The Agency Cost of Financial Decision Making: An Empirical Analysis

by

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(ABSTRACT)

Jensen and Meckling in "Theory of the Firm: Managerial Behavior and Capital Structure" [1976] introduced the concept that managers choose their ownership in the firm and leverage ratio to minimize agency costs. Easterbrook [1984] and Rozeff [1982] extended this notion with the hypothesis that dividends are paid to reduce equity agency costs. Myers [1977] explained debt agency costs as being a possible underinvestment problem with risky debt, and Jensen [1986] hypothesized that increases in debt could control the free cash flow agency problem. This dissertation will be a comprehensive test of Jensen and Meckling's agency theory including extensions by Rozeff, Easterbrook, Myers and Jensen. To test agency theory a contemporaneous three equation model determining managerial ownership, leverage and dividends is specified. The exogenous variables include variables which are expected to impact upon agency costs, diversification measures, and variables registering non-agency explanations of leverage and dividends. This dissertation provides critically needed empirical evidence on the agency problem and a specific test of Jensen and Meckling.

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Chapter I

Introduction

The capital structure puzzle and the dividend puzzle have recently been resolved through the application of agency theory. The agency problem arises because firms are owned and managed by different individuals and, therefore, the actions of management may not be in the best interest of the firm's claimholders. Jensen and Meckling [1976] introduced the idea that managers choose their stock ownership of the firm and the mixture of outside debt and equity ownership to minimize the costs of the agency problem. Rozeff [1982] and Easterbrook [1984] incorporate into the agency model the idea that dividends also play a role in controlling agency costs.

This dissertation examines the use of three managerial decisions—managerial ownership, corporate leverage and dividends to control agency costs. The separate agency theories of this decision making are first integrated into a mathematical model. Comparative statics are performed on this model, and they provide testable empirical implications. A cross-sectional empirical test of 603 industrial firms is performed.

The theoretical model developed in this dissertation offers a number of new results. First, it incorporates all three decisions into a relatively familiar cost minimization framework. The model thus integrates the optimality conditions contained in the Jensen and Meckling model, and in Rozeff's dividend model. A unique feature of the model stems from the fact that comparative statics can be performed to examine exogenous effects on all three corporate decisions. The comparative statics reveal some determinant effects; however, a number of effects previously believed to be determinant are shown to be ambiguous.

The empirical analysis contains some results found in prior studies, as well as a number of new results. Most importantly, the Jensen and Meckling model is tested in this study for the first time, and the evidence clearly supports that model. The theory that dividends are used to control by agency costs is also supported.

This remainder of the dissertation is organized in five chapters. Chapter 2 describes the existing agency literature of financial decision making. In Chapter 3 the theoretical model is developed, and comparative statics are performed on the model. Chapter 4 describes the methodology of the empirical tests and the data used in these tests. Chapter 5 reports the results of the empirical tests, and compares the study to others. Chapter 6 summarizes the findings.

Chapter II

The Agency Theory of Corporate Financial Decision Making

2.1 Introduction

In the principal-agent relationship the principal hires a second party, the agent, who is delegated the responsibility for making decisions on behalf of the principal. A fundamental problem confronting the parties to this agency relationship is the design of a mutually agreeable joint contractual agreement, that, among other things, mitigates economic waste. This principal agent paradigm has been applied to modern corporate finance where managers are hired to make corporate decisions for the claimholders of the firm, primarily stockholders and bondholders. While managers may hold the equity and the debt of the firm, they may also have incentives different than other claimholders because their wealth does not derive solely from the value of their claimholdings. Of course, bondholders and stockholders are rational, and knowing management's incentive to act in ways detrimental to their wealth, they will pay accordingly less for their claims. Everything else the same, managers will

therefore want to maximize firm value and will thus seek ways to reduce or eliminate these agency problems.

Managers can control agency problems by making certain financial decisions. Jensen and Meckling introduced the idea that managers will choose their ownership in the firm and leverage to minimize agency costs. Rozeff and Easterbrook introduced the idea that dividend policy can also be used to control the agency problem. Thus it has been argued that three primary corporate decisions are made to control the agency problem; managerial ownership, leverage, and dividends.

2.2 Agency Costs

The agency problem gives rise to agency costs which can be further separated into two different kinds of agency costs; there are the equity agency costs from the manager-stockholder conflict, and the debt agency costs from the stockholder-bondholder conflict. These also include the costs of trying to control agency costs.

2.2.1 Equity Agency Costs

The costs due to managers not acting in the best interests of the stockholders are called equity agency costs. The difference between the value of the equity if the manager owned all of the stock and the actual value when other investors own stock provides one measure of equity agency costs. For example, Jensen and Meckling suggest that managers consume on the job perquisites, more perquisites than they

would if they owned all the firm's equity, and thus the consumption of perquisites reduces equity value and is an equity agency cost.

Agency costs include managers acting in other ways which reduce equity value. Managers may invest in certain projects which give them personal benefits rather than increased stockholders' wealth. For example, managers may overinvest in negative net present value projects, thereby increasing the size of the firm, hence their empire (Jensen [1986]), but reducing stockholders' wealth. To reduce these kinds of agency costs, management should seek ways to pay out excess cash. Also, since managers generally have a disproportionately large amount of their personal wealth invested in the firm, they may make investment decisions that decrease the risk of the firm more than outside stockholders would like (Easterbrook). This incentive arises from the principle of portfolio diversification; if managers hold suboptimally diversified portfolios, they will prefer to reduce firm risk below what would be optimal if they held a well diversified portfolio. Thus, managers have incentive to invest cautiously to decrease firm risk and the resulting loss in stock value is an equity agency cost.

Of course, rational investors pay less for the stock of a company with higher agency costs; hence, the reduced market value of equity represents the potential gain to be had by managers from reducing equity agency costs. To that end, managers can hire outside monitors or bond themselves to reduce agency costs. To be effective, the outside monitors must essentially come into the firm, observe managers' actions, and then certify the extent to which managers are acting to maximize shareholders' wealth. This hiring of outside monitors should increase stockholders expectations and therefore increase stock price. The cost of these monitors is another equity

agency cost. Bonding is also expensive as it requires examining management behavior ex-post, and penalizing managers for value reducing behavior.

2.2.2 Debt Agency Costs

Debt agency costs arise because bondholders want the firm to act in ways different from that preferred by stockholders. When this conflict of interest is present, corporate decisions have the potential for transferring wealth from bondholders to stockholders and visa versa. In general, debt agency costs do not arise when the debt is riskless, and, within a Capital Asset Pricing Model framework, risky debt agency costs are irrelevant because stockholders are the same individuals as bondholders. However, in an imperfect world, debt agency costs will be present due to different risk and investment preferences of stockholders and bondholders.

This conflict of interest is made most apparent when equity is viewed as a call option. In this case, stockholders prefer risky projects and bondholders, in general, prefer low risk projects (Galai and Masulis [1976]). Stockholders' wealth will increase with risk and bondholders wealth will decrease with risk, *ceteris paribus*. Stockholders have very large potential gains on their stock, while their loss is limited by the initial investment. Bondholders, on the other hand, face gains limited by the promised repayment and interest payments with their limited losses. The potential therefore arises that managers could redistribute wealth from bondholders to stockholders by increasing the risk of the firm (Jensen and Meckling). Bondholders will enter into long-term agreements with the company at fixed interest rates reflecting current risk of the firm. Because of the potential for managers to increase risk after the bonds

are issued, which would cause a wealth transfer from bondholders to stockholders, bondholders will demand higher rates of interest than they would when there is no risk-shifting potential. Bond covenants may be used to restrict managers risk shifting actions (Smith and Warner [1979]).

Another potential agency cost of risky debt arises because managers, acting in stockholders interests, have an incentive to underinvest. In particular, if the firm has a possibility of going into default, stockholders may be reluctant to invest money when the net present value of a project is less than the promised repayment of debt (Myers [1977]). In such a case, stockholders' investment merely serves to benefit bondholders. These agency costs will be high for firms with discretionary investment opportunities and lower for firms with high assets in place, *ceteris paribus*. Thus the presence of this kind of underinvestment problem will further reduce the value of the firm.

When bondholders enter into bond contracts, they will see the potential for risk shifting and underinvestment and will reduce what they pay for the bonds accordingly. These costs for controlling the bond agency problem are also debt agency costs. Managers may try to reduce these agency costs by hiring outside monitors to report on managers' actions (Jensen and Meckling), or there may be extensive costs incurred in arranging the bond indentures (Smith and Warner). This monitoring cost is also a debt agency cost.

2.3 Controlling the Agency Problem

This dissertation focuses on controlling agency costs through the making of major financial decisions by managers: the managerial ownership decision, the leverage decision and the dividend decision. Of course, other ways exist to control the agency problem, for example the agency problem is mitigated with ex-post settling up (Fama [1980]). Managers who act in ways detrimental to firm and stockholders' wealth may ultimately pay for these reductions. Moreover, the scope of managers' deviation from contract is controlled by the managerial labor market. In a world in which managers' actions can be directly observed, full ex-post settling up will occur, and there will be no agency problem. However, in an imperfect world, where actions are not directly seen, the agency problem exists and managers will resort to other means for minimizing agency costs. In particular, managers can make financial decisions to reduce agency costs.

2.3.1 Managerial Ownership

If managers own all the stock of the firm, they are fully self employed, and they will bear the full cost for any value reducing decisions. Therefore, there will be no equity agency costs. Also, if there are no bonds outstanding, managers are the only owners of the firm, therefore there will be no bond agency costs. In this case, the sum of the equity agency costs and the bond agency costs, i.e., total agency costs, will be zero.

2.3.1.1 Theories of Managerial Ownership

In most firms the manager will not hold all of the stock because of wealth limitations and diversification costs. Jensen and Meckling argue that, in this case, as outsider ownership increases total agency costs will rise. In particular, total agency costs rise in a such a manner so that the marginal total agency costs initially rise and then decline as the percentage of outside ownership rises. This case is depicted in Figure 1, where α denotes the percent of equity held by managers so $1-\alpha$ is the percent of outside equity ownership.

Jensen and Meckling assume managers are the entrepreneurs who originate the firm using their own wealth. Thus, initially, the manager's portfolio is poorly diversified, being too heavily invested into the firm. At this point, the manager incurs very high opportunity costs due to poor diversification. To further incorporate the benefits to the manager of the need for diversification, Jensen and Meckling argue that the marginal diversification benefit to the manager's portfolio (MB) falls as she owns less of the firm, i.e., as outside ownership increases. In other words, the smaller the amount of the manager's wealth in the firm, the less is the manager's need to seek diversification so managers make ownership decisions that offset diversification costs with benefits of reduced agency cost. In this case, managers will choose inside ownership (α^*), hence optimal outsider ownership, so that marginal total agency costs (MC) just equal the marginal benefits of diversification, *ceteris paribus*. This is shown in Figure 2.

However, *ceteris* is not always *paribus*. Manager perquisite consumption, whether on the job or at home, also depends on consumption preferences and not just own-

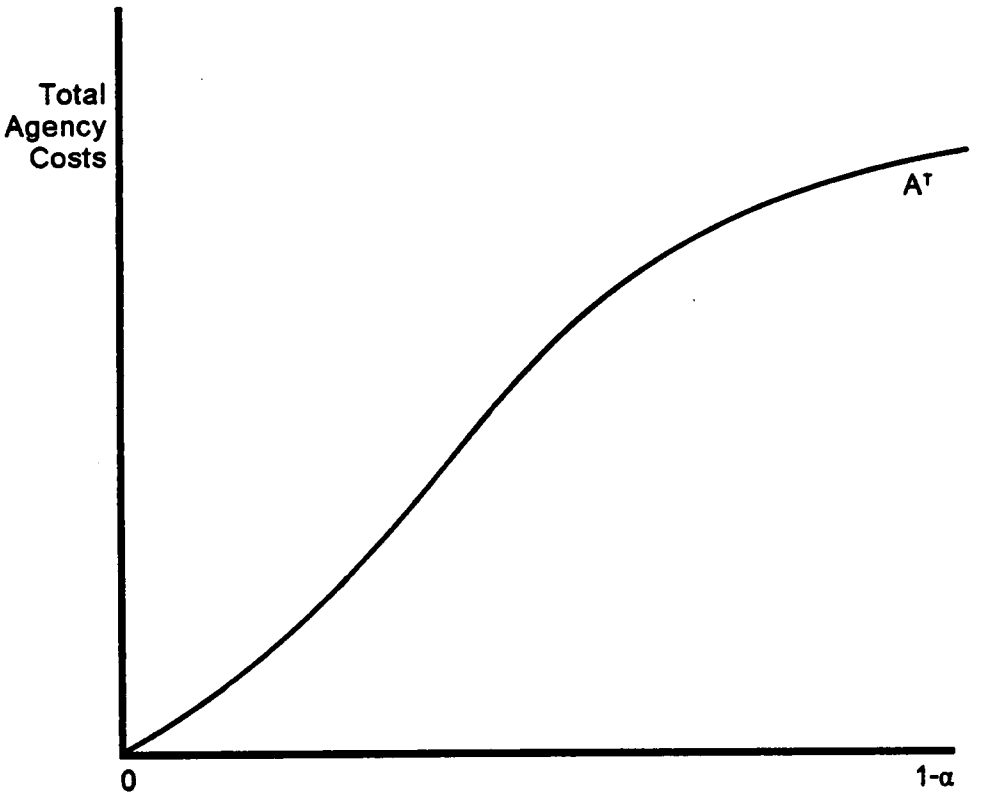

Figure 1. Total Agency Costs: As outside ownership increases, total agency costs rise, but marginal agency costs rise and then fall.

