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Perotti, E.C.; von Thadden, E.-L.

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Tinbergen Institute Discussion Paper

# **Outside Finance, Dominant Investors and Strategic Transparency**

*Enrico C. Perotti*

*Ernst-Ludwig von Thadden*

### **Tinbergen Institute**

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### **Tinbergen Institute Amsterdam**

Keizersgracht 482  
1017 EG Amsterdam  
The Netherlands  
Tel.: +31.(0)20.5513500  
Fax: +31.(0)20.5513555

### **Tinbergen Institute Rotterdam**

Burg. Oudlaan 50  
3062 PA Rotterdam  
The Netherlands  
Tel.: +31.(0)10.4088900  
Fax: +31.(0)10.4089031

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# Outside Finance, Dominant Investors and Strategic Transparency\*

Enrico C. Perotti<sup>†</sup>      Ernst-Ludwig von Thadden<sup>‡</sup>

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## Abstract

This paper studies optimal financial contracts and product market competition under a strategic transparency decision. When firms seeking outside finance resort to actively monitored debt in order to commit against opportunistic behaviour, the dominant lender can influence corporate transparency. More transparency about a firm's competitive position has both strategic advantages and disadvantages: in general, transparency results in higher variability of profits and output. Thus lenders prefer less information dissemination, as this protects firms when in a weak competitive position, while equityholders prefer more disclosure to maximize profitability when in a strong position. We show that bank-controlled firms will be opaque, while shareholder-run firms prefer more transparency. In fact, we can predict a clustering of characteristics associated with bank dominance: opaqueness, low variability of profits, slightly reduced average profits, uncertainty about assets in place, and relatively high financing needs all should be observed jointly for bank controlled firms.

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<sup>†</sup>University of Amsterdam and CEPR

<sup>‡</sup>Université de Lausanne and CEPR

# 1 Introduction

Comparative corporate governance has long focused on the controversy between the proponents of market-centered versus institution-centered governance. The debate over their relative information efficiency is more recent. On the one hand, in the spirit of Diamond (1984), it has been argued that information gathering may be best delegated to large intermediaries to avoid duplicating efforts. On the other hand, the market microstructure literature has emphasized the importance of decentralized market trading to support information collection (see, e.g., Holmström and Tirole (1993)).<sup>1</sup>

The present paper does not take a view on the quality of information-gathering by banks versus markets; rather it focuses on their effect on the *diffusion of information*. Our starting point is the widely held perception that bank-dominated firms are more opaque.<sup>2</sup> As in Bhattacharya and Chiesa (1995), we argue that bank-dominated financing relationships are less transparent to external observers. In contrast, market-based financing results in more corporate information becoming known to both investors and competitors.

There are some simple possible reasons for this. A main bank may be able to fund or arrange directly the entire investment requirement by its creditor firm, thus limiting information leakage to the market. Bank loan monitoring may reduce the need for public transparency; it may lead to a low level of trading liquidity and this in turn may discourage information-gathering by investors (see Boot and Thakor (2000) for an analysis of the interaction of firm information disclosure and investor information collection). In fact, there is evidence that firms with more opaque assets have less liquid securities (see Hedge and McDermott (2000)).

This paper suggests a new explanation, recognizing that when information is disclosed to more than one audience, this will have strategic effects in a context of imperfect competition (Bhattacharya and Ritter, 1982; Gert-

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<sup>1</sup>A considerable literature has explored corporate performance in countries with active capital markets and those economies such as Japan and Germany where markets have less influence and strong direct ties exist between companies and financial intermediaries. See Mayer (1988) for an interesting descriptive approach, and, e.g., Rajan (1992) and von Thadden (1995) for theoretical analyses.

<sup>2</sup>Although we know of no precise empirical study of this phenomenon (presumably because of the difficulty of classifying firms as bank-dominated or not), Flannery, Kwan, and Nimalendran (1998) present convincing evidence on the opaqueness of assets of banks' themselves.

ner, Gibbons and Scharfstein, 1988). Most of this literature has focused on the incentive to disclose once a firm has acquired some private information. Firms with good news prefer more or less disclosure depending on the nature of their private information. When it concerns their own strength, better firms may want to enhance visibility (e.g. by an IPO as a mean to commit to more disclosure, as in Stoughton, Wong and Zechner, 1996). When good information concerns the profitability of the market, and competitors may choose to enter, firms with better information prefer less disclosure, and thus private, bilateral financing (Yosha, 1995; Gertner, Gibbons and Scharfstein, 1988).<sup>3</sup>

We are interested in a strategic rather than tactical decision: we thus investigate the long term transparency decision rather than ex post disclosure choice. Specifically, we study the incentives for transparency under different forms of corporate governance.

In our model, capital structure and investor dominance emerge endogenously as the outcome of an optimal financing choice. Investors face both potential managerial moral hazard and information asymmetry. Firms may choose to raise debt, since more valuable firms wish to avoid undervaluation through an equity issue (as in Myers and Majluf, 1984), while the less valuable firms pool in order to benefit from underpriced debt.<sup>4</sup> Furthermore, investor holdings may need to be concentrated in firms which face severe moral hazard problems, in order to ensure monitoring. We thus obtain an endogenous corporate governance structure; in the case of concentrated debt, we speak of bank dominance, while in the other cases we speak of equity dominance (either internal or external). The case of managerial control can be subsumed under either case, depending on the shape of their incentive scheme; following Dewatripont and Tirole (1994), we assume that their incentives have been designed to be congruent with shareholders' interest. Thus our model generates in equilibrium a broad variation of firm financing and governance structures.

Dominant investors in our model focus on long-term decisions, such as the transparency choice; this determines how easily and credibly ex post information will be disseminated. In our framework, ex post information

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<sup>3</sup>Hedge and McDermott (2000) find that firms with more equity investment by banks, and with higher leverage, have less liquid securities and higher measures of opaqueness.

<sup>4</sup>This is consistent with the pecking-order hypothesis (Myers, 1994): firms choose to issue the least information-sensitive liabilities to avoid adverse selection costs. For evidence on the pecking order theory, see Shyam-Sunder and Myers (1994).

is reliable only if the firm has committed to a long-term disclosure policy which will allow investors to ascertain objectively its true quality. Ex post a transparent firm is not able to suppress bad information; similarly, an opaque firm will not be able to reveal credibly any good news it may have.<sup>5</sup>

The reason why information dissemination matters is that firms face product market competition, so public information is observed by both investors and competitors (as in Bhattacharya and Ritter (1982) and Gertner, Gibbons and Scharfstein (1988)). The starting point of our analysis, which we borrow from the literature on industrial organization, is that a firm less transparent than its competitor does not necessarily enjoy a strategic advantage. In fact, more opaque firms will exhibit less variability in profits and output relative to more transparent competitors. In addition, on average profits are higher for transparent firms. These are general results from the theory of competition under imperfect information (for an excellent survey, see Kühn and Vives, 1994).

The economic intuition for the impact of transparency on profits is as follows. Less transparent firms reveal less to competitors on their competitive strength. When firms act on the basis of less information, their expectation over competitors' output is either too high or too low. This hurts firms which are strong, as it leads competitors to be more aggressive, forcing the firm to restrain its output; but it protects weak firms, which face less aggressive competition and can better protect their market share and profitability. As a result, under less transparency expected profits are lower, but the volatility of profits and output are lower as well. These results are quite robust and hold for the case of Cournot as well as Bertrand competition regardless of whether products are strategic complements or substitutes.

A reduced volatility (and in particular the higher profitability in low profit states) has the effect of increasing the return to all claimholders with a fixed claim on the firm. Consequently, there is a natural preference by lenders for less information dissemination, as they do not gain from higher profits but suffer from higher risk. Our main result - in the spirit of Jensen and Meckling's (1976) analysis of agency costs of debt and equity - is that dominant

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<sup>5</sup>One example for this “bonding approach” to corporate disclosure to the decision to go public. In Roëll's (1996) review of this decision, enhanced visibility is cited as the first or second most important motivation to go public. Mirroring this, somewhat ironically, the most important costs are “increased pressure on senior management due to closer public scrutiny” and disclosure requirements. This confirms that the commitment to ex-post disclosure can be costly.

lenders will discourage transparency, as this would endogenously undermine the value of their claims. Moreover, and beyond Jensen and Meckling (1976), although this form of governance produces on average lower profits, it can arise as an equilibrium response to moral hazard and adverse selection.<sup>6</sup> In contrast, firms dominated by shareholder interests prefer greater transparency, as information dissemination on average increases profitability as well as risk.<sup>7</sup>

There are several empirical implications arising from our modelling. Lender-dominated firms (and firms in bank-dominated financial systems) are less transparent than equity-run firms (and firms in shareholder-oriented systems). Moreover, corporate profitability should be less volatile in bank-dominated firms, and slightly lower on average in equity-run firms. In fact, our theory predicts a clustering of attributes in financial contracting: we expect to observe jointly bank dominance, opaqueness, low variability of profits, slightly reduced average profits, uncertainty about assets in place, and relatively high financing needs. Because of the non-uniqueness of equilibria for low levels of debt, these predictions should be stronger, the higher the level of debt in the system. Bank dominance should be prevalent when moral hazard on the side of the firm is an important issue, either because of the ability of managers to appropriate resources or of its incentives to divert them to unprofitable operations (e.g. in conglomerate firms).

