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The Dynamics of the Management-Shareholder Conflict

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Abstract

This paper investigates the distribution of equity ownership between entrenched corporate insiders and dispersed outsiders when management has the ability to divert or manipulate the cash flows and when it is costly for equityholders to verify or prove any managerial wrongdoing for a third party such as a court. Management chooses the distribution of equity ownership so as to maximize private benefits against the risk of potential control challenges. When shareholders are long term oriented, then outside shares trade at a premium over their value to management, and management is inclined to sell off its equity stake to dispersed outsiders. When shareholders are short-term oriented, then outside shares trade at a discount below their value to management, and disciplinary pressure can be substantially reduced via strategic share purchases.

Introduction

Since the fundamental work of Berle and Means (1932) a lot of academic attention has been devoted to the study of corporate ownership and control. The present paper investigates the distribution of equity ownership between entrenched corporate insiders and dispersed outsiders when management has the ability to divert or manipulate the cash flows and when it is costly for equityholders to verify or prove any managerial wrongdoing for a third party such as a court.

The reason why no such investigation has been carried out earlier is that until recently the consensus in the security design literature was that costly verification of cash flows and management ability to divert or manipulate the cash flows are incompatible with outside equity financing (Townsend (1979), Diamond (1984), Gale and Hellwig (1985), Hart and Moore (1989), Bolton and Scharfstein (1990)). In recent papers, however, Fluck (1997, 1998) shows that beside debt outside equity *with unlimited life* is also an optimal financing in this framework. Her work opened the way for our investigation of the forces that shape the ownership structure of corporations.

We model here outside equity as a tacit agreement between entrenched management and dispersed outside investors, supported by equityholders' right to dismiss management independently of the realization of the cash flows or regardless of performance and by the lack of a prespecified expiration date on equity[1]. We define an entrenched manager as one who is unlikely to be fired because dispersed equityholders have difficulty in coordinating their effort

[1]There are at least two main approaches to modelling managerial entrenchment. According to the first approach a manager is considered entrenched if it is hard to find a replacement who would do better than his predecessor (Shleifer and Vishny (1989)). According to the second approach a manager is entrenched if he is unlikely to be fired because dispersed equityholders have difficulty in coordinating a successful control challenge against unsuitable management (Zwiebel (1996)). Our model includes elements from both approach.

to carry out a successful control challenge. When ownership is dispersed, control challenges initiated by dissident shareholders may succeed only after several rounds of reinitiation[2].

When control challenges are prone to failure and succeed only after repeated attempts, then shareholders' willingness to discipline management depends on their time preference and, thereby on the real cost of financial capital. We find that when the real cost of capital is low and, consequently, dissident shareholders have long time horizon, then they are willing to discipline unsuitable management no matter how long it takes to win the control challenge or how much it costs in the short run. Although a control challenge is more costly to win the smaller the outside ownership is, management can not substantially reduce the threat of the control challenge by increasing its equity stake in the company. Consequently, when investors have sufficiently long time horizon, outside shares trade at a premium over their value to management, and top management tends to hold a negligible stake, or no stake at all in their company.

When the cost of capital is high, investors heavily discount future payments. They are less willing to undertake a control challenge if it is highly costly in the short run. Since a control challenge is more costly to win the smaller the outside ownership is, management might increase its equity stake in the company when investors have a short horizon. On the one hand, the credibility of the dismissal threat declines as control challenges become more costly to carry out allowing management to increase appropriation of control benefits. On the other hand, a higher management stake in the company aligns the objective of management with those of the shareholders and, thereby, limits appropriation of control benefits (Jensen and

[2]In the corporate world it is fairly common for control challenges to take several rounds before they succeed. Reinitiated tender offers have been examined in Harrington and Prokop (1993) and Franks and Harris (1989). Harrington and Prokop (1993) study the dynamics of rising takeover bids in uncontested tender offers. In an empirical study of UK corporate acquisitions Franks and Harris (1989) find that more than 9 percent of uncontested tender offers involved multiple bids.

Meckling (1976)). The dominant of these two effects determines the managerial response. In our model management accummulates shares when shareholders are short term oriented.

There are interesting implications one can draw from this theory about systematic intertemporal variations in the distribution of corporate ownership. When the real cost of financial capital is sufficiently low then companies are dispersely held with at most a small fraction of equity owned by management. Following an unanticipated jump in the cost of capital that shifts the cost of capital upward, management may suddenly and massively increase their equity stake in their company. Similarly unexpected plunges in the real cost of financial capital ending a period of high cost of capital may induce management to drastically reduce their equity stake and may induce many corporations that went private in periods immediately following a sharp increase in the cost of capital, to reverse their course of action.

Management's ability to counter disciplinary forces by entrenching themselves has been previously stressed by Shleifer and Vishny (1989) and Stulz (1988). In Shleifer and Vishny (1989) management entrenches themselves by investing the firm's resources to make themselves more valuable to shareholders and costly to replace. In Stulz (1988) managers control votes through various contractual arrangements that increase their bargaining power or decrease the value of control of the target for the bidders. In the present paper strategic share purchases serve as means for management of entrenching themselves. Strategic share purchases occur in our model when they are most effective to reduce disciplinary pressure. Management may cope with disciplinary pressure by voluntarily limiting private benefits of control when they can not effectively counter it. When the cost of capital is high and outside shares trade at a discount below their value to management, then disciplinary pressure can be substantially reduced via strategic share purchases.

Our research is also related to the literature on the timing of the wave of MBOs (Lowenstein (1985), Shleifer and Vishny (1988) and Blair and Litan (1991)). Lowenstein attributes the accummulation of MBOs in the early 1980s to changes in the tax law favoring the use of debt. Shleifer and Vishny (1988) argues that tax law changes, inflation and innovation for risky unsecured debt contributed to an increase in the threat of corporate takeovers and the MBO-wave was the management's response to preempt the market pressure. Blair and Litan (1991) report a strong statistical relationship between the MBO-wave and the the cost of capital movements[3] of the early 1980s. They found that the corporate buyouts followed and were motivated by a rise in the cost of financial capital. In our model changes in the cost of capital drive a wedge between entrenched management's and dispersed outsiders' valuations of shares. Management exercises its option to buy (sell) shares when the option is in the money: when management values shares more (less) than outsiders do.[4]

Our paper is organized as follows. Section 2 outlines the model. Section 3 derives the equilibrium dividend policy. Section 4 presents the security market equilibrium. Section 5 investigates the determinants of the equilibrium ownership structure. Section 6 presents the implications of our theory for concentration of outside ownership. Section 7 summarizes the conclusions. Appendix A contains some of the proofs, Appendix B presents a more technical version of the model.

[3]The real cost of capital was measured as the nominal rate on Moody's AAA-rated bonds minus three-year moving average of percentage changes in personal consumption expenditure index.

[4]Since our model suggests that management would be willing to pay a premium to reduce the credibility of the dismissal threat, our theory is also consistent with the substantial value increases during the 1980s takeover wave (Smart (1991)).