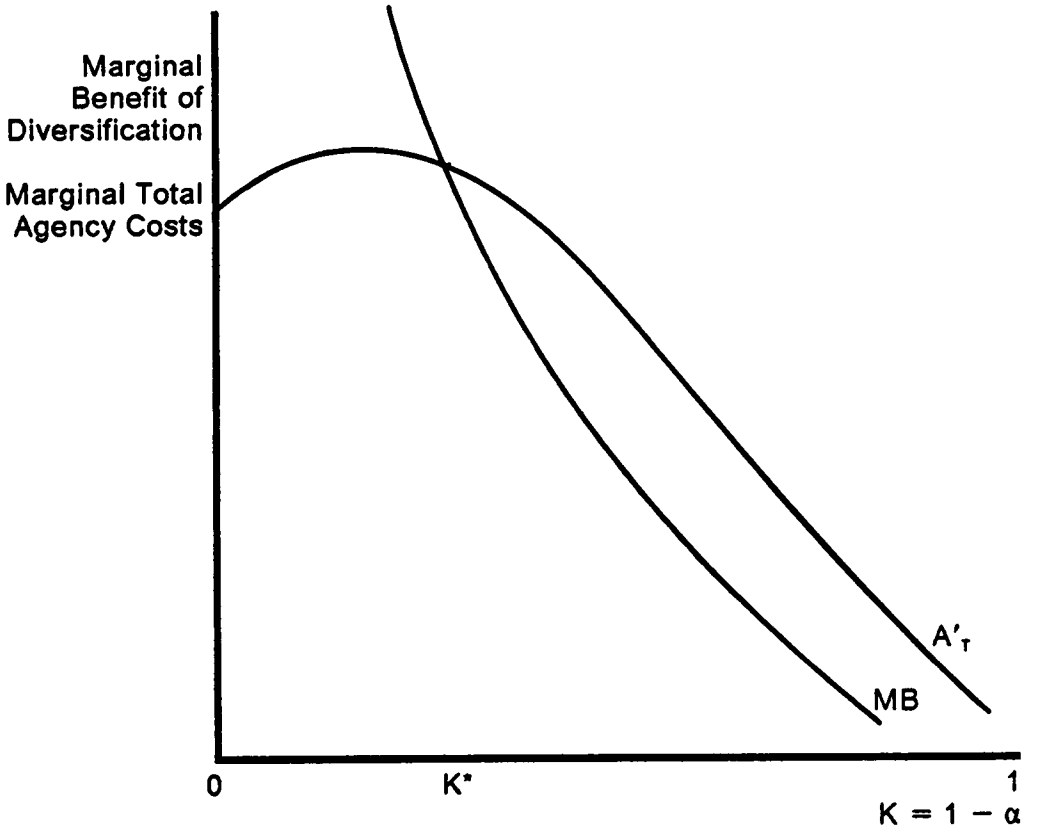

Figure 2. Optimal Outside Ownership: Optimal outside ownership is where the marginal agency costs of outside ownership (A'_T) equal the marginal benefits to diversification of outside ownership (MB).

ership (Demsetz [1983]). Owner-managers have to pay for their perquisite consumption through lower profits, but they receive benefits of the perquisites. Owners who do not manage receive no benefits for perquisite consumption, but will pay for the perquisites through lower profits, therefore non-manager owners will tolerate less managerial perquisite consumption if they can detect it. Firms with very small managerial ownership may actually have less perquisite consumption and lower agency costs as the owners will not allow perquisite consumption to decrease profits. Firms with large managerial ownership may have owners that prefer perquisite to at home consumption and may have high equity agency costs.

2.3.1.2 Empirical Evidence on Managerial Ownership and Agency Costs

Direct tests of Jensen and Meckling's agency theory are particularly rare. Demsetz and Lehn [1983] regressed agency variables on outside stockholder ownership concentration, and Morck, Shleifer and Vishney [1986] looked at how differences in board of director ownership affects the firm's performance.

Demsetz and Lehn hypothesized that the more concentrated the stock holdings, the less the agency problem. If there are only a few large investors these investors find it more in their interest to protect their wealth by engaging in monitoring activity. When there are many investors, each with only a small portion of their wealth in the firm, the benefit for an individual investor to monitoring each firm is small. Therefore, more concentrated outside stockholder ownership will be associated with greater monitoring, hence, less of an agency problem. To test this proposition, Demsetz and Lehn constructed a Herfandahl Index of ownership concentration and regressed this index on agency variables. One agency variable which they call amenity potential is

a dummy variable with a value of one to denote sports clubs or media firms, which they argue are more prone to high perquisite consumption. They find that firms with higher amenity potential have more concentrated ownership. Another independent variable is regulatory climate which is a dummy variable, equalling one for utilities, and represents more stringent regulation. They find that firms with less stringent regulation have higher ownership concentration. Finally, they regress instability of the firm, measured by three different risk measures, on ownership concentration and find a positive relationship as they expected. Overall, Demsetz and Lehn find evidence supporting agency theory. Demsetz and Lehn also examine if corporate performance is affected by ownership concentration. They regress a corporate performance measure on ownership concentration and find no relationship. Demsetz and Lehn conclude that ownership concentration does not affect how well firms perform. The benefits of non-owner managers offset the agency costs from non-owner managers.

Morck, Shleifer and Vishney argue that board of director ownership may control agency costs, but only up to a point. If management has been managing too long, there may be an entrenchment problem, a notion potentially similar to Demsetz and Lehn's idea that owner managers will be freer to consume perquisites, *ceteris paribus*. The entrenched management may not exhibit value maximizing behavior, but because they own a large portion of the firm, outside stockholders cannot remove them. To test the entrenchment versus agency theory, Morck, Shleifer and Vishney segregate board ownership into three groups: less than 5%, between 5% and 20%, and over 20%. They find that corporations with moderate board ownership have the highest profit rate while those with highest ownership have the lowest profit rate. This is consistent with the idea that up to a point managerial ownership may reduce

perquisite consumption, while high managerial ownership can result in increased perquisite consumption because entrenched management may prefer on the job consumption to high profits.

2.3.2 *Leverage*

Corporate leverage decision can alter both debt and equity agency costs.

2.3.2.1 Leverage Effect on Debt Agency Costs

In the Jensen and Meckling world, debt agency costs are directly related to the proportion of outside leverage, but then fall at a decreasing rate with decreases in leverage. Because of the wealth redistribution problem, with more outside debt (higher leverage), there is a greater potential wealth transfer at stake so there are higher debt agency costs, *ceteris paribus*. This effect is exacerbated further because more risky debt increases the potential for, hence costs of, the underinvestment problem. A further debt agency cost arises with leverage increases through potential for claim dilution. If the firm can issue bonds of higher or equal priority to current bonds, this can dilute existing bondholders' claims to the firm. Thus, the monitoring costs associated with bond covenants will expand, *ceteris paribus*. Of course, if all bonds are riskless, this cost will not arise.

2.3.2.2 Leverage Effect on Equity Agency Costs

Leverage is a second potential tool for reducing equity agency costs. However, its use is not free as it can increase debt agency costs. The leverage effect is simply due to scale; if total outside ownership is held constant, as the outside leverage percentage increases, absolute outside equity ownership must decrease. Thus, since the lower the dollar value of outside equity, the lower are equity agency costs, increasing outside leverage lowers equity agency costs. In addition to these effects, increased leverage can serve to decrease agency costs for companies with a high free cash flow problem (Jensen). For firms who have a lot of cash and few positive net present value projects, stockholders are better off if the excess cash is paid out to the firms' owners. However, empire building managers will want to internally invest the cash to increase firm size, even if it means investing in poor projects. Jensen argues that oil companies in the 1970's experienced high free cash flow problems; the price of oil was high leading to high cash flows, but the demand for oil output was decreasing causing investment in oil wells to be unprofitable. Nevertheless, managers continued to invest in these oil wells causing a fall in stock price, inflicting agency costs on stockholders. Managers can expunge the extra cash by paying dividends or leveraging to increase interest expense. Since, promised dividends are not enforceable while promised interest payments are, Jensen argues that firms with a higher free cash flow problem should adjust their capital structure towards greater leverage, *ceteris paribus*.

2.3.2.3 Choosing Optimal Leverage

The above discussion suggests that leverage increases debt agency costs, and correspondingly decreases equity agency costs. The optimal leverage ratio is where the marginal debt agency costs equal marginal equity agency costs, thus minimizing total agency costs (see Figure 3).

Of course, the debt and equity agency cost functions are also influenced by exogenous variables. For example, companies with potential free cash flow problems will have higher equity agency costs, while those with high managerial ownership will have lower equity agency costs, *ceteris paribus*. Also, high growth firms, and high dividend paying firms, should have higher debt agency costs, *ceteris paribus*.

2.3.2.4 Evidence on Leverage Agency Costs

Bradley, Jarrell and Kim [1984], and Long and Malitz [1985], both find support for Myers' agency theory. Each study conducts a cross-sectional test in which leverage is the dependent variable. Bradley, Jarrell and Kim regress leverage on a measure of Myers like costs and non-agency variables. They suggest that firms with high advertising expense and R&D expenses relative to sales have fewer assets in place, and they find a negative relationship between this growth measure and leverage.

Long and Malitz regress leverage separately on R&D, advertising and capital expenditures, each deflated by an asset measure; they argue that the first two variables represent investment in intangibles, while capital expenditures represent investment

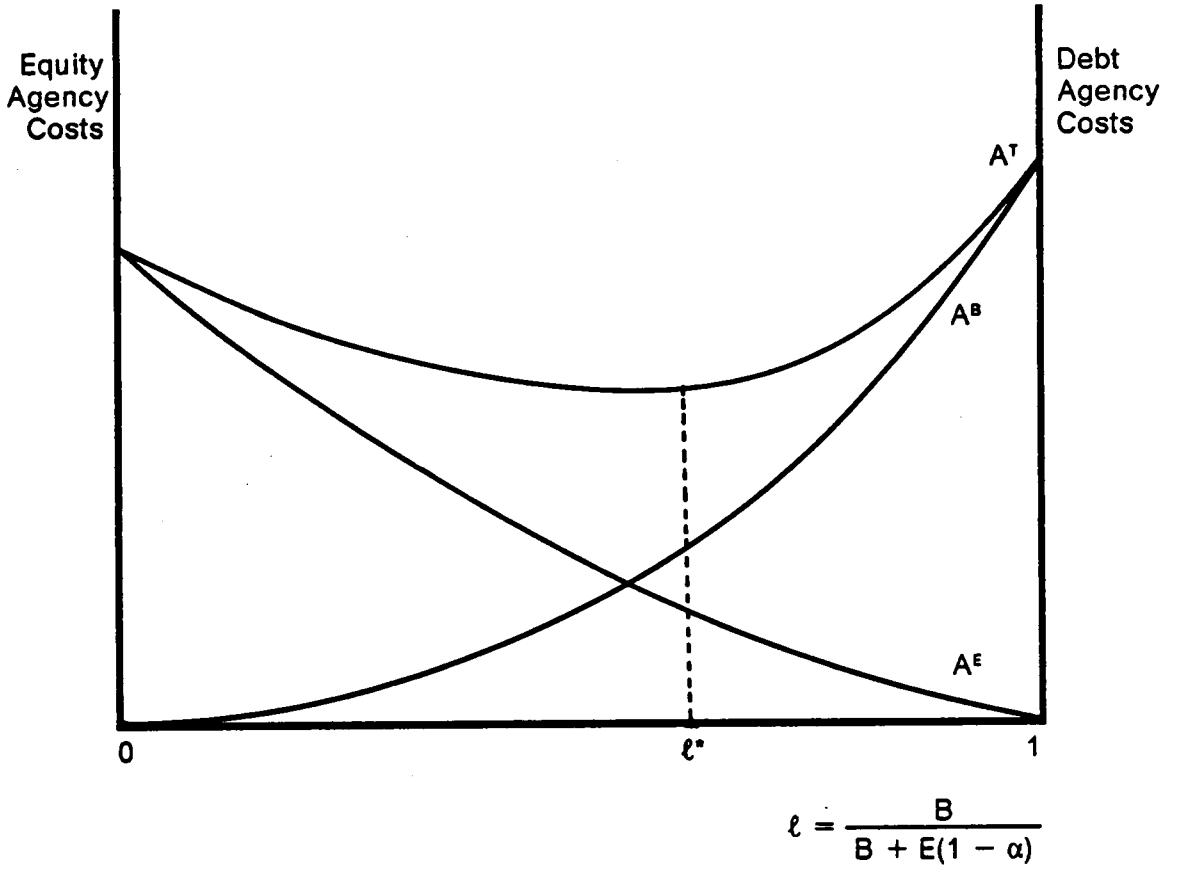

Figure 3. Agency Costs: Total agency costs fall then rise as a function of outside leverage holding inside ownership α fixed. Bond agency costs plus equity agency costs equal total agency costs (A^T), and the optimal leverage is where total agency costs are minimized, ℓ^*.

in tangible assets. They suggest intangible investment is difficult to monitor as expenditures in intangibles is kept secret. Therefore, firms with high proportion of intangible investment will have higher debt agency costs while those with a high proportion of investment in tangibles will have low debt agency costs. They find a negative relation between both R&D and advertising on leverage, but a positive relationship between capital expenditures and leverage which they conclude supports Myers' debt agency theory.

Kim and Sorensen [1986] also do a cross-sectional leverage test of Myers, and Jensen and Meckling, sorting their firms into insider ownership groups and examining leverage. They find firms with high insider ownership have high leverage ratios; and conclude that this supports Jensen and Meckling. In fact, this result supports the idea that leverage and managerial ownership are complements in reducing agency costs. To measure growth opportunities they use growth in EBIT, and find a negative relationship between growth and leverage which they conclude supports Myers' idea. They also examine the impact of leverage on measures of business and total risk and find a positive relationship with leverage. A further test of Myers is firm size as a proxy of diversification in which they find an insignificant relationship which Myers predicted.

To date the only empirical evidence against leverage agency theory is limited to a study done by Barclay and Litzenberger [1986] who test Jensen's free cash flow concept. Barclay and Litzenberger suggests that firms issuing debt with a cash flow problem should have higher announcement day returns than other issuing firms without the free cash flow problem. Using Tobin's Q ratio to proxy for free cash flow, they report finding no significant differences in announcement day returns with high

Tobin's Q firms versus low Tobin's Q firms. They conclude this is evidence against Jensen's free cash flow idea.

2.3.3 The Dividend Effect on Agency Costs

Traditionally, the payment of dividends has puzzled economists since dividends impose taxes and may also raise the firm's future flotation costs. However, in recent agency literature the use of dividends has been hypothesized as a way to control equity agency costs, but it also to increases debt agency costs.

2.3.3.1 Dividends and Equity Agency Costs

Managers may reduce equity agency costs by paying regular dividends. When dividends are paid, cash leaves the firm forcing management to meet future capital requirements by issuing new capital, leading to the hiring of underwriters. The underwriters, before they agree to issue, will monitor the manager's actions (Rozeff, Easterbrook). This monitoring is better than hiring an outside auditor because underwriters are exposed to risk of loss of money when selling the issue and loss in reputation if they sell "bad" stock. Therefore, paying regular dividends, leading to regular capital issues provides monitoring of managers and a reduction in agency costs. Optimal dividend policy is that payout ratio for which the marginal costs of dividends equals the marginal reduction in equity agency costs. Costs include taxes on dividends, the cost of raising new capital, and the cost of increased debt agency costs due to dividends.

Easterbrook looks at the risk-shifting potential of dividends and recognizes the incentive of managers to reduce firm risk through decreasing the debt to equity ratio, inducing a wealth transfer from stockholders to bondholders. By paying regular dividends, the debt to equity ratio can be kept at a relatively high level reducing equity agency costs, *ceteris paribus*. By restricting dividends agency costs of debt may be reduced, but agency costs of equity may be increased.

2.3.3.2 Dividends and Debt Agency Costs

The payment of dividends will increase the agency costs of risky debt since retained earnings fall, raising the debt to equity ratio, *ceteris paribus*. In turn, debt risk is increased thereby inducing a wealth transfer to stockholders. Also the increased payment of dividends will increase the potential for the underinvestment problem.

Smith and Warner suggest that to control the possible risk shifting of the firm after bonds have been issued, bond covenants will include restrictions on dividends.

2.3.3.3 Evidence on Dividends and Agency Costs

The evidence on the effect of dividends on agency costs is mixed. Rozeff regresses the dividend payout ratio on agency and other variables including insider ownership, the number of shareholders, growth in revenues and beta. Rozeff suggests that the greater the percentage of insider ownership, or the fewer the stockholders, less of an agency problem will exist so dividends are needed less, *ceteris paribus*. He uses beta to proxy for equity issuance costs, and argues that when growth is higher, dividends are needed less as the firm must go to capital markets anyway. Rozeff finds

the hypothesized relationships and thus finds support for the agency theory of dividends. It should be noted, however, that with respect to the bond covenants issue, Kalay [1982] does not find evidence that firms write binding dividend restrictions in their bond covenants. Apparently, while bondholders are aware of the risk shifting potential of dividends, managers typically do not shift risk as much as possible, keeping dividends well below the limitations.

