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EMPIRE BUILDING BY CORPORATE MANAGERS:

Corporation as a Savings Instrument

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ABSTRACT: The paper studies the consequences of separation of ownership and control on corporate investment. It provides a formal proof of Jensen´s influential proposal that independent corporate managers tend to overinvest, thus failing to maximize the wealth of corporate owners. Management is assumed to be risk-averse with preference for prudence. Another key assumption is that the return on human capital of the management can be saved only inside the firm; "inefficient" investment therefore operates as an insurance device. A linear incentive contract will not eliminate the inefficiency. We show that the empire building motive is related to the degree of uncertainty. It is shown that it is the relative share of non-risky and risky income in the managers' reward structure that matters for optimal investment response to increased output price uncertainty. The model provides an integration of the traditional neoclassical theory of investment and the theory of investment under separation of ownership and control emphasized by the theory of corporate finance.

JEL classification: D21, G31

KEY WORDS: empire building, investment, uncertainty, risk aversion, prudence

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TIIVISTELMÄ: Raportissa analysoidaan osakeyhtiön investointikäyttäytymistä, kun omistus ja liikkeenjohto ovat eriytyneet. Malli tarjoaa formaalisen selityksen M. Jensenin vaikutusvaltaiselle näkemykselle, että yritysjohdolla on taipumus "yli-investoida". Mallissa johdon oletetaan olevan riskiä kaihtava ja sen oletetaan toimivan varovaisuusmotiivin pohjalta. Toinen olettamus on, että johdon henkisen pääoman tuotto pääasiassa on säästettävissä yrityksen sisällä, jolloin "tehottomasta" investoinnista tulee johdon väline tasoittaa riskillistä tulovirtaa kannattavuusepävarmuuden oloissa. Osoitetaan, että lineaarinen kannustinpalkkaus ei eliminoi tätä mekanismia ja että "empire building"- motiivin voimakkuus riippuu kannattavuusepävarmuuden määrästä. Kehitetty malli edustaa perinteisen neoklassisen investointimallin ja yritysten rahoitusteorian näkemysten integraatiota.

I Introduction

The quality of corporate investment behavior has been subject to an increased concern. It is more than a decade since Jensen (1986) advanced his influential vision of the conflict of interest between corporate managers and shareholders resulting in inefficient corporate investment behavior: "*Corporate managers are the agents of shareholders fraught with conflicting interests.*" "*Managers have incentives to cause their firms to grow beyond the optimal size.*" In Jensen's view, "*Growth increases managers' power by increasing the resources under their control. It is also associated with increases in managers' compensation, because changes in compensation are positively related to the growth in sales.*" Moreover, regarding the conflict between owners and managers as the central weakness of the publicly held corporations, Jensen (1989) pointed to the need of organizational innovations.

The view of the conflict of interests within a corporation, as envisioned by Adam Smith in his *The Wealth of Nations* [1937 ed. p.700] is deeply rooted in today's theory of corporate finance starting with Jensen and Meckling (1976) and Easterbrook (1984). In Tirole's (1989 p.34) words: "*It is a postulate...of most economic theory, that firms maximize expected profits. There is, however, a widespread feeling that in practice firms' managers have other objectives.*" In their study of performance pay and top-management incentives, Jensen and Murphy (1990) claimed: "*Managerial actions and investment opportunities are not perfectly observable by shareholders; indeed, shareholders do not often know what actions the chief executive officers can take or which of these actions will increase shareholders' wealth.*" They argued that the CEO compares only his private gains and cost from pursuing a particular activity.[1]

The subsequent literature has confirmed that Jensen has identified an issue which is of major relevance when the profession wants to build the understanding of how investment decisions are undertaken and how market economies operate under agency relations. One of the fundamental implications of Jensen's view is that managers of publicly held corporations tend to invest "too much". Such an implication should be of concern also for policy makers. Unfortunately, the "empire building" motive has so far eluded a formal justification starting with economic fundamentals. Moreover, there is no clear understanding as to why such a motive might arise

and what purpose it would serve. The current paper tries to fill up this gap. It introduces a formal model of investment behavior of independent corporate management. The approach is based on the following fundamental ideas. First, information is asymmetric between public shareholders and corporate managers. Second, the behavior of management is governed by risk aversion and by the preference for prudence. Third, the return on human capital of managers can be saved only inside the firm; the firm functions like the savings instrument for management. This allows the management to reduce the riskiness of its intertemporal income stream in exchange for a reduction in current revenue. Jensen's view arises in such a framework. The idea that the return on human capital of managers can be saved only inside the firm should perhaps not be taken too literally. The key point is that the corporation typically operates as the dominating savings instrument. Namely, most often independent managers can derive private benefits from the resources of company over which they have command. Typically, the private value of such benefits exceeds the cost to the company of such resources and is related to the size of the company, measured by capital or market value. Existence of such non-cash private benefits is important in creation of the empire building motive.

There are several contexts where the research agenda of the current paper can be contributive. First, in spite of the suggestion by Jensen and others, the mainstream neoclassical theory of investment has abstracted from the agency problems. Instead, it has focused exclusively on analyzing corporations which are run by the wealth-maximizing perfects agents of shareholders. There is an obvious need to integrate the neoclassical tradition with the theory of corporate finance and managerial economics which has introduced corporate managers with their own targets.

