# Liquidity and Control: A Dynamic Theory of Corporate Ownership Structure

by

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The paper develops a theory of ownership structure based on the notion that corporate control and secondary market liquidity are not perfectly compatible with each other. We analyze the tradeoff between these two objectives for two different ownership structures: the privately held firm, which is characterized by restricted trading opportunities for owners and non-anonymous trading, and the publicly traded firm where trading opportunities are unrestricted and trading is anonymous. We develop pricing formulas for each structure, compare these with each other, and derive predictions for optimal ownership design, depending on the institutional structure of the capital market. (JEL: G 32, D 23)

## 1. Introduction

This paper develops a new model to reconsider an old question in corporate finance. Ever since the publication of BERLE and MEANS' [1933] *The Modern Corporation and Private Property*, it is well recognized that if a large corporation has a diffuse shareownership then managers may have more discretion to pursue objectives which are not necessarily in the best interest of shareholders. While the problem is well understood, there is less agreement on the best corporate governance structure to overcome the difficulties associated with the separation of ownership and control. Some economists have argued that it suffices to give managers the right remuneration package (DYBVIG and ZENDER [1991]). Others have proposed that a large bank could monitor managers (DIAMOND [1984]). Others yet have argued that when the need arises shareholdings become concentrated (perhaps through a takeover) and the mere threat of such concentration is sufficient to discipline management (MANNE [1965]). Free-riding by small shareholders may, however, make takeovers difficult (GROSSMAN and HART [1980]), and may require dilution benefits for raiders to

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mitigate this problem. Alternatively, the presence of large shareholders could also overcome this free-rider problem (SHLEIFER and VISHNY [1986]).

Our starting point is to ask why shareholdings are dispersed in the first place. We argue that dispersion is beneficial to the extent that it increases the liquidity of the secondary market in the firm's stock, and concentration is costly because it lowers liquidity in the secondary market. Concentration, on the other side, is valuable, because large shareholders have a greater incentive to monitor management.

We study this basic tradeoff between liquidity and control under two different types of ownership structure. First, we consider a stylized model of a privately held firm, which is defined by two main characteristics. With this type of ownership, ownership is limited to a well-defined group of individuals, outside of which the trading of shares is not allowed (the first characteristic). The advantage of this arrangement is that trading among owners is non-anonymous (the second characteristic), the downside is that trading partners are naturally limited. The second type of ownership structure we consider is the public listing on a stock market. This structure has the opposite characteristics: trading with outsiders is completely unrestricted, and it is anonymous. We view these two structures as extremes whose analysis brings out useful comparative results, but which should not necessarily be interpreted in the strict legal sense. For example, a publicly listed company with few dominant owners and a thin secondary market is close to the first category analyzed here, while a large unlisted cooperative with many members has much in common with what we summarize under the heading of "publicly traded."

For the privately held firm we ask whether the owners of the firm should design the firm's ownerhip structure so as to always maintain a controlling interest, or whether they should try to achieve maximum liquidity through maximum dispersion, hoping that a controlling interest will emerge through trading in shares when the need arises. The advantage of maintaining a controlling block is that management is likely to be better supervised. But, the cost is in terms of a less liquid stock. The advantage of dispersion is that the firm reduces its cost of capital by extracting a liquidity premium. The main drawback is that management is not adequately supervised in all contingencies because, due to free-riding, a controlling interest may not always arise through the trading of shares.

When a firm goes public the nature of the liquidity/control tradeoff changes, but the tradeoff itself remains. On the one hand, a larger set of agents will take an active interest in the stock, so that trading opportunities are improved. On the other hand, when the firm goes public trading in shares becomes more anonymous. As a result, controlling blocks may be harder to sustain, exactly because of the same structural reason as in the privately held case: the free-rider problem. In addition, more informational asymmetry may arise between the blockholder and other shareholders, a second effect which reduces liquidity. We study the pure free-rider problem first, and then proceed to the issue of information induced illiquidity in section 5. The main contribution of this paper is to derive the different values which can be realized through these different ownership structures and to compare them among each other.

The distinction between privately held and publicly traded may, to the casual observer, empirically simply be a question of company size. The example of Germany shows that this is not true. Out of the 100 largest German firms identified by LIEDTKE [1996] for 1994, 16 were wholly owned subsidiaries of foreign companies and 5 were owned by the public sector. Of the remaining 79 firms, 27 were privately held. Here, we define a firm as privately held if it is either not incorporated as a joint stock corporation ("Aktiengesellschaft"), or if it is a joint stock corporation whose stock is held, possibly through intermediate holdings, by no more than 5 owners with no trading activity.[1]

The basic question addressed in this paper is relevant to a firm's decision to go public, to a government's decision concerning a privatization strategy, and more generally to the question of the relative benefits of different financial systems: A US-style financial system – in which the proportion of traded securities relative to other sources of firm financing is high, versus a French or German-style financial system – in which secondary security markets are relatively thin but controlling interests in firms are common.

In a thought provoking paper on the history of US financial regulation since the Great Depression, BHIDE [1993, 32 and 43] has argued that:

> "US regulators have promoted market liquidity at the expense of the efficient governance of firms... The liquidity promoted by US policies has obvious benefits: investors can encash their assets quickly and diversify cheaply. The same policies, however, impair governance by encouraging diffuse stockholding and discouraging active investing."

Our model captures this basic tradeoff and provides a framework in which the value of various ownership structures (of both privately held and publicly traded companies) can be compared and the effects of stockmarket regulations on insider trading and on disclosure of ownernship changes can be assessed. In fact, our model allows to analyze stock market disclosure requirements along two dimensions. First, we can analyze the impact of mandatory announcements of trades, such as Section 13d or 16d filings in the US and the EU Transparency Directive of December 1988. Second, we can analyze how transparency with respect to trading motives affects market values. We show that transparency with respect to informational motives can be desirable, but only if it does not discourage the collection of valuable information. In particular, in our model publicly traded firms have a higher value if insider information about future firm values is present than if this is not the case, even though this information makes the market less liquid. With respect to the first type of disclosure, such

[1] The public listing of these companies (who are few) is mostly done for tax reasons and international visibility. The classification given here is our own, based on the detailed descriptions provided by LIEDTKE [1996] for the year 1994.

regulation is value increasing in our model. Yet, we show that the real issue is whether critical thresholds (such as the 5% threshold in the US) are crossed from above, rather than from below. This finding provides a new perspective on the regulatory debate, because the literature on corporate takeovers has usually argued against such thresholds, on the grounds that they hinder the emergence of toeholds which make value increasing takeovers more likely. Our analysis shows that a regulator can actually satisfy both objectives, because the problem is asymmetric: Disclosure requirements for the build up of blocks can be designed to be less stringent than those for the dismantling of blocks.

Finally, we hope that the present model can add to the literature on conceptual grounds. In fact, we approach the problem of ownership structure from two different angles and integrate the two perspectives in one consistent model. The first is the contract theoretic approach, in which ownership is designed in a first stage, interactions take place in a second, and final values are realized and distributed in a third stage. The second perspective is a general equilibrium approach in the spirit of, e.g., KREPS [1977] and DOW and GORTON [1995], in which overlapping generations of investors trade shares and thus determine ownership and control structures in a stationary rational expectations market equilibrium. By imbedding the contractual model in such an overlapping generations structure, we can make explicit comparisons, in particular with respect to long-run comparative statics.

There is a large literature related to our model. The most closely related papers are MAUG [1998] and PAGANO and RÖELL [1998]. Maug considers a publicly traded firm with a large shareholder, who obtains inside information in her monitoring activities. He determines the effect of insider trading legislation on the large shareholder's incentives to monitor. Contrary to BHIDE [1993], he argues that insider trading legislation can improve monitoring if trading based on information obtained through monitoring is allowed, but not trading based on other forms of inside information. The basic point of his paper is that if liquidity is improved as a result of this type of legislation, then it is easier for the large shareholder to realize her gains from monitoring. In a similar framework, but with a different objective, KAHN and WINTON [1998] study the behavior of large insiders who have the choice between active intervention and speculative sellout after they have monitored. Our model of informed trading in anonymous markets (subsection 5.1) can be viewed as a reduced form of their richer model.[2] A similar perspective on liquidity is provided by DE MARZO and DUFFIE [1997] who, following LELAND and PYLE [1977], investigate the design of securities when the issuer has inside information (which creates the illiquidity problem). They do not consider corporate control issues which are the principal focus of our study.

[2] Complementing KAHN and WINTON [1998] and going beyond our analysis of section 5, FOUCAULT and PALOMINO [1997] have recently studied the impact of trading anonymity on information acquisition and market illiquidity.

PAGANO and RÖELL [1998] consider a privately held firm with a large shareholder which needs to increase its capital base by bringing in new shareholders. The firm has the option of remaining private and introducing another set of large shareholders or going public and getting a new set of small shareholders. The benefit of the first option is that the firm can avoid paying large listing costs. The drawback is that, as in BURKART, GROMB and PANUNZI [1997], there may be excessive monitoring by large shareholders and the stock is less liquid. Both drawbacks are avoided when the firm goes public but then the firm must incur listing costs.

