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Corporate Ownership, Dividend Policy, and Capital Structure Under Asymmetric Information.

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CORPORATE OWNERSHIP, DIVIDEND POLICY, AND CAPITAL STRUCTURE UNDER ASYMMETRIC INFORMATION

The Louisiana State University and Agricultural and Mechanical Col. PH.D. 1986

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CORPORATE OWNERSHIP, DIVIDEND POLICY, AND CAPITAL STRUCTURE UNDER ASYMMETRIC INFORMATION

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Interdepartmental Program In Business Administration

by
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ABSTRACT

This study investigates the role of insider ownership in the dividend policy and the leverage decision of the firm. An asymmetric information model is developed with the proportion of equity owned by insiders, dividend payout, and debt as signals of firm value. Analysis of the model yields testable hypotheses that insider ownership is negatively related to the payout and debt ratio of a firm. Cross-sectional regression analysis of leverage and payout ratio on the insider ownership is performed to test for the hypotheses.

The hypothesis that firms with large insider holdings have lower leverage than firms with small insider holdings is a joint test of the signalling and risk aversion explanations. An examination of the systematic and non-systematic risk across closely and widely held firms is used to differentiate between the alternative explanations.

The empirical evidence is consistent with the hypotheses that closely held firms have lower leverage and payout ratios compared to widely held firms. Two insider ownership variables: (1) percentage of insider ownership and (2) number of insiders are used to measure ownership control. The percentage of insider ownership is negatively related to the payout and leverage while the number of insiders has a

positive relationship. These relationships are stable over time. The results also indicate that industry factors are significant in explaining variations in payout and leverage ratios across firms.

A significant positive relationship is observed between insider ownership and the non-systematic risk of a firm. This finding tends to reject the risk aversion explanation, as firms with large non-systematic risk have higher insider shareholdings than firms with small non-systematic risk, after controlling for size. The relationship between insider ownership and systematic risk is negative, which is consistent with lower leverage for such firms.

Finally, the study finds conflicting evidence for dividends and leverage being "substitute signals" of firm value. In some industries analyzed, payout and leverage ratios are positively related while in other industries the relationship is negative. The main objective of this study is to provide empirical evidence in the divdend policy and capital structure area.

Chapter I

INTRODUCTION

Traditional corporate finance has developed several models in capital structure and dividend policy but lacks a generally accepted theory. Myers (1984) points out that we have little understanding of capital structure and of how firms choose the proportion of debt or equity they issue. Both the target debt ratio and the lowest cost of capital theories offer unsatisfactory explanations of the cross-section of debt to equity ratios observed in industry. In dividend policy, several studies provide evidence that dividend changes convey information.[1] Black (1976) looks at both the supply and demand sides of the dividend problem and concludes that there is no satisfactory explanation of how firms set their dividends. Despite subsequent efforts by numerous researchers, dividends continue to remain a puzzle.[2]

---

[1] Studies that provide empirical evidence include: Aharony and Swary (1980),Asquith and Mullins (1983), and Brickley (1983).

[2] A partial list includes Litzenberger and Ramaswamy (1979), (1982), Miller and Scholes (1982), Hess (1982), and Eades, Hess, and Kim (1984).

In their landmark papers, Modigliani and Miller (1958),(1961) show that, assuming perfect capital markets with symmetric information, the value of the firm is independent of its capital structure and dividend policy decisions. With the introduction of taxes and tax subsidies, DeAngelo and Masulis (1980) show that an optimal firm specific capital structure exists. The introduction of bankruptcy costs also produces an optimal capital structure equilibrium. Altman (1984), provides evidence for significant bankruptcy costs. However, Haugen and Senbet (1978) argue that bankruptcy costs associated with liquidation are not relevant to the capital structure decision.

For the dividend policy decision, Miller and Scholes (1978) argue that, with taxes, "home made leverage" can be used to avoid paying taxes on dividend income, thus reinforcing the dividend irrelevance argument. However, Modigliani (1982) argues that as long as the tax rate on dividend income exceeds that on capital gains, dividend payouts will reduce the value of the firm. This suggests that firms should not pay any dividends. The issue remains controversial as Peterson, Peterson, and Ang (1985) estimate that individuals do not shield dividend income from higher taxation as suggested by Miller and Scholes (1978).

Several researchers have suggested agency costs and informational asymmetry as determinants of optimal dividend policy and capital structure.[3] Jensen and Meckling (1976) argue that firms will choose an optimal capital structure that minimizes the agency costs of the firm. An optimal capital structure equilibrium could be achieved by minimizing the agency costs of debt and equity. The existence of optimal debt ratios may also be explained by balancing the tax benefit of debt versus the increased agency costs incurred by the use of leverage.

Rozeff (1982) suggests that an optimal dividend policy is one obtained by a tradeoff between higher flotation costs of raising external funds and the reduced agency costs when a firm increases dividend payout. He argues that increased dividend payouts will be accompanied by a need to raise external capital to finance the firm's projects. For the firm to receive these funds at the lowest cost, management must disclose information regarding the use of these funds, decreasing the informational asymmetry between management and security holders. Easterbrook (1984), in a similar manner, argues that dividends provide a low cost monitoring function for investors and thus reduce agency costs.

---

[3] A detailed discussion on the sources of agency costs is provided in Chapter III.

With asymmetric information, Ross (1977) and Bhattacharya (1979) use similar approaches to develop models that show debt and dividends may be used as signals to reduce information asymmetry. More recently, Sarig (1985) develops the "substitute signal" hypothesis in which both dividends and leverage may be used as substitute signals of firm value. In Sarig and Scott (1985) empirical evidence is presented in favor of this hypothesis. The authors find a positive correlation between dividend yield and leverage for an aggregate sample of 894 NYSE firms. However, the study provides no control for the difference in investment opportunity set across industries.

Several signalling equilibria models have been developed using leverage and dividends as signals, assuming that a firm's insider-managers know more about the value of its assets and investment opportunities than outside investors.[4] Leland and Pyle (1977) show that the proportion of the equity owned by the insider-managers is itself a signal to outside investors.

The approach adopted in this paper is similar to the one suggested by Myers (1984):

---

[4] Ross (1977) and Heinkel (1982) develop equilibria models using leverage as a signal. Bhattacharya (1979), Miller and Rock (1985), and John and Williams (1985) show equilibria with dividends as a signal.

"We should start with a story based on asymmetric information and expand it by adding only those elements of the static tradeoff which have clear empirical support." In this study, an asymmetric information framework is developed with three signals of firm value: (1) the percentage of equity held by owner-managers, (2) leverage, and (3) the dividend payout. It is hypothesized that once ownership is determined endogenously, closely held firms will have a lesser incentive to signal through leverage and dividends than firms which are widely held, since insider ownership is itself a signal. Other motivations such as risk aversion on the part of insiders as alternative explanations of the hypothesis are considered. Myers (1984) suggests that if a firm's informational asymmetry is reduced it will prefer to issue equity over debt. Since insider ownership is a proxy for the degree of information asymmetry, in the Myers and Majluf (1984) framework, firms with high insider ownership (low information asymmetry) should have low debt in their capital structures. This is consistent with the hypothesis in the present study. Since the issue can be examined empirically, a cross-sectional analysis is performed to determine the influence of ownership structure on the dividend and leverage decisions of the firm.

The main objectives of this study are:

(1) To develop a model in the asymmetric information framework that provides testable hypotheses for the relationship between the proportion of equity held by insiders and the dividend and leverage decisions of the firm.

(2) To develop a methodology that tests the theoretical hypotheses related to insider ownership.

(3) To provide further empirical evidence on the possibility of capital structure and dividend policy being complementary signals.

A survey of existing theoretical and empirical studies is presented in Chapter II. This is followed by a more detailed discussion of the agency and asymmetric information issues involved in this study. An objective function is derived in a multi-dimensional signalling framework, and testable implications are developed. In Chapter IV, the ownership and financial data used in this study are described. The empirical methodology and construction of variables used to test the hypotheses that insider ownership has a significant effect on the firm's dividend policy and capital structure decisions are also included in this chapter.

Chapter V presents the results of the empirical tests. The initial analysis uses analysis of variance (ANOVA) and non-parametric statistical tests to determine differences in

payout and leverage ratios across closely and widely held firms. A significant difference is observed in the aggregate data for payout ratios. For debt, although the leverage ratios for closely held firms are lower than for widely held firms, the difference is not statistically significant. The results of these tests provide some evidence in favor of the hypothesis that closely held firms have lower dividends and leverage than widely held firms.

Cross-sectional regressions of leverage and payout ratios on the percentage of insider ownership suggest a significant negative relationship. Results of the tests to determine whether industry factors affect the firm's leverage and dividends are consistent with earlier findings of Bradley, Jarrell, and Kim (1984) who show a significant increase in explanatory power when industry dummy variables are introduced in a linear regression model for the determinants of leverage. However, there is still a lack of explanatory power, especially for the leverage results, suggesting that factors other than ownership, financial characteristics, and industry effects play a role in the determination of leverage and dividends.

The study provides evidence in favor of the role of leverage as a signal of firm value. The hypothesis that lower leverage for closely held firms may be motivated by risk

aversion on the part of owner-managers is rejected in cross-sectional tests of ownership with the firm's systematic and non-systematic risk. Empirical findings of the study suggest that ownership is a significant factor in the determination of debt and dividend decisions of a firm.

Chapter II

LITERATURE REVIEW

This chapter provides a survey of previous relevant research in the asymmetric information and agency cost area. The first part of the chapter concentrates on a review of the theoretical models and the role of signalling in capital structure and dividend policy equilibrium of the firm. A discussion of empirical studies in this area is included in the latter part of the chapter.

The models discussed assume an information asymmetry in capital markets, with insiders having superior information regarding the end of period firm value. Akerlof (1970) shows that with asymmetric information, a signalling mechanism must exist in order to achieve market equilibrium for a product. The models, however, differ in the choice of financial variables used to signal firm value (dividend,leverage, and insider ownership) and whether the signal is costless (non-dissipative) or costly. For costly signalling, the cost function must satisfy the Spence (1973) condition that the marginal cost of signalling is positive and decreasing with respect to the true determinant of value.

2.1 DIVIDEND POLICY AND ASYMMETRIC INFORMATION

The existing models of asymmetric information in the dividend signalling area are one dimensional in structure. These models consider dividends as the only signal of firm value but are different in the cost functions used to arrive at an equilibrium.

Bhattacharya (1979) develops an asymmetric information model with dividend policy as a signal of the future cash flows. The true distribution of these cash flows is known only to the insider-managers. To arrive at a signalling equilibrium the author considers two costs: (1) the tax differential between the capital gains and dividend income tax and (2) the cost of additional financing needed (if any), to pay this dividend. The second cost assumes that a firm will signal through dividends even if it has to raise additonal funds by issuing new equity.

Miller and Rock (1985) develop a model for the value of the firm under differential information. The cost of signalling in their study is the loss of funds for real investment due to the increased dividends. In the Miller and Rock equilibrium, the firm will have a lower level of investment under dividend signalling than under the full information model. Among the conclusions for dividend policy, the authors find that the payout ratio should be an increasing

function of the proportion of shares held by the "outside" investors, although no empirical evidence is presented. Analysis of the model also yields the empirically testable hypothesis that unexpected dividend and earnings changes convey information.

John and Williams (1985) consider a dissipative signalling model with differential taxes on dividends and capital gains. An equilibrium is established by the balancing of an increase in stock price due to the dividend signal versus the loss due to incremental taxes on the dividends. In the study the authors assume that the firm declares a dividend only if the demand for cash by the shareholders and the firm exceeds the supply of cash.