Section 2 : The Model of the Corporation

Section 2.1. The basic model

We consider a firm that is owned partly by risk neutral outside investors, I, and partly by its own risk neutral management, M. Of the fixed number of shares, n, outside shareholders hold one share each. Internal control shareholders (management) may hold blocks of any size.

We make the traditional assumptions of the incomplete contracting literature (see Grossman and Hart (1986)). The earnings of the company under current management, v_M, and under the alternative management, v_I are observable for the two parties, but are not verifiable for a third party such as a court, and, consequently, can not be contracted upon. Management enjoys private benefits of control. They have the ability to divert or manipulate the cash flows of the company, to shirk, or to follow suboptimal investment policies (see also Hart and Moore (1994, 1995)).

The model of the corporation is a dynamic game with a common discount factor δ. Management maximizes the discounted present value of their equity shares plus the discounted present value of their control benefits *conditional on retaining control in the future.* The corporate earnings net of the management's private benefits of control are then paid out as dividends, d. For our purposes we divide dividends into two parts, the subtotal received by outside investors, d_I, and the subtotal received by management, d_M.

Section 2.2. The success of a control challenge

Outside equityholders can go along with management or can challenge management[5].

[5]When management has the ability to divert cash flows on a one to one basis, then granting him pure cash, or cash flow incentives would fail to induce management to honor investors' claim (see Hart and Moore (1989)). The only way management can be effectively disciplined is by a threat of dismissal through a control challenge. Fluck (1998) demonstrated that the threat of dismissal combined with financial incentives

Owners, dissatisfied with the value, may initiate a corporate control contest for the dismissal of the management team. The success of a control challenge in a given round is assumed to be a random variable with distribution $(p(i), 1 - p(i))$, where i is the fraction of shares held by outsiders. The distribution of this random variable reflects the degree of managerial entrenchment. When p is less than 1, then control challenges may succeed only after several rounds of reinitiations.

To assess the degree of managerial entrenchment in the corporation, we employ the Shapley values of a normalized cooperative majority voting game. Zingales (1994) and Zwiebel (1995) proposed the Shapley values of a normalized cooperative majority voting game to capture the strategic importance of shareholders in forming controlling coalitions.

In a normalized cooperative majority voting game, the value of a shareholder I, $v(I)$ is one or zero depending on whether or not I owns more than 50 percent of the votes. The Shapley value of votes held by a shareholder I, $\phi_I(v)$, is the probability that those votes are pivotal in a random coalition formation.

For a normalized cooperative majority voting game that is superimposed on our model of corporation the Shapley-value of a small shareholder I is defined as

$$\phi_I(v) = \sum_{S \subset N-I} \frac{|S|!(|N| - |S| - 1)!}{|N|!}(v(S \cup I) - v(S))$$

where $v(S)$ is the value of shares held by coalition S, and $|S|$ is the number of shareholders in coalition S.

To assess the strategic importance of small shareholders in forming controlling coalitions, we multiply the Shapley value of an outside shareholder I, $\phi_I(v)$, by the number of small

can indeed be effective in disciplining management.

shareholders, i. Thus, the degree of managerial entrenchment becomes

$$1 - p(i) = 1 - (i \times \phi_I(v)).$$

The Shapley value has sensible properties. It attributes no value to votes of outside shareholders when management owns more that fifty percent of the votes and very little value when management owns a large but minority proportion of the votes. Consistent with Stulz (1988) and Song and Walkling (1993) that the success of an acquisition attempt decreases with managerial ownership, the Shapley value of small shareholders, $p(i)$, is increasing in i. That is, the higher the fraction of outside equity is, the more likely that outsiders come up with the majority votes to win. Furthermore, since the Shapley-value is, by construction, superadditive[6], the Shapley value of outside equity increases as outside equity becomes more concentrated (Zingales (1995)). That is, when shareholders $J1$ and $J2$ pool their shares and become a single shareholder, say J, then $\phi_J(v) \geq \phi_{J1}(v) + \phi_{J2}(v)$.

Section 2.3. The set of actions and payoffs

Payoffs to management and to outside shareholders in the corporation are presented in Figure 1 below. If no control challenge is initiated, then outsiders receive their fraction of the dividends, d_I, the management has decided, and management receives the remaining fraction of the dividend payments plus their private benefits of control, $v_M - d_I$. A control change occurs if outsiders successfully challenge management. If the outsiders' challenge is successful, then inside shares are diluted and outsiders receive v_I in dividends. If the outsiders' challenge is unsuccessful then management retains control, and outsiders receive their dividends, d_I and management receives their dividends plus private benefits of control that amounts to $v_M - d_I$. In line with the managerial entrenchment literature (see Shleifer

[6]For a comprehensive discussion of the Shapley value see Myerson (1991).

and Vishny (1989))[7], we assume that earnings under incumbent management, v_M, are higher than under the control of outsiders, v_I.

Figure 1 is a diagram of the component game that is played repeatedly as long as no control change occurs. In the component game, outside shareholders decide whether to fire (F) or to retain (R) management. As long as the management team stays in control, they set the dividends.

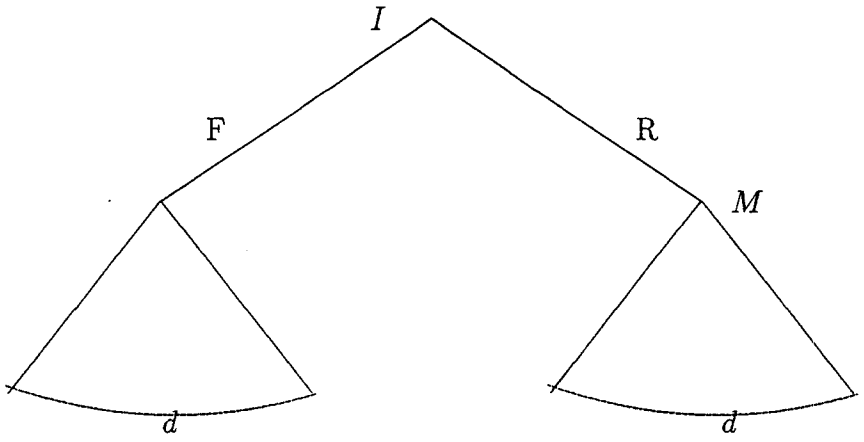

Figure 1: The component game

It is straightforward to see that the component game, when played only once, is dominance solvable. When the game is played only once, retaining future control is worthless, so management has a (weakly) dominant strategy: retain all the proceeds as private benefits, report no earnings and pay no dividends. There is a unique subgame perfect equilibrium in which managers announce no dividends and face a corporate control contest. If, however, the game is played repeatedly over time then equilibria in which management retains control over the operation of the assets and voluntarily limits private benefits of control becomes

[7]Shleifer and Vishny (1989) shows that a manager has an incentive to invest the firm's resources in assets whose value is higher under him than under the best alternative.

supportable by the credible threat of dismissal.

Section 3: The equilibrium dividend policy

Section 3.1: The characterization of the equilibrium dividend policy

If maintaining control in the future is valuable then management maximizes private benefits of control conditional on retaining control of the assets in the future and makes regular dividend payments in equilibrium. An equilibrium dividend policy is an implicit contract between management and outside shareholders supported by the threat to dismiss management and by the lack of a prespecified expiration date on equity.