Another set of papers related to our study are HUDDART [1993] and ADMATI, PFLEIDERER and ZECHNER [1994] on the one hand, who respectively stress the incentive or control benefits of concentrations and the risk-diversification benefits of dispersion, and DIAMOND and VERRECCHIA [1982] and HOLMSTRÖM and TIROLE [1993] on the other, who emphasize the informational benefits of listing and observing a quoted stock price for overcoming managerial incentive problems. HOLMSTRÖM and TIROLE [1993] is most closely related since they contrast the benefits of insider trading by a large shareholder who monitors management with the costs of capital for the firm which results from greater insider trading in more liquid secondary markets.

Our analysis of the free-rider problem is related to ZINGALES [1995] and GROMB [1993], who show how free-riding by small shareholders can be used to increase the ex ante value of the firm, and MELLO and PARSONS [1994], who also compare ex ante dispersed shareholding, which may possibly give rise to concentration through ex post trading, with ex ante concentrated shareholding. Finally, BEBCHUK [1994] considers the problem of the trading mechanism of controlling blocks when large shareholders obtain both monetary and private benefits of control; he contrasts the equal opportunity rule (according to which minority shareholders can participate in the sale of the block on the same terms) and the market rule (where no distinction is drawn between shareholders according to the size of their holdings). We shall come back to some of these and other studies in the main body of the paper.

The organization of the paper is as follows. Section 2 outlines the model. It describes a firm in a stationary world that is owned by a succession of overlapping generations of owners. Section 3 deals with the privately held firm. It considers first the case of a firm with an initial dispersed ownership structure and describes how a controlling block may emerge through ex post trading. It goes on to analyze an ownership structure where a controlling block is set up ex ante. Finally, it compares the values of these alternative ownership structures. Section 4 deals with the publicly traded firm. It studies, first, firm valuation when stock market trading is anonymous, and provides comparative statics with the privately held firm. Then it briefly discusses trading in non-anonymous markets. Section 5 introduces the problem of informational asymmetry between large monitors and small shareholders and reconsiders the issue of market trading. Section 6 offers a few concluding comments and interpretations to our model.

## 2. The Model

The main components of the model include the firm's technology, the preferences of shareholders and managers, the firm's corporate charter, and the timing of events and moves. We take up these components in turn.

### 2.1 The Firm's Technology

Consider a firm that operates for an infinite number of time periods, $t = 1, 2, \ldots$. The firm is run by a manager who in every period pays out a random flow return $Y_t$ to the firm's owners.[3] The returns $Y_t$ are independently, identically distributed random variables, such that

$$(1)\qquad Y_t = \begin{cases} R & \text{with probability } \pi, \\ 0 & \text{with probability } 1 - \pi. \end{cases}$$

In the state of nature where $Y_t = 0$, it is possible to reorganize the firm to obtain a higher flow return of $L$, where $R > L > 0$. We assume that the manager never wants to carry out the reorganization herself, and that she cannot be contractually forced to do so. Reorganization can only happen if a shareholder is monitoring the firm. Monitoring, however, is costly. A cost $C, 0 < C < (1 - \pi) L$, must be incurred to determine the true state of nature. This cost is borne privately; whoever monitors cannot share the cost with other shareholders.

Every period, a safe investment is available yielding the certain per period rate of return $\rho$. Therefore, the firm's expected value at any date under efficient monitoring and reorganization is given by

$$(2)\qquad V^* = \frac{1}{1-\delta}[\pi R + (1 - \pi) L - C],$$

where $\delta = \dfrac{1}{1+\rho}$ denotes the discount rate.

### 2.2 Shareholder Preferences

The economy is composed of overlapping generations of identical three-period lived investors. When young, investors do not consume and save for future consumption. Future consumption needs are uncertain, which creates a demand for liquidity. To simplify the modeling of liquidity as much as possible, we follow Gorton and Pennacchi [1990] and others by assuming that investors

[3] More generally, these cash flows are paid out to those outside the firm who have a claim on them. In principle, these claimants could be bond-holders as well as equity-holders. The analysis is very general in this respect, and we only choose the "ownership" terminology here to fix ideas.

are risk neutral with respect to intra-period consumption and that they want to consume either only in the middle period of their life or only in the last period. The probability at birth with which middle-aged consumption is preferred is $q$, old-age consumption is preferred with probability $1 - q$. Hence, when young, investors have the following simple identical preferences over consumption ($c_0$, $c_1$, $c_2$) in the three periods of their life:

$$u(c_0, c_1, c_2) = qc_1 + (1 - q)c_2. \tag{3}$$

An investor only finds out exactly when he wants to consume at the beginning of the middle period of his life. The individual consumption shocks are assumed to be independent. Thus, even though investors are identical ex ante, they generally have different liquidity needs ex post. We shall refer to investors who want to consume in middle age as "impatient" and to those who can wait one period longer as "patient." The preferences specified in (3) provide the simplest possible specification of liquidity preferences.[4]

When young, each investor inherits an endowment $w$, $0 < w < V^*$, and nothing in later periods of his life ($w$ can be either interpreted as material wealth or as the limit to the exposure to the given firm resulting from the internal capital budgeting of the investor). To exclude trivial cases, in (7) in section 3 and (13) in section 4, we shall furthermore impose the restriction that $w$ be larger than some minimum value. This together with the above restriction implies that an individual investor's wealth is sufficient to buy some part of the firm, but not the whole firm.

### 2.3 *The Firm's Charter: Privately Held or Publicly Traded*

At any point in time, the firm is owned by a set of investors whose ownership status is determined by the firm's charter. We distinguish between two main types of ownership, a privately held firm and a publicly traded firm.

If the firm is publicly traded, it is listed on the stock market, and each owner has the right to sell his shares to anybody at any time. If the firm is privately held, there exists no such market. In addition, privately held firms typically do not allow their shareholders to sell their shares to anyone they like, and if they do, only after a costly screening procedure. Therefore, the liquidity of shares in a privately held firm is restricted. We capture these restrictions in our model by making the extreme assumption that, if the firm is private at time $t$, shares must always be sold to an inside shareholder in period $t + 1$, unless the firm as a whole is sold to a new set of owners. Thus, outsiders can only acquire shares in the private firm when all insiders want to sell. This occurs either in period $t + 2$, when the patient initial owners retire, or in period $t + 1$, in the event that

[4] The preferences assumed here are linear DIAMOND and DYBVIG [1983] preferences. For analysis of more general preferences, see, in particular, JACKLIN [1987] and VON THADDEN [1994].

all owners turn out to be impatient. We describe the precise trading mechanism for the two ownership structures in sections 3 and 4, respectively.

Another difference between private and public firms is the cost of trading. In practice, any publicly traded firm must bear a fixed cost of flotation; this cost can amount to up to 10% of the value of the firm at the time of the initial public offering. Similarly, when a privately held firm is sold to a new set of owners, there are substantial transactions cost (these include, among others, notaries' fees, auditing costs, and the costs of establishing exactly what assets and liabilities the new owners have a title on). We shall make the simplifying assumption that besides the fixed listing cost, $F > 0$, for a publicly traded firm, and the transaction costs, $K > 0$, of selling a privately held firm there are no other significant trading costs.[5] Moreover, we assume that $K = (1 + g)\,C$, with $g \geq 0$. This assumption reflects the idea that the transaction cost involved in selling the firm comprises at least the cost of ascertaining the value of $Y_t$, so that $K \geq C$.

Having described the two different types of ownership structure the firm can choose, it remains to determine how the choice of ownership structure is made. We assume that the firm's charter is determined by the owners of the firm and that it can be changed every period by unanimous agreement of all owners.[6] More precisely, at the beginning of period $t = 0$, there is an owner, or group of owners, wanting to sell the firm at the best possible price. This owner chooses a corporate charter and sells the firm. If the new owners agree to change the charter in $t = 1$, they do so, otherwise the existing charter remains valid until $t = 2$, etc.

Firm ownership is attached to shares. We assume that there is a finite number of shares, and therefore, a finite number of shareholders. Denote the number of shares under private ownership by $M^{pr}$, and that under public listing by $M^{pu}$. For simplicity, we will assume that $M^{pr}$ and $M^{pu}$ are exogenous constants.[7] We then denote the per share values of the flow returns in (1) by lower case letters: $y_t^{pr} = Y_t/M^{pr}$, $r^{pr} = R/M^{pr}$, etc. When there is no risk of confusion, we shall drop the superscripts.

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5 Arguably family-owned firms which are passed on from generation to generation within the family do not incur the same transaction costs when a new generation takes over. By excluding this possibility our model may exaggerate the size of the transaction cost incurred when ownership of a privately held firm changes hands.

6 Given that in the present model there is no disagreement among agents about future uncertainty, the type of decision rule for changing the charter is irrelevant. One can assume other decision rules, such as majority rule, without affecting the results below.

A good example illustrating the idea that the choice of ownership structure is always on the firm's agenda is the case of Goldman Sachs. This partnership has been contemplating the possibility of going pulic already five times in the last twenty five years (see *Financial Times*, January 23, 1996). Each time it has voted against this option.

7 These constants should be thought of as determined by physical limits and transaction costs. An interesting extension of the model would be to include them as choice variables in the corporate charter (i.e. allow for share repurchases, stock splits, etc.).

### *2.4 The Sequence of Moves and Events*

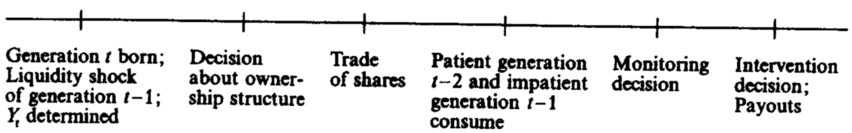
To complete the description of the model we provide the timing of all events and moves within a given period $t$.

