Ownership structure, Voting and Risk [*]

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Abstract

We analyze the determinants of a firm's ownership structure when decisions over risk are taken by majority vote of risk averse shareholders. We show that when a fraction of small, diversified shareholders abstains from voting, mid-sized blockholders may emerge to mitigate the conflict of interests between one large shareholder, who prefers less risky investments, and these small, non-voting shareholders. The paper offers a novel explanation for the puzzling observation that many firms have multiple blockholders. The paper develops numerous empirical implications, for example on the link between ownership structure and risk choices and on the relative size of blocks.

JEL: G32, G34, G11.

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The corporate governance literature has widely recognized the role of a large shareholder in mitigating free-rider problems regarding monitoring or other value enhancing actions that arise when there is dispersed ownership.[1] There is, however, a vast empirical literature which shows that ownership structure often takes more complex forms, ranging from one large shareholder to multiple intermediate-sized shareholders to fully dispersed structures.[2] The few theoretical studies which attempt to explain this heterogeneity in ownership structure focus on the role of mid-sized blockholders in disciplining managers or in sharing control benefits (see Winton (1993), Zwiebel (1995), Bennedsen and Wolfenzon (2000) and Edmans and Manso (2011), discussed in more detail below).

This paper offers a novel rationale for the existence of multiple mid-sized blockholders: they endogenously arise to mitigate the conflicts of interest between the largest blockholder on the one hand and dispersed shareholders on the other. More precisely, suppose there is an initial owner of a firm who wants to issue shares to raise capital for an investment project. The initial owner cannot commit to taking a value enhancing action in the future, e.g. monitoring the manager, unless he holds a sufficiently large stake (e.g. Maug (1998)).[3] Outside investors demand shares conditional on the offer price set by the initial owner. Both the owner and other investors are risk averse. Once the ownership structure is established, shareholders vote on the riskiness of the project that the firm subsequently undertakes. The investment technology is such that higher returns can only be achieved by increasing risk. Investors' preferences over the available risk/return profiles depend endogenously on their chosen shareholding. The higher the ownership stake, the lower the preferred

[1] Grossman and Hart (1980), Stiglitz (1985), Shleifer and Vishny (1986), Holmström and Tirole (1993), Admati et al. (1994), Burkart et al. (1997), Pagano and Röell (1998), Bolton and von Thadden (1998) Maug (1998), Kahn and Winton (1998) among others look at the active role of monitoring by the shareholder while Admati and Pfleiderer (2009) and Edmans (2009) focus on the shareholder's threat to exit from the firm as a governance tool.

[2] In the US (where it is widely agreed that regulation helps dispersed ownership), 67% of public firms have more than one shareholder with a stake larger than 5%, while only 13% are widely held and 20% have only one blockholder (Elaborations from the database of Dlugosz et al. (2006)). In Europe (where concentrated ownership is the norm), in eight out of the nine largest stock markets of the European Union the median size of the second largest voting block in large publicly listed companies exceeds five percent (data from the European Corporate Governance Network). La Porta et al. (1999) find that 25% of the firms in various countries have at least two blockholders while Laeven and Levine (2008) find that 34% (12%) of listed Western European firms have more than one (two) large owners where large owners are considered shareholders with more than a 10% stake.

[3] The moral hazard problem allows us to endogenize the existence of a first large shareholder. The model is, however, robust to alternative reasons why we have a large shareholder, e.g. signalling his faith in the firm to outside investors.

risk exposure, creating an endogenous conflict of interest between the initial owner, who must hold a large block, and dispersed shareholders.

We assume, realistically, that only a fraction of the small shareholders are active in that they actually vote. This assumption can be justified by a cost of voting and the free-rider problem that arises when an individual's vote is not pivotal.[4] The (partial) abstention from voting by small shareholders potentially drives a wedge between a shareholder's cash flow rights and the power in decision taking. For example, if the initial owner is the only blockholder, he might have a minority of cash flow rights, but a majority of votes cast. Dispersed shareholders thus might anticipate that the future investment decision will not be in their favour, which reduces their willingness to pay for the shares. Since the total fraction of shares they hold may be large, this reduction in share price hurts the initial owner. The latter may then benefit from the emergence of another smaller blockholder who would be pivotal and indirectly serve as a commitment device for the initial owner to shift the choice of risk towards an outcome that is more favourable to dispersed shareholders. Paradoxically, of course, as an additional shareholder acquires a larger stake, his preferences move closer to those of the initial owner, who holds a large stake. The additional blockholder thus allows the initial owner to sell shares at a higher price, without going as far as allowing small shareholders to implement their preferred choice of risk. Note however that because the benefit of choosing the project is outweighed by the cost of being poorly diversified, the mid-sized blockholder, in spite of being pivotal, benefits less from his shareholding than dispersed shareholders. In this sense he provides a public good to dispersed shareholders.

In addition to the above ownership structure, we show that other ownership structures may emerge, depending on the severity of the moral hazard problem in monitoring faced by the initial owner. If the moral hazard problem is severe, the initial owner must retain a large stake, increasing the subsequent conflict of interest with dispersed shareholders. In this case, the equilibrium ownership structure will feature one large shareholder (the initial owner) who is pivotal in voting and a fringe of dispersed shareholders, who pay a low price for their shares. Conversely, when conflicts

[4] For a micro foundation of shareholder abstention from voting, see van Wesep (2014). In the US vote turnout of shareholders is between 70% and 80% (Bethel and Gillan (2002), Ferri and Sandino (2009) and Hamdani and Yafeh (2013)). Practitioners are aware of the importance of passive investors. GMI Ratings for CalPERS (2013) documents the importance of absenteeism and regulation on how to deal with the broker non-votes.

of interest are small (the moral hazard problem is mild), a dispersed ownership structure may arise in which the initial owner is the only blockholder, but he has a small stake and so will be outvoted by dispersed shareholders, who thus will be willing to pay a high price for their shares.

Our model has implications for how decisions on risk are affected by ownership structure: in particular, decisions are effectively determined by the shareholder who is pivotal - and that may not be the largest shareholder, but could be a mid-sized blockholder. The idea that mid-sized blockholders are activists in firm decisions is supported empirically (Helwege et al. (2012) and Yermack (2010)) and by survey evidence (McCahery et al. (2010)), but has so far been difficult to explain from a theoretical perspective.

In our model multiple large shareholders are associated with higher risk. These predictions are consistent with the findings of several papers in the empirical literature, which show that firms with less concentrated ownership invest in higher risk projects, such as R&D and skill intensive activities (Carlin and Mayer (2000; 2003), Faccio et al. (2001), John et al. (2008), Laeven and Levine (2009), Wright et al. (1996)).

Our model also predicts that multiple large shareholders choosing higher risk, should be positively related to higher firm value while a single large shareholder is associated with lower firm value. Consistent with our theory, several papers find that firms with multiple blockholders have higher market value (Lehmann and Weigand (2000), Volpin (2002) and Maury and Pajuste (2005)).[5]

Furthermore the model highlights how ownership structure affects underpricing in IPOs. In an equilibrium where blockholders are present, share prices are below the reservation price of a well diversified shareholder. Hence, according to our theory, IPO underpricing arises when mid-sized blocks are present and does not occur with other ownership structures. This is consistent with some empirical studies that find a relationship between underpricing and ownership structure (Brennan and Franks (1997), Chitru et al. (2004) and Goergen and Renneboog (2002)).[6]

The model identifies a set factors which affect ownership structure and through it a firm's risk

[5] Konijn et al. (2011), however, find the opposite relation empirically.

[6] Stoughton and Zechner (1998) and DeMarzo and Urosevic (2006) show that IPO underpricing can serve to ensure the participation of large investors who can monitor and hence be value enhancing. In these papers, control considerations are absent and the role of multiple large investors is not analyzed. Empirically these models imply that there is no difference between one or multiple blockholders.

profile. One is the degree of moral hazard linked to the value enhancing action taken by the largest blockholder. Even though the value enhancing action does not affect risk directly, it affects the size of the largest block and hence firm's risk preferences. In particular our theory predicts that for medium sizes of the largest blockholder at least another blockholder should emerge. Moreover, the size of the second largest block increases in the size of the largest block (so as to counterbalance its voting power). Moreover, the size of each block decreases in the number of blockholders. These predictions are confirmed empirically by Carlin and Mayer (2000).

Another factor which affects ownership structure is regulation determining voting rules and the possiility of proxy voting. In the US for example broker non-votes and absenteeisms are treated differently across states: In California shares that are not voted are counted as voting with management, while they are counted as abstentions in Delaware (GMI Ratings for CalPERS (2013)). Our model predicts that, *ceteris paribus*, economic systems which thwart voting by minority shareholders should have firms with more concentrated ownership. This happens because a large initial owner can retain an outright majority of votes cast with a smaller fraction of shares owned - obviating the need to introduce a second blockholder. Conversely, ownership structures where effective control is with dispersed shareholders are harder to sustain, as they require a larger fraction of total share ownership to be in the hands of small, dispersed shareholders. We are not aware of empirical work that directly tests for such a relationship. There is, however, indirect evidence from the comparison of ownership structures in the UK and the US. Becht et al. (2009) find higher risk taking and higher value creation in the UK, and link it to UK pension fund activism. The UK legal system favours smaller but significant ownership stakes that can be thought of as mid-sized blocks.

The inherent degree of riskiness of a firm also affects its ownership structure. Firms operating in very risky sectors can potentially suffer large conflicts of interest between the largest blockholder and small shareholders. Our model predicts multiple blockholder ownership structures in such firms, while firms operating in more mature sectors should tend to have only one large shareholder with a fringe of small shareholders.

Growth opportunities have similar implications for ownerships. Firms with significant growth opportunities should exhibit larger conflicts of interest among shareholders. Hence, we expect such firms to have less dispersed ownership structure.

The theoretical and empirical literature on the role of blockholders in corporate governance is extensively discussed in Edmans (forthcoming). We therefore focus our discussion of the literature only on the most closely related papers. In the existing literature, the main rationale for the existence of blockholders is to discipline a manager, either through monitoring and/or through the threat of 'exit' (Kahn and Winton (1998), Edmans (2009) and Admati and Pfleiderer (2009)). When multiple blockholders are present, the monitoring effort of the single blockholder is reduced because of free rider problems (Winton (1993) and Noe (2002)). Hence, the exit route becomes a more efficient tool to discipline the manager (Edmans and Manso (2011)).

Alternatively blockholders arise to overcome wealth constraints at the cost of sharing private benefits (Zwiebel (1995)) or diverting cash (Bennedsen and Wolfenzon (2000)). In Zwiebel (1995), multiple blockholders may arise from the following trade-off. On the one hand, investors are wealth constrained, so several of them are needed to finance the firm. On the other hand, shareholders in control have to share a fixed amount of private benefits. The sharing rule of private benefits is such that large blockholders lose out when additional (mid-sized) blockholders emerge. Similarly, Bennedsen and Wolfenzon (2000) study a wealth-constrained initial owner who needs to issue shares to finance a project. The winning coalition of shareholders can divert cash from minority shareholders. Bennedsen and Wolfenzon (2000) show that multiple blockholders may arise so as to internalize more of the negative cash flow effects implied by subsequent expropriation by the winning coalition.

We provide a new rationale for the existence of medium-sized blockholders. Risk aversion determines the rise of blockholders even when no wealth constraints are present: the initial owner could choose to borrow funds and retain an undiluted equity stake, but he chooses not to do so because of risk aversion. Unlike Zwiebel (1995) and Bennedsen and Wolfenzon (2000), in our model blockholders share the cost of being undiversified and may actually be better off when one or more additional blockholders emerge.

Moreover, in Zwiebel (1995) and Bennedsen and Wolfenzon (2000) ownership structure affects the division of private benefits or cash diversion, both of which are difficult fo observe empirically.

In contrast to that, in our model ownership structure is linked to risk choices of the firm, which in principle can be measured. Specifically, in our model, but unlike Zwiebel (1995) and Bennedsen and Wolfenzon (2000), blockholders play an active role in determining a firm's risk exposure. Therefore, we predict that more concentrated ownership structures are associated with more conservative investment choices.

Our paper is also related to some of the literature on inside equity ownership, where an insider's risk aversion plays a crucial role (see Lambert et al. (1991), Sung (1995), Ou-Yang (2003) and Edmans and Gabaix (2011) for theoretical treatments and Prendergast (2002) for a review of the empirical contributions). This literature focuses on the role and extent of internal/managerial ownership, while our model is mainly concerned with the composition of external ownership.

Finally, the paper contributes to the literature on voting. Typically, in models on voting, individual preferences are fixed and independent of the voting power of an agent (see Dhillon (2005) for a review). By applying voting theories to corporate governance, we show that voters as shareholders have risk preferences that depend endogenously on their voting power. Moreover, voting power is itself endogenized through the ability to purchase shares at an endogenously determined price. One contribution our paper makes in this context is to point out the important role that vote abstention by small shareholders has on the overall ownership structure of a firm.

1. The Model

There is an entrepreneur (the initial owner) who has an investment opportunity requiring capital, K. The initial owner can finance the project by issuing equity or by personal borrowing. There is a large number, N, of potential investors.

The initial owner and the potential investors have identical utility functions:

$$u_j = -\frac{1}{\gamma}e^{-\gamma Y_j} \tag{1}$$

where $j \in \{i, E\}$, E refers to the initial owner, i refers to a potential investor, γ is the parameter of risk aversion and Y_j is final wealth. Each agent j, is initially endowed with 1 unit of wealth. As agents have CARA preferences, this assumption is w.l.o.g.