Chapter III

Theoretical Model

To see how agency costs affect managerial decision making, a cost minimization model is derived incorporating Jensen and Meckling's choice of managerial ownership and leverage, Myers' risky debt theory, Easterbrook's and Rozeff's agency theory of dividends, and Jensen's free cash flow theory. An agency cost function is derived which includes both direct agency costs and the costs to control the agency problem—bankruptcy costs, flotation costs, and costs for manager's personal non-diversification. This model assumes managers minimize total agency costs given the agency problem incentives.

3.1 Introduction

In order for managers to minimize agency costs, investors must realize the possibility of managers' excess perquisite consumption which is the assumption that Jensen and Meckling make. In fact, managers must be penalized fully for any potential agency costs through reduced stock and bond prices. Therefore, to increase security

prices, managers must act in ways to reduce potential agency costs. Three financial decisions are examined in this study which may reduce agency costs—managerial ownership, leverage and dividends, these are chosen by managers to minimize total agency costs.

3.2 Diversification Payments

One way for managers to minimize agency costs and increase security prices is to own all of the firm's securities. However, managers may not have the wealth to do this. Also, if managers invest all of their personal wealth into the firm, their portfolio will be totally undiversified. This lack of diversification causes managers to incur portfolio risk that other investors are not exposed to. If managers are risk averse they will want a diversified portfolio and will not invest all of their personal wealth into the firm even if they have the resources to do so. In fact, unless managers are compensated for having an undiversified portfolio, they will not hold any more of the firm's stock then is in the market portfolio.

In this model, I assume the company fully reimburses the manager directly for any lack of diversification caused by owning a portion of that company. By increasing her ownership in the firm the manager will increase her portfolio risk, but is compensated monetarily for that increased risk. Ideally, managers will be on the same risk-return indifference curve regardless of their ownership in the firm assuming stock price stays constant. However, if increasing managerial ownership decreases agency costs more than it increases managerial compensation, stock prices will rise causing

manager's portfolio return to rise. The increased return will put the manager on a higher indifference curve as increased risk is totally compensated.

Figure 4 shows an example of manager increasing utility by increasing ownership in the firm. The manager is originally at point A with $E(R_1)$ and σ_1. When she increases ownership in the firm, her risk rises to σ_2 but the firm gives her extra compensation to move her to point B with $E(R_2)$ and restoring her to indifference curve 1. However, because of the manager's increased ownership, stock price rises causing her expected return to rise to $E(R_3)$ and increase utility so that she is on indifference curve 2. The manager increased utility by increasing ownership of the firm and reducing agency costs.

3.3 Cost Minimization Model

Managers minimize total agency costs given fixed investment. Total agency costs are:

$$C = A^E(\alpha, \ell, \delta) + A^B(\alpha, \ell, \delta) + f(\alpha) + P(\delta) + \gamma(\ell), \qquad [3.3.1]$$

where:

C = agency costs,

$A^E(\alpha,\ell,\delta)$ = agency costs of equity,

$A^B(\alpha,\ell,\delta)$ = agency costs of bonds,

$f(\alpha)$ = manager's compensation for holding α of the firm,

$P(\delta)$ = penalty on dividends which consist of underwriting costs,

$\gamma(\ell)$ = expected value of bankruptcy cost,

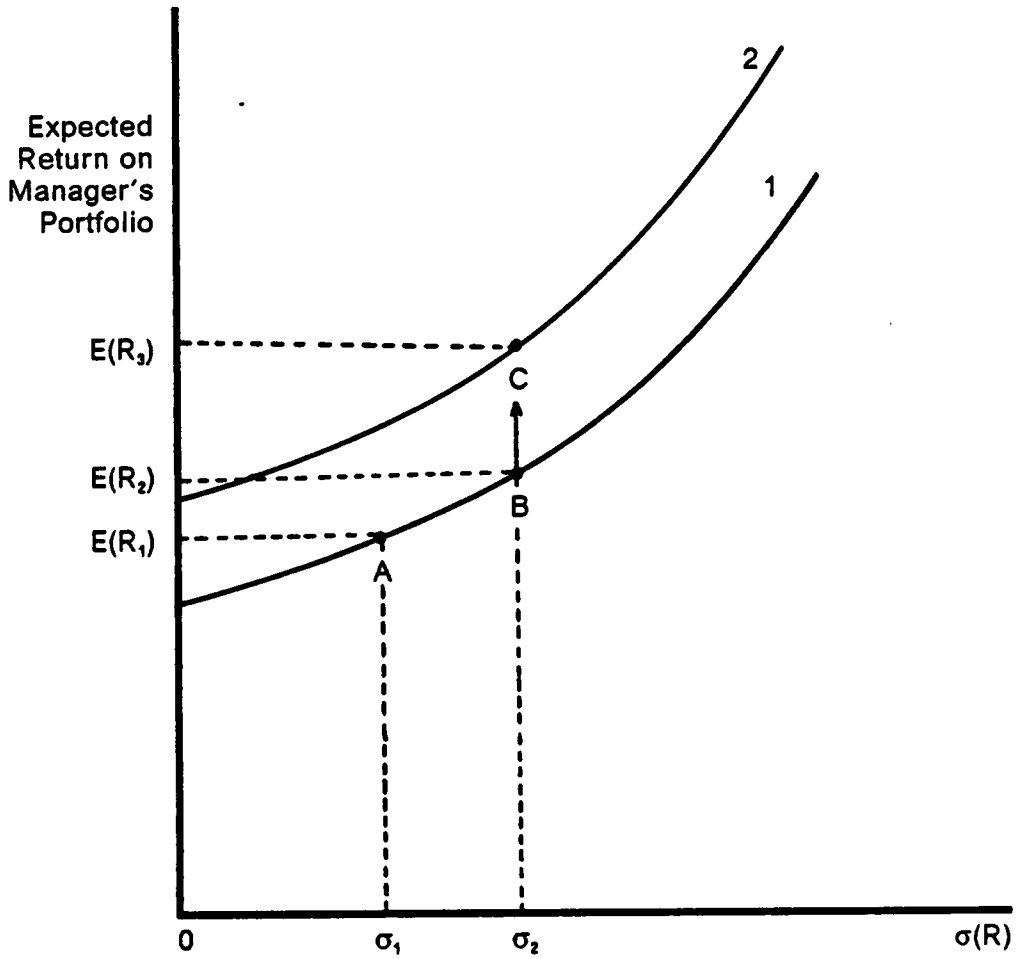

Figure 4. Manager's Personal Welfare and Portfolio Risk: Increasing managers investment in the firm will put him or her on a higher indifference curve if it is a cost minimizing decision.

α = the percent of common stock held by the manager,

ℓ = outside leverage ratio,

δ = dividend payments.

3.3.1 Agency Costs

The agency costs of equity are the direct costs due to the stockholder-manager conflict. These include the basic Jensen and Meckling agency costs: perquisite consumption by managers, monitoring and bonding costs from hiring outside monitors, and costs due to non-optimal investment policy. Following the recent agency literature, the agency costs of equity are assumed to be a function of managerial ownership, leverage and dividends. Jensen and Meckling assume that both increases in managerial ownership and leverage will decrease equity agency costs. Easterbrook and Rozeff assume increases in dividends also decrease equity agency costs.

The agency costs of debt include the direct costs from the stockholder bondholder conflict, reduced bond prices from possible managerial risk shifting, monitoring and bonding costs, and costs from underinvestment. The agency literature assumes that bond agency costs are a function of managerial ownership, leverage and dividends. Jensen and Meckling hypothesize the greater the managerial ownership the lower the bond agency costs. Jensen and Meckling and Myers assume the higher the leverage, the higher the bond agency costs. Bond agency costs may also increase with dividends as high dividends can transfer wealth from bondholders to stockholders as the debt ratio is increased.

3.4 The Cost Minimization Problem

Managers choose ownership, leverage and dividends to minimize agency costs:

$$\text{Min } C = A^E(\alpha, \ell, \delta) + A^B(\alpha, \ell, \delta) + f(\alpha) + P(\delta) + \gamma(\ell), \qquad [3.4.1]$$

yielding the first order conditions:

$$\frac{\partial C}{\partial \alpha} = A^E_\alpha + A^B_\alpha + f_\alpha = 0, \qquad [3.4.2]$$

$$\frac{\partial C}{\partial \ell} = A^E_\ell + A^B_\ell + \gamma_\ell = 0, \text{ and} \qquad [3.4.3]$$

$$\frac{\partial C}{\partial \delta} = A^E_\delta + A^B_\delta + P_\delta = 0, \qquad [3.4.4]$$

where the subscripts indicate partial derivatives.

3.4.1 Optimal Managerial Ownership

Consider first the managerial ownership condition which can be rewritten as:

$$-(A^E_\alpha + A^B_\alpha) = f_\alpha. \qquad [3.4.5]$$

This condition says that managers increase their common stock ownership until the increased compensation for diversification just equals the decrease in the sum of the agency costs of debt and equity. This corresponds with Jensen and Meckling's equilibrium ownership condition except that in this model f_α replaces Jensen and Meckling's marginal benefit to diversification. This optimality condition is depicted

in Figure 5 which reflects the fact that the ownership agency costs of both debt and equity initially fall at an increasing rate as managerial ownership increases and then at a decreasing rate as assumed by Jensen and Meckling. In particular, as managers own more stock they have more incentive to maximize shareholder's wealth, hence, reducing perquisite consumption. Moreover, as managers increase ownership, keeping the outside leverage ratio constant, the total amount of debt falls, lowering debt agency costs, a result that will be relevant subsequently. A possible offsetting effect is that the higher is managerial ownership the more incentive there is for managers to act in shareholders interest, which includes redistributing wealth from debtholders; however, if the scale effect of debt dominates, the marginal agency costs for bonds will decrease as marginal ownership increases.

3.4.2 Optimal Outside Leverage

From the second first order condition:

$$A_\ell^B + \gamma_\ell = - A_\ell^E. \qquad [3.4.6]$$

This says that leverage should be increased until the marginal decrease in equity agency costs just equals the marginal increase in the sum of debt agency costs and bankruptcy costs.

This condition is similar to Jensen and Meckling's leverage condition, which says that optimal leverage occurs where marginal debt agency costs equal marginal equity agency costs. In my model there are the additional debt costs of bankruptcy which increase with leverage. As in the Jensen and Meckling model, increasing leverage

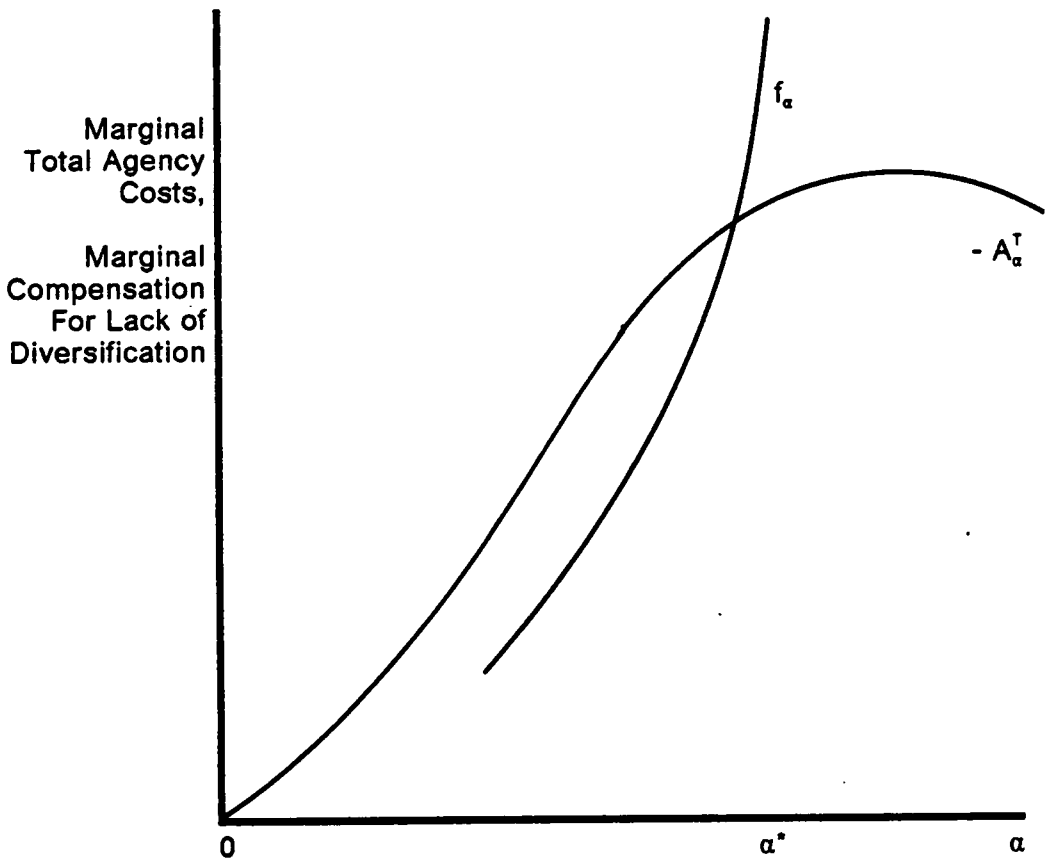

Figure 5. Optimal Managerial Ownership: Increasing managerial ownership decreases marginal agency costs of debt and equity while increasing marginal managerial compensation for lack of diversification.

increases the agency costs of debt plus bankruptcy costs and decreases equity agency costs. This is shown in Figure 6.

3.4.3 Optimal Dividend Payout

The third first order condition may be rewritten as:

$$- A_{\delta}^{E} = P_{\delta} + A_{\delta}^{B}, \qquad [3.4.7]$$

which states that the dividend yield should be increased until the decreased marginal equity agency cost equals the increased penalty on dividends plus the increased marginal bond agency costs. This is similar to Rozeff's optimality condition, and is described in Figure 7.