Given the ownership distribution, $(i, n-i)$, any equilibria in the dynamic game specify the dividend policy, d_I, as a function of corporate characteristics and market parameters. The class of equilibria that we focus on specifies a play in which outsiders retain management at first and as long as equilibrium dividends are paid. If management offers too low a dividend payment or if management fails to pay any dividends at all; or if outsiders deviate by initiating a corporate control contest then both parties resort to the one-shot equilibrium. In case of a deviation by management, it is indeed rational for outsiders to punish them, since it is the threat of punishment that supports the dividend-paying equilibrium. Given that a deviation has occurred, and that it induces punishment in the form of a control challenge, retaining control in the future is no longer valuable and the management's best response coincides with short-run maximization. Similar reasoning underlines the subgame perfection of the equilibria concerning deviations by outside shareholders. The pair of equilibrium strategies $(\sigma^I; \sigma^M)$ are formally specified below.

For I: Do not challenge management in the first period and as long as (d_I^*, R) was played in the prior period. If any deviation occured, play F until you succeed in control.

For M: Pay dividends d_I^* in the first period. Continue paying it as long as (d_I^*, R) was played in the previous period. If any deviation occured, follow the 'no dividend payment' policy forever.

The next step is to specify the equilibrium dividend policy. An equilibrium dividend policy must have the property that it is individually rational for incumbents to pay out dividends and it is individually rational for outsiders to accept the resulting periodic payments and not to challenge control.

Outsiders do not challenge management if, by doing so, the present discounted value of their future payoffs exceeds the present discounted value of the future payoffs that they receive by initating a control contest. That is, if

$$(I): \frac{d_I}{1-\delta} \geq \frac{p(i)v_I}{1-\delta} + (1-p(i))d_I + \frac{\delta(1-p(i))p(i)v_I}{1-\delta} + \frac{\delta^2(1-p(i))^2p(i)v_I}{1-\delta} + \ldots$$

The left-hand side of the incentive-compatibility constraint for outsiders is the payoff along the equilibrium path. The right-hand side is the payoff associated with a one-shot deviation followed by the prespecified equilibrium play. Once outsiders have deviated, a control change is induced with probability $p(i)$. If the challenge is successful, then control is transferred. If the challenge is unsuccessful, then the control contest is reinitiated in the following period. The payoffs associated with deviations by outsiders are expected payoffs. Expectation is taken with respect to the outcome of the corporate control contest. Simplifying the above expression we find that outsiders will not deviate if

$$d_I \geq \frac{p(i)v_I}{p(i) + \delta(1-\delta)(1-p(i))^2}.$$

The upper limit on the size of the equilibrium dividends is given by the management's incentive compatibility constraint. Management is willing to pay out dividends period by

period as long as by doing so the present discounted value of their future payoffs exceeds the present discounted value of their future payoffs associated with deviating. It is sufficient to consider the largest possible deviation by management: paying no dividends at all. The right-hand side of the inequality below shows the expected payoffs associated with the managerial deviation from the equilibrium strategy. Expectations are taken with respect to the outcome of the control contest initiated by outsiders along the punishment path.

$$(M): \ \frac{v_M - d_I}{1-\delta} \geq v_M + \delta(1-p(i))v_M + \delta^2(1-p(i))^2 v_M + \ldots$$

Consequently, the upper limit on dividend payments in equilibrium:

$$d_I \leq \frac{\delta p(i) v_M}{1-\delta(1-p(i))}.$$

The following proposition summarizes the findings.

Proposition 1 *Dividend policies that sustain the management's control and specify equal periodic dividend payments (in real terms) are subgame perfect equilibria for all d_I^* such that*

$$\underline{d}_I^* \equiv \frac{p(i) v_I}{p(i) + \delta(1-\delta)(1-p(i))^2} \leq d_I^* \leq \frac{\delta p(i) v_M}{1-\delta(1-p(i))} \equiv \overline{d}_I^*.$$

As long as δ is such that $\underline{d}_I^* \leq \overline{d}_I^*$ then at least one such equilibrium exists. This inequality is satisfied if and only if

$$v_I \leq \hat{\delta}\, v_M \qquad \text{where } \hat{\delta} = \delta(\delta + p(i)(1-\delta)). \tag{1}$$

This condition requires that the maximal amount management is willing to pay out in dividends exceeds the minimal amount the outsiders are willing to accept while complying

with the management's control. In other words, if incumbents are clearly superior managers ($v_M \geq \frac{v_I}{\hat{\delta}}$), then their control can be sustained as a dividend-paying equilibrium for any reasonable discount factor. Notice that outsiders always challenge incumbents who are poor managers ($v_I > v_M$). In addition, they will also challenge managers who are only marginally better than the alternative, $v_M \geq v_I \geq \hat{\delta} v_M$, so contests will be initiated too often.

Assuming that outside investors are willing to provide finance if they break even, it is natural to select the management's most preferred equilibrium for further investigation[8].

Section 3.2. The properties of the equilibrium dividend policy

After taking the first derivative of $\underline{d}_I^*$ it is straightforward to see that $\underline{d}_I^*$ is increasing in p. Outsiders as a group are paid more in dividends the higher p is, or alternatively, the shorter a successful control challenge is. In other words, outsiders as a group are paid more in dividends, the more effective they are in disciplining management.

In particular, if $p = 1$ (the case analyzed by Fluck (1998)), then outsiders can guarantee themselves the full value of their outside option, v_I, in dividends. If, however, $p = 0$, that is, if outsiders have no chance to ever discipline management, then they can not enforce any dividends from management. This happens, for instance, if management holds more than fifty percent of the votes.

Furthermore, since p increases as the fraction of outside equity rises, outsiders as a group are paid more in dividends, the more they own in the company. Finally, after taking the second derivative of $\underline{d}_I^*$, we find that the dividend payment outsiders as a group receive is concave in p. The degree of concavity is determined by the investors' time preference. As a

[8]Both the management's and the outsiders' most preferred equilibrium (and any linear combination of the two) has the property that is needed for our results to hold, namely, that d_I is increasing and concave in p.

consequence, the impact of an increase in managerial ownership varies with investors' time preference.

Section 4. The security market equilibrium

Section 4.1. Security market

We now describe how trading between management and outside investors implements the equilibrium ownership structure.

There are three types of participants in the security market: internal control shareholders (management), existing and potential outside shareholders. Management can hold onto their shares, purchase additional shares, or sell some or all of their shares. Outside shareholders can sell their shares or hold onto their shares. Potential outside shareholders can buy one share from management or they can replace an outside shareholder by purchasing his share.

The timing of the model is as follows. First internal control shareholders submit limit orders to a broker. A limit order consists of the desired number of shares to be sold (purchased), $k^M < 0$ ($k^M > 0$,) and the minimum (maximum) price at which the trade can be executed, q^M. Then existing and potential outside shareholders submit the set of prices, $Q^I(i-k^M)$, $Q^{PI}(i-k^M)$ at which they are willing to sell or purchase their one share, respectively, conditional on the post-trade equity ownership by outsiders. The orders are publicly observable. If there are prices at which both sides are willing to trade then the orders are executed.