There seems to be no empirical study covering all attributes predicted by our theory. This is probably partially due to the difficulty of defining empirically our concept of investor dominance,<sup>8</sup> but partially also because the interplay of corporate governance, capital structure, and firm behavior has not yet received sufficient attention by applied researchers. We hope that our theoretical analysis helps to provide first stepping stones in this direction.

In the scattered empirical work available, there is evidence that Japanese companies with influential main banks have been less profitable than more in-

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<sup>6</sup>It is worth stressing that moral hazard and adverse selection both are crucial ingredients of the model, because we endogenize two dimensions of the financing decision: capital structure and corporate governance

<sup>7</sup>The well-known listing of Daimler-Benz on the NYSE, on pressure by Deutsche Bank, which shed light on a traditionally opaque company, is an interesting example. While Deutsche Bank was the dominant investor in Daimler-Benz, it held at the time more than a quarter of the firm's equity, and acted thus probably more as a shareholder than as a lender.

<sup>8</sup>But see Böhmer (1997) for an example of how to do and work with it.



dependent companies (Caves and Uesaka, 1976; Weinstein and Yafeh, 1998) and that transparency is greater for independent companies (Weinstein and Yafeh, 1998). They also tend to be less liquidity constrained (Hoshi, Kashyap and Scharfstein, 1991), which is consistent with our result that bank-monitored finance is available to firms who would otherwise not obtain financing.<sup>9</sup> Overall, these firms appear to have less variability in profitability and grow comparatively less than independent companies (Nakatani, 1984). All these facts are consistent with our result that bank-dominated firms ought to be less transparent and have lower average profits and less volatility of economic results than more transparent, market-financed rivals.

Another interesting case in point is Germany. Until 1998, disclosure requirements for listed firms in Germany were significantly weaker than those demanded by U.S. GAAP. In particular, neither cash flow statements nor detailed segment reports were mandatory under the German commercial code. Yet, there was significant variation in voluntary reporting practices. While we do not know of empirical studies explicitly addressing our question of the link between investor dominance, transparency, and earnings volatility, there seems to have been a consensus that those firms that voluntarily provided more accounting information were ‘capital market-oriented’ as opposed to dominated by interests of banks or private owners (see, e.g., Goebel and Fuchs, 1995, Leuz, 1998).

The remainder of this paper is organized as follows. Section 2 sets out the model. In sections 3 we analyze product market competition. Section 4 studies the transparency decision. Section 5 analyses firm financing and governance, offers some interpretations and comparative statics. Section 6 concludes. In the Appendix we collect the formulae needed to derive our results formally.

## 2 The Model

### 2.1 Product market interaction

The model is a dynamic game between two firms and their investors, in which financing and control decisions are taken first, and then the firms compete

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<sup>9</sup>For evidence on the costs and benefits of dominant bank financing in the U.S., see Petersen and Rajan (1994).

on the product market. We describe first the product market stage, and then the earlier part of the game.

Once the two firms are financed, they compete on the product market. The firms produce differentiated products and act as Cournot competitors. Firms have either a high quality or a lower quality product, which has an effect on the relative attractiveness of their own product vis-a-vis their competitor's. Quality is described by a parameter  $\theta_i$  which can take two values. When the product is of high quality,  $\theta_i = \theta_H$ , while  $\theta_i = \theta_L$  otherwise, with  $\theta_H > \theta_L$ . Product quality is uncertain; ex ante either firm has a prior probability  $q$  of having a high quality product. The probability of high quality is common to both firms and commonly known.<sup>10</sup> The realization of a firm's  $\theta$  may become publicly known before or after the production decision; we shall discuss this in the next subsection. In either case, once output is realized, customers base their purchase on actual quality.

The inverse demand function faced by firm  $i$  is given by

$$P_i = \begin{cases} \theta_i - Q_i - \gamma Q_j & \text{if } Q_i + \gamma Q_j \leq \theta_i \\ 0 & \text{if } Q_i + \gamma Q_j \geq \theta_i \end{cases}, \quad (1)$$

where  $i = 1, 2$ ,  $j \neq i$ , and  $-1 \leq \gamma \leq 1$ .  $\gamma$  can be interpreted as the degree of substitutability between the firms' products, and describes the intensity of competition in the market. If  $\gamma > 0$  the two goods are strategic substitutes under Cournot competition; if  $\gamma < 0$ , the goods are strategic complements. By inverting the demand system (1) one sees that Bertrand competition has the same structure, with strategic complements becoming strategic substitutes and vice versa. Hence, although our discussion is in terms of quantity choices, the above specification covers the Bertrand case as well.<sup>11</sup>

In order to focus on the impact of transparency on competition, we assume that productivity is equal across firms and that marginal costs for each firm are constant and normalized to zero.

Finally, we assume throughout that the production decision of the firm is taken by managers (who can be owners, see below) who maximize profits,  $\pi_i = P_i Q_i$ . This is in contrast to an important strand of the literature inspired by Brander and Lewis (1986), that analyses product market competition under the impact of capital structure. In particular, in Brander and

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<sup>10</sup>Given our linear demand specification, the difference in product quality can as well be interpreted as a difference in marginal costs. The two formulations are equivalent.

<sup>11</sup>This specification of demand is standard and can be derived from quadratic preferences of a representative consumer (see, e.g., Singh and Vives (1984)).

Lewis (1986), if a firm has risky debt, its equity holders have an incentive to distort  $Q_i$  away from the profit-maximizing level in order to take advantage of limited liability. Since this effect is empirically not well documented and theoretically ambiguous, we choose to work with the simple assumption of profit maximization.<sup>12</sup> In particular, at the product market stage we assume away the issue of opportunism by managers or inside equity holders (see, e.g., Hart, 1995). We introduce opportunism in the longer-term decisions about investment discussed in the next subsection.

To simplify the presentation we impose three types of parameter restrictions. First, we shall assume that firms produce a positive level of output whatever the constellation of  $(\theta_1, \theta_2)$ , i.e. that there is no exit. This requires assuming that demand even for a low quality product is sufficiently strong. The following assumption, which will be maintained throughout the paper, is sufficient to guarantee this in the different settings we consider later on:

$$\theta_L \geq \theta_H - \theta_L. \quad (2)$$

Second, we will concentrate on the case  $\gamma \geq 0$ . And third, we assume that equilibrium prices, and hence profits, are positive in all contingencies. This restriction is binding for competition under incomplete information when  $\gamma$  is close to 1 and  $q$  close to 0, i.e. when competition is head-on and quality is likely to be low. In this case, competition is particularly severe, strategy differences between strong and weak firms are particularly pronounced, and the equilibrium price can be zero if a firm turns out to be of high quality, after all. The precise condition we impose is that

$$\gamma + \gamma(1 + \gamma)(1 - q) \leq 2. \quad (3)$$

Condition (3) holds independently of  $q$  if  $\gamma \leq .73$  and independently of  $\gamma$  if  $q \geq 1/2$ . It is worth emphasizing that all our qualitative results continue to hold if  $\gamma$  is negative or condition (2) or (3) are violated, only some formulae will change. In fact, without (2) or (3) differences in firm characteristics and behavior will be stronger and the variance result (Proposition 1) that drives our analysis will be strengthened.

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<sup>12</sup>We have investigated Brander-Lewis type incentives in an earlier version. The treatment is much more complex and does not add much to our results. For theoretical work on the general problem see, e.g., Maksimovic (1988), Bolton and Scharfstein (1990) and Showalter (1995); for contrary empirical evidence see Chevalier (1995).

## 2.2 Finance and control

In order to enter the market described above, firms need external financing of  $I > 0$ . Firms are differentiated by the nature of their productive assets and by the value of their existing operations. As we shall explain now, the characteristics of the firm influence their interaction with the capital market, both with respect to the terms of finance and to the control rights of external investors.

Firms are potentially subject to moral hazard in production. But some firms operate in sectors, countries, or environments in which the nature of assets allows external financiers to eliminate moral hazard more easily, whereas the activity or location of other firms makes it more difficult to control managerial discretion. The moral hazard and control problem is an elementary version of the model used by Holmström and Tirole (1997,1998); we assume that, unless controlled, the owner or manager of the firm can divert the new funds  $I$ , more or less efficiently, and that there is no diversion at all when she is controlled. As, for example, in Burkart, Gromb and Panunzi (1998), firms differ in their ability to divert funds: a “type- $\phi$ ” firm obtains  $\phi I$ ,  $0 \leq \phi \leq 1$ , for private consumption when it diverts  $I$ . Hence,  $\phi = 0$  firms are effectively immune to moral hazard, whereas  $\phi = 1$  firms can divert funds on a 1:1 basis.