An agent j can invest his wealth either in the firm or in the risk free asset. We define respectively w_j and $1 - w_j$ the fraction of wealth invested in the firm and the risk free asset. Since each agent is endowed with one unit of wealth, w_j also denotes the amount of wealth invested in the firm. The gross return of the risk free asset is normalized to 1. The return and the risk of the firm is determined during the game. No assumptions on w_j are made, so borrowing and short selling are possible.

There are 5 periods: $0, ..., 4$. At date 0 the initial owner chooses to invest w_E in the firm and to retain a fraction α_E of shares. The remaining fraction, $1 - \alpha_E$, is tendered through a take-it-or-leave-it offer to outside investors in exchange for the remaining capital, $K - w_E$. We assume that the initial owner, if he raises any capital at all, raises exactly the amount of capital required to undertake the project.[7] Thus, $\frac{1-\alpha_E}{K-w_E}$ represents the fraction of shares per unit of capital invested by outside investors; or alternatively $\frac{K-w_E}{1-\alpha_E}$ is the capital invested per fraction of shares, that is, the issue price. The initial owner acts as a monopolist in setting this price, implicitly determined at date 0 by the initial owner's choice of w_E and α_E. Note that although all outside investors pay the same price, $\frac{K-w_E}{1-\alpha_E}$, this price is not necessarily the same as the price implicitly paid by the initial owner, $\frac{w_E}{\alpha_E}$.

At date 1 shares are issued and a potential outside investor, i, maximizes his utility by choice of w_i, which corresponds to demand for shares $\alpha_{i,D} = \frac{1-\alpha_E}{K-w_E} w_i$. We assume that if there is under-subscription the project cannot go ahead. If there is over-subscription, shares are distributed according to the following rationing rule: shares are distributed to investors according to the size of the demand (larger ones first), and, whenever there is a tie, investors are chosen randomly and if chosen receive the full quantity demanded. Hence, when attributed, investor i receives a fraction $\alpha_i = \alpha_{i,D}$ of shares. The ownership structure, once established, is observed by all.

At date 2, shareholders decide on the risk/return profile of the firm's business activities, captured by an investment opportunity with value, $\tilde{V}$, which is uncertain and given by $\tilde{V} = (R + \tilde{\epsilon})X + \mu K$ with $\tilde{\epsilon} \sim N(0, \sigma^2)$ and parameters $R > 0, \sigma > 0$. $X \in [0, \bar{X}]$ captures a choice of risk/return profile,

[7] If the firm has to invest the surplus in the risk free asset, it can be shown that the initial owner never wishes to raise more than $K - w_E$ from outside investors.

determined by a shareholder vote and μK is the extra expected cash flow from a value enhancing action (described in more detail below). Hence, $\tilde{V} \sim N(\bar{R}X + \mu K, X^2\sigma^2)$.[8]

X can be thought of as a decision on the type of project a firm will invest in, or the nomination of a CEO who comes with a certain risk profile. Ex-ante, i.e. when shares are issued, X is a non contractible action, maybe because it is impossible to describe at that point all possible business opportunities that may later emerge. It becomes contractible ex-post (at date 2) when the set of all possible future investments becomes known (as in Grossman and Hart (1980)).[9] At that point X is determined by the Condorcet voting mechanism: the Condorcet winner, if it exists, is the project that wins against every other project in pair-wise majority voting. We assume one-share-one-vote and, in case of tie-break, the outside investors, and among them those with the largest fraction of shares, win.

In order to capture different participation in the vote, we assume that a fraction λ of outside investors are *ex-ante* 'active'. An active investor, if he becomes a shareholder, will vote. The remaining fraction of outside investors are 'passive', that is they never vote. Moreover, outside investors take into account their anticipated voting behaviour (active or passive) when choosing their demand for shares. We define liquidity shareholders as those outside investors who hold an optimally 'diversified' portfolio (given their beliefs on the investment characteristics). This is in contrast with 'blockholders' who we define as shareholders that are not fully diversified. We assume that *ex-post* a fraction λ of liquidity shareholders is active in any ownership structure. This assumption can be justified by the observation that the utility of an individual liquidity shareholder does not change regardless of whether he casts his vote or not. Hence, active and passive investors are willing to pay the same price to become liquidity shareholders. We show later that only active investors choose to become blockholders. Hence, blockholders always vote. Strictly speaking, the fraction of active investors in the remaining population therefore changes. Since N is large, we approximate this fraction by λ.[10]

[8] Scaling RX by the size of the investment K does not change the qualitative results of the model.

[9] In order for voting to play some role, there must be something to vote on, i.e., something not already contracted upon (see Hart (1995, p. 92-93)).

[10] Alternatively, we could assume that there is an infinite number of outside investors and that there is a lower bound on the size of a claim that can be held (e.g., nobody can hold a claim worth less then one cent). This ensures that there is a well defined maximum dispersion of ownership (see Proof of Propositions 2-4).

The rationale for assuming $\lambda < 1$ is that some investors may have a prohibitive cost of obtaining and understanding the firm's investment proposals, or actually exercising their vote.[11] A higher λ corresponds to a decrease in the cost of vote participation, due for example to the introduction of new disclosure rules which lower the cost of understanding investment proposals, or the possibility of voting by proxy. The parameter λ captures the effect of regulation on a firm's ownership structure.

In period 3 the initial owner decides whether to take a non-contractible costly value enhancing action, denoted by $\mu \in \{0, 1\}$.[12] When management and control are separate, $\mu = 1$ can be interpreted, for example, as the decision to monitor the manager. Otherwise, μ could simply refer to the choice of a costly effort level. In the rest of the paper we will refer to $\mu = 1$ as monitoring, though, as we said, it can be interpreted much more broadly. We assume that the action increases the project value proportionally to the required investment, i.e. by μK, at a cost of $m\mu K$.

Note that the assumption that the monitoring decision occurs after the voting decision is w.l.o.g. Finally at period 4 pay-offs are realized. Figure 1 shows the time-line of the game.

— INSERT DhillonFig1.pdf HERE —-

Taking into consideration that $\alpha_{i,D} = \frac{1-\alpha_E}{K-w_E} w_i$, we formulate the maximization problem of the initial owner and outside investors in terms of certainty equivalent. Investor i's objective function is:

$$U_i = \alpha_{i,D} (RX + \mu K) - \frac{K - w_E}{1 - \alpha_E} \alpha_{i,D} - \frac{\gamma}{2} \sigma^2 X^2 \alpha_{i,D}^2 + 1 \tag{2}$$

The first part of expression (2) is the expected wealth from investing in the firm, the second part

[11] Alternatively, they might not think strategically and believe that their vote cannot affect the overall outcome. As will become clear later, this belief is actually self-fulfilling in equilibrium in that passive investors end up choosing stakes that are too small to make them pivotal.

[12] Assuming that only the initial owner can take this action does not affect the results: Proposition 6 shows that if the initial owner does not have the incentive to take the action, no other investor does.

is the cost of acquiring the stake and the third part is the dis-utility from risk exposure.

Similarly, the initial owner's objective function is:

$$U_E = \alpha_E(RX + \mu K) - w_E - \frac{\gamma}{2}\sigma^2 X^2 \alpha_E^2 + 1 - m\mu K \tag{3}$$

Our notion of equilibrium is subgame perfect equilibrium (see Appendix A.1.1 for a more detailed definition). Therefore, each player's choice at a given date is made, given the history of play up to that date, and given expectations about future actions. These expectations have to be correct in equilibrium. At date 0, the initial owner chooses α_E, w_E so as to maximize (3). Then, at date 1, all outside investors simultaneously choose $\alpha_{i,D}$ maximizing (2). At date 2 all active shareholders vote, maximizing their respective objective functions, (3) for the initial owner and (2) for the outside investors. Finally, at date 3, the initial owner chooses whether or not to monitor. Moreover, the optimization is subject to the following constraints: *i)* Feasibility: The initial owner is able to raise the minimum capital needed, i.e. $K - w_E = \sum_i w_i$ and *ii)* Full Subscription: $\alpha_E + \sum_i \alpha_{i,D} \geq 1$. The rationing rule ensures that $\alpha_E + \sum_i \alpha_i = 1$. $\alpha_E = 0$, $w_E = 0$ corresponds to the case where the initial owner does not raise capital and invests all his wealth in the risk free asset, i.e. $U_E = 1$. It is obvious that the initial owner will raise capital if he gets a utility of at least 1.

Note that in many putative equilibria more than one investor needs to buy shares. In such cases there is also trivially a no-trade equilibrium where no investor buys any shares anticipating that no other investor will buy shares and the project will then not go ahead.

2. Monitoring Incentives, Voting and Outside Equity Ownership

2.1 Monitoring Incentives and Voting Game

We solve the game by backward induction. We first derive the initial owner's monitoring choice, given that at date 3 the ownership structure $\boldsymbol{\alpha} = (\alpha_E, \alpha_1, ..., \alpha_N)$ and the voting outcome, denoted by X_{med}, are already known. For ease of exposition, we order the outside investors by decreasing stake, so that α_1 denotes the largest outside shareholder.

Lemma 1. The initial owner chooses $\mu = 1$ iff $\alpha_E \geq m$.

The initial owner monitors if and only if his stake in the firm in sufficiently large, $\alpha_E \geq m$. Once α_E is observed, outside investors can infer the equilibrium monitoring decision.

The second last stage is the voting game. We now derive agent j's ideal project, X_j, i.e., that X which maximizes U_j, given the agent's shareholding, α_j. Note that because of its additive effect, the monitoring decision does not affect the optimal X.

Lemma 2. The ideal project X_j for shareholder $j \in \{i, E\}$, is uniquely defined by:

$$X_j = \min\left[\frac{R}{\gamma\sigma^2\alpha_j}, \bar{X}\right] \tag{4}$$

The desired risk exposure X_j decreases in the shareholder's stake α_j. This follows from the fact that the objective function is quadratic in X. Moreover, for any given α_j shareholder preferences on X are single peaked. Hence, by the median voter theorem (Black (1948)), there exists a Condorcet winner on the set $[0, \bar{X}]$ and it coincides with the preferred project of the median voter. The vote outcome, X_{med}, is thus the ideal project of that shareholder whose ideal project is such that 50% of the voting shareholders would have (weakly) preferred a smaller X and 50% a (weakly) higher X.[13] Denote by $\bar{\alpha} \equiv \frac{R}{\gamma\sigma^2\bar{X}}$ the fraction of shares below which a shareholder's ideal project is the high risk corner $\bar{X}$, i.e. for $\alpha_j \leq \bar{\alpha}$, $X_j(\alpha_j) = \bar{X}$.

Note that because the monitoring decision does not depend on the firm's risk choices and vice versa, the timing of the two decisions can be reversed.

2.2 Ownership Subgame

In the ownership subgame, outside investors buy shares having observed (α_E, w_E), anticipating the voting outcome, given their beliefs about the equilibrium ownership structure (i.e. other investors' demands), and anticipating the initial owner's monitoring decision. In addition, active investors take into account that their own stake may affect the voting outcome.

[13]Consider the frequency distribution of shares of initial owner and active investors only on the set X. The median X is the unique X_j such that exactly half the shares are on either side of it.

Formally, an Equilibrium Ownership Structure (EOS) is a Nash equilibrium of the subgame corresponding to a particular combination (α_E, w_E). In particular:

Definition 3. An Equilibrium Ownership Structure (EOS) is a vector $\boldsymbol{\alpha}$ such that for a given (α_E, w_E), the following conditions are satisfied:

a) Investors maximize their expected utility by choice of $\alpha_{i,D}$, given (w_E, α_E) and their beliefs on other agents' stake, α_i and the monitoring choice, μ. If they are passive they act given their beliefs on X_{med}, while if they are active they choose $\alpha_{i,D}$ strategically, taking into account the impact of their vote on X_{med};

b) Beliefs must be correct in equilibrium;

c) All shares should be attributed, i.e. $\sum_i \alpha_{i,D} \geq \sum_i \alpha_i = 1 - \alpha_E$;

d) $\mu \in \arg\max U_E$ given (w_E, α_E, X_{med}).

We define 4 types of EOS depending on who is pivotal. When there is a conflict of interest, the identity of the pivotal shareholder matters, and we distinguish between three cases (i) the n-Blockholders EOS, where n outside blockholders are pivotal; (for simplicity, we focus on the case where all blockholders hold the same fraction of shares, α_n, although it is easy to extend the results to asymmetric cases); (ii) the Initial Owner EOS; or (iii) the Liquidity Shareholders EOS. There may, however, be no conflict of interest in equilibrium, in which case the issue of who is pivotal does not arise. This is the fourth case we consider.

The next step is to find the EOS for each pair (α_E, w_E). The analysis is quite technical and is largely relegated to Appendix A.2.3. Below, we discuss some preliminary results that help develop intuition for the main mechanisms at work. We start by analyzing the optimal fraction of shares held by liquidity shareholders and blockholders.

Consider first the liquidity shareholders' shares. We denote $\alpha_{l,med}$, the shares demanded and attributed to liquidity shareholders when the anticipated voting outcome is X_{med}. A straightforward maximization of the utility function (2) with respect to α_i yields:

$$\alpha_{l,med} = \frac{X_{med}R + \mu K - \frac{K - w_E}{1 - \alpha_E}}{\gamma X_{med}^2 \sigma^2} \tag{5}$$

In the particular case where $X_{med} = \bar{X}$, we denote the optimal fraction of shares (the solution of the maximization above) by $\bar{\alpha}_l$.

