offer to B is a take-it-or-leave-it offer. Agent B then either accepts the offer and production commences, or rejects the offer and the game ends, and agent B takes a job in his alternative occupation to obtain his reservation utility $\bar{u}$.

[10] This assumption is similar to Milgrom (1981). As it turns out, there are no strategic misrepresentation incentives if one assumes that agent B's belief about the correct action depends on agent A's true belief rather than the reported action, but agent A must report an action for B to determine whether the action is correct.

[11] Central to the model is the notion that disclosure is a strategic and voluntary *choice* for A, so B cannot acquire that information absent the disclosure.

Conditional on agent A believing that a particular action is correct, the probability that agent B will also believe that it is correct is $\rho \in [0,1]$. If A chooses $\delta = n$, then B does not observe A's action choice and believes that the probability that the action choice is correct is ρ. If A chooses $\delta = d$, then B determines whether the action is correct and accepts or rejects A's offer on that basis.

Even though A and B have different priors about the correct action, it is assumed that these prior beliefs are rational in the sense of Kurz (1994 a,b). Thus, there is fundamental disagreement in which neither side's beliefs can be invalidated based on historical or contemporaneous information.

B's strategy space is {accept offer, reject offer}. B's decision of whether to accept to A's offer when $\delta = d$ can be viewed as a function: $\theta_d : [0,1]^2 \times \{S_1, S_2\} \to [0,1]$ which is a probability $\theta_d(\alpha_d, \rho, S)$. That is, B accepts A's offer with probability θ_d. B's decision of whether to accept A's offer when $\delta = n$ can be viewed as a function: $\theta_n : [0,1]^2 \to [0,1]$, which is a probability $\theta_n(\alpha_n, \rho)$. That is, B accepts A's offer with probability θ_n. Define $\theta(\delta, \rho) = \theta_\delta$ with $\delta \in \{d, n\}$.

We can now write the participation constraint for B in the disclosure case as:

$$\int u(\alpha_d x)\theta_d(\alpha_d, \rho, S) f_G(x)dx + [1 - \theta_d(\alpha_d, \rho, S)]\bar{u} = \bar{u} \tag{1}$$

and in the no-disclosure case as:

$$\int u(\alpha_n, x)\theta_n(\alpha_n, \rho) f(x|n)dx + [1 - \theta_n(\alpha_n, \rho)]\bar{u} = \bar{u} \tag{2}$$

where $f(x|n) \equiv \rho f_G(x) + [1-\rho] f_B(x)$, and it is recognized that A will only propose an action that he believes is correct. Note that the stipulation that B receives his reservation utility, $\bar{u}$, in case he rejects A's offer simply reflects the fact that $\bar{u}$, represents B's utility in the next best alternative to contracting with A. The following result is useful.

Lemma 1: *There exists* $\bar{\rho}_{\min} \in [0,1]$ *such that*

$$\theta_n(\alpha_n, \rho) = \begin{cases} 1 \text{ if } \rho \geq \bar{\rho}_{\min} \\ 0 \text{ otherwise} \end{cases}$$

Moreover,

$$\theta_d(\alpha_d, \rho, S) = \begin{cases} 1 \text{ if B believes S is correct} \\ 0 \text{ otherwise} \end{cases}$$

The intuition is that in the no-disclosure case, B's reservations utility constraint can be satisfied with $\alpha_n \in [0,1]$ only as long as ρ is high enough, since we know that at $\rho = 0$, B will disagree with A's choice of action almost surely and will reject the offer. In the disclosure case, B will reject the offer if he believes A's choice of S is not correct and strictly prefers to take it if he believes S is correct.

Now, A's strategy space is $\{S_1, S_2\} \times [0,1] \times \{n, d\}$. Thus, after choosing an action S, A must choose $\{\alpha, d\} \in [0,1] \times \{n, d\}$ to maximize his expected utility:

$$\int u([1-\alpha]x)\theta(\delta, \alpha) f_G(x)dx \tag{3}$$

subject to (1) or (2), depending on δ. Given Lemma 1, we can write (1) as:

$$\int [u(\alpha_d x) - \bar{u}] f_G(x)dx = 0 \tag{4}$$

Similarly, we can write (2) as:

$$\int [u(\alpha_n x) - \bar{u}]\{\rho f_G(x) + [1-\rho] f_B(x)\}dx = 0 \tag{5}$$

Note that with Lemma 1, (3) will become: $\int u([1-\alpha_d]x)\rho f_G(x)dx$ with disclosure and $\int u([1-\alpha_n]x) f_G(x)dx$ with no disclosure. We can now state our main result.

Proposition 1: *There exists* $\bar{\rho}_{\max} \in [0,1)$ *such that agent A will choose* $\delta = n \forall \rho \geq \bar{\rho}_{\max}$ *and* $\delta = d \forall \rho < \bar{\rho}_{\max}$.

Thus, A does not disclose S when ρ, the likelihood of agreement with B, is sufficiently high, but discloses for ρ below that threshold. The intuition can be understood as follows. Disclosure policy has the effect of determining the allocation of control rights over whether production commences. When A discloses information, B possesses these control rights (see Lemma 1). When A withholds information, these control rights belong to A. Loosely speaking, control rights are optimally allocated to the party that bears the greatest risk from being *denied* control rights. From Lemma 1 we know that for $\rho < \bar{\rho}_{\min}$, A can never get B to participate without disclosure because the "risk" to B from not controlling production is so high that it is not possible to satisfy the participation constraints of both A and B for a given size of the

total economic surplus. So A discloses. Then for low values of ρ above $\bar{\rho}_{\min}$, the "risk" to B from permitting production is still high because A – who possesses control rights in this case – may produce when B thinks it's a bad idea. So, while the participation constraints of A and B can be satisfied, B charges a relatively high price as compensation for bearing this "risk", and thus demands a high share of the output. This means that the *net* value of the asset to A (the expected utility from non-disclosure) is relatively low. Thus, *relative* to not disclosing, A does not have much to lose by disclosing; the "risk" to A with disclosure is that B may stop production, but since the value of producing without disclosure is low anyway, this risk is "small". Hence, A's disclosure policy gives control to B for low values of ρ. For high values of ρ, B charges a relatively low price for participating without disclosure because B's "risk" is low, and this makes the *net* value of the production to A high. The risk to A from disclosure is that production may be denied, and this risk is "large" because, *relative* to the no-disclosure option, the lost net asset value is high. Control rights are thus allocated to A.

Another way to see the intuition is to start with the observation that A would always prefer to retain control rights over production commencement, holding *fixed* the cost of doing so, where the cost is the output share that needs to be surrendered to ensure B's participation. The reason is that such control guarantees to A a positive surplus, and this exceeds A's autarky utility of zero. However, the cost to A of maintaining control rights is *not* fixed. Rather, it is increasing in disagreement, or decreasing in ρ. Thus, when ρ is sufficiently high, A retains control because the cost of satisfying A's *endogenous* control preference is relatively low. But as ρ declines, this cost increases, and at some point it is simply too costly for A to retain control, so it is surrendered via disclosure.

It is instructive to use Proposition 1 to contrast the heterogeneous-prior solution with the common-prior solution. With common priors, A and B would always agree on the correct choice of action. However, B would not know what action was chosen until A disclosed it. In this case, as expected, the standard full-disclosure result obtains.

Corollary 1: *If A and B always have the same prior beliefs about the correct action, then A always discloses information about the action choice to B.*

This result is obvious, but it provides the necessary benchmark to evaluate the impact of disagreement. With common priors, A faces no risk in disclosing information to B, so A makes full disclosure. Thus, the partial disclosure result here comes from the heterogeneous-priors assumption.

This contrast helps to clarify the main intuition behind Proposition 1. With disagreement, disclosure serves two functions: communication of information that has inherent value, and allocation of decision rights over production. As indicated earlier, by disclosing, A gives B the opportunity to *decide* whether to invest I or not, thereby giving to B the decision right over whether production should commence. This might lead one to think that disclosure corresponds isomorphically to a transfer of decision rights. The following result shows, however, that this intuition is not correct in general.

