Essays in Corporate Finance

by

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Abstract

In this thesis we consider the role of managerial incentives in the financing and investment activities of firms. In Chapter 1 we present a model illustrating that a potential cost of strong incentives for managers is that it may raise the cost of external finance by exacerbating asymmetric information problems. We show that this effect has the observable implication that strong managerial incentives can increase the sensitivity of a firm's investment to its internal cash flow in the presence asymmetric information. At the same time, we model how strong incentives for managers will decrease the sensitivity of investment to internal cash flow in the presence of a strong managerial preference for growth or size.

In Chapter 2 we investigate empirically the results presented in Chapter 1 by estimating reduced form investment regression equations on a panel of 411 firms for the years 1973-1976. We use insider ownership as a proxy for the strength of managerial incentives. We find strong evidence that the sensitivity of investment to cash flow increases with insider ownership at low levels of ownership, and then levels off and decreases slightly at higher levels of insider ownership. We interpret these findings to be evidence for capital market problems such as asymmetric information inflating the cost of external funds. We argue that our evidence is inconsistent with the other leading alternative explanations of the observed sensitivity of investment to cash flow.

In Chapter 3 we present empirical evidence on one of the mechanisms providing managers with incentives. We consider the determinants of executive dismissals for a panel of 228 large industrial firms in the 1930's. Our estimates of the sensitivity of executive dismissal to firm performance for the 1930's was statistically no different from estimates obtained by researchers using data from more recent years. We interpret this finding as evidence against the assertion that modern compensation contracts are suboptimally constrained due to implicit political pressure. We present strong evidence that in the 1930's performance relative to the industry was the metric used to gauge performance by managers. Finally, we find no systematic relationship between ownership by inside directors, outside directors, or blockholders, in the sensitivity of executive dismissal to performance.

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Chapter 1: Imperfect Capital Markets and Managerial Incentives

Charles J. Hadlock
1 Introduction

What incentives should be given to managers to maximize the value of the firms that they manage? Several papers in the empirical literature suggest that the direct incentives given to managers are too weak to be consistent with the predictions of principal agent theory.\footnote{This point is argued strongly by Jensen and Murphy (1990).} One hypothesized cost of these weak managerial incentives is that managers will spend discretionary funds on negative NPV projects. In light of this problem, Hart (1991) and Stulz (1990) have argued that the firm’s capital structure should be used to alleviate the problem of managerial overspending of available funds.

In this paper we consider a potential benefit of weak managerial incentives. The argument we make is essentially that weak managerial incentives can be used as a commitment device to alleviate problems arising from asymmetric information in the capital market.\footnote{See Stein (1989) for another potential benefit to weak managerial incentives. Katz (1991) and Fershtman and Judd (1987) have considered the use of agents as precommitment devices.} An interesting consequence of our analysis is that there can be a tradeoff in giving managers incentives to maximize shareholder value at the time they make an investment decision. While weak incentives can be used as a way overcoming asymmetric information problems in raising capital, managers need to be given strong incentives in order for them not to overspend internal funds.

This tradeoff between the costs and benefits of having managers rewards closely aligned with firm performance has some important practical implications. Our analysis suggests that managers should be given strong incentives to maximize the value of the firm’s shares when the firm has more than sufficient internal cash to fund all of its profitable investment opportunities and managers value growth or size. Conversely, managers should be given weak incentives when the firm has insufficient internal cash and faces the prospect of going to an external capital market characterized by asymmetric information.

While these prescriptions concern the role of the firm’s financing and investment prospects on incentives, we present comparative statics results that can be turned
around to use observations on incentives to infer something about the firm's financing and investment prospects. These comparative statics results suggest a direct empirical test of two of the leading competing explanations of the importance of internal funds in the determination of a firm's investment level. The intuition for the comparative statics results we present, formalized below, is as follows.

Suppose managers have more cash than they need to fund all of the firm's positive NPV investment opportunities but that managers have a preference for growth or size. As manager/shareholder alignment increases, managers will internalize more of the financial consequences of their overinvestment decisions. This results in a lower propensity to waste internally generated cash, and thus a lower sensitivity of investment to cash flow. Suppose instead that there are information problems in the external capital market and that the firm's cash flow is insufficient to fund all of its positive NPV investment projects. In this case, as manager/shareholder alignment increases, managers will internalize more of the high cost of external funds when making their investment decisions. The market realizes that managers of undervalued firms will be more hesitant to sell underpriced claims, and thus in equilibrium the premium on external funds becomes even greater. The net effect is to increase the managers reliance on internal funds when making investment decisions, thus resulting in a higher sensitivity of investment to cash flow.

The rest of the paper is organized as follows. Section 2 presents a model of the impact of managerial incentives on the relationship between investment and internal cash flow when the firm faces underinvestment problems due to insufficient internal funds and the high cost of external finance. Section 3 extends the model of to consider the impact of managerial incentives on the relationship between investment and internal cash flow when the firm faces overinvestment problems due excessive internal cash and agency problems. In section 4 we discuss how the two models fit together and the empirical predictions that arise. We conclude in section 5.

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3An empirical test based on these comparative statics results is contained in Hadlock (1994).
2 Investment Under Asymmetric Information

In this section we outline a model that incorporates the role of managerial incentives on the investment and financing decision of firms when there is asymmetric information in the external capital market. A criticism of the original Myers and Majluf (1984) analysis of financing in the presence of asymmetric information is the maintained assumption that managers act in the interest of existing shareholders when making investment and financing choices. Several authors have pointed out that shareholders typically could write contracts with managers to provide them with incentives to overcome potential investment biases introduced by information problems in the capital market.\textsuperscript{4} Even if these types of explicit optimal contracts are not feasible, forces in the managerial labor market could also give managers incentives that overcome information biases on investment decisions.\textsuperscript{5}

We take as a starting point to our analysis that managers act only partially in the interest of existing shareholders when they make an investment and financing decision. We use a parameter $\alpha \epsilon (0, 1)$ in the managerial utility function that denotes the weight managers put on existing shareholder claims when making their decision. The parameter $\alpha$ will be interpreted as the alignment of interest of managers and current shareholders.

We first outline the setup of the model. We then characterize the unique pure strategy equilibrium of the model. Finally we derive some comparative statics results when the parameters that enter the equilibrium are varied. These comparative statics properties provide an avenue to identify empirically between two of the leading competing explanations of the importance of internal cash flow on investment.

\textsuperscript{4}See in particular the analysis of Dybvig and Zender(1991).

\textsuperscript{5}Hiring a manager with a reputation to pursue all positive NPV projects regardless of their information could be a commitment by the firm to an efficient investment policy, and thus these are the managers firms would like to hire to raise the ex ante value of the firm.
2.1 The Setup

The model we consider here has three periods. At time $t = 0$ the firm has some assets in place. These assets generate a cash flow of $c$ which is available for investment at $t = 1$. At $t = 1$ managers make an investment decision and raise any additional desired funds for the investment through an equity issue.\footnote{We consider an equity issue as the method of finance to highlight the role of asymmetric information. To simplify the analysis we assume that the firm at $t = 0$ is an all equity firm.} At time $t = 2$ the firm’s assets are liquidated. The original assets in place have a liquidation value of $A$. The only other asset at liquidation is the return from the $t = 1$ investment.

We attempt to incorporate the simplest possible asymmetric information into the manager’s investment decision. We assume that at $t = 1$ the firm’s cash flow, $c$, is known to the market. We also assume that the market knows the returns to investment. Specifically, the market knows that investment spending of $i$ yields a return of $f(i)$. We assume that $f(0) = 0$, $f(i) = gi$ for $i \leq i_e$, and $f(i) = bi$ for $i > i_e$, where $g > 1$ and $b < 1$. If we define $NPV(i) = f(i) - i$, then for $i < i_e$ the marginal investment is positive NPV, and above $i_e$ the marginal investment is negative NPV. The efficient investment decision is clearly to invest exactly $i_e$.

At $t = 1$ the market does not know the value of $A$. It is only known that $A = A_l$ with probability $p_l$ and $A = A_h$ with probability $p_h$. We call firms with $A = A_h$ and $A = A_l$ the high and low type firms respectively. When managers make their investment and financing decision at $t = 1$ they have private information regarding whether their firm is of the high or low type. We assume that they raise any external funds through an equity issue. The total amount available for investment will be the sum of internal cash $c$ and external funds raised $e$. In this section we assume that the firm has insufficient internal funds for its good investments so that $c < i_e$. This is the region where asymmetric information can lead to suboptimal investment.

Formally we model the investment/financing decision at $t = 1$ as a signalling game. Managers announce the amount of external funds, $e$, that they want to raise. The market then forms its beliefs about the firm’s type and prices equity so that
a fraction \( s(e) \) of the firm must be sold in new equity to raise the desired funds.\(^7\)

We look for Perfect Bayesian Equilibria (PBE) of this signalling game. We let \( \mu(e) \)
denote the market's belief of the probability that the firm is a high type firm following
fund announcement \( e \). We can write the market's expected value of the firm's assets
in place following a fund announcement of \( e \) by \( A(e|\mu) = \mu(e)A_h + (1 - \mu(e))A_l \).

Competition in the securities market implies that the number of shares sold given the
market's beliefs must satisfy \( s(e|\mu) = \frac{e}{A(e|\mu) + g(c+e)} \). We restrict the manager's funding
announcements to lie in the interval \([0, i_e - c] \).\(^8\)

To complete the model we must describe the manager's objective function. In
making their investment decision we assume that a manager of a type \( j \in \{h, l\} \) firm
chooses \( e \) to maximize

\[
\alpha(1 - s(e|\mu))(A_j + g(c + e)) + (1 - \alpha)(A_j + g(c + e) - e).
\]  

(1)

The parameter \( \alpha \) is intended to capture the weight managers place on the liquidation
value of the claims of original shareholders, and \( 1 - \alpha \) is the weight they place on
the claims of all eventual shareholders, both old and new. The smaller \( \alpha \) is the less
weight managers put on any transfer between old and new shareholders resulting from
asymmetric information.\(^9\)

Given a set of beliefs, \( \mu \), it is useful to rewrite the managers payoff of a type

\(^7\)It is more natural to assume that firms announce the fraction of equity to be sold, \( s \), and the
market updates its beliefs and prices securities so that the issue raises \( e(s) \) in new funds. The two
approaches are equivalent and the analysis of fund announcements rather than share announcements
leads to a nice interpretation.

\(^8\)This is without any loss of generality. To keep the notation simple in our specification of the
managers action space we implicitly ignore the possibility that the firm raises more cash than it
needs to invest \( i_e \). In that event managers would want to invest \( i_e \) and hold on to the rest of the
cash until liquidation. It will become clear that any equilibrium with this outcome is equivalent to
an equilibrium where the firm raises just enough to invest \( i_e \) and has no extra cash.

\(^9\)The important feature captured in our specification of managerial utility is that higher \( \alpha \) cor-
responds to managers placing more weight on the claims of current shareholders relative to their
other objectives. The chosen specification leaves out all managerial objectives except maximizing the
returns to current and future shareholders. In particular managerial preferences for size or control
are ignored. We will discuss these points later in the paper.
$j \in \{h, l\}$ firm that raises $e$ as

$$A_j + g(c + e) - e + \alpha \frac{(A(e|\mu) - A_j)e}{A(e|\mu) + g(c + e)}. \tag{2}$$

Writing the manager's payoffs in this way, we see that her payoff to raising $e$ in external funds is the sum of the value of assets in place, the return to the investment assuming fairly priced external funds, and $\alpha$ times any transfer from old to new shareholders as a result of security mispricing on shares that raise $e$ in total funds. The fundamental tradeoff in a manager's investment decision comes from the tradeoff of suboptimal investment versus the gains or losses incurred by the selling of mispriced securities.

A PBE of this signalling game is a pair of fund announcements and a set of beliefs, $(e_h, e_l, \mu)$ such that for a manager of a type $j$ firm where $j \in \{h, l\}$, $e_j$ maximizes (2). For all $e$ on the equilibrium path $\mu(e)$ is determined by Bayes' rule. We will restrict our attention to equilibria $(e_h, e_l, \mu)$ where the beliefs off the equilibrium path satisfy the Intuitive Criterion refinement of Cho and Kreps (1987). Since $\alpha$ and $c$ are part of the manager's payoffs, there is a role for them to affect the equilibrium outcome. We first characterize the unique pure strategy equilibrium for fixed $\alpha$ and $c$, and then we consider how the equilibrium changes when these parameters change.

### 2.2 Characterization of an equilibrium

Consider any separating equilibrium $(e_h, e_l, \mu)$. Since the market learns the firm's type it must be that $A(e_t|\mu) = A_t$, so that the equilibrium payoff to a low type firm manager given by (2) is $A_l + g(c + e_l) - e_l$. No matter how pessimistic the market's beliefs, managers of a low type firms can guarantee themselves at least $A_l + g i_e - i_e + c$ by raising funds of $i_e - c$. Thus in any separating equilibrium low type firms must invest efficiently so that $e_l = i_e - c$ and the manager's payoff is

$$A_l + g(i_e) - i_e + c. \tag{3}$$

Following any announcement $ee(0, i_e - c)$, the most optimistic beliefs by the market
are that the firm is surely the high type in which case $\mu(e) = 1$ and $A(e|\mu) = A_h$. Using (2) and simplifying, the upper bound on a low type firm manager’s payoff for raising $e$ can be written as

$$A_l + g(c + e) - e + \alpha \frac{(A_h - A_l)e}{A_h + g(c + e)}.$$  \hspace{1cm} (4)

Comparing (3) and (4), the gain for a manager of a low type firm from deviating from their prescribed strategy in any separating equilibrium cannot be greater than

$$\alpha \frac{(A_h - A_l)e}{A_h + g(c + e)} + [g(c + e) - e - (gi_e - i_e + c)].$$  \hspace{1cm} (5)

The first term in this expression is positive. This term reflects the maximum potential transfer from new shareholders to old shareholders from issuing overpriced securities that raise $e$ in proceeds multiplied by $\alpha$, the amount that the manager internalizes this transfer. Since $i_e > c + e$ the second term in the above expression is negative. This term reflects the low type firm’s loss from raising insufficient funds to exhaust all of its positive NPV investment opportunities. Since both terms are increasing in $e$, the entire expression is increasing in $e$. The expression is negative for $e = 0$ and positive for $e$ close to $i_e - c$, thus there exists an $\varepsilon_l \in (0, i_e - c)$ such that

$$\alpha \frac{(A_h - A_l)\varepsilon_l}{A_h + g(c + \varepsilon_l)} + [g(c + \varepsilon_l) - \varepsilon_l - (gi_e - i_e + c)] = 0.$$  \hspace{1cm} (6)

Clearly the low type would never deviate from offering $i_e - c$ to offer less than $\varepsilon_l$. Furthermore, the low type will strictly prefer offering $e\varepsilon_l(i_e - c)$ to a prescribed separating equilibrium choice of $i_e - c$ if the market interprets such a deviation as being a high type firm.

Consider a candidate equilibrium $(e_h, \varepsilon_l, \mu)$ where $e_h = \varepsilon_l, \varepsilon_l = i_e - c, \mu(e) = 1$ for $e \leq e_h, \mu(e) = 0$ for $e > e_h$, and $\varepsilon_l$ is defined implicitly by (6) above. We have shown that the low type will not want to deviate given these beliefs since the loss from suboptimal investment is (weakly) greater than any gain from security overpricing. The high type firm has no incentive to announce that he is raising less than $\varepsilon_l$ since
the funds raised from any such action will be fairly priced, while investment will be cut even further below the efficient level than it is by raising $e_l$. If the high type deviates and raises $e > e_l$, the market believes the firm is of the low type and the payoffs to the high type manager following such an action will be

$$A_h + g(c + e) - e - \alpha \frac{(A_h - A_l)e}{A_l + g(c + e)}. \quad (7)$$

The gain to deviating for the high type will be

$$- \alpha \frac{(A_h - A_l)e}{A_l + g(c + e)} + g(c + e) - e - (g(c + e_l) - e_l). \quad (8)$$

Suppose the high type can deviate by offering $e_d > e_l$ and do better than her equilibrium payoff. This would imply that the derivative of (8) with respect to $e$ is positive at some $e > e_l$ so that

$$g - 1 > \frac{\alpha(A_h - A_l)}{A_l + g(c + e)} - \frac{\alpha(A_h - A_l)e}{(A_l + g(c + e))^2} \quad (9)$$

for some $e > e_l$. The right side of the above inequality is decreasing in $e$, so that if it is profitable for the high type to deviate the best deviation is to choose $e_d = i_e - c$. This says that if it pays for the high type to deviate and let the market think he is the low type, he should raise all the funds he can to invest at the efficient level. Noting that $\frac{e_l}{A_h + g(c + e_l)} < \frac{i_e - c}{A_l + gi_e}$ and using (6) it is immediate that

$$- \alpha \frac{(A_h - A_l)(i_e - c)}{A_l + gi_e} + gi_e - i_e + c - (g(c + e_l) - e_l) < 0. \quad (10)$$

Thus deviating and offering $i_e - c$ yields lower payoff to the high type and there is no profitable deviation for the high type.

We have shown that our candidate separating equilibrium $e_h = e_l$, $e_l = i_e - c$, and $\mu(e) = 1$ for $e \leq e_h$, $\mu(e) = 0$ for $e > e_h$ is in fact an equilibrium. Since neither type would want to deviate and offer $e < e_l$, the Intuitive Criterion puts no restriction on beliefs in this region. Since both types would deviate and offer $e(e_l, i_e - c)$ under
optimistic beliefs, the Intuitive Criterion places no restrictions here also. Thus beliefs off the equilibrium path are not restricted by Cho-Kreps and our equilibrium satisfies that refinement.

There is a useful interpretation of the above equilibrium. When the low type cuts investment pretending to be high, she loses from undertaking suboptimal investment and gains by selling a relatively small number of overpriced shares. When the high type pretends to be low, he gains from overcoming suboptimal investment and loses by selling a relatively large number of underpriced shares. Thus the low type has less of an incentive to deviate. Since $e_l$ is defined to be the point where the low type is just indifferent about deviating to $e_l$ and pretending to be high, at this point the high type will strictly prefer not to deviate to pretend to be low.

2.3 Uniqueness of the equilibrium

First we show that we identify above the only separating equilibrium outcome that satisfies the Intuitive Criterion. Consider a separating equilibrium $(e_h, e_l, \mu)$ that has a different equilibrium outcome than the equilibrium we identify above. Since in any separating equilibrium $e_l$ must equal $i_e - c$, the only way for the equilibrium outcome to be different is if $e_h \neq e_l$. If $e_h > e_l$ and the low type deviates and offers $e_h$, the market would interpret this as the action of a high type. By the definition of $e_l$ this would give the low type higher than her equilibrium payoff. Thus it must be that $e_h < e_l$.

Define $\epsilon = \frac{e_l - e_h}{2}$. Since $e_h + \epsilon < e_l$, by the definition of $e_l$ no matter what the markets believes the low type does better following her equilibrium strategy than offering $e_h + \epsilon$. The high type would like to deviate to $e_h + \epsilon$ if this is interpreted by the market as the high type. Thus the Intuitive Criterion requires that $\mu(e_h + \epsilon) = 1$. With these beliefs the high type deviates and the equilibrium breaks down. Thus the equilibrium outcome we have identified is the unique separating equilibrium to this investment/financing signalling game that satisfies the intuitive criterion. In this equilibrium the low type invests efficiently and the high type invests suboptimally due to the fear of underpricing of shares.
We now check that there are no pooling equilibria to this game that satisfy the Intuitive Criterion refinement. Suppose there was a pooling equilibria where both firms raise $e_p$. Define $A = p_h A_h + p_l A_l$. The payoffs to managers of a low type firm will be $A_l + g(c + e_p) - e_p + \alpha \frac{(A - A_l)e_p}{A + g(c+e_p)}$. We want to show that for some low $e$ only the high firm has any incentive to deviate and offer this $e$. The Intuitive Criterion will then require that the markets posterior following such a deviation is that the firm is a high type, and this breaks down the equilibrium.