1. The period begins with the birth of generation $t$; at the same time the liquidity shock of generation $t-1$, and the state of nature $Y_t$ is realized (but not revealed).
2. Following these events, the existing owners determine the corporate charter (ownership structure) of the firm.
3. Next, share trading takes place.
4. Following trade the patient shareholders of generation $t-2$ and the impatient shareholders of generation $t-1$ consume.
5. Once the new shareholders of the firm are in place, the decision on whether to monitor (which reveals $Y_t$ to the monitoring investor) is taken.
6. Finally, the intervention/reorganization decision is taken; and the period's realized cash flows are paid out to shareholders.

This sequence of moves and events is summarized in the time line of figure 1.

*Figure 1*

Timing of Period $t$




To close this section, it is worth highlighting some key features of our model. First, agents are involved in share trade either twice or three times in their lifetime, depending on their preference shock. Second, impatient shareholders obtain exactly one payout (when they are middle-aged), while patient shareholders obtain two (when middle-aged and old). Third, after they have experienced the liquidity shock, but before trading, the shareholders can change the ownership structure of the firm.

## *3. The Privately Held Firm*

Consider the firm at the beginning of period $t$, when the existing owners sell the firm as a privately held company to a new set of owners. The main question that arises at this point is how to determine the optimal number of new shareholders and the size distribution of their shareholdings. The basic tradeoff the existing owners face is one between *liquidity* and *control*: The more dispersed the new shareholdings are the more liquid shares will be at date $t+1$, but greater dispersion also reduces the incentives of any one shareholder to monitor the manager and intervene efficiently.

Monitoring is not an issue in period $t$, since it is a by-product of the sale transaction. Indeed, the new owners ascertain the value of $Y_t$ at the time of the sale and intervene efficiently following the sale. However, in period $t+1$ new information must be collected about $Y_{t+1}$ and monitoring takes place only if shareholders are induced to monitor. Only a shareholder with a large enough stake will have an incentive to monitor. Specifically, her holdings $h$ must be such that

$$\frac{h}{M}(1-\pi)L \geq C,$$

where $M = M^{pr}$ are the total number of shares, $C$ is the cost, and $(1-\pi)L$ the expected return of monitoring. We denote the minimum stake necessary for monitoring by $T$,

$$T = M\frac{C}{(1-\pi)L},$$

and assume that it is integer: Thus, whether monitoring takes place in period $t+1$ depends on the emergence of a large shareholder, and whether such a shareholder emerges depends on the form of ownership structure inherited from period $t$, the liquidity shocks of shareholders in period $t+1$, and how trading in shares in period $t+1$ modifies this distribution of shares.[8] In period $t+2$, monitoring is not an issue again since the firm is sold to a new set of owners, who intervene efficiently in that period, etc.[9]

We do not need to model the process of trade among owners of a privately held firm in detail. For the results of our analysis to hold, it is sufficient to assume that the trading game in $t+1$ has the following structure.

1. Assumption NAT (Non-Anonymous Trading): Trading is non-anonymous.
2. Assumption EX (Existence): For each realization of liquidity demand, trading has an equilibrium.
3. Assumption MLP (Minimum Liquidity Provision): In equilibrium, no impatient shareholder is unable to sell his shares.
4. Assumption DEP (Dispersion Ex Post): Suppose that the initial ownership structure is completely dispersed. A large shareholder (holding at least $T$ shares) emerges in equilibrium, if and only if the number of impatient shareholders at time $t+1$, $I$, satisfies $I+1 < T$.

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[8] Unless all original owners turn out to be impatient in period $t+1$, in which case the firm is sold in period $t+1$.

[9] Our firm is infinitely lived. In reality, most privately held firms only survive for a few years or decades. We could allow for finite-lived firms. However, this would only add unnecessary complications to the model.

Assumption NAT states that trades among owners in a privately held firm are observable. In particular, this assumption excludes the possibility of an anonymous Walrasian market for shares. It implies that the price(s) at which shares are traded reflect(s) the ownership structure that results from trading. Assumption EX is obviously necessary. Note that because of the incidence of the monitoring cost after trading, existence of equilibrium (in the Nash sense or the Walrasian sense) is not automatically guaranteed.[10] Assumption MLP is an obvious minimum requirement with respect to the efficiency of the trading mechanism.

Assumption DEP states that shareholdings will remain dispersed ex post, if ownership is dispersed ex ante and the number of liquidity tracers is sufficiently small. Note that if $I \geq T - 1$, a patient small shareholder can, in principle, form a (controlling) block of at least $T$ shares, solely by buying up impatient shares. If $I < T - 1$, however, a controlling block needs patient shares, too, i.e. shares that can hold out until $t + 2$ in order to reap the rewards from improved corporate control. Assumption DEP implies that this free-rider problem is sufficiently strong to prevent a controlling block from being formed.[11]

For the reader who wants to fix his or her ideas, the following game is a simple example of a trading mechanism in $t + 1$ satisfying the above assumptions.[12] Obviously, more complex and more realistic trading procedures are possible.

1. Aggregate liquidity demand, $I$, becomes publicly known.
2. All shareholders can simultaneously make non-discriminatory unrestricted bids for shares.
3. All shareholders can sell to the highest bidder at the offered price (one bidder is selected at random in case of a tie).

This game resolves the coordination problem which creates the need for assumption EX, by allowing potential sellers to focus on one shareholder as a potential buyer. Since the tender offer must be unrestricted, all liquidity traders can sell out; thus assumption MLP is satisfied.

Intuition suggests that the more concentrated the ownership structure in period $t$, the more likely is the emergence of a large shareholder in period $t + 1$.

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10 For example, if trading is standard Walrasian, equilibrium fails to exist, because demand correspondences are not upper hemi-continuous (see section 4 for a generalization).

11 The precise form of the free-rider effect operating here is not essential. As long as free-riding does prevent the emergence of a large shareholder in some contingencies, the tradeoff between liquidity and control which is our focus arises. The formulation given here has the advantage of simplicity (see HOLMSTRÖM and NALEBUFF [1992] for a discussion of the free-rider problem with a finite number of shareholders).

12 We have analyzed a variant of this game, without wealth constraints, in BOLTON and VON THADDEN [1998a]. The proofs given there can easily be adapted to the present framework.

Thus, the problem of design of ownership structure in period $t$ reduces essentially to the choice between two ownership structures. One is to create a large block of shares in period $t$, expecting it to persist in period $t + 1$; the other is to start out with a dispersed ownership structure and rely on trading in period $t + 1$ to achieve efficient concentration only when it is needed. The first structure has less liquid shares to the extent that it reduces the number of shareholders below the maximum of $M$, and thus reduces the number of potential buyers of shares in period $t + 1$. But, by creating a large block of shares ex ante, this structure ensures a more efficient supervision of management in period $t + 1$. The second structure maximizes liquidity but at the expense of efficient monitoring in period $t + 1$.

We consider these two alternatives – dispersed ownership and concentrated ownership in the privately held firm – in turn and then determine under what circumstances either of these equity structures dominates.[13]

Because of the stationarity of the intertemporal problem, we can concentrate on stationary structures. Therefore, let $v^D$ and $v^C$, respectively, denote the current value per share of the firm when its ownership is dispersed, $D$, and concentrated, $C$.

### 3.1 Maximum Initial Dispersion

Under this ownership structure there are $M$ shareholders initially, each owning one share. The key issue under this structure is whether a large shareholder emerges after trading in the secondary market at date $t + 1$. The main factor preventing the emergence of a controlling block is free-riding by small patient shareholders. All the small patient shareholders are willing to sell their shares to another shareholder only at the ex post value of these shares. If a controlling block were to emerge with probability one, then small patient shareholders would only be willing to sell their shares at the price $\pi r + (1 - \pi) l + \delta v^D$ per share, where $l = L/M$. But no bidder would offer to buy shares at that price in order to build a controlling block, because he must be compensated for paying the monitoring cost $C$. For this reason, the emergence of a controlling block in the secondary market is not guaranteed. There is, however, an important factor favoring the emergence of a controlling block: liquidity selling by the impatient shareholders.

Assumption DEP casts this tradeoff in a simple form: No controlling block emerges (because of free-riding) when there are too few impatient shareholders, whereas a controlling block emerges for sure if there are sufficiently many impatient shareholders. Therefore, concentration in $t + 1$ obtains with probability

$$\lambda = \lambda(M, \pi, q, L, C) = \sum_{i=T-1}^{M-1} \binom{M}{i} q^i (1 - q)^{M-i}.$$

[13] It will become clear in the analysis that follows that the two structures we consider are the only relevant ones.

With probability $q^M$ the firm is sold to new outside owners in period $t + 1$, and with probability $1 - \lambda - q^M$ the old owners continue without a controlling block.