Second, the role of executive compensation and its relationship to corporate performance has been subject to public debate and active economic research in recent years. Milgrom and Roberts (1992) provide a review of management pay structures and of their incentive effects. They report that during the 1980s, CEO compensation in the largest U.S. corporations grew four times as much in percentage terms as the pay of the average employee. Moreover, in the U.S., the ratio of CEOs' total compensation to the pay of an average worker is several times larger than the comparable figure in other leading industrial countries and in smaller U.S. firms. The chief difference between the compensation of the heads of major U.S. firms and their counterparts in large foreign firms and in smaller U.S. firms is the element of long-term incentive compensation tied to stock prices. Such plans became almost universal in large U.S.

firms in the 1980s but have been rare abroad and in smaller companies. An important question is whether such CEO compensation schemes provide the managers with the appropriate incentives to maximize the market value of the firm or whether it is Jensen's view which is the correct one. We introduce a linear compensation package which is commonly used and we show that it will not eliminate the inefficiency detected.[2] To make sure, nothing is known of optimal contracts in the current context. However, it becomes plausible from our analysis that "efficient" contracts might actually necessitate some inefficiency in investment.

Third, the paper shows that the empire building motive is related to the degree of uncertainty. Thus, the model turns out to be relevant for evaluating another issue in the theory of corporate investment subject to extensive research effort: the effects of market uncertainty. It was more than 20 years ago that Sandmo (1971) suggested in his now classic work that price uncertainty makes a competitive firm produce less output than a firm operating under price certainty would produce.[3] Subsequently, this conclusion was challenged by Hartman (1972) and Abel (1983) who came to the counterintuitive result that for a firm operating under constant returns and convex costs of adjustment, increased uncertainty about future prices implies more capital demand today.[4] It is now known within the neoclassical framework that their result is reversed in the case of decreasing returns (Hartman (1973)), imperfect competition (Caballero (1991)) and with irreversible investment (Pindyck (1991)). Craine (1989) has suggested that in a general equilibrium framework, an increase in exogenous risk reallocates resources towards less risky business.[5] Unfortunately, the results concerning the effects of price uncertainty above have all been derived on the traditional neoclassical assumption that corporate managers are perfect and risk-neutral agents of the shareholders. This is a problematic starting point when it comes to examining the effects both of uncertainty and asymmetric information. We ask therefore whether the earlier results can survive when the assumption of a firm's value-maximizing risk-neutral, perfect management is replaced by a risk-averse management with its own targets. Imperfect spanning in asset markets means limited access for a management to insurance against income risk. It makes the management concerned about uncertainty for personal reasons and creates an incentive to look for alternative savings devices. Moreover, it was suggested long ago by Leland (1968) that the preference for prudence is important for behavior under uncertainty. Thus, there is a need to explore the effects of the preference for prudence.[6]

The model which we introduce will be formulated in the framework of stochastic optimal control. The introduction of managers' risk aversion and preference for prudence turns out to be

technically quite a hard task. It leads to a control problem with a forward-looking integral constraint.[7] The payoff includes many novel results. We first prove analytically (Section II) that management independence typically creates an overinvestment incentive as Jensen suggested. It has previously been suggested that risk aversion and incomplete markets are likely to make the investment-uncertainty relationship negative. We show next (Section III) that this intuition goes wrong when a firm is run by risk-averse managers with a preference for prudence. Interesting enough, we show that risk-aversion and preference for prudence may lead to overinvestment, not underinvestent as typically thought. In such a case, increased uncertainty strengthens the empire building motive. We provide a precise description of how this incentive is related to managers' preferences. We show that it is the relative share of non-risky and risky income in the managers' reward structure that matters for optimal revision of an investment program under increased output price uncertainty. This finding is of interest in the light of the recent discussion of CEOs' compensation schemes. Indeed, under plausible hypotheses of decreasing absolute risk aversion and decreasing preference for prudence, current investment may decrease when managers' income is hedged by a fixed income. However, when there is less of such hedging, we show that it is in the interest of managers to respond by increasing current rate of investment instead. Intuitively, this result follows because the management's limited opportunity to diversify and finance consumption by borrowing against human capital creates a precautionary motive which enforces the technology effect discussed in the earlier literature and calls for more current capital investment. Capital investment provides a precautionary strategy for prudent risk-averse management. One way to state our result is that having more capital under their control, the managers are entitled to a less risky income stream.

II Management Preferences and Overinvestment

We consider a share company under separation of ownership and control. Conflict of interests may arise in many ways; our model is consistent with several explanations. We assume that investment planning is complex enough to require special competence. Some agents, called managers, have access to the required skill while the outside shareholders are atomistic and do not possess such a skill and hence confine themselves to trading the firm's shares. There is a moral hazard problem arising from hidden information (instead of unobservable effort). It arises because even if the agent's behavior (choice of investment) is observable, it is impossible for the principal to know if it is the best, i.e. value-maximizing investment decision that is chosen.

Once the relationship has been established, this type of moral hazard problem may arise if the agent obtains (price) information that will determine which investment is best for the agent. One can think that it is costly for shareholders to follow the price information in various markets. Alternatively, we suggest that it is difficult for the principals to have information about the agent's true preferences.[8] Third as stated, the principal will not have the required human capital to judge the value-maximizing investment program.[9] Consequently, the principal does not know the true conditions under which the investment decisions are undertaken. Moreover, at the moment of signing the contract the agent does not know the future conditions under which he will carry out his tasks.[10]

Information is thus asymmetric. The informational constraint introduced here represents a vital departure from the neoclassical tradition. The implication is that the ordinary shareholders are unable to judge the optimal investment rule and the decisions by the managers. Their best response is to take the management's announcement of future investment policy as given. The shareholders are, however, assumed to understand that the production technology is characterized by constant returns.