Consider a deviation offer of $e_d < e_p$. Assuming the most optimistic beliefs following this deviation yields an upper bound on the gains to deviation. The low type gains at most

$$g(c + e_d) - e_d + \alpha \frac{(A_h - A_l)e_d}{A_h + g(c + e_d)} - \left[ g(c + e_p) - e_p + \alpha \frac{(A - A_l)e_p}{A + g(c+e_p)} \right]$$

while the high type gains at most

$$g(c + e_d) - e_d - \left[ g(c + e_p) - e_p - \alpha \frac{(A_h - A_l)e_p}{A + g(c+e_p)} \right]$$

Noting that $\frac{e_p}{A + g(c+e_p)} > \frac{e_d}{A_h + g(c+e_d)}$ implies that $\frac{e_p(A_h - A_l)}{A + g(c+e_p)} > \frac{e_d(A_h - A_l)}{A_h + g(c+e_d)} - \frac{e_p(A - A_l)}{A + g(c+e_p)}$ it is clear that (12) > (11). Thus the high type has more of an incentive to deviate and cut investment. By continuity there exists an $e_d$ such that (11) is negative and (12) is positive. For such a deviation the Intuitive Criterion requires that the market believes the deviator is the high type, which breaks down the proposed equilibrium.

We can now conclude that we have found the unique pure strategy equilibrium to the investment/financing signalling game. The equilibrium is a separating equilibrium where the low type raises funds to invest at the efficient level and the high type cuts back on investment from the efficient level because of the high cost of external finance. The funding level chosen by the high type firm, $q_h$ is implicitly given by the equation (6) above. The funds raised in equilibrium by the high type can be thought of as the largest amount the high type firm can issue without the low type being interested in sacrificing some investment to issue overpriced shares and mimicking the high type.
The reason this is an equilibrium is that when a low type mimics a high type the low type loses \( NPV(i_e) - NPV(e_i + c) \) and gains by selling overpriced securities for a sum of \( e_l \). A high type trying to mimic the low type gains this NPV amount on the increased investment but loses by selling underpriced securities for a sum of \( i_e - c \). Since \( i_e - c > e_l \), the cost from underpricing to a high type deviating is larger than the benefits from overpricing to a low type deviating. Since by definition \( e_l \) just balances the low types incentives between deviating and not, the high type will strictly prefer not to deviate. The benefits to deviating are the same as the low types but the costs are larger.

2.4 Comparative statics of the equilibrium

The model we presented above is intended to illustrate how the degree to which managers care about current shareholder value increases the severity of information biases on investment. Previous research on the effects of asymmetric information on investment suggest the following points: 1) increases in internal cash raise investment spending; 2) more severe information problems lower investment spending; and 3) more severe information problems increase the sensitivity of investment spending to internal cash. The third point above motivates several of the empirical studies in this area.

In this section we derive comparative statics results for the equilibrium of our model corresponding to each of these points when we interpret manager/shareholder alignment, \( \alpha \), as a measure of the severity of information problems. Note that the first two points above are a direct consequence of information problems raising the cost of external funds. The third point is not a direct consequence of a higher cost to external funds.\(^{10}\) We verify that all three of these points hold in our model under fairly weak conditions and provide some intuition as to why they hold.

\(^{10}\)A higher cost to external funds results in raising less external funds at any level of cash. This does not immediately imply that at higher \( \alpha \) an increase in cash results in a larger increase in external funds raised.
Writing the high type's investment as \( i = c_t + c \) we can rewrite (6) above as

\[
(g - 1)(i_e - i) = \frac{\alpha(A_h - A_l)(i - c)}{A_h + gi}. \tag{13}
\]

The left hand side is the loss from passing up \( i_e - i \) in positive NPV investment opportunities. The right hand side is the amount existing shareholders of low type firms benefit by selling overpriced securities to the market for a sum of \( i - c \) multiplied by \( \alpha \), the amount the manager internalizes this transfer. If \( \alpha \) is close to 0, managers care very little about the gains or losses due to asymmetric information. In the limit both firms raise \( i_e - c \) and invest at the efficient level.\(^{11}\) Conversely as \( \alpha \) approaches 1 the asymmetric information problems become increasingly internalized by managers. Low type managers become more eager to sell overpriced securities and this decreases investment by the high type firm.

We first consider the role of cash flow \( c \) on the firm's investment level. As cash flow increases the firm has more internal finance to fund investment. Since internal funds are cheaper than external funds, intuitively this should increase investment. In the context of our model consider the condition (13) above that gives us the amount of investment by the high type firm. Suppose cash increases from \( c \) to \( c + \Delta c \) and investment spending by the high type does not change at all. If the low type tries to imitate the high type she now gains on the sale of \( \Delta c \) less overpriced securities. However, by imitating the high type the low type's losses from sacrificing good investment opportunities is unchanged. Thus if \( c \) increases by \( \Delta c \) and investment spending by the high type does not change, the low type strictly prefers not to imitate the high type. This implies that investment by the high type can increase before the low type is again indifferent about imitation. Thus higher cash \( c \) should imply higher

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\(^{11}\)This is related to the point of Dybvig and Zender (1991) that when asymmetric information is important shareholders may want to write a contract with their managers that has the effect of setting \( \alpha = 0 \) as a commitment to an efficient investment policy. This can raise the ex ante value of the firm.
equilibrium investment. Differentiating (13) with respect to \( c \) implicitly yields

\[
\frac{\partial i(\alpha, c)}{\partial c} = \frac{1}{A_h + g_i \left(1 - \frac{g(1-c)}{A_h + g_i} + \frac{q-1}{\alpha(A_h - A_i)}\right)}.
\]

(14)

The numerator and denominator of this expression are both clearly positive so that \( i_c \) has the positive expected sign suggested by the above intuition. The fact that investment increases with internal cash in our model is just a formalization of the idea that since asymmetric information raises the cost of external funds there is role for internal liquidity to be determinant of investment.

We now formalize the idea that at higher \( \alpha \) the consequences of the information asymmetry are more severe because the managers internalize more of the mispricing that arises due to asymmetric information. In our model the fact that low type firms are eager to look like high type firms is the binding constraint that characterizes the equilibrium condition given in (13). As \( \alpha \) increases managers of low type firms become more eager to look like high type firms, and the low type manager’s perceived gain from pretending to be a high type as given on the right side of (13) increases. Investment must adjust downwards so as to decrease the benefits to fooling the market (decrease in right side of (13) ) and increase the costs to fooling the market from suboptimal investment (increase the left side of (13) ). This is confirmed by differentiating (13) implicitly with respect to \( \alpha \) and simplifying

\[
\frac{\partial i(\alpha, c)}{\partial \alpha} = -\frac{(i_c - i)(q-1)}{\alpha^2(A_h - A_i)} \left(\frac{1}{A_h + g_i \left(1 - \frac{g(1-c)}{A_h + g_i} + \frac{q-1}{\alpha(A_h - A_i)}\right)}\right)
\]

(15)

which is clearly less than 0.

We have shown that the more managers care about current shareholder value the more investment is driven below the efficient level of in the presence of asymmetric information and a need to go to the external market for funds. It is in this sense that we say that information problems become more severe as \( \alpha \) increases.

We establish now that under fairly general conditions this model predicts that an increase in \( \alpha \) also generates the more observable implication that investment becomes
more sensitive to internal cash, that is \( \frac{\partial i}{\partial \alpha dc} \).

Note that when \( c = i_e \) the high type firm invests \( i_e \) regardless of \( \alpha \). If \( c < i_e \) investment will be cut back more for higher \( \alpha \) firms since managers internalize more of the gains/losses from security mispricing. In particular \( i_\alpha < 0 \) implies that if \( \alpha > \hat{\alpha} \) then \( i(\alpha, i_e) - i(\alpha, c) > i(\hat{\alpha}, i_e) - i(\hat{\alpha}, c) \). This is equivalent to

\[
\int_c^{i_e} i_c(\alpha, c)dc > \int_c^{i_e} i_c(\hat{\alpha}, c)dc.
\]

which says on average \( \frac{\partial i}{\partial c} \) is higher for higher \( \alpha \) firms.

To arrive at a more exact conclusion, consider an increase in cash from \( c \) to \( c + \Delta c \) and the consequent increase in equilibrium investment from \( i \) to \( i + \Delta i \). Using (13), the new equilibrium must satisfy

\[
(g - 1)(i_e - i - \Delta i) = \alpha \frac{A_h - A_l}{A_h + gi + g\Delta i} (i + \Delta i - c - \Delta c).
\]

Using the initial equilibrium condition and simplifying, this yields

\[
(g - 1)\Delta i = \alpha \frac{A_h - A_l}{A_h + gi + g\Delta i} (\Delta c - \Delta i) + \alpha \frac{A_h - A_l}{A_h + gi} (i - c) \frac{g\Delta i}{A_h + gi + g\Delta i}.
\]

The left side of this equation is the decrease in cost to the low type from fooling the market, since fooling the market entails sacrificing \( \Delta i \) fewer profitable investment opportunities than in the initial equilibrium. The right side of this equation is the decrease in benefits to the low type from fooling the market. The first term on the right side of this equation is the decrease in benefits associated with selling \( \Delta c - \Delta i \) fewer external funds being sold than are sold in the initial equilibrium. The second term on the right side is a consequence of the fact that increases in investment decreases slightly the relative asymmetry of the post investment total asset values of high and low type firms. As a result, an increase in investment of \( \Delta i \) entails a slight decrease in the level of overpricing, and therefore decreases slightly the benefits to the low type of selling \( i - c \) overpriced external funds to the market. This effect will be small when the value of assets in place is large compared to the scale of investment.
This last effect does not depend directly on \( \alpha \), but rather only depends indirectly on \( \alpha \) through the role of \( \alpha \) in determining the initial equilibrium conditions.

In the initial equilibrium the benefits to the low type of fooling the market exactly equal the costs, so we can rewrite the second expression on the right side of (18) in terms of the original costs to fooling the market. Making this substitution and moving this term to the left side of the equation we have

\[
(g - 1)\Delta i - (g - 1)(i_e - i)\frac{g\Delta i}{A_h + gi + g\Delta i} = \alpha \frac{A_h - A_l}{A_h + gi + g\Delta i}(\Delta c - \Delta i). \tag{19}
\]

Suppose now that the value of the high type firm's existing assets are sufficiently large that we can ignore the second term on the left side of (19). In this case the new equilibrium is determined by balancing the low types decreased costs to fooling the market of \((g - 1)\Delta i\), with the decreased benefits from fooling the market associated with selling fewer overpriced securities given by

\[
\alpha \frac{A_h - A_l}{A_h + gi + g\Delta i}(\Delta c - \Delta i). \tag{19'}
\]

For higher \( \alpha \) firms, the low type managers put relatively more weight on the decreased benefits from selling fewer overpriced funds. Thus, for low type managers of higher \( \alpha \) firms to be once again indifferent about fooling the market, requires that they experience a smaller decrease in external funds raised in response to the increase in internal cash.

This means for the higher \( \alpha \) firms, \( \Delta c - \Delta i \) must be smaller, or equivalently \( \Delta i \) is larger. Mathematically this can be seen directly by inspecting (19) above if we ignore the second term on the left side.

Now we consider explicitly the role of the second term on the left side of (19). We show that as long as this term is not too large, the result and intuition in the previous paragraph are unchanged. Specifically, if we assume that the parameters of the model are such that \( 1 > \frac{g(i_e - i)}{A_h + gi} \), then we show that \( i_{ac} > 0 \). If \( 1 > \frac{g(i_e - i)}{A_h + gi} \), then the left side of (19) is still increasing in \( \Delta i \). This means that the decreased cost associated with passing up \( \Delta i \) positive NPV investment opportunities and still fooling the market outweighs the decreased benefit of a slightly smaller level of underpricing on the
securities issued. From (19) it is immediate that under these conditions $\Delta i < \Delta c$.

We consider now a firm with a slightly higher $\alpha$. The left side of (19) is still increasing in $\Delta i$, although at a slower rate since $i_\alpha < 0$. If we call the left side of (19) the net decreased costs from sacrificing $\Delta i$ less investment opportunities, then for higher $\alpha$ firms the net decrease in costs is smaller. As earlier, an increase in $\alpha$ results in the low type manager putting more weight on the decreased benefits to fooling the market from selling fewer underpriced funds given by the right side of (19). Thus for the higher $\alpha$ firms the net decrease in costs for raising $\Delta i$ above 0 is smaller, while the net decrease in benefits from lowering $\Delta i$ below $\Delta c$ is larger.

Thus to make the low type manager of the higher $\alpha$ firm once again indifferent about fooling the market, requires a smaller decrease in external funds raised in response to the increase in internal cash, or equivalently a larger increase in investment.

If $A + gi$ is large then small increases in investment have a very small effect on decreasing the post investment asymmetry of asset values between the high and low type firms when they both invest $i$. In addition, if $(g - 1)(i_e - i)$ is small, then any decrease in overpricing impacts a fairly small number of overpriced shares. A combination of $A + gi$ large or $(g - 1)(i_e - i)$ small will insure that the left side of (19) is increasing in $\Delta i$. This is captured in the condition that $1 > \frac{g(i_e - i)}{A_h + gi}$ or equivalently $A_h + gi > g(i_e - i)$. Since this condition is not expressed solely in terms of the parameters of the model, it is difficult to gauge exactly how restrictive it is. We show in an appendix A that if $A_h > i_e$ then for all $g, c, \alpha, A_t$ this condition will automatically be satisfied. Thus $A_h > i_e$ is sufficient to guarantee the comparative statics result that we wanted to establish- the sensitivity of investment to cash flow is increasing in $\alpha$. The condition is a fairly weak one.\(^{13}\)

\(^{12}\)This direct effect is reinforced by the fact that $i_\alpha < 0$.

\(^{13}\)If in fact $A_h < i_e$ then for some small subset of the other parameters the condition $1 > \frac{g(i_e - i)}{A_h + gi}$ will fail to hold and for some smaller subset the sensitivity of investment to cash flow will be decreasing in $\alpha$. This is made precise in the Appendix A. When the condition $1 > \frac{g(i_e - i)}{A_h + gi}$ does not hold the net decreased costs from sacrificing $\Delta i$ less investment opportunities is actually negative. Condition (19) then will imply that $\Delta c < \Delta i$, so that the sensitivity of investment to cash flow is greater than 1. We see then that a necessary condition for the sensitivity of investment to cash flow to be decreasing in $\alpha$ is that the sensitivity of investment to cash flow is greater than 1.
3 Investment With Agency Problems

In this section we present a model where managers have a preference for size which leads them to invest past the point where all positive NPV projects have been exhausted. We incorporate in to this model an assumption that managers have an aversion to external funds. This aversion to external funds is essential to generate a role for the availability of internal funds to affect investment decisions.\textsuperscript{14}

The setup of the model in this section is the same as the model in the previous section with the following differences. We assume that at time $t = 1$ the manager always has more cash then needed to fund the firm’s good investment projects, that is $c > i_e$. This assumption highlights the role of the availability of internal cash in the decision to overinvest invest so called “free cash flow”. We assume that managers derive private benefits from size which can be represented by a concave benefits function. Specifically, we denote the private benefits for investing at level $i$ as $p(i)$, where $p(0) = 0, p' > 0, p'' < 0, p''' > 0$, and $\lim_{i \to \infty} p'(i) = 0$. The assumption that $p''' > 0$ does play a role in the later analysis. This assumption requires that marginal private benefits from size decrease more slowly as the size of the investment increases. Note that if $p''' < 0$ everywhere then eventually $p' < 0$, so that $p''' < 0$ is inconsistent with everywhere nondecreasing utility from size.\textsuperscript{15}

Finally we change our assumption about how managers raise funds. We assume that there is no substantial asymmetry in information in raising external funds. Instead we assume that the manager’s utility function reflects an aversion to the use of external funds.\textsuperscript{16} An aversion to external funds appears necessary for the availability

\textsuperscript{14}Later in the paper we discuss how the model in this section and the model in the previous section can both be viewed as parts of a single model of the firm’s investment decision. Viewed in this way, each of the models we present correspond to a certain parameter set of the single model. All empirical tests based on our conclusions can then be viewed as a test of different parameter values.

\textsuperscript{15}While it is common in the literature to assume managers derive a private benefit from size it would be nice to endogenize this preference by deriving it from other, more fundamental, managerial objectives.

\textsuperscript{16}We do not justify this assumption from more fundamental principles. There are several avenues along which a managerial aversion to external funds might be justified. These include aversion to bankruptcy, aversion to outside control, or difficulty in getting outside directors to agree to raising funds for poor projects.
of internal funds to play a role in the firm’s investment decision. We represent this aversion to external funds as a convex loss in utility to the manager of \( l(e) \) for raising \( e \) in external funds. We assume that \( l(0) = 0, l' > 0, l'' \geq 0 \).  

We assume that the manager’s utility function from investing \( i \) is the sum of \( \alpha \) times the return to shareholders, plus the utility derived from the size of the investment minus the disutility from raising external funds for the investment. Since we have assumed that \( c > i_e \), the manager will always invest at least \( i_e \). Subtracting out constants, the manager’s maximization problem is equivalent to maximizing

\[
p(i) - \alpha(1 - b)(i - i_e) - l(i - c).
\]  

As in the asymmetric information case, we consider the role of \( \alpha \) and \( c \) in determining the firm’s level of investment and the role of \( \alpha \) in the sensitivity of investment to internal cash flow. We show that for several general specifications of managers aversion to external funds there is a sense in which investment becomes less sensitive to cash flow as \( \alpha \) increases.

It is useful to define \( \bar{i}(\alpha) \) as the most a manager with parameter \( \alpha \) would ever invest if she had unlimited internal funds. Clearly \( \bar{i}(\alpha) \) is either the solution to \( p'(i) = \alpha(1 - b) \) or if \( p'(i_e) < \alpha(1 - b) \) then it equals \( i_e \). As \( \alpha \) increases the manager places more weight on shareholder value and has a smaller incentive to overinvest internal funds. In particular, if \( \bar{i}(\alpha) > i_e \) then \( \frac{d\bar{i}(\alpha)}{d\alpha} = \frac{1 - b}{p''(\bar{i})} < 0 \).

### 3.1 Case 1- Linear aversion to funds

We first consider the case where the manager’s aversion to external funds is linear so that \( l' \) is a constant. We define \( \bar{i}(\alpha) \) to be the lowest level of internal cash for which the manager will not want to raise some additional external funds. Clearly \( \bar{i}(\alpha) \) either is the solution to \( p'(i) = \alpha(1 - b) + l' \) or if \( p'(i_e) < \alpha(1 - b) + l' \) then

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\(^{17}\)One specification of \( l(e) \) can be derived from the work of Hart and Moore(1989). In their model the manager views all funds as costless, but is limited in how much he can raise by a debt overhang effect. Beyond this level external funds have infinite cost, so that \( l(e) \) is the (extreme) limit of convex functions.
it equals \( i_e \). As \( \alpha \) increases the manager has a smaller incentive to raise external funds for bad projects, so that if \( \tilde{i}(\alpha) > i_e \) then \( \frac{di(\alpha)}{d\alpha} = \frac{1-b}{p''(i)} < 0 \). Writing the investment chosen by the manager as \( i(\alpha, c) \) it is clear that \( c > \tilde{i}(\alpha) \Rightarrow i(\alpha, c) = \tilde{i}(\alpha), \) \( c \in [\tilde{i}(\alpha), i(\alpha)] \Rightarrow i(\alpha, c) = c \) and \( c \in [i_e, \tilde{i}(\alpha)] \Rightarrow i(\alpha, c) = \tilde{i}(\alpha) \). It is readily apparent that investment is decreasing in \( \alpha \) and increasing in \( c \) as in the asymmetric information case, that is \( \frac{di(\alpha, c)}{d\alpha} \leq 0 \) and \( \frac{di(\alpha, c)}{dc} \geq 0 \) with strict inequality for some \( (\alpha, c) \).

3.1.1 Case 1a

Suppose that \( p'(i_e) < l' \). In this case the manager is extremely averse to using external funds and thus he never raises them, that is \( \tilde{i}(\alpha) = i_e \) for all \( \alpha \). The only effect from an increase in \( \alpha \) is to decrease \( \tilde{i}(\alpha) \).