Let θ^M, θ^I, θ^{PI} denote the discounted present value of an internal control, outside, and potential outside shareholder's receipts associated with the trading strategies and the implied dividend policy, respectively. Then, an equilibrium of the trading model that supports a

dividend-paying equilibrium in the corporation is the six-tuple

$$(k^M, q^M, \sigma^M, Q^{PI}(i-k^M), Q^I(i-k^M), \sigma^I)$$

such that both internal control shareholders and their trading partners play best responses and have rational expectations of the outcome of the trade. That is, for all $k^{M'} \neq k^M$

$$\theta^M(k^M, q^M, \sigma^M, Q^{PI}(i-k^M), Q^I(i-k^M), \sigma^I)) \geq \tag{2}$$
$$\theta^M(k^{M'}, q^M, \sigma^M, Q^{PI}(i-k^{M'}), Q^I(i-k^{M'}), \sigma^I)$$

holds. In addition, for all existing outside shareholder l, and for all $Q_l^{I'}(i-k^M)$:

$$\theta_l^I(k^M, q^M, \sigma^M, Q^{PI}(i-k^M), Q^I(i-k^M), \sigma^I)) \geq \tag{3}$$
$$\theta_l^I(k^M, q^M, \sigma^M, Q^{PI}(i-k^M), Q_l^{I'}(i-k^M), Q_{-l}^I(i-k^M), \sigma^I)$$

holds. Finally, for all potential outside shareholder l, and for all $Q_l^{PI'}(i-k^M)$:

$$\theta_l^{PI}(k^M, q^M, \sigma^M, Q^{PI}(i-k^M), Q^I(i-k^M), \sigma^I)) \geq \tag{4}$$
$$\theta_l^{PI}(k^M, q^M, \sigma^M, Q_l^{PI'}(i-k^M), Q_{-l}^{PI}(i-k^M), Q^I(i-k^M), \sigma^I))$$

holds. Such equilibrium exists if there are prices at which both sides are willing to trade, that is, if

$$\emptyset \neq \begin{cases} [q^M, \infty) \cap Q^{PI}(i-k^M) & \text{if } k^M < 0 \\ (0, q^M] \cap Q^M(i-k^M) & \text{if } k^M > 0 \end{cases}, \tag{5}$$

and if the corresponding equilibrium dividend policy $d_I^*(i-k^M) = \frac{p(i-k^M)v_I}{p(i-k^M)+(1-\delta)\delta(1-p(i-k^M))^2}$ satisfies (M) and (I) in the corporation game.

Section 4.2. Managerial trading

Internal control shareholders and outsiders value their shares differently. While outside shares are valued at the discounted present value of all future dividend per share, or *average dividends,* internal control shareholders' private valuation of a share is equal to the present discounted value of the *marginal change in the total dividends.* If the former exceeds (falls short of) the latter, then management can realize a gain by selling (purchasing) shares[9]. Management would be willing to sell (purchase) shares if the price they pay plus the dividends they are obliged to pay out to outsiders in equilibrium under the ex-post ownership structure, is less (more) than the dividends, they are obliged to pay out to outside shareholders in equilibrium under the ex-ante ownership structure.

Proposition 2 *Whenever inequality (1) holds and whenever the equilibrium dividend per share, $d_I(i)/i$, is a decreasing function[10] of i, then management prefers to sell its equity stake in the company.*

Proof: See Appendix.

When $d_I^*(i)/i$ is decreasing in the fraction of shares held by outsiders, then the dividend-per-share, $d_I^*(i)/i$, exceeds the marginal change in total dividends, $d_I^*(i-1) - d_I^*(i)$. Hence, management values his shares less than outsiders do. Even though incumbents trade with buyers at equilibrium market value and the buyers get the full value they paid for, internal control shareholders can, by selling their shares, realize a potential gain at the expense of

[9]This situation is somewhat analogous to Bulow and Rogoff (1988) model of debt-buybacks in Latin-America. In Bulow and Rogoff (1988) debt is sold at average value but the gain from the buy-back is the marginal value. Debt buy-back is not profitable for the country because the induced marginal change in debt falls short of the price paid for.

[10]Recall from Section 4 that d_I, the sum of all dividends received by outsiders, is always non-decreasing in i.

existing shareholders. Consequently, when the dividend per share is a decreasing function of the fraction of shares held by outsiders, the incumbents' optimal strategy is to sell all their shares at a price equal to the post-trade market value of a share[11].

Consistent with empirical evidence that managerial trading moves the share price, new-coming outsiders are accompanied by a fall in average market return on investment. While no new value is created in the process, value is transferred from existing outside shareholders to management.

Even though each shareholder has one vote (Grossman and Hart (1988), Harris and Raviv (1988)), outsiders' failure to promptly exercise their rights enables management to appropriate a disproportionately large share. Hence outsiders' failure to exercise control brings a distortion in the one-share one-vote rule[12].

The next proposition establishes that when the dividend-per-share is increasing in the fraction of outside equity, then companies with a controlling managerial equity stake also arise in equilibrium.

Proposition 3 *Whenever inequality (1) holds and the dividend per share, $d_I^*(i)/i$, is increasing in the fraction of shares held by outsiders, then management finds it profitable to increase its equity stake in the company.*

Proof: The proof is analog to that of Proposition 2 and is omitted.

When $d_I^*(i)/i$ is increasing in the fraction of shares held by outsiders, then the marginal

[11]Worth mentioning that management can also achieve the same goal by issuing new shares. By issuing new shares management can increase the fraction of shares held by outsiders and, thereby, can realize a potential gain at the expense of existing outside equityholders. The new equity issue will be accompanied by a fall in the share price.

[12]An alternative mechanism to discipline management when dispersed outside shareholders are completely unable to do so is hostile takeovers. For studies of how the threat of a hostile takeover can discipline management see Morck, Shleifer and Vishny (1989) and Zwiebel (1996).

change in total dividends, $d_I^*(i-1) - d_I^*(i)$ exceeds the dividend-per-share, $d_I^*(i)/i$. Hence, management's private valuation of shares exceeds that of the outsiders. Consequently, when the dividend per share is an increasing function of the fraction of shares held by outsiders, the incumbents' optimal strategy is to increase its equity stake in the company.

Corollary 1 extends Proposition 3 for the case when the dividend-per-share has an interior maximum[13]. The proof is analog to that of Proposition 2 and is omitted.

Corollary 1 *Whenever inequality (1) holds and the dividend per share, $d_I^*(i)/i$, has an interior maximum at i^*, then in equilibrium any manager with a stake smaller than $n - i^*$ finds it profitable to increase its equity stake in the company.*

Worth noting that when the dividend-per-share is increasing in the fraction of shares held by outsiders, it is profitable for management to purchase shares even at a premium over the pre-buyout market value of a share. Since buyout will occur if the managerial entrenchment effect outweighs the convergence-of-interest effect, the buyout will be followed by a fall in the share price. Consistent with Stulz (1988) and Morck, Shleifer and Vishny (1988), an increase in inside ownership makes management more entrenched and less subjected to the discipline of the market for corporate control in our model. This implication is also in line with evidence reported by Morck, Shleifer and Vishny (1988) that Tobin's Q falls as managerial ownership becomes large.