A useful benchmark is to consider outside shareholders' preferred choice of X and α, if they had the power to determine X.

Lemma 4. If $\frac{K-w_E}{1-\alpha_E} > \mu K$, outside investors preferred choice is $X_{med} = \bar{X}$ and $\alpha_i = \bar{\alpha}_l$.

An outside shareholder can reduce exposure to risk by diversifying optimally (reducing his α_i). If she could choose unilaterally X, her ideal project would be $\bar{X}$, the maximum risk/return project. The optimal demand corresponding to $\bar{X}$ is $\bar{\alpha}_l$ by definition.[14]

It follows immediately from Lemma 4 that in a Liquidity Shareholder EOS (i.e., when the liquidity shareholders are pivotal) the equilibrium choice of risk is $\bar{X}$.

Consider next the demand for shares by blockholders, if they arise.

Lemma 5. If $\frac{K-w_E}{1-\alpha_E} > \mu K$, blockholders arise only if they are pivotal. In an n-Blockholder EOS they would therefore hold

$$\alpha_n = \frac{\alpha_E - \lambda(1-\alpha_E)}{(1-\lambda)\,n} \tag{6}$$

where $\alpha_E > \alpha_n > \alpha_{l,n}$.

The purpose of becoming a blockholder (and holding a suboptimal portfolio) is to move the decision away from X_E towards $\bar{X}$. If blockholders arise at all, they must therefore be pivotal and hence, only active investors choose to become blockholders.

It is also clear from (6) that blockholders cannot arise when $\lambda = 1$. In such a situation we can have two cases. The initial owner has an outright majority and is in control, so acquiring a block will not change that. Alternatively the liquidity shareholders have an outright majority and are in control, in which case outside shareholders already achieve the best they can hope for and there is no need for a blockholder. When $\lambda < 1$ and no blockholders arise, there are $(1-\lambda)(1-\alpha_E)$ shares that are not voted. An active shareholder can potentially change the voting outcome by purchasing a block of these shares and using them to tip the voting balance.

[14] Lemma 12 in the Appendix shows that in equilibrium the initial owner always prefers to set a price high enough to satisfy $\frac{K-w_E}{1-\alpha_E} > \mu K$.

An individual blockholder's stake is the minimum required to become pivotal, given by (6). A blockholder always wants to hold fewer shares than the initial owner. This is because in order to become pivotal it is sufficient for the blockholder to position herself between the initial owner and the liquidity shareholders. No blockholder wants to own more, as that would expose her to higher risk without changing anything in terms of control. If she holds any less, she ceases to be pivotal and would then prefer to be a liquidity shareholder. Note that this differs from Bennedsen and Wolfenzon (2000) where outside investors prefer to be part of the winning coalition and multiple blockholders of equal size arise.

A blockholder will then choose an X between the preferred choice of the liquidity shareholders and of the initial owner (Lemma 4). This is the sense in which blockholders mitigate the conflicts of interest between the initial owner and the liquidity shareholders.

As the blockholders arise to counterbalance the initial owner's voting power, the larger the initial owner's stake, the larger the blockholders' ($\frac{\partial \alpha_n}{\partial \alpha_E} > 0$). These predictions are consistent with Carlin and Mayer (2000) who report a positive relationship between the size of the largest blockholder and the second and third blockholders.

Note also that what determines whether blockholders gain control is their joint stake $n\alpha_n$. Therefore, when there are more blockholders each one can be smaller as long as they add up to a stake that can counterbalance the initial owner ($\frac{\partial \alpha_n}{\partial n} < 0$). In line with these results, Carlin and Mayer (2000) find that when a third blockholder is present, the size of the second is significantly smaller than the first, but similar to the third blockholder. This differs from Zwiebel (1995): there blockholders arise because of the initial owner's wealth constraints and hence the larger the initial owner's stake the smaller is the external blockholders'.

Before moving on to a full description of equilibria we introduce some additional notation. In order to get full subscription, the initial owner must satisfy outside investors' participation constraints by setting a low enough price, $\frac{K - w_E}{1 - \alpha_E}$. This corresponds to a lower bound on w_E as a function of α_E. This lower bound will differ depending on the ownership structure and is denoted $\underline{w}_{E,\iota}$ with $\iota = \{E, n, L\}$ depending if respectively an Initial Owner, an n-Blockholders or a Liquidity Shareholders ownership structure emerges. The exact values of $\underline{w}_{E,\iota}$ are given in equations (22)-(24)

in the Appendix.

We partition the equilibria into two types: Monitoring Equilibria and Non-monitoring Equilibria. The next proposition characterizes what happens when the initial owner chooses not to monitor.

Lemma 6. In any equilibrium where $\mu = 0$, the initial owner either does not raise capital, if $w_{E,L} > 0$ or sells the firm, if $w_{E,L} \leq 0$. When selling the firm the unique equilibrium which arises is a Liquidity Shareholder EOS with $X_{med} = \bar{X}$, $\alpha_E = 0 < m$, $w_E = \underline{w}_{E,L}$ and each shareholder's stake is $\bar{\alpha}_l$.

Lemma 6 shows that when the initial owner chooses not to monitor he also exits from the firm ($\alpha_E = 0$). The choice of $\alpha_E > 0$, $\mu = 0$ is dominated by the choice of either selling the firm or not raising capital. Since the initial owner acts as a monopolist in the pricing of shares and has no constraints on his shareholdings from monitoring, he can extract the full rent of the firm without incurring any risk by simply selling the firm (i.e. $\alpha_E = 0$, $w_E < 0$). Investors are willing to buy shares only if the value created is high enough to compensate for the risk. When this is not the case, the initial owner does not raise capital ($w_E = \alpha_E = 0$).

Since all agents have CARA utility with the same coefficient of risk aversion, the initial owner cannot benefit from selling the firm to another agent who would then monitor. The Liquidity Shareholder EOS is the only ownership structure which can arise when the initial owner sells the entire firm.

In what follows, we will use the non-monitoring pay-off of the initial owner, i.e. the maximum pay-off from either not raising capital (pay-off is 1) or selling (payoff is $R\bar{X} - K + 1$) as the reservation utility that defines his participation constraint.

3. Equilibrium Ownership

This section analyzes the final step of the model, i.e. the initial owner's choice of α_E and w_E. It provides necessary and sufficient conditions for the existence of equilibria with different possible ownership structures, namely an n-Blockholder EOS (Section 3.1), an Initial Owner EOS (Section

3.2), a Liquidity Shareholder EOS (Section 3.3) and a No Conflicts EOS (Section 3.4).

3.1 n-Blockholder Equilibria

This section shows under which parameter values an n-Blockholder equilibrium arises.

Proposition 1. If

$$m \in \left(\max\left[\bar{\alpha}, \tilde{\alpha}, \underline{m}_n(n)\right], \min\left[\hat{\alpha}(1), \bar{M}_n(n)\right]\right], \tag{7}$$

then the only equilibrium ownership structure (with positive trade) is an n-Blockholder EOS.

In an n-Blockholder EOS, the initial owner chooses $\mu = 1$, $\alpha_E = m$, $w_E = \underline{w}_{E,n}$ and the n blockholders hold α_n given by (6). The firm's project, X_{med}, is given by (4) with $\alpha_j = \alpha_n$ and liquidity shareholders' position, $\alpha_{l,med}$, is given by (5).

The full expressions for $\tilde{\alpha}$, $\hat{\alpha}(1)$, $\bar{M}_n(n)$ and $\underline{m}_n(n)$ are given in the Appendix.

Proposition 1 demonstrates that for intermediate monitoring costs the firm will have multiple blockholders. In equilibrium the initial owner retains just enough shares to have an incentive to monitor, i.e. $\alpha_E = m$ (Lemma 1). When $\alpha_E = m > \bar{\alpha}$ (condition (7)), the initial owner prefers low risk/return projects, while outside investors prefer high returns even with higher risk. Hence, there is an endogenous conflict of interests.

When some liquidity shareholders do not vote ($\lambda < 1$), there exists a parameter range such that liquidity shareholders do not have the majority of votes cast ($\tilde{\alpha} < \alpha_E = m$) even if the initial owner does not hold the majority of the shares ($\alpha_E = m < \frac{1}{2}$). Without outside blockholders the initial owner would have control and choose low risk/return. However, when $m \leq \hat{\alpha}(1) < \frac{1}{2}$, a single active shareholder prefers to deviate from being perfectly diversified, to becoming a (pivotal) blockholder and changing the voting outcome towards a higher level of risk/return. Thus, the only possible type of ownership structure has at least one outside blockholder. Proposition 1 highlights the fact that it is not necessarily the largest shareholder who effectively determines a firm's decisions. Instead, mid-sized blockholders may have effective control.

Although all active investors are ex-ante identical, only some of them decide to become blockholders. This is like in a (discrete) public goods provision problem: the outside blockholders contribute to the public good (by increasing X) because the value of the public good to them is sufficiently high. This allows some recipients of the public good (the liquidity shareholders) to free-ride. This free-rider problem constitutes a coordination problem among investors and hence, the number n of blockholders is not uniquely determined.

This also implies that allocations to liquidity shareholders are rationed and they would be willing to pay a higher price for the shares.[15] The difference between their willingness to pay and the price set by the initial owner can be interpreted as IPO underpricing. Unlike the usual public goods contribution game, however, when blockholders buy a larger block of shares, their preferences over X change and are closer to those of the initial owner. This is why the presence of blockholders mitigates, but does not remove, the conflict of interests between the initial owner and outside investors.

Note that the initial owner could prevent blockholders' entry by increasing his shareholding to $\alpha_E \geq \frac{1}{2}$ to get full control.[16] This would, however, reduce the price at which he can sell shares, because liquidity shareholders would then anticipate a less favourable choice of X. The initial owner may therefore prefer having outside blockholders, which serve as a commitment device to implement a more risky project, and allow him to sell the shares at a higher price. This result differs from Zwiebel (1995) and Bennedsen and Wolfenzon (2000), where the initial owner would prefer not to have any blockholders so as not to share the private benefits of control, but the initial owner is forced to bring blockholders on board because of capital constraints.

Alternatively, the initial owner can choose either not to monitor and exit from the firm, or not to raise capital at all (see Lemma 6). Condition $m \in [\underline{m}_n(n), \bar{M}_n(n)]$ ensures that the initial owner prefers to have outside blockholders over either increasing his holdings to get full control, or exiting the firm / not raising capital.

The initial owner chooses to retain the minimum fraction of shares to preserve the incentive to monitor ($\alpha_E = m$). If he were to hold a larger (but still minority) stake ($m < \alpha_E < \frac{1}{2}$), the

[15] The initial owner cannot take advantage of this, because increasing the share price would drive out the blockholder(s), reducing the value of the shares to liquidity shareholders. Only when the initial owner could price discriminate between blockholders and liquidity shareholders would this be possible.

[16] Remember that the initial owner is not capital constrained, and could therefore finance the whole project alone ($w_E = K$), possibly by borrowing. However, in equilibrium, he prefers to rely on outside equity in order to limit his risk exposure.

blockholders would react by increasing their own holdings, preventing the initial owner from gaining control. Although the resulting larger blockholdings would shift the vote outcome towards more conservatism, its negative impact on the issue price coupled with an increase in the initial owner's risk exposure make such a move undesirable.

Note also that the initial owner cannot prevent blockholders' entry by setting a different w_E. With $w_E = \underline{w}_{E,n}$ the initial owner extracts the maximum rent subject to satisfying blockholders' participation constraints. If he sets a higher w_E (a lower share price) he loses rent, without changing the ownership structure. If he were to set a lower w_E (higher price) outside shareholders' participation constraint would be violated and there would be no demand for shares. Finally, note that $\underline{w}_{E,n}$ can be negative and $\alpha_E > 0$. In this case the capital raised from outside investors $K - w_E$ exceeds the investment, K, required for the project. The initial owner retains the difference ($-\underline{w}_{E,n} > 0$), which can be interpreted as a compensation for the monitoring costs and the entrepreneurial idea.

The next corollary shows that an n-Blockholder equilibria exist even when $m > \hat{\alpha}(1)$, uniqueness of the equilibrium ownership structure cannot be guaranteed.

Corollary 1. If

$$m \in \left(\max\left[\bar{\alpha}, \tilde{\alpha}, \hat{\alpha}(1), \underline{m}_n(n)\right], \min\left[\frac{1}{2}, \hat{\alpha}(n), \bar{M}_n(n)\right] \right), \tag{8}$$

then there exists an n-Blockholder EOS with $n \geq 2$.

When $\alpha_E > \hat{\alpha}(1)$, the type of ownership structure is no longer unique. The initial owner now has a large stake and therefore a single investor does not have an incentive to acquire the large block required to counterbalance the initial owner. An $n-$Blockholder EOS still exists since several strategic investors would be willing to jointly hold the required block. In addition there may exist an Initial Owner EOS, as shown in the next section.

3.2 Initial Owner Equilibria

In this section we discuss the conditions under which an Initial Owner equilibrium arises. In this ownership structure, the initial owner holds a block and there is a fringe of liquidity shareholders.

Proposition 2. If either

(A)

$$m \in \left(\max\left(\bar{\alpha}, \hat{\alpha}(1)\right), \min\left[\bar{M}_E, \frac{1}{2}\right]\right] \tag{9}$$

or (B)

$$m \in \left(\max\left[\frac{1}{2}, \bar{\alpha}\right], \min\left[\bar{M}_E, 1\right]\right] \tag{10}$$

there exists an Initial Owner EOS and $\alpha_E = m$.