Having determined when a controlling block emerges, we can calculate the value of a privately held firm under maximum dispersion, $V^D$. For this, it is useful to note that in period $t + 1$-trading, because of assumption MLP, shares are allocated efficiently among initial shareholders. Even though limited wealth or ex post market power (e.g. if only one shareholder is patient) may yield very bad bargains for some shareholders ex post, this is just a redistribution which does not affect firm value ex ante, when investors are symmetric. Firm value, therefore, is given by the solution to the Bellman equation (where we make use of the stationarity of the problem):[14]

$$V^D = (\pi R + (1 - \pi) L - (1 + g) C) + \delta q^M V^D + \delta[(1 - q^M)(\pi R + \delta V^D) + \lambda((1 - \pi)L - C)]. \tag{4}$$

The first term on the right hand side of (4) represents the expected flow return in period $t$ net of the transactions cost $K = (1 + g)C$. The second term represents the discounted value of the firm in period $t + 1$ in the event that all shareholders are impatient. The third term is the expected discounted value in period $t + 1$ in the event where at least one shareholder is patient. In the latter event the firm is not sold in period $t + 1$, and shareholders obtain an expected flow revenue of $\pi R$, when no controlling block emerges; and $\pi R + (1 - \pi) L - C$, when a large shareholder monitors the manager in that period. Note that the reasoning behind (4) is valid regardless of the investors' wealth, as long, of course, as $w > v^D + C$ (so that each investor can buy one share and monitor if necessary).

Solving (4) for $V^D$, we obtain the value of the privately held firm under maximum dispersion.

*Proposition 1:* The value of the privately held firm under maximum ownership dispersion is

$$V^D = \frac{1}{1 - \delta}\left(\pi R + \frac{1 + \delta\lambda}{1 + \delta - \delta q^M}((1 - \pi) L - C) - \frac{gC}{1 + \delta - \delta q^M}\right). \tag{5}$$

The value of the privately held firm under maximum dispersion is divided into two terms: The first term is the present discounted value of expected future cash flows (net of monitoring costs) and the second term is the present discounted value of recurrent transaction costs of private ownership transfer.

[14] Here, $V^D$ is average firm value (i.e. firm value calculated before the realization of $Y_t$ has been ascertained). The price at which the firm changes owners will depend on the $Y_t$. This formulation allows us to do the comparative statics with only one formula instead of two, without affecting the results.

### 3.2 Concentrated Ownership

To guarantee that the manager of the firm is always monitored, a sufficiently large controlling block must be set up in period $t$. In order to derive a pricing formula which is as simple as (4), we first assume that investors are not wealth constrained.

Clearly it is counterproductive to set up more than one controlling block in period $t$, since this reduces liquidity and creates a public-action problem among the blockholders. Also, the controlling block should not be too large since this would again unnecessarily reduce the liquidity of the stock. Hence, if ownership is concentrated, one investor should own a block of $T$ shares and all other investors one share.

Because trading is non-anonymous (assumption NAT), a blockholder will always want to sell her shares as a block when trading in period $t+1$. The reason is that breaking up a block can only lower the ex post value of the shares by reducing the likelihood of monitoring, and this will be immediately reflected in the price. Hence, (average) firm value under ex ante concentration is given by the solution to the following Bellman equation:

$$(6) \qquad V^C = (\pi R + (1-\pi)L - (1+g)C) + \delta q^{M-T+1} V^C + \delta(1 - q^{M-T+1})[\pi R + (1-\pi)L - C + \delta V^C].$$

It is instructive to compare the second and third term on the RHS of this equation with those of (4). Under concentrated ownership the probability of selling the whole firm to a new set of owners early and thus incurring the transactions cost $(1+g)C$ is higher, but the flow return in period $t+1$, when the existing owners remain in place is also higher. These two terms capture precisely the tradeoff between *liquidity* and *control* in the privately held firm.

Solving (6) we obtain the value of the privately held firm under concentrated ownership and no wealth constraints. How does this reasoning change when investors have limited wealth? Clearly, for (6) to hold, it is necessary that the group of investors as a whole has total wealth of at least $V^C$. Furthermore, the large blockholder must be able to purchase the block at the issue stage at its ex post value. As we have shown in a related context (Bolton and von Thadden [1998 a]), this value will be less than par if single shares trade at their ex post value in $t+1$. Since liquidity trading in $t+1$ can be absorbed by patient small shareholders (at or below the ex post value depending on their wealth), who are, as in the case of dispersed ownership, symmetric ex ante, this lower bound on investor wealth is sufficient to obtain the result.[15]

[15] Blocks in this situation will typically be issued at less than par because of the public good they constitute. However, the bound on investor wealth, (7), must also take the anticipated costs of monitoring into account.

*Proposition 2:* If investors' wealth satisfies

$$w > \frac{T}{M} V^C, \tag{7}$$

the value of the firm with a controlling block is given by:

$$V^C = \frac{1}{1-\delta}\left(\pi R + (1-\pi) L - C - \frac{gC}{1+\delta-\delta q^{M-T+1}}\right). \tag{8}$$

Comparing $V^D$ and $V^C$ it immediately appears that the present discounted value of transaction costs of ownership transfer is higher under concentration than under dispersion. On the other hand, the net present discounted value of cash flows is higher under concentration. It is therefore not clear a priori which ownership structure is better. The next subsection investigates in some detail the liquidity/control tradeoff by comparing $V^D$ and $V^C$, and provides conditions under which $V^D$ is dominated by $V^C$.

### *3.3 The Liquidity/Control Tradeoff*

The comparison between $V^D$ and $V^C$ depends on all parameters of the model. Here we shall consider four of them: the probability of liquidity demand (impatience) $q$, the transaction cost of ownership transfer $g$, the expectation and volatility of returns which vary with $\pi$, and the monitoring costs $C$. Before proceeding, however, it is helpful to simplify the expression for $V^C - V^D$. Straightforward computations yield the following formula.

*Lemma 3:* Concentration dominates dispersion ($V^C - V^D > 0$), if and only if

$$[1-\lambda-q^M][(1-\pi)L-C] > \frac{q^{M-T+1}-q^M}{1+\delta-\delta q^{M-T+1}} gC. \tag{9}$$

A number of useful insights can now be obtained by inspecting this inequality. We shall state them as propositions.

*Proposition 4:* Concentration dominates dispersion, if $q \mapsto 0$.

*Proof:* When $q \to 0$, the RHS of inequality (9) goes to zero, while the LHS remains strictly positive. *Q.E.D.*

This proposition is fairly intuitive: When $q$ is small, expected liquidity demand is low and this favors concentration. One might be tempted to conclude that the other extreme is also true: When $q \mapsto 1$, there is a high value of liquidity and therefore a dispersed ownership structure is preferable. However, when $q \mapsto 1$, the supply of liquidity by inside shareholders is also small. That is, when $q \mapsto 1$, it is likely that *all* inside shareholders want to sell their shares in period $t+1$, even when the firm starts out with a dispersed ownership structure. Therefore, the added liquidity benefit of dispersion is small. Indeed, when $q = 1$, $V^C = V^D$. It is, thus, not obvious how the two structures compare when $q \mapsto 1$.

The following proposition shows that the tradeoff for large values of $q$ depends in fact on the transaction costs of ownership changes, $g$.

*Proposition 5:* For $g$ large enough, there exist $0 < \underline{q}(g) < 1$, such that for all $q \in (\underline{q}(g), 1)$, dispersion is preferred to concentration. For $g$ small enough, $V^D(q) < V^C(q)$ for all $q \in (0, 1)$.

*Proof:* The RHS of (9) is strictly concave in $q$ and equal to 0 for $q = 0$ and $q = 1$. Its derivative with respect to $q$ at $q = 1$ is equal to $-(T-1)gC$. The LHS of (9) is strictly concave and decreasing in $q$, with value $(1-\pi)L - C$ at $q = 0$, value 0 at $q = 1$, and derivative $-2M((1-\pi)L - C)$ at $q = 1$.

*Q.E.D.*

For high values of $g$ and $q$ dispersion dominates since a privately held dispersed firm is able to offer good liquidity services with respect to period $t+1$-trading. In contrast, a concentrated privately held firm would offer poor liquidity and would force existing shareholders to sell to outsiders (and thus incur the transaction cost $g$) too frequently.

An interesting implication of proposition 5 is that in countries where the market for privately held firms is efficiently organized (and where as a consequence $g$ is low) one should expect to see more concentration in ownership in privately held firms.

Since preferences for liquidity are difficult to measure one would like to know how optimal share distribution varies with more directly observable parameters. In an interesting empirical study of the determinants of share concentration in large US corporations, DEMSETZ and LEHN [1985] have found that corporations working in unstable environments, with greater uncertainty, have a more concentrated ownership structure. Moreover, the largest shareholders in those corporations are not well diversified. They suggest that this greater concentration may be due to a greater need for monitoring of managers when there is more uncertainty. This explanation may also apply to the privately held firms in our model. To see this concretely it suffices to consider how the value of the firm under a given ownership structure is affected by changes in $\pi$, the probability of obtaining high cash flows. Indeed, a reduction in $\pi$ keeping $\pi R$ fixed can be interpreted as an increase in risk. An inspection of (9) yields the following.

*Proposition 6:* Concentration is more attractive for lower values of $\pi$. That is,

$$\frac{\partial}{\partial \pi}(V^C(\pi) - V^D(\pi)) < 0.$$

*Proof:* Observe first that $\frac{dT}{d\pi} > 0$. Therefore, the RHS of (9) is increasing in $T$. Since the effect of $\pi$ on $\lambda$ is of second order, the LHS is decreasing in $\pi$.

*Q.E.D.*

In the thought experiment of proposition 6, a decrease in $\pi$ should be understood as an increase in uncertainty of flow returns. When there is more uncertainty managers have more discretion and therefore there is a greater need for monitoring and intervention.

A similar reasoning shows how the decision to set up a controlling block is affected by the cost of monitoring $C$.