If \( \alpha' > \alpha \) then \( \tilde{i}_c(\alpha, c) \geq i_e(\alpha', c) \) with strict inequality for \( c \in (\tilde{i}(\alpha'), \tilde{i}(\alpha)) \). In this case an increase in \( \alpha \) decreases the sensitivity of investment to internal cash flow by decreasing the managers propensity to waste high levels of internal cash.

3.1.2 Case 1b

If it is the case that \( p'(i_e) > l' \) then for all \( \alpha \) sufficiently small \( \tilde{i}(\alpha) > i_e \) and \( \frac{di(\alpha)}{d\alpha} < 0 \). Consequently it cannot be the case that \( \frac{\partial^2 i(\alpha, c)}{\partial \alpha \partial c} < 0 \) for all \( \alpha \) and \( c \). However, we can still show that as \( \alpha \) increases then investment is less sensitive than cash flow in an average sense. Since \( \tilde{i}(\alpha) \geq \tilde{i}(\alpha) \) and \( p'' > 0 \) it must be that \( \frac{1-b}{p''(i)} < \frac{1-b}{p''(\tilde{i})} \) which implies that \( \frac{di(\alpha)}{d\alpha} < 0 \). This means that the range of cash levels for which investment is sensitive to cash flow, \([\tilde{i}(\alpha), \tilde{i}(\alpha)]\), shrinks in size as \( \alpha \) increases. Thus if \( \alpha' > \alpha \) and \( c \) is sufficiently large then \( i(\alpha, c) - i(\alpha, i_e) > i(\alpha', c) - i(\alpha', i_e) \). In this sense the average sensitivity of investment to cash flow is decreasing in \( \alpha \). An increase in \( \alpha \) decreases the manager's propensity to waste internal cash and also her propensity to raise external cash to waste. We have shown that the first effect is larger than the second so that the range of cash values where the manager will spend all of her internal funds shrinks with \( \alpha \).
3.2 Case 2- Convex aversion to funds

We now consider the case where \( l \) is a general convex function and \( \lim_{x \to 0} l'(x) = 0, l'' > 0 \). If \( c > \tilde{i}(\alpha) \) then \( i(\alpha, c) = \tilde{i}(\alpha) \) and if \( c < \tilde{i}(\alpha) \) then \( i(\alpha, c) \) is implicitly given as the solution to the first order condition \( p'(\tilde{i}) = \alpha(1 - b) + l'(\tilde{i} - c) \). Differentiating this expression with respect to \( \alpha \) yields \( i_\alpha = \frac{1 - b}{l'' - p'} < 0 \) and with respect to \( c \) yields \( i_c = \frac{p''}{l'' - p'} > 0 \), so again investment decreases with \( \alpha \) and increases with \( c \). Differentiating \( i_c \) with respect to \( \alpha \) generates

\[
\frac{\partial^2 i(\alpha, c)}{\partial \alpha \partial c} = \frac{l''(l'' - p'') i_\alpha - l''(l'' - p'') i_c}{(l'' + p'')^2} < 0. \tag{21}
\]

Since \( i_\alpha < 0 \), this expression is negative exactly when \( l'' p''' > l'' p'' \) or equivalently when \( l'' > l'' \frac{p''}{p''} \). By assumption \( l'' > 0, p'' < 0 \), and \( p''' > 0 \). Thus \( l'' > 0 \) is sufficient to assure that \( \frac{\partial^2 i(\alpha, c)}{\partial \alpha \partial c} < 0 \) when \( c < \tilde{i}(\alpha) \). As earlier \( \frac{d(i(\alpha, c))}{d\alpha} < 0 \) and we can conclude that if the slope of the managers aversion to external funds increases rapidly so that \( l''' > 0 \) then \( \frac{\partial^2 i(\alpha, c)}{\partial \alpha \partial c} \leq 0 \) for all \( c \).

Even when we cannot assume that \( l''' > 0 \) everywhere we can again establish that in an average sense the sensitivity of investment to cash flow is decreasing in \( \alpha \). To see this note that if \( c_2 > \tilde{i}(\alpha) > c_1 \) then

\[
i_\alpha(c_1) - i_\alpha(c_2) = \frac{1 - b}{p''(i(\alpha, c_1)) - l''(i(\alpha, c_1))} - \frac{1 - b}{p''(\tilde{i}(\alpha))} \tag{22}
\]

The assumptions \( l'' > 0, p''' > 0 \) imply that \( i_\alpha(c_1) > i_\alpha(c_2) \). Thus if \( \alpha' > \alpha \) it must be that \( i(\alpha, c_2) - i(\alpha, c_1) > i(\alpha', c_2) - i(\alpha', c_1) \). Thus we see that on average the sensitivity of investment to cash flow over any interval \([c_1, c_2]\) where \( c_2 > \tilde{i}(\alpha) > c_1 \) is decreasing in \( \alpha \).

4 Empirical Predictions

While the two models above were presented as separate models, they can be viewed as two polar cases of a single model where there is asymmetric information in the
external capital market while at the same time managers derive private benefits from size and are hesitant to go to the external market for poor projects. The fundamental parameters in this single model are: 1) the degree of asymmetric information in the capital market, 2) the size of the private benefits derived by managers from growth and the extent of their aversion to external funding, and 3) the level of internal cash available to the firm relative to its investment prospects.

One can view $\alpha$ as having two effects on the manager's investment and financing decision. The first is that $\alpha$ affects how much managers internalize any inflated costs in the market for external funds. A leading example of the high potential costs of external finance are the Myers and Majluf (1984) type asymmetric information models such as the one we presented in section 2 above. However, models based on ex post asymmetric information along the lines of Townsend (1979), or models that emphasize transfers among existing security holders such as Myers (1977), are other examples of how the cost of external funds can be inflated. If increasing $\alpha$ either raises the premium on external funds or the degree to which such a premium is internalized, then we would expect investment to decrease with $\alpha$ as long as internal cash flow is below the manager's most preferred level.\footnote{In the model presented above increases in $\alpha$ result in both an increase in the premium on external funds and the degree to which the premium is internalized.} \footnote{By the most preferred level we mean the investment level that would be chosen by the manager with access to limitless internal funds.} Furthermore, we demonstrate above that this also generates the observable comparative statics prediction that investment becomes more sensitive to cash flow as $\alpha$ rises as long as cash flow falls below the manager's most preferred investment level.

The second effect of an increase in $\alpha$, illustrated in the second model above, is that it decreases a manager's incentive to use funds for negative NPV projects. This is the point that has been emphasized by Jensen (1986). One can view this effect as raising roughly equally the cost of internal and external funds to the manager, since regardless of the source of funds an increase in $\alpha$ decreases the perceived return to investing either an internally or externally generated dollar by the same amount. If managers have an aversion to using external funds, an increase in $\alpha$ results in a larger
relative increase in the price of internal funds. In the limiting case where managers view external funds as infinitely expensive, an increase in $\alpha$ will only act to decrease the manager's willingness to use internal funds for poor projects. We showed above that this effect will generally lead to a decreased sensitivity of investment to internal cash flow if the firm's cash flow falls in the neighborhood of the manager's most preferred investment level.

While our two models emphasize these different potential roles for $\alpha$, the importance of these two effects is an empirical question. Do managers really care enough about size that they overinvest excess internal cash? Are asymmetries in the capital market substantial enough to cause inefficient investment? The relevance of these two questions is closely related to the availability of internal funds for use by the firm. If asymmetric information exists in the capital market but firms always have enough internal funds for all of their good investment projects, the presence of such asymmetric information is fairly unimportant. Similarly, if managers spend all of the internal funds available to them because they value size, but the internal funding is never enough to fund all of the firms positive NPV investment projects, then the consequences of the managerial preferences to overspend are unimportant.

In our first model it is the high cost of external finance due to transfers between security holders and the fact that cash flow is below the level where the manager would invest if she had limitless internal funds that drives the comparative statics properties. The driving force behind the comparative statics results of the second model is that managers value size and have a preference for internal funds, while at the same time cash flow varies over a neighborhood that includes the level where the manager would invest if she had limitless internal funds.

If we can identify an empirically observable variable that is related to $\alpha$ and exhibits some cross sectional variation, then we can observe which of the alternative comparative statics properties the data is consistent with. If market imperfections in the external capital market are important, then we expect an increase in the alignment of interest of managers with current shareholders to increase the sensitivity of investment to cash flow. If the market imperfection results in underinvestment,
than as a increase underinvesting in low cash states becomes more severe. If the firm
has a stochastic cash flow that is typically more than enough to fund all of its good
investment opportunities and if managers have a propensity to overspend internal
funds, then a higher alignment of interest of managers and shareholders will decrease
the sensitivity of investment to cash flow. Overinvesting in the high cash states is
alleviated.

5 Conclusion

The fact that high manager/shareholder alliance can alleviate overinvestment prob-
lems has been well recognized in the theoretical and empirical literature. One of the
contributions of our analysis above is that it illustrates how, in the presence of asym-
metric information, high manager/shareholder alliance can be a mixed blessing. 20
While shareholders would like managers not to invest in large positive NPV projects
if external funds are costly due to information asymmetries, this is true only in an
ex post sense. Ex ante, low managerial interest in shareholder value could essentially
commit the firm, regardless of type, to always raise funds for the efficient investment
project. 21 The efficient investment decision would always be made and the ex ante
value of the firm would be maximized.

In the analysis above we focus on the role of managerial incentives in the presence
of asymmetric information problems and so called “free cash flow” problems asso-
ciated with managerial overspending. Our analysis suggests that there could be an
important tradeoff in explicitly tying managerial rewards to firm performance. We
do not explicitly discuss the optimal contract with the manager to overcome both of
these problems simultaneously.

20 Stein (1989) has pointed out some other disadvantages of excessive focus on stock price by
managers.
21 See Dybvig and Zender (1992) and Acemoglu (1993) for discussions of optimal contracts between
managers and shareholders that alleviate information related biases in investment decisions. Along
similar lines, John and John (1993) argue that another advantage to lower manager/shareholder
alignment is that it commits management to avoid actions that benefit shareholders at the expense
of creditors, thus lowering the agency costs of debt.
In fact, our empirical predictions are most useful if we do not observe optimal contracts in practice, that is if $\alpha$ in the analysis above is exogenous.\footnote{Actually we do not need that managerial contracts in practice are completely exogenous. All we really need is a measure of manager/shareholder alliance that is determined in practice by a process that is independent of the financing and investment problems discussed above.} If $\alpha$ is exogenous and varies within a set of firms or over time for a single firm, then the comparative statics results presented above are empirically implementable. In particular, these comparative statics results allow us to identify situations where a firm has insufficient internal funds and asymmetric information problems are substantial, versus situations where a firm has excessive internal cash flow and managerial overspending is a potentially serious problem. Interestingly, it could be that our understanding of the empirical relevance of these two potential problems could tell us something about how optimal incentives for managers should be designed.
Appendix A

Suppose that $A_h > i_e$. Note that

$$g(i_e - i) = (g - 1)(i_e - i) + i_e - i = \alpha \frac{(A_h - A_t)(i_e - c)}{A_h + gi} + i_e - i < i_e < A_h$$

where we have used the equilibrium condition (13) in the text. Comparing the first and last term in this expression we conclude that $A_h > g(i_e - i)$ which trivially implies the desired condition $A_h + gi > g(i_e - i)$ given in the text. Suppose instead that $A_h < i_e$. As $A_t$ and $c$ approach 0 and $g$ and $\alpha$ approach 1 it will clearly be the case that $i$ approaches 0. Thus under the maintained assumption for some subset of parameters sufficiently close to these limits it must be that $A_h + gi < g(i_e - i)$. Inspection of (18) then reveals that for some set of $\alpha$ it will be that $i_{ac} < 0$. 
References


Chapter 2: Ownership, Liquidity, and Investment

Charles J. Hadlock
1 Introduction

What is the role of liquidity in a firm’s investment decisions? If capital markets are perfect and external funds are perfect substitutes for internally generated funds, then there is no role for liquidity to affect investment decisions. This conclusion is in apparent contrast to a large body of empirical evidence dating back to Meyer and Kuh (1957) that suggests that a firm’s level of investment is highly correlated with its cash flow.

This paper attempts to empirically distinguish between the leading competing explanations of this empirical finding that have been suggested in the literature. There are three interpretations for the finding that liquidity is highly correlated with investment. The first interpretation is that capital markets are perfect and that a firm’s liquidity proxies for the quality of its investment opportunities. According to this view, the observed explanatory power of liquidity for investment simply indicates that when firms have good investment opportunities they invest more, and therefore it is not evidence for rejecting the assumption of perfect capital markets.

Recent research by Fazzari, Hubbard, and Petersen (1988), Hoshi, Kashyap, and Scharfstein (1991), and Lamont (1993), provides evidence that liquidity has a real effect on investment, even after taking into account the potential correlation between a firm’s cash flow and its investment opportunities. These studies provide substantial evidence for the rejection of the assumption of perfect capital markets. They are less successful, however, in distinguishing between the two leading imperfect capital markets explanations as to why liquidity could affect investment.

One of these interpretations is derived from the large number of information based models of financing decisions of the type outlined by Myers and Majluf (1984). These models predict that external funds are more costly than internally generated funds because of asymmetric information problems in the external capital market. This wedge in costs between internal and external funds can cause a firm to forego certain investment projects that it would pursue if it had enough internally generated cash to fund them. Consequently, these information based models predict a role for the
availability of internal funds in the investment decision. Furthermore, these models typically suggest that the relation between liquidity and investment is a symptom of underinvestment; firms pass up some positive NPV projects because of the high costs of external funds arising from information problems.

An alternative interpretation of the relation between liquidity and investment can be derived from agency type models exemplified by Jensen's Free Cash Flow theory (1986). These theories emphasize the agency problem that exists in directing managers to pursue investment policies that are in shareholders' best interest. According to these theories, managers often have preferences for growth and size that lead them to invest internal funds even when all positive NPV investment opportunities have been exhausted. As a result of this managerial propensity to overinvest excess cash, these theories too predicts that liquidity can be an important determinant of investment. These models suggests that the relation between liquidity and investment is a symptom of overinvestment; managers overspend internal funds on unprofitable projects.

The asymmetric information explanations and agency explanations of the relation between liquidity and investment have very different implications. These include issues regarding corporate financial policy and capital structure, the ownership structure of firms, the importance of relationships with suppliers of capital, and the consequences of recessions. It is therefore a crucial matter to understand the empirical importance of these two opposing sets of theories and their impact on the investment behavior of firms.

A recent paper by Blanchard, Lopez-de-Silanes, and Shleifer (1992) attempts to empirically distinguish between the asymmetric information and agency explanations as to why internal funds are different than external funds when a firm makes an investment decision. They consider a set of firms which experience a large cash windfall at a time when their investment opportunity set does not change. They claim to find evidence that supports the agency models over the asymmetric information models. However, the key to their identifying between the two types of models relies on looking at what firms do with a big windfall of cash when it is clear that they
have fairly poor investment opportunities;\textsuperscript{1} in fact, it is precisely in those situations that we would expect agency problems with managers to be particularly severe. It is when firms have little cash and good investment opportunities that we might expect information related biases on investment decisions to be important.

A wealth of empirical and anecdotal evidence has been presented in the corporate finance literature in support of both of these theories concerning the differences between internal and external funds. In view of this evidence, the perspective we take in this paper is that information problems in the capital markets and agency problems with managers both can play a role in affecting a firm’s reliance on internal funds. The relative importance of the two effects on investment decisions for a broad cross section of typical firms is therefore an empirical question.

Determining the role of internal funds on a firm’s investment activities is complicated by the fact that the firm’s investment opportunity set is unobservable. At best it is measured with substantial noise through Tobin’s q. Some researchers have attempted to circumvent this problem by looking at what a firm a does with a change in internal cash flow when the investment opportunity set does not change. If one is confident that investment prospects do not change, then in a perfect capital market world a change in internal cash flow should not change investment. Researchers have found that such changes in liquidity in fact do result in changes in investment activity.\textsuperscript{2} However, without clear prior beliefs as to whether the firm’s marginal investment project is of positive or negative NPV, this evidence still leaves unidentified the culprit behind such a finding.

A second approach in the literature is to order firms according to a priori beliefs as to the size of the difference between the firms internal and external cost of funds. This is the approach pioneered by Fazzari, Hubbard, and Petersen (1988) and Hoshi, Kashyap, and Scharfstein (1991) (hereafter FHP and HKS respectively). These authors sort firms into groups based on their a priori beliefs about the severity of the asymmetric information problems that the firm faces. They show that liquidity has

\textsuperscript{1}Median Tobin’s q in their sample is .522.
\textsuperscript{2}See Blanchard, Lopez-de-Silanes(1992), and Lamont(1993).
more explanatory power for the investment behavior of the firms that they a priori
expect to have a higher cost of external funds due to more severe information prob-
lems. The authors conclude that this is evidence against the perfect capital market
assumption and evidence in favor of the presence of asymmetric information induced
financing constraints.

The approach used by FHP and HKS suggests a strategy for disentangling the
asymmetric information and agency biases on investment decisions. We can view
the asymmetric information models as theories about why external funds look too
expensive to managers, while the free cash flow models are theories about why internal
funds look too cheap to managers. In either case managers view internal funds as
less costly than external funds. In the study by HKS it is not clear if belonging to a
Japanese keiretsu lowers the cost of external funds by alleviating information problems
or raises the cost of internal funds to managers by alleviating agency problems. Under
both scenarios the difference between the cost of external and internal funds is lowered
so that the firm would rely less on internal cash in its investment activities.

The challenge is to identify an observable characteristic that simultaneously raises
the relative cost of external funds when information problems are important, while
lowering the relative cost of external funds when agency problems are important. If
we take a firm’s sensitivity of investment to cash flow as a metric of the high relative
cost of external finance, then the identified characteristic should raise the sensitivity
of investment to liquidity when information problems are important. Conversely it
should lower the sensitivity of investment to cash flow when free cash flow problems
are important. Finally, as in earlier studies, in a world with perfect capital markets
such a characteristic would have no impact on the sensitivity of investment to cash
flow.\footnote{In this latter case any estimated sensitivity of investment to cash flow can be viewed as a measure
of the correlation between cash flow and investment demand.}

Hadlock (1994) develops a framework that motivates how manager/shareholder
alliance can alleviate free cash flow problems while at the same time exacerbating
information problems, thus serving as a characteristic with the desired properties

\footnote{In this latter case any estimated sensitivity of investment to cash flow can be viewed as a measure
of the correlation between cash flow and investment demand.}
outlined above. Furthermore it is shown in a theoretical framework that increased manager/shareholder alliance generates observable comparative statics results that can distinguish between the two roles of internal cash flow on investment. Using a parameter $\alpha$ that represents manager/shareholder alignment, it is shown that increases in $\alpha$ increase the sensitivity of investment to cash flow in the presence of asymmetric information and insufficient internal funds to exhaust all positive NPV investment projects. If instead the firm has more internal funds than it needs and managers value size, then increases in $\alpha$ result in a decrease in the sensitivity of investment to internal cash flow.

One variable that is related to managerial incentives and exhibits substantial cross sectional variation is the ownership interest of managers in their firms. In this paper we use data on managerial ownership as a proxy for manager/shareholder alignment. Using this data we examine the impact of ownership on the sensitivity of a firm's investment to its internal cash flow. This investigation allows us to directly test between the two leading interpretations of the importance of internal funds on investment that are outlined above. Furthermore, if capital markets are perfect and there is no causal effect of internal cash flow on investment, then we should find no systematic relationship between ownership and the sensitivity of investment to cash flow.

The rest of the paper is organized as follows. Sections 1 outlines how we use the ownership data in our empirical specification. Section 2 outline our basic specification and empirical approach. Section 3 describes the data. Section 4 presents the empirical results. Section 5 concludes.