We recognize that management's ability to buy or sell shares may be limited by wealth constraints or by restrictions on the sale of equity received as part of the managerial compensation package. Because of wealth constraints, or as a consequence of stock-based compensation packages, management may hold less or more equity, respectively, than they would

[13]If the dividend-per-share has an interior minimum, then the management's optimal strategy depends on the precise shape of the dividend-per-share function and the size of the managerial ownership stake.

otherwise wish. Our analysis suggests that when the dividend-per-share is a decreasing function of the fraction of shares held by outsiders, then outsiders can benefit from granting management equity shares and restricting the sale of these shares[14]. When the manager holds restricted shares, then he can not reduce his ownership stake as much as he would otherwise wish and outsiders will enjoy higher dividend-per-share[15].

In contrast, when the dividend-per-share is increasing in the fraction of shares held by outsiders then shareholders do not benefit from granting restricted shares as managerial compensation. To the extent that management is willing to pay a premium over the market value of shares when the dividend-per-share is increasing in the fraction of shares held by outsiders, granting restricted shares or executive stock options as managerial compensation might actually reduce shareholder value then. Our reasoning implies that market factors that drive a wedge between entrenched management's and dispersed outside shareholders valuation of shares can not be ignored when deciding whether or not to grant stock-based compensation to management.

Section 5: The equilibrium ownership structure

The fraction of outside equity has two opposite effects on dividends, and, consequently on the share price. As p falls (by a rise in the management's stake) the threat of dismissal becomes less and less credible and outsiders can only enforce smaller dividend payments. On

[14]Gorton and Grundy (1997) develops an interesting theory of optimal managerial compensation in a principal agent model of a long-lived firm with assets-in-place and multiple managers. The authors show that an optimal managerial compensation scheme, an example of which is granting management company shares and restricting the sale of these shares, is one that combines deferred managerial compensation with some degree of managerial entrenchment. In Gorton and Grundy (1997) entrenchment is desirable when it is necessary to make credible the promise of deferred compensation, and it is the loss of deferred compensation that penalizes a manager who resigns in order to free-ride on a replacement's effort.

[15]Worth highlighting that executive stock options are no substitutes for restricted equity shares in this case.

the other hand, as p falls, the outsiders' net gain from winning control rises, dividends go up, management's appropriation of private benefits declines and the interests of the parties converge. Similarly as p rises (by a fall in management's stake), the threat of dismissing management becomes more credible and, consequently, outsiders demand more value. On the other hand, as p rises, the outsiders' net gain from winning control falls, dividends fall, management's appropriation of control benefits rises and the interests of the parties diverge.

In the context of the managerial payoff these two effects are the managerial entrenchment (credibility-of-dismissal) effect and the convergence-of-interest effect. The convergence-of-interest effect dominates the managerial entrenchment effect when an increase in managerial ownership would benefit outside shareholders more than management. This is the case when dividend payments decrease (increase) as the fraction of inside (outside) equity increases but at a diminishing rate so that the dividend-per-share actually rises (falls). When the convergence-of-interest effect dominates the managerial entrenchment effect then revenues from selling shares exceed the corresponding rise in future dividend payments, and management prefers to sell its equity stake. The managerial entrenchment effect dominates the convergence-of-interest effect whenever shares can be purchased by management for less than what management gains by reducing future dividend obligations. This is the case when dividend payments are increasing and sufficiently convex in the fraction of outside equity so that the dividend-per-share rises (falls) as outside equity increases (decreases). When the managerial entrenchment effect dominates the convergence-of-interest effect then management prefers to purchase more equity shares in the company.

The next two propositions highlight that the monotonicity properties of the equilibrium dividend-per-share and, consequently, the equilibrium ownership structure ultimately depends on the real cost of financial capital. Our first result implies that when the real cost of

capital is very low or, alternatively, when investors have sufficiently long time horizon then management prefers to sell its equity stake in the company.

Proposition 4 *There exists a $\underline{\delta}$ sufficiently close to* 1 *(or there exists a $\overline{r}$ sufficiently close to* 0*) such that for any $\delta > \underline{\delta}$ (or for any $r < \overline{r}$) $d_I^*(i)/i$ is decreasing in i for any non-decreasing function $p : Z_+ \mapsto (0, 1]$.*

Proof: See in Appendix.

The intuition is as follows. Whenever the cost of capital is very low, then outsiders are relatively long-term oriented. They challenge control unless they receive dividends that are *equal* to their post-contest eventual payoff, almost regardless of the likelihood of success. They hardly care how many attempts it takes to win control as long as the expected length of time is finite. Since their decision whether to challenge control is made almost regardless of the probability of success, there is hardly any dividend premium associated with additional outsiders improving the odds of the corporate control contest. Consequently, whenever the real cost of financial capital is very low, the dividend-per-share decreases in the fraction of outside ownership. It follows then from Proposition 2 that whenever the dividend-per-share decreases as the fraction of outside equity shares increases, management prefers to sell its equity stake in the company.

The next proposition shows that high cost of capital may give rise to ownership structures with substantial managerial equity stakes.

Proposition 5 *If $p : Z_+ \to (0, 1]$ is monotone increasing and satisfies the convexity property*

$$(i-1)\frac{p(i)-p(i-1)}{p(i-1)} \geq \frac{p(i)+c(1-p(i))^2}{c(1-p(i-1)p(i))} \quad \forall i:\ 1 \leq l \leq i < n \tag{6}$$

where $c = \delta(1-\delta)$, then $d_I^*(i)/i$ is increasing for $i \geq l$.

Proof: See Appendix.

Proposition 5 demonstrates that when p increases and satisfies (6) for every $l \leq i < n$, then $d_I^*(i)/i$ increases for $i \geq l$. It follows from Corollary 1 that whenever $d_I^*(i)/i$ increases in i for $i \geq l$, then any management holding less than $n - l$ is willing to increase its equity stake in the company. Notice that, as Figure 2 illustrates, the right hand side of condition (6) decreases in the cost of capital for reasonable cost of capital values ($r \leq 100\%$).