Corollary 2: *As long as a choice of action that A believes is wrong yields A an expected utility lower than with autarky, an arrangement whereby A gives B access to all of A's information and lets B pick the preferred action is strictly Pareto dominated by an arrangement in which A retains control over the action choice and decides to disclose the chosen action.*

The intuition for this corollary is that a transfer of decision rights to B means that there is now a state in which B will choose an action that results in the density function of output being $f_B(x)$. Given that $\int u(cx) f_B(x)dx < 0$ for any $c \in (0,1]$, A experiences a negative expected utility in this disagreement state. By contrast, when A retains control over the action choice and discloses information, B withholds investment in the disagreement state and A experiences his autarky expected utility of zero, so A's overall expected utility is higher with retaining control over the action choice and disclosing this choice than with transferring all decision rights to B. The Pareto dominance follows from the fact that B's participation constraint holds tightly in both arrangements.

4. A MODEL OF CORPORATE STRATEGY DISCLOSURE

In this section, the model is specialized to analyze corporate strategy disclosure.

A. The Model

Many of the elements of the model analyzed in the previous section will carry over to this setting. There is universal risk neutrality and the riskless rate is zero. The firm is owned by shareholders who are wealth-constrained. There is a manager in place at $t = 0$ who makes the decisions to maximize the wealth of the initial shareholders, i.e. there are no agency problems. The firms needs to raise $\$I$ at date $t = 1$ to finance a project that will pay off at $t = 2$. Because the initial shareholders are wealth-constrained, the financing must be raised from new investors. The firm is all-equity financed and the new financing will be raised in the form of equity. In exchange for providing $\$I$ of financing to the firm, the new investors receive ownership $\alpha \in [0,1]$ in the firm; α will be solved for endogenously. At $t = 0$, the firm can disclose value-relevant information about itself to the capital market. There are no disclosure requirements in the model, so all information disclosure, if any, is voluntary. Conditional on the information disclosed by the firm at $t = 0$, investors decide at $t = 1$ whether or not to provide financing.

Now, the firm also needs to choose the "strategy", $S \in \{S_1, S_2\}$, to maximize project value. If the "correct" strategy is chosen, the expected payoff is $G > 2I$, whereas the choice of the "wrong" strategy leads to an expected payoff of 0. The manager randomly draws a prior belief about which strategy is the correct strategy. The probability the manager will believe S_1 is the right strategy is $q \in (0,1)$, and the probability he will believe S_2 is the right strategy is $1 - q$. The manager's belief is rational in the sense of Kurz (1994a,b). It is assumed that the beliefs of the initial shareholders coincide with the manager's beliefs. Information about strategy is referred to as "subjective information".

Conditional on the manager believing that a particular strategy is right, the probability that (new) investors will believe it is correct is $\rho \in (0,1)$, and $1 - \rho$ is the probability that investors will believe the strategy is wrong. The parameter ρ will be referred to as the "agreement parameter." This parameter

may be affected by firm characteristics (size, industry, etc.) that determine its visibility among investors and by the manager's track record and credibility with the capital market. Low-visibility firms with small investor bases may have low values of ρ. The investors' belief is also rational in the sense described above. It is assumed that ρ varies in the cross-section and the ρ for every firm is common knowledge.[12]

The firm's manager voluntarily decides about the firm's choice of strategy. As in the previous section, disclosure has value to investors in that it permits them to decide whether to invest.

From the investors' standpoint, the expected cash flow of the firm's project cash flow is ρG. Now, let $\rho_{\min}$ be such that:

$$\rho_{\min} G = I. \tag{6}$$

Attention is limited to firms with $\rho \geq \rho_{\min}$. The reason is that it is impossible for firms with $\rho < \rho_{\min}$ to raise financing without disclosure, so any analysis of a *choice* between disclosure is inherently uninteresting. The event sequence is shown in *Figure 1*.

Figure 1 goes here

As in the previous section, the strategy space of the manager (and hence the initial/old shareholders) is $\{S_1, S_2\} \times \{n, d\} \times [0,1]$, and that of the new investors is {accept, reject}.

B. Analysis

Will the firm choose to disclose its choice of strategy to the market? To address this question, consider the program faced by the firm's manager who is making decisions to maximize the wealth of the initial shareholders. If the manager chooses *not* to disclose information, then the wealth of the initial shareholders, as assessed by the manager, is:

$$[1-\alpha_n]G \tag{7}$$

[12] The assumption that all investors have the same ρ for any given firm is not crucial (e.g., see Boot, Gopalan and Thakor (2008)), although investor heterogeneity in this regard may pave the way for other interesting analyses, such as stock repurchases, since the firm may wish to use cash to buy out low-ρ investors and increase its price.

where α_n is the share of ownership that must be sold to new investors in order to raise I with no disclosure of S. That is,

$$\alpha_n \rho G = I \,. \tag{8}$$

Note that if the firm does not disclose its strategy, then investors realize that the strategy they view as correct will be adopted by the manager with probability ρ, in which case the value of the project (and hence the firm) is G, and the investors' share of it is α_n. Hence, the outside investors' expected wealth is $\alpha_n \rho G$. Equation (8) follows from the fact that in a competitive capital market, the participation constraint of investors is tight, the riskless rate is zero, there is risk neutrality, and the firm is raising I.

Substituting (8) in (7), the expected wealth of the initial shareholders can be written as:

$$\begin{aligned} W_n &= \left[1 - \frac{I}{\rho G}\right] G \\ &= G - \frac{I}{\rho}. \end{aligned} \tag{9}$$

If the manager chooses to disclose information about the strategy the firm has adopted, then investors will purchase the equity being sold and provide financing at $t = 1$ if they agree that the strategy is correct. This happens with probability ρ, and the expected wealth of the initial shareholders is :

$$\rho\left[1 - \alpha_d\right] G \tag{10}$$

where α_d is the fractional ownership sold to investors with disclosure. Note that

$$\alpha_d G = I \tag{11}$$

because investors only provide financing when they agree with the manager's choice of strategy. Substituting for α_d from (11) into (10) yields the expected wealth of the initial shareholders as:

$$\begin{aligned} W_d &= \rho\left[1 - \frac{I}{G}\right] G \\ &= \rho\left[G - I\right]. \end{aligned} \tag{12}$$

I will refer to α_n or α_d as the firm's "cost of external equity" since it represents the dilution the initial shareholders suffer to raise I. A comparison of (9) and (12) yields the following result:

***Proposition 2**: The cost of external equity is decreasing and convex in the agreement parameter ρ for firms that disclose information about S. There exists a cut-off value, $\rho^* = I\left[G - I\right]^{-1}$, of ρ such that firms with $\rho \le \rho^*$ choose to disclose information about the strategy choice S, and firms with $\rho > \rho^*$ choose not to disclose. Conditional on obtaining financing, the cost of external equity financing for any firm that discloses information about S is lower than that of any firm that does not disclose.*

This proposition has two main empirical predictions. The first is that the cost of equity capital is higher without disclosure than with disclosure *ceteris paribus*. Thus, firms that anticipate raising capital will have stronger incentives to disclose information. A second empirical prediction is that the likelihood of disclosure is higher for lower -ρ firms. I am not aware of any direct evidence on this front, but this prediction could be tested in the future using the proxies for ρ developed, for example, in Dittmar and Thakor (2007), and Thakor and Whited (2011). There is, however, existing evidence that is suggestive. Ali, Klasa and Yeung (2009) find that, among firms controlled by founding families, those with higher-quality earnings (which would presumably have higher ρ 's) disclose less information about corporate governance practices. Similarly, Santema, Hoekert, van de Rijt and Oijen (2005) report that in countries with more concentrated ownership (which may imply higher ρ), there is less disclosure.

The intuition for this proposition is similar to that for Proposition 1. To flesh it out further, note that from (9) and (12), it follows that:

$$\partial W_n / \partial \rho > 0, \partial^2 W_n / \partial \rho^2 < 0 \tag{13}$$

$$\partial W_d / \partial \rho > 0, \partial^2 W_d / \partial \rho^2 = 0 \tag{14}$$

and W_n and W_d are equal at $\rho = 1$. Thus, the determination of ρ^* looks the way it is shown in *Figure 2*.