If either

(C)

$$m \in \left(\max\left[\bar{\alpha}, \tilde{\alpha}, \right], \min\left[\underline{m}_{\frac{1}{2}}, \bar{M}_E, \frac{1}{2}\right]\right) \tag{11}$$

or (D)

$$m \in \left(\max\left[\bar{M}_{\frac{1}{2}}, \bar{\alpha}, \tilde{\alpha}, \right], \min\left[\bar{M}_E, \frac{1}{2}\right]\right) \tag{12}$$

there exists an Initial Owner EOS and $\alpha_E = \frac{1}{2}$.

In an Initial Owner EOS, $X_{med} = X_E$, $\mu = 1$, $w_E = \underline{w}_{E,E}$ and all outside investors are liquidity shareholders with a stake equal to $\alpha_{l,E}$.

In cases (B), (C) and (D) this is the unique equilibrium with positive trade.

The full expressions for $\bar{M}_E$, $\underline{m}_{\frac{1}{2}}$ and $\bar{M}_{\frac{1}{2}}$ are given in the Appendix.

This proposition summarizes the four possible cases when an Initial Owner eauilibrium arises. In such an equilibrium the initial owner is in control and chooses project X_E. He invests just enough capital to induce the liquidity shareholders to buy shares ($w_E = \underline{w}_{E,E}$) and extracts all the rent. Condition $m \leq \bar{M}_E$ ensures that the initial owner prefers ex-ante to monitor rather than not to monitor.

In the first 2 instances, as we found in the n-Blockholder equilibrium, the initial owner retains just enough shares to have an incentive to monitor, i.e. $\alpha_E = m$.

In case (B), the monitoring costs are so high, $m > 1/2$, that the initial owner holds more than 50% of the shares, so no outside investor can ever take control. In this case the Initial Owner equilibrium is the only possible ownership structure (with positive trade).

A less obvious result is that an Initial Owner equilibrium also exists when $\hat{\alpha}(1) < m < \frac{1}{2}$ (case (A)). In such a case the initial owner holds less than 50% of the shares and there is a conflict of interest between initial owner and outside investors ($\alpha_E = m > \bar{\alpha}$ and hence $X_E < \bar{X}$). As $m > \hat{\alpha}(1)$, no single active investor has a unilateral incentive to deviate to becoming a blockholder in order to influence the voting decision. Here n active shareholders need to co-ordinate to buy blocks and be in control (Corollary 1). If no co-ordination occurs, an Initial Owner equilibrium arises.

There are two other cases when an Initial Owner equilibrium exists. The initial owner can choose to hold more shares than strictly needed to satisfy the monitoring incentive compatibility constraint. He chooses to do so in order to avoid the loss of full control in favour of the blockholders. This occurs when the monitoring costs are either very low $m < \underline{m}_{\frac{1}{2}}$ (case (C)) or very high, $m > \bar{M}_{\frac{1}{2}}$ (case (D)). If m is close to half, the cost of retaining more shares (relative to m) and getting full control is relatively low: the initial owner does not lose much by way of diversification, but gets a discontinuous jump in the benefit of control. When monitoring costs are low, yet the conflicts of interest are large ($\bar{X} \geq X_n >> X_E$), the initial owner faces a large cost from ceding control. For this reason he prefers to increase α_E to a point where he can control the vote outcome, i.e. $\alpha_E = \frac{1}{2}$.

3.3 Liquidity Shareholder Equilibrium

We now study the equilibrium when liquidity shareholders are in control.

Proposition 3. If

$$m \in \left(\bar{\alpha}, \min\left[\frac{1}{2}, \tilde{\alpha}, \bar{M}_L\right]\right), \tag{13}$$

then the only equilibrium ownership structure (with positive trade) is a Liquidity Shareholder EOS. The equilibrium is characterized by $X_{med} = \bar{X}$, $\mu = 1$, $\alpha_E = m$, and $w_E = \underline{w}_{E,L}$ and outside investors hold $\bar{\alpha}_l$.

The full expression for $\bar{M}_L$ is given in the Appendix.

A Liquidity Shareholder equilibrium exists when the monitoring costs are sufficiently low ($m \leq \tilde{\alpha}$) so that there are enough active liquidity shareholders to be pivotal, but not so low as to render conflicts of interest negligible (i.e. $m > \bar{\alpha}$). In this equilibrium, the liquidity shareholders are in control, while the initial owner retains just enough shares to monitor, $\alpha_E = m$ and invests just enough capital to induce the liquidity shareholders to buy shares ($w_E = \underline{w}_{E,L}$).

Note that the initial owner could always choose to retain a strictly higher fraction of shares to induce a n-Blockholder ownership structure ($m < \alpha_E < 1/2$) or remain in control himself ($\alpha_E = 1/2 > m$). In either of these cases, the vote outcome would be closer to his own preferred project. However, the higher control comes at the expense of a lower price, more dilution and a less diversified portfolio for the initial owner. For this reason the initial owner strictly prefers the Liquidity Shareholder ownership structure. Finally, condition $m \leq \bar{M}_L$ ensures that the initial owner prefers ex-ante to monitor rather than not to monitor.

3.4 No Conflicts of Interest Equilibrium

We finally show under which parameters the equilibrium features no conflicts of interest among shareholders.

Proposition 4. There exists an equilibrium without conflicts of interest if

$$m \in \left(0, \min\left[\bar{\alpha}, \bar{M}_E, 1\right]\right]. \tag{14}$$

In this equilibrium, $X_{med} = \bar{X}$, $\mu = 1$, $\alpha_E = m$, $w_E = \underline{w}_{E,L}$

Now the monitoring costs are so low ($m \leq \bar{\alpha}$) that the initial owner's stake is small enough to remove any conflict of interest with outside investors: everybody now agrees that the firm should move to the corner of maximum risk/return $\bar{X}$. In this case it is immaterial who has a majority of votes cast, so we do not further analyze the identity of the class of shareholders that has an effective majority.

Figure 2 provides a graphic representation of the equilibria as a function of the monitoring costs, m, and the invested capital, K.

—INSERT Fig2 here—

As the monitoring costs increase we move from an equilibrium with no conflicts of interest among shareholders to a situation where liquidity shareholders are in control, to an n-Blockholder equilibrium and finally to an Initial Owner equilibrium.

Increasing the capital required for the investment induces the initial owner not to invest money as the investment becomes unprofitable. On the other hand, when the capital required is low but the monitoring cost is high the value of monitoring is limited and hence the initial owner prefers not to monitor and sell the firm.[17]

4. Comparative Statics and Empirical Implications

In this section we explore the empirical predictions of our model. For each model parameter, we investigate the effects first on the possible equilibria, then on the size of the blocks and finally on the firm's risk and value.

The effect of agency problems

A key parameter determining ownership structure is the monitoring cost m, which can be interpreted more broadly as a proxy for the level of agency problems in the firm. As we saw in Lemma 1, the value of m is directly proportional to the required stake of the initial owner.[18] We showed that the ownership structure depends on the size of the initial owner's stake: when the initial owner has an intermediate stake (agency problems are significant but not very severe), multiple blockholders emerge (Proposition 1). If the initial owner's required stake is very high (very severe agency problems), the initial owner is predicted to be the only large shareholder: he exercises control while the remaining shares are dispersed among liquidity shareholders, who hold

[17] The precise parameter range for which the owner sells out or does not raise capital is obtained from the violation of the initial owner's participation constraint (see proofs of Propositions 1-4).

[18] This element is common to all the models where the initial owner arises to monitor or is manager of the firm, but not to all the models on ownership structure (e.g. Zwiebel (1995) and Bolton and von Thadden (1998)).

the optimally diversified portfolio (Proposition 2). When the initial owner's required stake is very low (low agency problems), the firm is widely held (Propositions 3 and 4).

An important implication of our model is that it is not necessarily the largest shareholder who determines firm's choices, but rather the pivotal one: the median shareholder can be the initial owner, the blockholders or the liquidity shareholders, and it is his/her size that determines the firm's risk choices (see Lemma 2). Our model suggests that less concentrated ownership structures should be correlated with higher firm risk. This is a novel result in the theoretical literature. To the best of our knowledge there is no empirical study that specifically focuses on the issue of ownership structure and risk, although some authors present indirect evidence consistent with our predictions. Carlin and Mayer (2003) show that high risk firms have multiple blockholders, while low risk firms usually have a single large shareholder. John et al. (2008) demonstrate a negative relationship between ownership concentration and risk. Laeven and Levine (2008) focus on ownership structure of banks and show that the risk-taking behaviour of banks depends on the ownership structure: banks with at least one blockholder are more conservative than firms with dispersed ownership. Finally, Faccio et al. (2011) find that firm's risk choices are positively correlated with the degree of diversification of the largest shareholder which is consistent with our theory. In addition we predict that risk choices should depend on the stake of the second blockholder, if there is one. Therefore, it would be interesting to extend this study to analyse the role of the other blockholders in determining the firm's risk choices.

In our model the presence of blockholders also increases firm value.[19] This prediction is common to models where blockholders have a governance role (Kahn and Winton (1998), Maug (1998), Admati and Pfleiderer (2009), and Edmans and Manso (2011)), but differs from theories where blockholders can decrease value because of overmonitoring (Burkart et al. (1997)) or inefficient monitoring (Winton (1993)). In Bolton and von Thadden (1998) and Edmans (2009) a blockholder has both a governance role and reduces liquidity of share trading. In our case blockholders increase value not because they discipline managers (the initial owner does that), but because they mitigate the conflict of interest among shareholders. Empirically, with the exception of Konijn et al.

[19]In the model n-Blockholder equilibria are often the only possible equilibria. In such cases, blockholders increase value in the sense that the alternative of having an initial owner in control would destroy value.

(2011), an inverse relationship between firm value and ownership structure concentration has been documented in numerous studies (Barclay and Holderness (1989), Kirchmaier and Grant (2005), Lehmann and Weigand (2000), Volpin (2002), Roosenboom and Schramade (2006), Faccio et al. (2001) and Maury and Pajuste (2005)). These studies confirm the relationship between value and concentration, but they are unable to pin down the mechanism through which this occurs.

Unlike Zwiebel (1995) our model predicts that the size of the second blockholder's stake is positively related to that of the initial owner (Lemma 5). In our model, blockholders need to hold a larger stake when the initial owner's stake is bigger, so as to counterbalance his voting power. Moreover, in those firms that have multiple blocks, we would expect the largest block to be larger than the sum of the remaining blockholdings (see equation (6)).

Turning to predictions on risk and return, as the number of blockholders, n, increases, the size of each of the blocks decreases (Lemma 5) and the risk/return of the firm increases (Lemma 4): when there are several blockholders, each one can be smaller and still counterbalance the initial large shareholder. In line with these predictions, Carlin and Mayer (2000) find a positive relationship between the size of the largest blockholder and the second and third blockholders. Moreover, when a third blockholder is present, the size of the second is much smaller and similar to the third one.

The effect of voting participation by liquidity shareholders

When there is an n-Blockholder ownership structure, an increase in the vote participation of liquidity shareholders, λ, reduces the size of the median block, α_n. A higher λ has two effects on ownership structure. When λ increases, an outside investor can hold a smaller block and be pivotal (see equation (6)). This reduces a blockholder's risk exposure and shifts the voting outcome closer to her initial ideal project, lowering outside investor's opportunity cost of becoming a blockholder. In Figure 2 this corresponds to a shift to the right of $\tilde{\alpha}$. At the same time, when m is low, a higher λ makes it easier for liquidity shareholders to gain control and so there is no need for blockholders. Thus, the parameter range for the liquidity shareholder ownership structure widens. In Figure 2, this corresponds to a shift to the right of $\hat{\alpha}$. Overall then an increase in the participation of liquidity shareholders reduces ownership concentration. (See Lemma 17 in the Appendix for proofs of these statements.)

Note also that a larger vote participation by liquidity shareholders shifts the decision away from the initial owner's preferred project. This reduces his willingness to raise capital or to monitor (Lemma 17 in the Appendix).

Because of these opposite effects of liquidity shareholders' vote participation on the cost of issuing shares, the initial owner prefers some degree of passiveness of the outside investors. It can be shown that the optimal λ from the initial owner's perspective is always smaller than 1. The initial owner therefore has incentives to create an environment that hinders vote participation, at least up to a point. Only under some circumstances would he prefer a total exclusion of liquidity shareholders, i.e. $\lambda = 0$, or of outside investors in general. The initial owner prefers some voting liquidity shareholders to ease the rise of blockholders who in turn serve as a commitment device to choose a high risk/return project and hence to set a lower price (see also the discussion on dual class shares in section 5.1). This point is line with Becht et al. (2003) who point out that there is a trade-off between favouring minority shareholders and monitoring of managers: too much minority protection can reduce the incentive to monitor.

In practice participation of liquidity shareholders can be influenced by the institutional details of how voting is carried out. For example, the ability to vote by proxy greatly reduces the cost of voting. Similarly, information disclosure regulation may affect the cost for a shareholder to take informed decisions and thereby impact vote participation by small dispersed shareholders. The Institutional Shareholder Services (ISS) reports, although costly, can help to take informed decisions and hence to increase vote participation. Although the ISS also makes recommendations on how to vote freely available, this does not necessarily eliminate absenteeism: when choosing risk/return of a project, shareholders' preferred choices depend on their stake. There is therefore not one recommendation that all investors agree upon. Since the ISS's recommendations target institutional shareholders, it is not necessarily in the best interest of liquidity shareholders to follow them. Although improvements in the availability of information are unlikely to generate 100% vote participation in practice, we would expect them to increase λ and thereby reduce ownership concentration.