In our model, investment cannot be included in the terms of the contract not for the reason that it would not be observable but for the reason that the shareholders do not have the required skill to find out the value-maximizing investment program. A first-best full-information contract where the agent is rewarded by a fixed salary and asked to undertake an investment program which maximizes the market value of the firm would not lead to right incentives. *Manager's investment is not a variable which can enter into a contract because shareholders cannot control investment.*

Both the earlier principal agent models and the practical observations suggest that owners try to introduce appropriate incentive schemes to shape the executives' behavior. The compensation of the senior executive officers is set in practice by the firm's board of directors, thought to represent the interests of the shareholders. The best established empirical regularity is that pay rises with the size of the firm. It is also statistically well established that pay for senior executives is sensitive to firm performance. When performance is measured by accounting rates of return, Rosen (1990) found that the elasticity of top executive pay with respect to accounting rates of return lies near 1.0. The schemes are firm-specific and many firms have experimented with a variety of managerial incentive-pay formulas. Thus, the manager's compensation can be

made contingent upon performance of the firm. Since both profits and share value depend on the investment decision undertaken by the agent, it is appropriate to introduce the reward as a function of both of them. They both depend also on the stochastic variable (price).

Inability to control the agent's behavior implies an important efficiency loss. The optimal contract can be thought to be determined by the trade-off between two conflicting objectives: efficiency (in the optimal distribution of risk between the participants) and the incentives of the agent (additional risk). However, when the agent chooses the investment level instead of effort in a dynamic hidden information model, nothing is known about the optimal contract. We see below that no linear contract exists which maximizes the share value. In spite of the fact that linear contracts may be optimal only under restrictive conditions, studying their implications is important, because they are the most used in practice. We hence study linear contracts because they are so commonly observed in the real world and because they are tractable. One can think that only linear contracts are feasible for several reasons, including costs of writing and implementing contracts.[11]

Let k stand for the capital stock. We denote the firm's short-run profit function, strictly convex in its output price p, by $pk\pi(p)$. This follows from the assumption of constant returns. Price p is assumed to follow a geometric Brownian motion, $dp_t/p_t = \sigma dz_t$, where dz_t is the increment of a Wiener process with $\sigma^2 > 0$ as its variance rate. Let V denote the current stock market price of the shares of the company. The labor contract delegates the investment decisions to the managers. We assume that the owners or their representatives have decided upon the managers' compensation (m_t) to be related to corporate performance. We investigate the implications of a general management remuneration scheme

$$(1) \quad m = \psi_o + \psi_1 pk\pi(p) + \psi_2 V, \quad \psi_o > 0,\ \psi_1 > 0,\ \psi_2 > 0,$$

where ψ_o is the payment which is unrelated to the state variables. In addition, the remuneration is positively related to profits and the stock value. One can think that $pk\pi(p)$ represents the profit reported by the management when shareholders find it hard to have price information in markets. The scheme (1) provides at most a partial hedge (ψ_o) for the managers' against income risk because $\psi_1, \psi_2 > 0$. There is thus a certain degree of risk-sharing between the owners and the managers. Moreover, the managers are constrained by the fact that their current policy does

not only affect their current reward (through ψ_2) but also has an effect on their future rewards (through ψ_1 and ψ_2). Our formulation (1) is sufficiently flexible to cover salaries which are fixed in advance, performance-tied bonuses, restricted stock awards, and management compensations in the form of phantom stock plans. Obviously, myopic behavior cannot be expected to be optimal for the management in the light of compensation structure (1), even though we have no plans to introduce any costs of adjusting corporate capital into the model.[12]

Use D to denote the flow of dividends to corporate owners, $D(k,p) = pk\pi(p)\text{-}j\text{-}m$, where j = the current rate of investment, $jdt = dk$, and introduce the owners' capital market opportunity cost, say r. By investing the internal funds, the managers can control dividends. There is nothing in the model to restrict the managers from investing the free cash flow (in the sense of Jensen (1986)) to projects with negative net present value instead of paying the cash flow out as dividends. The standard asset pricing argument gives the valuation of corporate shares in the stock market as the expected discounted value of future cash dividends

$$(2) \qquad V(k_t,p_t) = E_t\int_t^{\infty} e^{-r(\tau-t)}D(k_\tau,p_\tau)d\tau,$$

where E_t is an expectations operator, conditional on all information acquired by the owners through to time t. The owners know that from each unit of current profit, fraction ψ_1 is paid out to the management in light of the contract. They also know that fraction ψ_2 of a change in the stock price is absorbed by the management. This must then affect the effective discount rate of the owners. It is possible to show this effect explicitly by elaborating (2) a few steps further. The derivation is technically tedious and it is carried out in the appendix. We report here the final outcome before we develop the rest of the model:

$$(3) \qquad V(k_t,p_t) = \frac{-\psi_o}{r+\psi_2} + \left(\int_t^{\infty} e^{-(r+\psi_2)(\tau-t)}E_t[(1-\psi_1)p_\tau\pi(p_\tau)d\tau]\right)k_t +$$

$$\int_t^{\infty} e^{-(r+\psi_2)(\tau-t)}E_t[(\int_\tau^{\infty} e^{-(r+\psi_2)(y-\tau)}E_\tau((1-\psi_1)p_y\pi(p_y))dy-1)j_\tau]d\tau.$$

The share value expression (3) is helpful in studying how the owners value the firm. Under any announced investment program, the market value can be decomposed, net of the present value of the fixed management remuneration (the first term $-\psi_o/(r+\psi_2)$), as between two effects. The present value of income from capital accumulated so far, is the second term in (3) i.e. $V_k k_t$ where V_k stands for Tobin's "q", i.e. the multiplier of k_t in (3). The expected discounted value of the net cash flow from the future investment program, whatever it will be is given by the last and a somewhat more complicated expression in (3). The second term in (3) therefore summarizes the effect of the firm's history while the last and first terms capture the effect of its expected future on the value of the firm. We should emphasize that in (3), shareholders are not assumed to regard the flow $\{j_\tau\}$ as the choice variable, but consider it parametric because of informational asymmetries. Note then from the second term in (3) that under any given investment program, $V_{kp} > 0$, $V_{kpp} > 0$. Thus, V_k is convex in price.[13]