In general, the degree of exposure to moral hazard will be a continuous variable; to facilitate the exposition, we consider only the extremes where managerial moral hazard does not play a role at all ( $\phi = 0$ ) and where managerial discretion is so large that it poses serious control problems ( $\phi = 1$ ). A firm’s  $\phi$  is public information. For simplicity, we further assume that control causes no direct costs to the controller, but that a large stake is required to be able to exert influence.<sup>13</sup>

In the spirit of Myers and Majluf (1984), the value of existing operations is private information. Overall firm value, therefore, has two components: the value from existing operations,  $V \in \{V_L, V_H\}$ ,  $V_L < V_H$ , and the return  $\pi$  from the new venture, if undertaken. Investors know the ex-ante distribution of  $V$ , with  $\text{prob}(V = V_H) = h$  and  $\text{prob}(V = V_L) = 1 - h$ . Firms cannot signal their type by any action besides the type of financing they seek.<sup>14</sup>

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<sup>13</sup>It is not difficult to embellish the model by considering a more refined moral hazard problem, less than perfect control, or positive monitoring costs. However, there are no insights to be gained from such additional effort.

<sup>14</sup>Note we have assumed that the moral hazard of  $\phi = 1$  - firms only concerns the new liquid funds  $I$ . This is a reasonable first approximation. Our results would be strengthened

The variables  $\phi$  and  $V$  are independent across the population of firms. There are, therefore, four possible firm types:  $(\phi, V) = (0, V_L), (0, V_H), (1, V_L), (1, V_H)$ .

To simplify notation, we assume that the firm has no debt to begin with. It is straightforward to verify that our analysis would continue to hold if the firm had some debt outstanding. The financing options for the new venture consist of diffused equity (DE), concentrated equity (CE), diffused debt (DD), or concentrated debt (CD). Concentration requires a large investor who takes a significant stake in the company and is granted some control rights to oversee management decisions. We interpret concentrated debt as main bank financing and dispersed debt as bond financing (or multiple bank financing). When the firm issues concentrated debt it becomes bank-dominated; else it is equity dominated, either by inside equity (under DE or DD) or by outside equity (under CE).

We do not consider the possibility of a mix of debt and equity financing for the new investment. As will become clear later, this creates no loss of generality as far as DE, CE, and DD are concerned (which can be arbitrarily combined without changing the analysis). If, however, controlling debt stakes could be sufficiently small (and be combined with any of the other options to raise the total of  $I$ ), the analysis would change. Yet, we view this possibility as implausible, because typically some concentration of lending is needed to provide sufficient incentives for the lender to monitor.<sup>15</sup>

As mentioned earlier, we assume that “day-to-day” productive decisions such as the level of output  $Q$  are taken by managers so as to maximize profits. On the other hand, we assume that dominant investors can exert influence over some longer-term strategic choices and focus here on one particular such choice, namely that of a firm’s transparency.

Thus, we define investor dominance as the ability to control managerial moral hazard and the capacity to determine the transparency policy of a firm. This latter policy is a long-term choice which takes place before firms receive private information about their product market prospects (given by  $\theta_i$ ). A firm may choose a policy of transparency either by maintaining a broad ex-ante disclosure policy, facilitating access to management and company resources for analysts and researchers, creating a transparent asset structure in the sense empirically studied by Hedge and McDermott (2000), encouraging

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if we assumed that the firm can also divert a fraction of returns from existing projects.

<sup>15</sup>Holmström and Tirole (1997) make this point elegantly in a more detailed model.

secondary trading in the firm's stock, list on stock exchanges with stringent disclosure requirements, etc.<sup>16</sup>

For simplicity, we assume that a firm can be either transparent ( $T$ ) or opaque ( $O$ ) with no differential cost. For a transparent firm, its quality parameter  $\theta_i$  becomes publicly known once it is realized. If a firm is opaque, its  $\theta_i$  is private knowledge to the firm at the production stage. We do not model here how information is disseminated, see Bhattachya and Chiesa (1995), in a banking context, and Perotti and von Thadden (1998), in a market-microstructure context, for explicit models of this issue. The revelation mechanism cannot be changed after private information is obtained.<sup>17</sup>

### 2.3 Summary: the game

To wrap up the description of the model, we summarize here the stages of the game, together with the relevant decision variables. The game is among two firms, drawn from a large population of ex-ante identical and independent firms, and a large number of risk-neutral investors.

1. Firms' types  $(\phi, V)$  are realized.  $\phi$  becomes public information,  $V$  is private information to the firm.
2. Firms choose their form of financing among DE, CE, DD, and CD, in order to raise  $I$ . If a firm chooses debt, it offers a standard debt contract  $D > 0$ ; if it chooses equity, it offers a fraction of its equity  $s \in (0, 1)$ .
3. Investors accept the offer or not; in cases of several acceptances or oversubscription, the firm chooses its investors randomly.
4. If the firm issues concentrated finance (CE or CD), the controlling investor chooses whether to monitor management and chooses the firm's

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<sup>16</sup>For the latter, the decision by European firms to list on the NYSE is an example. Another example is the decision to switch from the British Unlisted Securities Market to the Official List of the LSE. For an empirical analysis of listing decisions driven by such motives, see Kukies (1999).

<sup>17</sup>There will be, of course, an ex-post incentive to reveal more if the information is good, or less if the information is bad. We assume that there is no credible way to selectively communicate this information ex post, unless a reliable mechanism has been established in advance to allow information to be verified by outsiders.

transparency policy,  $C \in \{T, O\}$ . If there is no controlling investor, the firm chooses  $C$ .

5. In the absence of monitoring, firms of type  $\phi = 1$  choose whether to divert the funds raised,  $I$ . Firms who have received external funding and not diverted it, invest  $I$ .
6. For those firms that have invested, product quality  $\theta$  is realized. For transparent firms, this information becomes public immediately, for opaque firms  $\theta$  is private information..
7. Firms compete by choosing quantities  $Q$  (if there is only one firm to have invested, it acts as a monopolist).
8. Firm quality is publicly revealed, demand and returns  $\pi$  are realized, and investors are repaid. Under an equity contract, investors receive  $s(V + \pi)$  or  $sV$ , depending on whether the firm has invested or not; under a debt contract, investors receive either  $\min(V + \pi, D)$  or  $\min(V, D)$ .

### 3 Product Market Competition

We analyze the game using the concept of perfect Bayesian Nash equilibrium, by first solving for equilibria of the subgame starting at stage 4 of the overall game tree. This is possible, because the asymmetric information about existing operations,  $V$ , has no impact on the product market interaction in stages 4 - 8. Of course, the form of the finance contract chosen in stages 1 - 3 matters for the second phase of the game. But taking these contracts as given, decisions in the second phase are independent of the value of  $V$  of either firm.

We first examine, in this section, the impact of more or less public information on product market interaction. This amounts to finding the Nash equilibria of the interaction at stage 7. Because of the assumption that managers maximize expected gross profits at the product market stage, this game can be analyzed without regard to capital structure.

If a firm acts as a monopolist (either because the other firm has received no funding or because it has diverted its funds), its choice is trivial, and in particular, does not depend on its transparency. We consider therefore

the subgame with two competing firms. As firm quality  $\theta$  is either public information or it remains private, we have two possible informational states for each firm, resulting from the choices in stage 4:  $T$  ( $\theta$  revealed) or  $O$  ( $\theta$  private information). In total, this yields four subgames, which we shall discuss now in turn.

### 3.1 Competition under symmetric information

We first consider competition under symmetric information, defined as a situation in which the information on each firm's  $\theta$  is public.

Both firms simultaneously choose their quantities  $Q_i$  to maximize profits, taking the other's choice as given. Hence, firm  $i$  chooses  $Q$  as to  $\max_Q(\theta_i - Q - \gamma Q_j)Q$ .

Firm  $i$ 's behavior will depend on its own  $\theta$  and that of its competitor. We therefore have four different possible states,  $ij = HH, HL, LH, LL$ , for the interaction. It is straightforward to verify that the firm's actions in Nash equilibrium are given by

$$\begin{aligned} Q_{HL}^{TT} &= \frac{1}{2+\gamma} \left( \theta_H + \frac{\gamma}{2-\gamma}(\theta_H - \theta_L) \right), \\ Q_{HH}^{TT} &= \frac{\theta_H}{2+\gamma}, \\ Q_{LL}^{TT} &= \frac{\theta_L}{2+\gamma}, \\ Q_{LH}^{TT} &= \frac{1}{2+\gamma} \left( \theta_L - \frac{\gamma}{2-\gamma}(\theta_H - \theta_L) \right), \end{aligned}$$

where the superscript  $TT$  denotes the fact that both firms'  $\theta$  have been revealed.  $Q_{ij}^{TT}$  denotes a firm's equilibrium action if itself has quality  $\theta_i$  and its competitor quality  $\theta_j$ . By assumption (2) all these quantities are positive. The corresponding profits (remember that costs are normalized to zero) are

$$\pi_{ij}^{TT} = (Q_{ij}^{TT})^2. \quad (5)$$

The ordering of the four different profit levels is intuitive. In fact, we have

$$\pi_{HL}^{TT} > \pi_{HH}^{TT} > \pi_{LL}^{TT} > \pi_{LH}^{TT},$$



where  $LH$  is the worst possible state for firm  $i$  and the firm makes lower profits than in state  $LL$ , the second worst state, etc.<sup>18</sup>

The analysis of this standard form of market interaction is quite simple. The effect of complete information is to produce some implicit coordination on output decisions, as each firm conditions its production on the actual strength of its competitor's demand and thus on the competitor's ability to expand beyond its own market.