The effect of the potential conflicts-of-interests

Potential conflicts of interests can be due to different factors: growth opportunities of the firm, profitability or riskiness of the sector where the firm operates and finally the risk aversion of investors.

The parameter $\bar{X}$ captures the availability of important growth opportunities for the firm. The larger the growth opportunities, or the higher is $\bar{X}$, the bigger is the interval of m for which blockholder ownership structures emerge (Lemma 18 in the Appendix). As discussed above, the main driving force for outside investors to become blockholders in our model is that there are conflicts of interest between the initial owner and outside investors. In keeping with this logic, blockholders' incentives to hold blocks increase with the degree of conflicts (formally, the incentive constraint to become a blockholder is less binding). Growth opportunities therefore affect the ownership equilibrium outcome. The initial owner, as a large undiversified investor, is not willing to take full advantage of these growth opportunities. The emergence of blockholders allows these growth opportunities to be exploited.[20] Blockholders however choose their shareholdings in order to become pivotal. Thus, growth opportunities (measured by $\bar{X}$) determine whether blockholders emerge, but not the size of their stakes which depends on the fraction of shares held by the initial owner.

Furthermore, *ceteris paribus*, in more mature sectors, characterized by a choice only of relatively low risk projects (low $\bar{X}$), ownership structures with multiple blockholders are less likely to be observed. In very innovative industries (high $\bar{X}$), on the other hand, we should observe multiple blockholders. In such cases, blockholders could be represented by institutional investors, e.g. private equity funds who look for firms with a high risk/return profile.[21]

Alternatively the conflicts of interest among shareholders can be affected by the risk/return ratio of the sector in which the firm operates, i.e. $\frac{\sigma^2}{R}$. The initial owner's share participation cannot be reduced due to the monitoring incentive compatibility. When the sector's risk/return ratio increases, his preferred project therefore features a lowers X. This corresponds to an increase in the conflicts of interests with the outside investors whose preferred project is the maximum risk,

[20] We thank an anonymous referee for bringing this to our attention.

[21] Note that even though private equity funds may be diversified to some degree, they often hold only a small number of portfolio companies, leaving them with significant exposure to idiosyncratic risk.

i.e. $\bar{X}$.

Empirically we would therefore expect that the difference in risk profile between firms with one or more blockholders and those with a dispersed ownership structure to be larger in riskier sectors. Moreover, larger conflicts resulting from a higher $\frac{\sigma^2}{R}$ favour the emergence of blockholders.

The risk/return ratio also affects the participation constraint of investors. The larger is the risk/return ratio, the lower is the price the initial owner can charge as investors demand to be compensated for the higher risk. This tightens the initial owner's participation constraint, implying that he prefers not to raise capital or to sell the firm.

Finally, risk aversion also affects the conflicts of interest, despite the fact that all investors, including the initial owner, have the same degree of risk aversion. An increase in risk aversion affects ownership structure and risk choices in the same way as an increase in the risk/return ratio: the larger risk aversion, the larger is the difference in risk choices among firms with different ownership structures, the wider the range of parameters for which blockholders arise and the lower is the price at which shares are issued.

The effect of the capital invested

The amount of capital needed for the project, K, is a measure of the project profitability: the value of the project is $RX - K(1 - \mu(1 - m))$, which is decreasing in K. The amount of capital however *per se* does not affect the magnitude of a firm's risk. Hence, as it can be seen in Fig. 2, the capital needed for the project, K, does not influence the ownership structure.

At the same time, the amount of capital invested does affect the initial owner's participation constraint. For a fixed m, as K increases, the extra capital needed has to be contributed by the initial owner. That is because the outside investors' participation constraint is always binding in equilibrium. Hence, the initial owner's participation constraint gets tighter as K increases (see Fig. 2). This suggests that if the capital needed is very high, monitoring equilibria are less likely.

Ownership structure and underpricing

Our paper offers an alternative explanation for the relationship between underpricing in IPOs and ownership structure observed by Brennan and Franks (1997), Boulton et al. (2010), Nagata and

Rhee (2009) and Yeh et al. (2008). In our n-Blockholder equilibrium, liquidity shareholders free-ride on blockholders in the sense that they would be willing to pay a higher price for the shares than the price set by the initial owner. In particular, the larger is the differential between the size of the blocks and the size of the minority stakes, the higher is the rent that diversified shareholders obtain and the higher the extent of underpricing. As in Stoughton and Zechner (1998) and DeMarzo and Urosevic (2006), our theory predicts that underpricing occurs when blockholders are present and is higher, the larger the size of outside blockholdings. This prediction contrasts with models where blockholders arise so as to extract private benefits of control or expropriate minority shareholders (see for example Grossman and Hart (1980), Zwiebel (1995) and Bennedsen and Wolfenzon (2000)). However, while in Stoughton and Zechner (1998) and DeMarzo and Urosevic (2006) underpricing occurs so as to guarantee the participation of a single large shareholder who must undertake costly monitoring, in our model underpricing occurs so as to guarantee the participation of mid-sized shareholders.

5. Robustness

5.1 Dual-class Shares

The model assumes a one-share-one-vote rule in order to determine voting power. Of course, this rule may not be optimal in all contexts (see, for example, Burkart and Lee (2008) and Adams and Ferreira (2008)) and we therefore investigate an extension where cash flow and voting rights are independent choice variables. In this case the initial owner would retain the same cash flow rights as in the basic model in order to satisfy his monitoring incentive compatibility constraint. However, he could undermine the emergence of outside blockholders by allocating fewer voting rights to outside equity. The next lemma shows that even if the initial owner had this possibility, in some parameter range, he would still prefer to release control to blockholders.

Lemma 7. The initial owner prefers an n-Blockholders ownership structure over issuing dual class shares so as to retain control if:

$$n \leq \frac{(m\lambda + m - \lambda)\left(1 + m + \sqrt{5m^2 - 6m + 1}\right)}{2m^2(1-\lambda)} \tag{15}$$

When the number of blockholders is sufficiently low, the initial owner prefers to have blockholders rather than issuing dual class shares. The reasoning goes back to the intuition discussed in section 3.1. The blockholders are a commitment device for the initial owner to choose a high risk/return project. This allows him to demand a higher share price. When the number of blockholers is high, the difference in the risk profile between the initial owner's preferred project and the one actually arising from the vote becomes very large. In such a case the initial owner would prefer, if possible, issuing dual class shares and retaining control.

5.2 Vote trading

An interesting question is if vote trading could affect vote participation and thus ownership structure. Christoffersen et al. (2007) document the existence of a market for votes. Although absenteeism continues to be observed even when votes can be traded, it would be interesting to incorporate this possibility in the model. The implications of such a market are not obvious. When the vote borrower is anonymous (as is the case in practice according to Christoffersen et al. (2007)), it is not clear whether a passive investor ends up selling his vote to the initial owner or a blockholder. One would have to check who has the highest willingness to pay in order to determine how vote trading would affect the voting outcome. Moreover, if votes are traded at positive prices (which will presumably be the case since initial owner and blockholders compete to buy them), this needs to be factored into investor's initial demand for shares. Therefore allowing for vote trading does not simply amount to setting $\lambda = 1$ in the current model.

5.3 Number of Blockholders

One of the main results of the paper is that blockholders arise endogenously to mitigate the conflict of interest between the initial owner and outside investors. For some parameter values this is the only equilibrium ownership structure. Although the type of ownership structure is uniquely determined, the number n of blockholders is not. A natural question to ask is what the optimal number of blockholders would be from the initial owner's point of view. This would then predict the number of blockholders in a situation where the initial owner could choose the number of blockholders, for example in a closely held corporation.

Lemma 8. *In a n-Blockholder equilibrium, the optimal number of blockholders for the initial owner is given by:*

$$n^* = \left\lfloor \frac{(1+m)(m-\lambda+m\lambda)}{2m^2(1-\lambda)} \right\rfloor > 0 \tag{16}$$

The preferred number of blockholders for the initial owner stems from the following trade-off. On the one hand, a smaller number of blockholders means that each of them holds a larger stake, which pushes the equilibrium choice of risk closer to the initial owner's preference. On the other hand, the larger stake increases risk exposure of blockholders reducing the price they are willing to pay.[22]

The initial owner therefore does not always prefer the lowest number of blockholders (unlike in Zwiebel (1995) and Bennedsen and Wolfenzon (2000)). When the monitoring costs, m, or the fraction of active liquidity shareholders, λ, increase, the optimal number n^* of blockholders goes down. Higher monitoring costs imply a higher fraction of shares held by the initial owner and hence a lower preferred risk/return. Thus the initial owner would prefer fewer (but larger) blockholders who push down the equilibrium risk/return profile ($\frac{\partial n^*}{\partial m}$ is negative for $m \geq 2\lambda > \tilde{\alpha}$).

Similarly when more liquidity shareholders vote (λ goes up), a fixed number of blockholders could hold smaller blocks and still be jointly pivotal. This drives the vote to a higher risk/return combination - further away from the initial owner's preference. Thus, when λ is high, the initial owner prefers fewer blockholders ($\frac{\partial n^*}{\partial \lambda}$ is negative for $m \leq \frac{1}{2}$).

[22] The reduction in project risk, is a second order effect which is dominated by the negative impact of the greater risk exposure generated by larger stakes. The price impact is therefore unambiguously negative.

6. Conclusions

This paper analyzes the determinants of ownership structure and its effect on the risk profile of a firm when decisions are taken through shareholder voting. The need for monitoring renders a large shareholder beneficial to the firm. Because of his large stake, he is more conservative regarding the firm's risk profile than well diversified shareholders, leading to a conflict of interest. We show that this provides incentives for mid-sized blockholders to emerge so as to mitigate the conflicts of interests between the largest and minority shareholders. We use the model to explain different ownership structures observed in reality: one large shareholder with a fringe of minority shareholders when the moral hazard problem is severe, multiple mid-sized blocks for an medium degree of moral hazard and fully dispersed ownership when the moral hazard is mild.

The model provides a framework to explain a variety of phenomena reported in empirical studies such as the positive relationship between the presence of blockholders and firm value, ownership concentration and risk or the role of ownership in IPO underpricing. An important message of our paper is that there is a clear distinction between ownership structures with one large shareholder and those with multiple intermediate-sized blockholders, both in terms of the conditions under which they occur as well as their implications for firm choices.

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A. Appendices

A.1 The Model

A.1.1 Equilibrium definition. Below we provide a definition for equilibria with positive trade. Equilibrium is a monitoring level, $\mu \in \{0,1\}$, a fraction α_E^* of shares held, a fraction of wealth invested w_E^* by the initial owner, a decision X_{med}^* and an allocation of shares among investors, $\boldsymbol{\alpha}^*$ such that: (i) α_E^* and w_E^* maximize the utility of the initial owner given the anticipated demand, the anticipated monitoring level, μ, and the anticipated ownership structure $\boldsymbol{\alpha}$: (ii) each active investor chooses $\alpha_{i,D}$ to maximize her utility given w_E^*, α_E^*, the anticipated μ and the anticipated shares of all other active investors; (iii) Each passive investor chooses $\alpha_{i,D}$ to maximize his utility given w_E^*, α_E^* and the anticipated μ and X_{med}; (iv) in equilibrium there must be full subscription; (v) the value enhancing decision must be optimal for the initial owner given his stake and the vote outcome; (vi) expectations are rational.

A.2 The Equilibrium Ownership Structure

A.2.1 Monitoring Incentives and Voting Game. Proof of Lemma 1: At date 3, the ownership structure, $\boldsymbol{\alpha}$, and thus X_{med} are already fixed. Given the initial owner's objective function (3), he chooses $\mu = 1$ iff the utility from $\mu = 1$ is greater than from $\mu = 0$, that is when:

$$\alpha_E \left(X_{med}R + K\right) - \frac{\gamma}{2}\alpha_E^2 X_{med}^2 \sigma^2 - mK \geq \alpha_E X_{med} R - \frac{\gamma}{2}\alpha_E^2 X_{med}^2 \sigma^2 \tag{17}$$

Rearranging the condition yields $\alpha_E \geq m$ is obtained. ■

Proof of Lemma 2: We maximize the objective functions (over X) of the outside investors, (2), and of the initial owner, (3), given the fraction of shares held, α_j. ■

A.2.2 Ownership Subgame. Proof of Lemma 4:

By Lemma 2, the optimal X for investor i is given by $X_i = \min\left[\frac{R}{\gamma\sigma^2\alpha_i}, \bar{X}\right]$. Plugging it into equation (2), investor i's utility function is decreasing in α_i if $X_i > \bar{X}$ and $\frac{K-w_E}{1-\alpha_E} > \mu K$. Thus, investor i's ideal project is $X = \bar{X}$ and the corresponding optimal shares are $\bar{\alpha}_l$. ■

Proof of Lemma 5: We prove (A) $\alpha_n > \alpha_{l,med}$; (B) $\alpha_n = \frac{\alpha_E(1+\lambda)-\lambda}{(1-\lambda)n}$; (C) $\alpha_E > \alpha_n$.

(A) To see that $\alpha_n > \alpha_{l,med}$, we reason by contradiction. Suppose that $\alpha_n < \alpha_{l,med}$ with $X = X_{med}$. In such a case the blockholder could do better holding $\alpha_n = \alpha_{l,med}$ keeping $X = X_{med}$. Hence, $\alpha_n < \alpha_{l,med}$ cannot be an EOS as it contradicts part a) of Definition 3.