Figure 2 goes here

When the firm discloses information, the benefit to the initial shareholders from having a higher ρ is *linearly* increasing in ρ . This is because the benefit is simply the probability of receiving financing

and this probability is ρ itself. When the firm does not disclose information, the probability of receiving financing is one, so it is unaffected by ρ. The benefit of higher ρ shows up in this case in a reduction in the cost of financing, α_d. Since α_d is decreasing and convex in ρ, the initial shareholders' value function, W_d, is increasing and concave in ρ. The W_d curve lies below the W_n curve at the lowest feasible ρ, $\rho_{\min}$, cuts it once at ρ^*, and then converges to the W_n curve at $\rho = 1$, as shows in *Figure 2.*

Let us now return to our discussion in the previous section about the relationship between disclosure and transfer of decision rights. Here choice of the wrong strategy leads to a payoff of zero,[13] which is the same as the payoff with autarky. Hence, we would expect that disclosure and transferring control rights to the investors would be equivalent. To see this, suppose that instead of disclosing, the manager offers a financing arrangement such that investors have access to all the manager's information and can pick their preferred strategy. Investors always finance the project and then implement their preferred strategy, with $\alpha G = I$, which is (11). The manager thinks that with probability $1-\rho$ the chosen strategy will be wrong and thus evaluates the expected wealth of the initial shareholders to be $\rho[1-\alpha]G$, which is (10). This means that, from the perspective of the initial shareholders, disclosure can be reinterpreted as a transfer of decision rights to investors. Of course, a comparison of this result with Corollary 2 shows that this equivalence holds only with risk neutrality when the choice of the wrong strategy by investors leaves the initial shareholders no worse off than with autarky. With risk aversion, disclosure strictly Pareto dominates transferring control rights to investors because the choice of the wrong strategy leads to a lower expected utility than with autarky.

In the risk-neutrality case, however, this equivalence result makes the intuition more transparent. The efficient financing arrangement should transfer decision rights over strategy choice by considering the surplus of both the initial shareholders and the new investors. But, given that these conflict due to disagreement, decision rights should rest with the group with the greater ownership. Factors that increase

[13] This corresponds to our assumption in the previous section that $\int x f_B(x)dx = E(x) = 0$. The difference is that now we have risk neutrality.

the amount of ex-post ownership of the initial shareholders, such as a more valuable project of a lower cost of investment, imply that the manager should retain more decision rights. In a more subtle manner, greater agreement implies that the project is simply more inherently valuable which, again, increases its value to the initial shareholders. Hence, more agreement implies greater property rights retained by the manager or, equivalently, less disclosure.

In reality, of course, disclosure is more than a transfer of decision rights. Proprietary disclosure costs may introduce an additional cost associated with disclosure, whereas spillover benefits of disclosure in terms of stronger incentives for the firm's partners to undertake strategy-specific investments (as in Ferreira and Rezende (2007)) will make disclosure more profitable for the initial shareholders. These trade-offs are well understood, however, and this paper has little to additionally contribute on that front.

Nonetheless, the result that disclosure with potential disagreement affects the allocation of decision rights sheds further light on the contrast between disagreement and settings in which there is uncertainty about the receiver's preferences (which could, for example, because of the inclusion of more general preferences than monotonic preferences as in Seidman and Winter (1997) or due to uncertainty about the receiver's opportunity set for investment as in Suijs (2007)). Whereas disagreement forges a natural link between disclosure and decision control, preference uncertainty does not.

C. Discussion of the Analysis

A few points are worth noting about the preceding analysis. First and foremost, potential disagreement is higher when the firm discloses information about its strategy, i.e. greater disclosure leads to potentially higher disagreement. There is nothing terribly deep about this result *per se*—it follows from the construction of the model; the main contribution of Proposition 2 lies elsewhere, namely in the characterization of optimal disclosure policy based on the extent to which managers and investors are likely to agree with each other. Nonetheless, it is interesting to contrast this result of greater disagreement with more disclosure to the standard asymmetric-information finding that more disclosure reduces informational asymmetry and causes agents to move closer to each other in their assessments.

Second, it might appear that there is a benefit to the manager from simply discovering the investors' view of the correct strategy and then precommitting to the adoption of this strategy prior to issuing equity. This, however, is highly impractical. Given that the manager is raising funds from new investors, he would have to literally poll the whole capital market before raising financing to see what investors like. And since investors are merely expressing opinions, they have "no skin in the game". An agent's expressed opinion may, therefore, have little to do with true beliefs and the firm's competitors may deliberately mislead the firm by pretending to be potential investors in the firm.[14]

Getting back to the analysis, the following result is a consequence of Proposition 2.

Corollary 3: *As the firm becomes intrinsically more valuable through an increase in* G*, the cut-off value of the agreement parameter for disclosure,* ρ^**, decreases*

As the project becomes more valuable, fewer firms disclose information. The intuition is that an increase in G increases the ex-post ownership of initial shareholders for every ρ, so there are more values of ρ for which the manager should retain more decision rights by avoiding disclosure.

There are two ways of interpreting this result. One is in the sense of Proposition 2. Holding G fixed, firms with higher ρ's do not disclose and firms with lower ρ's do. The *ex ante* expected value of the firm prior to the decision of whether or not to disclose is ρG. Thus, the higher the ρ, the higher is the *ex ante* value of the firm, and Proposition 2 asserts that it is the higher-valued firms that disclose less. The other is in the sense of Corollary 3. As G increases, the measure of firms that do not disclose goes up. There is now a compounded effect—the measure of non-disclosing firms goes up *and* each non-disclosing firm is more valuable because G is higher.

[14] Even if these practical difficulties could be pushed aside, there is no apparent gain from this approach. If the manager discovers that investors endorse the strategy he likes, he will go ahead and disclose his strategy. If he discovers that investors like a different strategy (one that he views as producing no value), he will prefer to not disclose his strategy. Rational anticipation of this by investors will mean that they will refuse to finance such firms and no disclosure can no longer be part of the equilibrium policy. But since it was optimal for some firms to not disclose in the absence of this "pre-play communication", these firms will be worse off. Hence, it follows that such pooling of investors will lead to a worse outcome for firms.

The result that there is no disclosure by the firms that have the least disagreement with investors stands in sharp contrast to results in models with exogenous or endogenous proprietary costs of disclosure. In the exogenous disclosure-costs models of Dye (1986), Verrechia (1983), and Wagenhofer (1990), it is the firms with sufficiently unfavorable information that do not disclose. For comparison purposes, if we interpret high ρ and/or high G as favorable information or good news and low ρ and/or low G as unfavorable information, then our result is the exact opposite. In the endogenous disclosure-costs model of Suijs (2007), there is a partial-disclosure equilibrium in which the firm discloses average information and withholds both very unfavorable and very favorable information. Thus, none of these papers have the result the most favorable information would not be disclosed. The main reason for this difference is that the disagreement set-up is fundamentally different from a private-information setting. Because ρ is common knowledge, a firm that has a high ρ does not possess any private information that investors do not have. That is, while such a firm has favorable information, it is not good *news*. But there is nonetheless the potential that the firm's choice of strategy, which is private information, could generate disagreement if disclosed, and it is the expected cost of this disagreement that deters the high-ρ firm from disclosure. The key is that the strategy choice *is news*, but it *cannot* be classified as either good news or bad news until it is disclosed and the reaction of investors to it is known.[15] A subtlety is that the firm can still determine whether the expected value of the strategy is high or low if disclosed (based on ρ) and hence can have an expectation about whether its private information will be good news or not.

5. EXTENSION OF THE ANALYSIS: IMPACT OF CORPORATE GOVERNANCE

In this section, the interaction of disclosure with corporate governance is examined. There are obviously many aspects of corporate governance and hence many ways to model this possible interaction. For concreteness, I will model corporate governance as a mechanism for aligning the interests of the manager more closely with those of the shareholders.

[15] This is a key difference, even relative to a model like that of Suijs (2007) in which the firm is uncertain of how investors will react to its private information because of their alternative investment opportunities. Nevertheless, the private information of the firm about its return can be unambiguously rated as good, average or bad, even though its rating *relative* to the investor's other opportunities (that the firm does not know) is not known to the firm.