2.2 LEVERAGE AND ASYMMETRIC INFORMATION

Ross (1977), uses the manager's compensation schedule to arrive at a signalling equilibrium. The manager is rewarded at the end of the period for a correct signal while a penalty is imposed if the firm goes bankrupt. It is hypothesized that managers use leverage to convey information about a firm's future earnings. The empirical implication of the model is that firm value will be an increasing function of leverage.

Heinkel (1982) develops a costless signalling model using risky debt as a signal of firm value. A necessary condition for stable costless equilibrium in the model is that the face value of debt is an increasing function of insider ownership. Heinkel (1982) derives a one dimensional signalling equilibrium in which riskier, more valuable firms have larger amounts of debt financing.

Myers and Majluf (1984) use asymmetric information to derive conclusions regarding the supply of debt or equity securities in the capital markets. The authors argue that managers with superior information will know the true value of the firm's stock and issue only stock when it is overvalued by the market. Otherwise, they will issue debt. The market recognizes this and views new stock issues as negative information and discounts the stock price accordingly. Thus firms forego positive net present value projects if the net present value of the project being financed is less than the amount the issue is discounted by investors. Since the discount is dependent upon the information asymmetry about the project's outcome, Myers and Majluf suggest that if the information asymmetry is eliminated or reduced for a short period of time, firms will tend to only issue stock over that period. One testable implication of this observation is that when firms have a reduced information asymmetry due to high insider ownership, one should observe a lower leverage.

Recently, Sarig (1985) has developed a model in which dividends and leverage are substitute signals of firm value. The model is based on both dividends and debt being a commitment by the firm's management to maintain a level of future cash outlays in the form of dividend payouts and interest payments on debt. The two costs considered to arrive at an equilibrium are: (1) the bankruptcy cost of debt and (2) the additional cost of financing required to meet the dividend payments. It is hypothesized that leverage is used by the firm until the marginal cost of a deviation from the optimal capital structure of the firm exceeds the marginal cost of additional dividends. The model is similar to that hypothesized in the present study as it establishes a multi-dimensional signalling equilibrium.

2.3 INSIDER OWNERSHIP AND ASYMMETRIC INFORMATION

Leland and Pyle (1977) develop a signalling equilibrium using the insider's ownership as a signal of firm value. The authors argue that a manager retaining a large proportion of the equity of a firm sends a positive signal about his expectations of future expected cash flows. The signal is costly due to the loss of personal diversification by the manager. Downs and Heinkel (1982) provide empirical evidence in favor of the Leland and Pyle hypothesis by studying the proportion of equity retained by owners after a firm

goes public. The authors find that firm value is an increasing function of the proportion of equity retained at the time of going public.

2.4 EMPIRICAL STUDIES

Until recently there has been little empirical evidence on asymmetric information models. Even today, there is little work that relates ownership, dividends, and leverage as signals of firm value. A majority of the empirical work is on the influence of information asymmetry on observed stock price reaction to new issues of debt and equity.

Rozeff (1982) uses a cross-sectional test, similar to the present study, on a model that relates dividend payout to the fraction of equity held by insiders. The author finds a significantly negative relationship between percentage insider ownership and dividend payout. However, there are several problems with the study that warrant further investigation. Some problems with and omissions from the Rozeff study are presented below:

(1) The study did not control for size of the firm, thus the ownership variable may have been a proxy for size.

(2) The regression variables are estimated by averaging data over several years. This may introduce a bias in the results. The payout ratio, for example, has been aggre-

gated over six years. The present study uses annual payouts for dividends thus eliminating any bias.[5]

(3) The insider ownership data collected from the Value Line Investment Survey are only approximate data in many cases, which may have biased the results.[6]

(4) There is no control for variables such as the investment opportunity set that vary across industries and may significantly influence the dividend policy and leverage decisions of the firm. This study controls for variations in investment opportunites by employing both intra and inter industry tests. Bradley, Jarrell, and Kim (1984) find a significant industry effect in cross-sectional tests for leverage.

(5) The study does not control for the number of insiders and thus does not distinguish between a firm that has a large percentage owned by one insider and a firm with many "small" insider shareholders.

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[5] It is assumed that the one year payout is the equilibrium or steady state value.

[6] For a comparison of the Value Line and the Disclosure data used in this study, see Appendix A. A random sample of 99 firms was chosen for the comparison. About 30 percent of the observations from Value Line are significantly different from the Disclosure data, although the means are not significantly different. A similar percent of the data was stated as approximate in Value Line. For example the insider ownership data for Jamesway corporation is given in Value Line as "about 20 percent".

Several recent studies examine security price reaction around new security issues. The evidence presented suggests that one explanation for the negative price reaction to new issues is the information asymmetry between managers and outside securityholders. Mikkelson and Partch (1986) use stock price reaction to new issues of common stock and convertible debt to explain asymmetry of information between managers and investors. The authors find a positive price effect in the period before announcement and a two day negative return at the time of the announcement. This suggests that managers do indeed time sales of new securites when the market overprices them and investors discount this at announcement of the new issue.

For offers that were cancelled, the authors find that the price reaction, after the announcement, is opposite that of completed offerings. Between announcement and cancellation a significant negative return is observed. Whereas for the completed offerings, a significant positive return is observed, suggesting that managers tend to cancel offerings that they view as underpriced. In cross-sectional tests a larger negative price impact on new issues of common stock and convertible debt is observed as compared with straight debt.

Asquith and Mullins (1986) and Masulis and Korwar (1986) find that negative returns during announcements of stock offerings for utilities are smaller than those for industrials. In these studies, the authors hypothesize that this may be due to the larger information asymmetry for industrials as compared with the regulated industry. Asquith and Mullins also hypothesize that the negative price reaction to new issues represents a substantial "cost of false signalling" to firms that finance dividend signals through new issues.

Masulis and Korwar (1986) also differentiate between offerings that involve a decrease in the percentage shareholdings of the management and those that do not. They find that the negative price reaction to an announcement that includes a decrease in insider holdings is significantly stronger than that for offerings that have no change in percentage of insider holdings. This is consistent with the Leland and Pyle (1977) model and the hypothesis in this study that higher insider holding reduces information asymmetry.

Eckbo (1986) examines the announcement effect of debt offerings. He finds a negative price impact of debt offering announcements. The author thus finds evidence for the asymmetric information models of Miller and Rock (1985) and

Myers and Majluf (1984) that predict a negative price reaction to new issues for both debt and equity. Models that predict leverage to be a positive signal of firm value (Ross (1977) and Heinkel (1982)) are rejected.

Kim and Sorensen (1986) provide empirical evidence for the relationship between agency costs and the leverage decision of a firm. In their study, firms are split into two groups: (1) those with an insider ownership of less than five percent (widely held firms) and (2) those with an insider ownership of over 25 percent (closely held firms). Kim and Sorensen find that closely held firms have higher leverage than widely held firms, which is contrary to the hypotheses and results of this study.

Several potential sources of error that may have distorted the results of the Kim and Sorensen study are presented below:

(1) The division of firms into groups by insider ownership and elimination of firms with percentage insider holdings between 5 and 25 percent is arbitrary and introduces a selection bias in the sample. Also the data for insider ownership is obtained from Value Line with a limited sample of 164 firms (82 firms in each ownership group) used for the analysis. The problems with data from Value Line are discussed above.

(2) For the regression analysis a one-zero dummy variable is used as a proxy for the insider ownership. The use of the percentage insider ownership, without deleting firms in the intermediate group, would eliminate any selection bias and provide a continous variable for the analysis.

(3) The matching of firms into pairs representing closely held and widely held firms, within an industry, and deleting firms that do not match may have also introduced a selection bias.

(4) Kim and Sorensen do not control for the number of insiders and thus do not distinguish between a firm that has a large percentage owned by one insider and a firm with many "small" insiders.

The present study eliminates the above problems and uses a comprehensive sample of 1765 firms for the analysis.

2.5 SUMMARY

Information asymmetry has a wide range of implications. In general, the value of the firm under asymmetric information will be less than the value of the firm under perfect information.

As discussed above, the implications for pricing of new issues have been empirically investigated by several re-

searchers. The Eckbo (1986) study finds evidence for the asymmetric information models of Miller and Rock (1984) and Myers and Majluf (1985) but rejects the positive signalling models of leverage by Ross (1977) and Heinkel (1982).

The present study addresses the implications of information asymmetry for dividend payout and leverage equilibrium of the firm. A more direct empirical approach of cross-sectional tests is used to provide evidence for the positive signalling models of both dividends and leverage.

Chapter III

MODEL AND HYPOTHESES

In agency literature, the corporation is viewed as a complex set of contracts. For this study, the discussion is restricted to contracts between managers (agents) and the other claimholders of the firm. Assuming that the agents and securityholders are utility maximizing individuals with different self interests and information sets, there will be a conflict of interest, creating an agency problem. Agency costs, as defined by Jensen and Meckling (1976), are incurred in the form of: (a) monitoring and bonding expenses and (b) the loss by the securityholders due to the own welfare maximization decisions of the managers.

In order to decrease total agency costs, several mechanisms have been discussed in financial literature. Competitive market mechanisms are discussed in Fama (1980). Fama suggests that the "threat of takeovers" and managerial labor markets force managers to act in a value maximizing manner. Another means of reducing agency costs is through direct contractual provisions. Smith and Warner (1979) discuss contractual provisions between stockholders and bondholders and Smith and Watts (1984) suggest the use of management

compensation contracts between securityholders and managers to reduce agency problems.

The focus of this study is the signalling mechanism of reducing agency costs. For this study, the agency cost and information asymmetry arguments have been synthesized, since one of the principal sources of agency costs is informational asymmetry.[7]

3.1 THE MODEL

The purpose of the model and the analysis is to derive testable implications for dividend policy, leverage, and insider ownership. Consider a firm which makes decisions in a one period planning horizon. The beginning of the period is is time 0 and the end is time 1. At time 0, an information asymmetry exists. The insider-managers have superior information regarding firm value at time 1 as compared with the outside investors. Dividends, leverage, and insider ownership are costly signals of firm value and at time 0 insider-managers make signalling decisions regarding firm value at

[7] It should be noted that the study is not a complete characterization of agency cost equilibria. Other sources of agency costs not considered in this study are: (1) the propensity of the agents to consume excessive perks (see Jensen and Meckling (1976)); (2) the incentive for the firm to undertake high risk projects that transfer wealth from the bondholders to the stockholders (see Barnea et al. (1985)); and (3) the incentive for managers to forego positive net present value projects (see Myers (1977)). Also other agency issues such as agent compensation are not discussed.

time 1.

The outside shareholders form some estimate of the value of the firm based on the dividend, leverage, and ownership signals of the insiders. The market price of stock at the end of the period (time 1), is based upon an estimate of future investment opportunities of the firm $V(D,B,\alpha)$ and the realization of uncertain cash flows, X, at the end of the period.

The probability density function of the cash flows, f(X), is identical across firms and λ is a location parameter for the cash flow distributions of each firm within the economy such that:

$$f(X) = 0 \quad \text{for } X < \lambda$$
$$\text{and} \qquad > 0 \quad \text{for } X \geq \lambda$$

The insider's objective function can then be written as:

$$\underset{D,B,\alpha}{\text{Max}} \; E(D,B,\alpha) = \frac{1}{1+R}\Big[\, V(D,B,\alpha) + \int_{\lambda}^{\infty} Xf(X)dX - \int_{B}^{D+B} \beta(D+B-X)f(X)dX - \int_{\lambda}^{B} \gamma(B-X)f(X)dX - \delta(\alpha,A) \,\Big] \tag{1}$$

Subject to $B \geq 0$, $D \geq 0$, and $0 \leq \alpha \leq 1$.

where

E is the time 0 firm value,

D is the dividend paid at time 1,

B is the face value of debt due at time 1,

α is the proportion of equity held by the insiders,

R is the risk free rate of return,

V is the value of the investment opportunities of the firm at time 1,

X is the cash flow of the firm at time 1,

f(X) is the density function of the cash flows at time 1,

β is the cost function of raising additional funds to finance the firm's projects,

γ is the cost function of raising additional funds to meet the debt payments,

δ is the cost function imposed on the insiders due to loss of diversification, and

A is a measure of the non-systematic risk of the firm.