(B) Because investor i's utility function is decreasing in α_i if $\frac{K-w_E}{1-\alpha_E} > \mu K$, a blockholder arises iff he can change X_{med}, that is iff an n-Blockholder EOS arises. To win the vote, the n blockholders and a fraction λ of liquidity shareholders who are active, should have at least the same votes as the initial owner, that is: $\alpha_E \leq n\alpha_n + \lambda(1 - \alpha_E + n\alpha_n)$. Solving this equation proves:

$$\alpha_n \geq \frac{\alpha_E\,(1+\lambda)-\lambda}{(1-\lambda)\,n} \tag{18}$$

Denote respectively with $U_{l,med}$ and $U_{n,med}$ the value functions of a liquidity shareholder and of a blockholder when $X = X_{med}$. We define also X_n the X_{med} in an n-Blockholders EOS.

Consider first the case where $X_{med} = X_n < \bar{X}$, shareholder n is the median shareholder and $\alpha_n > \bar{\alpha}$. Using equation (2), the utility of the median shareholder is:

$$U_{n,n} = 1 + \alpha_n\left(RX_n + \mu K - \frac{K-w_E}{1-\alpha_E}\right) - \frac{\gamma}{2}\alpha_n^2 X_n^2 \sigma^2 \tag{19}$$

By Lemma 2 and the fact that $X_{med} = X_n < \bar{X}$, this is equivalent to

$$U_{n,n} = \alpha_n(\mu K - \frac{K-w_E}{1-\alpha_E}) + 1 + \frac{R^2}{2\gamma\sigma^2} \tag{20}$$

By assumption, $\mu K - \frac{K-w_E}{1-\alpha_E} < 0$, hence $U_{n,n}$ is decreasing in α_n.

If $X_{med} = X_n = \bar{X}$, we have that $U_{n,n}$ is decreasing in α_n because $\bar{\alpha}_l < \alpha_n$. Hence, a blockholder will not hold more than the minimum needed to change the vote decision, i.e.:

$$\alpha_n \leq \frac{\alpha_E (1+\lambda) - \lambda}{(1-\lambda) n} \tag{21}$$

From (18) and (21) part (B) follows.

(C) To see that $\alpha_E > \alpha_n$, we reason by contradiction. Suppose that $\alpha_E \leq \alpha_n$. From part (B), we know that $U_{n,n}$ is decreasing in α_n and an investor is better off setting $\alpha_n = \alpha_E$. But this implies that $X_{med} = X_1 \geq X_E$ and de facto the outside investor does not affect the vote outcome. Hence, he prefers to be a liquidity shareholder and his optimal shareholding is given by $\alpha_{l,E}$. Contradiction. ■

A.2.3 The EOS. In this part, we provide sufficient conditions under which various EOS exist for different pairs of $(\alpha_E, w_E) \in S \equiv [0,1] \times (-\infty, \infty)$. This is needed since, in order to show that a putative equilibrium is subgame perfect, we must look at what happens off the equilibrium path.

Define $\eta = (K - w_E)/N(1-\alpha_E)$, the fraction corresponding to one share (recall that we assume a finite number of shares). Define $\underline{w}_{E,\iota}$ with $\iota = E, n, L$ the minimum wealth that the initial owner needs to pledge to guarantee a positive demand of outside investors respectively in the Initial Owner, n-Blockholder and for the Liquidity Shareholder EOS:

$$\begin{aligned}
\underline{w}_{E,E}(\alpha_E) &\equiv K - (RX_E + \mu K)(1-\alpha_E) + \epsilon_E && (22)\\
\underline{w}_{E,n}(\alpha_E) &\equiv K - \left(RX_n + \mu K - \frac{\gamma}{2} X_n^2 \sigma^2 \alpha_n\right)(1-\alpha_E) && (23)\\
\underline{w}_{E,L}(\alpha_E) &\equiv K - \left(R\bar{X} + \mu K\right)(1-\alpha_E) + \epsilon_L && (24)
\end{aligned}$$

where ϵ_ι with $\iota = \{E, L\}$ is the extra initial owner's investment needed to guarantee a strictly positive liquidity shareholders' participation and hence a positive demand, i.e. $\epsilon_j \equiv \gamma X_j^2 \sigma^2 \eta$. Note that when $X_E = \bar{X}$, $\underline{w}_{E,E} = \underline{w}_{E,L}$.

In addition we need the following notation:

$$\underline{\underline{w}}(\alpha_E) \equiv K - \mu K(1-\alpha_E) \tag{25}$$

$$\hat{\alpha}_1(n) \equiv \frac{2\lambda}{2(1+\lambda) - n(1-\lambda)} \tag{26}$$

$$\hat{\alpha}_2(n) \equiv \frac{2\bar{\alpha}(1-\lambda)n + \lambda - \sqrt{\lambda^2 + 4\bar{\alpha}(1-\lambda)n\left(\bar{\alpha}(1-\lambda)n - 1 - 2\bar{\alpha}(1+\lambda)\right)}}{2\left(1+\lambda\right)} \tag{27}$$

$$\hat{\alpha}(n) \equiv \max[\hat{\alpha}_1(n), \hat{\alpha}_2(n)] \tag{28}$$

$$\tilde{\alpha} \equiv \frac{\lambda}{1+\lambda} \tag{29}$$

Suppose α_E is fixed, then $\underline{\underline{w}}(\alpha_E)$ is the maximum w_E such that $\mu K \leq \frac{K-w_E}{1-\alpha_E}$. $\hat{\alpha}(n) = \{\alpha_E | \alpha_E \leq \hat{\alpha}(n) \implies \underline{w}_{E,E} \geq \underline{w}_{E,n}\}$. $\hat{\alpha}(n) = \hat{\alpha}_1(n)$ when $X_n < \bar{X}$, and $\hat{\alpha}(n) = \hat{\alpha}_2(n)$ when $X_n = \bar{X}$. Finally $\tilde{\alpha} = \{\alpha_E | \alpha_E \leq \tilde{\alpha} \implies \alpha_E \leq \lambda(1-\alpha_E)\}$.

Lemma 9. Suppose

$$\alpha_E \in \left(\max\left[\bar{\alpha}, \min\left[\frac{1}{2}, \hat{\alpha}(1)\right]\right], 1\right] \tag{30}$$

and

$$w_E \in \left[\underline{w}_{E,E}(\alpha_E), \min[\underline{w}_{E,1}(\alpha_E), \underline{\underline{w}}(\alpha_E)\right) \tag{31}$$

there exists an Initial Owner EOS, with $X_{med} = X_E < \bar{X}$. If $w_E < \underline{w}_{E,E}$ there is a no Trade EOS.

Proof An Initial Owner EOS exists if conditions of Definition 3 are satisfied:

1. Investors choose α_i optimally.

   Suppose $\alpha_E > \frac{1}{2}$. The supporting beliefs of investors are that all other investors buy $\alpha_{l,E}$. Given the majority rule, outside investors cannot influence the vote outcome, the initial owner is pivotal, $X = X_E$. Hence, because $w_E \leq \underline{\underline{w}} \implies \mu K \leq \frac{K-w_E}{1-\alpha_E}$, the optimal choice for outside investors is $\alpha_{l,E}$.

   When $\alpha_E < \frac{1}{2}$, an Initial Owner EOS exists iff no single (active) investor has a unilateral incentive to deviate from $\alpha_{l,E}$. The only possible deviation is for the investor to buy a sufficiently large block and be able to change the vote outcome X_{med}. However, since $\underline{w}_{E,E} \leq$

$w_E \leq \underline{w}_{E,1}$, $U_{l,E} > 1 > U_{1,1}$, no liquidity shareholder has a unilateral incentive to deviate.

2. Beliefs are correct in equilibrium.

3. $w_E \geq \underline{w}_{E,E}$ guarantees that investors buy a strictly positive fraction of shares. Since there are sufficiently many outside investors, there is full subscription.

4. Since the above conditions hold for any arbitrary choice of $\mu \in \{0,1\}$, they are consistent with any monitoring choice and, in particular, with $\mu \in \arg\max U_{E,med}$.

When $w_E < \underline{w}_{E,E}$, investors demand a non positive fraction of shares and so we assume that the beliefs are that no-one buys a positive amount of shares. Thus, there is a No Trade EOS. ■

Corollary 2. There exists an EOS with no conflicts, i.e. with $X_{med} = X_E = \bar{X}$ if

$$\alpha_E \in (0, \bar{\alpha}] \tag{32}$$

$$w_E(\alpha_E) \in \Big[\underline{w}_{E,E}(\alpha_E), \underline{\underline{w}}(\alpha_E)\Big) \tag{33}$$

If $w_E < \underline{w}_{E,E}$ there is No Trade EOS.

Proof When $\alpha_E \in (0, \bar{\alpha}]$ there are no conflicts of interests between outside investors and the initial owner, $X_{med} = X_E = \bar{X}$. The rest of the proof follows the same steps as the proof of Lemma 9 just replacing X_E by $\bar{X}$ and noting that this is the first best for investors so they have no incentive to deviate. ■

Lemma 10. Suppose

$$\alpha_E \in \left(\tilde{\alpha}, \min\left[\hat{\alpha}(n), \frac{1}{2}\right]\right] \tag{34}$$

$$w_E \in [\underline{w}_{E,n}(\alpha_E), \underline{\underline{w}}(\alpha_E)) \tag{35}$$

there exists an n-Blockholder EOS, with $X_{med} = X_n \leq \bar{X}$. If $w_E < \underline{w}_{E,n}$ there is a No Trade EOS.

Proof An n-Blockholder EOS exists if conditions of Definition 3 are satisfied:

1. Investors choose α_i optimally.

   We first look at the optimal blockholders' choice. The supporting beliefs of investors are that exactly $n-1$ other outside investors buy α_n fraction of shares and together with a fraction λ of liquidity shareholders, who hold $\alpha_{l,n}$, vote for X_n. From Lemma 5, blockholders arises if they are pivotal and shift decision closer to their first best $X = \bar{X}$. To be able to shift decision, the necessary conditions are: 1) $\alpha_E > \tilde{\alpha}$, i.e. without blockholders liquidity shareholders cannot be pivotal and choose $X = \bar{X}$; 2) $\alpha_E \leq \frac{1}{2}$, i.e. the initial owner is not necessarily in control and so blockholders can become pivotal; $\alpha_E \leq \hat{\alpha}(n)$, i.e. no blockholder can do better by deviating as long as $U_{n,n} \geq U_{l,E}$ (this is the best deviation possible, if any block is reduced by even one share the decision shifts to X_E). Since $w_E \leq \underline{\underline{w}}$, $U_{n,n}$ is decreasing in α_n so a blockholder holds just enough shares to be pivotal.

   We now show that there is no profitable unilateral deviation of liquidity shareholders: $\alpha_{l,n}$ maximizes a liquidity shareholder's utility given X_n. The only reason to hold a different fraction is to change X_{med}. To achieve that a liquidity shareholder can buy more shares than α_n but this will end up shifting X towards a lower value than X_n so further away from his first best and be undiversified.

2. Beliefs are correct in equilibrium.

3. Both blockholders and liquidity investors demand a strictly positive fraction of shares. Since there are sufficiently many outside investors, there is full subscription.

4. Since the above conditions hold for any arbitrary choice of $\mu \in \{0, 1\}$, they are consistent with any monitoring choice, in particular, with $\mu \in \arg\max U_{E,med}$.

When $w_E < \underline{w}_{E,n}$ the investors' participation constraint is not satisfied and so we assume that the beliefs are that no-one demands a positive amount of shares. Thus, there is a No Trade EOS. ■

Lemma 11. If

$$\alpha_E \in \left(\bar{\alpha}, \min\left(\tilde{\alpha}, \frac{1}{2}\right)\right] \quad (36)$$

$$w_E(\alpha_E) \geq [\underline{w}_{E,L}(\alpha_E), \underline{\underline{w}}(\alpha_E)) \quad (37)$$

there exists a Liquidity Shareholder EOS. If $w_E < \underline{w}_{E,L}$ there is a no Trade EOS.

Proof A Liquidity Shareholder EOS exists if conditions of Definition 3 are satisfied:

1. Investors choose α_i optimally: The supporting beliefs of investors are that all others buy exactly $\bar{\alpha}_l$ and $X_{med} = \bar{X}$. $\alpha_E \leq \tilde{\alpha}$ guarantees that $X_{med} = \bar{X}$. No liquidity shareholder wants to increase or decrease his shareholdings since this is the most preferred project (see Lemma 4).

2. Beliefs are correct in equilibrium.

3. $w_E \geq \underline{w}_{E,E}$ guarantees that outside investors demand a strictly positive fraction of shares. Hence, all shares are subscribed.

4. Since the above conditions hold for any arbitrary choice of $\mu \in \{0, 1\}$, they are consistent with any monitoring choice, in particular, with $\mu \in \arg\max U_{E,med}$.

When $w_E < \underline{w}_{E,L}$ the investors' participation constraint is not satisfied and so we assume that the beliefs are that no-one demand a positive amount shares. Thus, there is a No Trade EOS. ■

Corollary 3. If $w_E(\alpha_E) \geq \underline{\underline{w}}(\alpha_E)$, there is an EOS where the initial owner holds α_E and one investor holds $\alpha_1 = 1 - \alpha_E$. $X_{med} = min[X_E, X_1]$.