3.5 Second Order Conditions

The second order conditions require that the determinant of the three-by-three matrix of second derivatives and cross-partial derivatives be positive:

$$H = \left| \frac{\partial(C_{\alpha}, C_{\ell}, C_{\delta})}{\partial(\alpha, \ell, \delta)} \right| = \begin{vmatrix} C_{\alpha\alpha} & C_{\alpha\ell} & C_{\alpha\delta} \\ C_{\ell\alpha} & C_{\ell\ell} & C_{\ell\delta} \\ C_{\delta\alpha} & C_{\delta\ell} & C_{\delta\delta} \end{vmatrix} > 0, \qquad [3.5.1]$$

that the determinants of the two-by-two principal minors of the Hessian be positive:

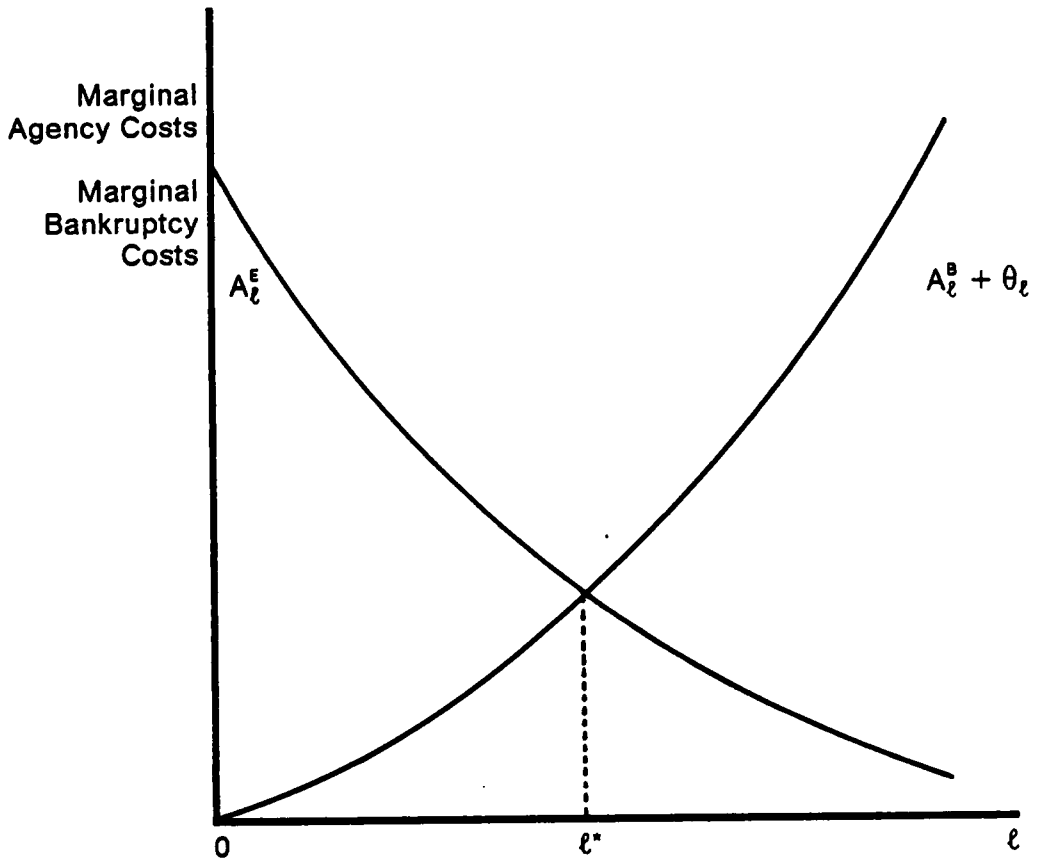

Figure 6. Optimal Outside Leverage: Equilibrium outside leverage (ℓ) is where marginal agency costs of bonds plus marginal bankruptcy cost equal marginal equity agency costs.

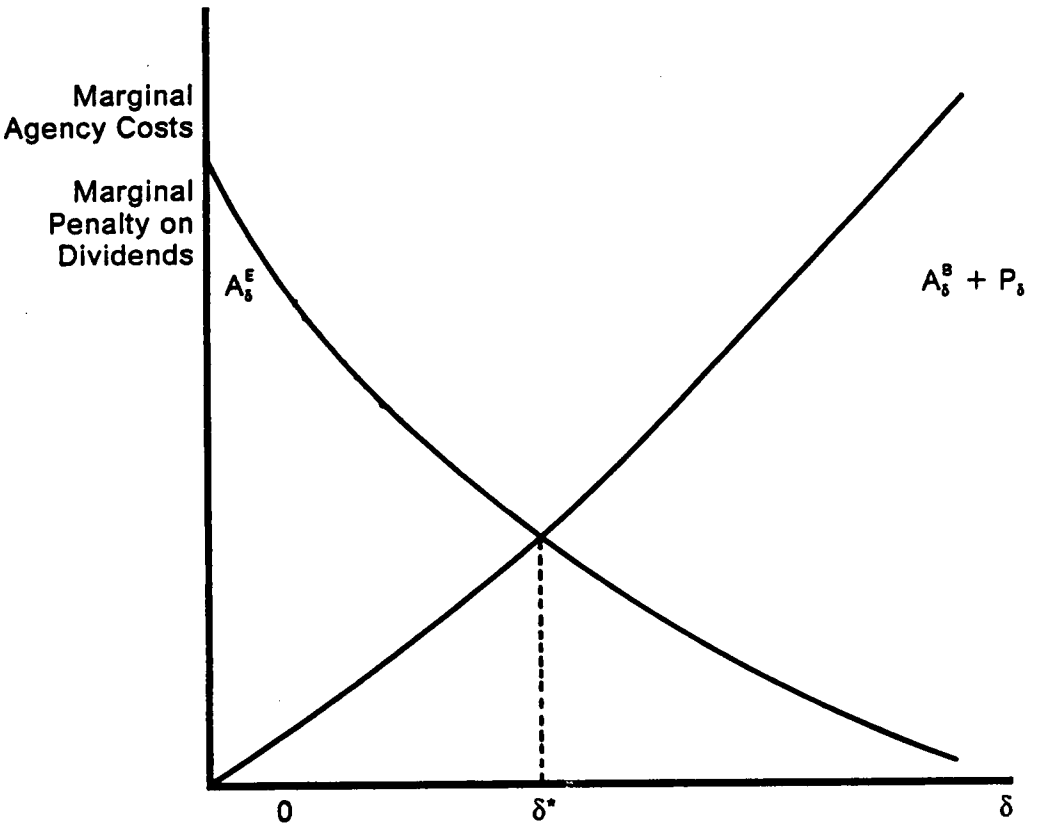

Figure 7. Optimal Dividend Payout: Optimal dividend payout ratio, δ, is where marginal agency costs equal marginal penalty on dividends.

$$H_{\alpha\alpha} = \begin{vmatrix} C_{\ell\ell} & C_{\ell\delta} \\ C_{\delta\ell} & C_{\delta\delta} \end{vmatrix} > 0, H_{\ell\ell} = \begin{vmatrix} C_{\alpha\alpha} & C_{\alpha\delta} \\ C_{\delta\alpha} & C_{\delta\delta} \end{vmatrix} > 0, \text{ and } H_{\delta\delta} = \begin{vmatrix} C_{\alpha\alpha} & C_{\alpha\ell} \\ C_{\ell\alpha} & C_{\ell\ell} \end{vmatrix} > 0. \quad [3.5.2]$$

and that the diagonal elements of the Hessian, $C_{\alpha\alpha}$, $C_{\ell\ell}$ and $C_{\delta\delta}$, all be positive.

3.6 The Substitutability of Ownership, Leverage and Dividends

As managerial ownership, leverage and dividends are all tools to control agency costs, they may or may not be substitutes in maximizing the value of the firm. In this section, the analytical conditions that correspond to the economic conditions of substitutability and complementability are identified. These conditions are then used to identify the impact on the endogenous variables of exogenous effects.

3.6.1 Assumptions of Substitutability

In general, the three managerial decisions need not be economic substitutes, however, leverage and dividends are presumed to be substitutes. This occurs if increases in leverage and dividends increase bond agency costs and decrease equity agency costs. Given dividends and leverage are true substitutes, then by definition, if the cost of one of the factors rise the use of that factor will decrease and the use of the other factor will rise. In other words, an increased price of leverage will cause dividends to rise and an increased price of dividends will induce a rise in the use of leverage.

In general, there is no *a priori* basis for supposing that managerial ownership is always a substitute for dividends or for leverage. Increases in managerial ownership decrease equity agency costs and decrease bond agency costs—thus, there is no basis for supposing one of these effects always dominates the other. If an increased price of managerial ownership causes leverage and dividends to rise, then ownership is a substitute for leverage and dividends. However, if an increase in the price of managerial ownership induces a decrease in leverage or in dividends, which would occur if the marginal debt agency costs of leverage and dividends shift greatly with changes in ownership, ownership is a complement of leverage and dividends.

3.6.2 *Implications of Substitutability*

Analytically, when the factors can be defined as substitutes or complements, the signs of the determinants two by two non-diagonal matrices are known. This is seen as follows.

3.6.2.1 Substitutability and Managerial Ownership

As discussed previously, leverage and dividends may be substitutes or complements of managerial ownership. If they are substitutes, then $\frac{\partial \ell}{\partial A_\alpha^E} > 0$ and $\frac{\partial \delta}{\partial A_\alpha^E} > 0$. If they are complements, then $\frac{\partial \ell}{\partial A_\alpha^E} < 0$ and $\frac{\partial \delta}{\partial A_\alpha^E} < 0$. This assumes that companies are already at equilibrium. If the marginal equity costs shift, these partials indicate the direction of the change of leverage and dividend policy.

Analytically:

$$\frac{\partial \ell}{\partial A_\alpha^E} = -\frac{1}{H}\left|\frac{\partial(C_\alpha, C_\ell, C_\delta)}{\partial(\alpha, A_\alpha^E, \delta)}\right| = -\frac{1}{H}\begin{vmatrix} C_{\alpha\alpha} & 1 & C_{\alpha\delta} \\ C_{\ell\alpha} & 0 & C_{\ell\delta} \\ C_{\delta\alpha} & 0 & C_{\delta\delta} \end{vmatrix}$$

$$= -\frac{1}{H}[-(C_{\ell\alpha}C_{\delta\delta} - C_{\delta\alpha}C_{\ell\delta})] = -\frac{1}{H}(-H_{\alpha\ell}). \qquad [3.6.1]$$

Thus, if leverage and managerial ownership are substitutes, then $H_{\alpha\ell} = H_{\ell\alpha} > 0$. If they are complements $H_{\alpha\ell} = H_{\ell\alpha} < 0$.

Analyzing the substitutability of managerial ownership and dividends:

$$\frac{\partial \delta}{\partial A_\alpha^E} = -\frac{1}{H}\left|\frac{\partial(C_\alpha, C_\ell, C_\delta)}{\partial(\alpha, \ell, A_\alpha^E)}\right| = -\frac{1}{H}\begin{vmatrix} C_{\alpha\alpha} & C_{\alpha\ell} & 1 \\ C_{\ell\alpha} & C_{\ell\ell} & 0 \\ C_{\delta\alpha} & C_{\delta\ell} & 0 \end{vmatrix}$$

$$= -\frac{1}{H}(H_{\alpha\delta}) \qquad [3.6.2]$$

If dividends and managerial ownership are substitutes, this is positive leading to $H_{\alpha\delta} = H_{\delta\alpha} < 0$, and if they are complements, $H_{\alpha\delta} = H_{\delta\alpha} > 0$.

3.6.2.2 The Substitutability of Leverage and Dividends

The sign of $H_{\ell\delta} = H_{\delta\ell}$ are known because in this model leverage and dividends are assumed to be substitutes. An increased cost of leverage should lead to an increase in the quantity of dividends.

Examining the impact on dividends of an increase in A_ℓ^B :

$$\frac{\partial \delta}{\partial A_\ell^B} = -\frac{1}{H}\begin{vmatrix} C_{\alpha\alpha} & C_{\alpha\ell} & 0 \\ C_{\ell\alpha} & C_{\ell\ell} & 1 \\ C_{\delta\alpha} & C_{\delta\ell} & 0 \end{vmatrix} = -\frac{1}{H}(-H_{\ell\delta})$$

$$= \frac{H_{\ell\delta}}{H} > 0, \qquad [3.6.3]$$

hence $H_{\ell\delta} = H_{\delta\ell} > 0$. In words, as the marginal cost of leverage rises, use of dividends will rise and visa versa.

3.7 Comparative Statics of the Model: General

3.7.1 Introduction

In general, different firms have different levels and types of agency problems so they choose different levels of managerial ownership, leverage and dividends. However, through comparative static analysis, the model will indicate how changes in exogenous effects impact upon the decision variables.

Exogenous variables that affect the agency problem include a Myers' growth variable, a Jensen free cash flow variable, firm risk, the diversification of the firm, probable bankruptcy costs and flotation costs.

3.7.2 *Firm Diversification*

In this model managers are compensated for the lack of diversification of personal wealth. Thus, the more diversified the firm is, the more diversified managerial holdings in the firm become, so the less managers must be compensated for the lack of diversification from holding the firm's stock. From the model:

$$C_{\alpha\lambda} = f_{\alpha\lambda} < 0, \quad C_{\ell\lambda} = 0, \quad \text{and} \quad C_{\delta\lambda} = 0, \qquad [3.7.1]$$

where:

λ = firm diversification.

This leads to the following comparative static effects:

$$\frac{\partial \alpha}{\partial \lambda} = -\frac{1}{H}(\underset{-}{f_{\alpha\lambda}})[\underset{+}{H_{\alpha\alpha}}] > 0, \qquad [3.7.2]$$

$$\frac{\partial \ell}{\partial \lambda} = -\frac{1}{H}(\underset{+}{-f_{\alpha\lambda}})\underset{?}{H_{\alpha\ell}} = ??, \quad \text{and} \qquad [3.7.3]$$

$$\frac{\partial \delta}{\partial \lambda} = -\frac{1}{H}(\underset{-}{f_{\alpha\lambda}})\underset{?}{H_{\alpha\delta}} = ??. \qquad [3.7.4]$$

As the firm becomes more diversified, the cost of α falls so α rises. The signs of $\frac{\partial \ell}{\partial \lambda}$ and $\frac{\partial \delta}{\partial \lambda}$ depend on whether ℓ and δ are substitutes or complements of α. If ℓ and α are substitutes $H_{\alpha\ell} > 0$ so $\frac{\partial \ell}{\partial \lambda} < 0$; if they are complements $H_{\alpha\ell} < 0$ so $\frac{\partial \ell}{\partial \lambda} > 0$. If δ and α are substitutes $H_{\alpha\delta} < 0$ so $\frac{\partial \delta}{\partial \lambda} < 0$; if they are complements $H_{\alpha\delta} > 0$ so $\frac{\partial \delta}{\partial \lambda} > 0$.

3.7.3 *Flotation Costs*

Flotation costs for issuing new equity, φ, affect the choice of dividends and may affect managerial ownership and leverage. To determine the effects of changes in flotation costs on the three choice variables, the following cross partial derivatives of the cost functions are obtained:

$$\frac{\partial C_\alpha}{\partial \varphi} = 0, \quad \frac{\partial C_\ell}{\partial \varphi} = 0, \quad \text{and} \quad \frac{\partial C_\delta}{\partial \varphi} = P_{\delta\varphi} > 0. \qquad [3.7.5]$$

The sign of $P_{\delta\varphi}$ is positive as the marginal penalty for dividends rises as flotation costs increase. The effects of flotation costs on the endogenous variables are:

$$\frac{\partial \alpha}{\partial \varphi} = -\frac{1}{H}(\underset{+}{P_{\delta\varphi}})\underset{?}{H_{\delta\alpha}} = ??, \qquad [3.7.6]$$

$$\frac{\partial \ell}{\partial \varphi} = -\frac{1}{H}(\underset{-}{-P_{\delta\varphi}})\underset{+}{H_{\delta\ell}} > 0, \text{ and} \qquad [3.7.7]$$

$$\frac{\partial \delta}{\partial \varphi} = -\frac{1}{H}(\underset{+}{P_{\delta\varphi}})\underset{+}{H_{\delta\delta}} < 0 \qquad [3.7.8]$$

The effect of flotation costs on α will be positive if α and δ are substitutes as $H_{\delta\alpha} < 0$, and the effect will be negative if they are complements because $H_{\delta\alpha} > 0$. In any case, $\frac{\partial \alpha}{\partial \theta}$ should have the opposite sign of $\frac{\partial \delta}{\partial \lambda}$ as they both depend on the indeterminate $H_{\delta\alpha}$.