The objective function consists of five different terms. $V(D,B,\alpha)$ represents the outsider's estimate of the firm's growth opportunities. This estimate is based on the signal by insiders at time 0. The next term represents the sum, over all states of the world, of the firm's cash flows X.

The third term in the expression is similar to the one developed in Bhattacharya (1979) and Eades (1982). Here, β represents the cost function imposed on the firm for raising additional funds (due to dividend signalling) in order to finance the firm's projects at the end of the planning horizon. This cost becomes large, especially when the firm's cash flows are smaller than the dividends and debt paid out at the end of the period. The upper limit of integration reflects the additional funds necessary to pay both dividends and debt payments. It should be noted that it is optimal for the firm to pay off debt before any dividends are paid.

The fourth term in the objective function represents the costs of leverage signalling. These costs are incurred in the form of increased bankruptcy costs. Again, the cost becomes large when the firm's cash flows are less than the face value of debt maturing at the end of the period. These costs may be incurred in the form of distress sales of assets to meet the debt payments. Here, γ is the cost function that describes the costs associated with raising funds to meet the debt payments. Since it is optimal for the firm to pay off their debt before they pay out any dividends, the limits of integration on the cost of debt term are from λ to B.

The final term represents the loss of personal diversification by insiders because they retain a portion of the firm's equity for signalling purposes. Here δ represents the cost function for the loss of diversification suffered by the insiders. These costs may be incurred by the insider's, to diversify their portfolios or by the firm to raise additional funds to diversify. It is assumed that these costs are not state dependent and are a function of the percentage insider holdings and the non-systematic risk measure, A, of the firm.

The primary difference between the objective function developed above and the work of Bhattacharya (1979) and Eades (1982) is that a multi-dimensional model is considered here with insider ownership, dividends, and leverage as signals of firm value. The previous studies consider a one dimensional model with dividends as signals.

For the optimal solution of the function (1) the following conditions must be satisfied:

$$\frac{dE}{dB} = \frac{dV}{dB} - \frac{dTC}{dB} = 0 \qquad (2A)$$

$$\frac{dE}{dD} = \frac{dV}{dD} - \frac{dTC}{dD} = 0 \qquad (2B)$$

$$\frac{dE}{d\alpha} = \frac{dV}{d\alpha} - \frac{d\delta}{d\alpha} = 0 \qquad (2C)$$

where TC is the total cost of signalling.

The explicit first and second derivatives of the total cost with respect to each of the signals are derived in Appendix D. The marginal cost of the signals is positive and under the assumptions outlined in Appendix D satisfy the Spence condition that:

$$\frac{dTC}{dB}, \frac{dTC}{dD}, \frac{d\delta}{d\alpha} > 0 \qquad (3)$$

It can be shown that a change in the marginal cost of each signal, holding other costs constant will yield:

$$\frac{d\alpha}{dA} = - \frac{d^2\delta}{d\alpha^2} / \frac{d^2\delta}{d\alpha dA} < 0 \qquad (4)$$

$$\frac{dB}{dA} = \frac{d^2\delta}{d\alpha dA} / \frac{d^2TC}{dB^2} > 0 \qquad (5)$$

and

$$\frac{dD}{dA} = \frac{d^2\delta}{d\alpha dA} / \frac{d^2TC}{dD^2} > 0 \qquad (6)$$

Equations 4, 5, and 6 are explicitly derived in Appendix D. Thus α and B will move in opposite directions in response to a change in the marginal cost of signalling via

insider holdings. Also, α and D will move in opposite directions in response to a similar change.

Since some firms within the economy have more non-systematic risk than others, insiders find it more costly to own a significant portion of such firms due to higher loss of personal diversification. The marginal cost of signalling, via insider ownership, for such firms is higher than others and thus the equilibrium condition leads to a different optimal signalling policy. To compensate for the higher marginal cost of signalling with insider ownership, firms will signal through either dividends or leverage. Thus for data in which cross-sectional variations in the relative cost or benefit of the signals is important a negative relationship should be observed. Formally, the relationship between α and B and α and D may be written as:

$$\frac{dB}{d\alpha} \text{ and } \frac{dD}{d\alpha} < 0 \qquad (7)$$

This suggests the following hypotheses for leverage and dividend signalling:

H1: Widely held firms will have higher leverage than closely held firms, ceteris paribus.

H2: Widely held firms will have higher payouts

than closely held firms, ceteris paribus.

The leverage hypothesis (H1) as stated above is a joint test of signalling and risk aversion hypotheses. McLean (1984) argues that owner-managers, apart from holding equity in the firm, have an additional stake, human capital, invested in the firm. Thus managers, being risk averse individuals, will have an incentive to decrease the probability of default and utilize less debt in the firm's financial structure. An empirical test, later in the study, provides evidence for the signalling hypothesis and rejects the risk aversion hypothesis.

The dividend clientele effect may be argued as significantly contributing to the dividend signalling hypothesis (H2). If it is assumed that the owner managers are high tax bracket individuals, they may indeed have little incentive to pay dividends, since dividends are taxed at a higher rate than capital gains. However, in a Miller and Scholes world, this is not apparent. This issue has not been addressed in the present study and may be an interesting issue for future research.

Chapter IV

DATA AND METHODOLOGY

The insider ownership and financial data used in this study are primarily obtained from the Disclosure public company information data base. Insider ownership data of NYSE, AMEX, and OTC firms are included for the fiscal year 1981 and 1984.[9] Other sources of data used in this study include the Compustat Annual Industrial tapes for finanacial information and the Center for Research in Securities Prices (CRSP) tapes for monthly stock prices.

4.1 THE DISCLOSURE DATA BASE

Use of the Disclosure data base for financial research is relatively new. The only other study to use insider ownership data from the Disclosure tapes is by Lloyd, Jahera, and Goldstein (1986). Ownership and comprehensive financial data for over 4500 firms are available from these tapes.

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[9] Any bias introduced due to the fiscal year data for financial information and year end data for ownership is investigated by eliminating firms that do not have December as their fiscal year end. The results do improve when only firms with December year end are included in the analysis, however the difference was not very significant. The larger sample is used for the study as it provides a big enough sample size for the industry analysis.

The ownership summary provides the number of shareholders and the percentage of outstanding stock owned by four major classes: (a) investment firms, (b) institutions, (c) 5 percent owners, and (d) insiders. A sample ownership record for A. G. Edwards Inc. is presented in Table 4.1 . The source of these data is the filings by institutions and individuals with the SEC.

Since Disclosure is a relativley new source of information for research, some of the existing and potential problems with the use of the data are discussed below:

(1) Unlike Compustat and the CRSP data bases, the Disclosure tapes are not formatted to facilitate easy use. Missing data are not coded and are excluded from the data listed. Thus each company record has a variable length which makes the data difficult to access without substantial reformatting.

(2) The Disclosure tapes include about 9500 firms. However, data frequently are missing and ownership records for only about 4500 firms are available. A majority of the firms also have missing sources and uses of funds statements.

(3) Since error rates have not been compiled for the Disclosure tapes, a comparison of results using this information is necessary with results from other sources such as the Compustat tapes.

TABLE 4.1

Sample Ownership Record from Disclosure

A. G. Edwards Inc.

Type	Date(Q,M)	Owners	Change	Held	%Own
Invest Cos	12/31/84(Q)		0	0	0.00
Institutions	12/31/84(Q)	35	579	2721	20.20
5% Owners	12/31/84(M)	3	NA	1390	10.32
Insiders	12/31/84(M)	101	NA	2762	20.51

where Q denotes data that are revised quarterly,
M denotes data that are revised monthly,
Change denotes the change in number of shares held in thousands, and
Held denotes the number of shares held in thousands

As discussed above, a comprehensive error rate investigation and substantial reformatting are required before the tapes can be widely used for financial research.

4.2 THE SAMPLE

An initial analysis is performed on the aggregate sample of 1765 firms. Selection of the sample for analysis is based on the following criteria:

(1) Complete data on financial statements and insider ownership must be available on the Disclosure tapes;

(2) Industry groups with less than 30 firms have been excluded from the industry analysis. The aggregate analysis, however, includes all firms with complete data;

(3) Firms with insider ownership of 99.99 percent were deleted from the sample due to the possibility of double counting from filings with the SEC[10]

(4) For the dividend analysis, firms with negative earnings during the year have been deleted from the sample. However, firms not paying dividends are included, as this may represent the firm's dividend policy decision.

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[10] This is based on discussions with a representative of Computer Directions Advisors, Inc., the firm that collects the data from SEC filings.

Financial data for firms are cross checked for accuracy with data from the Compustat annual industrial tapes by comparing regression results with data from both sources. The ownership data for a sample of firms is also compared with the data from the Value Line Investment Survey (see Appendix A).

In order to control for the influence of exogenous variables, such as the investment opportunity set of the firm, further analysis is done on an industry basis. The industry groups are identified by the primary SIC code of the firms. However, the classification is done on the basis of homogeneity within the industry rather than two, three, or four digit SIC codes.[11] For a complete discussion of the use of SIC codes as a means of classifying industry groups see Bowen, Daley, and Huber (1982). The sample classification for this paper and the number of firms within each industry are presented in Table 4.2 . A total of ten industries, each with over 30 firms having complete financial data, are identified. The sample size for the dividend analysis is less than the number in Table 4.2 because firms with negative

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[11] Other means of classification into homogenous groups with similar investment opportunity sets are considered. One proxy used for the investment opportunity set is the growth in net fixed assets. The variable is used as a continous variable and in the dummy form in cross-sectional regressions for leverage and payout. In these regressions the variable is insignificant in explaining cross-sectional variations in debt and payout ratios.

earnings are excluded for this analysis. A majority of the industries (eight) are non-regulated. Two regulated industries, national banks and electric services, are included in the analysis for comparison of the results with the non-regulated group.

For the initial analysis, firms within each industry group are split into three categories based on the degree of insider ownership. The three groups chosen for analysis are: (1) insider ownership of below 10 percent (group 1), (2) insider ownership between 10 and 45 percent (group 2), and (3) insider ownership of over 45 percent (group 3). The primary issue involved here is one of control of the firm.[12] Group 1 with an insider ownership of less than 10 percent is classified as the widely held group. Group 2 is the intermediate group, which in some cases may be argued to contain closely held firms and in other cases widely held firms, depending upon the type of firm and its ownership. Group 3 is hypothesized to consist of closely held firms.

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[12] The division of firms into groups by percentage insider ownership is based on the degree of control exercised by the insiders on the firm's decisions. Another classification used is the same as Kim and Sorensen (1986): group 1 (less than five percent insider ownership, group 2 (between 5 and 25 percent insider ownership), and group 3 (above 25 percent insider ownership). The results for both these classifications were virtually the same. However, the former classification was used as it yields a better distribution of firms among groups. Unequal group sizes reduce the power of the overall test for difference in means.