2 Ownership as a proxy for manager/shareholder alliance

In the empirical work that follows we will use as our measure of manager/shareholder alliance the stock holdings of managers in their firms. The literature on insider shareholdings suggests that insider shareholdings can have two effects on the incentives
in a firm. One is the simple notion that larger insider holdings alleviate conflicts of interest between managers and outside shareholders; managers internalize more of the financial consequences of their actions. A second potential effect is that when insider holdings become substantial in percentage terms, management can insulate itself from various forms of external oversight, including the market for corporate control.\footnote{Stulz(1988) presents a formal theoretical argument illustrating this point.} An empirical study by Morck, Shleifer, and Vishny (1988) found evidence for these two effects. Regressions of Tobin’s $q$ on inside ownership indicated a nonmonotonic relationship. Their evidence suggests that $q$ increases with ownership initially, and then decreases as entrenchment sets in. Other empirical studies have also found similar nonmonotonic relations between inside ownership and corporate value, though there are several conflicting findings among these studies.\footnote{See McConnell and Servaes(1990) and Hermelin and Weisbach(1991).} The most robust finding seems to be that corporate value increases with ownership at low levels of ownership, and that there is some evidence of entrenchment effects setting in at higher levels of ownership. The precise level where entrenchment effects set in is not clear from existing theoretical or empirical evidence. Morck, Shleifer, and Vishny (1988) suggest 5 percent as cutoff point.

If we take into account the possibility of entrenchment effects, the relation between manager/shareholder alignment ($\alpha$ in Hadlock (1994)) and insider ownership may not be monotonic. In particular $\alpha$ may be increasing with ownership at low levels and decreasing at high levels. With the possibility of entrenchment effects, the model in Hadlock (1994) suggests the following testable relationship. If a firm has a stochastic cash flow that is insufficient to fund all of its good investment opportunities and if information problems raise the cost of external finance, then the sensitivity of investment to cash flow should initially go up with inside shareholdings, and then potentially level off or go down. If on the other hand a firm’s cash flow is more than sufficient to fund its good investment opportunities and managerial overinvestment is a problem, we should see the reverse. If capital market imperfections and agency problems are both unimportant, then insider shareholdings should have no systematic
relationship to the correlation between investment and cash flow.

3 Empirical Specification

We now turn to our empirical specification. To analyze the effect of ownership on the sensitivity of investment to cash flow, we use the same basic regression specifications as FHP and HKS. We refer the reader to those studies for a more thorough discussion of specification issues. The idea in these specifications is to regress a firm’s investment expenditures on several controls that proxy for the quality of the firm’s investment prospects, and then also to include a measure of liquidity as an explanatory variable. The basic regression specification that we build on is:

$$\frac{\text{Invest.}}{K} = \text{(controls)} + \beta_0 Q + \beta_1 \frac{\text{Lag. Sales}}{K} + \beta_2 \frac{\text{Cash Flow}}{K} + \epsilon$$  \hspace{2cm} (1)

The variable $K$ above is a measure of the firm’s capital stock and $Q$ is a tax adjusted measure of Tobin’s $q$ which is intended to control for the quality of a firm’s investment opportunities. There is a substantial theoretical literature exploring the relation between $Q$ and the optimal investment policy of the firm.\(^6\) Under certain stringent conditions, there is direct relation between $Q$ and the firm’s optimal investment level. In practice these conditions are almost certainly not fully met.\(^7\) It is thus likely that $Q$ does not completely control for the profitability of investment. Our liquidity measure, cash flow, is also likely to be correlated with the profitability of investment. Thus we would expect it to enter with a positive coefficient even in the absence of information or agency problems.\(^8\) We include lagged sales in all our regressions due to their demonstrated explanatory power in the empirical investment literature.\(^9\) The other controls that we include are firm and year dummies. Firm fixed effects are included as the standard remedy to control for the likely complicated

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\(^6\)See especially Hayashi (1982).

\(^7\)To say nothing of the well known deficiencies in measuring $Q$ accurately.

\(^8\)This is essentially the chief difficulty in interpreting earlier studies attempting to demonstrate the effects of liquidity on investment arising from market imperfections.

\(^9\)See the comments by HKS on the use of lagged sales.
correlation between firm specific factors that affect investment decisions and the other right hand side variables. Year dummies are intended to remove any yearly macro related effects on investment. The sources of data and precise definitions we use to construct these variables are discussed in the following section and a data appendix.

The key innovation in the studies by FHP and HKS, is those authors’ attempt to identify the part of $\beta_2$ that is due to information problems in the capital market. They do this by looking at the difference in estimated $\beta_2$ coefficients among different groups of firms where a priori one could order the severity of information problems.\(^{10}\)

As mentioned earlier, there is some difficulty in determining if these groupings of firms also implicitly sort firms by the severity of agency problems with managers or by the extent to which cash flow signals investment profitability.

In the current study we are interested in how managerial ownership influences the estimated cash flow coefficients. We choose to exploit the continuous nature of ownership data by modifying specification (1) above to include terms interacting ownership with cash flow. This is more powerful than dividing firms in to several broad ownership level classes and comparing estimated cash flow coefficients between the different classes. Our discussion above suggests that the relation between ownership and the sensitivity of investment to cash flow could be nonmonotonic due to entrenchment effects setting in at higher ownership levels. To allow for this possibility, we further modify specification (1) to allow ownership to interact with cash flow in a piecewise linear fashion. We initially allow the slope to change at 5% ownership as this is the level where Morck, Shleifer, and Vishny (1988) suggest that entrenchment effects begin to become important. Thus we modify (1) above to arrive at our basic specification of the form:

$$\frac{I}{K} = \beta_0 Q + \beta_1 \frac{\text{Cash Flow}}{K} + \beta_2 \frac{\text{Cash Flow}}{K} * \text{OWNL5} + \beta_3 \frac{\text{Cash Flow}}{K} * \text{OWNG5} + \beta_4 \frac{\text{Lagged Sales}}{K} + \epsilon$$

where $\text{OWNL5} = \min(5, \text{OWNER})$, $\text{OWNG5} = \max(0, \text{OWNER} - 5)$ and $\text{OWNER}$ is the

\(^{10}\)FHP divide a sample of US firms based on dividend policy. HKS divide a sample of Japanese firms according to whether or not they belong to a keiretsu
percentage of equity held by insiders. If information effects dominate managerial overspending effects, then using the model presented above we would expect $\beta_2 \omega$ to be positive. If overspending effects dominate, then $\beta_2$ should be negative. If entrenchment is likely above a certain ownership level, then the expected sign of $\beta_3$ is opposite of that of $\beta_2$.

4 Data

4.1 Ownership Data

The source of our ownership data is the Value Line Investment Survey from January to March of 1976. The Valueline data source appears to be the cheapest source of reliable ownership data and has been used in several studies including McConnell and Servaes(1990). We identified all nonfinancial unregulated firms in the surveys. The regulated firms we excluded included all utilities, airlines, railroads, trucking companies, and natural gas pipelines. This left us with a set of 1112 potential firms. For each of these firms we recorded the level of inside ownership reported by Valueline. For our purposes insider holdings were defined as the sum of any holdings that Valueline reports for insiders, officers, directors, management, and any family holdings that Valueline notes. We found the needed ownership data for 929 firms. For 901 of these firm's we were able to find CUSIP identifiers that we used to search the Compustat tapes.

For several firms in the resulting sample Value Line reports the inside ownership level as “Less Than 1 percent”. Since these firms comprise a substantial number of the firms with very low inside ownership, we did not want to eliminate the information that they could provide us. Of these firms 13 are also in the sample constructed by Hermalin and Weisbach (1991). The mean insider holdings level for these 13 firms

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11Kole(1992) presents some results comparing Valueline data to other data sources.
12We also excluded a firm if it was more than 50% owned by another firm or if it was not based in the U.S.
13We dropped 153 firms for no ownership data, 27 for an ambiguous insider ownership figure, and 3 for large class B holdings by insiders.
from their 1975 proxy statements as recorded by Hermalin and Weisbach(1991) is .59%.\textsuperscript{14} We therefore use .59% as our insider holdings measure for all of the firms which Value Line reports as having less than 1 percent insider holdings.\textsuperscript{15}

4.2 Accounting Data

For the resulting companies we searched the Compustat tapes for accounting data. For firms where Compustat data was available we constructed Tobin's q, tax adjusted $Q$, and cash flow as described in appendix B. Investment in a given year was taken to be the firm's capital expenditures. The measure of $K$ we use the beginning of period replacement cost of the firm's capital stock estimated by the procedure outlined in the appendix and derived from the work of Salinger and Summers(1983). It is not clear whether dividends should be subtracted from cash flow since their availability as a source of funds is open to question. In the results reported below we do not subtract common dividends in our definition of cash flow, but we have found very similar results when we do subtract dividends from cash flow.

While the \textit{Value Line} ownership data is published in early 1976, the original source of most of this data is the 1975 corporate proxy statements which are issued primarily in the spring of 1975. The basic regression evidence we report below is based on the investment behavior for our firms over 1973-1976, a period which is roughly centered around the time that our ownership data was recorded. Since our estimation includes firm fixed effects, we need several years of accounting data to get precise estimates. However, if we pick too long a time period, the ownership data is likely to be unreliable. We pick four years as a reasonable compromise.\textsuperscript{16}

We restrict ourselves to companies for which we can obtain all the needed Compustat variables for each year. We further eliminate any firm that the Compustat footnotes indicate was involved in a merger or acquisition.\textsuperscript{17}

\textsuperscript{14}I thank Michael Weisbach for providing me with his data.
\textsuperscript{15}If we instead use 0 or 1 for the insider holdings of these firms our results are essentially unchanged.
\textsuperscript{16}Similar estimates over three and five year periods yield very similar results that can be obtained from the author.
\textsuperscript{17}These deletions were made primarily because Compustat footnote #1 indicated that the firm's
our firms, it was clear that there were some severe outliers for each of the explanatory variables. To objectively eliminate outliers we developed the following procedure. We eliminated any firm from our sample that had $Q$, cash flow, or lagged sales, as a fraction of the estimated replacement cost of the capital stock, in the top or bottom 1 percentile of the entire sample in any year, or a stock of cash and securities in the top 1 percent of the entire sample. These selection procedures leave us with a balanced panel of 411 firms from 1973-1976. In our final sample 74% of our firms are manufacturing firms (2 digit sic codes between 20 and 39).

4.3 Summary Statistics

Table 1A presents the basic distribution of ownership for our final sample of 411 firms. The median (mean) level of insider ownership is 12% (17.4%) and exhibits the same skewed distribution noted by previous authors. Our median and mean ownership are higher than in the studies of McConnell and Servaes(1990) and Morck, Shleifer, and Vishny(1988). This is most likely due to the fact that we have comparatively more small firms in our sample. While our ownership data comes from the same original source as McConnell and Servaes(1990), we eliminate regulated firms which tend to be very large.

We are particularly concerned that the ownership data we propose to use may be proxying for other factors that might affect the observed sensitivity of investment to cash flow. In Table 1B we present some basic summary statistics by ownership level quartiles. The only variable that exhibits a clear monotonic relationship to ownership is the size of the firm measured by the book value of assets in 1973. The median firm in the lowest ownership quartile is more than three times as large as any other ownership quartile. Furthermore, the relationship between size and ownership is clearly monotonic. We take this in to account in our regression analysis by controlling for size in some specifications.

The literature on ownership has suggested that ownership may also be systemat-
ically related to leverage and $q$. While simple univariate comparisons based on our summary statistics reveal no such relationship, it is possible that a more sophisticated multivariate approach would uncover some such relationship. To take in to account this possibility, in our empirical analysis in we add controls for $q$ and leverage in some specifications.

5 Results

5.1 Basic Results

Our set of basic regression results are reported in Table 2. The first column of estimates is the standard investment/cash flow regression that has been presented by previous authors. Our estimate on $Q$ of .0037 is small but significant at the 1% level. This estimate is similar to the estimates of FHP and others. If one interprets the $Q$ theory of investment literally it implies extremely high adjustment costs to installing capital. The coefficient on lagged sales is large and significant, consistent with other studies. The coefficient on cash flow is .241 and it is significant at the 1% level. This coefficient is very close to the .254 estimate reported by FHP for their class 3 firms over the 1970-1975 time period. It would be premature to interpret this coefficient as evidence of liquidity affecting investment for the standard reason that cash flow could simply be proxying for the quality of the firm's investment projects over time. This is why we emphasize the difference in estimated cash flow coefficients for firm's with varying levels of insider ownership.

In column 2 we add terms interacting cash flow with ownership in the piecewise linear fashion corresponding to specification (2) above. We define $OWNL5 = \min(5, OWNER)$ and $OWNG5 = \max(0, OWNER-5)$ where $OWNER$ is the percentage of equity held by insiders. The coefficient on cash flow in column 2 of .020 is small and statistically insignificant. This estimate implies that for a firm with no insider hold-

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18See for example Friend and Lang (1988) for some evidence on ownership and leverage. The ownership and $q$ literature has already been cited. We control independently for $q$ in case ownership is correlated with $q$ for reasons other than the alignment of interest of managers and shareholders.
ings investment is essentially completely insensitive to changes in internal cash flow. The coefficient on the OWNL5 interaction term of .062 is large and statistically significant at the 5% level \((t = 2.8)\). It implies that as insider ownership increases from 0 investment becomes increasingly sensitive to cash flow at a rapid rate. Our estimates imply that a firm with 5% insider holdings invests an additional 31 cents of each dollar of internally generated cash compared to a firm with no insider holdings. This is a surprisingly large number.

The coefficient on the OWNG5 interaction term of -.0042 is significant at the 11% level \((t = 1.635)\). This estimate indicates that as ownership increases above 5% the estimated sensitivity of investment to cash flow decreases, albeit at a slow rate. This estimate implies that a firm that has 50% insider holdings invests 19 cents less of each dollar of cash flow compared to a 5% insider ownership firm. A graph of the relation between insider holdings and the estimated sensitivity of investment to cash flow implied by these estimates is contained in Figure 1.

Our interpretation of the positive OWNL5 coefficient is that it provides evidence that the sensitivity of investment to cash flow is driven by the high cost of external finance arising from asymmetric information or other market imperfections. This is what our model above would predict if increasing ownership in this range proxies for managers placing more weight on shareholder value. The literature on insider ownership provides substantial evidence that at these low levels ownership is a good proxy for incentives. The large positive coefficient on the OWNL5 coefficient seems to provide fairly strong evidence against a Jensen(1986) free cash flow interpretation of the sensitivity of investment to cash flow. As managers own more shares we would certainly expect this to decrease their propensity to waste internal cash. We consider the significantly positive OWNL5 coefficient to be the main empirical finding of this paper.

The interpretation of the OWNG5 coefficient is slightly less clear. If one interprets the previous ownership studies as providing evidence that because of entrenchment effects increases in ownership above 5% actually decrease the alignment of interest of managers and shareholders, then the negative coefficient is again consistent with
the presence of market imperfections and inconsistent with managerial overspending. We emphasize the evidence from the OWNL5 coefficient since the interpretation of how ownership proxies for incentives in that case is most convincing. What is interesting about the negative coefficient on OWNG5 is that it provides further evidence that the relationship between ownership and incentives is not monotonic. The effect of increasing ownership from 4% to 5% on managerial decision making might be substantially different then an increase in ownership from 18% to 19%.

5.2 Robustness of Results

One potential criticism of the results reported above is that ownership proxies for other omitted variables that might effect the observed sensitivity of investment to cash flow. We are particularly concerned with the possibility that our results are driven by the fact that ownership is strongly negatively correlated with size. If cash flow is more informative about investment opportunities for small firms, then the significant coefficient on OWNL5 reported above may have nothing to do with asymmetric information. To control for these possibilities we add several additional controls to our basic specification. The results are reported in column 3 of Table 2. When we interact cash flow with LOGSIZE73, the log of the firm's 1973 book value of assets, the coefficient is actually positive and insignificant. Thus in our sample investment does not appear more sensitive to cash flow for smaller firms.19 When we interact cash flow with measures of leverage and Q we also get insignificant coefficients. Finally we interact Q with OWNL5 and OWNG5 to allow for the possibility that variations in ownership affect managers' reactions to investment opportunities which is then transmitted to the coefficient on Q. Again all our estimates are insignificant on these coefficients. The addition of these controls has little effect on the cash flow

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19It is interesting to note FHP report when they divide their sample by size they do not get significantly different cash flow coefficients for the different size groups. When we divide our sample in to thirds based on size (LOGSIZE73) we also do not get significantly different cash flow coefficients for the different size groups using the basic specification in column 1 of Table 2. While one might interpret this as evidence against information based liquidity constraints, an alternative argument is that within these samples of very large firms size is not a good proxy for the severity of information biases.
coefficients reported above in the specification without these controls. Since none of these additional coefficients were significant we dropped them from all subsequent specifications.

The basic measure of liquidity that we have used is the firm's annual cash flow which is the measure emphasized most in previous studies. In our estimation this is the most exogenous measure of liquidity and the most appropriate for analyzing the response of investment to the availability of internal funds. Some authors have also used stock measures of liquidity in analyzing investment behavior. In column 4 of Table 2 we add to our basic specification terms including the stock of cash and short term securities the firm has on hand at the start the year and the interaction of this variable with OWNL5 and OWNG5. The cash and securities coefficient of .148 is significant at the 5% level. The interaction of OWNL5 with cash and securities is negative but insignificant. The interaction of OWNG5 with cash and securities is .0024 and is significant at the 10% level. This is opposite to the finding above that the flow measure of liquidity interacted with OWNG5 was significant and negative. We place more confidence in the results using the flow measure, as the stock measure is likely to be endogenous since firms manage their cash position. In any case, we stress the results for the interaction of OWNL5 with cash flow as that is the most robust relationship we find and it is also the case where the interpretation of ownership proxying for incentives is least ambiguous.

In columns 5 and 6 of Table 2 we present estimates where we have used an alternative definition of cash flow with common dividends are subtracted out. The basic character of our results are unchanged. Cash flow interacted with OWNL5 remains significant at the 5% level. Cash flow interacted with OWNG5 is negative in both specifications but it is insignificant if we do not include the stock of cash terms (column 5). While the estimate on the stock of cash changes very little (.148 to .142) and remains significant at the 5% level, the interaction of the stock of cash with the both ownership terms are not significant even at the 10% level.

With little theoretical guidance from the literature we initially picked 5% as the point where the slope on the (OWNER*cash flow) relationship could change to be con-
sistent with previous research, in particular the study of Morck, Shleifer, and Vishny (1988). Ideally one would like to use the data to choose the point where the change in slope occurs. We performed a grid search to find the maximum likelihood estimate of this point. We defined OWNLX=min(X,OWNER) and OWNGX=max(0,OWNER-X) and then searched over all possible X values using the specification of column 2 in Table 2. This search yielded an estimate for X of 6.0 which is the X that minimizes the residual sum of squares. We present in Table 3 the results of our basic regressions where we use OWNL6 and OWNG6 rather than OWNL5 and OWNG5. Note that the standard errors in this table are reported as if we had chosen 6% as the slope change point initially and do not account for the fact that we used the data to estimate pick the 6% point. 20 Using the 6% cutoff instead of 5% does not change any of the basic results reported above. The interaction of cash flow with OWNL6 rather than OWNL5 changes the estimate very little and the relationship remains highly significant. The size and significance levels of the other coefficients remain very similar to the results based on the 5% cutoff presented in Table 2 and discussed above. 21 In Figure 1 we add a graph of the relation between insider holdings and the estimated sensitivity of investment to cash flow implied by the estimates in the first column of Table 3 using the 6% slope change.

As a further check on the basic robustness of our results, in Table 4 we divided the sample into four groups based on ownership and then estimated cash flow coefficients for each group. The first column of estimates is for the sample of firms that have below the median level of ownership within the set of firms that have under 5% insider holdings. The second column is for firms with above the median within the below 5% holdings set of firms, and columns 3 and 4 are based on the same division for the above 5% insider holdings firms. The cash flow coefficients are .105, .254,.293, and .188 respectively. This pattern of coefficients is generally consistent with the estimated coefficients from Table 2 where we used interaction terms to find that the

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20 To get the correct standard errors that account for using the data to pick the cutoff point is a difficult and non-standard econometric problem.

21 A similar grid search using an alternative definition of cash flow with subtracted dividends subtracted out yielded an estimate of 5.0% as the point where the slope changes.
sensitivity of investment to cash flow first increases sharply with ownership and then levels off and decreases slowly with ownership. Unfortunately none of these four estimates is significantly different from the others, which is not surprising given the relatively small number of firms in each group.