### 3.2 Competition under symmetrically incomplete information

We now consider the case of competition when there is no public information about any firm's quality available. We shall index all variables by  $OO$ , as all the  $\theta$ 's are private information.

Now each firm makes its output decision at a time when there is imperfect information about the level of its competitor's product-specific demand  $\theta_j$ . In this case each firm will choose output as a function only of its own  $\theta_i$ , and therefore chooses  $Q_i$  to maximize

$$E_{Q_j} P_i Q_i = \begin{cases} (\theta_i - Q_i - \gamma q Q_H^{OO} - \gamma(1-q)Q_L^{OO})Q_i & \text{if } Q_i \leq \theta_i - \gamma Q_H^{OO} \\ (1-q)(\theta_i - Q_i - \gamma Q_L^{OO})Q_i & \text{if } \theta_i - \gamma Q_H^{OO} \leq Q_i \leq \theta_i - \gamma Q_L^{OO} \\ 0 & \text{if } Q_i \geq \theta_i - \gamma Q_L^{OO}, \end{cases} \quad (6)$$

where  $Q_i^{OO}$  denotes a firm's equilibrium action when it has quality  $\theta_i$  (note that equilibria are player-symmetric). The logic behind formula (6) is simple: if firm  $i$  chooses a very high quantity ( $Q_i \geq \theta_i - \gamma Q_L^{OO}$ ), then it is sure to drive prices to zero; if it chooses a smaller, but sufficiently high quantity ( $\theta_i - \gamma Q_H^{OO} \leq Q_i \leq \theta_i - \gamma Q_L^{OO}$ ), prices will be zero if the opponent is strong and positive if the opponent is weak; and for all other quantities ( $Q_i \leq \theta_i - \gamma Q_H^{OO}$ ) prices will always be positive.

It is readily verified that the game again has a unique (Bayesian) Nash equilibrium. As assumed in Section 2, we restrict attention to parameters for which the first case in (6) is relevant, in order to keep the calculations simple. It is then straightforward to show that assumption (3) implies

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<sup>18</sup>If  $\gamma < 0$ , i.e. if the goods are strategic complements, we have  $\pi_{HH}^{TT} > \pi_{HL}^{TT} > \pi_{LH}^{TT} > \pi_{LL}^{TT}$ : in  $LL$ , the worst possible state for firm  $i$ , it produces less than in state  $LH$ , the second worst state, etc.

$$\begin{aligned}
Q_H^{OO} &= \frac{1}{2 + \gamma} \left( \theta_H + \frac{\gamma}{2}(1 - q)(\theta_H - \theta_L) \right), \\
Q_L^{OO} &= \frac{1}{2 + \gamma} \left( \theta_L - \frac{\gamma}{2}q(\theta_H - \theta_L) \right),
\end{aligned}$$

which are positive by (2). The corresponding profit levels in the four possible states,  $\pi_{HL}^{OO}, \pi_{HH}^{OO}, \pi_{LL}^{OO}, \pi_{LH}^{OO}$ , are obtained by straightforward computations reported in the appendix.

As in the case of symmetric information, it is easy to show that these state-contingent profits are ordered as intuition suggests:

$$\pi_{HL}^{OO} > \pi_{HH}^{OO} > \pi_{LL}^{OO} > \pi_{LH}^{OO}.$$

By direct computation, one can check that both, expected value and variance of profits under symmetrically informed competition are higher than under symmetrically uninformed competition. This fact reflects a general result from the industrial organization literature (see, e.g., Kühn and Vives, 1994) and is at the heart of our argument in this paper. It is, therefore, useful to discuss its underlying rationale. The main difference in strategic interaction between the symmetrically informed and the symmetrically uninformed case is less aggressive output choice by the stronger firm in the most favorable state  $HL$  when both are uninformed: the weaker firm is “protected” by the lack of accurate information. In contrast, there is more output in the  $HH$  state, as both firms, attaching some probability the event of the competitor being weak, produce more aggressively than in a transparent system. This can be interpreted as a result of “poor coordination” due to less information, and leads to lower profitability. Similarly, under uninformed competition, output in state  $LL$  is lower, as both firms are too cautious due to the perceived risk of a strong competitor, and firms are more protected when in their weakest competitive position  $LH$ .

Thus the coordination failure due to lack of information makes profits higher on average for weaker firms. From an ex ante perspective, however, the reduced profitability due to poor coordination in high quality states, when marginal profitability is highest, is greater than the profit gain in low quality states. Hence, lack of information reduces expected profits (over all states) together with the variance.

### 3.3 Competition under asymmetric information

The last case to consider is the asymmetric case, in which the type of one firm, say firm 1, is unknown to the market, whereas the other's type is known. Now firm 1, when making its output decision, knows the state of firm 2, but firm 2 does not know  $\theta_1$ . In this case, firm 1 will choose output as a function of  $\theta_1$  and  $\theta_2$  and therefore produce as to  $\max_Q(\theta_1 - Q - \gamma Q_2(\theta_2))Q$ , where  $Q$  depends on  $\theta_1$  and  $\theta_2$ . Firm 2, on the other hand, seeks to maximize

$$E_{\theta_1} P_2 Q_2 = \begin{cases} (\theta_2 - Q_2 - \gamma q Q_1(\theta_H, \theta_2) - \gamma(1-q)Q_1(\theta_L, \theta_2))Q_2 \\ \quad \text{if } Q_2 \leq \theta_2 - \gamma Q_1(\theta_H, \theta_2) \\ (1-q)(\theta_2 - Q_2 - \gamma Q_1(\theta_L, \theta_2))Q_2 \\ \quad \text{if } \theta_2 - \gamma Q_1(\theta_H, \theta_2) \leq Q_2 \leq \theta_2 - \gamma Q_1(\theta_L, \theta_2) \\ 0 \text{ if } Q_2 \geq \theta_2 - \gamma Q_1(\theta_L, \theta_2), \end{cases} \quad (8)$$

where  $Q_2$  depends on  $\theta_2$  only.

It is straightforward (if lengthy) to show that the game has a unique (Bayesian) Nash equilibrium  $(Q_H^{TO}, Q_L^{TO}, Q_{HL}^{OT}, Q_{HH}^{OT}, Q_{LL}^{OT}, Q_{LH}^{OT})$ , which we spell out in the appendix, again for the case defined in assumption (3), in which the first line in (8) is relevant. Here,  $Q_i^{TO}$  is the equilibrium quantity produced by the firm whose  $\theta$  is known (and who cannot condition on the other firm's strength), and  $Q_{ij}^{OT}$  the quantity produced by the firm with private information about its type (who faces a transparent competitor) when its own quality is  $i$  and that of its competitor  $j$ . The corresponding eight profit levels (for each state and each firm) are given in the appendix.

Again, it can easily be verified that equilibrium quantities and profits are ordered as in the two equilibria under symmetric information. For example, the profits of a transparent firm facing an opaque firm are highest when the firm has high quality and the competitor low quality, second highest when both have high quality, third highest when both have low quality, and lowest when the firm has low and its competitor high quality.

In order to understand the costs and benefits of disclosure in this context, it is useful to compare the profit levels of firm  $i$  in the case where both firms are transparent ( $\pi^{TT}$ ) with those where firm  $j$  is transparent but firm  $i$  not ( $\pi^{OT}$ ). Direct inspection shows that profits are more variable under fully transparent competition than under competition with asymmetric information. As in the case discussed in the last subsection, the reason is that by disclosing more, the firm allows its competitor to react more precisely to the

situation on the product market, which makes the intercept of its residual demand more volatile (see Fried (1984), Li (1985), Shapiro (1986)).