*Proposition 7:* The higher the cost of monitoring $C$, the more attractive is dispersion.

Thus, as DEMSETZ [1983] has pointed out in another context, equilibrium dispersion may be as much a reflection of an efficient response to high intervention costs as of inefficient management entrenchment.

### *4. The Publicly Traded Firm*

In this section we shall consider the other polar form of ownership structure we are interested in, the public listing of the firm on a stock exchange. We had characterized the privately held firm by two key properties: the prohibition to sell shares to outsiders and the non-anonymity of trading. We shall characterize the publicly listed firm by the two opposite extremes: the complete freedom to sell to anybody and an anonymous market of shares.

The restriction to trading within the pre-specified group of owners in the privately held firm clearly has costs in terms of liquidity. For example, when shareholders are all likely to be impatient there is little hope that investors are willing to buy the shares at a good price. This is a situation where it might make sense to float the company. Indeed, one of the main motives for going public in practice is to allow existing shareholders to sell their stake to a set of new shareholders, without exposing the new shareholders to too much liquidity risk. The option of going public, however, is not always available to small and medium sized firms because the listing cost $F$ is simply too high relative to the size of the firm. Moreover, in most exchanges listed firms are required to have a minimum capitalization as well as a minimum number of shares and shareholders.[16] Thus, the analysis of this section applies to firms whose size is sufficiently large that the option of going public is real.

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[16] An interesting example of a firm that has been in this position is Mesa Petroleum. This firm had too few shareholders to be eligible for floatation on NASDAQ. To resolve this problem, T. Boone Pickens, the CEO of Mesa, decided to merge his oil drilling company with a worthless copper mine that just happened to have sufficiently many shareholders (see PICKENS [1988]).

When the firm is listed on an exchange the liquidity of the stock is increased since there is a larger number of potential shareholders. In practice, however, the liquidity of a listed stock is not only a function of the number of potential shareholders but also of the specific trading mechanism on the exchange (e.g. whether trade is organized by market makers or through an order-driven centralized market clearing system). As in the previous section we shall not attempt to model the details of the trading mechanism. Instead, we shall abstract entirely from market microstructure issues and simply assume that the exchange is an anonymous Walrasian market.

In such a market any listed firm's shares are perfectly liquid; they always trade at a price equal to the firm's ex post value.[17] However, mirroring the tradeoff in the privately held firm, this liquidity may come at the expense of a loss of control. One consequence of anonymous trading is that if market prices reflect the expectation that efficient monitoring by a blockholder is taking place, then the blockholder has an incentive to reduce her monitoring activities and discretely unwind her position before the market realizes what is happening. This point has been stressed in other contexts by HUDDART [1993], ADMATI, PFLEIDERER and ZECHNER [1994], and KAHN and WINTON [1998].

More precisely, with anonymous trading there is no equilibrium in which a controlling block is in place with probability one. To see this, suppose by contradiction that a large shareholder is always in place. Then, the firm's stock price is

$$p = \frac{\pi r + (1 - \pi) l}{1 - \delta}.$$

But, at that price, the large shareholder is not compensated for her monitoring. As a consequence, either a large block does not emerge, or an existing large block is dispersed secretely on the market. Similarly, there is no equilibrium in which no controlling block ever emerges, since under this hypothesis the equilibrium share price would be equal to

$$p = \frac{\pi r}{1 - \delta}.$$

At this price it would pay an individual shareholder to buy up a sufficient number of shares, intervene, and sell all the shares in the next period, thereby making a guaranteed arbitrage profit.

[17] Formally, with a continuum of market participants, the probability of all participants' being impatient is zero by the Law of Large Numbers.

### *4.1 The Rational Expectations Equilibrium*

The above discussion suggests that an equilibrium may exist only if the emergence and persistence of controlling blocks is not perfectly predictable.[18] Indeed, we shall solve for a rational expectations equilibrium in which shareholders expect that with probability $\alpha > 0$ no controlling block emerges in any given period.

If a controlling block emerges only with probability $(1 - \alpha)$ in any given period, then competition forces the equilibrium price of a single share to satisfy

$$p = \pi r + (1 - \alpha)(1 - \pi) l + \delta p, \tag{10}$$

where $r = R/M$, $l = L/M$, and $M = M^{p*}$. Similarly, an investor who buys up a block of $B \geq T$ shares makes a profit of

$$B(\pi r + (1 - \pi) l + \delta p - p) - C.$$

In equilibrium, a large shareholder cannot make strictly positive profits. Therefore, for any given block size we must have:

$$p = \frac{1}{1 - \delta}\left(\pi r + (1 - \pi) l - \frac{C}{B}\right). \tag{11}$$

This shows that an investor who builds up a controlling block always has an incentive to buy as many shares as possible so as to maximize the returns he gets from monitoring. Thus, if a large block emerges, it necessarily consists of $B = w/p$ shares if $w/p \leq M$ and of the whole firm if $w > pM$. Substituting the optimal block size into (11) yields the equilibrium value of the publicly traded firm.

*Proposition 8:* The value of the publicly traded firm in an anonymous stock market is

$$V^p = \frac{1}{1 - \delta + C/w}(\pi R + (1 - \pi) L) - F. \tag{12}$$

Several observations are in order. First, note that the condition $w < V^*$ implies that the optimal block will always be smaller than $M$: The firm is not traded as a whole. Next, we still have to verify that the block investors buy in equilibrium is actually large enough to exercise control, i.e. that $w/p \geq T$. Using (12), this condition can be rewritten as

$$(1 - \delta) w \geq \frac{\pi R}{(1 - \pi) L} C. \tag{13}$$

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[18] The analysis in this section abstracts from regulatory features present on different stock exchanges. It can thus be used as a benchmark to evaluate different pieces of regulation. We come back to the issue of block persistence later.

Just as (7), this condition is a minimum wealth condition without which the corporate control problem would be uninteresting, and we shall impose it throughout.

Third, it is interesting to note that the block an investor will want to buy in the anonymous market setting is maximal, i.e. that the investor's wealth constraint is binding, whereas the constraint has not been binding in the context of the privately held firm. Indeed, in this latter case, firm value is maximized by creating as small a block as is compatible with efficient monitoring in order to obtain optimal liquidity. In the case of anonymous markets, liquidity (as measured by the number of market participants) is already optimal, and therefore, blocks can be made as large as possible in order to subsidize monitoring costs maximally.

Still, monitoring will be subject to free-riding in this case. By combining (10) and (11), we obtain

$$\alpha = \frac{M}{B}\frac{C}{(1-\pi)L} = \frac{T}{B}.$$

Here, $\alpha$ can be thought of as a measure of the loss of control in equilibrium or as a measure of the extent of the free-rider problem. Note that by (13), $\alpha \leq 1$. By substituting for $B$ and $p$ we obtain

$$\alpha = \frac{\pi R + (1-\pi)L}{(1-\pi)L}\frac{C}{(1-\delta)w + C}. \tag{14}$$

Thus, in particular, the loss of control is higher the tighter the wealth constraint of investors (the lower is $w$), the higher the discount factor $\delta$, and the higher the cost of monitoring $C$. If investors' wealth is severely constrained ($w$ is relatively small), the size of a block that can be acquired at a given price will be relatively small. Although equilibrium prices will, by (11), be smaller, too, this effect is less than proportional because of the fixed cost $C$. Hence, blocks are more expensive to acquire, the loss of control will be larger, and firm value be lower.

### 4.2 Publicly Traded Versus Privately Held

Having determined the respective value $V^P$, $V^C$ and $V^D$ we can now establish under what circumstances it is desirable for a firm to go public. A key difference between $V^P$ on the one hand and $V^C$ and $V^D$ on the other is that the degree of investor impatience, $q$, appears in the latter two values, but not in the first one. The reason is, of course, that $q$ is important in a situation in which potential trades are limited by the corporate charter, but is immaterial if trading is completely unrestricted. As we have seen in the last section, in the former case the size of $q$ determines the tradeoff between liquidity and control. But because listing of a firm's stock on an exchange may also involve a control loss, it is not clear a priori that going public is always a dominant solution.

The comparisons between the different ownership structures are obtained by directly comparing $V^P$, $V^C$ and $V^D$. We begin by comparing $V^P$ with $V^C$. The following proposition follows by straightforward calculations from (8) and (12).[19]

*Proposition 9:* A privately held firm with concentrated ownership has a higher value than on otherwise identical publicly traded firm if

$$\frac{1}{1-\delta}(\pi R + (1-\pi)L) > \left(1 + \frac{g}{1+\delta-\delta q^{M-T+1}}\right)\left(w + \frac{C}{1-\delta}\right) - \left(1 + (1-\delta)\frac{w}{C}\right)F. \tag{15}$$

Proposition 9 brings out several comparative statics results, some of which are obvious. For example, it is clear that the higher the fixed cost of floatation $F$, the less attractive is the option of going public. Similarly clear is that the higher the cost of transferring the ownership of a privately held firm, $g$, the less attractive is the option of keeping the firm private. It is also clear that a higher loss of control $\alpha$, given by (14), makes the publicly traded firm less valuable. However, most factors affecting $\alpha$ also affect $V^C$. Ceteris paribus, then, (15) shows that an increase in monitoring costs $C$, although it increases $\alpha$, makes the decision to go public more attractive, simply because these costs weigh more heavily in the privately held firm. Next, (15) shows that the lower $q$ and the higher $M^{pr}$, the lower the benefits of listing. In other words, when liquidity in the privately held firm is adequate (either because there are many shareholders or these shareholders are likely to be patient), it is less desirable to go public.