Rather than assuming that the manager always maximizes the wealth of the initial shareholders, it is now assumed that the manager maximizes his expected utility and that he must expend privately-costly effort to find the good project. Specifically, the manager chooses effort $e \in \{0,1\}$ with a private cost of $e\omega$, where $\omega > 0$. The manager's effort choice is unobservable to others. While the manager has access to the bad project with probability 1, the probability that the good project will be available is $r(e)$, with $r(1) = r \in (0,1)$ and $r(0) = 0$. The manager's reservation utility is zero.

Corporate governance seeks to incent the manager to choose $e = 1$ to search for the good project. Governance quality is measured by the cost of achieving this alignment between the manager's interests and the (initial) shareholders' interests. It is assumed that the manager enjoys a non-pecuniary intrinsic-satisfaction benefit of $\beta > 0$ from investing in the good project. This benefit can derive from numerous sources. For example, it can be related to the sense of loyalty the manager has to the firm, the social prestige associated with being at the helm of a *successful* firm, and the fact that the strength of the directors' support for the CEO may be positively related to the firm's success. Through the governance process, the directors may be able to influence some of these factors. As a short-hand way to express this, it will be assumed that better governance results in the manager's utility maximization being more closely aligned with the maximization of (initial) shareholders' wealth via a higher β.

Let the manager's compensation be ϕ_1^n if the payoff G_H is observed at $t = 2$ in the no-disclosure case, and ϕ_1^d if the payoff G_H is observed at $t = 2$ in the disclosure case. The manager receives nothing if the firm's payoff is zero at $t = 2$. It is straightforward to verify that this is the optimal structure of managerial compensation, given the assumptions on observability and managerial reservation utility. It is assumed that managerial compensation comes out of the date-2 cash flow of the firm, so the cost of this compensation is borne by both the initial and the new shareholders.

Now consider the no-disclosure case. The manager chooses e to maximize his expected utility:

$$\max_{e \in \{0,1\}} r(e)\left[\phi_1^n + \beta\right] - \omega e. \tag{15}$$

Incentive compatibility (IC) requires that the manager at least weakly prefers $e=1$ to $e=0$. Since the IC constraint binds at the optimum, we have $r\left[\phi_1^n+\beta\right]-\omega=0$ or

$$\phi_1^n=\frac{\omega}{r}-\beta. \tag{16}$$

Similarly, with disclosure, the manager chooses e to maximize his expected utility:

$$\max_{e\in\{0,1\}} r(e)\rho\left[\phi_1^d+\beta\right]-\omega(e). \tag{17}$$

The key difference is that with disclosure, the probability that the manager will find a good project and raise financing for it is only $r(e)\rho$, compared to $r(e)$for the no-disclosure case.

Again, since the IC constraint binds at the optimum, we can solve for ϕ_1^d :

$$\phi_1^d=\frac{\omega}{r\rho}-\beta. \tag{18}$$

The expected wealth of the initial shareholders with disclosure is

$$r(e)\rho[1-\alpha_d][G_H-\phi_l^d] \tag{19}$$

where

$$\alpha_d=\frac{1}{G_H-\phi_l^d} \tag{20}$$

and (18) gives ϕ_1^d. The initial shareholders' expected wealth with no disclosure is given by:

$$r(e)[1-\alpha_n][G_H-\phi_l^n] \tag{21}$$

where

$$\alpha_n=\frac{1}{\rho\left[G_H-\phi_l^n\right]} \tag{22}$$

Note that ϕ_l^n is given by (16). The cut-off ρ^{**} is the value of the agreement parameter at which the wealth of the initial shareholders is the same from disclosure and no disclosure. We now have:

Proposition 3: *The higher the β (the better the corporate governance), the lower is the expected cost to the firm of compensating the manager, regardless of whether the firm discloses additional information or not. Regardless of the quality of corporate governance, the high-payoff bonus, ϕ_1, that must be promised*

to motivate the manager to choose $e=1$ *is lower in the absence of disclosure than with disclosure. As the quality of corporate governance improves (* β *increases), there is a reduction in the value of the cut-off agreement parameter,* ρ^{**}*, such that firms with* $\rho \le \rho^{**}$ *disclose additional information and firms with* $\rho > \rho^{**}$ *do not.*

The intuition is as follows. As β increases, the manager's utility from finding the good project goes up, so it becomes cheaper for the shareholders to motivate him to expend the necessary effort to maximize the probability of availability of the good project.

The proposition also says that disclosure impacts executive compensation—conditional on holding fixed the high firm payoff, the cost of managerial compensation for the shareholders is always higher with disclosure than without. The reason is that, with disclosure, there is a probability of $[1-r(e)]+[1-\rho]r(e)$ that even a manager who chooses $e=1$ will not be able to invest in the good project and receive compensation ϕ^d. Without disclosure, the probability that the manager will not be able to invest in the good project is $[1-r(e)]<[1-r(e)]+[1-\rho]r(e)$. Thus, a smaller bonus in the high-payoff state has to be paid to motivate the manager when the firm does not disclose. See *Figure 3*.

Figure 3 goes here

Finally, governance (β) affects the cut-off agreement parameter, $\rho**$, below which firms disclose – as governance improves, the cut-off moves to the left. The intuition is as follows. An increase in β increases the wealth of initial shareholders in both the disclosure and no-disclosure cases because it reduces the bonus that must be paid to the manager to provide the necessary incentives. However, in the disclosure case, this wealth increase occurs with probability $r(e)\rho$, which is the probability that investment will occur in a project, In the no-disclosure case, the corresponding probability is $r(e)$. Thus, the marginal impact of a higher β on shareholder wealth is always greater with no disclosure than with disclosure. This means the relative advantage of not disclosing grows with β, and the no-disclosure option dominates for a larger range of ρ values.

A surprising aspect of Proposition 3 is the implication that improvements in corporate governance are accompanied by *less* voluntary disclosure. This is the exact opposite of the usual agency argument: firms disclose less information because of agency conflicts generated by managers who do so to protect their (inefficient) private benefits. This argument would suggest that an improvement in corporate governance would make it more difficult for managers to undertake policies that protect personal rents and hence lead to greater voluntary disclosure.

6. OPTIMAL DISCLOSURE POLICY FOR BANKS

Financial firms like banks have information disclosure considerations that potentially differ from those for non-financial firms, due to a variety of factors. One of these is the relatively high leverage of banks compared to non-financial firms. The other is that this leverage is of shorter maturity than the maturity of assets, so there is rollover risk and financial fragility. In this section, the model of the previous section is modified to explore issues specific to banks.

A. Model and Analysis

At $t = 0$, the bank starts out with a loan portfolio with an expected value of $\bar{V}_{AIP}$. If the asset value is not impaired, it will be V_{AIP} at $t = 2$. There is, however, a non-zero probability that the asset value will suffer an impairment at $t = 1$ that will make its value γV_{AIP}, with $\gamma \in (0,1)$.

The bank also has (uninsured) debt of *D* outstanding at $t = 0$, which is short-term (demandable) in nature.[16] That is, the bank owes depositors *D* at $t = 2$, but depositors can demand withdrawal of *D* at $t = 1$ if they so wish. If the bank has the ability to repay the full amount at $t = 1$, it will do so and continue to operate until $t = 2$. If the bank is unable to meet the withdrawal at $t = 1$ in full, it will be liquidated and will cease to exist. In this case, the bank experiences a bankruptcy cost of $B > 0$.