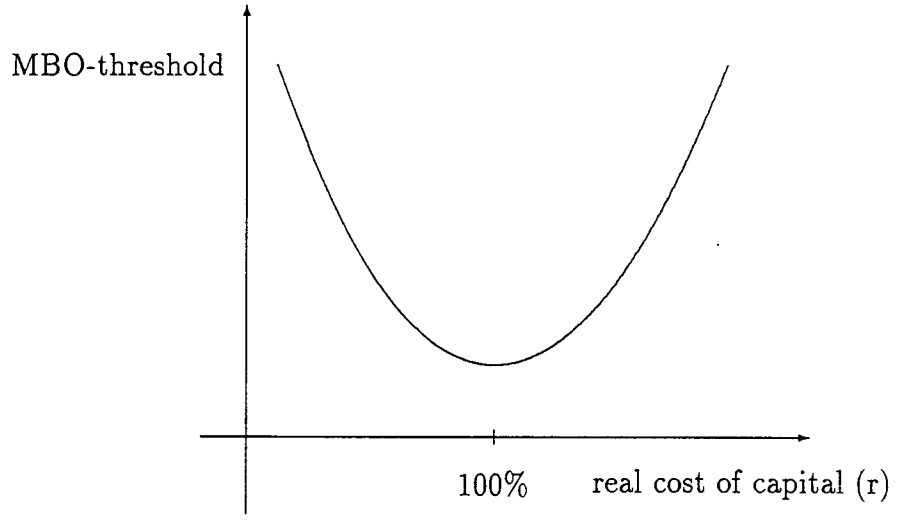

Figure 2: The MBO-threshold and the real cost of capital

Hence as the cost of capital rises more and more convex functions satisfy property (6). Notice also that condition (6) serves as a threshold. Whenever the inequality holds for $l \leq i < n$, management will purchase shares and sizeable managerial holdings (up to $n - l$ shares) will arise in equilibrium. Whenever the inequality is violated for all i, management finds it profitable to sell its equity stake in equilibrium. It is as if the manager were holding a put and a call option on the company with the market price as exercise price. These shares have a private value for the management. Whenever shares sell at a premium (discount)

relative to their value to management, management exercises its option to sell (purchase) shares in the company.

The states with low and high real cost of capital give rise to different ownership structures. Hence unanticipated changes in the real cost of financial capital might induce buyout/reverse buyout transactions. An unanticipated rise in the real cost of capital might induce management to increase its equity stakes. An unanticipated plunge in the real cost of capital might induce the incumbents to sell shares or go public. While shares are priced differently, buy-out patterns are the same when shareholders assign small positive probabilities to movements in the cost of capital as shown in Appendix B.

Notice also that although the *threat* of control challenges declines as the real cost of capital rises, more control challenges may be initiated following the rise in the real cost of capital, since a rise in the cost of capital may also upset the existence condition (1). If this is the case, retaining control in the future is worthless for management. Management reports no earnings, pays no dividends, and, as a result, control challenges are initiated for the dismissal of the management team.

Section 6. Concentration of outside ownership

So far we have limited outside investors to hold one share each. In this section we extend our model of corporation to incorporate concentrated outside ownership by assuming that one outside shareholder, K, can purchase a block of k shares.

Our first step is to assess the impact of the concentration of outside equity on managerial entrenchment. If one shareholder holds $k > 1$ shares and the rest of the outsiders hold one share each, then the degree of managerial entrenchment, $1 - p(i,k)$ can be calculated as

$$1 - p(i,k) = 1 - ((i-k)\phi_I(v) + \phi_K(v)),$$

where $\phi_I(v)$ denotes the Shapley-value of a small shareholder and $\phi_K(v)$ denotes the Shapley-value of the concentrated outside shareholder. As we noted in Section 1.2, it follows from the superadditivity property of the Shapley-value that when shareholders $J1$, $J2$, ..., JK are replaced by a single shareholder K, then $\phi_K(v) \geq \sum_{l=1}^{k} \phi_{Jl}(v)$. Hence, concentration of outside ownership increases outside shareholders' control over management.

Whether or not the equilibrium ownership structure is affected by the potential concentration of outside equity depends on the real cost of financial capital. Recall from Proposition 4 that when the cost of capital is low, then outsiders are long-term oriented and they are willing to carry out a control challenge regardless of the probability of success. Since the probability of success does not affect the threat of a control challenge, concentration of outside equity does not lead to improved managerial performance. Hence, when the cost of capital is low, concentration of outside equity has no effect on the dividends, or on the share price. Therefore, K will be indifferent between buying k shares in one firm, or one share each in k firms. Regardless of whether there is a concentrated outside equityholder, Proposition 4 applies: When the cost of capital is low, the dividend-per-share will be a decreasing function of the fraction of outside equity. Hence, Proposition 2 also applies: Management will find it profitable to sell its shares to outsiders.

When the cost of capital is high, then ownership concentration has a direct effect on the equilibrium ownership distribution between management and outside shareholders. When shareholders are short-term oriented, their willingness to discipline management depends on the cost of the control challenge and ultimately on the probability of success. Since concentration of outside equity improves the probability of success, it also improves managerial performance by increasing the threat of the control challenge. Hence, dividends increase as outside equity becomes more concentrated and so increases the share price. Since in equilib-

rium K must pay the price that reflects the improved probability of success, he is indifferent between purchasing k shares in one firm, or purchasing one share each in k firms.

There are two questions that we need to investigate here. One is whether in the presence of a large shareholder management would want to increase its equity stake. The second is whether in a firm with dispersed outside equity, K can stop management from purchasing additional shares by buying a block of k shares himself.

Consider first the case when the cost of capital is high and there is a large outside shareholder. As outside ownership becomes more concentrated small shareholders play a lesser role in disciplining management, so additional small shareholders are more likely to decrease the dividend-per-share in companies with concentrated outside ownership. As a result, companies with dispersed outside ownership are more likely to satify (6), whereas companies with concentrated outside ownership are more likely to fail (6). Hence, it follows from Proposition 5 that management is more likely to purchase shares in companies with dispersed outside ownership than in companies with concentrated outside ownership.

Consider next the case when outside equity is dispersed and (6) holds. It then follows from Proposition 3 and Corollary 1 that management finds it profitable to increase its equity stake in the company. K can not stop the management buyout by outbidding management and purchasing a block of k shares from dispersed outside equityholders, since the maximum K would be willing to pay for a block of k shares,

$$k \times \frac{p(i,k)v_I}{i(p(i,k)+\delta(1-\delta)(1-p(i,k))^2)},$$

is less than the maximum management would be willing to pay for these shares,

$$k \times \frac{p(i,k)v_I}{i(p(i,k)+\delta(1-\delta)(1-p(i,k))^2)} +$$
$$(i-k) \times \left(\frac{p(i,k)v_I}{i(p(i,k)+\delta(1-\delta)(1-p(i,k))^2)} - \frac{p(i-k,0)v_I}{i(p(i-k,0)+\delta(1-\delta)(1-p(i-k,0))^2} \right).$$

Management can outbid K because management gains more from the buyout, since the buyout also reduces the value of the remaining outside shares (see the second term in the above expression). Nevertheless, the potential presence of K might force management to pay a premium to outside equityholders over the post-buyout price of a share.

Summarizing these implications, our theory suggests that when the real cost of financial capital is sufficiently low, then companies are held by outsiders. Following an unanticipated jump in the cost of capital, concentration of outside ownership increases shareholder value and it might be worthwhile for management to purchase a substantial equity stake in the company even at a premium.