What is more, one can show that profits are ordered state by state. Profits under full transparency,  $\pi^{TT}$ , are a “median-preserving spread” of profits under unilateral non-transparency,  $\pi^{OT}$ , in the sense that  $\pi^{TT}$  is statewise lower than  $\pi^{OT}$  in the two unfavorable states ( $LL, LH$ ) and statewise higher in the two favorable states ( $HH, HL$ ). Hence, expected profitability is always higher for the  $T$  - firm than for the  $O$  - firm in the strong quality state, and vice versa in the weak quality state. Building on our discussion in the last subsection, the economic intuition is as follows. When in the state of high demand, a firm whose quality is public information ( $T$ ) can produce more aggressively than if it were opaque, because the firm knows that its competitor knows its strength, and will thus restrain its output. In addition, in this case the  $T$  - firm does not restrain its output when its competitor is strong, since it does not know it. The analogue argument applies for the low quality state. Hence, being transparent confers an important strategic advantage - the advantage of forcing the other to restrain himself when one is strong, i.e. when the gains from aggressiveness are highest -, even if the competitor remains opaque.

Because of the convexity of profits in  $\theta$  (see (A11) - (A15) in the appendix), the increased volatility of profits under transparency has an interesting consequence: outward shifts of high profit realizations are more important than downward shifts of low realizations. This, however, increases the mean. Formally, it can be checked by direct calculation that this holds true regardless of the choice  $C \in \{T, O\}$  of the other firm. The above findings about relative profit levels drive our analysis of transparency choice in the next section; we, therefore, summarize them in the following proposition. We note in passing that what is important for the analysis is the variance result, not that on mean profits.

**Proposition 1** *For any choice  $C \in \{T, O\}$  of the other firm, the mean and the variance of a firm’s profits are higher under transparency than under opacity:  $E\pi^{TC} > E\pi^{OC}$  and  $\text{var } \pi^{TC} > \text{var } \pi^{OC}$ .*

**Proof.** Direct computation shows that

$$E\pi^{TT} - E\pi^{OT} = q(1-q)\frac{\gamma^2}{(2-\gamma)^2}(\theta_H - \theta_L)^2(2 - \frac{\gamma^2}{4}) > 0 \quad (9)$$

$$E\pi^{TO} - E\pi^{OO} = q(1-q)\frac{\gamma^2}{(2+\gamma)^2(2-\gamma)^2}(\theta_H - \theta_L)^2\left(3 - \frac{\gamma^2}{4}\right) > 0 \quad (10)$$

The result for the variances follows similarly. ■

## 4 Moral Hazard and Transparency Choice

In stages 4 and 5 of the game, dominant investors decide whether to monitor, and moral-hazard-prone firms ( $\phi = 1$ ) who are not monitored decide whether to invest their funds or whether to divert them. We now analyze these decisions working backwards, beginning with the firms' decision in stage 5.

### 4.1 Diversion

Consider a firm of asset type  $\phi = 1$  who is not monitored, either because it has no dominant investor or because its dominant investor decided not to monitor. In either case, its payoff from diverting its funds depends on the type of outside finance it has raised in stages 2 and 3 of the game and on the transparency choice in stage 4.

Suppose first that the firm has been financed through debt with face value  $D$ . Then the firm will divert its funds instead of investing, if and only if

$$E_\pi \max(V + \pi - D, 0) < I + \max(V - D, 0), \quad (11)$$

where  $V \in \{V_L, V_H\}$  is the firm's value without investment and  $\pi$  the return from investing (here  $\pi$  is any of the random variables derived in the last section - which one is decided in stage 4 - or the monopoly return). Similarly, the firm diverts under equity finance if and only if

$$(1 - s)E_\pi \pi < I. \quad (12)$$

Both conditions, (11) and (12), simply state that the return from investing  $I$  is smaller than the gain from stealing  $I$ .

### 4.2 Monitoring

In stage 4 of the game, dominant investors, if they exist, decide whether to monitor  $\phi = 1$  - firms. This decision depends on what they know about the firm's existing value  $V$ . Consider, for example, the case where the financing

choice in stages 2 and 3 has been CD, i.e. the dominant investor is a creditor. If stages 2 and 3 have revealed the firm's  $V$ , the creditor will monitor if and only if (11) holds and

$$E_{\pi} \min(V + \pi, D) \geq \min(V, D), \quad (13)$$

i.e. if the debtor would divert and the returns with monitoring exceed those without. Clearly, condition (13) is always satisfied. The reason why we note this obvious inequality, is to show that the argument would continue to hold for small positive monitoring costs (which would be added on the right hand side of (13)).

With the assumption of small monitoring costs, the other subgames are similarly obvious: a dominant investor will monitor a  $\phi = 1$  - firm if and only if the firm would divert otherwise.

### 4.3 Transparency

The other decision taken in stage 4 of the overall game is the choice of transparency, either by the firm itself (if there is no dominant investor) or by the dominant investor. If (off the equilibrium path) the contracts in stage 2 and 3 are such that one firm does not obtain funding or diverts its funds in stage 5, there is only one firm on the market in stage 6 to 8, and transparency does not matter.<sup>19</sup> We can, therefore, focus on the case of two firms who will compete on the product market.

Consider first a firm that is equity financed. The following proposition is a straightforward implication of Proposition 1.

**Proposition 2** *For an equity-financed firm (choices CE or DE in stages 2 and 3), transparency is a dominant strategy in the subgame of transparency choice in stage 4.*

Indeed, because transparency causes an increase in mean profits regardless of the competitor's choice, whoever controls the firm prefers transparency

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<sup>19</sup>Remember that transparency is a strategic tool to influence product market competition. It does not matter for a monopolist, because consumer purchases are made under full information.

over opaqueness, as long as his payoff is increasing in  $E\pi$ .<sup>20</sup> As mentioned earlier, Proposition 2 continues to hold if the firm has debt outstanding, but is equity controlled. This also follows from the next proposition, which considers the subgames following dispersed debt financing (where the firm's equity holders are in control).

**Proposition 3** *If a firm is financed through dispersed debt, transparency is a dominant strategy in the subgame of transparency choice.*

**Proof.** Denote the debt level of the firm in question by  $D$ . Given the choice  $C \in \{T, O\}$  of the other firm, the firm prefers to be transparent if and only if

$$\delta_C(D) := E \max (V + \pi^{TC} - D, 0) - E \max (V + \pi^{OC} - D, 0) \geq 0. \quad (14)$$

As discussed in Section 3, it is straightforward to show by direct calculation that profits under  $TC$  are more variable than under  $OC$  (for  $C \in \{T, O\}$ ), with  $\pi^{TC}$  being a “median-preserving spread” of  $\pi^{OC}$ , in the sense that  $\pi^{TC}$  is statewise lower than  $\pi^{OC}$  in the two unfavorable states for the firm in question ( $LL, LH$ ) and statewise higher in the two favorable states ( $HH, HL$ ). Figure 1 summarizes this finding graphically.

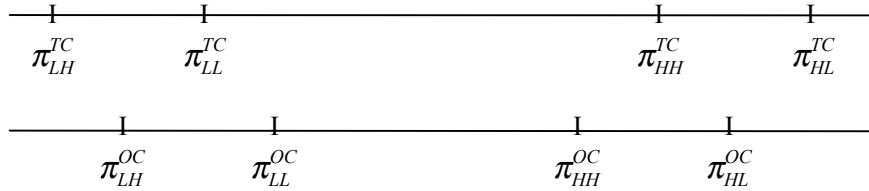


Figure 1: Comparison of  $\pi^{TC}$  and  $\pi^{OC}$  for  $C \in \{O, T\}$

This state-by-state comparison of profit levels implies that  $\delta_C(D) > 0$  for all  $D < V + \pi_{HL}^{TC}$  if only  $\delta_C(0) > 0$ . This is because the graph of  $\delta_C$  is

<sup>20</sup>Dominance is only weak in some off-the equilibrium- path subgames, because the firm may be a monopolist or embezzle regardless of transparency choice (which is the case if (12) holds even if the firm chooses  $T$ ).

(weakly) single-peaked, which becomes clear when walking backwards from  $V + \pi_{HL}^{TC}$  (where  $\delta_C = 0$ ) in Figure 2.

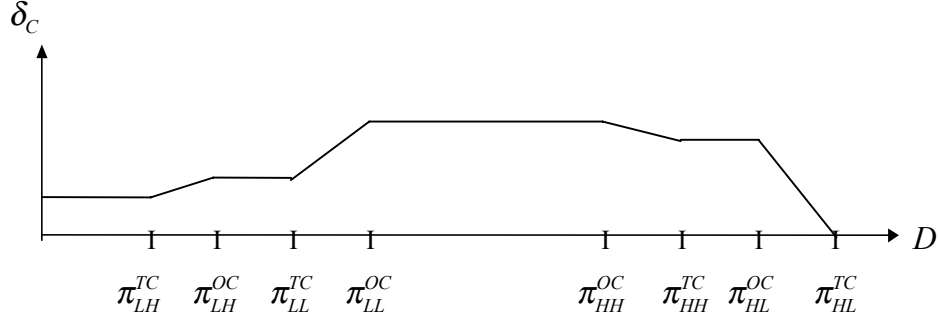


Figure 2: The graph of  $\delta_C$

In other words,  $\delta_C$  is positive for all  $D$  if only  $E\pi^{TC} > E\pi^{OC}$ , which has been shown in Proposition 1. ■

As discussed in Section 3, the effect of information revelation is in general to produce some implicit coordination in output decisions, as the informed firm conditions its production on the actual strength of its competitor's demand and thus on the competitor's ability to market aggressively. This implicit coordination is so valuable that an equity-controlled firm unilaterally prefers to become transparent. Hence, the case of equity control is a direct generalization of the literature on endogenous information sharing, cited in Section 3, to the case of a capital structure with debt and equity.