Furthermore, although this is ambiguous in (15), a direct comparison of $V^P$ and $V^C$ shows that increasing investors' wealth $w$ makes the publicly traded firm more attractive. In particular, in a world in which investors' funds are sufficiently large relative to the value of the firm, we would expect the firm to be publicly traded.[20] This result contradicts the somewhat naive intuition that investors would want to keep a firm private if only they had enough funds. Yet, it has a sound economic rationale which our analysis brings out. If investors have sufficiently large wealth to own substantial stakes in firms, public joint stock ownership allows them to indeed buy large stakes without loosing too much in terms of liquidity. In a privately held firm the fear of illiquidity tends to keep large stakes smaller, thus reducing the private gains from monitoring.

Note that when $g = 0$, the first best is attained when the firm is privately held and ownership is concentrated. But, when $F = 0$ the first best is not necessarily

[19] Note that since the number of shareholders only matters in the privately held firm, $M = M^{pr}$ in formula (15).

[20] Although this is outside the confines of the present model, this result suggests that if investors' wealth is heterogeneous, public listing can be attractive for larger firms, because it allows to attract at least one rich investor, without loosing too much liquidity.

attained if the firm is publicly held. Full efficiency is achieved in this case in the degenerate case in which the firm is held and traded as one block, i $B = M$, or $w \geq V^*$.

We know from section 3 that concentration in the privately held fin superior to dispersion if $q$ is small. For larger values of $q$, therefore, comparison of $V^P$ and $V^D$ becomes relevant.

*Proposition 10:* A privately held firm with dispersed ownership has a hi value than an otherwise identical publicly traded firm if

$$\frac{C}{(1-\delta)w+C}(\pi R+(1-\pi)L-C) > \frac{1-\lambda-q^M}{1+\delta-\delta q^M}\delta(1-\pi)L + \frac{g-1+\lambda+q^M}{1+\delta-\delta q^M}C - F(1- \tag{16}$$

A full comparative statics exercise of (16) is beyond the scope of the pres paper. However, several insights are relatively simple and point to an inter ing conclusion. As (16) or a direct comparison of $V^P$ and $V^D$ show, the follo ing constellations increase the relative value of private dispersed owners as compared to public listing: high listing costs $F$, small investor wealth small costs of ownership transfer $g$, small monitoring costs $C$, a large disco factor $\delta$, and a large success probability $\pi$. Except for the first two variab which only apply to the publicly listed case, all these constellations are ca where privately concentrated ownership tends to dominate privately disper ownership.

This observation suggests that, depending on $F$ and $w$, mainly two compa sons are relevant for the question of ownership design. If $F$ is relatively low a $w$ relatively high, public listing is relatively attractive, and the ownership desi question is whether to be publicly listed or privately held with concentrat ownership. If, on the other hand, $F$ is relatively high and $w$ relatively low, publ listing is relatively unattractive, and the question is whether to be private concentrated or privately dispersed. Put differently, the two key questions ar whether, given the characteristics of the firm, liquidity or control is the domi nant consideration, and, if liquidity is the dominant concern, whether to obtai it through public listing. Put differently again, if listing costs are low, ceteri paribus, we do not expect to observe privately helf firms with dispersed owner ship.[21]

[21] Yet, the precise tradeoff, in particular for large $q$, remains to be evaluated. This would be all the more useful because the German data mentioned in the introductio show that privately held firms with dispersed ownership do exist: Out of the 27 privately held firms that we have identified, 6 can be considered to have "dispersed ownership." Here, ownership is defined as dispersed if the firm is not listed and there are at least approximately 100 owners, as far as is known.

### *4.3 Block Trading*

An important assumption in the preceeding analysis has been that blocks can be secretly assembled and unwound. While this is a reasonable assumption for completely unregulated stock markets,[22] it is at odds with regulatory practice in several developed markets. In the US, for example, Section 13d filings must be made with the SEC within 10 days after ownership has crossed the barrier of 5%, and Section 16d requires disclosure of all trades above that barrier. The EU Transparency Directive stipulates similar obligations, although there the (lowest) critical barrier is only 10%. The analysis of this section, therefore, does not directly apply to present US equity markets. It can, however, serve as a benchmark against which to judge the value of some types of regulation.

The opposite extreme view to the one adopted in the preceeding analysis would be to assume that blocks can never be broken up secretly and a separate, perfect market for blocks exists.[23] It is simple to see that in this situation the free-rider problem of corporate control, and with it the inefficiency associated with public trading, is eliminated. For, if such a market exists, blocks will be traded on this market at their ex post value (accounting for monitoring costs), single shares will trade at a price $(\pi r + (1 - \pi) l)/(1 - \delta)$, blocks are always preserved, and firm value will be first best. The reason is that blockholders cannot exploit small shareholders' ignorance, but in turn are fully compensated for their services. Thus, it seems, all firms should be publicly traded (except for fixed listing costs).

How robust is this conclusion? In order to check its robustness in at least one important dimension, we now generalize the model to the case of asymmetric information.

## 5. *Asymmetric Information*

Asymmetric information has often been suggested as an important source of illiquidity in stock market trading. In the context of corporate governance, the impact of asymmetric information on liquidity has been emphasized, in particular, by Coffee [1991] who has argued that large ownership stakes are necessarily illiquid, because any attempt to sell them off would be perceived by the market as a sign that the seller possesses adverse information. In this section we want to integrate asymmetric information issues into our analysis and study this type of argument more thoroughly.

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[22] A good case can be made for putting the German stock markets prior to 1996 (when the new securities exchange act was adopted) into this category, at least as far as transparency is concerned (see, e.g., Adams [1994]).

[23] Note that this is not necessarily the case under the regulatory structures mentioned before. A grey zone always exists. In particular, even in the US, the "Wall Street Rule" of corporate governance (selling out if news are bad) occasionally seems to involve the break up of at least moderate size blocks.

To facilitate the comparison with the preceeding analysis, but also because the issue is of interest in itself, we will first consider the case of anonymous market trading under asymmetric information. Afterwards we will consider block trading.

### *5.1 Anonymous Trading Under Asymmetric Information*

To introduce asymmetric information as simply as possible, assume that when monitoring in period $t$, the large shareholder learns also $Y_{t+1}$. We shall derive a rational expectations equilibrium similar to the one studied in the last section.[24]

When trading in period $t + 1$, the blockholder has an informational advantage, giving rise to an adverse selection problem. We assume that when trading at date $t + 1$, market participants know the ownership structure of the firm in period $t$; in particular, they know whether the firm had a controlling block in period $t$ or not, and if it had one they also know the age of the blockholder. Furthermore, we assume that small traders do not know whether an existing blockholder is attempting to unwind her position. Large buyers notice this, of course, when buying into the firm. However, all market participants will be aware of the fact that a middle-aged blockholder can have two different motives if she decides to sell her stake: liquidity motives or adverse information.

It seems plausible that most participants in the market should know the ownership structure of the firm in the previous period and that they know something about the identity of the blockholder (in particular her approximate "age"). What may be debatable is the assumption that small traders do not notice when an existing blockholder wants to sell her stake. It is worth pointing out that the same partially revealing equilibrium prices would obtain (the probabilities $\alpha$ would change) in a model with the opposite extreme assumption, namely that small traders learn exactly when a blockholder wants to sell. Therefore, the critical aspect of anonymous trading is the fact that the buyers of shares are anonymous.

Given this information structure, the partially revealing equilibrium has the following properties.[25]

1. In equilibrium, all agents are indifferent between building up a controlling block or holding only a small stake (say, one share).
2. In addition, all agents correctly anticipate the size of blocks and the probability with which a controlling interest emerges or persists in equilibrium.
3. The sustainability of a block, $1 - \alpha$, the size of a new block, $B$, and the price of shares, $p$, differ depending on whether the market suspects informed

[24] This model has several features in common with Dow and Gorton [1993], [1995]. In particular, they also have an OLG structure and focus attention on non-revealing rational expectations equilibria. However, they do not consider corporate control issues.

[25] It can be verified that no fully revealing rational expectations equilibrium exists.

trading or not. If, at the time of trading, a controlling block is in place and owned by a middle-aged investor, all market participants must be aware of the possibility that this investor sells for informational reasons. We denote by $p_I$ the share price in this case, by $B_I$ the new block size, and by $\alpha_I$ the probability that no new block emerges, conditional on the existing blockholder selling out. If, on the other hand, there is no large investor in place or if this investor is old, hence must sell regardless of his information, there is no information in the market, and we denote the outcome by $\alpha_N$, $p_N$, $B_N$.