As a final check on the interpretation of our results we employ the following division. If our finding above that the sensitivity of investment to cash flow is increasing with ownership is a symptom of asymmetric information and market imperfections, then this effect should be strongest for firms with the best investment opportunities. One rough way to group firms based on the quality of their investment opportunities is to divide them by Tobin's q.\textsuperscript{22} We pursue this approach by dividing our sample of firms in to three groups based AVQ which is the average of the firm's beginning of period tax adjusted Q over the 1973-1976 period.

In Table 5 we present regression results for each of these three groups. For the lowest Q group, investment for the 0 ownership firms is insensitive to cash flow. The interaction of cash flow with the ownership measures are also small and insignificant. For the medium Q group the sensitivity of investment to cash flow for 0 ownership firms is small and insignificant. The interaction of cash flow with OWNL5 is much larger and it is economically significant at .039, but it is still statistically insignificant due to the large standard error. The OWNG5 interaction term is small, positive, and insignificant. For the highest Q firms with 0 ownership the cash flow coefficient is estimated to be negative but not significantly different from 0. What is most interesting is that for the highest Q firms ownership seems to have a very large estimated effect on the sensitivity of investment to cash flow. The coefficient of .113 on (OWNL5*cash) flow is significant at the 1% level. This estimate implies that for the highest Q firms a 5% insider owned firm spends 56.5 cents more out of each dollar of internally generated funds then does a firm with no inside ownership. The difference in the coefficients on (OWNL5*cash flow) between the lowest and highest Q groups is significant at the 5% level (t=2.35). For the highest Q firms the interaction

\textsuperscript{22}HKS divide their sample in to high and low q firms to disentangle underinvestment and overinvestment models.
term of cash flow with OWNG5 is -.007 and it is significant at the 10% level.

The results reported in Table 5 indicate that the comparative statics results we expected to see for firms that face severe information biases on their investment decisions appear strongest for the highest Q firms. We would have been particularly concerned if all of our results were driven by the low Q firms which we would expect to have the poorest investment opportunities and to be the least likely to exhibit the asymmetric information comparative statics properties. We interpret the results from dividing our sample by the level of Q as further evidence that asymmetric information drives the observed sensitivity of investment to cash flow for our broad cross section of firms.

6 Conclusion

In this paper we have attempted to distinguish between the competing explanations as to why liquidity is a highly correlated with investment at the firm level. We use a framework presented in Hadlock (1994) that proposes to identify between investment biases arising from capital market imperfections such as asymmetric information, and those arising from agency problems and managerial overspending. Our approach is to consider the role of managerial motives in the firm's investment decision. If it is most likely that a firm will face information problems and an inflated cost of external finance, then the sensitivity of investment to cash flow should increase as managers place more weight on the returns to shareholders. If, on the other hand, it is most likely that the firm has excessive cash and managers like to overinvest, then we should see the exact reverse relationship between incentives and the sensitivity of investment to cash flow. If neither of these investment biases is important, then managerial incentives or a suitable proxy should have no systematic relationship to the sensitivity of investment to cash flow.

We investigate these relationships empirically by estimating reduced form regression equations on a panel of 411 firms for the years 1973-1976. We find strong evidence that the sensitivity of investment to cash flow increases with insider ownership at low
levels of ownership, and then levels off and decreases slightly at higher levels of insider ownership. We also find that these comparative statics findings are largest and most statistically significant for firms in the sample with high relative values for Tobin’s q.

Our interpretation of these findings is that they are consistent with capital market problems such as asymmetric information that inflate the cost of external funds. Our findings appear inconsistent with agency based overinvestment explanations of the role of liquidity in a firm’s investment decisions. Our findings are also inconsistent with the assumption of perfect capital markets. These results add to the literature that suggests that financial slack can be valuable to a firm because it allows the firm to avoid the information problems present in the external capital market. Furthermore, our results help confirm the potential importance of contractual and institutional relationships that can mitigate the adverse consequences of information asymmetries and market imperfections. The results in this study indicate that one relationship that may be empirically important in determining the consequences of capital market imperfections is the relationship between shareholders and managers.
Data Appendix

All accounting data in this paper was taken from Standard and Poor's Compustat data base.\textsuperscript{23} We constructed Tobin’s $q$ and tax adjusted $Q$ along the same lines as Salinger and Summers(1983) and Fazzari, Hubbard, and Petersen(1988) with a few minor changes. The $q$ and $Q$ that we calculate are beginning of period values incorporating accounting data from the end of the previous period along with the current year’s tax parameters. The specific components of $Q$ were constructed in the following way.

\textit{Market value of equity (MV)}. Calculated as the end of year common stock price times shares outstanding plus preferred dividends divided by the preferred stock yield.

\textit{Value of debt (Debt)}. We use the book value of long term debt rather than trying to estimate its value. FHP report that their results are essentially unchanged regardless of whether they use book value or estimated values. We add to the book value of long term debt the book of current liabilities and then subtract the book value of all current assets except inventories.

\textit{Market value of inventories (Invent)}. For LIFO firms we use book value of inventories. For firms that use some FIFO inventory accounting we use the Salinger and Summers(1983) method of estimating the value of inventories by starting with the first year of available accounting data and working forwards taking in to account inflation. When firms use multiple inventory methods we assume that the first reported method accounts for 2/3 of their real inventories and the second method accounts for 1/3 of their real inventories. The precise method for estimating inventories is taken directly from Salinger and Summers(1983).

\textit{Replacement value of capital stock ($K$)}. For the first year of accounting data for a given firm we adjust the book value of Net Property Plant and Equipment by that year’s aggregate ratio of net capital stock at current cost to net capital stock at historical cost.\textsuperscript{24} We then proceed by using the algorithm outlined by Salinger and Summers except that we use the fixed investment price deflator from the Economic Report of the President (1991) rather than using the CPI. We assume that tax and actual depreciation are double declining balance. The average life of the capital stock is calculated using all years of available data.

\textit{Value of Depreciation Bond (DepBond)}. Taxable property plant and equipment is estimated by the method used in Salinger and Summers (1983) except that for the first year of available data we assume that it is equal to the book value of net property plant and equipment. We then multiply taxable property plant and equipment by an expression containing only tax parameters and the baa bond rate as given in Salinger and Summers(1983).

\textit{Tax parameters}. The effective tax rate on capital gains and dividends is taken from Feldstein, Dicks-Mireaux, and Poterba(1980). The investment tax credit rate

\textsuperscript{23}Compustat data for most firms was found on the 1984 primary, supplementary, tertiary tape which was the oldest tape available. The data for the remaining firms was taken from a complete set of the 1987 tapes.

\textsuperscript{24}We use the same Department of Commerce(1982) figures that are used by Schaller(1990) in his $Q$ construction.
is taken to be the statutory rate times the year's ratio of equipment investment to equipment and structures investment as reported in the 1991 Economic Report of the President. The effective corporate tax rate is taken from Jorgenson and Yun (1991).

Definition of q and Q. With above data in hand we calculated Tobin's q and tax adjusted Q as follows.

\[
Tobin's\ q = \frac{MV + Debt - Invent}{K}
\]

\[
Tax\ Adjusted\ Q = \frac{1}{1 - \tau} \left[ \frac{1 - c MV - DepBond}{K} + \frac{Debt - Invent}{K} - (1 - k - \tau z) \right]
\]

where \(\tau\) is the effective corporate tax rate, \(\theta\) is the effective marginal tax rate on dividends, \(z\) is the present value of one dollar in depreciation allowances, \(c\) is the marginal effective tax rate on capital gains, and \(k\) is the investment tax credit rate.

CashFlow. The cash flow definition we use is based on the definition used by Lehn and Poulsen (1989). We subtract from operating income interest payments, income taxes, and preferred dividends, and then add back in this year's deferred taxes minus the previous years deferred taxes. One could make the case that since common dividends may be costly to cut they should also be subtracted in our calculation of the firm's cash flow. While we did not do this in the regressions reported in the text, the results are very similar if we subtract out common dividends. We use as our measure of the stock of cash for the firm the beginning of period book value of cash and short term securities reported by Compustat.
References


Effect of Ownership on the Sensitivity of Investment to Cash Flow

X indicates slope change at 5% and 0 denotes slope change at 6%

Figure 1

Estimated Sensitivity of I/K to CF/K

Percentage of Equity Held by Insiders

0 5 10 20 30 40 50
### Table 1A

**Distribution of Insider Ownership for Entire Sample of 411 Firms**

<table>
<thead>
<tr>
<th>Percentage of Equity Held By Insiders</th>
<th>Number of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1%</td>
<td>68</td>
</tr>
<tr>
<td>1-3%</td>
<td>41</td>
</tr>
<tr>
<td>3-5%</td>
<td>38</td>
</tr>
<tr>
<td>5-10%</td>
<td>54</td>
</tr>
<tr>
<td>10-20%</td>
<td>72</td>
</tr>
<tr>
<td>20-30%</td>
<td>52</td>
</tr>
<tr>
<td>30-40%</td>
<td>36</td>
</tr>
<tr>
<td>40-50%</td>
<td>24</td>
</tr>
<tr>
<td>&gt; 50%</td>
<td>26</td>
</tr>
</tbody>
</table>

### Table 1B

**Summary Statistics of the Data Grouped by Quartiles Based on Level of Insider Ownership**

<table>
<thead>
<tr>
<th>Variable</th>
<th>All 411 Firms</th>
<th>Ownership below 25th percentile</th>
<th>Ownership in the 25th to 50th percentile</th>
<th>Ownership in the 50th to 75th percentile</th>
<th>Ownership above 75th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median I/K</td>
<td>.169</td>
<td>.165</td>
<td>.161</td>
<td>.173</td>
<td>.181</td>
</tr>
<tr>
<td>Mean std. deviation I/K</td>
<td>.067</td>
<td>.053</td>
<td>.066</td>
<td>.079</td>
<td>.075</td>
</tr>
<tr>
<td>Median CF/K</td>
<td>223</td>
<td>.205</td>
<td>.226</td>
<td>.244</td>
<td>.215</td>
</tr>
<tr>
<td>Mean std. deviation CF/K</td>
<td>.053</td>
<td>.038</td>
<td>.057</td>
<td>.055</td>
<td>.054</td>
</tr>
<tr>
<td>Median Tobin's q (tax unadjusted)</td>
<td>.730</td>
<td>.801</td>
<td>.755</td>
<td>.661</td>
<td>.700</td>
</tr>
<tr>
<td>Median lagged sales/K</td>
<td>3.57</td>
<td>2.90</td>
<td>3.84</td>
<td>3.90</td>
<td>3.53</td>
</tr>
<tr>
<td>Median long term debt/book value of assets</td>
<td>.194</td>
<td>.185</td>
<td>.227</td>
<td>.189</td>
<td>.182</td>
</tr>
<tr>
<td>Median book value of assets in 1973</td>
<td>163</td>
<td>637</td>
<td>190</td>
<td>125</td>
<td>114</td>
</tr>
<tr>
<td>Median cash and securities/K</td>
<td>.119</td>
<td>.116</td>
<td>.114</td>
<td>.148</td>
<td>.125</td>
</tr>
</tbody>
</table>

Notes: Medians calculated for all firms over all years from 1973 to 1976. The standard deviations are calculated for each firm and then averaged across firms. I is capital expenditures, CF is cash flow, and K is the calculated replacement cost of the firm’s capital. Note that sales, long term debt, cash and securities, book value of assets, and K are calculated for the beginning of each year based on previous year accounting data from Compustat. See the text and appendix for more on the data definitions.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient 1</th>
<th>Coefficient 2</th>
<th>Coefficient 3</th>
<th>Coefficient 4</th>
<th>Coefficient 5</th>
<th>Coefficient 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q (tax adjusted)</td>
<td>.0037 (.0008)</td>
<td>.0039 (.0008)</td>
<td>.0003 (.0012)</td>
<td>.0035 (.0008)</td>
<td>.0041 (.0008)</td>
<td>.0036 (.0007)</td>
</tr>
<tr>
<td>Q * OWNL5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.0006 (.0004)</td>
<td></td>
</tr>
<tr>
<td>Q * OWNG5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.000004 (.000004)</td>
<td></td>
</tr>
<tr>
<td>sales/K</td>
<td>.034 (.005)</td>
<td>.033 (.005)</td>
<td>.032 (.005)</td>
<td>.030 (.005)</td>
<td>.036 (.005)</td>
<td>.032 (.005)</td>
</tr>
<tr>
<td>cash flow/K</td>
<td>.241 (.041)</td>
<td>.020 (.087)</td>
<td>.003 (.160)</td>
<td>.040 (.086)</td>
<td>.039 (.092)</td>
<td>.003 (.087)</td>
</tr>
<tr>
<td>(cash flow/K) * OWNL5</td>
<td>.062 (.025)</td>
<td>.057 (.027)</td>
<td>.077 (.025)</td>
<td>.045 (.022)</td>
<td>.055 (.022)</td>
<td></td>
</tr>
<tr>
<td>(cash flow/K) * OWNG5</td>
<td>-.0042 (.0026)</td>
<td>-.0052 (.0027)</td>
<td>-.0057 (.0026)</td>
<td>-.0033 (.0022)</td>
<td>-.0044 (.0021)</td>
<td></td>
</tr>
<tr>
<td>(cash flow/K) * LOGSIZE73</td>
<td></td>
<td></td>
<td></td>
<td>.023 (.023)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(cash flow/K) * LEV73</td>
<td></td>
<td></td>
<td></td>
<td>-.383 (.329)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(cash flow/K) * Q73</td>
<td></td>
<td></td>
<td></td>
<td>.001 (.003)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cash and securities/K</td>
<td></td>
<td></td>
<td></td>
<td>.148 (.063)</td>
<td>.142 (.060)</td>
<td></td>
</tr>
<tr>
<td>(cash and securities/K)*OWNL5</td>
<td></td>
<td></td>
<td></td>
<td>-.022 (.016)</td>
<td>-.017 (.015)</td>
<td></td>
</tr>
<tr>
<td>(cash and securities/K)*OWNQ5</td>
<td></td>
<td></td>
<td></td>
<td>.0024 (.0013)</td>
<td>.0019 (.0013)</td>
<td></td>
</tr>
<tr>
<td>Number of Firms</td>
<td>411</td>
<td>411</td>
<td>411</td>
<td>411</td>
<td>410</td>
<td>410</td>
</tr>
<tr>
<td>R² (Adjusted R²)</td>
<td>.72(.62)</td>
<td>.72(.62)</td>
<td>.72(.53)</td>
<td>.73(.63)</td>
<td>.71(.61)</td>
<td>.72(.62)</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: The dependent variable in the above is the firm's annual capital expenditures as reported by Compustat normalized by K, the beginning of period replacement cost of the firm's capital stock. All estimates are computed using OLS with White (1980) standard errors reported under the coefficient estimates. The regressions include firm and year dummies that are not reported. LOGSIZE73 is the log of the book value of the firm's assets at the beginning of 1973, LEV73 is the firm's leverage at the beginning of 1973 measured as long term debt over book value of assets, and Q73 is the beginning of 1973 tax adjusted Q.
Table 3
Investment Regression Results- Slope Changing at 6% Insider Ownership

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q (tax adjusted)</td>
<td>.0039 (.0008)</td>
<td>.0035 (.0008)</td>
</tr>
<tr>
<td>sales/K</td>
<td>.033 (.005)</td>
<td>.030 (.005)</td>
</tr>
<tr>
<td>cash flow/K</td>
<td>.036 (.083)</td>
<td>-.021 (.082)</td>
</tr>
<tr>
<td>(cash flow/K) * OWNL6</td>
<td>.051 (.021)</td>
<td>.064 (.022)</td>
</tr>
<tr>
<td>(cash flow/K) * OWNG6</td>
<td>-.0048 (.0028)</td>
<td>-.0065 (.0028)</td>
</tr>
<tr>
<td>(cash and securities)/K</td>
<td>.145 (.059)</td>
<td></td>
</tr>
<tr>
<td>(cash and securities/K) * OWNL6</td>
<td>-.019 (.013)</td>
<td></td>
</tr>
<tr>
<td>(cash and securities/K) * OWNG6</td>
<td>.0027 (.0014)</td>
<td></td>
</tr>
<tr>
<td>Number of Firms</td>
<td>411</td>
<td>411</td>
</tr>
<tr>
<td>R² (Adjusted R²)</td>
<td>.73 (.63)</td>
<td>.72 (.62)</td>
</tr>
</tbody>
</table>

Table 4
Investment Regression Results for Subsamples of the Data Grouped by the Level of Insider Ownership

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Q (tax adjusted)</td>
<td>.0015 (.0010)</td>
<td>-.0022 (.0026)</td>
<td>.0045 (.0019)</td>
<td>.0037 (.0009)</td>
</tr>
<tr>
<td>sales/K</td>
<td>.036 (.012)</td>
<td>.031 (.011)</td>
<td>.019 (.008)</td>
<td>.037 (.008)</td>
</tr>
<tr>
<td>cash flow/K</td>
<td>.105 (.086)</td>
<td>.254 (.068)</td>
<td>.293 (.078)</td>
<td>.188 (.055)</td>
</tr>
<tr>
<td>cash and securities/K</td>
<td>.119 (.054)</td>
<td>.118 (.046)</td>
<td>.047 (.031)</td>
<td>.106 (.044)</td>
</tr>
<tr>
<td>Which Firms</td>
<td>Ownership less than the median among firms with under 5% insider holdings</td>
<td>Ownership greater than or equal to the median among firms with under 5% insider holdings</td>
<td>Ownership less than the median among firms with over 5% insider holdings</td>
<td>Ownership greater than or equal to the median among firms with over 5% insider holdings</td>
</tr>
<tr>
<td>Number of Firms</td>
<td>72</td>
<td>75</td>
<td>130</td>
<td>134</td>
</tr>
<tr>
<td>R² (Adjusted R²)</td>
<td>.77 (.68)</td>
<td>.69 (.58)</td>
<td>.74 (.65)</td>
<td>.72 (.62)</td>
</tr>
</tbody>
</table>

Notes: The dependent variable in the above tables is the firm’s annual capital expenditures as reported by Compustat normalized by K, the beginning of period replacement cost of the firm’s capital stock. All estimates are computed using OLS with White (1980) standard errors reported under the coefficient estimates. The regressions include firm and year dummies that are not reported. OWNL6 is defined as min(OWNER, 6) and OWNG6 is defined as max(OWNER-6, 0).
### Table 5

**Investment Regression Results For Subsamples of the Data Grouped by the level of Q**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Coefficient</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q (tax adjusted)</td>
<td>.013 (.004)</td>
<td>.016 (.003)</td>
<td>.004 (.001)</td>
</tr>
<tr>
<td>sales/K</td>
<td>.052 (.008)</td>
<td>.011 (.007)</td>
<td>.026 (.008)</td>
</tr>
<tr>
<td>cash flow/K</td>
<td>.014 (.130)</td>
<td>.023 (.165)</td>
<td>-.113 (.117)</td>
</tr>
<tr>
<td>(cash flow/K) * OWNLS5</td>
<td>.003 (.032)</td>
<td>.039 (.042)</td>
<td>.113 (.034)</td>
</tr>
<tr>
<td>(cash flow/K) * OWNGS5</td>
<td>.000 (.003)</td>
<td>.002 (.005)</td>
<td>-.007 (.004)</td>
</tr>
<tr>
<td>cash and securities/K</td>
<td>.026 (.042)</td>
<td>.118 (.049)</td>
<td>.108 (.030)</td>
</tr>
<tr>
<td><strong>Which Firms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms with AVQ in bottom 33rd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>percentile of the sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms with AVQ between the 33rd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and 67th percentile of the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms with AVQ in the top 33rd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>percentile of the sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of Firms</strong></td>
<td>136</td>
<td>140</td>
<td>135</td>
</tr>
<tr>
<td><strong>R² (adjusted R²)</strong></td>
<td>.60 (.46)</td>
<td>.69 (.58)</td>
<td>.73 (.63)</td>
</tr>
</tbody>
</table>

**Notes:** The dependent variable in the above table is the firm’s annual capital expenditures as reported by Compustat normalized by K, the beginning of period replacement cost of the firms capital stock. All estimates are computed using OLS with White (1980) standard errors reported under the coefficient estimates. AVQ for a given firm is defined to be the average of its beginning of year Q’s for the period 1973-1976. The regressions include firm and year dummies that are not reported.
Chapter 3: Ownership, Compensation, and Executive Turnover

Charles J. Hadlock
Gerald B. Lumer
1 Introduction

To what extent do managers of public firms have an incentive to act in the interest of the shareholders whose assets they manage? Following the seminal work of Berle and Means (1932), it has long been recognized that dispersed ownership in public corporations can lead to a divergence from value maximization. Consequently, understanding the various contractual and market based mechanisms that guide managers to maximize shareholder value has been the focus of intensive research efforts.