TABLE 4.2

Industry Groups in Sample

	No of Firms
Aggregate Data	1765
Mining SIC Nos.	
Crude Petroleum & Natural Gas 1310,11	125
Manufacturing SIC Nos.	
Printing & Publishing 2710 - 2795	56
Electronic Computing Equipment 3573	92
Radio and T. V. Communication Equipment 3662	67
Measuring and Controlling Instruments 3820,22,23,24,25,29	50
Surgical and Medical Supplies 3840,41,42,43	34
Transportation & Public Utilities SIC Nos	
Electric Services 4911,31	79
Retail Trade SIC Nos.	
Eating & Drinking Places 5810,12,13	39
Finance SIC Nos	
National Banks, Fed Members 6025	108
Services SIC Nos.	
Computer Data Processing 7370,72,74,79	66
	716

The number of firms in this table are obtained after eliminating firms with incomplete financial information.

Analysis of variance (ANOVA) is used to test whether significant differences exist in the leverage and payout ratios among the 3 groups. Since both the payout and leverage ratios are non-normal (see Appendix B and C for normality test results), the non parametric Kruskal-Wallis test is used. The non-normality for payout ratios is probably due to the deletion of observations with negative values and a large proportion (33 percent) of firms not paying dividends. Transformations of the ratios did not eliminate the problem.

Another underlying assumption of ANOVA is that all firms in the sample are independent of each other. Since firms are split into groups within industries, it may be argued that the independence assumption is violated within groups. However, past studies on payout and leverage have shown that a significant portion of the variability in these ratios is due to non-industry factors. Boquist and Moore (1984) argue that leverage preferences vary across managers, even if they are from the same industry.

The overall F test from ANOVA detects at least one contrast that is different from zero, therefore, a pairwise comparison of means is necessary to complete the analysis. The Tukey-Kramer test is used for the pairwise comparison of means as it is considered the best overall approach (see Stoline (1981)).

Finally, cross-sectional regression analysis is performed using two different approaches. The first set of regressions are performed on the aggregate sample and each industry separately. In the next set, the regressions are performed on the aggregate sample using dummy variables for industry classification. The models used for the regressions and a discussion of the explanatory variables follow.

4.3 THE LEVERAGE MODEL

The functional form of the leverage equation is assumed to be linear, as in previous studies by Bradley, Jarrell, and Kim (1984) and Long and Malitz (1983):

$$\delta = \beta_0 + \beta_1 \text{ \%Insid} + \beta_2 \text{ NoInsid} + \beta_3 \text{ Stddev} + \beta_4 \text{ RAD} + \beta_5 \text{ Sales} + \beta_6 \text{ Depr} + e$$

where

δ is the leverage ratio of the firm,[13]

β_0 is the intercept term,

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[13] The leverage ratio is defined as:

$$\frac{\text{long term debt}}{\text{long term debt} + \text{Market value of equity}}$$

This ratio eliminates the problem of inclusion of leases and convertible debt which may be used to reduce the agency problem. For a discussion of how convertible debt may be used to eliminate the agency problem see Jensen and Meckling (1976). Also, leases have been shown to be substitutes for debt (see Ang and Peterson (1984)), and may as such distort the results.

%Insid is the percentage of insider holdings,

NoInsid is the natural log of the number of insiders,

Stddev is the standard deviation of the first difference in earnings before interest and taxes (EBIT) over five years,

RAD is the ratio of research and development expenditures to total assets,

Sales is the natural log of the firm's sales revenue,

Depr is the ratio of depreciation to total assets,

β_1, β_2, β_3, β_4, β_5, and β_6 are the coefficients of the corresponding explanatory variables, and

e is the error term.

Summary statistics of the variables used for the regression are presented in Table 4.3 .

TABLE 4.3

Summary Statistics for Leverage Data

Variable	N	Mean	Std Dev	Min	Max
Ltdebt	1771	0.1944	0.1962	0	0.9985
%Insid	1771	23.7166	23.8802	0	95.9700
NoInsid	1771	2.2565	0.9445	0	4.6151
Stddev	1765	85.8218	134.6567	0.6070	958.3270
RAD	1771	0.0112	0.0311	0	0.2628
Depr	1771	0.0136	0.0264	0	0.1898

4.4 EXPLANATORY VARIABLES - LEVERAGE

4.4.1 Insider Ownership

The insider ownership variable is defined as the percentage of outstanding equity held by insiders.[14] It is hypothesized that insider ownership is negatively related to the firm's leverage. The variable is available from the ownership summary on the Disclosure tapes.

4.4.2 Number of Insiders

The number of insiders is the other variable used to measure the concentration of control of the firm. The larger the number of insiders, the less closely held the firm. This variable has not been used in earlier studies, since it has only been available through SEC filings. Prior studies have used Value Line data which only reports percent insider ownership.

The number of insiders provides another dimension for the measurement of the degree of control of a firm.[15] The hy-

[14] An insider is defined by the SEC as any officer, director, or a 10 percent principal stockholder. Insiders are required to file form 3 with the SEC within 10 days of establishing an initial position in any of the firm's registered securities. Whenever there is a change in the number of shares held (purchase, sale, exercise of option, gift, or stock split) the insider must file form 4 within 10 days after the month end following the event date.

[15] The issue of large blocks of stocks controlled by insiders that do not get along with each other as compared

pothesized sign on this variable is positive. The data are available directly from the ownership summary on the Disclosure tapes.

4.4.3 Standard Deviation of EBIT

Bradley, Jarrell, and Kim (1984) show that the variability in a firm's earnings before interest and taxes (EBIT) is an important determinant of leverage. The greater the variability in EBIT, the higher the probability of default and the lower the leverage. Also higher EBIT variability implies higher operating leverage if the variability in sales is held constant. Traditional finance assumes that operating and financial leverage should be negatively related as firms with high business risk have a lower capacity for financial risk. However, Myers (1977) suggests a positive relationship between leverage and business risk. He argues that a firm with high business risk will borrow more, as risky debt does not negatively influence the firm's market value to the same extent that it influences a low business risk firm. The variable (stddev) is estimated by calculating the standard deviation of the first difference in EBIT over the past five years. The hypothesized relationship between leverage and variability in EBIT is positive.

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with several "small" insiders voting together is not addressed in the study.

4.4.4 Research and Development Expense

Long and Malitz (1983) hypothesize that the firm's intangible investment opportunities reduce its debt capacity. Their argument is that bondholders cannot effectively monitor the intangible investments of the firm such as investments in R&D. Firms also usually will not divulge their R&D plans as this may provide important information to competitors. Since the bondholders are not able to monitor these investments, there is an incentive on the part of the current owner-managers to undertake risky projects resulting in a wealth transfer from the bondholders to the stockholders. This follows from the argument that equity may be modelled as a call option on the firm. The stockholders may, at the maturity of the debt, buy back the firm from the bondholders or default. It is also well known that the value of a call option is an increasing function of risk. Thus there is an incentive on the part of stockholders to undertake risky projects.

Bondholders realize this and in a rational expectations model demand higher interest on the debt of firms with large intangible investments, thereby reducing the firm's debt capacity. Thus the hypothesized sign for the R&D variable is negative. The variable is estimated as a ratio of R&D expenses to total assets.

4.4.5 Sales Revenue

Sales revenue is used as a proxy for firm size and is included in the set of regressors to control for any "size effect". Studies by Ferri and Jones (1979) and Flath and Knoeber (1980) argue that larger firms have more debt capacity and are able to issue debt at a lower cost when compared to smaller firms. Since larger firms are typically more closely followed by analysts and investors, size is an important consideration as smaller firms should have a greater information asymmetry than larger firms. Arbel (1985) finds that firms that are not closely followed by analysts outperform firms that are closely followed. He attributes this "neglected firm effect" to the difference in information asymmetry between firms. However, one would expect a negative correlation between firm size and insider ownership; the smaller the firm, the more closely held it is likely to be.

4.4.6 Depreciation

This variable provides an estimate of the firm's tangible asset base. It eliminates assets that may be non-producing or obsolete, essentially eliminating assets that have already been depreciated. Since a majority of the firms use straight line depreciation for financial reporting purposes, variations due to different depreciation practices for tax

purposes are eliminated. Myers (1977) and subsequently Long and Malitz (1983) argue that firms with a larger asset base will have a greater capacity to support debt, since fixed assets are relatively easy to monitor and provide collateral for bondholders. The hypothesized sign on the depreciaton variable is positive. A similar variable is used in Bradley, Jarrell, and Kim (1984). The variable is standardized by taking a ratio of depreciation expense to total assets.

A summary of the explanatory variables and the hypothesized relationship between the explanatory variables and the leverage ratio is presented in Table 4.4 .

TABLE 4.4

Hypothesized Signs of the Explanatory Variables:

Dependent Variable - Leverage Ratio

Explanatory Variable	Hypothesized Sign	Variable Name
Percentage of insider ownership	-	%Insid
Natural logarithm of the number of insiders	+	NoInsid
Standard deviation of the first difference in earnings before interest and taxes over the past five years	+	Stddev
Ratio of research & development expenses to total assets	-	RAD
Natural logarithm of sales revenue	+	Sales
Ratio of depreciation expense to total assets	+	Depr

4.5 THE DIVIDEND MODEL

The dividend payout model is similar to the model developed by Rozeff (1982). The regression model to be estimated is of the form:

$$P = \beta_0 + \beta_1 \%Insid + \beta_2 Noinsid + \beta_3 DOL + \beta_4 DFL + \beta_5 Sgroth + \beta_6 Sales + e$$

where

P is the payout ratio of the firm, [16]

β_0 is the intercept term,

%Insid is the percentage of insider holdings,

NoInsid is the natural log of the number of insiders,

DOL is the degree of operating leverage of the firm,

DFL is the degree of financial leverage of the firm,

Sgroth is the geometric mean of the percentage sales growth over the past five years,

Sales is the natural log of the firm's sales revenue,

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[16] The payout ratio is defined as the ratio of dividends per share to earnings per share. Preferred stock dividends are excluded.

β_1, β_2, β_3, β_4, β_5, and β_6 are the coefficients of the corresponding independent variables, and

e is the error term.

Results of this study, however, will be stronger than the Rozeff study since:

(1) An additional explanatory variable has been introduced to control for size.

(2) The investment opportunity set has been controlled by conducting the analysis on an industry basis.

(3) Any distortion introduced by averaging the data over several years has been eliminated.

(4) An additional variable, number of insiders, has been added to distinguish between firms that have a large percentage owned by one individual as compared to the percentage owned by several individuals.

(5) Disclosure data is used, which eliminates any approximate ownership data and provides a larger sample size for analysis.

Summary statistics of the data used in the regression are presented in Table 4.5.

TABLE 4.5

Summary Statistics for Payout Data

Variable	N	Mean	Std Dev	Min	Max
Payout	1771	0.2598	0.2515	0	0.9893
%Insid	1771	23.7166	23.8802	0	95.9700
NoInsid	1771	2.2565	0.9445	0	4.6151
Sales	1771	19.0663	1.9365	6.4599	26.7544
DOL	1770	7.3416	15.5195	0.0930	166.1400
DFL	1771	1.4530	1.5821	-15.1221	27.8500
Sgroth	1725	22.8829	33.3290	-24.5999	237.1999

4.6 EXPLANATORY VARIABLES - PAYOUT

The agency variables used in this model are the same as in the leverage model. Again, the hypothesized relationship between payout and insider ownership is negative. On the other hand, the hypothesized relationship between the number of insiders and the payout ratio is positive. The firm's sales revenue is included to control for the firm "size effect".