Whether depositors withdraw at $t = 1$ or not depends on the publicly-observable realization of an exogenous liquidity shock, which occurs with probability $\pi \in (0,1)$. Thus, if the shock occurs, depositors

[16] Demandable debt is a central feature of banking and can be rationalized in many ways. See Calomiris and Kahn (1991) for a model in which such debt serves to discipline bank managers. Thakor (2012) uses similar logic to rationalize short-maturity debt in non-depository financial institutions.

need to consume right away and have no choice but to demand immediate payment at $t = 1$; if the shock does not occur, they leave their money in the bank until $t = 2$, a conjecture that will be verified later. It is assumed that

$$\bar{V}_{AIP} > D > \gamma V_{AIP} \tag{23}$$

This assumption means that at $t = 0$, the expected value of the loan portfolio is large enough to pay off depositors, i.e., the economic value of the bank's equity in the portfolio is positive. However, conditional on the loan portfolio value being impaired at $t = 1$, there is a debt overhang problem in the sense that the economic value of the bank's equity in the loan portfolio becomes negative. For simplicity, there is *no* disagreement about any of the values related to this loan portfolio.[17]

The bank's debt is assumed to be uninsured. One can therefore think of this as uninsured subordinated debt in depository institutions or short-term debt in investment banks, hedge funds and the like. Whether it is depository institutions like commercial banks or non-depository financial institutions like investment banks, short-term debt, that can be withdrawn at short (or no) notice, is ubiquitous.[18] Modeling uninsured short-term debt permits an analysis of a broad class of financial intermediaries.

Further, for simplicity, it is assumed that the depositors' liquidity shock and asset-value impairment shock are perfectly correlated, so asset-value impairment also occurs with probability $\pi \in (0,1)$. That is, one possible reason for this is that there may indeed be a causal link between the two. Depositors may run the bank because they have observed asset-value impairment,[19] consistent with Gorton's (1988) empirical evidence, or a run by depositors induces a decline in asset values as many banks rush to sell assets, causing selling pressure that results in a fire-sale price, as in Shleifer and Vishny (1992). This assumption is not essential, but it simplifies the algebra. Without it, the bank would face a

[17] Introducing disagreement about the value of the loan portfolio that is in place at $t = 0$ does not change the core intuition being delivered by the formal analysis in this section, but it makes the analysis more complicated.
[18] For example, Bear Stearns funded itself largely with 30-day paper, and faced a survival crisis when this funding dried up.
[19] This is formally not the case in the model here, since the liquidity shock experienced by depositors is purely exogenous.

liquidation threat only when the joint event defined by the confluence of the liquidity shock and asset-value impairment occurs.

The rest of the model structure remains the same as in Section 4. The bank needs to raise *$I* in financing at $t = 1$ to finance a new loan portfolio that will pay off at $t = 2$. The new financing will be raised through an equity issue.[20] In exchange for providing *$I*, the new investors will receive ownership $\alpha \in [0,1]$ in the firm. At $t = 0$, the bank can disclose value-relevant information about itself to the capital market. All information disclosure is voluntary, and conditional on this disclosure, investors decide at $t = 1$ whether or not to provide financing to the bank.

The value of the new loan portfolio depends on the strategy $S \in \{S_1, S_2\}$ chosen by the bank, and a correct strategy leads to a loan portfolio value of $G > 2I + D \text{ at } t = 2$, whereas a wrong strategy leads to a value of zero. The manager will believe with probability *q* that S_1 is the correct strategy and with probability $1 - q$ that S_2 is the correct strategy. The probability that the new equity investors will agree with the manager that the chosen strategy is correct is ρ and the probability that they will disagree is $1 - \rho$. The sequence of events is depicted in *Figure 4.*

Figure 4 goes here

Lemma 2: *If the depositors who funded the old loan do not suffer a liquidity shock at* $t = 1$*, they do not withdraw their deposits at* $t = 1$*. If they suffer a liquidity shock at* $t = 1$*, they withdraw their deposits.*

It is by assumption that the depositors withdraw funding if they experience a liquidity shock. If they do not suffer a liquidity shock, then they are assured that by waiting until $t = 2$ they will receive their promised repayment *D*, which is the same amount they would receive if they withdrew at $t = 1$. Hence, they wait until $t = 2$ to be repaid. This now leads us to the main result of this section.

[20] With only one more period to go, it does not matter whether financing is raised via debt or equity at $t = 1$.

Proposition 4: *There exists a cut-off value,* ρ_b^**, of the agreement parameter such that banks with* $\rho \le \rho_b^*$ *choose to disclose information about the strategy choice S, and banks with* $\rho > \rho_b^*$ *choose not to disclose. For B sufficiently large, the value of* ρ_b^* *is decreasing in* π*, the probability of the liquidity shock experienced by the bank's depositors.*

The intuition is as follows. As the probability of a liquidity shock increases, the probability that the bank will need to raise additional financing from new shareholders to replace lost deposits in order to prevent liquidation at $t = 1$ goes up. This means that the possibility that investors may disagree over strategy choice and thus be unwilling to provide financing becomes more costly as the liquidity shock becomes more likely. Since strategy disclosure leads to a positive probability that new investors may deny funding, whereas a no-disclosure policy leads to a zero probability that funding will be denied when there is (old) loan portfolio-value impairment, the no-disclosure policy becomes more attractive as the likelihood of a liquidity shock increases.

One implication of this result is that banks will have stronger incentives to *not* disclose strategic information than non-financial firms that have non-demandable, longer-maturity debt that is not subject to the same withdrawal risk to which bank debt is subject. That is, the fragility of banks and other financial firms induces them to disclose *less* information than non-financial firms.

While what has been modeled is disagreement about a new loan, it is straightforward to obtain the same results if the disagreement was about assets in place. To see this, suppose the bank has assets in place worth V_{AIP} according to the bank manager. At *t=1*, depositors may withdraw funding with probability π. The bank can raise equity to replace the lost deposit funding if it has not disclosed some details regarding its assets in place or if it has disclosed this information and shareholders agree with the bank (with probability ρ) that the assets in place are worth V_{AIP}; with probability $1-\rho$ the shareholders believe the assets in place are worthless. This alternative set-up will deliver qualitatively the same results as the model analyzed earlier. Note also that due to the ease with which banks can transform their existing asset portfolios (e.g. Myers and Rajan (1998)) and the relative opaqueness of such

transformations to outsiders, the boundary between assets in place and new assets that may be acquired in support of a new strategy may be quite blurred for banks.

B. Regulatory Policy Implications

The focus of recent bank regulation, most notably the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, has been on requiring banks to disclose more information. This discussion has also been extended to include the disclosure of more strategic information due to its potential systemic risk implications. The core principle is that greater informational transparency will lead to greater financial stability. However, the analysis here reveals that the exact opposite may occur. If forced to disclose more information, banks are likely to become more fragile since some new disclosure requirements may be binding in the sense that banks that would not have voluntarily disclosed information are now required to do so. This greater disclosure increases the odds that these banks may not be able to replace lost deposits when they experience liquidity shocks.

A second interesting implication has to do with the increased uncertainty financial institutions may perceive when it comes to the extent of disclosure necessary for compliance, with the possibility of regulatory sanctions in case the institution is deemed to have disclosed too little. That is, when it comes to disclosure of subjective strategic information, what the law requires may not be entirely clear due to possible unavoidable ambiguities. A reasonable conjecture is that, faced with this uncertainty, banks will disclose more information—perhaps going even beyond strictly-interpreted regulatory guidelines—in order to reduce the probability of regulatory sanctions. Indeed, the recent evidence provided by Hanley and Hoberg (2012) in the context of the impact of litigation risk on strategic disclosure appears to support this conjecture. This will reinforce the effect of increasing fragility discussed above.

What sort of disclosure policy should the regulator adopt? The standard approach is to start with the assumption that the regulator seeks to maximize social welfare. But welfare analysis is not possible with heterogeneous beliefs because there is no way to determine whose beliefs to use. Nonetheless, if we assume that the objective of the regulator is to minimize banking fragility and that the cost of financing for the bank does not matter to the regulator – it is merely a transfer payment – then it follows that there

should be *no* regulatory demand for information disclosure. This does not preclude regulators asking for information for regulatory purposes, but there is nothing to be gained by forcing banks to disclose to the market what they would not voluntarily disclose.

The final important implication for banks comes from the corporate governance analysis. We know from Proposition 3 that an improvement in corporate governance leads to *less* voluntary disclosure of strategic information. This means that improving corporate governance cannot only have the direct effect of reducing fragility by improving bank management (a well-understood benefit not modeled here), but it can also indirectly reduce fragility by inducing banks to reveal less strategic information.