Proof If $w_E(\alpha_E) \geq \underline{\underline{w}}(\alpha_E)$, $U_i(\alpha_i)$ is increasing in α_i. Each investor demands all the shares tendered. The rest of the proof follows the steps of the previous Lemma. ■

Proof of Lemma 6: We apply backward induction. Suppose the initial owner raises capital he maximizes the following objective function:

$$\max_{\alpha_E, w_E} U_E\left(\mu = 0\right) = RX_{med}(\alpha_E)\alpha_E - \frac{\gamma}{2}X_{med}(\alpha_E)^2\sigma^2\alpha_E^2 + 1 - w_E \quad (38)$$

subject to the condition to have a positive demand of shares by outside investors: $w_E \geq \underline{w}_{E,\iota}$ with $\iota = \{E, n, L\}$.

Substituting for $\underline{w}_{E,\iota}$ in the objective function, it can be checked that $U_E\,(\mu = 0)$ is decreasing in α_E for all $\underline{w}_{E,\iota}$, for $X_{med} \leq \bar{X}$. Therefore, $\alpha_E = 0$ is the optimal choice of the initial owner for any ownership structure. In this case, the only possible ownership structure is the Liquidity Shareholder EOS with $X_{med} = \bar{X}$.

To satisfy the participation constraint of outside investors, $w_E \geq w_{E,L}$. Because $U_E\,(\mu = 0)$ is decreasing in w_E, $w_E = \underline{w}_{E,L}$ and the initial owner's utility is given by $R\bar{X} - K + 1$. If he invests in the risk free asset his utility is 1. Hence, the initial owner's value function, defined as $V_{E,NM}$, is then given by equation:

$$V_{E,NM} = \max[R\bar{X} - K + 1, 1] \tag{39}$$

We now show that if the initial owner chooses not to monitor then no other outside investor would choose to hold a block and monitor. The utility from monitoring of an outside investor is smaller than the utility from monitoring of the initial owner iff:

$$\alpha_n(RX + K) - (K - \underline{w}_{E,n})\alpha_n - \frac{\gamma}{2}\sigma^2 X^2 \alpha_n^2 - mK < \alpha_E(RX + K) - \frac{\gamma}{2}\sigma^2 X^2 \alpha_E^2 - \underline{w}_{E,\iota} - mK \tag{40}$$

From equation (23), $(K - \underline{w}_{E,n}) > 0$. Thus, no outside investor wants to monitor. ■

A.3 Monitoring Equilibria

Lemma 12. In any equilibrium where $\mu = 1$, $\frac{K - w_E}{1 - \alpha_E} > K$.

Proof Consider first an EOS where no blockholders exist. Suppose to the contrary, that there is an equilibrium with $\frac{K - w_E}{1 - \alpha_E} < K$. From Lemma 3 investors demand all the shares (the utility function is increasing in α_i). Hence, the initial owner can increase his utility by decreasing w_E, and ensure a strictly positive demand. The initial owner will do this until $\frac{K - w_E}{1 - \alpha_E} \geq K$. Contradiction. ■

We now present few lemmas which provide expressions for the value function of the initial owner under the alternative ownership structures that could be obtained. They will be needed to prove the existence of the equilibria.

The following lemmas use the intervals of the EOS described in Section A.2.3. However, given

Lemma 12 the requirement $w_E < \underline{\underline{w}}_E$ is ignored w.l.o.g..

Lemma 13. Suppose the conditions of Corollary 2 are satisfied, and the equilibrium of the game is the one with no conflicts with $X_{med} = \bar{X}$, then the initial owner sets $\alpha_E = m$, $w_E = \underline{w}_{E,E}$ and the value function of the initial owner, defined as $V_{E,NC}$, is given by:

$$V_{E,NC} = R\bar{X} + 1 - \frac{\gamma}{2}\bar{X}^2 m^2 \sigma^2 - mK - \epsilon_L \tag{41}$$

Proof By Lemma 1, in any monitoring equilibrium, $\alpha_E \geq m$. By Corollary 2, the EOS with no conflicts exists if $\alpha_E \in (0, \bar{\alpha}]$ and $w_E \geq \underline{w}_{E,E}$ and the maximization problem of the initial owner must solve:

$$\begin{aligned} \max_{\alpha_E, w_E} U_E &= (R\bar{X} + K)\alpha_E - \frac{\gamma}{2}\bar{X}^2 \alpha_E^2 \sigma^2 + 1 - w_E - mK && (42) \\ \text{s.t} \quad & w_E \geq \underline{w}_{E,E} && (43) \\ & \alpha_E \in [m, \bar{\alpha}] && (44) \end{aligned}$$

As U_E is decreasing in the wealth invested, w_E, the initial owner chooses w_E such that it satisfies the participation constraint of the liquidity shareholders, (43), with a strictly positive demand. Inserting it in the initial owner's objective function we obtain:

$$R\bar{X} + 1 - \frac{\gamma}{2}\bar{X}^2 \alpha_E^2 \sigma^2 - mK - \epsilon_L \tag{45}$$

This expression is decreasing in α_E. Hence the initial owner retains just enough shares to satisfy the monitoring constraint: $\alpha_E = m$. Inserting $\alpha_E = m$ in the initial owner's utility function, expression (41) results. ■

Let $\underline{b} = \max\left[\bar{\alpha}, \min\left[\frac{1}{2}, \hat{\alpha}(1)\right]\right]$.

Lemma 14. Suppose the conditions of Lemma 9 are satisfied and the equilibrium of the game is an Initial Owner equilibrium, then $X_{med} = X_E < \bar{X}$, $w_E = \underline{w}_{E,E}$, $\alpha_E = \max[m, \underline{b}]$, and the value function of the initial owner, defined as $V_{E,E}$, is:

$$V_{E,E} = RX_E + 1 - \frac{\gamma}{2}X_E^2 \max[m, \underline{b}]^2\sigma^2 - mK - \epsilon_E = \frac{R^2}{\gamma\sigma^2}\left(\frac{1}{\max[m, \underline{b}]} - \frac{1}{2}\right) + 1 - mK - \epsilon_E \quad (46)$$

Proof The proof follows the same steps as for the proof of Lemma 13 using Lemmas 1 and 9. Detailed proof is available upon request. ■

Lemma 15. Suppose the conditions of the n-Blockholder EOS are satisfied (Lemma 10) and the equilibrium of the game is an n-Blockholder equilibrium with $X_{med} = X_n$, the initial owner sets $\alpha_E = \max[m, \tilde{\alpha}]$, $w_E = \underline{w}_{E,n}$ and the value function of the initial owner, defined as $V_{E,n}$, is:

$$V_{E,n} = RX_n + 1 - mK - \frac{\gamma}{2}X_n^2\sigma^2(\max[m, \tilde{\alpha}]^2 + \alpha_n - \alpha_n \max[m, \tilde{\alpha}]) \quad (47)$$

Proof The proof follows the same steps as for the proof of Lemma 13 and it applies Lemmas 1 and 10. Detailed proof is available upon request. ■

Lemma 16. Suppose the conditions for the Liquidity Shareholder EOS are satisfied and there exists a Liquidity Shareholder equilibrium with monitoring. Then, $\alpha_E = \max[m, \bar{\alpha}]$, $w_E = \underline{w}_{E,L}$ and the value function of the initial owner, defined as $V_{E,L}$, is:

$$V_{E,L} = R\bar{X} + 1 - mK - \frac{\gamma}{2}\bar{X}^2\sigma^2(\max[m, \bar{\alpha}])^2 - \epsilon_L \quad (48)$$

Proof The proof follows the same steps as for the proof of Lemma 13 and it applies Lemmas 1 and 11. Detailed proof is available upon request. ■

A.3.1 n-Blockholder Equilibria. Proof of Proposition 1: Let:

$$\underline{m}_n(n) \equiv \max\left[\underline{m}_{n,RC}(n), \underline{m}_{n,S}(n), \underline{m}_{\frac{1}{2}}(n)\right] \quad (49)$$

$$\bar{M}_n(n) \equiv \min\left[\bar{M}_{n,RC}(n), \bar{M}_{\frac{1}{2}}(n)\right] \quad (50)$$

where $\bar{M}_{n,RC}(n)$ and $\underline{m}_{n,RC}(n)$ are the first two biggest solutions of the equation $V_{E,n} = 1$. $\bar{M}_{n,S}(n)$ and $\underline{m}_{n,S}(n)$ are defined as the two biggest solutions of the equation $V_{E,n} = \bar{R}\bar{X} + 1 - K$; $\bar{M}_{\frac{1}{2}}$ and

$\underline{m}_{\frac{1}{2}}(n)$ are the two solutions of $V_{E,n} = V_{E,E}|_{\alpha_E=\frac{1}{2}}$. More precisely:

$$\underline{m}_{\frac{1}{2}}(n) \equiv \frac{\lambda(1+\lambda)+n(1-\lambda)\left(1-\sqrt{8(3n-1)\lambda^2+(4-24n)\lambda}\right)}{11n^2(1-\lambda)^2+(n(1-\lambda)-(1+\lambda))^2} \tag{51}$$

$$\bar{M}_{\frac{1}{2}}(n) \equiv \frac{\lambda(1+\lambda)+n(1-\lambda)\left(1+\sqrt{8(3n-1)\lambda^2+(4-24n)\lambda}\right)}{11n^2(1-\lambda)^2+(n(1-\lambda)-(1+\lambda))^2} \tag{52}$$

We solve the game by backward induction. The initial owner chooses α_E and w_E, anticipating the EOS and $\mu = 1$. His problem can be partitioned into the following intervals of α_E: (1) $\alpha_E \in \left[m, \frac{1}{2}\right)$; (2) $\alpha_E \in [\frac{1}{2}, 1]$; (3) $\alpha_E \in [0, m]$. We first describe the beliefs on the EOS and the corresponding value functions in each of these intervals.

Case (1). By Lemma 1, $\mu = 1$. All investors anticipate monitoring in the last stage. We assume the following beliefs about the EOS at date 1: if $w_E \geq \underline{w}_{E,n}$ the anticipated EOS is the n-Blockholder one which exists by Lemma 10. By Lemma 15 in such a case the initial owner's value function, $V_{E,n}$, is given by equation (47). If $w_E < \underline{w}_{E,n}$ then the EOS is the No Trade EOS with corresponding value function equal to 1.

Case (2). By Lemma 1, $\mu = 1$. If $w_E \geq \underline{w}_{E,E}$ there exists an Initial Owner EOS (Lemma 9). By the proof of Lemma 14, he minimizes α_E, i.e. $\alpha_E = \frac{1}{2}$ and his value function is therefore:

$$V_{E,E}|_{\alpha_E=\frac{1}{2}} = \frac{3}{2}\frac{R^2}{\gamma\sigma^2} + 1 - mK - \epsilon_E \tag{53}$$

Case (3). In this interval Proposition 6 applies. The initial owner's value function is $V_{E,NM} = \max\left[1, R\bar{X} - K + 1\right]$.

It is sufficient to check that under condition 7, $V_{E,n} \geq \max(V_{E,E}|_{\alpha_E=\frac{1}{2}}, V_{E,NM})$. Note that $V_{E,n} \geq V_{E,E}|_{\alpha_E=\frac{1}{2}}$, iff $m \in [\underline{m}_{\frac{1}{2}}, \bar{M}_{\frac{1}{2}}]$.

Second we check that $V_{E,n} \geq V_{E,NM}$:

(i) $V_{E,n} \geq 1$ iff:

$$n(1-\lambda)\lambda R^2 + m\left(mn^2(1-\lambda)^2R^2 - n(1-\lambda)(\lambda m + m + 1)R^2 + 2K\gamma(\lambda m + m - \lambda)^2\sigma^2\right) < 0 \tag{54}$$

The left hand side is a third degree inequality which goes from $-\infty$ to ∞, and it is positive at $m = \frac{\lambda}{1+\lambda}$. Note also that when $m = \frac{1}{2}$, the left hand side can be either positive or negative. Hence, of the 3 potential roots for which the left hand side is equal to 0, we are interested to the two biggest ones and the negative values are between these two values, that is $\underline{m}_{n,RC}(1) < m < \bar{M}_{n,RC}(1)$.

(ii) $V_{E,n} \geq R\bar{X} - K + 1$ iff:

$$
\begin{aligned}
& 2\bar{\alpha}K\gamma(1+\lambda)^2\sigma^2 m^3 \\
& + \left(R^2\left(2(1+\lambda)^2 - \bar{\alpha}n(1-\lambda)(\lambda+1)\right) - n(1-\lambda) - 2\bar{\alpha}K\gamma\left(3\lambda^2+4\lambda+1\right)\sigma^2\right)m^2 \\
& + \left(\bar{\alpha}\left(2K\gamma\lambda(3\lambda+2)\sigma^2 - nR^2(1-\lambda)\right) - 4R^2\lambda(1+\lambda)\right)\bar{m} \\
& + \lambda\left(2\lambda R^2 + \bar{\alpha}\left(nR^2(1-\lambda) - 2K\gamma\lambda\sigma^2\right)\right) < 0 \qquad (55)
\end{aligned}
$$

The left hand side has the same features of the left hand side of condition (54). Hence this condition is satisfied when $\underline{m}_{n,S}(1) < m < \bar{M}_{n,S}(1)$.

Hence $V_{E,n} \geq V_{E,NM}$ under the conditions of the proposition.