4.6.1 Degree of Operating Leverage

The degree of operating leverage is hypothesized to have a negative relationship with payout ratio. Rozeff (1982) argues that the higher a firm's operating leverage, the more the firm will reduce payout to lower the cost of financing, other things being equal. The DOL is estimated using:

$$DOL = \Sigma \left| \frac{\% \Delta \text{ EBIT}}{\% \Delta \text{ Sales}} \right| / N$$

The absolute value of the past five years data is used since it is the magnitude of the volatility that is important and not the direction (see Reilly (1985)). The hypothesized sign for this variable is negative.

4.6.2 Degree of Financial Leverage

The degree of financial leverage is also hypothesized to have a negative relationship with the payout ratio. As with operating leverage, the higher a firm's financial leverage, the more the firm will reduce payout to lower its cost of financing, other things being equal. The DFL is estimated using:

$$DFL = \frac{EBIT}{EBIT - I}$$

where:

EBIT is the earnings before interest and taxes, and

I is the interest expense.

4.6.3 Sales Growth

The firm's sales growth provides an estimate of its growth opportunities. The geometric mean of the past five years' sales growth is used as a proxy for the sales growth. Typically, firms that have larger growth opportunities have a greater need for internal funds and thus pay out a smaller proportion of their earnings.

A summary of the explanatory variables and the hypothesized relationships between the explanatory variables and payout are presented in Table 4.6 .

TABLE 4.6

Hypothesized Signs of the Explanatory Variables:

Dependent Variable - Payout Ratio

Explanatory Variable	Hypothesized Sign	Variable Name
Percentage of insider ownership	-	%Insid
Natural logarithm of the number of insiders	+	NoInsid
Degree of operating leverage	-	DOL
Degree of financial leverage	-	DFL
Natural logarithm of sales revenue	+	Sales
Geometric mean of the five year sales growth	-	Sgroth

Chapter V

RESULTS

5.1 INSIDER OWNERSHIP AND DIVIDENDS

5.1.1 Group Analysis

Tests for the normality of the payout ratios are done before the analysis of variance (ANOVA) procedure is performed. The skewness, kurtosis, and the Kolmogorov-Smirnov D statistic indicate non-normality for the aggregate data as well as for the individual groups. The results of the tests are reported in Table 1B in Appendix B. The skewness and kurtosis for the the closely held group (group3) is the largest of the three groups. This is due to the fact that a large proportion of the closely held firms (52 percent) do not pay dividends, as compared with 22 percent for the widely held firms (group1).

The payout ratios are transformed using several different approaches. The results of the natural logarithm and the square root transformations are reported in Table 1B. Since the transformations did not significantly improve the normality, it is preferable to use the non parametric Kruskal-Wallis test.

The results of the group analysis for payout ratio are presented in Table 5.1 . Both the ANOVA and the non-parametric Kruskal- Wallis test results show significance at the 5 percent level for the aggregate data as well as four of the eight industries. Thus non-normality, in this case, does not alter the results substantially.

The Tukey-Kramer test results reported are for the pairwise comparison of means. Each pair of groups is presented in the table, with significant differences in pairs marked by an asterisk. As expected, these results also detect a difference in means in the same industries as the ANOVA and Kruskal-Wallis tests. Industries in which payout ratios are not significant have a large disparity in the number of observations across groups, resulting in a decrease in the power of the overall test. By casual observation, all industries except Computer Data Processing, had lower payouts for the closely held group (group 3) as compared with the widely held group (group 1).

TABLE 5.1

Results of the Group Analysis - Payout Ratio

Industry	Group	N	Group Mean Payout	Overall F ANOVA	ChiSq Kruskal Wallis	Tukey-Kramer Test
Aggregate Data	1	719	0.3499	101.19	183.20	1-2*
	2	706	0.2262	(.001)	(.001)	1-3*
	3	346	0.1411			2-3*
Crude Petroleum & Natural Gas	1	21	0.3632	3.69	6.67	1-2*
	2	22	0.1593	(.031)	(.036)	1-3*
	3	21	0.1589			2-3
Printing and Publishing	1	13	0.2405	6.01	8.78	1-2
	2	20	0.3349	(.005)	(.012)	1-3
	3	15	0.1627			2-3*
Electronic Computing Equip.	1	12	0.1497	8.10	10.98	1-2*
	2	29	0.0103	(.001)	(.004)	1-3*
	3	17	0.0147			2-3
Radio & TV Equipment	1	15	0.2658	4.98	8.87	1-2*
	2	17	0.1031	(.011)	(.012)	1-3*
	3	16	0.0553			2-3
Measuring & Control Instr.	1	4	0.1459	.02	0.24	1-2
	2	18	0.1299	(.956)	(.889)	1-3
	3	9	0.1195			2-3
Eating & Drinking Places	1	1	0.0000	1.31	2.78	1-2
	2	20	0.1339	(.185)	(.249)	1-3
	3	12	0.0737			2-3
National Banks	1	57	0.3613	0.69	0.86	1-2
	2	29	0.3437	(.311)	(.649)	1-3
	3	9	0.3011			2-3
Computer Data Processing	1	7	0.0340	1.62	2.25	1-2
	2	26	0.0360	(.265)	(.279)	1-3
	3	17	0.1100			2-3

* significant at the 10 percent level

Group 1: below 10 percent insider ownership
Group 2: between 10 and 45 percent insider ownership
Group 3: above 45 percent insider ownership

5.1.2 Regression Analysis

In order to detect if the dependent variable is related to the independent variables, a correlation analysis is performed. This analysis also helps detect potential multi-collinearity problems among the dependent variables. Table 5.2 shows the correlation matrix for the dividend payout variables. Several of the explanatory variables exhibit significant multicollinearity, as expected because of the increased sensitivity of the correlation analysis as the sample size increases. However, sales are highly correlated with %Insid, NoInsid, and Sgroth. Multi-collinearity does not, in general, influence the ability to obtain a good fit; it may however alter either the sign or the significance of the coefficients of the explanatory variables. One remedy is to run the regressions without the correlated variable, reducing the standard errors of the estimated regression coefficients of the independent variables. Thus sales is omitted for the initial set of regressions. Further analysis done with sales included as an explanatory variable shows that multicollinearity does not significantly alter the regressions.

All the signs in the correlation matrix are as predicted although DFL is not significant. As expected the number of insiders is positively correlated with the percentage of in-

TABLE 5.2

Correlation Matrix: Dependent Variable- Payout Ratio

(P Values in Parentheses)
1725 Firms

	Payout	%Insid	NoInsid	Sale	DOL	DFL	Sgroth
Payout	1.0000	-0.3057	0.3184	0.5216	-.1407	-.0088	-0.3481
	(0.000)	(.0001)	(.0001)	(.0001)	(.0001)	(.7103)	(.0001)
%Insid		1.0000	0.0462	-0.2814	.0618	.0834	0.1151
		(0.000)	(.0519)	(.0001)	(.0093)	(.0004)	(.0001)
NoInsid			1.0000	0.5141	-.0886	.0686	-0.1270
			(.000)	(.0001)	(.0002)	(.0039)	(.0001)
Sale				1.0000	-.1202	.0485	-0.2149
				(.0000)	(.0001)	(.0413)	(.0001)
DOL					1.0000	.0434	-0.1058
					(.000)	(.0677)	(.0001)
DFL						1.0000	0.0186
						(.0000)	(.4395)
Sgroth							1.0000
							(.0000)

sider ownership variable. The DFL and DOL variables are positively correlated, providing evidence for the Myers (1977) hypothesis that the value of a firm with high business risk is affected to a lesser degree by risky debt as compared with a firm that has small business risk. Thus firms with high business risk may use more risky debt in their capital structures.

The results of the least squares regression using payout as the dependent variable are presented in Table 5.3 . The residuals from the regression are tested for independence and non-normality. Results from the Kolmogorov-Smirnov test are presented in Table 1B in Appendix B. Also an approximate test for normality by Snedecor and Cochran (1980) is used. The test statistics are:

$$\frac{\alpha_3}{\sqrt{6 / N}} \qquad \frac{\alpha_4}{\sqrt{24 / N}}$$

where:

α_3 is the skewness of the distribution,
α_4 is the kurtosis of the distribution, and
N is the number of observations.

These statistics have a standard normal distribution. The results of the tests indicate non-normality of residuals. Several transformations of the dependent variables are used to obtain normality. The results for the natural logarithm and square root transformations are in Table 1B.

While the natural logarithm transformation improves kurtosis it increases the skewness. The square root transformation gives the best results with lower skewness and kurtosis. The Kolmogorov-Smirnov D statistic with the transformation improves from 0.08 to 0.03.

To test for independence of the residuals the Durbin-Watson test for first degree auto-correlation is used. The Durbin-Watson D is 1.88 with a first degree auto-correlation of 0.06, implying independent error terms. The plots of residuals versus the independent variables and predicted values are presented in Figures 1B to 7B in Appendix B. The plots appear to imply homoscedasticity.

The transformation of the dependent variable resulted in an increase in the R square value from 0.30 to 0.37. The significance of both the %Insid and the NoInsid variables also improved.

The regression for the the aggregate data substantiates the evidence in the correlation analysis. Even though significant multicollinearity does exist between sales and the other variables, the results are as hypothesized. The signs on all the variables are as predicted, although the DFL coefficient is not significant.

The R square and F values for the aggregate analysis are 0.37 and 167.19 respectively. These values compare favorably with the Rozeff (1982) results with an R square of 0.48 and an F value of 185.47. Both the insider variables are significant at the .001 level and the signs are as predicted. This provides further evidence for the hypothesis of this study that payout and insider ownership are negatively related.

In each of the industry groups except computer data processing and electric services, the percentage of equity held by insiders is negatively related to the payout ratio, though not significantly in all cases. The number of insiders is positively related to the payout in all nine industries.

In the electric services (utility) industry the results are contrary to those for a majority of the other industries. This is consistent with the asymmetric information hypothesis. Smith (1986), hypothesizes that the regulation process in the utility industry reduces the information asymmetry between managers and outside securityholders. Also by paying high dividends, utilities frequently have to raise external funds through capital markets. This process allows an effective monitoring by capital markets and the outsiders. In such a case the relationship between insider owner-

ship and dividends under asymmetric information will no longer exist since the difference in information is small.