3.7.4 *Risk of the Firm*

Firm risk is hypothesized to affect bankruptcy probability and equity agency costs. Firms with more stable earnings will have lower monitoring costs than those with less stable earnings and security returns. Because firm risk affects equity agency costs which affects all of the decision variables plus bankruptcy costs, the sign of risk will be indeterminate:

$$\frac{\partial C_\alpha}{\partial \theta} = A^E_{\alpha\theta} < 0, \quad \frac{\partial C_\ell}{\partial \theta} = \underset{-}{A^E_{\ell\theta}} + \underset{+}{\gamma_{\ell\theta}} = ??, \text{ and } \frac{\partial C_\delta}{\partial \theta} = A^E_{\delta\theta} < 0, \quad [3.7.9]$$

where:

θ = firm risk.

Therefore:

$$\frac{\partial \alpha}{\partial \theta} = -\frac{1}{H}[\underset{-}{A^E_{\alpha\theta}}\underset{+}{H_{\alpha\alpha}} - \underset{?}{A^E_{\ell\theta}}\underset{?}{H_{\ell\alpha}} + \underset{-}{A^E_{\delta\theta}}\underset{?}{H_{\delta\alpha}}] = ??, \quad [3.7.10]$$

$$\frac{\partial \ell}{\partial \theta} = -\frac{1}{H}[-\underset{-}{A^E_{\alpha\theta}}\underset{?}{H_{\alpha\ell}} + \underset{?}{A^E_{\ell\theta}}\underset{+}{H_{\ell\ell}} - \underset{-}{A^E_{\delta\theta}}\underset{+}{H_{\delta\ell}}] = ??, \text{ and} \quad [3.7.11]$$

$$\frac{\partial \delta}{\partial \theta} = -\frac{1}{H}[\underset{-}{A^E_{\alpha\theta}}\underset{?}{H_{\alpha\delta}} - \underset{?}{A^E_{\ell\theta}}\underset{+}{H_{\ell\delta}} + \underset{-}{A^E_{\delta\theta}}\underset{+}{H_{\delta\delta}}] = ??. \quad [3.7.12]$$

If the effect of firm risk is only on bankruptcy costs rather than agency costs, or the bankruptcy cost effect dominates the the signs of $\frac{\partial \ell}{\partial \theta}$ and $\frac{\partial \delta}{\partial \theta}$ become determinate.

The affect on the first order conditions would be:

$$\frac{\partial C_\alpha}{\partial \theta} = 0, \quad \frac{\partial C_\ell}{\partial \theta} = \gamma_{\ell\theta} > 0, \text{ and } \frac{\partial C_\delta}{\partial \theta} = 0. \qquad [3.7.13]$$

The sign of $\theta_{\ell\theta}$ is positive because an increase in probability of bankruptcy shifts the bankruptcy cost function up, increasing the bankruptcy function. The resulting comparative statics are:

$$\frac{\partial \alpha}{\partial \theta} = -\frac{1}{H}(\underset{+}{-\theta_{\ell\gamma}})\underset{?}{H_{\ell\alpha}} = ??, \qquad [3.7.14]$$

$$\frac{\partial \ell}{\partial \theta} = -\frac{1}{H}(\underset{+}{\gamma_{\ell\theta}})\underset{+}{H_{\ell\ell}} < 0, \text{ and} \qquad [3.7.15]$$

$$\frac{\partial \delta}{\partial \theta} = -\frac{1}{H}(\underset{+}{-\gamma_{\ell\theta}})\underset{+}{H_{\ell\delta}} > 0. \qquad [3.7.16]$$

The sign of $\frac{\partial \alpha}{\partial \theta}$ depends on whether α and ℓ are substitutes or complements; if they are substitutes $\frac{\partial \alpha}{\partial \theta} < 0$ while if they are complements $\frac{\partial \alpha}{\partial \theta} > 0$. However, if bankruptcy affects agency costs, the expected signs are indeterminate.

3.7.5 Myers' Growth Variable

Myers hypothesizes that firms with high growth rates have greater debt agency costs. Because agency costs affect financial decision making, the Myers' growth variable may also affect managerial ownership and dividends. Taking the partial derivative of the first order conditions with resect to Myers' growth (m), yields

$$\frac{\partial C_\alpha}{\partial m} = A^B_{\alpha m} < 0, \quad \frac{\partial C_\ell}{\partial m} = A^B_{\ell m} > 0, \text{ and } \frac{\partial C_\delta}{\partial m} = A^B_{\delta m} > 0 \qquad [3.7.17]$$

Because agency costs of bonds are in all three first order conditions, the effect of the Myers' growth variable on the endogenous variables is complex:

$$\frac{\partial \alpha}{\partial m} = -\frac{1}{H}\left[\underset{-}{A^{B}_{\alpha m}}\underset{+}{H_{\alpha\alpha}} - \underset{+}{A^{B}_{\ell m}}\underset{?}{H_{\ell\alpha}} + \underset{+}{A^{B}_{\delta m}}\underset{?}{H_{\delta\alpha}}\right] = ??, \qquad [3.7.18]$$

$$\frac{\partial \ell}{\partial m} = -\frac{1}{H}\left[-\underset{+}{A^{B}_{\alpha m}}\underset{?}{H_{\alpha\ell}} + \underset{+}{A^{B}_{\ell m}}\underset{+}{H_{\ell\ell}} - \underset{+}{A^{B}_{\delta m}}\underset{+}{H_{\delta\ell}}\right] = ?? \text{ and} \qquad [3.7.19]$$

$$\frac{\partial \delta}{\partial m} = -\frac{1}{H}\left[\underset{-}{A^{B}_{\alpha m}}\underset{?}{H_{\alpha\delta}} - \underset{+}{A^{B}_{\ell m}}\underset{+}{H_{\ell\delta}} + \underset{+}{A^{B}_{\delta m}}\underset{+}{H_{\delta\delta}}\right] = ??. \qquad [3.7.20]$$

The effect of the growth variable on managerial ownership, leverage, and dividends is indeterminate. Myers argues this growth variable should decrease leverage, but because both managerial ownership and dividends affect bond agency costs, this model does not show an unambiguous relationship. However, if dividends and leverage are substitutes for managerial ownership, $\frac{\partial \alpha}{\partial m} > 0$; as the Myers' growth problem increases the cost of leverage increases and more managerial ownership will be used. Also, if the marginal effects of dividends and managerial ownership in controlling the Myers' growth agency problem approach zero, Myers' expected result will follow: $\frac{\partial \ell}{\partial m} < 0$.

3.7.6 The Jensen Free Cash Flow Variable

A firm with high free cash flow has high cash flow but few good investments opportunities. Managers of this firm may then overinvest in negative net present value projects thus reducing stock value. Because the Jensen free cash flow variable, j,

affects equity agency costs, all three of the decision variables may be affected and the signs are generally indeterminate:

$$\frac{\partial C_\alpha}{\partial j} = A^E_{\alpha j} < 0, \quad \frac{\partial C_\ell}{\partial j} = A^E_{\ell j} < 0, \text{ and } \frac{\partial C_\delta}{\partial j} = A^E_{\delta j} < 0. \qquad [3.7.21]$$

So that:

$$\frac{\partial \alpha}{\partial j} = -\frac{1}{H}[\underset{-}{A^E_{\alpha j}}\underset{+}{H_{\alpha\alpha}} - \underset{-}{A^E_{\ell j}}\underset{?}{H_{\ell\alpha}} + \underset{-}{A^E_{\delta j}}\underset{?}{H_{\delta\alpha}}] = ?? \qquad [3.7.22]$$

$$\frac{\partial \ell}{\partial j} = -\frac{1}{H}[-\underset{-}{A^E_{\alpha j}}\underset{?}{H_{\alpha\ell}} + \underset{-}{A^E_{\ell j}}\underset{+}{H_{\ell\ell}} - \underset{-}{A^E_{\delta j}}\underset{+}{H_{\delta\ell}}] = ?? \qquad [3.7.23]$$

$$\frac{\partial \delta}{\partial j} = -\frac{1}{H}[\underset{-}{A^E_{\alpha j}}\underset{?}{H_{\alpha\delta}} - \underset{-}{A^E_{\ell j}}\underset{+}{H_{\ell\delta}} + \underset{-}{A^E_{\delta j}}\underset{+}{H_{\delta\delta}}] = ?? \qquad [3.7.24]$$

Jensen assumes higher levels of j will lead to higher leverage, but the affect is actually ambiguous because managerial ownership and dividends also control the equity agency problem. If the assumption is made that leverage is unique in controlling this agency problem, so the $A^E_{\alpha j}$ and $A^B_{\delta j}$ are close to zero, then $\frac{\partial \ell}{\partial j} > 0$ as Jensen predicts.

3.8 Summary

The three equation theoretical model leads to three equilibrium conditions for minimizing agency costs. Disturbing these equilibriums, comparative statics were performed which gave only four definite predictions of the model. The many indeterminate comparative statics are due to the possible interactions between the dependent variables in controlling agency costs.

Chapter IV

Methodology and Data

4.1 Introduction

The comparative statics of the model produce testable empirical implications. This chapter describes a linear econometric model, of the comparative statics, the variables used in this model, and the data used to test the model.

4.2 Empirical Model

The empirical model of the comparative static analysis of the agency model tested in this dissertation is as follows:

$$\alpha_i = a_0 + \underset{+}{a_1}\lambda_i + \underset{?}{a_2}\theta_i + \underset{\cdot}{a_3}\varphi_i + \underset{?}{a_4}m_i + \underset{?}{a_5}j_i + \varepsilon_{i\alpha}, \qquad [4.2.1]$$

$$\ell_i = b_0 + \underset{?}{b_1}\lambda_i + \underset{?}{b_2}\theta_i + \underset{+}{b_3}\varphi_i + \underset{?}{b_4}m_i + \underset{?}{b_5}j_i + \varepsilon_{i\ell}, \text{ and} \qquad [4.2.2]$$

$$\delta_i = c_0 + \underset{*}{c_1}\lambda_i + \underset{?}{c_2}\theta_i + \underset{-}{c_3}\varphi_i + \underset{?}{c_4}m_i + \underset{?}{c_5}j_i + \varepsilon_{i\delta}\,, \qquad [4.2.3]$$

where the variables are defined as in the last chapter:

α_i = managerial ownership of firm i,

ℓ_i = outside leverage ratio of firm i,

δ_i = dividend to asset ratio of firm i,

λ_i = firm i diversification,

θ_i = risk of firm i,

φ_i = flotation costs of firm i,

m_i = Myers' agency variable of firm i,

j_i = Jensen free cash flow variable of firm i,

ε_j = error term for firm i for dependent variables, ($j = \alpha, \ell$, and δ).

The a_0 - a_5, b_0 - b_5, and c_0 - c_5 are the coefficients to be estimated. The + or - underneath the coefficients indicate the sign expected by the comparative statics, the * indicates the signs of the coefficients are expected to be opposite, and the ? indicates the sign is theoretically indeterminate. The definite signs are that increased diversification impacts positively on managerial ownership, greater flotation cost impacts positively on leverage and negatively on dividends, and diversification has the opposite effect on dividends to the effect of flotation on managerial ownership. The empirical signs on firm risk may reveal whether bankruptcy probability or agency costs are the dominant effect of the variable. Also, the empirical signs of the indeterminate relationships in the model may lead to findings on whether or not managerial ownership is a substitute for leverage and dividends, and may reveal how financial decisions are used to control agency problems. If φ impacts positively on managerial ownership and λ impacts negatively on dividends, then managerial ownership and

dividends are revealed to be substitutes. If m has a negative impact on leverage and an insignificant effect on dividends and managerial ownership then leverage is revealed to be more useful than either ownership or dividends in controlling the Myers' growth problem. If j has a positive impact on leverage and an insignificant impact on managerial ownership and and dividends, then leverage is revealed to best control the free cash flow problem as Jensen hypothesizes. The results may also reveal the extent of substitutability between the endogenous variables.

The ordinary least squares (OLS) regression specifications [4.2.1 - 4.2.3] assume the endogenous variables are linear functions of the exogenous variables. Though this functional form is ad hoc, previous tests of agency theory have assumed essentially the same linear form (Rozeff; Bradley, Jarrell and Kim; and Long and Malitz).

4.3 Measurement of Dependent Variables

The three dependent variables of the model are managerial ownership, leverage and dividends.

4.3.1 Managerial Ownership

In the Jensen and Meckling model there is a single owner-manager who makes all of the firm's decisions, yet most corporations have many managers who control the firm's decision making. In this study, managerial ownership is measured by the percentage of the firm's common stock directly owned by officers and directors. The

number of shares owned by these individuals is collected from *Spectrum 6* [CDA Corporate Directory]; where only ownership codes of O, H or D for officers and directors are used, and only for direct ownership. Therefore managerial ownership, for firm i at time t, OWN_{it}, is measured as

$$OWN_{it} = \frac{O\&D\_SHRS_{it}}{TOT\_SHRS_{it}}, \qquad [4.3.1]$$

where:

$O\&D\_SHRS_{it}$ = total number of shares held by officers and directors of firm i at the end of year t (*Spectrum 6*), and

TOT_SHRS_{it} = the total shares outstanding of firm i's common stock at the end of year t, (COMPUSTAT Annual Item #25).

This ownership variable differs from the managerial ownership variable used by Rozeff and by Kim and Sorensen who use all of insiders' ownership as recorded in *Value Line*. One bias from using total insider ownership is that it can include bankers or other institutions that do business with the company, but do not control decision making. The measure of board and officer ownership used in this study is often much smaller than insider ownership reported by *Value Line*.

4.3.1.1 Leverage

The leverage ratio used in this study is the outside long-term debt ratio:

$$LEV_{it} = \frac{LTDEBT_{it}}{LTDEBT_{it} + MVCS^{o}_{it}}, \qquad [4.3.2]$$

where:

$LTDEBT_{it}$ = total long-term debt firm i year t (COMPUSTAT Annual Item #9),

$MVCS^{o}_{it}$ = market value of common stock held by non-managers in year t for firm i,
= $TOT\_SHRS_{it}(1 - OWN_i) \times MPRICE\_CS_{it}$,

TOT_SHRS_{it} = total shares of common stock in year t for firm i (COMPUSTAT Annual Item #25), and

$MPRICE\_CS_{it}$ = year end closing market price of common stock of firm i in year t (COMPUSTAT Annual Item #24).

The outside leverage ratio, therefore, is a mixture of market and book values. Most prior studies measure leverage as total debt to total assets, here, outside leverage is used because it is indicated by the model.

4.3.2 Dividends

The dividend measure is total common stock dividends divided by the market value of common stock,

$$DIV_{it} = \frac{COM\_DIV_{i,t}}{TOT\_SHRS_{i,t} \times MPRICE\_CS_{i,t}}, \qquad [4.3.3]$$

where:

COM_DIV_{it} = total common stock cash stock dividends of firm i in year t (COMPUSTAT Annual Item #21).