Recent work by La Porta et al. (1997a) reports evidence of an inverse cross-sectional relationship between the level of legal protection investors enjoy and the concentration of outside equity ownership. Our theory can be extended to incorporate the level of legal protection investors enjoy by introducing an additional variable, l, in the expression of the degree of managerial entrenchment. The interpretation of this parametrization is that when investors' legal protection is weak then their ability to participate in various coalition formations may be impaired. For example, in a country where all shareholder meetings are held at the same time at various locations, it is impossible for investors with shares in several companies to participate at their companies' shareholder meetings. The lower l, the more restricted outsiders are in forming winning coalitions and hence, the smaller the Shapley-value of an outsider becomes (Myerson(1991)). Thus, dividends fall as investors' legal protection weakens (La Porta et al. (1997b)). Consistent with La Porta et al. (1997a), our theory predicts higher ownership concentration in countries where investors' legal protection is weak and outsiders' ability to carry out a successful control challenge is severely limited.

Conclusion:

It has long been recognized in the literature (Shleifer and Vishny (1996) and references therein) that dispersed outside shareholders have difficulty to enforce their interest even when they hold the majority of the votes. Academic studies have focused on how dispersed shareholders behave in takeover contests (Grossman and Hart (1980a), Shleifer and Vishny (1986), Bagnoli and Lipman (1988), Hirshleifer and Titman (1988), Zingales (1995)) and also how concentrated outside equity can discipline management (Shleifer and Vishny (1986, 1996) and Fluck (1997,1998)). The present paper fills in an important missing link in the literature by showing how disperse outside equity can guarantee itself some value when management has the ability to divert or manipulate the cash flows, to shirk or to follow suboptimal investment policy and when it is costly to verify any managerial wrongdoing for a third party such as a court. We show that when dispersed shareholders hold the majority of shares, they can only enforce their claim to the extent they are willing to exercise their vote. The one-share one-vote rule prevails but with a twist: outside shareholders' effective claim is proportional to their effective vote only.

By directly modelling the disciplining mechanism and its dependence on the concentration and the time horizon of investors, we describe how deviation between management's and outsiders' valuation of shares can induce management to trade. Management chooses the distribution of equity ownership so as to maximize private benefits against the risk of potential control challenges. When shareholders are long term oriented, then outside shares trade at a premium over their value to management, and management is inclined to sell off its equity shares to dispersed outsiders. Buyouts occur following an unexpected jump in the cost of capital. When shareholders are short-term oriented, their ability to discipline management substantially declines as managerial ownership increases, and so increases man-

agement ability to appropriate private benefits in equilibrium. Consequently, management is willing to pay a premium for increasing its equity stake in the company.

The question naturally arises to what extent new debt issues might alter the contest for control. Since we do not yet have a theory of optimal security design for firms that issue *both* debt and equity, this question is beyond the scope of this paper. We hope that future research will investigate whether in this model with cash flows being diverted by management Jensen's solution to the free cash flow problem plays a role and explore to what extent, if any, the possibility of bankruptcy might alter the management's action.

Appendix A:

Proof of Proposition 2:

When $d_I^*(i)/i$ is decreasing in i, then the equilibrium strategies for I and PI are respectively:

$$\textit{For } I\textit{:} \text{ sell at or above } \begin{cases} \frac{d_I^*(i-k^M)}{(i-k^M)(1-\delta)} & \text{if } k^M \leq 0 \\ \frac{d_I^*(i+k^M)}{(i+k^M)(1-\delta)} & \text{if } k^M \geq 0 \end{cases}$$

$$\textit{For } PI\textit{:} \text{ buy at or below } \begin{cases} \frac{d_I^*(i-k^M)}{(i-k^M)(1-\delta)} & \text{if } k^M \leq 0 \\ \frac{d_I^*(i+k^M)}{(i+k^M)(1-\delta)} & \text{if } k^M \geq 0 \end{cases}$$

Given these schedules incumbents place a sale order of k^M if the resulting change in dividends is less than their sales receipts:

$$\frac{d_I^*(i-k^M)}{(1-\delta)} - \frac{d_I^*(i)}{(1-\delta)} < \frac{d_I^*(i-k^M)}{(i+k^M)(1-\delta)}.$$

This inequality holds whenever $d_I^*(i)/i$ is decreasing in i. No purchase is profitable for management then. Consequently, management finds profitable to sell its equity stake.

The only step left is to show that Q^I is the unique rational expectation subgame perfect trading strategy. Consider a trading strategy with a price schedule $Q^{I'}$ for $l \in I$ that specifies trading below some of the prices in Q^I. If l believes that trade is successful at the $Q^{I'}$ price then, since the dividend per share is decreasing, he would rather hold onto his share than trade it. If l believes that management will fail to purchase the desired number of shares then he is running the risk of being picked up at some lower than equilibrium price and would rather hold onto his shares. If $Q^{I'}$ differs from Q^I at one point only then l would simply be indifferent between trading and holding in the later case and he may as well hold onto his share. Now consider a trading strategy with a price schedule $Q^{I'}$ for $l \in I$ that specifies purchasing shares above some of the prices in Q^I. Such a $Q^{I'}$ would fail the test of subgame perfection. Similar argument proves that the trading strategy associated with Q^{PI} is the unique rational expectation subgame perfect trading strategy. **Qed**

Proof of Proposition 4:

$$\frac{d_I^*(i)}{i} - \frac{d_I^*(i-1)}{i-1} < 0$$

for all $i > l \geq 1$, if

$$\begin{aligned} &(i-1)c(p(i)-p(i-1)) - cp(i-1)(1-p(i))^2) - \\ &(i-1)c(p(i)-p(i-1))p(i-1)p(i) - p(i-1)p(i) \quad < 0 \end{aligned} \tag{7}$$

holds for all $i > l \geq 1$.

Taking the limit of (7) as c tends to zero, one finds that all but one term uniformly tend to zero. Therefore, (7) goes to $-p(i)p(i-1)$ and

$$-p(i)p(i-1) \leq -p(i_0)^2 < -1/2\, p(i_0)^2$$

for every $i \in [i_0, n]$, where $p(i_0) > 0$.

Consequently, there exists a $\tilde{c} > 0$ such that $\forall c > \tilde{c}$,

$$\begin{aligned}&(i-1)c(p(i)-p(i-1)) - cp(i-1)(1-p(i))^2) - \\ &(i-1)c(p(i)-p(i-1))p(i-1)p(i) - p(i-1)p(i) \quad < 0\end{aligned} \tag{8}$$

$\forall i \in [i_0, n]$.**Qed**

Proof of Proposition 5:

$d_I^*(i)/i - d_I^*(i-1)/(i-1) > 0$ for $i:\ 1 \leq l \leq i < n$ for a given $c \neq 0$ if

$$(i-1)c(p(i)-p(i-1))(1-p(i-1)p(i)) - cp(i-1)(1-p(i))^2) - p(i-1)p(i) > 0, \tag{9}$$

that is,

$$(i-1)\frac{p(i)-p(i-1)}{p(i-1)} \geq \frac{p(i)+c(1-p(i))^2}{c(1-p(i-1)p(i))} \quad \forall i:\ 1 \leq l \leq i < n \tag{10}$$

when $0 < p(i) < 1$. **Qed**

Appendix B:

In this appendix we describe a model of corporation wherein

(1) the discount factor is either high (H) or low (L) with positive probability each period;

(2) unexpected changes in the cost of capital have a persistent effect.