TABLE 5.3

Results of the Least Squares Regression:
Dependent Variable Payout Ratio - 1984
(T Statistics and P Values in Parenthesis)

Industry	N	Constant	(-) %Insid	(+) NoInsid	(-) DOL	(-) DFL	(-) Sgroth	(+) Sales	R Square	F Value
Aggregate Data	1725	-0.631	-.002	.033	-.002	-.002	-0.002	.057	0.37	167.19
		(-8.62)	(-8.59)	(4.21)	(-5.71)	(-0.52)	(-12.70)	(14.18)		
		(.001)	(.001)	(.001)	(.001)	(.601)	(.001)	(.001)		(.001)
Crude Pet. & Nat Gas	61	0.031	-.004	.158	.089	-.040	-0.001		0.39	8.47
		(0.17)	(-3.17)	(4.50)	(0.87)	(-1.50)	(-2.43)			
		(.865)	(.002)	(.001)	(.385)	(.139)	(.018)			(.001)
Printing & Publishing	47	0.684	-.003	.010	-.002	-.147	0.002		0.35	5.98
		(4.93)	(-3.16)	(0.28)	(-0.88)	(-3.71)	(1.15)			
		(.001)	(.003)	(.785)	(.383)	(.001)	(.257)			(.001)
Elect. Comp. Equipment	51	-0.194	-.001	0.118	-.044	.128	-0.001		0.24	4.22
		(-1.23)	(-1.66)	(3.45)	(-1.31)	(1.18)	(-0.71)			
		(.226)	(.104)	(.001)	(.198)	(.243)	(.482)			(.003)
Radio & TV Equipment	46	0.416	-.004	.036	-.018	-.051	-0.001		0.15	2.60
		(1.82)	(-3.09)	(0.71)	(-1.21)	(-0.33)	(-1.24)			
		(.076)	(.004)	(.484)	(.232)	(.743)	(.222)			(.039)
Measuring & Cntrl Inst	30	-0.432	-.001	0.037	-.016	.614	-0.003		0.11	1.76
		(-1.28)	(-0.16)	(0.46)	(-0.91)	(2.31)	(-1.46)			
		(.214)	(.874)	(.649)	(.372)	(.029)	(0.157)			(.159)
Surgical & Medical Sup	21	-0.306	-.003	0.209	.019	.034	-0.001		0.39	3.51
		(-1.06)	(-1.62)	(2.74)	(1.26)	(0.12)	(-0.36)			
		(.308)	(.126)	(.015)	(.228)	(.903)	(.727)			(.027)
Electric Services	90	1.503	.001	0.054	-.292	-.268	0.001		0.18	4.79
		(6.23)	(0.02)	(2.32)	(-3.19)	(-2.36)	(-0.03)			
		(.001)	(.983)	(.028)	(.002)	(.021)	(.969)			(.001)
Eating & Drinking Places	33	-0.009	-.001	0.128	-.006	.051	-0.001		0.26	3.24
		(-0.07)	(-0.96)	(3.10)	(-0.67)	(1.27)	(-1.59)			
		(.942)	(.347)	(.004)	(.509)	(.215)	(.123)			(.020)
National Banks	95	0.307	-.002	0.026	.023	.057	---		0.31	11.95
		(3.76)	(-3.61)	(1.26)	(1.46)	(5.52)				
		(.001)	(.001)	(.209)	(.147)	(.001)				(.001)
Comp. Data Processing	49	-0.113	.002	0.047	.009	-.002	0.001		0.01	0.89
		(-0.86)	(1.58)	(1.00)	(1.05)	(-0.06)	(0.62)			
		(.394)	(.120)	(.324)	(.301)	(.955)	(.538)			(.494)

5.2 INSIDER OWNERSHIP AND LEVERAGE

5.2.1 Group Analysis

Tests for the normality assumptions are performed before the ANOVA group analysis. The skewness, kurtosis, and the Kolmogorov-Smirnov D test statistic are reported in Table 1C in Appendix C. The test results indicate non-normality. Different transformations are attempted to obtain normality. The square root transformation does improve the Kolmogorov-Smirnov D statistic but fails to eliminate the problem. Thus the non-parametric Kruskal-Wallis test is preferable for these data.

The results of the group analysis for leverage are presented in Table 5.4 . For the aggregate data both the ANOVA and the Kruskal-Wallis tests detect a difference in group means. The Tukey-Kramer test results show a significant difference in the means of leverage ratios between the widely held group (group 1) and the closely held group (group 3). This provides evidence for the hypothesis of this study that there exists a negative relationship between leverage and insider ownership. The electrical services industry is excluded from this analysis as it does not have any firms in the closely held group (group1).

TABLE 5.4

Results of the Group Analysis - Leverage Ratio

Industry	Group	N	Group Mean Leverage	Overall F ANOVA	ChiSq Kruskal Wallis	Tukey-Kramer Test
Aggregate Data	1	719	0.2204	13.38	28.53	1-2*
	2	706	0.1667	(.001)	(.001)	1-3
	3	346	0.1966			2-3*
Crude Petroleum & Natural Gas	1	37	0.2684	2.33	5.48	1-2
	2	43	0.4282	(.101)	(.065)	1-3
	3	45	0.2940			2-3
Printing and Publishing	1	16	0.2025	4.63	7.03	1-2*
	2	26	0.0815	(.014)	(.030)	1-3
	3	14	0.1903			2-3
Electronic Computing Equip.	1	27	0.2105	6.16	11.34	1-2*
	2	46	0.0582	(.003)	(.013)	1-3*
	3	19	0.0880			2-3
Radio & TV Equipment	1	20	0.1245	0.25	0.46	1-2
	2	28	0.1059	(.776)	(.796)	1-3
	3	19	0.0795			2-3
Measuring & Control Instr.	1	8	0.0636	0.16	1.20	1-2
	2	25	0.1002	(.851)	(.904)	1-3
	3	17	0.1052			2-3
Surgical & Med Supplies	1	6	0.1570	0.09	0.49	1-2
	2	21	0.1652	(.918)	(.781)	1-3
	3	7	0.1310			2-3
Eating & Drinking Places	1	3	0.0543	1.63	3.04	1-2
	2	25	0.2184	(.209)	(.218)	1-3
	3	11	0.2421			2-3
National Banks	1	60	0.1984	4.45	8.57	1-2*
	2	37	0.1105	(.014)	(.014)	1-3
	3	11	0.2386			2-3*
Computer Data Processing	1	14	0.0952	1.28	3.78	1-2
	2	32	0.1512	(.285)	(.151)	1-3
	3	20	0.0782			2-3

* significant at the 10 percent level

Group 1: below 10 percent insider ownership
Group 2: between 10 and 45 percent insider ownership
Group 3: above 45 percent insider ownership

In the industry analysis, though six of the ten industries have a greater leverage for group 1 (widely held firms) than group 3 (closely held firms), the difference is significant in only one group. Thus, though the aggregate results are significant, the results of the industry analysis are not as good as the group analysis for dividends.

5.2.2 Regression Analysis

Initially, a correlation analysis is done to detect potential multi-collinearity problems and also to determine if a significant relationship exists between the dependent and the independent variables. Table 5.5 shows the correlation matrix between leverage ratio and the explanatory variables. Again sales are highly correlated with the %Insid, NoInsid, and Stddev. Since the multi-collinearity may influence either the sign or the interpretation of the coefficients of the explanatory variables, sales is not included in the regression. All the signs except Stddev are as predicted and each is significant at the .01 level.

Table 5.6 presents the least squares regression for leverage. The residuals from the regression are tested for independence and non-normality. Results from the Kolmogorov-Smirnov normality test are given in Table 1C in Appendix

TABLE 5.5

Correlation Matrix: Dependent Variable- Leverage Ratio

(P Values in Parentheses)
1765 Firms

	Ltdebt	%Insid	NoInsid	Sale	Stddev	RAD	Depr
Ltdebt	1.0000	-0.0677	0.1124	0.2810	-.0027	-.1750	0.2199
	(0.000)	(.0043)	(.0065)	(.0001)	(.9099)	(.0001)	(.0001)
%Insid		1.0000	0.0462	-0.2895	.1161	.0338	-0.0354
		(0.000)	(.0519)	(.0001)	(.0001)	(.1551)	(.1360)
NoInsid			1.0000	0.5141	-.1829	.0516	-0.0146
			(.000)	(.0001)	(.0001)	(.0300)	(.5381)
Sale				1.0000	-.3074	-.1407	0.0741
				(.0000)	(.0001)	(.0001)	(.0030)
Stddev					1.0000	.0946	-0.0463
					(.000)	(.0001)	(.0516)
RAD						1.0000	-0.0608
						(.0000)	(.0105)
Depr							1.0000
							(.0000)

C. The approximate test by Snedecor and Cochran (1980) described in the dividend analysis section is also used to detect non-normality. These test results indicate non-normality of residuals. Among the several transformations attempted, the square root transformation worked the best, reducing the Kolmogorov-Smirnov D statistic from 0.10 to 0.04.

The Durbin-Watson D for the auto-correlation is 1.96 with a first degree auto-correlation of 0.02, implying independent error terms. The plots of residuals versus the independent variables and predicted values are presented in Figures 1C to 6C in Appendix C. The plots appear to imply constant variance of error terms.

The transformation of the leverage ratios resulted in an increase in the R square value from 0.08 to 0.10. The significance of the insider variables also improved.

TABLE 5.6

Results of the Least Squares Regression:
Dependent Variable Leverage Ratio - 1984
(T Statistics and P Values in Parenthesis)

Industry	N	Constant	(-) %Insid	(+) NoInsid	(+) Stddev	(-) RAD	(+) Depr	R Square	F Value
Aggregate Data	1765	0.283	-.001	.036	.001	-1.373	1.988	0.10	37.50
		(17.27)	(-2.91)	(5.911)	(2.40)	(-7.52)	(9.32)		
		(.001)	(.003)	(.001)	(.016)	(.001)	(.001)		(.001)
Crude Pet. & Nat Gas	125	0.294	-.001	.094	-.001	-.773	0.188	0.27	10.24
		(5.23)	(-1.71)	(4.06)	(-1.04)	(-1.66)	(5.06)		
		(.001)	(.090)	(.001)	(.299)	(.100)	(.001)		(.001)
Printing & Publishing	55	0.361	0.001	-.041	.001	-3.943	2.061	0.22	3.96
		(4.82)	(0.20)	(-1.47)	(1.28)	(-1.91)	(2.60)		
		(.001)	(.846)	(.149)	(.207)	(.063)	(.012)		(.004)
Elect. Comp. Equipment	92	0.301	-.002	0.002	.001	-.127	0.689	0.11	2.08
		(3.85)	(-2.52)	(0.08)	(0.09)	(-0.36)	(1.95)		
		(.001)	(.014)	(.937)	(.929)	(.721)	(.054)		(.075)
Radio & TV Equipment	67	0.211	-.001	0.032	-.001	.124	0.795	0.07	0.94
		(2.69)	(-1.50)	(0.98)	(-0.97)	(1.14)	(0.63)		
		(.009)	(.138)	(.329)	(.337)	(.257)	(.531)		(.458)
Measuring & Cntrl Inst	50	0.054	-.001	0.119	.001	-.569	23.023	0.15	1.60
		(0.55)	(-0.49)	(2.74)	(0.04)	(-1.19)	(0.90)		
		(.581)	(.630)	(.009)	(.966)	(.241)	(.373)		(.181)
Surgical & Medical Supplies	34	0.316	-.001	0.084	-.001	-2.607	-3.435	0.28	2.21
		(1.91)	(-0.49)	(1.31)	(-1.11)	(-2.69)	(-0.58)		
		(.066)	(.628)	(.199)	(.278)	(.012)	(.568)		(.082)
Electric Services	79	0.440	.001	0.029	.004	18.63	1.201	0.10	1.70
		(4.72)	(0.01)	(1.18)	(1.57)	(0.74)	(2.43)		
		(.001)	(0.99)	(.239)	(.120)	(.459)	(.017)		(.144)
Eating & Drinking Places	39	0.155	.001	0.071	.001	---	1.252	0.16	2.81
		(1.67)	(1.29)	(1.99)	(0.27)		(1.80)		
		(.104)	(.205)	(.054)	(.782)		(.080)		(.041)
National Banks	108	0.259	-.001	0.036	.001	---	---	0.02	1.02
		(2.99)	(-0.58)	(1.13)	(1.31)				
		(.003)	(.563)	(.262)	(.192)				(.391)
Comp. Data Processing	66	0.143	-.001	0.070	-.001	-.449	0.279	0.09	1.23
		(1.55)	(-0.52)	(1.95)	(-0.14)	(-1.13)	(0.66)		
		(.125)	(.607)	(.056)	(.893)	(.262)	(.510)		(.305)

The results of the aggregate data support the group analysis results. For the aggregate data, the signs of the variables are as predicted and significant at the .01 level. This provides further evidence that insider ownership and leverage are negatively related. Though the R square of the regression is low, the overall F value indicates significance. The low R square implies that factors other than the financial factors and insider ownership considered in this study are also important determinants of the firm's leverage. Later in the chapter, the influence of industry effects is investigated. A low R square value in leverage studies is not uncommon. Kim and Sorensen (1986) report an R square of 0.15 in their regression analysis.