It remains to prove is that no other equilibrium ownership structure (except the No Trade equilibrium) exists in this interval. Since $m > \tilde{\alpha}$, the Liquidity Shareholder equilibrium is ruled out. Similarly since $m > \bar{\alpha}$, the equilibrium with no conflicts is ruled out. Thus the only other possible equilibrium in this interval is the Initial Owner equilibrium. Suppose such an equilibrium exists, it implies that the belief of the investors is $n = 0$ and all investors are liquidity shareholders each holding $\alpha_{l,E}$. Since $m \leq \hat{\alpha}(1)$, a liquidity shareholder would find it worthwhile to switch to holding a block. Contradiction. ■

Proof of Corollary 1: The proof is the same as Proposition 1, except that uniqueness of an n-Blockholder equilibrium is no longer guaranteed: if $m \in [\hat{\alpha}(1), \hat{\alpha}(n))$, an Initial Owner equilibrium exists as $\underline{w}_{E,E} \leq \underline{w}_{E,n}$. ■

A.3.2 Initial Owner Equilibria. Proof of Proposition 2: The proof of parts (A) and (B) follows the same steps as the proof of Proposition 1. Let $\bar{M}_E \equiv \min[\bar{M}_{E,RC}, \bar{M}_{E,S}]$ where $\bar{M}_{E,RC}$

and $\bar{M}_{E,S}$ are respectively the solutions for m of:

$$R\left(X_E - \bar{X} + K\right) - \frac{\gamma}{2}\sigma^2 X_E^2 m^2 - \epsilon_E = 0 \quad (56)$$

$$RX_E + K - \frac{\gamma}{2}\sigma^2 X_E^2 m^2 = 0 \quad (57)$$

We partition the maximization problem of the initial owner into the following cases: (1) $\alpha_E \in [\max[\underline{b}, m], 1] = [m, 1]$ (2) $\alpha_E \in [0, m]$. We first describe the beliefs on the EOS and the corresponding value functions in each interval.

Case (1). By Lemma 1, $\mu = 1$. Then all investors anticipate monitoring in the last stage. We assume that in this interval the initial owner EOS is anticipated as long as w_E satisfies condition (31) (Lemma 9). Lemma 14 implies then that: $\alpha_E = m$, $w_E = \underline{w}_{E,E}$ and the initial owner's value function, $V_{E,E}$, is given by equation (46). Otherwise when $w_E < \underline{w}_{E,E}$ we assume there is no trade and the initial owner's value function is equal to 1.

Case (2). This case is the same as Case (3) of Proposition 2. The initial owner's value function is $V_{E,NM} = \max[R\bar{X} - K + 1, 1]$.

Maximizing across intervals of Cases (1) and (2) the initial owner will choose $\alpha_E = m$ as long as $V_{E,E} \geq V_{E,NM}$. This occurs when $m \leq \bar{M}_E$.

When $m > \max\left[\frac{1}{2}, \bar{\alpha}\right]$ this is the unique equilibrium, induced by the uniqueness of the Initial Owner EOS.

The proof of parts (C) and (D) follows directly from Proposition 2 and Corollary 1, just reversing the condition $V_{E,E}|_{\alpha_E = \frac{1}{2}} \leq V_{E,n}$. ■

A.3.3 Liquidity Shareholder Equilibrium. Proof of Proposition 3: Let:

$$\bar{M}_L \equiv \min\left[M_{L,RC}, M_{L,S}\right] \quad (58)$$

where $\bar{M}_{L,RC}, \bar{M}_{L,S}$ are respectively the solutions in m of:

$$RK - \frac{\gamma}{2}\sigma^2 \bar{X}^2 m^2 - \epsilon_L \quad = 0 \tag{59}$$

$$R\bar{X} + K - \frac{\gamma}{2}\sigma^2 \bar{X}^2 m^2 \quad = 0 \tag{60}$$

Following the same steps as in the proof of Proposition 2, we break up the maximization problem into the following intervals of α_E: (1) $\alpha_E \in \left[m, \min\left(\tilde{\alpha}, \frac{1}{2}\right)\right)$; (2) $\alpha_E \in \left[\tilde{\alpha}, \min\left[\hat{\alpha}(n), \frac{1}{2}\right]\right]$; (3) $\alpha_E \in \left(\min\left[\hat{\alpha}(n), \frac{1}{2}\right], 1\right]$; (4) $\alpha_E \in [0, m)$. As before, we first describe the beliefs on the EOS in each interval and the corresponding value functions.

Case (1). By Lemma 1, $\mu = 1$. All investors anticipate monitoring in the last stage. We assume the following beliefs about the EOS at date 1: if $w_E \geq \underline{w}_{E,L}$ then the anticipated EOS is the Liquidity Shareholder EOS which exists by Lemma 11. If $w_E < \underline{w}_{E,L}$ the project does not go ahead and the initial owner gets value $V_{E,NT}$. By Lemma 16, if a Liquidity Shareholder equilibrium exists the initial owner's value function, $V_{E,L}$, is given by equation (48).

Case (2). If $w_E \geq \underline{w}_{E,n}$ there exists an n-Blockholder EOS by Lemma 15. The value function is given by $V_{E,n}$, expression (47). If $w_E < \underline{w}_{E,n}$ then the belief on the EOS is the No Trade EOS, with value function $V_{E,NT}$.[23]

Case (3). In this case the unique EOS is the Initial Owner EOS for $w_E \geq \underline{w}_{E,E}$. Using the proof of Lemma 14 we know that the initial owner minimizes α_E, i.e. $\alpha_E = \underline{d} \equiv \min[\hat{\alpha}, \frac{1}{2}]$ and the value function is given by $V_{E,E}$. If $w_E < \underline{w}_{E,E}$ the belief on the EOS is the No Trade EOS, with value function $V_{E,NT}$.

Case (4). As in Case (3) Proposition 2 the initial owner's value function is given by $V_{E,NM}$.

Note that $V_{E,E}|_{\alpha_E = \underline{d}} < V_{E,E}|_{\alpha_E = \tilde{\alpha}} = V_{E,L}$ as the initial owner's value function is decreasing in α_E. Hence, the liquidity shareholder ownership structure of Case (1) is preferred over the Initial Owner equilibrium in Case (3). Second, as in the proof of Proposition 2, $V_{E,n}|_{\alpha_E = \tilde{\alpha}(n)} < V_{E,n}|_{\alpha_E = m} < V_{E,L}$. Hence Case (1) is preferred over Case (2). $m \leq \bar{M}_L$ guarantees that $V_{E,L} \geq V_{E,NM}$. ■

[23] In this interval there can be also an Initial Owner EOS if $n > 1$ and $w_E \geq w^E$. In such a case the proof that shows that the initial owner prefers the Liquidity Shareholder EOS follows the same steps as Case (3).

A.3.4 No Conflicts of Interest Equilibrium. Proof of Proposition 4:

Proof of Proposition 4: We now partition into : (1) $\alpha_E \in [\max[0,m],1] = [m,1]$ (2) $\alpha_E \in [0,m]$. The proof follows the same steps as in the proof of Proposition 2. However, now in Case (1) there are no conflicts among shareholders. Uniqueness of the no conflicts equilibrium follows from uniqueness of the EOS. ■

A.4 Comparative Statics

Lemma 17. Suppose $m \leq \frac{1}{2}$ (a) $\frac{\partial\tilde{\alpha}}{\partial\lambda} = \frac{1}{(1+\lambda)^2} > 0$. (b) $\frac{\partial\hat{\alpha}}{\partial\lambda} \geq 0$. (c) $\frac{\partial V_{E,n}}{\partial\lambda} < 0$, (d) $\frac{\partial\alpha_n}{\partial\lambda} = -\frac{1-2\alpha_E}{n(1-\lambda)^2} < 0$

Proof The proof of parts (a) and (d) follows directly from the study of the derivative

(b) $\hat{\alpha}(n) \equiv \max[\hat{\alpha}_1(n), \hat{\alpha}_2(n)]$. $\frac{\partial\hat{\alpha}_1(n)}{\partial\lambda} = -\frac{2(n-2)}{(n(1-\lambda)-2(1+\lambda))^2}$. This is positive if $n < 2$, that is when $\hat{\alpha}_1(n) < 1/2$. $\hat{\alpha}_2(n)$ is defined as the threshold such that if $\alpha_E \leq \hat{\alpha}(n)$ then $\underline{w}_{E,E} \leq \underline{w}_{E,n}$ when $X_1 = \bar{X}$. This condition can be rewritten as:

$$RX_E \geq R\bar{X} - \frac{\gamma}{2}\bar{X}^2\sigma^2\alpha_n \tag{61}$$

Since $\frac{\partial\alpha_n}{\partial\lambda} < 0$, the above condition is less binding for higher λ and hence $\frac{\partial\hat{\alpha}_2}{\partial\lambda} > 0$.

(c) The sign of $\frac{\partial V_{E,n}}{\partial\lambda}$ is the same as the expression $\frac{1}{\alpha_n}\left(1 + m - \frac{m}{\alpha_n}\right)$. This is always negative as $m\left(1 - 2n\left(1-\lambda\right)\right) - \lambda + m^2\left(1+\lambda\right) < 0$. ■

Lemma 18. (a) $\frac{\partial\tilde{\alpha}}{\partial\bar{X}} < 0$; (b) $\frac{\partial\hat{\alpha}}{\partial\bar{X}} \geq 0$; (c) $\frac{\partial V_{E,n}}{\partial\bar{X}} = 0$, $\frac{\partial V_{E,NM}}{\partial\bar{X}} \geq 0$, $\frac{\partial V_{E,NC}}{\partial\bar{X}} = \frac{\partial V_{E,L}}{\partial\bar{X}} < 0$.

Lemma 19. (a) $\frac{\partial V_{E,NM}}{\partial K} \geq 0$; (b) $\frac{\partial V_{E,i}}{\partial K} < 0$ with $i = \{NC, n, E, L\}$; (c) $\frac{\partial w_E^j}{\partial K} > 0$ with $j = \{NC, n, E, L\}$;

Proof Proofs of Lemmas 18 and 19 follow from the study of the sign of the derivatives. ■

A.5 Robustness checks

Proof of Lemma 7: The initial owner prefers to issue dual class shares if:

$$V_{E,E}\,|_{\alpha_E=m} > V_{E,n}\,|_{\alpha_E=m} \tag{62}$$

Condition (15) follows. ■

Proof of Lemma 8: The initial owner's value function has a maximum for $n = n^*$. As $m > \frac{\lambda}{1+\lambda}$, $n^* > 0$. ■

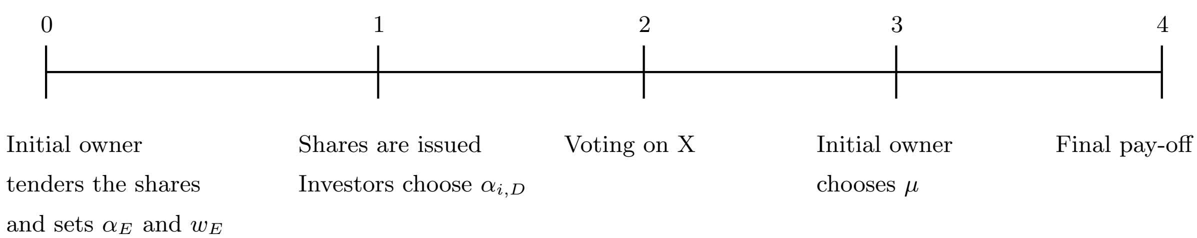

Figure 1: The Time Structure

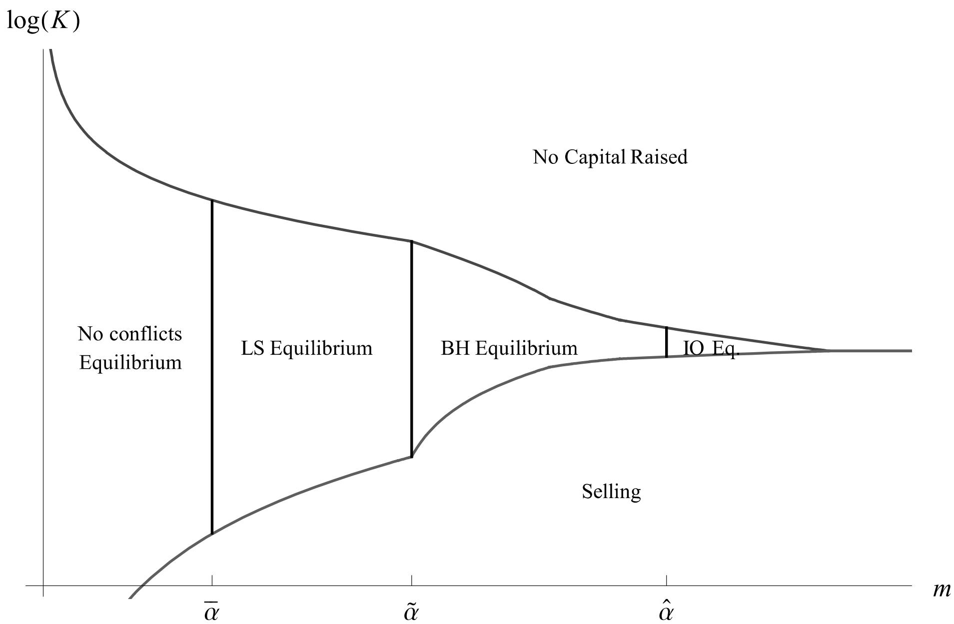

Figure 2: Example of Blockholder equilibrium ($R = 1$, $\gamma = 12$, $\sigma = 0.2$, $\bar{X} = 50$, $\lambda = 0.1$, $n = 1$). LS stands for Liquidity Shareholder, BH for Blockholder and IO for Initial Owner.