We now explicitly introduce the assumption that the firm is run by a risk-averse management taking the model into the direction of the managerial and corporate finance theories. We assume that $u(m)$ is the management's utility function with $u' > 0$, $u'' < 0$, $lim_{m\to 0}\, u'(m) = \infty$ with $A(m) = -u''(m)/u'(m) > 0$ as the measure of absolute risk aversion and $P(m) = -u'''(m)/u''(m) > 0$ as the Kimball (1990) measure of (absolute) prudence.[14] It holds for all utility functions with decreasing absolute risk aversion (within the HARA family) that $P(m) > 0$. It is also easy to see that $P(m) > 0$ holds for an exponential utility function with constant absolute risk aversion. Moreover, we recognize that the human capital of management cannot be diversified due to imperfect spanning in assets markets, nor is the management assumed to be engaged in capital market transactions. By investing, the management saves inside the firm. In the absence of spanning,[15] we introduce a positive discount rate for management, say α, stay loyal to the expected utility hypothesis and write the (separable) intertemporal utility as

$$(4) \qquad J(k_t, p_t) = \max_j E_t \int_t^\infty e^{-\alpha(\tau-t)} u(m(k_\tau, p_\tau, j_\tau))\, d\tau.$$

We consider the investment program which maximizes the management utility (4), not that which maximizes the value of the firm's shares (2). It is clear that the approach we have introduced is much more complicated in terms of management-owner interaction than what has been offered by the more traditional neoclassical models of corporate investment. Not

surprisingly therefore, it is more difficult to predict what the solution to the investment problem will be. Yet, as we will show, the complication we have introduced will provide a good payoff in terms of novel results.

To obtain these results, however, the informational assumptions introduced above need to be fully exploited. Since the atomistic shareholders are taken to be unable to judge which investment program is optimal for the managers, their best response is to take the announced investment program as given and, because of constant returns, regard the market value of shares as linear in capital. *It is hence rational for the shareholders to value the shares using this linearity rule,* $V_k > 0$ and $V_{kk} = 0$. It also follows that $V_{kj} = 0$, because the marginal valuation of capital is independent of the amount of capital.[16] To arrive at the optimal investment rule, we will employ the theory of stochastic optimal control which has proved to be a powerful approach in dynamic economic problems, thus becoming popular in economics and in finance.

We plan first to show that within the framework we have introduced, managers have no incentive to restrict their investment program to the projects with non-negative net present value, evaluated at the shareholders' discount rate. Instead, they have at any point on the adjustment path an incentive to use some of the free cash flow to invest in projects with negative net present value as suggested by Jensen (1986). In our model, this motive arises from that the company operates as a savings instrument for the manager. To verify, an investment program which maximizes the management's utility (4) has to satisfy the Hamilton-Jacobi-Bellman equation

$$(5) \qquad \alpha J(k,p)dt = \max_j H(j) = \max_j u(m(k,p;j))dt + E_t(dJ).$$

Note that $J_t = 0$ because the problem is autonomous. The right-hand side of (5), the expected gain on the current investment decision, is decomposed in the spirit of dynamic programming as between current utility and the expected gain in terms of the discounted future utilities. Optimality requires that the management equate the expected gain with the required gain (the left-hand side). To evaluate the expected rate of change in gain on the right-hand side, we use Ito's lemma, the fundamental principle in stochastic calculus, to write

$$(6) \quad (1/dt)E_t(dJ) = jJ_k + (\frac{1}{2})p^2\sigma^2 J_{pp}.$$

Here J_k is the conditional expectation of the value of all future utility gains to the management from the marginal capital. Carrying out the maximization on the right-hand side of (5), we find that any candidate for optimal control to qualify for an interior solution has to satisfy the following first-order condition

$$(7) \quad u'\psi_2 V_j + J_k = 0$$

where $\psi_2 V_j = m_j$. Intuitively, the first term in (7) measures the reduction in current utility from the marginal investment. However, there is a trade-off: the second term, J_k, gives the conditional expectation of the value of all future utility gains to the managers from the marginal capital. Indeed, a risk-averse manager is willing to accept reduction in current utility as an insurance premium in exchange for a safer income stream. One should pause at condition (7) to pay attention to the way the management-owner interaction shows up: both valuation functions V and J enter the first-order condition. Ask then how a marginal adjustment in current investment, j, changes the share value along the optimal path. Within the traditional theory, $V_j = 0$ by the optimality condition; here the value of V_j has, however, to be evaluated.

Since (7) depends on V, the asset pricing (2) creates a constraint for the management's maximization problem. It is, however, in an integral form. To cope with this technical difficulty, it is helpful to re-write it as follows. Over a short time interval dt, the asset holders value their shares (cf. Dixit and Pindyck (1994)) as the sum of current dividend and the share value, as discounted,

$$(8) \quad V(k_t,p_t) = D_t dt + e^{-rdt}E_t V(k_t+dk_t,p_t+dp).$$

We have suppressed the flow of investment j from valuation $V(k,p)$ for the reason that it is the strategic variable of the management but parametric for the asset holders. From (8), Ito's Lemma yields

$$(9) \quad (1/dt)E_t(V(k+dk,p+dp)-V(k,p)) = jV_k + (1/2)V_{pp}p^2\sigma^2.$$

Then, noting that $e^{-rdt} \approx 1-rdt$, one obtains from (8) and (9) that the market value V satisfies everywhere the partial differential equation

$$(10) \quad V(k,p) = [(1-\psi_1)pk\pi(p)-j-\psi_o+jV_k+(\frac{1}{2})V_{pp}p^2\sigma^2]/(r+\psi_2).$$

Differentiating with respect to *current* investment j_t, one finds that the impact of the investment program on share value is obtained as the present value

$$(11) \quad V_j = \frac{V_k-1}{r+\psi_2}.$$

The rather natural interpretation of (11) is that the asset holders compare the discounted future returns against the discounted costs of investment program. The discounted future returns from a marginally greater current capital stock are given by $\$V_k/(r+\psi_2)$ while the cost to shareholders of $\$1$ of corporate investment is given by $\$1/(r+\psi_2)$, allowing for the foregone interest.