In the industry analysis, the percentage of insider ownership has a negative coefficient in seven of the ten industries, though not always significant. Other variables also show similar consistency, though not all are significant.

It is possible that the results for the leverage analysis are biased due to the fact that for smaller (closely held) firms it is more expensive to raise equity than debt. This may be due to a number of reasons, one of which may be: lesser access of smaller firms to capital markets than larger firms. Since the study does not account for the difference in costs of raising debt and equity, the negative rela-

tionship between leverage and insider ownership may be stronger than indicated by the regression.[17]

Overall, the results of the leverage ratio are not as significant as the dividend ratio results. One possible conclusion is that dividends are used more frequently as signals than leverage. This is contrary to what is hypothesized by Sarig (1984).

5.3 INDUSTRY EFFECTS ON REGRESSIONS

In order to determine the influence of industry factors on the regression analysis, the data for all the firms in the ten industry groups are pooled together. A total of 523 firms are in the sample for the payout analysis and 715 firms for the leverage analysis. The results of the analyses for leverage and payout ratio are presented in Table 5.7 . A zero-one dummy variable is introduced as an industry dummy, thus a total of nine dummy variables are added to the regressions. The industry with a mean payout and leverage ratio closest to the aggregate mean is the excluded set.

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[17] When the sales variable is introduced in the regressions the signs of the coefficients are reversed, probably due to the multi-collinearity problem. Thus in the leverage analysis the results are more sensitive than in the dividend analysis. The regression results with the sales variable are not reported.

TABLE 5.7

Results of Least Squares Regression for Payout and Leverage Ratios With Industry Dummys

	Payout		Leverage	
	With Industry Dummy	Without Ind. Dummy	With Industry Dummy	Without Ind. Dummy
Firms	523	523	715	715
Constant	0.195 (4.26) (.001)	0.318 (7.62) (.001)	0.341 (7.88) (.001)	0.302 (11.54) (.001)
%Insid	-0.002 (-5.17) (.001)	-0.005 (-10.77) (.001)	-0.001 (-1.99) (.047)	-0.002 (-4.68) (.001)
Noinsid	0.091 (7.57) (.001)	0.088 (5.97) (.001)	0.041 (4.15) (.001)	0.041 (3.90) (.001)
Stdev	---	---	0.001 (0.64) (.520)	0.001 (0.65) (.512)
DOL	-0.002 (-1.04) (.297)	-0.008 (-2.90) (.004)	---	---
RAD	---	---	-0.040 (-0.45) (.654)	-0.282 (-3.03) (.003)
Depr	---	---	0.208 (6.39) (.001)	0.296 (9.26) (.001)
DFL	0.004 (0.41) (.652)	0.025 (2.24) (.025)	---	---
Sgroth	-0.001 (-3.62) (.001)	-0.001 (-6.41) (.001)	---	---
R Square	0.55	0.30	0.31	0.15
F Statistic (P Value)	48.06 (.001)	45.48 (.001)	23.92 (.001)	26.50 (.001)

Seven of the nine industry dummy variable coefficients are significant at the .01 level for the dividend analysis.

Eight of the nine industry dummy variable coefficients are significant at the .01 level for the leverage analysis.

For both the payout and leverage ratios a significant increase in the explanatory power of the models is observed. The R square for the payout ratio increased by 0.25 and that for the leverage ratio increased 0.16. This is consistent with the results of other studies such as the Bradley, Jarrell, and Kim (1984) study. This suggests that industry factors are significant in explaining the variations in leverage and payouts across firms. However, a significant portion of the variability remains unexplained and is probably due to the decisions of individual managers at the firm level. It should be noted that both the percentage of insider ownership and number of insiders continue to remain significant, with the hypothesized sign.

5.4 STABILITY OF THE RELATIONSHIP OVER TIME

Since the data used in the study is cross-sectional in nature and insider ownership data for 1981 are available, the cross-sectional regressions were checked for stability over time. Because the 1981 Disclosure tape does not report dividends and stock prices it is necessary to obtain these data from the Compustat tapes by matching firms on both tapes. In order to be consistent in the analysis, firms for 1984 are also matched. The results of the regressions for the aggregate data for payout and leverage ratios over both years are presented in Tables 5.8 and Table 5.9 .

TABLE 5.8

Results of the Least Squares Regression:
Dependent Variable Payout Ratio - 1984
(T Statistics and P Values in Parenthesis)

			(-)	(+)	(-)	(-)	(-)	(+)		
Industry	N	Constant	%Insid	NoInsid	DOL	DFL	Sgroth	Sales	R Square	F Value
Aggregate Data	1487	-0.962	-.002	.009	-.004	-.002	-0.002	.072	0.27	90.05
		(-11.27)	(-5.39)	(1.11)	(-4.60)	(-0.32)	(-3.91)	(15.62)		
		(.001)	(.001)	(.267)	(.001)	(.749)	(.001)	(.001)		(.001)

Dependent Variable Payout Ratio - 1981
(T Statistics and P Values in Parenthesis)

			(-)	(+)	(-)	(-)	(-)	(+)		
Industry	N	Constant	%Insid	NoInsid	DOL	DFL	Sgroth	Sales	R Square	F Value
Aggregate Data	1242	-0.623	-.002	.011	-.053	-.002	-0.002	.058	0.21	55.18#
		(-6.59)	(-5.38)	(1.09)	(-1.36)	(-2.37)	(-3.01)	(11.36)		
		(.001)	(.001)	(.274)	(.169)	(.018)	(.003)	(.001)		(.001)

TABLE 5.9

Results of the Least Squares Regression:
Dependent Variable Leverage Ratio - 1984
(T Statistics and P Values in Parenthesis)

			(-)	(+)	(+)	(-)	(+)		
Industry	N	Constant	%Insid	NoInsid	Stddev	RAD	Depr	R Square	F Value
Aggregate Data	1487	0.475	-.001	-.001	.001	-2.263	1.237	0.09	31.61
		(23.92)	(-2.39)	(-0.048)	(3.50)	(-11.19)	(5.50)		
		(.001)	(.017)	(.962)	(.001)	(.001)	(.001)		(.001)

Dependent Variable Leverage Ratio - 1981
(T Statistics and P Values in Parenthesis)

			(-)	(+)	(+)	(-)	(+)		
Industry	N	Constant	%Insid	NoInsid	Stddev	RAD	Depr	R Square	F Value
Aggregate Data	1242	0.528	-.001	-.007	-.001	-2.401	1.126	0.08	20.66
		(22.69)	(-2.52)	(-0.92)	(-0.20)	(-9.41)	(3.83)		
		(.001)	(.012)	(.360)	(.843)	(.001)	(.001)		(.001)

A total of 1242 firms matched for 1981 and 1487 for 1984. The mean payout and debt ratios for 1981 are 0.289 and 0.308 respectively, while those for 1984 are 0.273 and 0.293. The results for the payout ratio show a remarkable stability over the period. The percentage of insider ownership coefficient is significant for both years and has a negative sign. The number of insiders coefficient though positive, is not significant. This is probably because the data includes only NYSE and AMEX firms, which may not have as large a variation in the number of insiders as OTC firms. The signs across the other variables are also consistent. However all the variables are not significant. The R square for the 1984 data is a little better than that for the 1981 data.

The results for the leverage ratio also show a stable relationship over time. Again the percentage insider ownership is negatively related to the leverage and is significant at the .02 level. The number of insiders is not significant. The standard deviation variable, however, does not show a stable relationship. The coefficient is positive and significant for 1984 but is negative and insignificant for 1981. The R squares are similar, with the model for 1984 having a slightly better fit than the 1981 model.

5.5 SIGNALLING VS THE RISK AVERSION HYPOTHESIS

One implication of leverage being used as a signal of firm value is that closely held firms will have less leverage than widely held firms. However, it is not clear whether the lower leverage is due to the signalling motive or risk aversion on the part of the owner-manager. Since an owner-manager has a significant portion of his wealth invested in a single firm, the manager may have an incentive to decrease the riskiness of the firm by using lower leverage. Thus, whether the lower leverage is due to signalling or a risk aversion motive is an empirical issue.

In order to investigate this further, the percent insider ownership is regressed against the systematic and non-systematic risk of the firm to evaluate the relationship. A negative relationship between insider ownership and non-systematic risk would be consistent with a risk aversion motive for low levels of leverage. The risk aversion motive implies that a manager with a significant portion of his wealth in a single firm and under-diversificaton of personal wealth will, due to risk aversion on his part, make decisions that diversify the firm and lower non-systematic risk.

To evaluate the systematic and nonsystematic risk, the Cusip numbers for firms from Disclosure were matched with those on the CRSP tapes. A total of 1082 firms matched, 265

firms from the AMEX and 817 firms from the NYSE. The CRSP monthly tapes were used to compute firm systematic risk (beta) and non-systematic risk using 72 months of data from December, 1978 to December, 1984. To estimate the systematic and non-systematic risk of the firm, a single index market model is used:

$$R_j = \alpha_j + \beta_j R_k + \epsilon_j$$

where:

R_j is the return for firm j,
R_k is the return for the CRSP equal weighted market index,
β_j is Cov (R_j, R_k) / Var (R_k),
α_j is $E(R_j) - \beta_j E(R_k)$, and
ϵ_j is the error term for firm j.

The non-systematic risk of the firm is estimated from the variance of the error term. The percentage insider ownership from Disclosure is regressed on the systematic and non-systematic risk of the firm. The natural logarithm of the market value of equity is included in the regression to adjust for size. The market value of equity is obtained from the CRSP daily files.[18] The results of the regression are presented in Table 5.10 .

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[18] Three different measures for the market value of equity for the firm were used: (a) average market value over the six year period, (b) market value on December 31, 1984, and (c) market value on December 31, 1981. The results are virtually the same using any of the measures.

TABLE 5.10

Results of Regression of Ownership on Risk

$$O = \alpha_1 + \beta_1 \text{ SRisk} + \beta_2 \text{ NRisk} + \beta_3 \text{ Size} + \epsilon$$

(T Statistics and P Values in Parentheses)

N	α_1	β_1	β_2	β_3	R Square	F Value
1082	12.623	-1.387	138.169	-0.825	20.249	92.45
	(11.80)	(-3.82)	(6.35)	(-10.53)		
	(.0001)	(.0001)	(.0001)	(.0001)		(.0001)

where:

O is the percent insider ownership,
SRisk is the systematic risk of the firm,
NRisk is the non-systematic risk of the firm,
Size is the natural logarithm of the market value of equity of the firm,
α_1 is the intercept term,
β_1 , β_2, β_3, are the regression coefficients, and
ϵ is the error term.

The results show a negative relationship between ownership and systematic risk (beta). This tends to confirm the earlier finding of a negative relationship between ownership and leverage (since leverage and beta are positively correlated, see Hamada (1972)). The surprising result is the significantly positive relationship between ownership and the non-systematic risk of the firm. This finding tends to reject the risk aversion hypothesis, as insiders choose to own stock in firms that are not well diversified (high non-systematic risk). Thus, evidence from this analysis tends to favor the signalling hypothesis over the risk aversion hypothesis.

5.6 THE SUBSTITUTE SIGNAL HYPOTHESIS

Sarig (1985) hypothesizes that leverage and dividends may be used as substitute signals of firm value. Sarig and Scott (1985) provide preliminary evidence for the hypothesis. They find a significantly positive correlation between leverage and payout for an aggregate sample of 894 NYSE firms.