7. CONCLUSION

This paper has analyzed the disclosure of qualitative, subjective information that is inherently subject to multiple interpretations, and extracted its implications for non-financial firms and banks. Specifically, disclosing more subjective information when agents have rational but heterogeneous prior beliefs does *not* necessarily lead to greater agreement. Different agents may agree that there is a pot of gold at the end of the rainbow that is worth having, but they may disagree on the path to get there. And they may also believe that if the wrong path is chosen, the whole journey is a waste of time and resources. This leads to a theory of information disclosure when agents may disagree. In asymmetric-information models, firms voluntarily disclose all they know in the absence of considerations related to information spillovers to product-market competitors, because doing so lowers the cost of financing. The same effect obtains with greater disclosure when there is disagreement, *conditional* on obtaining financing. But with disagreement, disclosure entails a cost that is absent with asymmetric information—the probability of obtaining financing can be reduced by disclosure. Thus, disagreement introduces a tradeoff between the probability of obtaining financing and the cost of financing. In contrast to the existing literature, it is the intrinsically more-valuable firms that choose not to disclose, whereas lower-valued firms choose to disclose information.

The analysis has produced additional results about information disclosure with disagreement, some of which are amenable to empirical testing. First, firms that disclose more subjective information

have lower costs of capital.[21] Thus, conditional on obtaining financing, lower-ρ firms will invest more.[22] Second, voluntary information disclosure also interacts with corporate governance and executive compensation.

The model has strong implications for banking. In particular, it exposes a fundamental tension between the desire for greater transparency on the one hand and the desire for reduced fragility on the other. Greater transparency via enhanced disclosure of strategic information may compromise banking stability. However, an increased focus on improving corporate governance in banking could work through the voluntary strategic information disclosure channel to increase stability. Future research could focus on the interaction between bank information disclosure policy and microprudential regulation such as the design of capital requirements. (e.g. as in Acharya, Mehran and Thakor (2011)).

[21] This is consistent with the empirical evidence that firms that disclose more and have more transparent earnings end up with lower costs of capital. See, for example, Barth, Konchitchki and Landsman (2009).

[22] But, of course, the probability of obtaining financing is lower for firms with lower agreement levels. Dittmar and Thakor (2007) develop empirical proxies for agreement.

APPENDIX

Proof of Lemma 1: Consider the no-disclosure case first. From (2), it is apparent that the left-hand side (LHS) of (2) is continuous and increasing in ρ. Moreover, at $\rho = 0$, it is impossible to satisfy (2) since $\int u(\alpha_n x) f_B(x)dx < 0$. It is also apparent that the LHS exceeds $\bar{u}$ at $\rho = 1$ and $\alpha_n = 1$. Thus, $\exists \rho_{\min} \in (0,1)$ such that $\alpha_n \in (0,1)$ can be found to ensure that (2) holds as an equality. This means that $\theta_n(\alpha_n, \rho)$ can be set at $1 \; \forall \rho \geq \rho_{\min}$. It is transparent that $\theta_d(\alpha_d, \rho, S) = 0$ otherwise, since B's reservation utility can only be satisfied when he believes the correct strategy has been chosen. ■

Proof of Proposition 1: The proof relies on examining when the sum of the expected utilities of agents A and B is greater without disclosure than with disclosure. The total expected utility with no disclosure is:

$$T_n \equiv \int u((1-\alpha_d - \Delta\alpha)x) f_G(x)dx0 + \rho \int u((\alpha_d + \Delta\alpha)x) f_G(x)dx + [1-\rho]\int u((\alpha_d + \Delta\alpha)x) f_B(x)dx \tag{A-1}$$

and with disclosure it is:

$$T_d = \rho \int u((1-\alpha_d)x) f_G(x)dx + \rho \int u(\alpha_d x) f_G(x)dx + [1-\rho]\bar{u} \tag{A-2}$$

where $\Delta\alpha \equiv \alpha_n - \alpha_d$.

We want to examine when $T_n > T_d$.

There are two ways to see the proof. We know that $T_n = T_d$ at $\rho = 1$. So examine a small perturbation say $\rho = 1 - \varepsilon$, with $\varepsilon > 0$ arbitrarily small. The total monetary surplus in the no-disclosure case is

$$\begin{aligned}
&[1-\alpha_d - \Delta\alpha]\int x f_G(x)dx + \rho[\alpha_d + \Delta\alpha]\int x f_G(x)dx + [1-\rho][\alpha_d + \Delta\alpha]\int x f_B(x)dx \\
&= E_G(x) - \rho[\alpha_d + \Delta\alpha]\int x f_G(x)dx - [1-\rho][\alpha_d + \Delta\alpha]\int x f_G(x)dx \\
&\quad + \rho[\alpha_d + \Delta\alpha]\int s f_G(x)dx + [1-\rho][\alpha_d + \Delta\alpha]\int x f_B(x)dx \\
&= E_G(x) - [1-\rho][\alpha_d + \Delta\alpha]\{E_G(x) - E_B(x)\} \\
&= E_G(x) - [1-\rho][\alpha_d + \Delta\alpha]E_G(x) \;\; \text{since } E_B(x) = 0
\end{aligned} \tag{A-3}$$

where $E_G(x) \equiv \int x f_G(x)dx$ and $E_B(x) \equiv \int x f_B(x)dx$.

Relative to the common-priors case (where the total surplus is $E_G(x)$), there is a loss of $[1-\rho][\alpha_d + \Delta\alpha]E_G(x)$ with disagreement.

Similarly, the total monetary surplus in the disclosure case is:

$$\begin{aligned}
&\rho E_G(x) - \rho\alpha_d E_G(x) - [1-\rho]\alpha_d E_G(x) + \rho\alpha_d E_G(x) \;\; + [1-\rho]I \\
&= \rho E_G(x) - [1-\rho]\{\alpha_d E_G(x) - I\}
\end{aligned} \tag{A-4}$$

Note that $\alpha_d E_G(x) > \bar{u}$. Comparing (A-3) and (A-4) we see that no-disclosure generates a higher total monetary surplus if $[1-\rho]E_G(x) > [1-\rho][E_G(x)\{\alpha_d + \Delta\alpha - \alpha_d\} + I]$

or if

$$E_G(x)[1-\Delta\alpha] > I \tag{A-5}$$

Since $\partial\Delta\alpha / \partial\rho < 0$ and $\Delta\alpha = 0$ at $\rho = 1$, for ρ close enough to 1 we know by continuity that $\Delta\alpha$ can be made arbitrarily small. Thus, since $E_G(x) > I$, (A-5) holds for ρ close enough to 1. The proof with expected utilities instead of monetary payoffs follows for ρ close enough to 1 because of A and B have continuous preferences which are linear in the small. Hence, for $\rho \in (0,1]$ high enough, no disclosure is preferred.

Another way to see the proof is to examine (A-1) and (A-2) and note that the expected utility loss in going from no-disclosure to disclosure is $\int u([1-\alpha_d]x) f_G(x)dx$, and this loss occurs (for A) with probability $1-\rho$. The gain in expected utility in going from no-disclosure to disclosure (for B) is: $\bar{u} - \int u((\alpha_d + \Delta\alpha)x) f_B(x)dx$, and this gain also occurs with probability $1-\rho$. The incremental ownership $\Delta\alpha$ merely adjusts or this loss to ensure that B's reservation utility constraint binds in both cases. Thus, no-disclosure is preferred when:

$$\int u([1-\alpha_d]x) f_G(x)dx > \bar{u} - \int u(\alpha_d x + \Delta\alpha x) f_B(x)dx \tag{A-6}$$

Now consider a situation in which $\rho = 1-\varepsilon$, with $\varepsilon > 0$ arbitrarily small, so that $\Delta\alpha = \hat{\varepsilon} > 0$, is also arbitrarily small. Thus,

$$\begin{aligned}
&\bar{u} - \int u(\alpha_d x + \Delta\alpha x) f_B(x)dx \\
&\approx \bar{u} - \int u(\alpha_d x) f_B(x)dx \\
&< \int u(I - \alpha_d x) f_B(x)dx \\
&< \int u(I - \alpha_d x) f_G(x)dx \\
&< \int u(x - \alpha_d x) f_G(x)dx
\end{aligned}$$

Thus, for ρ close enough to 1, the no-disclosure policy dominates.