In his analysis of dividends Rozeff used the dividend payout ratio. However, if the dividend decision is a long-run decision, then use of the payout ratio will tend to reflect earnings variability more and long-term dividend policy less. To eliminate the problem introduced by volatility of earnings, as well as the problems created by negative dividend payout ratios, the dividend to market value of equity is used in this study.

4.4 Measurement of Independent Variables

Six independent variables are included in the econometric model: firm diversification, bankruptcy probability, flotation costs, a measure of Myers' growth, and a measure of Jensen's free cash flow.

4.4.1 Firm Diversification

The extent of firm diversification is measured in a risk return framework. In general, if the manager who derives utility from her personal portfolio decisions holds only the optimal market risky asset portfolio (M) combined with the risk free asset, which has a risk free return, R_F, then according to CAPM this manager will attain highest utility. However, the equilibrium condition of the Jensen and Meckling model recognized that the manager can reduce agency costs by increasing investment in the firm, but this results in a non-optimally diversified portfolio. To measure the opportunity losses from holding a portfolio overinvested in the company's stock and the risk free

asset, the diversification opportunity set from holding only the firm and the risk free asset is used. This firm specific measure is:

$$\lambda_I = \frac{E(R_I) - R_F}{\sigma_I} , \qquad [4.3.4]$$

where:

$E(R_i)$ = expected return firm i,

R_F = risk free rate,

σ_I = standard deviation of returns for firm i.

Thus, this measure is equal to Sharpe's performance measure, (Levy and Sarnat, [1984]). From the CAPM, the larger this measure, the lower are the opportunity losses from overinvesting in the firm. This is depicted in Figure 8 where the slope of the market line through (R_FM) is highest, and $\lambda_I > \lambda_J$. If the manager invests all of her personal wealth in a mixture of firm i and the risk free asset, she is better off than if she had to mix only firm j's stock with the risk free asset. Thus the manager will require higher compensation for the lack of diversification, that is the lower is λ.

To compute λ, the firm's expected return is measured as the nine year average of monthly returns over the 1977-1985 period. Rates of return are obtained from the CRSP Data file. The firms' rate of return standard deviation is measured over the same period. The risk free rate is the average of the monthly rate on three month treasury bills from *SAS Citibase* measured over the same nine year period. Figure 9 shows the graph of returns and standard deviations for the firms in this sample.

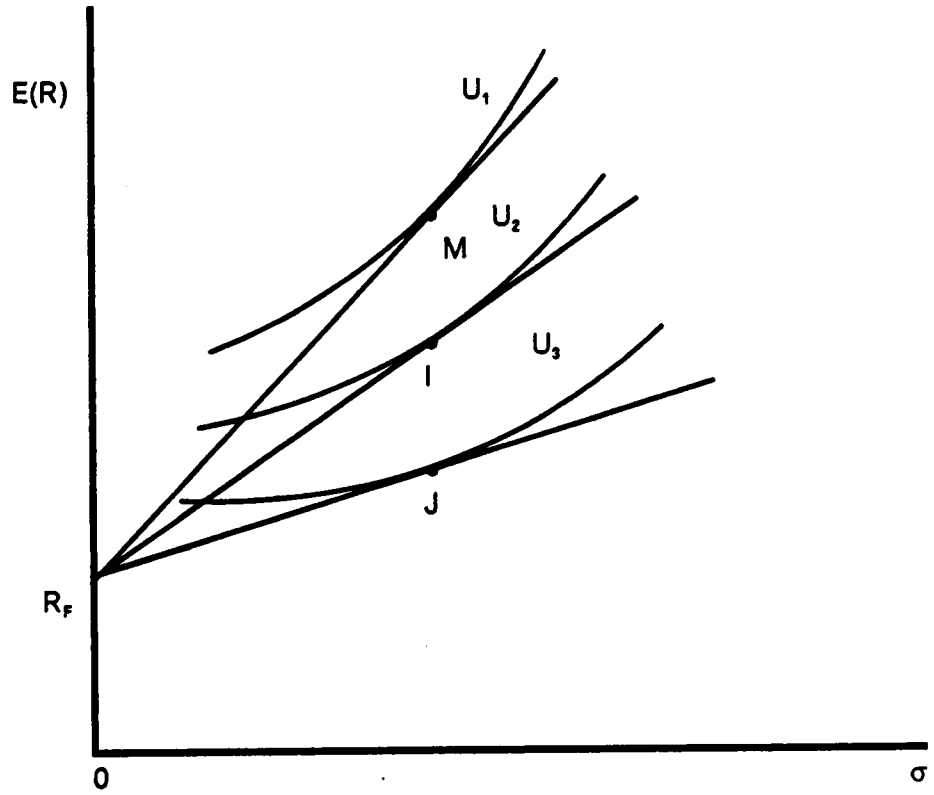

Figure 8. Diversification Measure: The the slope of R_FI reflects how well diversified firm i is.

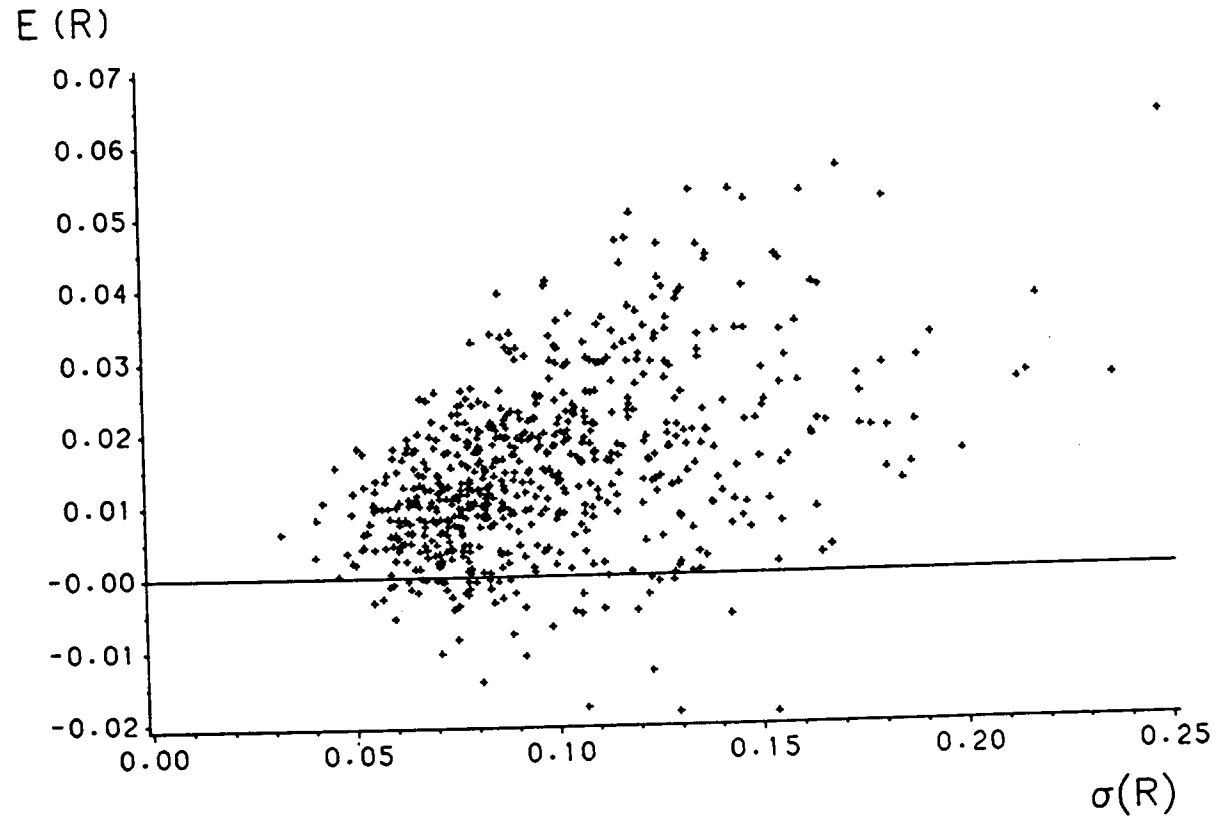

Figure 9. Sample Expected Return and Standard Deviation: Monthly expected return and standard deviation from 1977-1985.

4.4.2 *Flotation Costs*

Flotation costs are the costs of issuing new equity. *Ex ante*, flotation costs cannot be measured so a proxy must be constructed for these costs. A primary determinant of these costs has been shown to be the standard deviation of firm returns, while the evidence has been mixed on how well β is correlated with flotation costs (Hansen and Torregrosa [1987]). The higher the standard deviation, the higher the issuance costs as underwriters charge more for issuing securities of riskier firms. This study therefore uses standard deviation of firm returns, σ_i, to proxy for firm i's flotation costs.

4.4.3 *Firm Risk*

Firm risk is measured by the standard deviation of net operating income, deflated by assets. This measure is also used by Kim and Sorensen. It is a good proxy for firm risk as it measures how consistently the firm is able to pay interest costs. Firm risk is measured by the standard deviation of annual return on assets:

$$\theta_i = STD(ROA_{ti}) = STD\left(\frac{NOI_{ti}}{ASSETS_{ti}}\right), \qquad [4.4.5]$$

from 1972 to 1985, where:

NOI_{ti} = Net operating income year t for firm i (Annual COMPUSTAT #13 minus #14), and

$ASSETS_{ti}$ = total assets year t for firm i (Annual COMPUSTAT #6).

4.4.4 *Myers' Growth Variable*

The Myers' growth variable should measure the extent to which a firm has discretionary investment opportunities. Myers hypothesizes that firms with many investment opportunities relative to assets in place will have greater debt agency costs and, therefore, lower leverage. In practice, this has been measured by how growth oriented a firm is. Two measures in the extant literature are Bradley, Jarrell and Kim's use of research and development plus advertising divided by sales, and Long and Malitz's separate use of advertising and sales, each standardized by assets plus total capitalization. This study examines both measures plus a variation combining the two:

$$MYERS1_{it} = \frac{R\&D_{it} + ADV_{it}}{SALES_{it}}, \qquad [4.4.6]$$

where:

$R\&D_{it}$ = Research and Development expenses year t for firm i (Annual COMPUSTAT #46),

ADV_{it} = Advertising Expense year t for firm i (Annual COMPUSTAT #45),

$SALES_{it}$ = Total sales year t for firm i (Annual COMPUSTAT #12).

MYERS2 and MYERS3 are separated into two parts as Long and Malitz's measure is:

$$MYERS2A_{it} = \frac{R\&D_{it}}{ASSETS_{it}}, \qquad [4.4.7]$$

$$MYERS2B_{it} = \frac{ADV_{it}}{ASSETS_{it}}, \qquad [4.4.8]$$

$$MYERS3A_{it} = \frac{R\&D_{it}}{SALES_{it}} \text{ , and} \qquad [4.4.9]$$

$$MYERS3B_{it} = \frac{ADV_{it}}{SALES_{it}} \text{ .} \qquad [4.4.10]$$

All measures of Myers' growth variable are subject to a missing values problem. For firms examined in this study, both R&D and Advertising are often reported as missing on the COMPUSTAT tapes with a value of .0008 denoting a missing observation. To overcome this problem, this study assigns the mean value of the non-missing data to all missing values of the Myers' variable. This zero-order regression method is discussed by Maddala, *Econometrics* [1977], and its use gives unbiased estimates.

4.4.5 Jensen Free Cash Flows

To measure Jensen free cash flow, Barclay and Litzenberger used Tobin's Q and found no supporting evidence for the Jensen free cash flow hypothesis. As Barclay and Litzenberger's test did not support Jensen's theory, this study will examine a simple cash flow to asset ratio:

$$JENSEN1_{it} = \frac{NI_{it} + DEPR_{it} + INT_{it}}{ASSETS_{it}} \text{ ,} \qquad [4.4.11]$$

where:

NI_{it} = Net income year t for firm i (Annual COMPUSTAT #18), and

$DEPR_{it}$ = depreciation expense year t for firm i (Annual COMPUSTAT #14).

INT_{it} = interest expense year t for firm i (Annual COMPUSTAT #15).

and ASSETS are defined above.

One potential problem with this Jensen variable is that it may be high for firms with high free cash flow and for firms with relatively high cash flow that is not free, perhaps committed to investment. To remove the bias, an alternative measure will also be tested:

$$JENSEN2_{it} = \frac{JENSEN1_{it}}{1 + EMGROW_{it}}, \qquad [4.4.12]$$

where EMGROW measures the growth rate in the firm's historical employment level, and it is obtained by regressing relative employment on time:

$$\ln\left(\frac{EMPL_{ti}}{EMPL_{76i}}\right) = \alpha + \beta_i t + \varepsilon_t \qquad [4.4.13]$$

where:

t = an index from 0 to 9,

β = the estimated growth rate of employment, and

$EMPL_{it}$ = number of employees for firm i year t (Annual COMPUSTAT #29).

JENSEN2 thus adjusts JENSEN1 for the growth in the firm's output, where the proxy measure for output is growth in the firm's employment. When β_i is positive employment is rising, when β_i is negative employment is falling. An employment trend is used rather than an investment trend as the data cannot reflect whether the investment is profitable or unprofitable.

To provide insight into the behavior of these free cash flow measures, the average JENSEN1 and JENSEN2 are calculated for each COMPUSTAT two digit industry grouping. The resulting list of industries ranked by the mean of the respective JENSEN variables are presented in Table 1 and Table 2. These tables show that petroleum production and petroleum refining are in the top ten of both the JENSEN1 and JENSEN2 rankings. For industry classifications having ten or more firms, the two oil industry groups are ranked number two and four respectively for both variables. This high rank for the oil industries is anticipated by Jensen, who singles out the oil industry as a prime example of an industry with a serious free cash flow problem.

4.5 Sample Description

The sample of firms used in this study contains all firms which meet the following criteria:

1. Industrial firms that have complete data except for the Myers' variable on the Annual Industrial COMPUSTAT from 1981 to 1985. Thus the sample excludes utilities and financial institutions.
2. All firms must have complete returns of the CRSP monthly file from 1976 to 1985,
3. All firms must be present in the *Spectrum 6* Insider Holdings Series published by Computer Directions Advisors, Inc. for at least three of the years 1981-1985.

As a result of the sample criteria, a total sample size of 603 firms is obtained.