Incentives for managers to maximize shareholder value are governed both by internal forces, such as explicit and implicit reward schemes determined by the board of directors, and external markets, such as the market for corporate control and the product market. The importance of external markets in providing managers with incentives, and in particular the active market for corporate control, illustrates the failure of internally determined incentives to function adequately. In this paper we investigate empirically some of the internal incentives provided by the firm.

The internal incentives that have been widely discussed in the literature include incentives generated by linking pay to performance\(^1\), incentives generated by insider ownership\(^2\), and incentives generated by the threat of being fired\(^3\). In this study we present historical evidence on one of these incentive mechanisms, the threat of being fired if their firm performs poorly. In our investigation we use a unique data set that we have constructed on a panel of 228 firms for the 1930's. An advantage of the period we choose and the data available for this period is that we are able to explicitly investigate the relationship between all three of the internal incentive mechanisms that have been discussed in the literature. Specifically we present evidence on the relationship between the determinants of executive turnover and the compensation policies and ownership structure of firms. There are two distinct but related empirical questions that we address.

\(^1\)See Jensen and Murphy (1990)  
\(^2\)See Jensen and Meckling (1976), Morck, Shleifer, and Vishny (1986)  
1.1 Compensation and Executive Turnover

In their paper on incentives generated by CEO compensation policies, Jensen and Murphy (1990) suggest that executive pay was on the order of 10 times more sensitive to firm performance in the 1930's than it was in the 1970's and 80's. They argue that this finding is evidence for political pressure in the modern era constraining the ability of firms to reward managers for increasing shareholder value. Essentially their argument is that the 1930's observation on compensation policy is closer to the optimal contract between managers and shareholders, and therefore that political constraints on compensation in modern times are suboptimal contracts from the point of view of principal-agent theory. If this interpretation is correct, it suggests a serious market failure. In addition, it could help explain the increased activity in the market for corporate control as a response to suboptimal internal incentives given to managers.

The second important parameter in disciplining managers that is also under the control of the board of directors is the probability that a manager will be fired following poor performance. As Jensen and Murphy point out, the wealth effects generated by the threat of dismissal are at least on the same order of magnitude as the direct incentives generated by varying executive pay with performance. If Jensen and Murphy are correct in their assertion that top management pay to performance sensitivity in the modern era is constrained by political pressure, we would expect boards of directors to rely more heavily on the threat of firing managers as a substitute method of creating incentives. Below we estimate the dismissal probabilities following poor performance for our panel of 1930's firms and compare these estimates to those that have been obtained using more recent data. If Jensen and Murphy are correct, we expect the sensitivity of dismissal to performance to be higher in the modern era.

There are other explanations as to why dismissal sensitivities would be higher in the modern era. It could be that managers in the 30's were under less control by shareholders so that they could pay themselves high salaries when the firm did well, yet they could never be fired regardless of performance. This would appear in the data as more pay for performance in the 30's and less dismissal for performance. Thus
a finding of less dismissal for performance in the 30's is not conclusive evidence for
Jensen and Murphy's contention that the modern management contract is suboptimal,
only that observed management contracts looked different in the 1930's. Consequently
we only have the power to reject Jensen and Murphy's assertion, and on balance
evidence we present does this.

1.2 Ownership and Executive Turnover

The second issue we address concerns the cross sectional variation in the sensitivity
of executive turnover to firm performance. Ideally we would like to explain the incentives
provided to managers as a consequence of the incentives of those who monitor
managers, the board of directors in particular.

The incentives for boards to monitor managers has been widely discussed in the
business and academic press. Weisbach (1988) presents interesting evidence on the
cross sectional determinants of CEO dismissal probabilities. He finds that outsider
dominated boards are more likely to remove managers following poor performance
than are insider dominated boards. He argues that this is evidence that outside board
members play a valuable role in monitoring managers. If outside board members do
have this role, then we should find a similar effect in our data for the 1930's.

It is not clear theoretically why boards of directors should carefully monitor man-
agers without the proper financial incentives to do so. The primary financial incentive
for directors to actively monitor managers comes through their ownership interest in
the firm. Since the composition of the board is highly correlated with ownership of
stock by insiders, it could be that ownership structure drives the sensitivity of dis-
missal to performance. Weisbach tries to control for ownership in his analysis, but he
has only very limited data.

How does ownership by directors affect the degree to which directors monitor
managers? One would expect ownership by those who monitor managers to result
in increased monitoring, an idea suggested by Morck, Shleifer, and Vishny (1988),

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4See for example Mace (1971) and Vancil (1987).
and similar in spirit to Shleifer and Vishny (1986). As ownership becomes more concentrated in the hands of non-managers, there are fewer free rider problems and the manager shareholder relationship more closely approximates the basic assumptions of principal-agent theory.

The problem in addressing this issue empirically arises from a lack of data that can precisely separate ownership by those who monitor managers from ownership by those who are part of the management team. While a big stake by outside directors or blockholders could provide strong incentives to monitor managers, there is some evidence in the literature that big stakes by inside directors can have the opposite effect. In particular Morck, Shleifer, and Vishny (1988) find evidence that high levels of ownership can entrench managers. The evidence they present is fairly indirect, as it relies on an argument that an observed negative relationship between insider ownership and Tobin's q is a consequence of managerial entrenchment being transmitted through Tobin's q.

Most studies concerned with the effect of ownership on incentives are constrained by data limitations to group all ownership by officers and directors together, and typically data on blockholders is unavailable. These studies are thus unable to separate the role of outside ownership in increasing the severity of monitoring of managers from the role of inside ownership in entrenching managers and increasing their insulation from external discipline. Since these two roles for ownership are quite different, being able to separate the level of insider ownership from the level of outsider ownership could be very important.

In this study we use the sensitivity of dismissal to performance as a metric of the degree to which managers are monitored, or alternatively, as a measure of managerial entrenchment. We have been able to construct a unique data set described below that has precise data on the holdings of outsiders and the holdings of insiders. An added advantage of using data from the 1930's is that there was more cross sectional variation in ownership by officers, directors, and blockholders during this time period. While modern studies of insider ownership in the largest publicly traded corporations have samples with almost all firms having insider ownership below 5%,
our sample has many firms in this category but also proportionately more firms with more concentrated ownership.

We first present evidence on how inside ownership affects the sensitivity of dismissal to performance, which would appear to be a much more direct way to examine managerial entrenchment than the study by Morck, Shleifer, and Vishny. Certainly if ownership entrenches managers this should be reflected in the observation that managers with big stakes are not dismissed as frequently following poor performance as managers with small stakes. We are able to directly test this assertion below given out data. Secondly we examine the effect of outside ownership on incentives to monitor managers by considering how an outside ownership impacts the sensitivity of executive dismissal to performance. Our expectation is that if high outside ownership increases the severity of monitoring, then we should observe a positive relationship between outside ownership and the sensitivity of executive dismissal to firm performance.

The plan of the rest of the paper is as follows. In section 2 we discuss the data and present some summary statistics. More detailed discussion of the construction of the data is contained in a data appendix. In section 3 we present our basic results on the sensitivity of dismissal to performance in the 1930's as compared to modern data. In section 4 we discuss our ownership data. In section 5 we present results on the cross sectional variation of the sensitivity of dismissal to performance and its relation to the composition of the board and the ownership of the firm. Section 6 concludes and suggests some further questions that await the availability of more data.

2 Data

In this section we discuss the construction of the data used in this paper and present some summary statistics. More detailed discussion of construction of the database is contained in a data appendix. The questions we consider in this paper pertain to large publicly traded firms with fairly dispersed ownership structure. Previous studies typically draw as their universe of firms the largest publicly traded firms
that satisfy some selection criterion. We take as our universe of firms the 708 firms listed on the CRSP monthly tape with data for January, 1933. From this list we exclude all public utilities, railroads, and financial firms, by using the historical sic code for 1933. We also exclude those firms not listed in the 1933 issue of the Moody's Industrial Manual. For the remaining 512 firms we check the 1933 Moody's manual and record the book value of the firm's assets. Our original goal was to construct a data set of the approximately 250 largest industrials. We thus chose a 1933 Moody's book value of 20 million as our criterion for inclusion in our data set. Using this criterion and making deletions for bankruptcy, voting trusts, and some firms being controlled by other firms we arrive at a starting sample of 228 firms.

We followed the identity of the Chairman, President, Vice Presidents, officers, and directors from the 1933 Moody's manual through the 1940's manual. This entailed following the careers of 3572 officers and 4306 directors representing 6153 separate individuals. Since we want to predict when top managers are forced to leave firms it is important to control for unforced departures such as death, illness, and mandatory retirement. For all but 31 individuals who served at least one year as an elite officer, we found their birth date and death date by an intensive search of historical sources.

From the assembled data base we were able to construct annual variables related to when the top management team of the firm changed. We consider several types of management changes that are defined to be as comparable as possible to the study of Warner, Watts, and Wruck (1988). The title CEO was not widely used in the 1930's. For every firm/year Moody's has listed an individual as president or a single person as chairman and president. For 46% of the firm/years Moody's lists a person other than the president as Chairman, so that for roughly half of all our observations the top management team is comprised of two individuals.

We construct a binary variable called TOPCHANGE (abbreviated as TCHG) that is set to one if there is a change in the set of individuals serving on the top management team. TOPCHANGE can be one if either the president or chairman

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5 We use the term elite officer to refer to the Chairman and/or President
6 The comparable figure in Warner, Watts, and Wruck (1988) is 66%. 

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leave the firm or if the management teams increases from one person to two people. Typically this occurs when the president and chairman keeps the title of chairman and a vice president or outsider becomes president.

TOPCHANGE may be a very noisy measure of a manager being disciplined since a president becoming chairman and a new person being appointed president may be part of the normal management succession process. We construct an alternative binary variable called LEAVE that is set equal to one if a member of the top management team leaves the top management team altogether. Since every firm has exactly one president we construct a binary variable called PLEAVE that is set equal to 1 if there is a change in the firm's president in a given year. If the president is effectively the CEO, regressions using this variable should be equivalent to the CEO dismissal equations estimated by Weisbach (1988) and Coughlan and Schmidt (1984). Finally we construct a binary variable that is called OUTSIDE that is set equal to 1 if a person not previously employed by the firm is hired as part of the top management team. These hires are most likely the cleanest cases of the top management team changing in a way unrelated to the natural management succession process, and perhaps then most likely related to discipline for poor performance.

In Table 1 we present some basic summary statistics for the binary variables defined above. The binary variables constructed above are not coded as 1 if the change was the result of death or if the manager dies within a year of leaving office and his obituary refers to poor health in the decision to leave the firm. These firm/years are excluded from the sample. TOPCHANGE occurs in 9.5% of the firm/years in our data set as compared to the 11.5% occurrence for the similar variable used by Warner, Watts, and Wruck (1988). Of the cases where the top management team changes we find that 67% involve a top manager leaving the firm which is quite close to the figure of 63% in the Warner, Watts, and Wruck study.

Previous studies have pointed out that a large number of management changes occur when a top manager reaches age 65, a typical mandatory retirement age for many firms. This observation is borne out by our data. In Table 1 next to each column we present the number of firms that experience the indicated type of management
change where none of the managers are in the age 64 to 66 age bracket. In the analysis below we consider only firm/years where the top manager does not leave due to illness or death, and where none of the relevant managers are in the 64 to 66 year old age bracket. In addition we include a dummy variable for firm/years with any top manager over the age of 66, as it is likely that older managers have a higher probability of leaving a firm for reasons unrelated to being removed for poor performance.

The basic returns data we use in this paper are from the CRSP monthly tapes. A minor timing difficulty arises from the fact that the Moody’s manuals go to press on or about May 31 of each year. Most of the accounting data corresponds to the end of the company’s fiscal year preceding May 31, which for most firms is December 31 of the preceding calendar year. It is not clear whether the management composition data given in Moody’s is accurate as of the date of press or as of the date of the company’s last annual report, which is typically issued shortly after the end of the fiscal year. Ideally we would like to measure returns over some fixed length of time prior to the period of dismissal. This is problematic since the window of time for the dismissal is fairly large. Our solution is to measure returns immediately preceding dismissal as the annual return for the calendar year preceding the issue of Moody’s where the executive is no longer present. We call these returns current returns to distinguish them from lagged returns that we add later in the analysis. Thus the current return used to predict what firms experience top management changes between the 1933 Moody’s and the 1934 Moody’s is the 1933 calendar year annual return from the CRSP tape. These returns are the annual returns immediately preceding the top management change if we assume all changes occur on December 31 if the last year that a manager is listed in Moody’s.

Theoretically and empirically there are problems with using only the firm’s returns or lagged returns as an explanator of turnover. Many factors regarding the return on the firm’s stock are not directly affected by managerial input, and thus theoretically at least, should not be used as a way of rewarding or punishing managers. Typically one controls for this by measuring the firm’s annual return as the difference in the
firm's return from the market return. Warner, Watts, and Wruck estimate separate coefficients on the firm's return and the market return. This is more general than estimating a single coefficient for the difference of these returns, which essentially constrains the coefficient on return to equal the negative of the coefficient on market return. We also include the value weighted market return or the difference of the firm's return from the market return in our specifications.

In addition, we use the difference of the firm's return from the average return for all CRSP listed stocks with the same 2 digit sic code as the firm under consideration. Since the two digit sic return controls more specifically for industry wide effects that are presumably beyond a manager's control, theoretically one would expect it to be used more in rewarding and punishing managers. Researchers have had limited success in detecting that firms use returns relative to industry to reward or punish managers, although Gibbons and Murphy (1990) provide some evidence along these lines. We include returns relative to industry in several of our specifications.

3 Estimation Results For Management Changes

To maintain comparability with previous studies, we estimate logit models of executive turnover. A variety of specifications have been suggested in the literature. Some are more appropriate than others given our specific data. The basic idea in all of the results we report is to explain executive turnover as a function of the firm's performance. We have attempted to eliminate much of the noise in the binary variables that we use as measures of executive turnover so that our dependent variables are useful signals of managers being disciplined for poor performance.

In Table 2 we present our basic results. The first dependent variable we use is whether or not there is a top management change in a given year. The estimates in column 1 are the most comparable to the results reported by Warner, Watts, and Wruck. The only difference between our specification and their's is that they include lagged returns of two and three periods preceding the year of potential management changes where we limit ourselves to current and lagged returns only. Given their
limited results on lags of two periods and more and our smaller data set, this choice seemed prudent.

The estimated coefficient on the firm's current own return is -.30 and is significant at the 10% level using a one tailed test. The corresponding coefficient Warner, Watts, and Wruck is -.42 and the coefficient we obtain is not significantly different from theirs. Our lagged return variable is also of the expected negative sign, but the standard error is large and it is statistically indistinguishable from 0. It is also statistically indistinguishable from the significantly negative coefficient reported by Warner, Watts, and Wruck (hereafter abbreviated as WWW).

The coefficient on market return of .69 is of the expected positive sign and is also significant at the 10% level using a one tailed test. The corresponding coefficient in WWW is .57 and again there is no significance difference between the two. The coefficient on lagged market return of .79 is of the expected positive sign and significantly so. WWW estimate this coefficient to be essentially 0, but their estimate on this coefficient is imprecise and is not statistically different from ours.

The baseline results in column 1 of Table 2 confirm that changes in the top management team in the 1930's are similar in the 1930's to the modern era. When a firm performs poorly as measured by stock returns, then management changes occur with a higher probability. In addition the positive coefficient on market return indicates that the probability of a management change is related to the firm's performance relative to the market. It is interesting to note that the coefficients on return and market return are numerically very close to one another for the two time periods. This finding provides some evidence, albeit indirect, against Jensen and Murphy's argument that existing compensation contracts are suboptimal.

Theory would suggest that managers should be rewarded more on performance relative to industry rather than performance relative to the market since in the latter case managers face some unnecessary risk. Gibbons and Murphy (1990) present some limited evidence that executive turnover depends on performance relative to the 1

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7It appears that a one tailed test is most appropriate here as there are few reasons one would expect the management team to change following good performance. When not explicitly stated all significance tests used in this paper are one sided.
digit sic industry. Unfortunately their results disappear when they present regressions including both market return and 1 digit sic code return as independent variables.

In column 2 we present results where we have added the equal weighted return of all firms in the same two digit sic industry as the firm used in the observation. The results are quite surprising. The coefficient on own return remains of the expected negative sign and actually falls to -.47 which is significant at the 3% level. The coefficient on market return becomes a small negative number that is insignificantly different from 0. The coefficient on return for the firm’s two digit sic code of .63 is large, of the expected positive sign, and significantly different from 0 at the 5% level using a one sided test. The coefficients on lagged own return and lagged market return are essentially unchanged by the inclusion of the sic code return variables. Lagged sic code return is small, negative, and insignificantly different from 0.

The estimates when we include 2 digit sic return provide much stronger evidence for relative performance evaluation in the decision to change managers then in any previous studies. WWW mention that they tried using returns relative to industry, but the results were sufficiently uninteresting that they were not presented. Including independent variables for market return and 2 digit sic return are intended to capture the standards by which the firm’s performance is measured. An alternative used in the study by Weisbach(1988) is to use as independent variables the difference in the firm’s return from the market and the difference in the firm’s returns from 2 digit industry returns. Estimation of a model using these differences as independent variables is a restricted version of the more general estimation where each variable gets a separately estimated coefficient. There are a priori no strong reasons to believe that these restrictions do not hold. To economize on degrees of freedom and to simplify our discussions and interpretations, most of the results later in the paper use the difference between the firm’s returns and other benchmark returns as the independent variables.

In column 3 of Table 2 we present results where we have used these alternative definitions of returns as our independent variables. The coefficient on the firm’s return relative to the market and its lagged value are small and insignificant as is the
coefficient on lagged return relative to the industry. The coefficient on the difference between current return and 2 digit sic return of -.59 is of the expected negative sign and is significant at the 5% level using a one tailed test. Taken as a whole, the evidence on top management changes for our time period suggests that the sensitivity of management changes to performance was about on the same order of magnitude in the 1930's, but we present strong evidence for rewards being based on return relative to the industry rather than return relative to the market. One explanation for this finding may be that firms in the 1930's were much less diversified than modern firms. Thus the 2 digit sic code returns for this time period could be a more informative benchmark to compare the firm's performance against than are modern 2 digit sic returns.

To gauge the magnitudes of the estimates from column 3 of Table 2, we present the implied probabilities from these estimates of a top management change in Table 3. These probabilities are stated for a firm with all top managers below age 64 and all return variables except current return relative to the industry set equal to 0. For a firm with a return versus industry of -.05, which is the median for our sample, the estimates imply a probability of management change of 8.2%. If the firm underperforms its industry by 45% so that it is at the 10th percentile, the model predicts a management change with a probability of 10.1%. Conversely if the firm outperforms its industry by 47% placing it at the 90th percentile, then a change is estimated to occur with a probability of only 6.1%.

In the second set of three columns on Table 2 we present estimates where we use the dependent variable LEAVE rather then TCHG. For LEAVE to equal one either the president or the chairman of the firm must leave the top management team. It seem plausible that this is a less noisy measure of management being disciplined, since it is more likely that this event is a true demotion. Unfortunately observations the events that trigger LEAVE equal 1 are rarer, and this may result in a decreased ability to arrive at precise estimates.