We assume that the periodic discount factor follows a first-order Markov process with a stationary transition. The probabilities of $\delta_{t,t+1}$ H (or L) conditional on $\delta_{t-1,t} = H$ (or L) are assumed to be close to 1 and $Prob(\delta_{t,t+1} = H|\delta_{t-1,t} = H) = Prob(\delta_{t,t+1} = L|\delta_{t-1,t} = L)$. We will also use the following notations: $\delta_{0,0} = 1$ and $\delta_{0,k} = \pi_{j=1}^{k}\delta_{j-1,j}$.

Investors do not dismiss management in equilibrium as long as the payoff they anticipate in equilibrium exceeds the payoff they can attain by dismissing management and taking

control over the operation. Along the equilibrium path, each period outside equityholders receive dividends totalling d_I as long as no management buyout occurs. Outside shareholders rationally anticipate a potential management buyout following an unexpected rise in the cost of capital. When a buyout is proposed then tendering shareholders receive the tender price for each share and the remaining shareholders receive dividends equal to the post-tender value of their shares. When tendering shareholders hold out, they appropriate all the gains from the buyout at the expense of the remaining shareholders making management just indifferent between buying or not buying a majority stake in the company. For management to be indifferent between buying or not buying a majority stake in the company, it must be the case that management faces the same payment streams in these two scenarios. In other words, it must be the case that the price paid to tendering shareholders plus the post-buyout value of the remaining outside shares equals to $d_I(i)\sum_{k=0}^{\infty} E(\delta_{0,k})$, the present discounted value of dividends management expects to pay out when no buyout is initiated[16]. Since each shareholder have rational expectation, each anticipates to end up with $\frac{d_I(i)\sum_{k=0}^{\infty} E(\delta_{0,k})}{i}$ in case of a buyout. Those who remain with the company get

$$\frac{\sum_{k=0}^{\infty} E(\delta_{0,k} d_I(i'))}{i'} \leq \frac{d_I(i)\sum_{k=0}^{\infty} E(\delta_{0,k})}{i},$$

where i' is the fraction of shares held by the remaining outsiders following the buyout, and those who tender get

$$\frac{\sum_{k=0}^{\infty} E(\delta_{0,k} d_I(i))}{i} - \frac{\sum_{k=0}^{\infty} E(\delta_{0,k} d_I(i'))}{i'}$$

a price that includes a high premium over the pre-buyout market value of a share. At this price the offer is oversubscribed, everybody wants to tender, and each shareholder tenders with positive probability. This completes the outside equityholders' problem.

[16]where i is the fraction of shares held by outsiders before the buyout.

Having specified the outside shareholders' problem we can write their individual rationality constraints for the case when $\delta_{-1,0} = H$ and for the case when $\delta_{-1,0} = L$. When $\delta_{k-1,k}$ is high, dividends are d_I^H and when $\delta_{k-1,k}$ is low, period k dividends are d_I^L.

When $\delta_{-1,0} = H$ and current dividends are d_I^H :

$$p(i)d_I^H(i) + \sum_{k=1}^{\infty} E(\delta_{0,k}d_I(i)|\delta_{-1,0} = H) \geq$$

$$p(i)v_I + v_I \sum_{k=1}^{\infty}(1 - (1 - p(i))^k)E(\delta_{0,k}|\delta_{-1,0} = H), \tag{11}$$

When $\delta_{-1,0} = L$ and current dividends are d_I^L :

$$p(i)d_I^L(i) + \sum_{k=1}^{\infty} E(\delta_{0,k}d_I(i)|\delta_{-1,0} = L) \geq$$

$$p(i)v_I + v_I \sum_{k=1}^{\infty}(1 - (1 - p(i))^k)E(\delta_{0,k}|\delta_{-1,0} = L). \tag{12}$$

Notice that $\sum_{k=1}^{\infty} E(\delta_{0,k})$ exists since

$$\sum_{k=1}^{\infty} E(\delta_{0,k}) \leq \sum_{k=1}^{\infty} H^k = \frac{H}{1-H}.$$

After replacing the inequality signs with equality signs and rewriting these equations on a per share basis, we differentiate the right hand sides of the resulting equalities in i. The two expressions are shown below.

When the cost of capital is currently low:

$$\frac{(p'i - p(i))v_I + p'iv_I \sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = H)k(1 - p(i)^{k-1})}{i^2}$$

$$- \frac{v_I \sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = H)(1 - (1 - p(i)^k)}{i^2}. \tag{13}$$

When the cost of capital is currently high:

$$\frac{(p'i - p(i)v_I + p'iv_I \sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = L)k(1-p(i))^{k-1})}{i^2}$$

$$- \frac{v_I \sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = L)(1-(1-p(i))^k)}{i^2}. \tag{14}$$

Notice that $\sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = H)(1-p(i))^k$ exists and finite for every H finite, for every i, $p(i) > 0$, and for every q, $q \equiv Prob(\delta_{t,t+1} = H|\delta_{t-1,t} = H)$. Consequently, $\sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = H)k(1-p(i))^{k-1}$ also exists and finite for every H finite, for every i, $p(i) > 0$, and q. However, $\sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = H)$ fails to exist for any $H \geq 1$, $q = 1$. Therefore, for every p' bounded there exist pairs of $(\tilde{H}_{p'}, \tilde{q}_{p'})$ close to $(1,1)$ such that $\sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = H)(1-(1-p(i))^k$ exceeds $p'i \sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = H)k(1-p(i))^{k-1}$ for any pair (H,q), $1 > H > \tilde{H}_{p'}$ and $1 > q > \tilde{q}_{p'}$. As a result, for any pair (H,q), $1 > H > \tilde{H}_{p'}$ and $1 > q > \tilde{q}_{p'}$, expression (13) is negative regardless of p, for $p > 0$. It follows then from Proposition 2, that when the market value of outside shares decreases in fraction of outside ownership, as it is the case when (13) is negative, then management keeps no equity stake in the company. Hence, it is established that when the cost of capital is low then all the equity is held by outsiders.

When the discount factor suddenly plunges to L, so that (14) turns positive, then management offers to buy out the company. This is the case if

$$p'i > max\left\{p(i), \frac{\sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = L)(1-(1-p(i))^k)}{\sum_{k=1}^{\infty} E(\delta_{0,k}|\delta_{-1,0} = L)k(1-p(i))^{k-1}}\right\}$$

for some $i \in (\hat{i}, n)$ where $L << \tilde{H}_{p'}$, $(\tilde{H}_{p'}, 1)$ is a pair of cutoff values defined above. It follows from Proposition 3 that when the market value of outside shares increases in fraction of outside ownership, as it is the case when (14) is positive, then management is inclined

to increase its equity stake in the company, that is, to buy out the company. Hence, we have also established that unanticipated significant jumps in the cost of capital give rise to management buyouts. **Qed**

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