Firms must meet criteria 1 because many of the variables are measured as averages of annual data over years 1981 though 1985. Criteria 2 is required to measure the

TABLE 1
Jensen Free Cash Flow By Industry

JENSEN1
(Sorted by Descending Mean)
N = 603

Obs	Industry	Mean	Minimum	Maximum	N
1	ELECTRIC SERVICES	0.197412	0.17217	0.222656	2
2	AUTO REPAIR,SERVICES,GARAGES	0.190385	0.19038	0.190385	1
3	TRUCKING,LOCAL,LONG DISTANCE	0.176293	0.09200	0.299447	8
4	EATING PLACES	0.159973	0.13298	0.198508	5
5	HOTELS,MOTELS,TOURIST COURTS	0.156350	0.15328	0.159415	2
6	PRINTING,PUBLISHING & ALLIED	0.147044	0.03577	0.199032	13
7	CIGARETTES	0.143830	0.14097	0.146687	2
8	CRUDE PETROLEUM & NATURAL GS	0.142619	0.09587	0.191705	15
9	FOOD AND KINDRED PRODUCTS	0.142039	0.05907	0.216677	31
10	PETROLEUM REFINING	0.139887	0.08180	0.191490	21
11	GROCERY STORES	0.136653	0.07298	0.212892	13
12	MISC NONMETAL MINERALS, NEC	0.134809	0.08062	0.189003	2
13	MOTION PICTURE PRODTN, SVCS	0.134416	0.03206	0.271369	3
14	CHEMICALS & ALLIED PRODS	0.134331	-0.02098	0.214452	57
15	RUBBER & MISC PLASTICS PRODS	0.132749	0.06664	0.223607	13
16	TRANSPORTATION SERVICES	0.132746	0.08743	0.169026	3
17	ENGR, ARCHITECT, SURVEY SVCS	0.131773	0.06792	0.187307	3
18	PERSONAL SERVICES	0.131549	0.11378	0.149315	2
19	LUMBER & OTH BLDG MATL-RETL	0.130245	0.13023	0.130262	2
20	TELEPHONE COMM (WIRE, RADIO)	0.129739	0.08721	0.164437	13
21	APPAREL AND ACCESSORY STORES	0.128196	0.06843	0.164461	6
22	NURSING & PERSONAL CARE FAC	0.126219	0.05327	0.178539	5
23	DRUG & PROPRIETARY STORES	0.124245	0.06776	0.170843	10
24	PAPER AND ALLIED PRODUCTS	0.123912	0.08368	0.191336	21
25	ELEC,ELECTR MACH,EQ,SUPPLY	0.123509	-0.07974	0.237921	63
26	MOTOR VEHICLES & CAR BODIES	0.116408	0.00106	0.190916	34

TABLE 1(Continued)
Jensen Free Cash Flow By Industry

JENSEN1
(Sorted by Descending Mean)
N = 603

Obs	Industry	Mean	Minimum	Maximum	N
27	WATER TRANSPORTATION	0.113454	0.08227	0.131849	3
28	ADVERTISING AGENCIES	0.113402	0.05729	0.201446	10
29	DEPARTMENT STORES	0.113138	0.07346	0.163860	17
30	LUMBER AND WOOD PDS, EX FURN	0.112610	0.06849	0.150504	6
31	AUTOS & OTHER VEHICLES-WHSL	0.112365	-0.05063	0.171206	12
32	ENGR, LAB AND RESEARCH EQUIP	0.111321	-0.02632	0.171809	15
33	APPAREL & OTHER FINISHED PDS	0.111276	-0.02689	0.222914	12
34	AIR TRANSPORTATION,CERTIFIED	0.110602	0.05938	0.155402	7
35	METAL CANS, SHIPPING CONTAIN	0.108835	0.00249	0.156425	20
36	FOOTWEAR, EXCEPT RUBBER	0.106609	0.08978	0.134707	5
37	TEXTILE MILL PRODUCTS	0.105613	0.01876	0.145608	11
38	RAILROADS,LINE-HAUL OPERATNG	0.103389	0.07881	0.135256	5
39	PAPER & PAPER PRODUCTS-WHSL	0.101166	0.03050	0.157070	12
40	INTERCITY,RURAL HIGHWY TRANS	0.100997	0.10100	0.100997	1
41	OPERATIVE BUILDERS	0.095755	0.09539	0.096123	2
42	JEWELRY, PRECIOUS METAL	0.092631	-0.02139	0.155803	8
43	FLAT GLASS	0.091911	-0.19518	0.167040	17
44	RACING,INCL TRACK OPERATIONS	0.091434	0.07421	0.108661	2
45	ENGINES AND TURBINES	0.088432	-0.09514	0.184319	43
46	CONSTRUCTION-SPECIAL TRADE	0.081211	0.06592	0.096504	2
47	HOUSEHOLD FURNITURE	0.079206	0.04862	0.109791	2
48	AGRICULTURE PRODTN-LIVESTOCK	0.078828	0.07883	0.078828	1
49	BITUMINOUS COAL AND LIGNITE	0.071490	0.02213	0.131166	3
50	BLAST FURNACES & STEEL WORKS	0.065368	-0.02765	0.160267	28
51	CONSTRUCTION-NOT BLDG CONSTR	0.061367	0.05233	0.070407	2
52	METAL MINING	0.059637	-0.07439	0.167388	7
53	*******OVERALL AVERAGE	0.117706	-0.19518	0.299447	603

TABLE 2
Jensen Free Cash Flow By Industry

JENSEN2
(Sorted by Descending Mean)
N = 603

Obs	Industry	Mean	Minimum	Maximum	N
1	AUTO REPAIR,SERVICES,GARAGES	0.179988	0.17999	0.179988	1
2	ELECTRIC SERVICES	0.171821	0.14835	0.195293	2
3	TRUCKING,LOCAL,LONG DISTANCE	0.171757	0.09707	0.296064	8
4	EATING PLACES	0.151948	0.11980	0.186290	5
5	HOTELS,MOTELS,TOURIST COURTS	0.151854	0.14793	0.155780	2
6	PRINTING,PUBLISHING & ALLIED	0.145768	0.04687	0.198680	13
7	MOTION PICTURE PRODTN, SVCS	0.144145	0.03104	0.275548	3
8	CRUDE PETROLEUM & NATURAL GS	0.143609	0.10343	0.203898	15
9	FOOD AND KINDRED PRODUCTS	0.141892	0.06064	0.222791	31
10	PETROLEUM REFINING	0.140262	0.08159	0.194955	21
11	MISC NONMETAL MINERALS, NEC	0.137427	0.08616	0.188691	2
12	RUBBER & MISC PLASTICS PRODS	0.136469	0.07101	0.233025	13
13	CIGARETTES	0.136115	0.13369	0.138537	2
14	CHEMICALS & ALLIED PRODS	0.134412	-0.02074	0.209140	57
15	GROCERY STORES	0.133431	0.07327	0.204479	13
16	TELEPHONE COMM (WIRE, RADIO)	0.129351	0.08323	0.163256	13
17	ENGR, ARCHITECT, SURVEY SVCS	0.127104	0.07272	0.175968	3
18	TRANSPORTATION SERVICES	0.126769	0.09746	0.152943	3
19	APPAREL AND ACCESSORY STORES	0.125329	0.08346	0.151271	6
20	PAPER AND ALLIED PRODUCTS	0.122232	0.08826	0.190649	21
21	ELEC,ELECTR MACH,EQ,SUPPLY	0.121585	-0.08171	0.230608	63
22	LUMBER & OTH BLDG MATL-RETL	0.118420	0.11282	0.124016	2
23	WATER TRANSPORTATION	0.118110	0.09462	0.132019	3
24	MOTOR VEHICLES & CAR BODIES	0.115900	0.00130	0.209006	34
25	PAPER & PAPER PRODUCTS-WHSL	0.115482	0.03956	0.219729	12
26	DRUG & PROPRIETARY STORES	0.114568	0.07101	0.155659	10

TABLE 2(Continued)
Jensen Free Cash Flow By Industry

JENSEN2
(Sorted by Descending Mean)
N = 603

Obs	Industry	Mean	Minimum	Maximum	N
27	LUMBER AND WOOD PDS, EX FURN	0.113004	0.07152	0.144879	6
28	AUTOS & OTHER VEHICLES-WHSL	0.112800	-0.05728	0.169731	12
29	NURSING & PERSONAL CARE FAC	0.111634	0.05674	0.165019	5
30	ENGR, LAB AND RESEARCH EQUIP	0.111436	-0.02716	0.172970	15
31	METAL CANS, SHIPPING CONTAIN	0.111254	0.00275	0.157667	20
32	TEXTILE MILL PRODUCTS	0.110511	0.02068	0.147165	11
33	PERSONAL SERVICES	0.108190	0.10022	0.116164	2
34	AIR TRANSPORTATION,CERTIFIED	0.107927	0.05829	0.151679	7
35	DEPARTMENT STORES	0.107682	0.07199	0.138566	17
36	APPAREL & OTHER FINISHED PDS	0.107502	-0.03315	0.207584	12
37	INTERCITY,RURAL HIGHWY TRANS	0.107027	0.10703	0.107027	1
38	ADVERTISING AGENCIES	0.106882	0.05339	0.183186	10
39	FOOTWEAR, EXCEPT RUBBER	0.104815	0.09060	0.132448	5
40	RAILROADS,LINE-HAUL OPERATNG	0.101052	0.07798	0.130978	5
41	OPERATIVE BUILDERS	0.099102	0.09367	0.104536	2
42	RACING,INCL TRACK OPERATIONS	0.096905	0.08127	0.112536	2
43	FLAT GLASS	0.094167	-0.20721	0.164431	17
44	JEWELRY, PRECIOUS METAL	0.093374	-0.02520	0.150470	8
45	ENGINES AND TURBINES	0.091393	-0.10595	0.195390	43
46	HOUSEHOLD FURNITURE	0.085180	0.05463	0.115729	2
47	BITUMINOUS COAL AND LIGNITE	0.084227	0.02329	0.165990	3
48	CONSTRUCTION-SPECIAL TRADE	0.080073	0.06557	0.094578	2
49	AGRICULTURE PRODTN-LIVESTOCK	0.077641	0.07764	0.077641	1
50	BLAST FURNACES & STEEL WORKS	0.066425	-0.03095	0.157987	28
51	CONSTRUCTION-NOT BLDG CONSTR	0.061877	0.04978	0.073974	2
52	METAL MINING	0.059530	-0.07041	0.156162	7
53	*******OVERALL AVERAGE	0.117280	-0.20721	0.296064	603

diversification variable as well as the flotation cost variable. Criteria 3 is required to compute the managerial ownership variable. Table 3 describes the means of the variables. Each table includes the mean, median, maximum and minimum values of each variable for the subset.

TABLE 3
Sample Statistics of the Entire Sample

N = 603

Variable	Mean	Median	Minimum	Maximum
ASSETS ($,000,000)	2,330.7634	759.938	26.0714	103,150.8047
MANAGERIAL OWNERSHIP	0.0641	0.032	0.0001	0.6205
OUTSIDE LEVERAGE RATIO	0.2680	0.248	0.0000	0.9061
DIVIDENDS TO EQUITY	0.0341	0.035	0.0000	0.2003
DIVERSIFICATION MEASURE	0.0874	0.088	-0.1301	0.3459
VOLATILITY OF ROA	0.0476	0.040	0.0041	0.4346
FLOTATION COSTS	0.0982	0.094	0.0428	0.2180
MYERS1	0.0417	0.042	0.0000	0.2579
MYERS2A	0.0264	0.016	0.0000	0.3538
MYERS2B	0.0287	0.029	0.0000	0.1592
MYERS3A	0.0179	0.013	0.0000	0.1955
MYERS3B	0.0237	0.023	0.0000	0.1480
JENSEN1	0.1177	0.123	-0.1952	0.2994
JENSEN2	0.1173	0.122	-0.2072	0.2961

Chapter V

Empirical Results

5.1 The General Model

In the general model managerial ownership, leverage and dividends are regressed separately on the five independent variables. The results are shown in Table 4.

Diversification (DIVER) affects ownership positively and significantly, leverage negatively and significantly, and dividends negatively and significantly. The first relationship is predicted by the model; to reduce agency costs more diversified firms have more managerial ownership. The negative and significant impacts of diversification on leverage and dividends is consistent with the expectations that managerial ownership is a substitute for both leverage and dividends.

The impact of flotation costs (FLTCOST) also is as predicted. Flotation costs have a negative affect on dividends and this effect supports the agency theory rationale for dividends and the model predictions. Flotation costs have a positive affect on lever-

TABLE 4
General Model

N = 603

	INTERCEPT	DIVER	RISK	FLTCOST	MYERS1	JENSEN2	Adjusted R^2
OWN	-0.0265	0.1554*	0.4168*	0.5594*	-0.2461**	0.1065	0.081
	(-1.358)	(3.009)	(3.388)	(3.670)	(-2.259)	(1.240)	
LEV	0.2674*	-0.7617*	-1.8202*	2.6308*	-1.0840*	-0.5054*	0.336
	(7.882)	(-8.478)	(-8.507)	(9.923)	(-5.720)	(-3.348)	
DIV	0.0778*	-0.0387*	0.0530**	-0.4458*	-0.0866*	0.0387**	0.336
	(19.940)	(-3.740)	(2.151)	(-14.618)	(-3.974)	(2.253)	
VIF	0.00	1.320	1.414	1.446	1.016	1.412	

() indicate t-statistics
* Significant at the 1% level
** Significant at the 5% level
*** Significant at the 10% level

age which the model predicted as dividends and leverage are assumed to be substitutes. Flotation costs also have a positive effect on managerial ownership. Recall that the model predicted that this effect has to be opposite in sign of the impact of diversification on dividends, and this opposite effect is found. These opposite signs are consistent with the model, and the actual signs are further evidence that managerial ownership and dividends are substitutes.

Firm risk (RISK) affects both managerial ownership and dividends positively and significantly, and leverage negatively and significantly. The model could not predict any determinate signs as this variable affects both bankruptcy probability and agency costs. The negative effect of bankruptcy probability on leverage supports classic leverage theory if bankruptcy probability is the dominant effect in RISK, and is in contrast to the findings of Kim and Sorensen who found that standard deviation of EBIT deflated by assets is positively related to leverage. One explanation of the difference in our findings is that the sampling techniques used by Kim and Sorensen involved a matched sample technique, whereas in this study, earnings volatility is measured continuously across all firms. Also this study uses an outside leverage ratio while Kim and Sorensen use a total leverage ratio. The significantly positive impact of bankruptcy costs on dividends and managerial ownership is consistent with two ideas; that managerial ownership and dividends are substitutes of leverage, and that they are both used to control agency costs.

Managerial ownership, leverage and dividends decrease as a result of increases in MYERS1. Thus, the Myers' growth variable performs as it did in Bradley, Jarrell and Kim's results; firms with increased growth have significantly lower leverage ratios. This is consistent with the model (equation 3.7.19) if the marginal agency costs of

Myers are larger with decreases in leverage, than are the marginal debt agency costs of Myers with changes in both ownership and leverage. Furthermore, increased Myers' growth opportunities significantly affect managerial ownership and dividends. The negative affect of growth on dividends is similar to the result found by Rozeff, however, the Rozeff growth measures are actual and predicted growth in stock market. This result is consistent with the model when dividends are a substitute for both ownership and leverage. However, the results on the managerial ownership equation are inconsistent with the joint hypotheses of substitutability of ownership with leverage and dividends and the model. With the substitution assumptions, equation 3.7.18 becomes determinate and positive while it is empirically negative. It appears as if managerial ownership does not increase when debt agency costs increase, or that the Myers' growth variable does not represent a debt agency cost.

Finally, the Jensen variable affects both leverage and dividends significantly. However, the impact on leverage is not as Jensen predicted, that the increased agency costs of free cash flow would be reduced through higher leverage. The results show that high cash flow firms have lower leverage, but higher dividends. From the model, this says the effects of ownership and dividends together dominate the leverage effect due to the Jensen agency problem. One explanation for this finding is that because dividends are slightly more flexible in paying out cash while increasing leverage is a more inflexible way of controlling high free cash flow, increasing dividends may be a better method for controlling excess, particularly over a five year period as examined here. In any event, the negative and significant relationship of JENSEN2 on leverage gives no support for the Jensen theory. On the other hand, the Rozeff and Easterbrook theories are supported; firms appear to control high cash flow problems with increased dividends.