Using (11), it is now helpful to solve for the marginal utility from the first-order condition (7) as

$$(12) \quad u'(m(j)) = -\frac{J_k}{(\frac{\psi_2}{r+\psi_2})(V_k-1)},$$

where the right-hand side is independent of j. We can show that the marginal valuation of capital J_k is always positive, as is the marginal utility on the left-hand side of (12), $u'(m(j)) > 0$. This goes as follows. To solve for J_k, differentiate (5) with respect to state variable k, make use of the transversality condition $lim_{t\to\infty} e^{-at}J_k(k,p) = 0$ and use Fubini's theorem to solve for the

marginal valuation of capital

$$(13) \qquad J_k(k_t,p_t) = \int_t^{\infty} e^{-\alpha(\tau-t)} E_t[u'(m(\tau))m_k(\tau)]d\tau$$

which is positive.

From time to time managers might come up with an exceptional idea, a "gold mine" with $V_k > 1$. Hence $V_j > 0$ in (11). In the framework of our model, it would then pay to expand capital at the maximum rate abstaining from paying dividends. Optimal current investment would not be finite and we would not be in the world of an internal optimum.[17] Most typically, however, the investment projects available are not "gold mines" but ones with more limited profitability.

Given the managerial independence, nothing prevents managers from investing in project with $V_k < 1$ i.e. with negative net present value. In fact, we can see that $V_k < 1$ is a necessary condition for the existence of a unique, finite, interior optimum for any linear contract with $\psi_o > 0, \psi_1 > 0, \psi_2 > 0$. Such an investment decision is against the interest of the owners who would vote against expansion in capital and who would prefer reduction in it, say through liquidation. This is a form of the Jensen's free cash flow case; mature companies with little profitable growth opportunities would continue to spend the cash flow inefficiently instead of paying it out as dividends. The question is: how much do the managers want to overinvest and how much are they willing to pay out as dividends.

To see how the interior solution arises recall that if $V_k < 1$, the right-hand side of (12) is positive and independent of j. The left hand side of (12) stands for the marginal utility of the management arising from an additional \$1 allocated to investment program instead of paying it out as cash dividend. To highlight the trade-off in (12), recall that the manager considers the firm as its savings instrument and is willing to sacrifice some of its current income in exchange for reduced riskiness of future income. Its desired income stream has stochastic characteristics which maximize is expected utility (4) from the intertemporal point of view. The dynamic problem is transformed into a sequence of "static" ones with the static first-order condition (12) providing the optimal current investment given the current states, price and capital. To consider the maximand $H(j)$ in (5) graphically (Figure 1), recall that J_k is independent of j by the

optimality principle. Thus jJ_k is an increasing linear function through the origin. The investment program, however, reduces current dividend and is priced as a reduction in the current stock market price. This *static* effect is immediate and creates a mechanism through which the current income by management is reduced, since $m_j < 0$ by $V_j < 0$. Thus $u(m(j)) + (1/2)p^2\sigma^2 J_{pp}$ is declining in j. The condition for an interior optimum (for positive investment j) is that the dynamic effect through jJ_k is stronger at the origin than the static effect. With large j, however, the negative static effect becomes stronger restricting the investment program. Since the current utility level must be strictly bounded from below (negative consumption is excluded), there will be limits to the empire building motive, $j^* < j^{max}$ in Figure.

Therefore, in the current model the management faces a trade-off between a current reduction in the value of assets, V, due to undertaking an investment program and the expected future gains from larger capital over the longer run. There will be a finite optimal current investment level (even in the absence of costs of adjustment or decreasing returns!). Such a case is characterized by the condition $V_k < 1$ in (7) which is also the condition for the existence of an interior optimum, i.e. a finite unique investment program in terms of project profitability. The second-order condition $u''(m)m_j^2 < 0$ is then also satisfied.[18] Suppose that the price falls so low that the management prefers disinvesting. Hence, even though we exclude the projects thought to be "gold mines", the corporation is still left with a systematic overinvestment incentive. It is consistent with utility maximization of corporate managers to accept projects with $V_k < 1$, though maximizing the shareholders' wealth calls for accepting only projects with $V_k \geq 1$. The incentive for "empire building" exists even when $V_k < 1$. Limits to capital expansion exist, however, and it is provided by the diminishing marginal utility.

To summarize, we have thus proved the existence of the "empire building" incentive in the absence of profitable projects when a corporation operates as a dominating savings instrument for the management:

Proposition 1. ***(Empire Building Motive) For managers with a concave utility function $u'(m) > 0$, $u''(m) < 0$ and with a management compensation scheme (1), it is rational to accept investment projects whose marginal value to the shareholders falls short of the marginal cost of investment.***

The management can thus alter the stochastic nature of its intertemporal income stream by the

choice of corporate investment. In light of its risk aversion, it is willing to trade-off some of the expected return as payment for a less risky income stream. When the firm grows, the compensation related to the total value of firm begins to dominate the unstable income related to current profits. One can also build the intuition as follows: temporary changes in price and hence in profitability create volatile in corporate earnings but need not change the stock price too dramatically since the shocks may be expected to be reversed in the future. Relatively speaking hence, a large firm provides a more stable income prospect than a small firm, though at the cost of reduced efficiency of investment.

We can ask whether one can find a compensation scheme among the linear ones, which would guarantee the efficient solution in the sense of market value maximization. The answer will be negative. This can be seen as follows. The marginal return on investment is given by $p\pi(p)$ in the absence of managerial compensation. A value-maximizing firm compares this return to the market rate of interest, r and regards profitable those projects which satisfy $p\pi(p) \geq r$. With managerial compensation, this condition is transformed into $(1-\psi_1)p\pi(p) \geq r + \psi_2$. Therefore, the compensation scheme we have studied makes it impossible to satisfy this condition for those projects which satisfy the condition $p\pi(p) = r$.