Moreover, for $\rho = 0$, we know that (5), the reservation utility constraint of B, can never hold, and hence by continuity it will not hold for ρ small enough. In these cases, disclosure is the only feasible policy. Q.E.D.

Proof of Corollary 1: With common priors, A's expected utility with disclosure is the same as without disclosure. So disclosure occurs. Q.E.D.

Proof of Corollary 2: With A in control and a policy of disclosure, the surplus in terms of expected utility is given by (A-2) and can be written as:

$$T_d = \rho \int u((1-\alpha_d)x) f_G(x)dx + \bar{u} \tag{A-7}$$

Now if B has control and still gets his reservation utility, the total surplus is:

$$\hat{T}_d = \rho \int u((1-\hat{\alpha}_d)x) f_G(x)dx + [1-\rho] \int u((1-\hat{\alpha}_d)x) f_B(x)dx + \bar{u} \tag{A-8}$$

where $\hat{\alpha}_d$ is B's ownership share when he has control.

Note that in the case in which A has control, B's reservation utility constraint can be written as:

$$\rho \int u(\alpha_d x) f_G(x)dx + [1-\rho]\bar{u} = \bar{u}$$

which means

$$\int u(\alpha_d x) f_G(x)dx = \bar{u} \tag{A-9}$$

Similarly, when B has control, his reservation utility constraint can be written as:

$$\int u(\hat{\alpha}_d x) f_G(x)dx = \bar{u} \tag{A-10}$$

Thus, $\alpha_d = \hat{\alpha}_d$. Now comparing (A-7) and (A-8) and recognizing that

$$\int u((1-\alpha_d)x) f_B(x)dx < 0,$$

it follows that $T_d > \hat{T}_d$. Q.E.D.

Proof of Proposition 2: W_n and W_d are given by (6) and (9), respectively. To solve for ρ^*, we equate W_n and W_d:

$$G - \left[I/\rho^*\right] = \rho^*\left[G - I\right]. \tag{A-11}$$

Solving (A-11) gives us:

$$\rho^* = \frac{I}{\left[G - I\right]}. \tag{A-12}$$

Note that $\rho^* \in (0,1)$ since $G > 2I$.

Now, no-disclosure is preferred if:

$$G - \left[\frac{I}{\rho}\right] > \rho\left[G - I\right]$$

or if:

$$G > I\left[\frac{I}{\rho} + 1\right]. \tag{A-13}$$

We see now that (A-13) holds for $\rho > \rho^*$, and for $\rho \le \rho^*$ the inequality is reversed and disclosure is preferred. Q.E.D.

Proof of Corollary 3: Differentiating (A-12) yields:

$$\partial\rho^*/\partial G = \frac{-I}{\left[G - I\right]^2} < 0.$$ Q.E.D.

Proof of Proposition 3: From (16) and (18) we see that $\partial\phi_1^n/\partial\beta < 0$ and $\partial\phi_1^d/\partial\beta < 0$, so an increase in β leads to a decline in managerial compensation. Next, comparing (16) and (18), we see that $\phi_1^n < \phi_1^d \;\; \forall \;\; \rho \in \left(\rho_{\min}, 1\right)$. Now solve for ρ^{**} by equating (19) and (21). Upon substitution and simplifications, we can write (19) as:

$$r\rho[G + \beta - I] - \omega \tag{A-14}$$

and (20) as:

$$r[G_H + \beta - \frac{I}{\rho}] - \omega \tag{A-15}$$

Equating (A-14) and (A-15) and simplifying, we can write:

$$\rho^{**}[G_H + \beta] = I[1 - p^{**}] \tag{A-16}$$

and the expression for ρ^{**} now follows.

It is clear that $\partial\rho^{**}/\partial\beta < 0$. Q.E.D.

Proof of Lemma 2: Suppose depositors suffer a liquidity shock. Then they have no choice but ot withdraw their deposits, so they do so. If they suffer no liquidity shock, it means that the value of the original loan portfolio is $V_{AIP} > D$, so they receive *D* regardless of whether they withdraw at $t = 1$ or $t = 2$. Hence, they wait until $t = 2$. Q.E.D.

Proof of Proposition 4: Consider the bank's initial shareholders' wealth with a disclosure policy, W_d^b, first. If depositors withdraw at $t = 1$, the bank can issue equity to cover the investment, *I*, in the new loan portfolio plus the deposit withdrawal, *D*, as long as the new equity investors agree that the bank chose the right strategy at $t = 0$. If they disagree and depositors withdraw at $t = 1$, the bank cannot raise new equity to just finance the lost deposits since the only asset in the bank is worth $\beta V_{AIP} < D$. So the bank liquidates in this case. If there is no liquidity shock, the bank raises only *I* to cover the investment in the new loan portfolio, and depositors are paid out of the proceeds of the new loan portfolio plus V_{AIP}. As before, the issue of investors disagreeing with the bank's portfolio choice arises only if disclosure occurred at $t = 0$. Thus, in the disclosure case:

$$\begin{aligned} W_d^b &= \rho\{\pi[1-\alpha_1][G+\beta V_{AIP}] + [1-\pi][1-\alpha_2][G+V_{AIP}-D]\} \\ &\quad + [1-\rho]\{[1-\pi][V_{AIP}-D] - \pi B\} \end{aligned} \tag{A-17}$$

where $\alpha_1 \equiv \dfrac{I+D}{G+\beta V_{AIP}}$ (A-18)

$$\alpha_2 \equiv \frac{I}{G+V_{AIP}-D} \tag{A-19}$$

Thus, we can write:

$$\begin{aligned} W_d^b &= \rho\{\pi[G+\beta V_{AIP}-I-D] + [1-\pi][G+V_{AIP}-I-D]\} \\ &\quad + [1-\rho]\{[1-\pi][V_{AIP}-D] - \pi B\} \end{aligned} \tag{A-20}$$

Clearly $\partial W_d^b / \partial\rho > 0,\ \partial^2 W_d^b / \partial\rho^2 = 0$.

Similarly, in the no-disclosure case, the wealth of the initial shareholders, W_n^b, is:

$$W_n^b = \pi[1-\alpha_3][G+\beta V_{AIP}] + [1-\pi][1-\alpha_4][G+V_{AIP}-D] \tag{A-21}$$

where

$$\alpha_3 \equiv \frac{I+D}{\rho G + \beta V_{AIP}} \tag{A-22}$$

$$\alpha_4 \equiv \frac{I}{\rho G + V_{AIP} - D} \tag{A-23}$$

It is clear that $\partial W_n^b / \partial \rho > 0$ and $\partial^2 W_n^b / \partial \rho^2 < 0$. Moreover, $W_n^b < W_d^b$ at $\rho = 0$ and $W_n^b = W_d^b$ at $\rho = 1$. So the determination of ρ_b^* is similar to the determination of ρ^* shown in *Figure 2*. At ρ_b^*, $W_n^b(\rho_b^*) = W_d^b(\rho_b^*)$. That is,

$$W_d^b(\rho_b^*) - W_n^b(\rho_b^*) = 0 \tag{A-24}$$

Totally differentiating (A-24) and rearranging yields:

$$\frac{d\rho^*}{d\pi} = \frac{V_{AIP}[1-\rho\beta] + [1-\rho][B-D] + [1-\alpha_3][G+\beta V_{AIP}] - [1-\alpha_4][G - V_{AIP} - D]}{\left[(\partial W_d^b / \partial \rho) - (\partial W_n^b / \partial \rho)\right]} \tag{A-25}$$

It is apparent from *Figure 2* that at the point at which W_n^b crosses W_d^b, the slope of W_n^b is steeper, i.e. $\partial W_n^b / \partial \rho > \partial W_d^b / \partial \rho$. Thus, the denominator in (A-25) is negative.

All the terms in the numerator except the last one are positive. Hence, for *B* large enough, the numerator will be positive, implying that $d\rho^* / d\pi < 0$. Q.E.D.

Figure *1*: Sequence of Events

$t = 0$	$t = 1$	$t = 2$
• Each firm's ρ is known. • Manager randomly draws his belief about the correct strategy. • Manager decides whether to disclose the firm's strategy to investors. • Investors draw their own belief about the correct strategy.	• Firm attempts to raise equity from investors to finance the project. • Investors either provide equity financing or not. • The firm invests in its project if financing is available.	• Project pays off and all shareholders are paid off based on the realized project payoff.