5.2 Specific Aspects of the Empirical Results

This section examines aspects of the econometric model. The findings of this examination suggest that the empirical results of the general model are quite robust.

5.2.1 Multicollinearity

There does not appear to be any serious multicollinearity problems between the independent variables. To test for multicollinearity, variance inflation factors (VIF) were computed:

$$VIF_i = \frac{1}{(1 - R_i^2)}, \qquad [5.2.1]$$

where the R_i^2 is obtained when regressing independent variable x_i on all the other independent variables in the model. The variance inflation factors in the sample are reported in Table 4. A variance inflation factor of 10 signals severe multicollinearity and a variance inflation factor of 1 arises when there is no multicollinearity. As the results of Table 4 show, the variance inflation factors are all close to one, suggesting there are no multicollinearity problems.

5.2.2 *Flotation Cost Problems*

According to some theories, the variable used as the flotation cost proxy, the standard deviation of firm returns may be affected by leverage with higher leverage firms having higher standard deviation of stock returns, *ceteris paribus*. To remove the possible difficulties introduced by using this variable, the regressions are run excluding FLTCOST and the results are shown in Table 5. The removal of FLTCOST causes the coefficient on RISK to become negative and insignificant in the dividend equation. One explanation for this sign change is that when flotation costs are removed the volatility of return on assets picks up the effect of flotation costs, causing a negative and insignificant effect of RISK on dividends. Aside from this change, the behavior of all remaining regressors is the same.

5.2.3 *Missing Values*

When collecting data, there usually are missing value problems. For the firms in this study, the R&D and advertising variables have severe missing value problems. Out of 603 observations, 272 firms were missing either R&D or advertising, or both. As described in the empirical chapter, to avoid severely reducing the sample size, the missing values for these variables are assigned the mean of the corresponding Myers' variable for firms not missing this data. This section examines if this technique has any influence on the results reported in Table 4.

MODEL I of Table 6 shows the results of the regressions when all firms with missing values for the Myers' variable are eliminated from the sample. The only significant

TABLE 5
No Flotation Cost Measure

N = 603

	INTERCEPT	DIVER	RISK	FLTCOST	MYERS1	JENSEN2	Adjusted R^2
OWN	0.0283**	0.1843*	0.6205*	-	-0.2799*	0.0151	0.061
	(2.235)	(3.574)	(5.596)		(-2.552)	(0.182)	
LEV	0.5252*	-0.6257*	-0.8618*	-	-1.2429*	-0.9353*	0.228
	(22.314)	(-6.535)	(-4.186)		(-6.103)	(-6.067)	
DIV	0.0341	-0.0616*	**-0.1094***	-	-0.0597**	0.1116*	0.099
	(11.679)	(-5.188)	**(-4.279)**		(-2.360)	(5.826)	
VIF	0.0000	1.2892	1.1258		1.0089	1.2931	

() indicate t-statistics
* Significant at the 1% level
** Significant at the 5% level
*** Significant at the 10% level

difference is that JENSEN2 is now significantly positive in the managerial ownership equation; for firms with reported R&D and advertising managerial ownership appears to be a tool to control Jensen free cash flow. Another change in significance is that the effect of risk in the dividend equation becomes insignificant. The coefficients in the leverage equation are not changed in sign, nor in significance. As an alternative check on this method for missing values, the regressions are rerun without the Myers' variable, while keeping the large sample. The results of the regressions are also shown in Table 6 MODEL II. The coefficients of the variables are very stable; they do not change with the elimination of Myers from the regression. Thus, the use of the mean value technique does not affect the regression results.

5.2.4 Alternative Myers' Measures

The variable used in the general model to measure the Myers' growth (MYERS1) is R&D plus advertising divided by sales, as suggested by Bradley, Jarrell and Kim. Long and Malitz also examine advertising and R&D, however, they separate the variables and measure them relative to assets (MYERS2A and MYERS2B respectively). Another alternative is to separate advertising and R&D and divide by sales (MYERS3A and MYERS3B respectively). The results of the regressions using these variables are reported in Table 7, MODELS I and II respectively.

Both MYERS2A and MYERS2B have significantly negative impacts on leverage, which duplicates the Long and Malitz's results. However, in the ownership and dividend equations, only MYERS2B (R&D relative to assets) has a significant impact. MYERS2A (advertising relative to assets) is insignificantly positively related to own-

TABLE 6
Missing Values Problem with Myers' Variable

MODEL I: No Firms that are Missing Myers' Variables (N = 331)

	INTERCEPT	DIVER	RISK	FLTCOST	MYERS1	JENSEN2	Adjusted R^2
OWN	-0.0682*	0.2362*	0.7920*	0.5572*	-0.2695*	**0.2274****	0.153
	(-2.639)	(3.402)	(4.651)	(2.819)	(-2.649)	**(1.946)**	
LEV	0.2736*	-0.6420*	-1.6320*	2.4937*	-1.0623*	-0.8200*	0.410
	(6.332)	(-5.527)	(-5.730)	(7.544)	(-6.245)	(-4.196)	
DIV	0.0691*	-0.0329**	**0.0234**	-0.3775*	-0.0851*	0.0608*	0.295
	(12.496)	(-2.214)	**(0.642)**	(-8.886)	(-3.915)	(2.432)	
VIF	0.0000	1.3518	1.4386	1.4745	1.0322	1.5323	

MODEL II: No Myers' Variable (N = 603)

	INTERCEPT	DIVER	RISK	FLTCOST	MYERS1	JENSEN2	Adjusted R^2
OWN	-0.0374**	0.1518*	0.4006*	0.5885*	-	0.0970	0.075
	(-1.972)	(2.931)	(3.251)	(3.862)		(1.127)	
LEV	0.2194*	-0.7777*	-1.8913*	2.7589*	-	-0.5475*	0.301
	(6.503)	(-8.439)	(-8.628)	(10.177)		(-3.576)	
DIV	0.0740*	-0.0399	0.0473***	-0.4355*	-	0.0354*	0.319
	(19.328)	(-3.818)	(1.902)	(-14.160)		(2.035)	
VIF	0.0000	1.3187	1.4091	1.4356		1.4084	

() Indicate t-statistics
* Significant at the 1% level
** Significant at the 5% level
*** Significant at the 10% level

TABLE 7
Alternative Myers' Variables

MODEL I: MYERS2 (N = 603)

	INTERCEPT	DIVER	RISK	FLTCOST	MYERS2A	MYERS2B	JENSEN2	Adjusted R^2
OWN	-0.0320*	0.1427*	0.4287*	0.6112*	**0.0970**	-0.4316*	0.1116	0.087
	(-1.666)	(2.744)	(3.490)	(4.025)	**(1.130)**	(-3.039)	(1.304)	
LEV	0.2695*	-0.7479*	-1.7355*	2.7504*	-0.3558*	-1.9402*	-0.4981*	0.375
	(8.277)	(-8.492)	(-8.343)	(10.696)	(-2.451)	(-8.068)	(-3.436)	
DIV	0.0773*	-0.0381*	0.0577**	-0.4357*	**-0.0215**	-0.1307*	0.0387*	0.343
	(20.123)	(-3.671)	(2.352)	(-14.370)	**(-1.259)**	(-4.608)	(2.266)	
VIF	0.0000	1.3478	1.4200	1.4454	1.0349	1.0146	1.4125	

MODEL II: MYERS3 (N = 603)

	INTERCEPT	DIVER	RISK	FLTCOST	MYERS3A	MYERS3B	JENSEN2	Adjusted R^2
OWN	-0.0311	0.1408*	0.4229*	0.6026*	**0.1165**	-0.4705*	0.1081	0.084
	(-1.611)	(2.709)	(3.442)	(3.960)	**(0.908)**	(-2.836)	(1.261)	
LEV	0.2760*	-0.7700*	-1.7710*	2.7025*	-0.6113*	-2.1339*	-0.5141*	0.374
	(8.436)	(-8.752)	(-8.518)	(10.494)	(-2.816)	(-7.601)	(-3.545)	
DIV	0.0776*	-0.0399	0.0555**	-0.4383*	**-0.0312**	-0.1490*	0.0379**	0.343
	(20.142)	(-3.856)	(2.266)	(-14.443)	**(-1.218)**	(-4.505)	(2.215)	
VIF	0.000	1.342	1.416	1.447	1.043	1.024	1.411	

() indicate t-statistics
* Significant at the 1% level
** Significant at the 5% level
*** Significant at the 10% level

ership and insignificantly negatively related to dividends. In these two equations, the R&D dominates the variable and advertising does not appear to measure the same thing as R&D. The advertising effect is not inconsistent with the model as MYERS1, MYERS2B, and MYERS3B are.

The use of MYERS3A and MYERS3B, which deflates by sales rather than assets, gives essentially the same results as when using MYERS2A and MYERS2B.

Overall, these results suggest that only in the leverage equation, entering R&D and advertising separately is as a sum, and deflating by assets, tells us essentially the same thing as deflating by sales. The Myers' effect presumably measures growth opportunities, but in the ownership and dividend equation, only R&D expenditures are significant. Currently, we have no obvious explanation for the positive insignificant effect of advertising in the ownership equation and the lack of significance of advertising in the dividend equation.

5.2.5 *An Alternative Jensen Measure*

As described in the empirical chapter, JENSEN2 attempts to capture the free cash flow problem. JENSEN1 is a simple average cash flow to asset ratio while JENSEN2 controls for firm growth. The general model regressions are also run using the simple JENSEN1 measure, and the results are reported in Table 8. The results are essentially the same in the leverage and ownership equations as those obtained using JENSEN2; however, in the dividend equation, while the coefficient remains positive it is no longer significant. Firms with high cash flow only pay significantly higher divi-

dends when employment is not falling, lending support to the hypothesis that dividends are only used to control free cash flow.

5.2.6 *Zero Dividend and Zero Leverage Firms*

If any of the dependent variables have large clusters of zero values, the parameters may be biased. While some firms in the sample have small managerial ownership, no firms have zero managerial ownership. However, over the five year period of this study, ten firms have zero leverage and forty-five firms have zero dividends. To see if the inclusion of these firms influences the parameter estimates, the general regression is rerun excluding those firms with zero dividends or zero leverage, and the results are presented in Table 9.

The regression results for the reduced sample are very similar to those for the whole sample, and it is concluded that inclusion of zero dividend and zero leverage firms does not bias the regression estimates.

5.2.7 *Summary*

This dissertation provides an integrated model of the agency theory of corporate finance. This model is examined and a number of empirical implications of this model are tested. The empirical results reported in this chapter provide support for the Jensen and Meckling model, for Myers, for Easterbrook and Rozeff, but not for Jensen's interpretation of how to best control the free cash flow problem. The

TABLE 8
An Alternative Jensen Measure

N = 603

	INTERCEPT	DIVER	RISK	FLTCOST	MYERS1	JENSEN1	Adjusted R^2
OWN	-0.0271	0.1514*	0.4144*	0.5672*	-0.2471**	0.1087	0.081
	(-1.374)	(2.860)	(3.370)	(3.680)	(-2.267)	(1.257)	
LEV	0.2809*	-0.7221*	-1.8100*	2.5516*	-1.0742*	-0.5890*	0.340
	(8.227)	(-7.868)	(-8.489)	(9.548)	(-5.685)	(-3.927)	
DIV	0.0793*	-0.0369*	0.0520**	-0.4496*	-0.0862*	**0.0280**	0.333
	(20.090)	(-3.475)	(2.109)	(-14.548)	(-3.943)	**(1.615)**	
VIF	0.0000	1.3862	1.4131	1.4790	1.0168	1.5127	

() indicate t-statistics
* Significant at the 1% level
** Significant at the 5% level
*** Significant at the 10% level

TABLE 9
No Zero Leverage or Zero Dividend Firms

N = 547

	INTERCEPT	DIVER	RISK	FLTCOST	MYERS1	JENSEN2	Adjusted R^2
OWN	-0.0285	0.1445*	0.3493*	0.5513*	-0.2153**	0.1274	0.069
	(-1.380)	(2.808)	(2.749)	(3.233)	(-2.009)	(1.460)	
LEV	0.2936*	-0.7076*	-1.5579*	2.2076*	-1.0350	-0.5537*	0.291
	(7.970)	(-7.710)	(-6.876)	(7.260)	(-5.415)	(-3.559)	
DIV	0.0758*	-0.0425*	0.0637**	-0.4059*	0.0827*	0.0340***	0.265
	(17.844)	(-4.020)	(2.439)	(-11.575)	(-3.754)	(1.893)	
VIF	0.0000	1.3051	1.4079	1.4578	1.0217	1.3794	

() indicate t-statistics
* Significant at the 1% level
** Significant at the 5% level
*** Significant at the 10% level

findings duplicate in some parts findings of Rozeff, Bradley, Jarrell and Kim and Long and Malitz, but they differ greatly from Kim and Sorensen's results.

The positive effect of diversification on managerial ownership supports Jensen and Meckling's theory; which requires that ownership depends positively on the benefits to diversification. Moreover, the opposite signs of bankruptcy cost on ownership and of diversification on leverage, and the opposite effect of flotation cost on ownership and diversification on dividends, provide further direct evidence supporting the Jensen and Meckling model. However, the positive effect of the Myers' variable on ownership is disturbing. On one hand, it does not support the Jensen and Meckling model. On the other, if the variables used in prior studies are not truly reflecting debt agency costs, then use of those variables should be examined further.

Myers' theory that high growth firms have lower leverage is supported by the findings of this study, and thus, the findings of Bradley, Jarrell and Kim, and Long and Malitz are corroborated. The findings also indicate that Myers growth affects managerial ownership and dividends. Firms with high Myers' growth reduce ownership, leverage and dividends. However, in the dividend and ownership equations, it is the R&D not advertising which is controlling these effects.

Support is also found for the conclusion that dividends are used to control both equity and debt agency costs, confirming the arguments of Easterbrook and Rozeff who introduce the notion of controlling equity agency costs through the use of underwriters. To assure capital markets that underwriters will be used, firms will thus pay dividends. This argument is also clearly supported by the findings that dividends are affected negatively by flotation costs.

The Jensen free cash flow variable has an affect on the dependent variables, but not in the way Jensen hypothesizes. Higher Jensen free cash flow is associated with higher dividends but lower leverage.

Chapter VI

Conclusion

This dissertation integrates the agency theory of financial decision making into a mathematical model and performs empirical tests of this integrated model. The results provide general support for the integrated theoretical model, support for the Jensen and Meckling model, and the contributions of Rozeff and Easterbrook. The results show support for traditional bankruptcy theory and some support for the Myers growth model. Financial decisions also appear to be chosen to control the free cash flow problem introduced by Jensen, but not in the way Jensen hypothesized. One unanticipated result is the negative effect that the variable used to test Myers' hypothesis has on managerial ownership. To distinguish whether it is the model or the measure of the Myers' variable that is misspecified, another debt agency cost proxy should be found. Nevertheless, this study provides much needed empirical research on the Jensen and Meckling model, and the results of this dissertation are fully consistent with that model.

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