The final subgames to consider at the stage of transparency choice are those in which a creditor is in control (CD). Here, two technical problems of little economic interest can complicate the analysis compared to that of Propositions 2 and 3. First, if the required loan,  $I$ , is smaller than  $V_L + \pi_{LH}^{TC}$  (the smallest possible return to investing if the other firm chooses  $C$ ), then debt will be riskless,  $D = I$ , and lenders will be indifferent between transparency and opaqueness. And second, if debt is so high (close to  $V_H + \pi_{HL}^{TC}$  in Figure 1) that the debtor goes bankrupt almost all the time, then the creditor will behave like the residual claimant and is, of course, indistinguishable from an equity investor. Neither of these two points poses a technical problem for



the analysis, but both create uninteresting sub-cases; to focus the exposition we shall assume them both away. For the first problem, this amounts to assuming that  $I$  is sufficiently large to make debt risky, independent of the transparency choice of the other firm. For the second, this requires to assume that  $I$  is not so big as to make debt look like equity. More precisely, we assume

$$V_L + \max(\pi_{LH}^{TT}, \pi_{LH}^{TO}) < I \ll V_H + \pi_{HL}^{TT}.^{21} \quad (15)$$

We can now state the sequel to Propositions 2 and 3.

**Proposition 4** *Assume that a firm is financed with concentrated debt and that Assumption (15) holds. If the creditor believes with some positive probability that the firm is of type  $V_L$ , then the creditor's dominant strategy in the transparency subgame in stage 4 is opaqueness,  $C = O$ .*

The proof is analogous to the one of Proposition 3 and omitted.<sup>22</sup>

The key feature of the case of creditor control is that the dominant interest now is to protect the downside of profits. As this downside is greater under opaqueness than under transparency (see Figure 1), the creditor will prefer opaqueness, even though its expected value is lower, if his debt is risky under transparency. As long as the creditor is not certain that the firm is of type  $V_H$ , Assumption (15) is a sufficient condition for debt being risky under transparency: as  $D > I$ , there is a positive probability ( $q(1 - q)$  times the probability the creditor attaches to  $V_L$ ) that  $V_L + \pi_{LH}^{TO} < D$ . Proposition 4 provides a converse to Propositions 2 and 3: whereas in the case of equity control firms will be transparent, dominant lenders will avoid transparency, if debt is risky. These results are surprisingly strong, as this behavior is produced by dominant strategies.

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<sup>21</sup>The first inequality deals with the first of the two points raised and rules out multiple equilibria generated by indifference - not a very interesting case. For a full analysis, see Perotti and von Thadden (1998). The second inequality states that  $I$  should be sufficiently smaller than the right hand side. The precise threshold is given by the smaller of the two  $I^C$ ,  $C \in \{T, O\}$ , for which  $I^C = E_\pi h \min(V_H + \pi^{OC}, D) + (1 - h) \min(V_L + \pi^{OC}, D) = E_\pi h \min(V_H + \pi^{TC}, D) + (1 - h) \min(V_L + \pi^{TC}, D)$ . This threshold lies between  $V_L + \pi_{HL}^{OO}$  and  $V_H + \pi_{HL}^{TT}$  (the maximum possible return) and is typically so high that the constraint in assumption (15) is not binding.

<sup>22</sup>A minor twist compared to that proof is that the controlling party here may not know the firm's profitability (if the financing in stage 2 and 3 is pooling). Therefore, the proof is in two (very similar) parts, one for the case of pooling, one for separating (and has more parts if one wants to consider mixed-strategy equilibria in the financing game).

Hence, if a firm is debt controlled, its dominant investor will choose opaqueness, a strategy which reduces the firm's expected profits. The interesting question, to which we turn now, is why a firm may approach such an investor.

## 5 Finance

The last step in our backwards induction analysis is the financing game in stages 2 and 3, where we will first study the interaction between one firm and the capital market. Given the dominance results in the last section, the case of two firms will be a simple extension. To simplify notation, we first suppress the reference to the other firm and let  $\pi^T = \pi^{TC}$  and  $\pi^O = \pi^{OC}$  denote the (random) future returns from investing, holding the transparency choice  $C$  of the other firm fixed. If the other firm does not invest,  $\pi^T = \pi^O$  is the monopoly profit. If the other firm invests, Proposition 1 has shown that  $E\pi^T > E\pi^O$ .

Let us first consider the case of a firm without a moral hazard problem ( $\phi = 0$ ). In this case, there is no need for outside monitoring, and the firm will finance itself through dispersed debt or outside equity, depending on its return characteristics. As this case is relatively standard corporate finance, we do not develop it here. The only feature of importance in our context is that the firm will be equity controlled, and therefore, by Propositions 2 and 3, transparent.

The more interesting case is that of a moral-hazard prone firm, i.e.  $\phi = 1$ . We shall focus on the pooling equilibrium in which both types of  $V \in \{V_L, V_H\}$  issue concentrated debt with zero expected profits to the investors. The firm's debt level,  $D^*$ , is then given by

$$E_{\pi, V} \min(V + \pi^O, D^*) = I. \quad (16)$$

Under this contract, both types of firms will be bank monitored and non-transparent. Denote the expected payoff of firm type  $i = L, H$  under this contract by

$$P_i = E_{\pi} \max(V_i + \pi^O - D^*, 0). \quad (17)$$

In order for this contract to be an equilibrium, several assumptions need to be satisfied. We will first derive these assumptions and later discuss their

restrictiveness. The first assumption is that the firm must be willing to undertake the project at all under these terms. This means

$$P_i \geq V_i, \quad i = L, H. \quad (18)$$

The next two assumptions concern deviations by the firm to different financing choices. In order to establish the proposed pooling equilibrium, we require that under the most unfavorable market belief following a deviation, such a deviation is less profitable to the firm than the equilibrium contract. In other words, we assume that off-the-equilibrium-path beliefs by the market are pessimistic. This assumption is in the spirit of Myers and Majluf's (1984) original work and of most of the empirical work on the pecking order, and yields a minimal set of restrictions for our analysis.

The first assumption in this vein excludes deviations to dispersed debt:

$$E_\pi \max(V_L + \pi^T - D, 0) < I + \max(V_L - D, 0), \quad (19)$$

$$\text{where } D \text{ is given by } E_\pi \min(V_L + \pi^T, D) = I. \quad (20)$$

Condition (20) describes the off-the-equilibrium scenario in which the firm raises fairly priced dispersed debt (with pessimistic market beliefs). Then there is no monitoring (by assumption), in which case we know from Proposition 3 that the firm prefers transparency over opaqueness. Condition (19) now states that the  $V_L$  type of firm in this situation will prefer to divert its funds. The payoff expected by investors, therefore, is  $\min(V_L, D)$  (remember the assumption that market beliefs are pessimistic), which, by Assumption (15), is strictly smaller than  $I$ . Thus fairly priced dispersed debt financing is not an option, as investors would refuse to underwrite it. Clearly, unfairly priced debt would only increase the firm's moral hazard problem.

The second assumption concerning alternative funding choices concerns equity finance. In order for a firm not to deviate to equity finance, we assume

$$P_i \geq (1 - s)(V_i + E_\pi \pi^T), \quad i = L, H, \quad (21)$$

$$\text{where } s \text{ is given by } s(V_L + E_\pi \pi^T) = I. \quad (22)$$

Given our assumption of zero monitoring costs, (21) is necessary and sufficient for a deviation to equity finance to be unprofitable under pessimistic

market beliefs (remember that by Proposition 2 controlling equity holders will choose transparency).

Conditions (18), (19) and (21) are necessary and sufficient for an equilibrium with concentrated debt to exist. Condition (18) implies that the new investment is profitable even under opaqueness, so that  $E\pi^O > I$ . Proposition 1 then ensures that the project is profitable under transparency. (19) demands that the moral hazard problem is sufficiently severe for the low-value firm (i.e. that new ventures create a large temptation to abuse funding), and (21) requires that the value dilution problem is sufficiently severe for both types of firm.<sup>23</sup> Finally, condition (21) requires that the value loss through lack of transparency be not too large.

The previous discussion had assumed the behavior of the other firm and its financiers to be fixed. Dropping this notational assumption, our discussion implies the following proposition.