III Increased Price Uncertainty

We have established above that when the firm grows, the optimal rate of investment depends upon the current price of output and the uncertainty about future prices. Here we plan to establish the relationship between the empire building motive and the degree of price uncertainty. Conditions (12) and (13) suggest that the effects of price uncertainty depend both on the convexity of V and V_k and the possible convexity of $u'(m)m_k$ in price. This is nothing more than the standard Jensen's inequality effect. The convexity of $u'(m)m_k$ is clearly related to the preference for prudence and risk aversion. In this section, we characterize the optimal investment behavior in terms of such preferences. Luckily enough, this can be accomplished without deriving the explicit solution for the unknown value function $J(k,p)$. We suggest that the model can be solved for the current investment as follows. To derive the investment equation in terms of management preferences and asset pricing, we start by eliminating the unknown value function J from the first-order condition. Differentiating (5) with respect to k and using (12) gives a version of the Euler-equation

$$(14)\quad \alpha u'[\frac{\psi_2(1-V_k)}{r+\psi_2}] = u'[\psi_1 p\pi(p)+\psi_2 V_k]+\frac{1}{dt}E_t dJ_k(k,p).$$

Moreover, the first-order condition (7) can be used to establish

$$(15)\quad J_{kp} = \frac{\psi_2}{r+\psi_2}[u''(1-V_k)m_p - u'V_{kp}]$$

$$(16)\quad J_{kpp} = \frac{\psi_2}{r+\psi_2}[u'''(1-V_k)m_p^2 - 2u''V_{kp}m_p + u''(1-V_k)m_{pp} - u'V_{kpp}].$$

We eliminate the last term in (14) using Ito's lemma. Solving for j, we then arrive at a compact expression for the current investment as

$$(17)\quad j = (\frac{1}{\eta_o})[\eta_1 + \sigma^2\eta_2].$$

We have adopted the following notation:

$$(18a)\qquad \eta_o = (\frac{1}{r+\psi_2})(1-V_k)m_k > 0,\quad \eta_1 = (\frac{1}{A(m)})[\psi p\pi(p) + \frac{(\alpha+r+\psi_2)V_k - \alpha}{r+\psi_2}] > 0,$$

$$(18b)\qquad \eta_2 = (\frac{1}{2})(\frac{1}{r+\psi_2})[(1-V_k)(P(m)m_k^2 - m_{pp}) + 2m_p V_{kp} - \frac{1}{A(m)}V_{kpp}]p^2$$

and we have denoted $\psi = \psi_1/\psi_2$.

With $V_k < 1$ and $m_k = \psi_1 p\pi(p) + \psi_2 V_k > 0$, the first effect in (17), η_1/η_o, is positive even for

projects with rather low profitability,[19] reflecting the view advanced above that the management has an incentive to let capital expand. Optimal investment, though positively related to current and future profitability, is inversely related to the measure of concavity of the utility function, $A(m)$ through η_1. This mechanism on optimal investment operates even in the absence of price uncertainty. That current investment is positively related to the value of V_k, the shadow price of capital for the owners through the η_1/η_o term, is also predicted by those models where the management stands ready to maximize the market value of shares. However, even large unexpected price shocks resulting in revaluation of V_k give rise only to small changes in investment through the η_1/η_o effect if $A(m)$ is "great" since diminishing marginal utility tends to stabilize revision of investment. Moreover, under hired management, this relationship is influenced both by r and α, through η_1/η_o. It is, however, the discount rate of the management which negatively affects current investment demand. As far as the management compensation structure is concerned, the partial effect on current investment operating through short-run profits becomes more important under large ψ_1/ψ_2.

Move to the second term, the uncertainty effect proper, $(\eta_2/\eta_o)\sigma^2$. Suppose that there is a small mean-preserving spread in price starting with $\sigma^2 = 0$. It is then *the sign of* η_2 which is informative as to the uncertainty effect. Though η_2 is rather involved, some conclusions are to hand. While the coefficient of absolute risk aversion $A(m)$ helps to study the impact of uncertainty on expected utility, the coefficient of preference for prudence $P(m)$ helps to study the impact of uncertainty on the expected marginal utility (hence on J_k). Note first that $2m_pV_{kp} > 0$ always. It is, however, not necessarily the case that increased price uncertainty induces the management to invest more. Take for the sake of illustration the case of quadratic utility with $P(m) = 0$ and low $A(m)$. Such a management would find it best to respond by currently investing less with increased price uncertainty. Even if $P(m)$ is positive, the term $P(m)m_k^2 - m_{pp}$ in η_2 may take either sign. It is, however, definitely positive when $P(m)$ is sufficiently large. This effect is reinforced when $A(m)$ is also large.

It is helpful to recall that the management reward consists of safe (through ψ_o) and risky (through ψ_1 and ψ_2) income. Let us introduce the plausible hypotheses of decreasing absolute risk aversion and decreasing preference for prudence. Though the relative shares of non-risky and risky income depend upon how the output price evolves, one is likely to have low $A(m)$ and low $P(m)$ when ψ_o is relatively high, providing high insurance. Conversely, when the share of risky income is greater, the management is likely to increase the current investment when the

output price uncertainty is increased. Therefore, the extent to which the management takes part in sharing risks with the stockholders is essential for the optimal management response to increased price uncertainty. We have

Proposition 2. ***(Empire Building and the Degree of Uncertainty) Under the type of compensation scheme (1) and with sufficient management risk sharing, increased uncertainty (in the mean-preserving sense) of future prices induces corporate management to increase current investment in capital strengthening the empire building motive.***