Figure 2: The determination of ρ^*

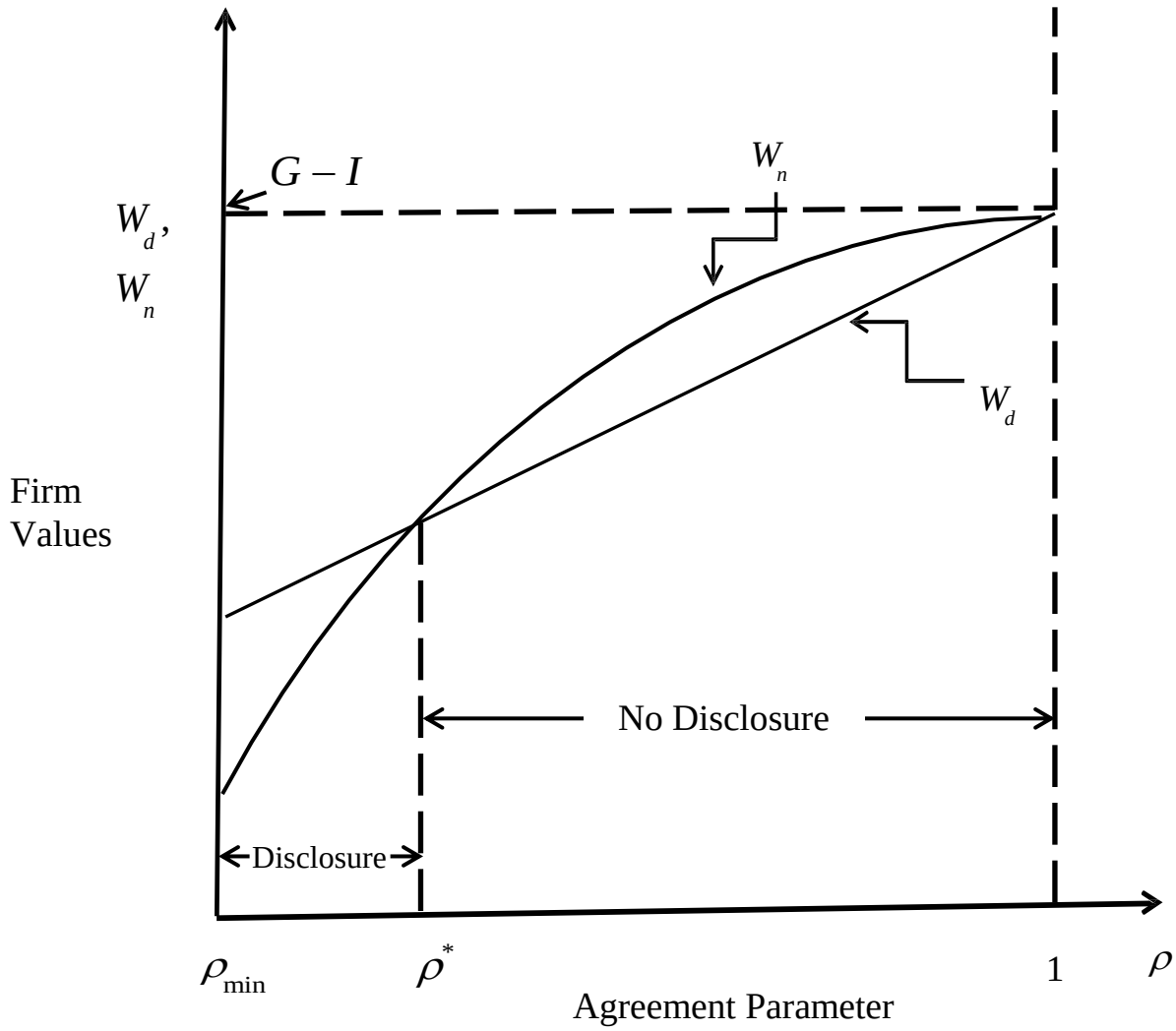

***Figure 3*:** Executive Compensation With and Without Additional Disclosure

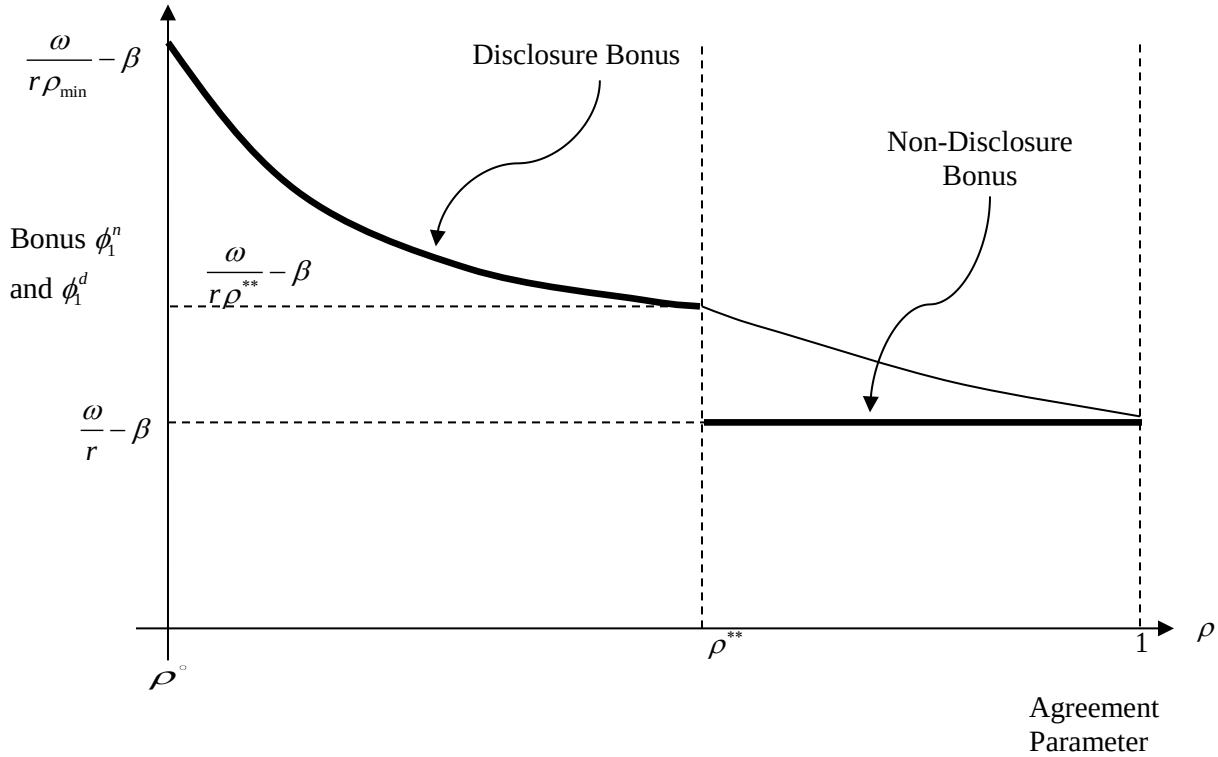

***Figure 4*:** Time Line for Optimal Disclosure Policy of Banks

t=0	t=1	t=2
• Bank starts out with legacy loan portfolio that matures at t=2. • Legacy deposits = D. • Value of legacy loan portfolio = V_{AIP} if not impaired. • Bank chooses strategy $S \in \{S_1, S_2\}$. • Bank chooses to disclose S or not.	• Depositors suffer liquidity shock *w.p.* π. • In this liquidity-shock state, legacy loan portfolio is impaired and worth $\gamma V_{AIP}, \gamma \in (0,1)$. • Bank attempts to issue equity to finance new loan portfolio (based on chosen S) as well as lost legacy deposits if necessary. • Investors provide financing if they agree with strategy $(w.p.\ \rho)$. • Bankruptcy cost B if bank liquidated.	• Assets in place (legacy loan portfolio) and new loan portfolio pay off. • Shareholders and depositors paid off.

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