The estimates in columns 4 and 5 confirm the findings when we used the dependent variable TCHG. The coefficient on the firm's own return remains negative, on the
same order of magnitude as the earlier coefficient, and significantly different from 0 at the 10% level. In column 6 our estimates on the coefficient for the firm's return minus the market return of -.22 is now of the expected negative sign but it remains statistically indistinguishable from 0. The coefficient on return minus industry return is also negative, but given the large standard errors it also is not significantly different from 0. The study by WWW does not use a variable directly comparable with LEAVE. While the results are not as conclusive as for the dependent variable TCHG, this is primarily a consequence of the larger standard errors. The numerical estimates remain fairly close to the estimates using the TCHG variable which we interpret as a crude confirmation of the findings reported above.

In Table 4 we present similar logit results where we use as a dependent variable PCHANGE. This variable is set equal to one if the president of the firm changes. An advantage to using this variable is that each firm has exactly one president each year where the top management team used in the previous variables can be either one or two individuals depending on the firm and the year. If the president is effectively equivalent to the modern day CEO, then estimation results using president dismissals as the dependent variable can be compared to estimates of CEO dismissal probabilities based on modern data.

The results for president changes are not strong. Current return, market return, and 2 digit sic return are not significant and several of these are opposite of the expected sign. Separate estimations of the difference of return from the market and from the industry in column 3 are also small and insignificant. The only variables that are significant are lagged returns and lagged market returns which are of the expected sign. However when we constrain these coefficients to be of equal magnitude and of opposite sign, as in column 3, the estimated coefficient on the difference between lagged returns and lagged market returns of -.22 while of the correct sign is not significantly different from 0.

This finding is difficult to compare to studies of CEO dismissals based on modern data which all impose the constraint that we impose in column 3. Contrary to our evidence on top management changes and departures reported above, it does not ap-
pear that the decision to change presidents is as strongly related to firm performance measured relative to the market or relative to the industry. This could be due to some data problems discussed in the appendix. Another likely possibility is that many of the presidents that change take instead the title of chairman while a new president moves in. The former president could still effectively be the CEO of the firm in the modern sense, until he steps down from office or gradually relinquishes that role. If these events are common and typically do not occur around the retirement window of age 64 to 66, then it could explain our lack of results.

Finally as in WWW we investigate the effect of stock returns on the probability that an outsider is brought in to a top management position, a very rare event. This occurrence is coded as the binary dependent variable OUTSIDE and reported in columns 4, 5, and 6 of Table 4. Presumably an outsider being brought in is the strongest possible penalty to the entire management of the firm, not just the top managers. Vice presidents and other officers who previously may have had a chance at the top management slot could have this probability dramatically reduced when an outsider joins the firm. In fact, they may even be replaced if the outsider brings in his own people to help run the firm.

The results using the dependent variable outside in column 4 of Table 4 are similar to the estimates by WWW. The firm’s own return of -.58 has the expected negative sign and it is significantly different from 0 at the 10% level using a one sided test. The coefficient on market return of 1.88 is large, of the expected sign, and significant at the 5% level. This regression and the earlier result using TCHG are the ones most comparable to WWW estimates. Interestingly the numerical size of these estimated coefficients in this specification is again fairly close to WWW. We get a slightly smaller coefficient on own return and a slightly larger coefficient on market return, but our estimates are both economically and statistically quite close the those by WWW. The results on industry return and performance relative to industry and the market are reported in columns 5 and 6. There is no conclusive evidence that the decision to bring in an outsider is related to industry performance or performance relative to the industry.
4 Ownership by the Board and Blockholders

The data on officers and directors that we pulled from Moody's allows us to calculate the composition of the board of directors for each firm/year. We are primarily interested in explaining how ownership by members of management and by the board helps explain the monitoring and entrenchment of management. Weisbach (1988) presents some limited evidence suggesting that it is the fact that outsiders are independent of managers that leads them to monitor managers, rather than their ownership interest.

We try to define outsiders in as similar manner as possible to Weisbach (1988). We define outsiders on the board to be all directors except those who are either officers with the firm, retired officers with the firm, or general counsel to the firm. The only data we do not have that Weisbach includes is the identity of the firm's investment bankers, whom he does not treat as outsiders. The basic breakdown of the fraction of outside directors on the board can be found in Table 5. The median board in our sample has 56% outsiders where Weisbach finds a median board composed of 45-50% outsiders. The evidence suggests that the breakdown between insiders and outsiders in the composition of the board of directors has changed little in the past 50 years.\textsuperscript{8}

It seems likely that the extent to which directors monitor managers should be closely linked to their economic incentives to doing so. Effectively the only real economic incentive for directors to do a good job comes through their ownership interest in the firms whose boards they sit on.\textsuperscript{9} Furthermore it has been suggested that the power of insiders to thwart efforts to replace them also is related to their ownership interest.

We are able to collect very detailed data on the ownership interest of all of the officers and directors in our sample who had positions with the firm in 1935. The data comes from a special SEC publication published in 1936 detailing the ownership interests of all officers and directors for all exchange listed firms in the United States. To our knowledge it is the most detailed data of this type available from one source

\textsuperscript{8}The difference between the two medians would presumably be even smaller if we had data on investment bankers.

\textsuperscript{9}See Kaplan and Reishus (1990) for other incentives for directors to do a good job.
for any time period this century. We have data on the holdings by each officer and
director of every class of equity security issued by the firm.

Of the 225 firms in our sample in 1935, 79 issued preferred stock that had voting
power. For a few firms there were three or more classes of voting securities and in a
handful of cases a class of stock other than common had more than one vote per share.
The ownership data we use in our analysis below is the share of votes controlled by
the various parties under consideration. The correlation between shares of common
held by a party and share of votes held by a party are approximately .98 for the
different divisions we discuss.\footnote{The correlation between share of dollar value of equities outstanding and share of votes held is
lower but always greater than .9. The basic character of our results is the same no matter what
ownership measure we use.}

There are two basic ownership measures that we use. One variable we use is
called INSIDE and is the sum of direct and indirect holdings by all officers and inside
directors of the firm. The second variable called OUTSIDE is the sum of holdings
by all outside directors and stockholders that are not affiliated with management.
More specific details on how we attributed joint holdings and other special cases is
contained in the data appendix and a data document that we have constructed. We
have attempted to carefully construct INSIDE and OUTSIDE to represent the total
holdings under the potential control of insiders and those certainly under control by
outsiders respectively. The results we report below are robust to using the most
stringent definition of ownership where we only count for each individual the shares
that they hold directly.\footnote{Of course for many individuals these are the same figure.}

The basic summary statistics for the distribution of ownership is contained in
Table 6. While ownership was more concentrated during this time period, it is evident
that at least for our sample of very large firms, ownership was still quite dispersed.
It is interesting to compare these figures to modern figures. Jensen and Murphy
(1990) report a median CEO shareholding of .16% where for presidents we arrive at
a median shareholdings of .42%. Morck, Shleifer, and Vishny report a median(mean)
insider holding of 3.4% (10.6%). In our sample the corresponding figures are 4.5%
and 8.79% respectively. Surprisingly, it appears that in fact our data indicate a fairly similar degree of board ownership over the two time periods. This may simply be a consequence of the fact that the firms we look comprise a larger fraction of the largest firms of the time period.

5 Boards, Ownership, and Turnover

5.1 The Composition of the Board and Turnover

As mentioned in the introduction, we are primarily interested in seeing if there is evidence that high inside ownership entrenches managers and/or if ownership by outsiders increases the severity of monitoring. Before proceeding we first analyze the role of the composition of insiders and outsiders on the board on the degree of entrenchment/severity of monitoring as indicated by the dismissal probability coefficients. In Table 7 we present logit estimation results where we have included variables related to the composition of the board as explanators of the cross sectional variation in dismissal probabilities and in the sensitivity of dismissal to performance. To maintain some comparability with Weisbach, we use his breakdowns in to three discrete classes of boards. We define the variable MIX to be equal to 1 if firm has 40-60% outsiders on the boards and a variable OUT set equal to 1 for firms with more than 60% outsiders.

In all future estimations reported in this paper we use for our return measures the difference of the firm's annual return from either the market or industry annual return. With interaction terms and lags in the analysis this seems to be the only way to keep the degrees of freedom manageable and these results are easier to interpret. Baseline results using the TCHG dependent variable are contained in column 1 of Table 7. The positive coefficient on OUT is significant at the 10% level and indicates that the outside dominated boards change the top management team more frequently holding performance fixed. The coefficient on the interaction of return relative to the market is of the expected negative sign and highly significant (t=2.21). This coefficient indicates that the outside dominated boards change the top management
team following poor performance more frequently than do insider dominated boards.

In the second column we add terms that include the firm's return relative to own industry and its lag. None of the coefficients on lagged returns are significant. The coefficient on current returns are interesting. The estimates suggest that the outside boards change top managers following poor performance relative to the market less frequently, while at the same time changing top managers when the firm does poorly relative to the industry more frequently. If one accepts the assumption that managers should be rewarded more relative to industry performance, then our finding would suggest that outside boards are more diligent at following this prescription. The evidence though is less convincing than it might first appear, as there are statistically no differences between outside boards and mixed boards. Furthermore the coefficient on return relative to the industry of 1.15 for inside boards is actually estimated to be large and positive, although not significantly so. Nevertheless, we find this difference between inside boards and outside boards in the use of relative performance measures to be quite interesting.

In columns 3 and 4 we present the same specifications as in columns 1 and 2 except that we use the dependent variable LEAVE rather than TCHG. The data here tell essentially the same story. The numerical magnitude of the effects interacting returns with the different board composition categories become somewhat larger and more significant. For the dependent variable LEAVE the aforementioned effects for outside boards are now estimated to be larger than for outside boards than for the mixed boards, but not significantly so. Unfortunately we still get the perplexing coefficient on current return relative to the industry that implies the fairly implausible relationship that for inside boards top managers leave more frequently when the firm does well relative to its industry. The estimates in columns 5 and 6 on president changes are sufficiently imprecise to warrant any conclusions.

\[\text{In fact, our justification for using one tailed tests in this paper arises from an assumption that such a finding is implausible.}\]
5.2 Ownership by Insiders and Outsiders and Turnover

The composition of the board of directors is strongly related to the distribution of ownership in the firm. If we regress the fraction of outsiders on the board on insider holdings and outsider holdings we get a constant of .56 (t=85.9), a coefficient on insider holdings of -.75 (t=15.0), and coefficient on outsider holdings of .25 (t=6.4). As Weisbach has suggested, it may be that any results we find for the composition of the boards affecting the severity of how managers are monitored may simply be a reflection of the fact that the composition of the board is correlated with the distribution of ownership. This would be true, for example, if ownership by insiders entrenches management by making managers hard to remove, while at the same time outside ownership increases the incentives to monitor managers and remove them when they are doing a poor job. It is precisely this issue of the role of inside ownership in entrenching managers and outside ownership in providing incentives to monitor managers that concerns us here.

In Table 8 we consider the role of inside ownership on executive turnover for our panel of firms. Since the exact functional specification of how inside ownership is related to entrenchment is not clear, we try two basic specifications. In one set of specifications we use the variable INSIDE which is just the total holdings of all insiders as described above. In a second set of specifications we use a variable called INSIDE\(_{5,100}\) which takes a value of 1 if inside ownership is above 5% and 0 otherwise. The 5% choice is arbitrary, but several studies that document evidence of managerial entrenchment use 5% as a cutoff point as to where share ownership is large enough that managerial entrenchment could become a detectable problem.

Column 1 and 2 present the basic results where we now include in our specifications inside ownership and the interaction of inside ownership with returns as independent variables, while using TCHG as the dependent variable. Columns 3 and 4 present the same results where we use LEAVE as the dependent variable. In all specifications the coefficient on inside ownership alone is small, insignificant, and in column 3 of the wrong sign. The data does not seem to support the assertion that firms with higher inside ownership experience fewer top management changes or top management
departures.

The coefficients on inside ownership interacted with return relative to the market do not tell any consistent story. If high ownership entrenches managers by insulating them from discipline following poor performance, we should observe a positive coefficient on the interaction of inside ownership and return relative to the market. In all four columns the coefficient on return relative to the market interacted with inside ownership is actually negative. For the first two columns which use TCHG as the dependent variable the coefficient is actually significantly negative. What is puzzling is that in all four columns the interaction of inside ownership and return relative to the market lagged one year is positive, and in three of the four cases significantly so. It is difficult to draw any conclusions from these contradictory findings. A further puzzling fact is that in all columns the estimated coefficient for return relative to the market for a firm with 0 inside ownership is positive, and significantly so in one case. Clearly the data does not strongly support the assertion that as inside ownership increases management turnover is less sensitive to performance.

The coefficients on uninteracted return relative to the industry remain negative and significant as found earlier in the paper. Relative performance evaluation seems to show up in our data fairly strongly. The evidence from the interaction of inside ownership and return relative to industry is inconclusive. While all four coefficients interacting current return with insider ownership are of the positive sign that we expect, only one is significant. Slightly more troubling is that all of the interaction coefficients of insider holdings with lagged return relative to industry are negative, although none are significantly so. Taken as a whole, the evidence on entrenchment from inside ownership manifesting itself in a decreased probability of management changes or dismissals following poor performance is weak.

In Table 9 we present estimation of the same specifications where we use the total ownership by outside directors and unaffiliated blockholders instead of insider holdings. We are looking for evidence that an increased financial incentive to monitor management arising from an outsiders ownership stake manifests itself in an increased sensitivity of management changes to performance. Thus we expect a negative coef-
ficient on the interaction of outside ownership and the return measures.

The coefficients on outside ownership alone are all very small and insignificant. The data does not support the assertion that increased outside ownership results in a higher turnover rate for our set of firms. All of the coefficients on the interaction of outsider ownership and the return measures relative to the market are insignificant as are the coefficient interacting outside ownership and current return relative to the industry. The only evidence for increased monitoring when outsiders have a larger stake is found in the coefficient interacting ownership with lagged return relative to industry. All four of these coefficients are negative and the coefficients in columns 1 and 2 which use TCHG as the dependent variable are significant at the 5% level.\textsuperscript{13} Taken as a whole the evidence that ownership provides effective incentives for outsiders to monitor managers and that this manifests itself in an increased probability of removal following poor performance is not strong.

6 Conclusion

In this paper we present evidence on some of the determinants of management turnover for a panel of 228 large industrial firms in the 1930's. Our estimates suggest that top management changes in the 1930's were about as sensitive to firm performance as estimates obtained by researchers using more recent data. In particular our estimates from specifications that most closely match those used by other authors suggests a very similar sensitivity of management changes to firm performance. We interpret this finding as evidence against Jensen and Murphy's assumption that modern compensation contracts are suboptimally constrained due to implicit political pressure. If managers today cannot be given optimal pay for performance incentives, we would expect that substitute incentives would be provided by making executive

\textsuperscript{13}It is possible that our lack of strong and consistent results using the ownership measures is a result of the fact that we do not use both ownership measures at the same time in our specifications. In Table 10 we present the same results as in Tables 8 and 9 except we incorporate terms for both types of ownership variables at the same time. The estimates are very similar to those obtained by looking at each type of ownership separately and all of our basic conclusions about the ownership variables are unchanged.
dismissals more sensitive to performance. The evidence we present rejects any change in the level of incentives generated by threat of dismissal.

As a by product of our analysis we have found several pieces of strong evidence for relative performance evaluation in the management turnover equations. It appears that in the 1930’s performance relative to the industry is used as a metric to gauge managers performance. This is in contrast to the much weaker evidence reported by Gibbons and Murphy (1990) in the part of their study concerning relative performance evaluation in turnover equations. One explanation for this finding may be that firms in the 1930’s were less diversified than firms today so that the industry return during that period was a more valid benchmark to use as a measure of managerial performance. This could explain the failure to find evidence of this sort of yardstick competition on modern data.

Finally, despite our rich data source, the evidence on ownership structure and management turnover is mostly inconclusive. We proposed that ownership by insiders, that is officers and inside directors, could entrench managers along the lines of the findings of Morck, Shleifer, and Vishny (1988). However our estimates do not show any significant and consistent relationship that higher insider ownership results in either less total management turnover or a smaller sensitivity of turnover to firm performance. We also proposed that the financial incentives of those who monitor managers should affect the quality of their monitoring. Again we find no strong evidence along these lines. We find no significant and stable relationship that higher outsider ownership affects the sensitivity of management turnover to performance. An understanding of this empirical puzzle awaits future research.
Data Appendix

This section briefly describes the data that is used in the paper. Further details about the sample construction are available from the author. The basic source of data on officers and directors are the 1933 to 1940 editions of the Moody’s manuals. For each company Moody’s lists all of the officers with a firm and their positions, as well as the entire set of directors for the firm. To the best of our knowledge Moody’s is the most comprehensive data source of this type in existence. Some researchers, notably Warner, Watts, and Wruck (1988) have used Standard and Poor’s Register of Corporations. The Poor’s data is not in a usable format for all of our time period, also some preliminary comparisons between the two data sources indicate that Moody’s may be more reliable.

For each of these firms we carefully investigated the Moody’s manuals and recorded for each year all of the officers and directors. For officers we recorded their position with the firm, although all officers below the vice president level are recorded as generic officers. To check the basic validity of the data, for the years 1935, 1937, and 1940 we compared all of the Chairman and Presidents listed by Moody’s with the listings in Poor’s. In no cases was a person listed in Poor’s and not in Moody’s, though the opposite did occur on several occasions. This suggests to us that, if anything, the Moody’s data is more accurate. In 5 cases Poor’s listed a person as Chairman and President while in Moody’s they were listed only as president and the firm had no Chairman. In our analysis we always assume that when only one person is listed as President or Chairman they are effectively the top manager of the firm. Thus the omission of the Chairman title when one person serves both positions is unimportant for our purposes. In addition we recorded the general counsel for each firm and the officers in 1924. As previous authors have suggested, the firm’s lawyers or retired officers who are on the board are effectively more like inside directors than outside directors.

One of the predominant reasons for top managers to leave their position with a firm is retirement or mandatory retirement. We are particularly concerned with the case of mandatory retirement at age 65. Other retirements are presumably linked to pressure exerted by the board. In addition deaths or retirements precipitated by illness are essentially involuntary and we would not expect them to be governed by the mechanisms disciplining managers that we are concerned with in this paper.

To find the ages of the top managers of these firms we search several sources. We found birthday information from the 1936, 1938, and 1941 editions of Who’s Who in American Commerce and Industry, Who Was Who, The Encyclopedia of American Biography, The Dictionary of American Biography. For individuals not in those sources we searched the entire New York times index from 1933 to 1978. Since almost all of these individuals presumably died before 1978, from their obituaries we are able to calculate their age at retirement. The firms we have chosen are essentially the largest 230 industrials in the United States over this time period, and thus we expected that the retirement or death of a top manager would be reported in one of.

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14By top manager we mean the president and chairman.
these sources. We were able to find data on all but 29 of the 512 managers in our sample. We defined a person to have died in office or left office due to illness if we find their obituary in the New York Times the year they left office and if the article mentions that they died in office or recently retired due to illness. This criterion yields 50 top managers leaving firms due to death or illness.

As mentioned in the text, we are able in this paper to exploit a unique data source on the ownership of shares by managers. As a consequence of the activities of the Securities and Exchange act of 1934, the SEC published a document entitled "The Official Summary of Holdings of Officers, Directors, and Principal Stockholders". This document is the predecessor of "The Official Summary of Security Transactions and Holdings" that the SEC has published continually since 1937. This document lists the holdings of all equity securities held by each officer, director, and blockholder with above 10% equity holdings as of December 31, 1935. It has these data for all firms that listed securities on a national exchange. All of our firms that are not in reorganization in 1935 or 1936 are listed in this document.

Since many firms used preferred stock that had voting power, and often in fact supervoting power, we were careful to record holdings of all of the equity securities. All but 12 of the officers and directors that served in 1935 were listed in the document, and the few who were not listed were officers that had fairly low positions in the firm. For each person there is a list of their direct holdings and then their indirect holdings through other companies, holding companies, estates, trusts, partnerships, and family members. For the indirect holdings sometimes the interest is reported proportionally, but more often the entire indirect holding is reported.

We use two measures of insider holdings. The strictest measure of insider holdings is the level of direct holdings or indirect holdings through a family member. The loosest definition is all indirect holdings, even those not proportionately reported. To avoid double counting when several individuals share an indirect holding, say by both having an interest in the same trust, we divide equally among all such parties the holding in question. We treat blockholders the same way.