**Proposition 5** *Let  $D^*$  be given by*

$$E_{\pi,V} \min(V + \pi^{OO}, D^*) = I,$$

*and assume that*

$$(A1) \ I > V_L + \pi_{LH}^{TO},$$

$$(A2) \ E_{\pi} \max(V_H + \pi^{OO} - D^*, 0) \geq V_H,$$

$$(A3) \ V_L + E\pi^{TO} < 2I,$$

$$(A4) \ E_{\pi} \max(V_H + \pi^{OO} - D^*, 0) \geq (1 - \frac{I}{V_L + E_{\pi}\pi^{TO}})(V_H + E_{\pi}\pi^{TO}),$$

$$(A5) \ E_{\pi} \max(V_L + \pi^{OO} - D^*, 0) \geq V_L + E_{\pi}\pi^{TO} - I.$$

*Then there exists a Perfect Bayesian equilibrium of the overall financing game in which the  $V_L$  and the  $V_H$  type of type  $\phi = 1$  firms are both financed by concentrated debt with the same face value  $D^*$  and in which both firms are opaque.*

**Proof.** We know from the earlier discussion that the existence of the pooling equilibrium in the game between a firm and its investors, taking the other firm's decision  $C$  as fixed, is equivalent to the five conditions (18), (19) and (21). Here we consider  $C = O$ . Condition (A1) is the first half of assumption

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<sup>23</sup>Note that (21) is a stronger condition than what is needed in the standard Myers-Majluf model, because here a deviation from debt to equity increases the expected value of the investment.

(15) in section 4; it can be verified that the second half of (15) is implied by the positive net worth condition  $E\pi^{OO} > I$ , which in turn is implied by (A2). (A3) is just (19), noting that  $D > V_L$  and substituting in for  $D$ . (A4) and (A5) are (21). (A2) states that the relevant participation constraint (18) is the one for the  $V_H$ -type. Indeed, writing out the condition for the  $V_L$ -type (denoting the c.d.f. of  $\pi^O$  by  $F$ ), one has

$$\begin{aligned}
E_\pi \max(V_L + \pi^O - D^*, 0) - V_L &= \int_{\pi \geq D^* - V_L} (V_L - D^* + \pi) dF(\pi) - V_L \\
&= \int_{\pi \geq D^* - V_H} (V_H - D^* + \pi) dF(\pi) - \int_{\pi \geq D^* - V_H} (V_H - V_L) dF(\pi) \\
&\quad - \int_{D^* - V_H}^{D^* - V_L} (V_L - D^* + \pi) dF(\pi) - V_H + (V_H - V_L) \\
&= E_\pi \max(V_H + \pi^O - D^*, 0) - V_H \\
&\quad + (V_H - V_L)F(D^* - V_H) + \int_{D^* - V_H}^{D^* - V_L} (D^* - V_L - \pi) dF(\pi) \\
&\geq E_\pi \max(V_H + \pi^O - D^*, 0) - V_H.
\end{aligned}$$

■

The set of assumptions in Proposition 5 may look restrictive, but they are fairly natural. Condition (A1) simply states that debt is risky, a necessary restriction for our analysis, which does not apply to the case of riskless debt.

Condition (A2) is the participation constraint for the  $V_H$ -type. If it is violated, the more valuable firm prefers to forego raising funds for the new venture. If the  $V_H$ -type accepts the dilution of existing firm value brought about by the debt contract, the  $V_L$  type does so, too (since they stand to gain from the overpriced funding). Condition (A2) is a strengthening of the condition that the project has positive net present value: the project should be sufficiently profitable for the firm to be interesting, even if the mispricing of the issued securities implies that the firm must give up part of its existing value in some contingencies.

Condition (A3) concerns the moral hazard problem. In its simplified form given here, it is easy to interpret: If investors receive a sufficient part of total returns of a bad firm,  $V_L + E\pi^{TO}$ , to break even, then the remainder is not attractive enough to keep the firm honest (in the terms of Holmström and Tirole (1997), the firm's pledgeable income is not sufficient). Conditions (A4) and (A5) concern the dilution problem of equity, which must be sufficiently strong for both types of firms, in order to rule out equity finance.

Interestingly, and different from the simplest Myers-Majluf case, it can be shown that neither of the two conditions implies the other.

Clearly, there are conditions under which other equilibria are possible. The case we study is one in which the investment is valuable enough to encourage external financing even if securities are mispriced, but not so large as to make owners insensitive to a proper pricing of existing activities or to make moral hazard negligible.

A qualitative interpretation of the conditions in Proposition 5 yields the following rough taxonomy. For the proposed pooling equilibrium to exist, the difference between returns under transparency and opaqueness should not be too large (in order to make the deviations in A3, A4, and A5 not too attractive),  $V_H$  should not be too large (for the high type's participation constraint (A2)) and not too small (for the dilution constraint (A4)),  $V_L$  should not be too large (for the moral hazard constraint (A3) and the dilution constraint (A5)), and  $I$  should be neither too high (for the participation constraint (A2)) nor too low (for the moral hazard constraint (A3) and the dilution constraint (A5)).

For concreteness and to get a sense of the order of magnitudes, Table 1 provides quantitative information for a simulation of the model with the following parameter specifications. For the product market stage, we fix  $q = \gamma = .5$  and  $\theta_H = 2\theta_L = 100$ . This yields  $E\pi^{TO} = 1078$  and  $E\pi^{OO} = 1056$ . We further fix  $h = .5$  (equal proportion of high and low asset value firms), let  $V_L$  and  $V_H$  vary, and investigate the constraints on  $I$  defined by (A1) to (A5). Table 1 reports the result for six different combinations of  $(V_L, V_H)$ .

$(V_L, V_H)$	lower bound on $I$	lower bound given by constraint	upper bound on $I$	upper bound given by constraint
(0, 400)	540	(A3)	950	(A2)
(0, 800)	540	(A3)	870	(A2)
(400, 800)	740	(A5)	970	(A2)
(0, 1200)	540	(A3)	860	(A2)
(400, 1200)	750	(A5)	960	(A2)
(800, 1200)	1150	(A5)	1050	(A2)

Table 1

These simulations reflect the rough taxonomy developed above; note that in the given specification the dilution constraint (A4) of the  $H$ -type is redun-

dant (this changes for different values of  $h$ ). Note also that for sufficiently high and homogenous values of existing asset values (the last row of Table 1), the dilution constraint of the  $L$ -type (A5) and the participation constraint (A2) of the  $H$ -type are inconsistent: the  $L$ -type's asset base is sufficiently important and similar to that of the  $H$ -type for him to no longer want to pool with the  $H$ -type at conditions that are acceptable to the  $H$ -type. Although these results are, of course, only illustrative, they show that the parameter values described by conditions (A1) to (A5) form a sufficiently large set and are of the right order of magnitude to make the proposed equilibrium relevant.

This allows us to characterize the firm characteristics for which our equilibrium of bank dominance and opaqueness is most relevant: firms with a large, profitable investment opportunity and moderate amount of assets in place, but with some uncertainty concerning their value, prone to a moral hazard conflict between insiders and outsiders, because of the ability of managers to divert resources according to their own goals.

Notice that if the firm is a young venture with few initial assets and little uncertainty about these assets ( $V_H$  small), the value of the new project will swamp any consideration of dilution, and equity financing would be preferred. This suggests that new firms with high growth opportunities are less likely to use bank debt, particularly if they are in a sector in which the gain from establishing leadership (i.e. the ability to show a strong competitive position via transparency) far exceed the cost of mispricing initial assets.<sup>24</sup> At the same time, concentrated ownership of equity will emerge in sectors and in countries in which it is hard to control moral hazard, and where there are strong strategic advantages to establish market leadership. This is consistent with the empirical results in the literature on the legal determinants of ownership (LaPorta et al., 1999).

## 6 Conclusions

In this paper we have highlighted the impact of the dominant investors on the diffusion of information. In particular, we provide a rationale for the

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<sup>24</sup>A high net present value of new ventures can also help to overcome the moral hazard risk of appropriation of new funding, since then appropriating investment funds is less attractive than capturing (a part of) the NPV of new investment. In this case there is less need of a concentrated investor structure.

observation that lender-dominated firms are often more opaque. We suggest that even besides the lower degree of transparency accompanying private debt financing, public disclosure and the informativeness of security prices may be deliberately discouraged by a dominant lender in order to reduce the riskiness of his loan.

An interesting side result is that the informational advantage of an opaque firm facing a transparent competitor does not translate in an outright competitive advantage. While lack of transparency ensures that it is shielded when in a weak competitive position, when the firm is in a strong position it cannot take full advantage of mutual knowledge of its strength to restrain output by competitors, losing market share precisely when its product is relatively profitable. Hence, the value of transparency depends on whether investors are interested in the upside or the downside of profits.