The equilibrium then is a tuple $(\alpha_I, p_I, \alpha_N, p_N)$, defined by the following system of four linear equations:[26]

$$(17) \qquad p_N = (\pi r + (1-\pi)l - c_N) + \delta[(1-\pi+\pi q)p_I + (1-q)\pi(r+\delta p_N)],$$

$$(18) \qquad p_N = (\pi r + (1-\alpha_N)(1-\pi)l) + \delta[\alpha_N p_N + (1-\alpha_N)p_I],$$

$$(19) \qquad p_I = \left(\frac{q\pi r + (1-\pi)l}{1-\pi+q\pi} - c_I\right) + \delta[(1-\pi+\pi q)p_I + (1-q)\pi(r+\delta p_N)],$$

$$(20) \qquad p_I = (\pi r + (1-\alpha_I)(1-\pi)l) + \delta\{(\alpha_I(1-\pi+\pi q) + (1-q)\pi)p_N + (1-\alpha_I)(1-\pi+\pi q)p_I\}.$$

The RHS of (17) represents the expected present discounted value *per share* of a block obtained in a contingency where either there was no block in place or the existing blockholder had to retire. In this contingency no information about the firm is revealed to the market. The first term represents the net expected flow return from period $t$ (since the blockholder buys $B_N$ shares in equilibrium if he is buying, he pays a monitoring cost per share of $c_N = C/B_N$). The second term represent the continuation value. This value comprises two parts: The first part represents the return from selling the firm in period $t+1$ (this happens whenever the blockholder is impatient – with probability $q$ – and whenever she is patient but gets bad news about the firm – with probability $(1-q)(1-\pi)$); the second part represents the return from selling the firm in period $t+2$ (this happens whenever the blockholder is patient and obtains good news about the firm – with probability $(1-q)\pi$). Given that a large block is in place at date $t+1$ the relevant equilibrium price at that date is $p_I$, and given that the blockholder must unwind her position at date $t+2$ the relevant equilibrium price is $p_N$.

[26] As is standard in finance, these conditions are zero profit ("no-arbitrage") conditions that keep all agents indifferent between buying and not. In order for the solution to these equations to define a (Walrasian) equilibrium, the auctioneer has to allocate agents appropriately (see KREPS [1977] for a discussion of this construct).

The RHS of (18) represents the expected present discounted value per share for a small shareholder (say, an agent holding only one share), under the same circumstances (when either no block is in place or the existing blockholder must retire). The first term represents the expected flow return from period $t$. Note that a small shareholder does not know whether a controlling block will emerge; he can only guess that it will emerge with probability $(1 - \alpha_N)$. The second term – the small shareholder's continuation value – can be understood as follows. The small shareholder is always ready to sell his share in period $t + 1$. Now, in that period it will be known whether the firm had a controlling block in period $t$ or not: If the firm did not have a controlling block the market price will again be $p_N$ (this occurs with probability $\alpha_N$); if the firm did have a controlling block (with probability $1 - \alpha_N$), the market value of the share will be $p_I$.

Next, the RHSs of (19) and (20) represent the payoffs of the large shareholder and a small shareholder respectively, in the contingency where a controlling block is already in place and the blockholder is middle-aged (so that she does not necessarily need to sell her position). The difference to the previous two equations then is, first, that in assessing the expected flow returns in period $t$ a new large shareholders must use conditional probabilities which reflect the fact that the blockholder from period $t - 1$ is determining her trading decision partly on the basis of private information. Second, small shareholders must adjust the probabilities about the emergence of a large block.

Solving the system (17)–(20) for the four unknowns $(\alpha_I, \alpha_N, p_I, p_N)$ yields the following solution.

*Proposition 11:* Suppose that blocks emerging in state $s \in \{N, I\}$ on an anonymous stock market with asymmetric information have the size $B_s$. Then there is a unique partially revealing equilibrium. In this equilibrium, *(i)* investors are indifferent between holding the controlling block or owning a small stake; *(ii)* controlling blocks do not emerge with certainty; *(iii)* the stock market price is given by

$$p_N = \frac{1}{1-\delta}\left(\pi r + (1-\pi)l - \frac{C/B_N}{1+\delta\pi(1-q)} + \delta\frac{1-\pi(1-q)}{1+\delta\pi(1-q)}\left(\frac{C}{B_N} - \frac{C}{B_L}\right)\right), \tag{21}$$

if the market knows that there is no informed trading; *(iv)* and by

$$p_I = \frac{1}{1-\delta}\left(\frac{q+\delta(1-\pi)(1-q)}{1-\pi+\pi q}\pi r + \frac{1-\delta\pi(1-q)}{1-\pi+\pi q}(1-\pi)l - \frac{C/B_N}{1+\delta\pi(1-q)} + \frac{1-\delta^2\pi(1-q)}{1+\delta\pi(1-q)}\left(\frac{C}{B_N} - \frac{C}{B_L}\right)\right), \tag{22}$$

if the market suspects that the blockholder may be selling as a result of bad news.

Thus, as in the previous section, anonymous trading in the stock market makes it impossible to guarantee that management is continuously monitored by a large shareholder. There is, however, another potential drawback of taking the firm public. This is that as a result of suspected insider trading the secondary market cannot perfectly insure shareholders against liquidity shocks. Not surprisingly, as can be checked from (21) and (22), the stock price fluctuates, with $p_N > p_I$, depending on whether the market suspects insider trading or not.[27] Thus, the blockholder is not insured against liquidity shocks; when she wants to sell in period $t+1$ for liquidity reasons she has to sell shares at a discount. Similarly, small shareholders face the uncertainty of whether a controlling block will emerge, and when it emerges they are exposed to the blockholder's liquidity shock. Therefore, keeping the firm private may be better for both control and liquidity reasons.

In order to explore this question, just as in the case of symmetric information, we have to analyze equilibrium block size and how it feeds back into the equilibrium price. As equations (17) and (19) show, blocks in equilibrium will always be maximal. Hence,

$$B_s = \frac{w}{p_s} \quad \text{for } s \in \{N, I\}. \tag{23}$$

Combining (21), (22), and (23), we obtain the value of the firm at the issue date, $V^P_{AI} = M^{pu} p_N - F$.

*Proposition 12:* The value of the firm when taken public in an anonymous market with asymmetric information is given by

$$V^P_{AI} = \frac{1}{1-\delta+\dfrac{C/w}{1+\delta\pi(1-q)}}\left[\pi R + \left(1 - \frac{2\delta\pi(1-q)}{1+\delta\pi(1-q)}\,\frac{C}{w+C}\right)(1-\pi)L\right] - F. \tag{24}$$

Equation (24) has exactly the same structure as its analogue under symmetric information (12). In particular, $V^P_{AI}$ does not depend on $M^{pu}$ (reflecting the fact that the demand for shares is independent of liquidity shocks) and is obtained

[27] Note that the observed sequence of equilibrium prices may well exhibit stretches of unchanging prices. The point is that ownership patterns, and therefore firm values, in the future cannot be predicted with certainty.

from $\pi R$ and $(1-\pi)L$ by a modified discounting rule. Two differences are noteworthy. First, the modified discount factor in (24) is greater than the one in (12), which tends to make $V_{AI}^P$ larger than $V^P$. Second, in (24) a term proportional to $(1-\pi)L$ is subtracted from the (modified) discounted value of $\pi R + (1-\pi)L$, which tends to make $V_{AI}^P$ smaller than $V^P$. Therefore, the comparison between $V_{AI}^P$ and $V^P$ is not clear a priori. However, if discounting is not too strong, an unambiguous statement is available.

*Proposition 13:* If $\delta > 1 - \dfrac{\pi R}{(1-\pi)L}$, then $V_{AI}^P > V^P$.

*Proof:* Direct computation shows that $p_N$ as given by (21) is larger than the share price under symmetric information, given by (11), if and only if

$$\frac{\pi R}{(1-\pi)L} > 1 - \frac{2\delta w}{w + C}. \tag{25}$$

The LHS of (25) is decreasing in $w$. Since $(1-\delta)w \geq \dfrac{\pi R}{(1-\pi)L} C$ by (13), substituting the threshold level for $w$ into (25) yields the result. *Q.E.D.*

Proposition 13 is interesting because it suggests that a structure with a potential informed trading problem is more valuable than one without. In interpreting the proposition one must, however, be careful, because it compares two different information structures. In the case of symmetric information we had assumed that information about $Y_{t+1}$ is unavailable at date $t$, whereas in this section we assume that it is available. If this information is available, it reduces average first-best monitoring costs, because there is no need for monitoring in $t+1$ if the firm is known to be good. This explains part of proposition 13. Yet, even without going into more detail, there is a lesson for regulation here. If disclosure requirements and insider trading punishments are so strict that they discourage the collection of valuable long-term information (information about $Y_{t+1}$), they can be value reducing.[28]

### *5.2 The Publicly Traded Firm in a Non-Anonymous Market*

To complete the analysis, we now consider the case of block trading under asymmetric information. In contrast to the last section, therefore, we assume that either stock market regulation or the firm's corporate charter can be designed in a way to prevent the unraveling of controlling blocks on the stock

[28] In BOLTON and VON THADDEN [1998 b], we discuss the issue of information acquisition and destruction in the context of ownership design in more detail.

market. For example, more disclosure requirements could be imposed on blockholders, or the corporate charter could ban the secret break up of blocks. If this is possible, the control loss of going public can be avoided, although the informational problem resulting from insider trading will still be present.

However, since blocks will not be broken up in equilibrium, single shares will be unaffected by the lemons problem in the market for blocks and trade at their first-best value,[29]

$$p_{AI}^{PB} = \frac{1}{1-\delta}(\pi r + (1-\pi) l). \tag{26}$$

Blocks, on the other hand, will be subject to a lemons problem. Denoting block size by $B$ (independently of the state by assumption), and letting $v_s$ denote the per share value of the block in state $s \in \{N, I\}$, depending on the age of the existing blockholder, the value of block shares is given by the following two no-arbitrage conditions:

$$v_N = \left(\pi r + (1-\pi) l - \frac{C}{B}\right) + \delta[(1-\pi+\pi q) v_I + (1-q)\pi(r + \delta v_N)], \tag{27}$$

and

$$v_I = \left(\frac{q\pi r + (1-\pi) l}{1-\pi+q\pi} - \frac{C}{B}\right) + \delta[(1-\pi+\pi q) v_I + (1-q)\pi(r + \delta v_N)]. \tag{28}$$

Note that (27) and (28) are identical to the corresponding equations (17) and (19) for the pricing of blocks in the case of anonymous trading, with the exception that monitoring costs per share do not depend on the state if single block shares are not traded. We can therefore directly use proposition 11 to obtain the following.