It is fairly typical that there is a blockholder that owns over 10% of the firm, and also that the blockholders holdings are reported as an indirect holding of the officer or director who has an interest in the block. In these cases all of the blockholding is attributed to the officer or director. We construct a variable called BLOCK which is the holding by each blockholder where we exclude blockholdings that are also reported as indirect holdings by officers and directors.

An additional issue that arises is the independence of the blockholders. In several cases the blockholder is an individual with same last name as an officer or director. Since we are concerned with the role of blockholders in monitoring managers, the independence of blockholders from management is an important issue. Thus we construct a second variable called OUTBLOCK which is the holding only by blockholders that appear to have no relationship to any inside director or to management. The outside holdings measure used in our analysis is the sum of the holdings of outside directors and OUTBLOCK.

The figures on holdings from the SEC are stated in shares. The number of shares outstanding of common in most cases was reported on the CRSP tapes. All other
shares outstanding numbers and the voting power of shares was recorded from the Moody’s manuals. In several cases there was a clear mistake in the CRSP shares outstanding data, typically where the number outstanding was off by a factor of 10 or 100.\textsuperscript{15} In all of these cases we replaced the CRSP numbers with the Moody’s data. Finally we obtained the prices of all preferred stock from the December 31, 1935 issue of the Wall Street Journal.

\textsuperscript{15}These cases were flagged by comparing the CRSP shares outstanding to the Moody’s shares outstanding numbers. Also the CRSP shares outstanding number at times yielded an insider holding number of above 100%
References


Table 1: Number of top management changes of each type for each year from 1933-1939.

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91
Table 2: Predicting Top Management Changes Using Lagged Returns

Coefficients from estimation of logit models of top management changes. 1189 firm/year observations from 1933 to 1939 (firm/years where top manager is between 64 and 66 years of age have been excluded from this sample). Asymptotic t-statistics in parentheses.

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Table 4: Predicting Top Management Changes Using Lagged Returns

Coefficients from estimation of logit models of top management changes. 1189 firm/year observations from 1933 to 1939 (firm-years where top manager is between 64 and 66 years of age have been excluded from this sample). Asymptotic t-statistics in parentheses.

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Table 5: The Composition of the Board for 223 firms in sample in 1936

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<td>10-20%</td>
<td>11</td>
</tr>
<tr>
<td>20-30%</td>
<td>35</td>
</tr>
<tr>
<td>30-40%</td>
<td>40</td>
</tr>
<tr>
<td>40-50%</td>
<td>56</td>
</tr>
<tr>
<td>50-60%</td>
<td>27</td>
</tr>
<tr>
<td>60-70%</td>
<td>23</td>
</tr>
<tr>
<td>70-80%</td>
<td>10</td>
</tr>
<tr>
<td>80-90%</td>
<td>14</td>
</tr>
<tr>
<td>90-100%</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 6: The Distribution of Ownership for firm presidents for our sample of 237 firms in 1935

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Share of Voting Stock Held by President (Mean 1.83%)</th>
<th>Share of Voting Stock Held By Insiders (Mean 6.4%)</th>
<th>Share of Voting Stock Held by Outsiders and Independent Blockholders (Mean 7.2%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10th</td>
<td>0%</td>
<td>.18%</td>
<td>.04%</td>
</tr>
<tr>
<td>25th</td>
<td>.08%</td>
<td>.66%</td>
<td>.48%</td>
</tr>
<tr>
<td>Median</td>
<td>.42%</td>
<td>2.73%</td>
<td>1.84%</td>
</tr>
<tr>
<td>75th</td>
<td>1.8%</td>
<td>7.09%</td>
<td>8.03%</td>
</tr>
<tr>
<td>90th</td>
<td>5.09%</td>
<td>16.39%</td>
<td>22.30%</td>
</tr>
</tbody>
</table>
Table 7 - The Composition of the Board and Top Management Changes

Coefficients from estimation of logit models of top management changes. 1189 firm/year observations from 1933 to 1939 (firm/years where top manager is between 64 and 66 years of age have been excluded from this sample). Asymptotic t-statistics in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>TCHG Coeff.</th>
<th>TCHG Coeff.</th>
<th>LEAVE Coeff.</th>
<th>LEAVE Coeff.</th>
<th>PCHG Coeff.</th>
<th>PCHG Coeff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.59 (.11)</td>
<td>-2.55 (.10)</td>
<td>-3.02 (.10)</td>
<td>-2.98 (.1)</td>
<td>-2.79 (.1)</td>
<td>-2.81 (.1)</td>
</tr>
<tr>
<td>MIX</td>
<td>.00 (.02)</td>
<td>-.14 (.42)</td>
<td>-.20 (.55)</td>
<td>-.21 (.53)</td>
<td>-.25 (.77)</td>
<td>-.24 (.67)</td>
</tr>
<tr>
<td>OUT</td>
<td>.42 (.54)</td>
<td>.14 (.44)</td>
<td>.38 (.21)</td>
<td>.12 (.33)</td>
<td>.12 (.41)</td>
<td>-.01 (.04)</td>
</tr>
<tr>
<td>Return-Mktret</td>
<td>-.62 (.12)</td>
<td>-1.42 (.60)</td>
<td>-.96 (.39)</td>
<td>-2.43 (.21)</td>
<td>-.26 (.53)</td>
<td>-65 (.83)</td>
</tr>
<tr>
<td>(Return-Mktret)*MIX</td>
<td>-.11 (.15)</td>
<td>1.39 (.13)</td>
<td>-.44 (.42)</td>
<td>1.33 (.92)</td>
<td>.01 (.02)</td>
<td>.87 (.87)</td>
</tr>
<tr>
<td>(Return-Mktret)*OUT</td>
<td>.52 (.86)</td>
<td>1.76 (.79)</td>
<td>.78 (.102)</td>
<td>2.95 (.238)</td>
<td>.47 (.84)</td>
<td>.92 (.99)</td>
</tr>
<tr>
<td>(Return-Sic2ret)</td>
<td>1.15 (.16)</td>
<td>2.08 (.16)</td>
<td>.56 (.64)</td>
<td>.60 (.56)</td>
<td>-1.36 (.27)</td>
<td>-60 (.56)</td>
</tr>
<tr>
<td>(Return-Sic2ret)*MIX</td>
<td>-2.40 (.21)</td>
<td>-2.68 (.18)</td>
<td>-1.36 (.27)</td>
<td>-60 (.56)</td>
<td>-60 (.56)</td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)*OUT</td>
<td>-1.75 (.58)</td>
<td>-3.16 (.26)</td>
<td>-3.16 (.26)</td>
<td>-60 (.56)</td>
<td>-60 (.56)</td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret),_</td>
<td>.09 (.22)</td>
<td>.25 (.37)</td>
<td>.27 (.61)</td>
<td>.57 (.76)</td>
<td>-.72 (.128)</td>
<td>-.42 (.56)</td>
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<tr>
<td>(Return-Mktret),_*MIX</td>
<td>.30 (.66)</td>
<td>-.70 (.75)</td>
<td>-.70 (.75)</td>
<td>.48 (.67)</td>
<td>-.93 (.79)</td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret),_*OUT</td>
<td>-1.28 (.21)</td>
<td>-.66 (.78)</td>
<td>-1.38 (.14)</td>
<td>-1.30 (.32)</td>
<td>.33 (.49)</td>
<td>.72 (.78)</td>
</tr>
<tr>
<td>(Return-Sic2ret),_</td>
<td>-.21 (.28)</td>
<td>-.35 (.43)</td>
<td>-.48 (.67)</td>
<td>-.48 (.67)</td>
<td>-48 (.67)</td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret),_*MIX</td>
<td>1.22 (.16)</td>
<td>1.78 (.32)</td>
<td>1.78 (.32)</td>
<td>1.91 (.152)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret),_*OUT</td>
<td>-.91 (.102)</td>
<td>-.17 (.17)</td>
<td>-.17 (.17)</td>
<td>-.49 (.54)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy if a top manager is over 66</td>
<td>.30 (.136)</td>
<td>.33 (.149)</td>
<td>.54 (2.11)</td>
<td>.56 (2.17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy if president is over 66</td>
<td>.88 (3.19)</td>
<td>.90 (3.22)</td>
<td>-257.80</td>
<td>-252.76</td>
<td>-290.01</td>
<td>-286.27</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-345.38</td>
<td>-337.92</td>
<td>-257.80</td>
<td>-252.76</td>
<td>-290.01</td>
<td>-286.27</td>
</tr>
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</table>
Table 8-Inside Ownership and Top Management Changes

Coefficients from estimation of logit models of top management changes. 1189 firm/year observations from 1933 to 1939 (firm/years where top manager is between 64 and 66 years of age have been excluded from this sample). Asymptotic t-statistics in parentheses.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Change in Management</th>
<th>Change in Management</th>
<th>Top Executive Leaves Firm</th>
<th>Top Executive Leaves Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Coefficient</td>
<td>Coefficient</td>
<td>Coefficient</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.44 (14.69)</td>
<td>-2.44 (14.26)</td>
<td>-2.92 (14.65)</td>
<td>-2.86 (14.11)</td>
</tr>
<tr>
<td>Return-Mktret</td>
<td>.51 (1.40)</td>
<td>.38 (1.06)</td>
<td>.09 (.19)</td>
<td>.09 (.20)</td>
</tr>
<tr>
<td>(Return-Mktret)*INSIDE</td>
<td>-7.50 (1.79)</td>
<td></td>
<td>-4.91 (1.00)</td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret)*INSIDE&lt;sub&gt;5,100&lt;/sub&gt;</td>
<td>-1.11 (1.61)</td>
<td></td>
<td>-1.00 (1.16)</td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret)&lt;sub&gt;1&lt;/sub&gt;</td>
<td>-.51 (1.25)</td>
<td>-.68 (1.47)</td>
<td>-.63 (.50)</td>
<td>-.71 (1.29)</td>
</tr>
<tr>
<td>(Return-Mktret)&lt;sub&gt;4&lt;/sub&gt;*INSIDE</td>
<td>6.76 (1.88)</td>
<td></td>
<td>4.18 (3.80)</td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret)&lt;sub&gt;4&lt;/sub&gt;*INSIDE&lt;sub&gt;5,100&lt;/sub&gt;</td>
<td>#</td>
<td>1.25 (1.96)</td>
<td>.81 (1.01)</td>
<td></td>
</tr>
<tr>
<td>Return-Sic2ret</td>
<td>-.91 (2.30)</td>
<td>-.62 (1.52)</td>
<td>-.86 (1.83)</td>
<td>-.59 (1.20)</td>
</tr>
<tr>
<td>(Return-Sic2ret)*INSIDE</td>
<td>5.12 (1.27)</td>
<td></td>
<td>7.06 (1.38)</td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)*INSIDE&lt;sub&gt;5,100&lt;/sub&gt;</td>
<td>.14 (.22)</td>
<td></td>
<td>.43 (.52)</td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)&lt;sub&gt;1&lt;/sub&gt;</td>
<td>-.32 (.77)</td>
<td>-.05 (.10)</td>
<td>.19 (.35)</td>
<td>.39 (.64)</td>
</tr>
<tr>
<td>(Return-Sic2ret)&lt;sub&gt;4&lt;/sub&gt;*INSIDE</td>
<td>-.10 (.03)</td>
<td></td>
<td>-1.95 (.56)</td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)&lt;sub&gt;4&lt;/sub&gt;*INSIDE&lt;sub&gt;5,100&lt;/sub&gt;</td>
<td></td>
<td>-.18 (.26)</td>
<td>-.62 (.70)</td>
<td></td>
</tr>
<tr>
<td>INSIDE</td>
<td>-.88 (.64)</td>
<td></td>
<td>.14 (.10)</td>
<td></td>
</tr>
<tr>
<td>INSIDE&lt;sub&gt;5,100&lt;/sub&gt;</td>
<td></td>
<td>-.09 (.36)</td>
<td>-.10 (.33)</td>
<td></td>
</tr>
<tr>
<td>Dummy for top manager older than 66</td>
<td>.29 (1.31)</td>
<td>.28 (1.30)</td>
<td>.51 (2.00)</td>
<td>.51 (2.01)</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-345.16</td>
<td>-346.57</td>
<td>-261.71</td>
<td>-262.30</td>
</tr>
</tbody>
</table>
Table 9-The Effect of Ownership by Outside Directors and Blockholders on Top Management Changes

Coefficients from estimation of logit models of top management changes. 1189 firm/year observations from 1933 to 1939 (firm/years where top manager is between 64 and 66 years of age have been excluded from this sample). Asymptotic t-statistics in parentheses.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Change in Mgmt.</th>
<th>Change in Mgmt.</th>
<th>Top Executive Leaves Firm</th>
<th>Top Executive Leaves Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.48 (15.03)</td>
<td>-2.42 (14.64)</td>
<td>-2.93 (14.68)</td>
<td>-2.92 (14.43)</td>
</tr>
<tr>
<td>Return-Mktret</td>
<td>.07 (.19)</td>
<td>-.06 (.16)</td>
<td>-.49 (1.01)</td>
<td>-.23 (.48)</td>
</tr>
<tr>
<td>(Return-Mktret)*OUTSIDE</td>
<td>.30 (.15)</td>
<td></td>
<td>1.93 (.83)</td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret)*OUTSIDE_{5,100}</td>
<td>.49 (.79)</td>
<td></td>
<td>.01 (.02)</td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret)_{t}</td>
<td>.00 (.01)</td>
<td>-.22 (.54)</td>
<td>-.30 (.63)</td>
<td>-.38 (.75)</td>
</tr>
<tr>
<td>(Return-Mktret)_{t}*OUTSIDE</td>
<td>-1.42 (.56)</td>
<td></td>
<td>-1.81 (.55)</td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret)<em>{t}*OUTSIDE</em>{5,100}</td>
<td>.35 (.67)</td>
<td></td>
<td>-.22 (.25)</td>
<td></td>
</tr>
<tr>
<td>Return-Sic2ret</td>
<td>-.61 (1.60)</td>
<td>-.34 (.81)</td>
<td>-.39 (.81)</td>
<td>-.31 (.62)</td>
</tr>
<tr>
<td>(Return-Sic2ret)*OUTSIDE</td>
<td>.24 (.10)</td>
<td></td>
<td>-.18 (.06)</td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)*OUTSIDE_{5,100}</td>
<td>-.78 (1.15)</td>
<td></td>
<td>-.39 (.47)</td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)_{t}</td>
<td>.19 (.45)</td>
<td>.38 (.82)</td>
<td>.40 (.74)</td>
<td>.45 (.77)</td>
</tr>
<tr>
<td>(Return-Sic2ret)_{t}*OUTSIDE</td>
<td>-4.16 (1.64)</td>
<td></td>
<td>-3.78 (1.28)</td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)<em>{t}*OUTSIDE</em>{5,100}</td>
<td>-1.51 (2.04)</td>
<td></td>
<td>-1.06 (1.15)</td>
<td></td>
</tr>
<tr>
<td>OUTSIDE</td>
<td>.01 (.01)</td>
<td></td>
<td>-.07 (.05)</td>
<td></td>
</tr>
<tr>
<td>OUTSIDE_{5,100}</td>
<td></td>
<td>-.16 (.58)</td>
<td></td>
<td>.01 (.03)</td>
</tr>
<tr>
<td>Dummy for top manager &gt; 66 yrs</td>
<td>.31 (1.40)</td>
<td>.31 (1.41)</td>
<td>.55 (2.14)</td>
<td>.54 (2.14)</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-349.00</td>
<td>-349.93</td>
<td>-259.65</td>
<td>-261.56</td>
</tr>
</tbody>
</table>
Table 10: Insider and Outsider Ownership and Top Management Changes

Coefficients from estimation of logit models of top management changes. 1189 firm/year observations from 1933 to 1939 (firm/years where top manager is between 64 and 66 years of age have been excluded from this sample). Asymptotic t-statistics in parentheses.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Change in Top Mgmt. Coefficient</th>
<th>Change in Top Mgmt. Coefficient</th>
<th>Top Exec. Leaves Coefficient</th>
<th>Top Exec. Leaves Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.48 (13.08)</td>
<td>-2.41 (12.72)</td>
<td>2.97 (13.03)</td>
<td>-2.89 (12.68)</td>
</tr>
<tr>
<td>Return-Mktret</td>
<td>.49 (.14)</td>
<td>.18 (.43)</td>
<td>-.15 (.27)</td>
<td>.07 (.13)</td>
</tr>
<tr>
<td>(Return-Mktret)*INSIDE</td>
<td>-7.37 (1.76)</td>
<td>-1.12 (1.65)</td>
<td>-4.63 (.97)</td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret)*INSIDE_{5,100}</td>
<td>-1.12 (1.65)</td>
<td>-4.63 (.97)</td>
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<td></td>
</tr>
<tr>
<td>(Return-Mktret)*OUTSIDE</td>
<td>.20 (.10)</td>
<td>1.60 (.69)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret)*OUTSIDE_{5,100}</td>
<td>.62 (.99)</td>
<td>1.60 (.69)</td>
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<td></td>
</tr>
<tr>
<td>(Return-Mktret)_t</td>
<td>-.49 (1.00)</td>
<td>-.77 (1.48)</td>
<td>-.61 (1.02)</td>
<td>-.68 (1.09)</td>
</tr>
<tr>
<td>(Return-Mktret)_t*INSIDE</td>
<td>6.45 (1.76)</td>
<td>3.81 (1.01)</td>
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<td></td>
</tr>
<tr>
<td>(Return-Mktret)<em>t*INSIDE</em>{5,100}</td>
<td>1.17 (1.81)</td>
<td>3.81 (1.01)</td>
<td>.75 (.93)</td>
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</tr>
<tr>
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<td>-.54 (.21)</td>
<td>-1.29 (.38)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Return-Mktret)<em>t*OUTSIDE</em>{5,100}</td>
<td>-.54 (.21)</td>
<td>-1.29 (.38)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return-Sic2ret</td>
<td>-.97 (2.10)</td>
<td>-.34 (.69)</td>
<td>-.89 (1.60)</td>
<td>-.45 (.77)</td>
</tr>
<tr>
<td>(Return-Sic2ret)*INSIDE</td>
<td>5.22 (1.28)</td>
<td>7.16 (1.38)</td>
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<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)*INSIDE_{5,100}</td>
<td>5.22 (1.28)</td>
<td>7.16 (1.38)</td>
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<td></td>
</tr>
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<td>(Return-Sic2ret)*OUTSIDE</td>
<td>.60 (.25)</td>
<td>.33 (.12)</td>
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<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)*OUTSIDE_{5,100}</td>
<td>.60 (.25)</td>
<td>.33 (.12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)_t</td>
<td>.02 (.04)</td>
<td>.36 (.64)</td>
<td>.65 (.97)</td>
<td>.76 (1.04)</td>
</tr>
<tr>
<td>(Return-Sic2ret)_t*INSIDE</td>
<td>-.87 (.27)</td>
<td>-3.07 (.86)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)<em>t*INSIDE</em>{5,100}</td>
<td>-.87 (.27)</td>
<td>-3.07 (.86)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)_t*OUTSIDE</td>
<td>-3.47 (1.35)</td>
<td>-4.18 (1.36)</td>
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<td></td>
</tr>
<tr>
<td>(Return-Sic2ret)<em>t*OUTSIDE</em>{5,100}</td>
<td>-3.47 (1.35)</td>
<td>-4.18 (1.36)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSIDE</td>
<td>-.77 (.55)</td>
<td>.24 (.16)</td>
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<tr>
<td>INSIDE_{5,100}</td>
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<td>-.10 (.39)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUTSIDE</td>
<td>.10 (.09)</td>
<td>.02 (.02)</td>
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<tr>
<td>OUTSIDE_{5,100}</td>
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<td>-.17 (.58)</td>
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<td></td>
</tr>
<tr>
<td>Dummy for top manager age&gt;66</td>
<td>.31 (1.42)</td>
<td>.31 (1.41)</td>
<td>.56 (2.18)</td>
<td>.55 (2.17)</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-342.56</td>
<td>-343.68</td>
<td>-257.77</td>
<td>-260.11</td>
</tr>
</tbody>
</table>