Note that $P(m)$ an $A(m)$ operate somewhat asymmetrically in the model since $A(m)$ enters both η_1/η_2 in (18a)-(18b) while $P(m)$ enters only the latter. Increased uncertainty involves the management becoming more prudent. With sufficient risk-sharing, the management finds it best to expand capital investment in the short run. The intuition for this result is as follows: it is optimal to cause a decline in current share prices and hence in current remuneration in exchange for higher compensation in the future. While greater price uncertainty makes the stock price and management remuneration more volatile, a current increase in capital investment provides the managers with an instrument for precautionary strategy. Though there is no safe asset for the management, there is a kind of insurance effect in that *capital investment functions as a precautionary mechanism for risk-averse, prudent management.* To compare our results with those in the literature, we notice that the Hartman-Abel result follows from one mechanism only, the convexity of the profit function $\pi(p)$. Introduction of management preferences and compensation scheme adds new mechanisms which are absent from the earlier work.

Note that the uncertainty effect η_2/η_0 is independent of the management's discount rate α. Note moreover that, the prudence effect on investment decisions depends positively on m_k^2, the impact of corporate assets on management compensation. We want to point out the additional result that the total effect of the owners' required rate of return (r) on optimal investment undertaken by the management is ambiguous. This is a somewhat disappointing result for those working with the more traditional neoclassical models. To sum up, the optimal current investment of the management depends positively on the marginal shadow price of capital for the owners but negatively on the discount rate of the management.

IV Concluding Comments

There has been an obvious need to integrate the theory of corporate finance emphasizing separation of ownership and decision-making and the neoclassical theory of investment focusing on wealth-maximizing investment strategies. This is what the current paper has done. Using the standard tools of neoclassical investment theory, it was possible to provide a formal confirmation of Jensen's (1986) influential proposal that corporate managers tend to invest in projects which are in conflict with the target of maximizing the wealth of corporate owners. Moreover, it was possible to reconsider the issue of the effects of increased uncertainty from a wider perspective than the earlier literature. The paper was successful in establishing the conditions under which increased price uncertainty tends to strengthen the empire building motive. Given our framework with separation of ownership and control and with shareholders restricted to choose among linear compensation schemes, inefficient investment behavior is unavoidable. This result seems to point to the view that under existing institutions, one should perhaps expect inefficient investment behavior to be more like a rule rather than an exception in market economies.

Footnotes:

1. Separation of ownership and control is most typical of the largest corporations, measured by sales or assets. Haubrich (1994) argued that the Jensen and Murphy results match the principal-agent theory. Narayanan (1985) found that when a manager has private information regarding his decisions, he has an incentive to make decisions which yield short-term profits but are not in the stockholders' interests. Kaplan (1994) discussed the recent dispute on whether Japanese managers maximize the firm's growth instead of the share price.

2. It has been suggested by Grossman and Hart (1982), Easterbrook (1984), Jensen (1986), Zwiebel (1994), Hart (1995) that capital markets do create mechanisms to control corporate managers' incentives to invest in unprofitable projects. The hypothesis of inefficient investment was developed also by Stulz (1990). Hart and Moore (1995) showed that long-term debt can be used to constrain managers' overinvestment incentive. In Rajan and Winton (1995), a credit contract creates an incentive for the bank to monitor the corporation. However, capital markets do not control use of the internal funds by the managers. This is the subject of the present analysis.

3. Though Sandmo (1971) studied the effects of risk aversion, his model can perhaps best be interpreted as a description of an owner-managed firm and its generality may therefore be rather limited. He also abstracted from capital investment.

4. Cf. also Hartman (1976). This result follows from Jensen's inequality stating that the expected value of a convex function of a stochastic variable exceeds the value of this function

when evaluated at the expected value of that variable. While Hartman's (1972) result was derived under any price distribution, Abel (1983) demonstrated its validity under a particular price process (the geometric Brownian motion) arriving at the explicit optimal investment rule. Abel managed to solve explicitly for a firm's equilibrium valuation and its relation to price uncertainty with the natural property that under constant returns a firm's value is linear in capital.

5. The reason is that though an increase in exogenous risk usually increases the expected output of a firm, it may also increase the risk of that technology.

6. While risk aversion means a desire to accept a safe income instead of a fair gamble, preference for prudence generates precautionary behavior, the desire to defer consumption when uncertainty increases.

7. As far as the author is aware, the control problem of the current paper including a forward-looking integral constraint has not been studied earlier in the literature.

8. The view that knowledge of preferences is private information is natural though it is a stricter constraint than that introduced by the early principal agent models.

9. The conflict of interests may also arise from career concerns, cf. Holmstrom and Ricart I Costa (1986).

10. To simplify the technical analysis, we exclude the analysis of the future states where he would choose to break off the relationship. We thus assume throughout that his participation constraint is satisfied.

11. In hidden action models, linearity is under some conditions efficient, cf. Holmstrom and Milgrom (1987) and Diamond (1995). For the optimality issue, see also Dybvig and Zender (1991) and Persson (1994). It is often suggested that linking of pay to performance does not create high-powered incentives to corporate managers and that corporate size is more relevant for incentives. Our model allows for this interpretation.

12. Abel (1983) derived the explicit expression for V_k in terms of price variance under the Cobb-Douglas production technology.

13. Allowing the stockholders to be better informed about the firm's investment planning would complicate the mechanisms of the model and make the analytic solution much harder, if not impossible, to obtain. The ability of the owners fully to understand the determination of the investment program would complicate the decision problem of the management. It then should also be optimal for the management to take account of the potential feedback effects from current capital to current investment. If the shareholders, however, had access to such an ability with perfect monitoring, the need to hire an outsider management would disappear in the first place.