*Proposition 14:* Suppose that there is a block of size $B$ which cannot be split up secretly. Then the value of block shares under asymmetric information is given by

$$v_N = \frac{1}{1-\delta}\left(\pi r + (1-\pi) l - \frac{C/B}{1+\delta\pi(1-q)}\right), \tag{29}$$

[29] The superscript *PB* stands for "publicly traded with blocks." Formula (26) assumes that small shareholders trade before the block transaction becomes public. If this information is available when trading, the formula only holds on average (which is all that is of interest here).

if the seller of the block is known not to act on private information (i.e. is old-aged); and by

$$(30)\qquad v_I = \frac{1}{1-\delta}\left(\frac{q+\delta(1-\pi)(1-q)}{1-\pi+\pi q}\pi r + \frac{1-\delta\pi(1-q)}{1-\pi+\pi q}(1-\pi)l - \frac{C/B}{1+\delta\pi(1-q)}\right),$$

if the seller of the block may act out of private information (is middle-aged).

As in the case of anonymous trading, it is straightforward to show that $v_N > v_I$ and that blocks must have maximum size. Since block size cannot be changed, this implies that $Bv_N = w$: Investor wealth is fully used up to buy the block in the more expensive state. Combining this fact with (29) yields

$$(31)\qquad v_N = \frac{1}{1-\delta+\frac{C/w}{1+\delta\pi(1-q)}}(\pi r + (1-\pi)l).$$

This together with (26) shows that the value of the firm under block trading, $V_{AI}^{PB} = Bv_N + (M-B)p_{AI}^{PB}$, is given by a very simple expression.

*Proposition 15:* If blocks cannot be broken up secretly, the value of the publicly traded firm under asymmetric information is

$$(32)\qquad V_{AI}^{PB} = \frac{1}{1-\delta}\left(\pi R + (1-\pi)L - \frac{C}{1+\delta\pi(1-q)}\right) - F.$$

Proposition 15 asks for several comments. *First,* $V_{AI}^{PB}$ is larger than $V^* - F$, the value of the firm with non-anonymous trading under symmetric information. This observation is the direct analogue to the one for the case of anonymous trading in proposition 13. Again, one must be careful to note that this does not reflect an advantage of an ownership structure that allows for informed trading, but rather a different information structure. In the model of this section, there is information about $Y_{t+1}$ available at time $t$, which decreases average monitoring costs as compared to the model with symmetric information. *Second,* and relatedly, although $V_{AI}^{PB} + F$ is larger than the first best under symmetric information, $V^*$, it is smaller than the first best under the information structure considered in this section. Clearly, this first best depends on the precise assumptions on monitoring and intervention costs. For example, if one makes the extreme assumption that intervention is costless if only monitoring has occurred, first-best monitoring takes place every second period, and the first-best firm value is $\frac{1}{1-\delta}\left(\pi R + (1-\pi)L - \frac{C}{1+\delta}\right)$, which is larger than $V_{AI}^{PB} + F$. Other assumptions are possible, and all yield the same insight: Firm value under block trading is smaller than the first best, because the possession of private information induces blockholders to trade too often, thereby destroying valuable information.[30]

*Most importantly*, proposition 15 indicates that the conclusion about block trading drawn in the last section is robust, at least with respect to the introduction of private information. By comparing (24) and (32), using (31), one sees that for two reasons firm value is higher if blocks cannot be broken up secretly. First, single shares are worth more because the recurring loss of control under anonymous trading is eliminated. Second, and more interestingly, as (31) shows, also the block is worth more. The reason for this is more subtle and shows that the simple form in which we have presented COFFEE's [1991] argument for illiquidity at the beginning of this section is flawed. Blocks under non-anonymous trading are indeed illiquid because the blockholder has to accept a discount when selling for liquidity reasons. However, if the blockholder can sell out secretly (the case of subsection 5.1) and, therefore, sell without a discount compared to single shares, this depresses the share price so much that her block is worth less than if she had committed to sell the block openly. Put differently, COFFEE's [1991] argument ignores the option value (of not selling in the good state) associated with block holding and underestimates the equilibrium share price response to making blocks more liquid through anonymous trading.

*Finally*, it is interesting to compare the publicly traded firm under the asymmetric information structure of this section to the privately held firm. For this, it is necessary to consider in more detail the informational asymmetries that exist in the privately held firm and compare them to the one in the publicly traded firm. It is too late now to present this comparison in detail, but it is worth pointing out that the qualitative conclusions of section 4 with respect to the impact of the different parameters of the model remain valid, if information asymmetries in the privately held firm are at least not greater than in the publicly traded firm.

## 6. *Conclusion*

Several clear predictions emerge from our analysis. *First of all*, a number of simple parameters, such as average liquidity demand by investors, the costs of transferring ownership, the cost of monitoring, and the volatility and mean of corporate returns, determine whether the corporate control problem for a privately held firm is better solved by ownership dispersion or concentration. *Second*, an ownership structure in which the firm is privately held with dispersed ownership is typically dominated by an arrangement where the firm is publicly traded, unless the fixed listing costs are disproportionately high. *Next*,

30 We study this issue in more detail in BOLTON and VON THADDEN [1998 b].

the choice between going public and remaining private with a concentrated ownership structure involves a clear liquidity/control tradeoff when stock market trading is anonymous. This tradeoff works in favor of public listing if investors' wealth levels are sufficiently high, and in favor of private concentration if wealth levels are lower. *Next*, if public trading of block shares is non-anonymous, public listing tends to be superior, because then the free-rider problem of control is mitigated and liquidity is optimal. *Finally*, the liquidity/control tradeoff is present whether or not there is asymmetric information between large and small shareholders, and asymmetric information has ambiguous effects on liquidity in publicly listed firms.

It is a difficult question to determine whether in reality informational asymmetries increase when the firm goes public. We believe that less is known about ownership changes by shareholders in public firms than by shareholders in private firms. This belief is partly based on the casual observation that more information about ownership changes is disclosed to shareholders in private firms. Also, many smaller shareholders who own shares in privately held firms do so because they have a special relation to the firm and therefore are likely to know more about the large shareholder in the firm. However, at least in the US, regulation strongly limits the discretion and secrecy of large shareholders, so it may well be that the opposite is true and that there is less informational asymmetry in publicly traded firms.

As far as regulation is concerned, our model allows to analyze stock market disclosure requirements along two dimensions. First, we can analyze the impact of mandatory announcements of trades above certain thresholds, such as Section 13d or 16d filings in the US and the EU Transparency Directive. Second, we can analyze how transparency with respect to trading motives affects market values. The first type of disclosure affects the likelihood with which blocks are built up or dissolved (the $\alpha$'s in the model), the second the inference problem over liquidity shocks and adverse information. As we have argued in section 5, transparency with respect to informational motives can be desirable, but only if it does not discourage the collection of valuable information. For our results indicate that firm values under insider information about future firm values are superior to those without such information even though this information makes the market less liquid. With respect to the first type of disclosure, our analysis shows that such regulation is value increasing, but that the real problem lies in the secret dissolution of blocks, i.e. arises if critical thresholds (such as the 5% threshold in the US) are crossed from above. This is interesting, because the literature on corporate takeovers has usually argued against such thresholds, in order to facilitate the emergence of toeholds which render value increasing takeovers more likely.[31] Our analysis shows that a regulator can actually satisfy both objectives, because the problem is asymmetric: Disclosure

[31] See, in particular, SHLEIFER and VISHNY [1986] and BURKART [1995].

requirements for the build up of blocks can be designed to be less stringent than those for the dismantling of blocks.

Even though our model does incorporate several dimensions that are relevant to the problem of design of ownership structure, it does leave out some important dimensions which ought to be investigated in future research. Thus, for example, the model rules out private benefits of control for the blockholder. If these benefits are present the nature of the problem may change. Note, however, that one special case with private benefits already fits into the current specification of our model: If we let $C$ represent private benefits rather than costs of monitoring (with $C < 0$) then most of our analysis can go through with minor changes. But this is a rather special case since the private benefits are not obtained by diverting resources from minority shareholders.

Another important dimension left out of the analysis is the possibility of debt financing. When one introduces debt one allows for the possibility that the monitor is a debt-holder rather than a large equity-holder. A similar tradeoff between control and liquidity can arise with respect to debt financing. For example, bank financing may provide better control but less liquidity than bond financing.

To close the paper, note finally that our model could be slightly modified to provide a simple and plausible explanation for the life-cycle of many of the most successful firms. Typically, most firms start out as privately held firms. It is only when the firm has grown large enough that it contemplates the decision to go public. This decision is then taken either because the founders of the firm want to liquidate their stake – and introducing the firm into the stock market is the cheapest way of carrying out that transaction –, or because their investment needs have become so large that the firm must reach out to a new set of shareholders – and, once again floating the company is the cheapest way of performing this operation.

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