As a basis for our analysis of the influence of lender control on firm transparency, the paper also provides a rationale for lender control. Our argument synthesizes two strands of the literature - the capital structure theory in the tradition of Myers and Majluf (1984) and the corporate control literature in the spirit of Holmström and Tirole (1997). We argue that although there is a downside to lender control - strategic interference which yields lower expected profits -, there is an important upside - the control of managerial moral hazard. If the firm's asset structure and environment makes managerial moral hazard an important issue ( $\phi = 1$ ), if the efficiency loss from opaqueness ( $E\pi^T - E\pi^O$ ) is not too large, if the required injection of funds ( $I$ ) is sufficiently large, but still small enough to make the project sufficiently profitable, and if the evaluation of existing firm value is sufficiently difficult ( $V_H - V_L$  large and  $h$  not too close to 1), we argue that firms will find it optimal to seek debt finance from a dominant investor.

Our notion of debtor control captures a limited, but probably important part in some institutional settings of the corporate governance problem. One qualification, however, that bears repeating is that in order to exert control, debt holders must act in a concerted manner, which is usually impossible if debt is widely held, and that equity must be relatively weak. This is due to the fact that out of bankruptcy, equity has the formal control rights and can, therefore, impose its preferences on debt holders (unless explicitly restricted by covenants). As a consequence, we have the following rough taxonomy to anchor the classification of our theory institutionally. "Equity control" is present whenever equity is strong (in particular, there is a large, active owner). "Debt control" prevails if equity is weak and there are influential debt



holders, in particular banks. Finally, if equity and debt are both relatively weak (e.g., widely held), we expect neither of our two modes to prevail, but rather management to be in control. In this latter case, our approach suggests that whether management has a preference towards opacity or transparency depends on whether its compensation package is more sensitive to downside risk or upside potential.

In an international context, our notion of debt control is presumably more relevant to Japanese or European than to US companies, where equity or management control seems to be the norm out of Chapter 7 bankruptcy. Thus on average our model predicts higher corporate transparency in the US (and perhaps the UK) relative to Japan and Europe.

On the corporate level, we predict that the following attributes of publicly traded companies be clustered: equity dominance (in particular, concentrated, non-institutional ownership), managerial compensation in the form of stock options, corporate transparency, (relatively) informative stock prices, and volatile earnings. On the other side, we expect to observe jointly: bank debt with active monitoring, less corporate transparency, less informative stock prices, and less volatile earnings. In fact, the paper predicts a kind of stickiness of opacity in the following sense. In equilibrium, investors in  $\phi = 1$  - firms (those who are difficult to monitor and control in the first place) will choose opacity, and  $\phi = 0$  - firms will be transparent. Hence, if the firm is difficult to monitor ex ante, it will be non-transparent ex-post, and vice versa.

Our model allows for several interesting extensions which may shed light on some recent trends in European capital markets. In the explicit market microstructure model in Perotti and von Thadden (1998), if market depth (i.e. the amount of noise trading) increases, informed trading profits increase. Suppose that initially corporate boards dominated by banks keep firms opaque so as to discourage information-gathering. Once liquidity increases enough, informed trading becomes profitable, and a policy of opacity can no longer restrain information dissemination. Then corporations will tend to become more transparent against the wishes of dominant debtholders. We would therefore argue that the large influx of international capital into the (continental) European financial market since the mid 1990s and the recent shift to more transparency of many European companies are related phenomena. Opacity of publicly traded companies may be increasingly hard to sustain as trading liquidity rises due to rising global investment flows.

## 7 Appendix

In this appendix, we provide the equilibrium quantities and profits for the three different possible informational structures in the product market. They are obtained by standard calculations. Throughout, we impose assumptions (2) and (3), which assure that quantities and prices are positive. For the case of competition under symmetric information  $(T, T)$ , the formulae are in the main text.

In the case where both firms' quality is private information,  $(O, O)$ , we have

$$\begin{aligned} Q_H^{OO} &= \frac{1}{2+\gamma} \left( \theta_H + \frac{\gamma}{2}(1-q)(\theta_H - \theta_L) \right), \\ Q_L^{OO} &= \frac{1}{2+\gamma} \left( \theta_L - \frac{\gamma}{2}q(\theta_H - \theta_L) \right), \end{aligned}$$

and equilibrium profits

$$\begin{aligned} \pi_{HL}^{OO} &= \frac{1}{(2+\gamma)^2} \left( \theta_H^2 + \frac{\gamma}{2}(2+\gamma q)\theta_H(\theta_H - \theta_L) \right. \\ &\quad \left. + \frac{\gamma^2}{4}(1-q)(1+(1+\gamma)q)(\theta_H - \theta_L)^2 \right), \end{aligned} \quad (\text{A1})$$

$$\begin{aligned} \pi_{HH}^{OO} &= \frac{1}{(2+\gamma)^2} \left( \theta_H^2 - \frac{\gamma^2}{2}(1-q)\theta_H(\theta_H - \theta_L) \right. \\ &\quad \left. - \frac{\gamma^2}{4}(1-q)^2(1+\gamma)(\theta_H - \theta_L)^2 \right), \end{aligned} \quad (\text{A2})$$

$$\pi_{LL}^{OO} = \frac{1}{(2+\gamma)^2} \left( \theta_L^2 + \frac{\gamma^2}{2}q\theta_L(\theta_H - \theta_L) - \frac{\gamma^2}{4}q^2(1+\gamma)(\theta_H - \theta_L)^2 \right) \quad (\text{A3})$$

$$\begin{aligned} \pi_{LH}^{OO} &= \frac{1}{(2+\gamma)^2} \left( \theta_L^2 - \frac{\gamma}{2}(2+\gamma - \gamma q)\theta_L(\theta_H - \theta_L) \right. \\ &\quad \left. + \frac{\gamma^2}{4}q(1+(1+\gamma)(1-q))(\theta_H - \theta_L)^2 \right). \end{aligned} \quad (\text{A4})$$

In the asymmetric case, where one firm's type is publicly revealed and the other's only privately known, the equilibrium is given by

$$Q_H^{TO} = \frac{1}{2+\gamma} \left( \theta_H + \frac{\gamma(1-q)}{2-\gamma}(\theta_H - \theta_L) \right), \quad (\text{A5})$$

$$Q_L^{TO} = \frac{1}{2+\gamma} \left( \theta_L - \frac{\gamma q}{2-\gamma}(\theta_H - \theta_L) \right), \quad (\text{A6})$$

$$Q_{HH}^{OT} = \frac{1}{2+\gamma} \left( \theta_H - \frac{\gamma^2(1-q)}{2(2-\gamma)}(\theta_H - \theta_L) \right), \quad (\text{A7})$$

$$Q_{HL}^{OT} = \frac{1}{2+\gamma} \left( \theta_H + \gamma \frac{2-\gamma(1-q)}{2(2-\gamma)}(\theta_H - \theta_L) \right), \quad (\text{A8})$$

$$Q_{LL}^{OT} = \frac{1}{2+\gamma} \left( \theta_L + \frac{\gamma^2 q}{2(2-\gamma)}(\theta_H - \theta_L) \right), \quad (\text{A9})$$

$$Q_{LH}^{OT} = \frac{1}{2+\gamma} \left( \theta_L - \gamma \frac{2-\gamma q}{2(2-\gamma)}(\theta_H - \theta_L) \right), \quad (\text{A10})$$

with profits

$$\pi_{ij}^{OT} = (Q_{ij}^{OT})^2 \quad (\text{A11})$$

for  $ij = HH, HL, LH, LL$ , and

$$\pi_{HH}^{TO} = \frac{1}{(2+\gamma)^2} \left( \theta_H^2 + \frac{\gamma^3(1-q)}{2(2-\gamma)}\theta_H(\theta_H - \theta_L) - \frac{\gamma^2(1-q)^2(2-\gamma^2)}{2(2-\gamma)^2}(\theta_H - \theta_L)^2 \right), \quad (\text{A12})$$

$$\pi_{HL}^{TO} = \frac{1}{(2+\gamma)^2} \left( \theta_H^2 + \frac{\gamma(4-\gamma^2 q)}{2(2-\gamma)}\theta_H(\theta_H - \theta_L) + \frac{\gamma^2(1-q)}{2(2-\gamma)^2}(2+2q-\gamma^2 q)(\theta_H - \theta_L)^2 \right), \quad (\text{A13})$$

$$\pi_{LL}^{TO} = \frac{1}{(2+\gamma)^2} \left( \theta_L^2 - \frac{\gamma^3 q}{2(2-\gamma)}\theta_L(\theta_H - \theta_L) - \frac{\gamma^2 q^2(2-\gamma^2)}{2(2-\gamma)^2}(\theta_H - \theta_L)^2 \right), \quad (\text{A14})$$

$$\pi_{LH}^{TO} = \frac{1}{(2+\gamma)^2} \left( \theta_L^2 - \frac{\gamma(4-\gamma^2(1-q))}{2(2-\gamma)}\theta_L(\theta_H - \theta_L) + \frac{\gamma^2 q}{2(2-\gamma)^2}(2(2-q) - \gamma^2(1-q))(\theta_H - \theta_L)^2 \right). \quad (\text{A15})$$

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