14. Recall that the preference for prudence which is related to precautionary behavior is reflected in the convexity of the marginal utility. The role of condition $u''' > 0$ in generating more prudent behavior in the case of uncertainty was derived by Leland (1968), who showed that risk aversion alone is insufficient to guarantee a precautionary demand for saving. The equivalence between the sign of u''' and an individual's preference for or aversion to downside risk was established by Menezes, Geiss and Tressler (1980).

15. For techniques of dynamic programming when spanning does not hold, see Dixit and Pindyck (1994).

16. One way to view our approach is to regard the owners as "followers" who take the management's strategy as given. Management, in turn, is a "leader" who understands the market's reaction to the announced investment policy through share valuation.

17. Introduction of convex adjustment costs, irreversibility of investment, or alternatively, decreasing returns to capital, would make the current investment finite even in such a case.

18. To see this, differentiate the right-hand side of (5) twice noting that $J_{kj} = 0$ by the principle of optimality and, $V_{jj} = 0$ from (6) and that $\psi_2 V_j = m_j$,

19. It is only required that $V_k > \alpha/(\alpha+r+\psi_2)$ though this is far from being necessary.

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Appendix: Deriving The Share Valuation, Equation (3)

Recall the definition of management remuneration

$$(1) \quad m = \psi_o + \psi_1 pk\pi(p) + \psi_2 V, \quad \psi_o > 0,\ \psi_1 > 0,\ \psi_2 > 0.$$

and the share valuation

$$(2) \quad V(k_t, p_t) = E_t \int_t^{\infty} e^{-r(\tau - t)} D(k_\tau, p_\tau) d\tau,$$

where corporate dividends are given by

$$D(k_\tau, p_\tau) = p_\tau k_\tau \pi(p_\tau) - j_\tau - m_\tau.$$

Inserting m from (1), the share value can be rewritten as

$$(2)' \quad V(k_t, p_t) = \int_t^\infty e^{(-r+\psi_2)(\tau-t)} E_t[(1-\psi_1)p_\tau k_\tau \pi(p_\tau) - j_\tau] d\tau - \frac{\psi_o}{r+\psi_2}.$$

Using the relationship between the flow of investment and stock of capital

$$k_\tau = k_t + \int_t^\tau j_s ds, \quad s \geq t,$$

the share value reads as

$$(2)'' \quad V(k_t, p_t) = (\int_t^\infty e^{-(r+\psi_2)(\tau-t)} E_t[(1-\psi_1)p_\tau \pi(p_\tau)] d\tau) k_\tau$$

$$+ \int_t^\infty \int_t^\tau e^{-(r+\psi_2)(\tau-t)} E_t[(1-\psi_1)p_\tau \pi(p_\tau) j_y] dy d\tau - \int_t^\infty e^{-(r+\psi_2)(\tau-t)} E_t[j_\tau] d\tau - \frac{\psi_o}{r+\psi_2}$$

Using Fubini's theorem (reversing the order of integration), it is convenient to rewrite this equation as

$$(3) \quad V(k_t, p_t) = \frac{-\psi_o}{r+\psi_2} + (\int_t^\infty e^{-(r+\psi_2)(\tau-t)} E_t[(1-\psi_1)p_\tau \pi(p_\tau) d\tau]) k_t +$$

$$\int_t^\infty e^{-(r+\psi_2)(\tau-t)} E_t[(\int_\tau^\infty e^{-(r+\psi_2)(y-\tau)} E_\tau((1-\psi_1)p_y \pi(p_y)) dy - 1) j_\tau] d\tau.$$

QED

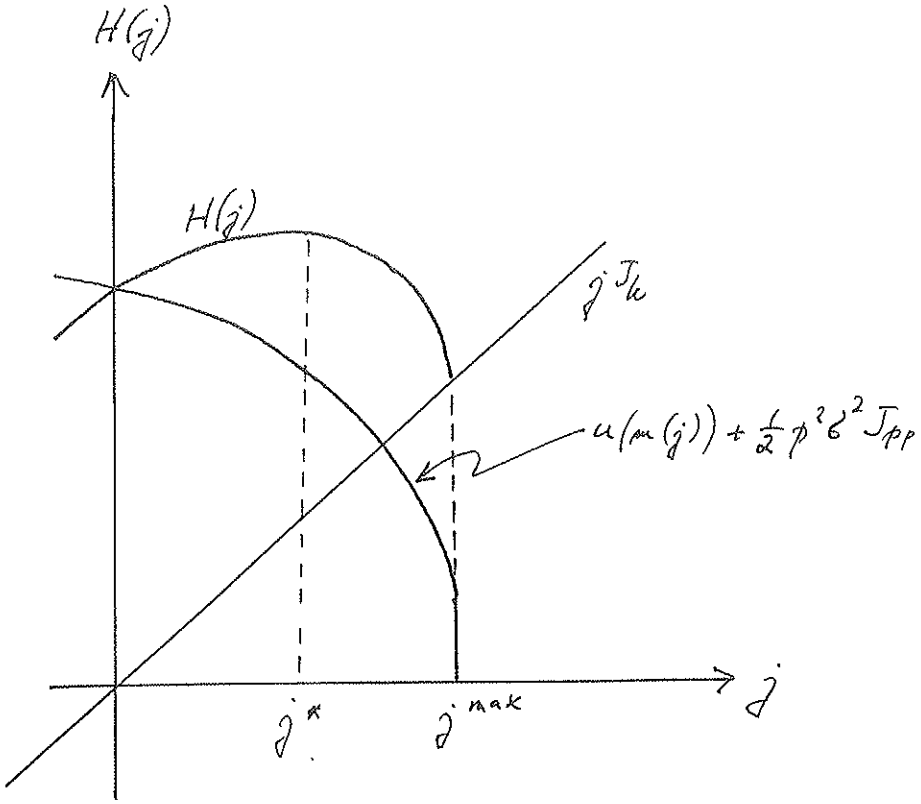

Figure. Optimal Investment

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