To investigate the issue further, a correlation analysis for 1771 NYSE, AMEX, and OTC firms is performed. The sample is then disaggregated into industries and the results are reported in Table 5.11 .

TABLE 5.11

Correlation Analysis of Payout and Leverage Ratios

Industry	N	Means		Correlation (P value in parenthesis)
		Payout Ratio	Leverage Ratio	
Aggregate Data	1771	0.260	0.194	0.136 (0.0001)
Crude Petroleum & Natural Gas	43	0.267	0.281	0.129 (0.4114)
Printing and Publishing	41	0.278	0.117	-0.568 (0.0001)
Electronic Computing Equip.	42	0.030	0.064	0.004 (0.9803)
Radio & TV Equipment	35	0.155	0.089	-0.128 (0.4629)
Measuring & Control Instr.	26	0.126	0.098	0.141 (0.4914)
Surgical & Med Supplies	14	0.146	0.111	0.676 (0.0079)
Electric Services	75	0.645	0.469	-0.415 (0.0002)
Eating & Drinking Places	22	0.106	0.219	0.051 (0.8209)
National Banks	77	0.354	0.152	0.265 (0.0197)
Computer Data Processing	37	0.050	0.099	-0.159 (0.3469)

The correlation for the aggregate sample is 0.136 and is significant at the .0001 level. However, when the data is disaggregated, four of the ten industries have negative correlations, two of which are significant at the .0002 level. Unlike the results of Sarig and Scott (1985), these results suggest that dividends and leverage may not be substitute signals in these industries.

Further, Sarig (1985) hypothesizes that leverage is initially is used by firms for signalling, since it is non-dissipative. When the use of leverage becomes costly for the firm, dividends will be used as a substitute signal. Evidence in this study appears to contradict this hypothesis. However, evidence presented in this study is preliminary and further research is needed in the substitute signalling area to determine exactly why differences in correlations exist between industries.

Chapter VI

CONCLUSIONS AND FURTHER RESEARCH

This study is motivated by the need to provide empirical evidence for dividend payout and financial leverage signalling equilibria in the informational asymmetry (agency) framework. The hypotheses, developed in the signalling equilibria framework, suggest that closely held firms (with high insider control) should have lower leverage and dividend payouts.

A cross-sectional analysis of the determinants of payout and leverage is performed with insider control variables as explanatory variables. Both ownership control measures: (1) percentage of insider ownership and (2) the number of insiders, are found to be significantly related to the dividend payout and leverage ratios. The percentage of insider ownership is negatively related to payout and leverage while the number of insiders has a positive relationship. This is consistent with the dividend and leverage signalling hypotheses developed in the study. The evidence indicates that both dividends and leverage are used as signalling mechanisms. This provides the most significant finding of the study. The results contradict the Sarig (1985) hypothesis

that leverage and dividends may be substitute signals of firm value, although further study is needed in this area. A comparison of the results for 1981 and 1984 indicates that the relationships are stable over time and are fairly robust to violations in the regression assumptions.

The evidence presented in this study is supportive of the Miller and Rock (1984) prediction that the payout ratio should be an increasing function of the shares held by "outside" investors. The correlation and regression analysis indicate that insider ownership and payouts are negatively related. The relationships are significant at the 0.001 level.

The study also provides support of the Myers and Majluf (1984) observation that a reduced information asymmetry should result in a lower leverage ratio of a firm as it will prefer to raise external funds through equity. Evidence that leverage and insider ownership are negatively related supports this hypothesis.

Evidence for the utility industry is consistent with the hypothesis of Asquith and Mullins (1986) and Masulis and Korwar (1986). They argue that information asymmetry between managers and outsiders is less in the utility industry, due to the regulation process and thus the lack of motivation to signal. Regression analysis of payout ratios,

for the utility industry, fails to detect a negative relationship between dividends and ownership.

The hypothesis that closely held firms should have lower leverage is a joint test of the signalling and risk aversion explanations. The cross-sectional regression of ownership on the firm's non-systematic risk provides evidence in favor of the signalling hypothesis. The negative relationship between ownership and non-systematic risk of the firm tends to reject the risk aversion hypothesis.

The primary weakness of the study is in the results for the leverage ratio. The explanatory power of the regression for the aggregate data is rather low, though the variables are significant at greater than the one percent level. Some of the industry regressions also have low explanatory power. The lack of explanatory power may due to a bias introduced in the results because of the differential cost of raising debt over equity, especially for smaller firms. The negative bias would result in a much stronger relationship than indicated by the regression results.

The strength of the results for the leverage ratio also hinges on the acceptance that the "size effect" does not significantly alter the results. Due to the multicollinearity problem, size is not included in the explanatory variables for the leverage ratio analysis.

To provide further evidence for the relationship between ownership and the leverage and payout ratios, a time series analysis using the event study methodology, may be performed. Firms with change in ownership and the date of this change in ownership (from closely to widely held or vice versa) may be identified. Around this date, the payout and leverage ratios before the change may be compared to those after the change. A decrease (increase) in insider ownership resulting in an increased (decreased) payout and leverage will present further evidence in favor of the use of dividends and leverage as signals.

The evidence against the substitute signalling hypothesis is preliminary and needs further investigation for an explanation of why dividends and leverage are positively related in some industries and negatively in others. Also other agency cost reduction mechanisms such as the manager's compensation schedule have not been addressed in this study. An extension of the present study may include managerial compensation to provide further evidence for the agency cost / signalling equilibrium.

The existence of ownership clienteles is another interesting issue that may be addressed in future work. The notion of dividend and leverage clienteles has received significant attention in financial literature; this study

raises the possibility of the existence of ownership clienteles.

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Appendix A

COMPARISON OF DISCLOSURE VS VALUE LINE DATA

A random sample of 99 firms was chosen for comparison. The firms are from apparel, retail stores, banking, fast foods, petroleum and gas industries.

34 firms have significantly different data (above 5 percent difference).

27 firms have approximate data in the Value Line Investment Survey.

Value Line data is from December, 1984 and January, 1985.

Co. Name	Exchange	Disclosure	Value Line
ADAMS MILLIS CORP	NYS	81.59	38.0
ALEXANDER S INC	NYS	51.89	39.4
AMERADA HESS CORP	NYS	18.44	18.0
AMERICAN NATURAL RESOURCES CO	OTH	0.35	1.0
AMES DEPARTMENT STORES INC	NYS	5.62	12.0
ASHLAND OIL INC	NYS	2.44	2.0
ASSOCIATED DRY GOODS CORP	NYS	5.53	3.1
BANK OF BOSTON CORP	NYS	0.72	1.0
BANK OF NEW YORK CO INC	NYS	0.53	0.6
BANK OF VIRGINIA CO	NYS	67.29	22.3
BANKAMERICA CORP	NYS	0.66	1.0
BANKERS TRUST NEW YORK CORP	NYS	6.94	2.0
BARNETT BANKS OF FLORIDA INC	NYS	1.44	1.9
CARL KARCHER ENTERPRISES INC	OTH	54.50	55.0
CARSON PIRIE SCOTT & CO	NYS	5.83	4.0
CHARMING SHOPPES INC	OTH	47.49	37.0
CHEMICAL NEW YORK CORP	NYS	3.48	1.0
CHEVRON CORP	NYS	0.33	1.0
CHURCH S FRIED CHICKEN INC	NYS	36.79	16.0
CITICORP	NYS	38.70	1.0
CITIZENS & SOUTHERN CORP	OTH	18.65	3.8
CLUETT PEABODY & CO INC	NYS	12.28	1.0
COASTAL CORP	NYS	7.82	8.0
DAYTON HUDSON CORP	NYS	4.71	1.0
DIAMOND SHAMROCK CORP	NYS	0.48	1.6
DIVERSIFOODS INC	OTH	17.00	26.0
DOLLAR GENERAL CORP	OTH	26.23	45.0
DUNKIN DONUTS INC	OTH	24.59	35.0
EXXON CORP	NYS	0.17	1.0
FAMILY DOLLAR STORES INC	NYS	40.38	41.0
FARAH MANUFACTURING CO INC	NYS	19.66	37.0
FEDERATED DEPARTMENT STORES IN	NYS	0.71	10.0
FIDELCOR INC	OTH	2.44	2.0
FIRST UNION CORP	OTH	5.04	4.3
FLEET FINANCIAL GROUP INC	NYS	2.86	2.0
GAP STORES INC	NYS	76.70	47.6
HAMILTON OIL CORP	OTH	76.09	79.0
HARTMARX CORP	NYS	4.54	5.0
HORN & HARDART CO	AMS	28.05	33.0
HOUSTON NATURAL GAS CORP	NYS	4.42	4.0
INTERNORTH INC	NYS	1.30	1.0
IRVING BANK CORP	NYS	0.03	1.0
JAMESWAY CORP	NYS	16.90	20.0
K MART CORP	NYS	0.50	1.0
K N ENERGY INC	NYS	2.82	2.0
LEAR PETROLEUM CORP	NYS	14.12	11.0
LEVI STRAUSS & CO	NYS	40.42	43.0

Appendix A continued

Co. Name	Exchange	Disclosure	Value Line
LIMITED INC	NYS	35.85	42.0
LIZ CLAIBORNE INC	OTH	51.99	31.0
MANUFACTURERS HANOVER CORP	NYS	6.69	1.0
MARINE MIDLAND BANKS INC	NYS	51.61	51.0
MAY DEPARTMENT STORES CO	NYS	4.35	1.0
MCDONALD S CORP	NYS	26.36	11.0
MELLON BANK CORP	NYS	9.73	10.0
MIDCON CORP	NYS	2.53	2.6
MITCHELL ENERGY & DEVELOPMENT	AMS	60.22	63.0
MOBIL CORP	NYS	0.30	1.0
MURPHY OIL CORP	NYS	23.76	35.0
NCNB CORP	NYS	22.62	22.0
NORDSTROM INC	OTH	34.55	57.0
OCCIDENTAL PETROLEUM CORP	NYS	11.34	3.0
ONEOK INC	NYS	3.35	2.0
PACIFIC RESOURCES INC	NYS	54.03	41.0
PALM BEACH INC	NYS	20.07	30.0
PANHANDLE EASTERN CORP	NYS	2.16	1.0
PETRIE STORES CORP	NYS	60.87	66.0
PHILLIPS PETROLEUM CO	NYS	0.57	3.5
PHILLIPS VAN HEUSEN CORP	NYS	5.22	18.0
PIC N SAVE CORP	OTH	33.23	20.0
PIONEER CORP TEX	NYS	2.40	3.6
QUAKER STATE OIL REFINING CORP	NYS	3.46	2.0
RAINIER BANCORPORATION	NYS	6.77	5.0
RUSS TOGS INC	NYS	0.00	20.0
RUSSELL CORP	AMS	62.03	47.0
SABINE CORP	NYS	10.58	9.5
SEAGULL ENERGY CORP	NYS	43.08	25.0
SEARS ROEBUCK & CO	NYS	35.92	20.0
SECURITY PACIFIC CORP	NYS	0.81	1.0
SHONEY S INC	OTH	33.86	35.0
SONAT INC	NYS	0.91	1.0
SOUTHLAND ROYALTY CO	NYS	24.86	19.9
STERLING BANCORP NEW YORK	NYS	15.85	14.0
STOP & SHOP COS INC	NYS	19.11	20.0
SUN BANKS INC	NYS	3.89	4.4
SYMS CORP	NYS	0.05	82.0
TENNECO INC	NYS	0.26	1.0
TEXAS EASTERN CORP	NYS	25.92	1.0
TEXAS OIL & GAS CORP	NYS	4.56	5.0
TRANSCO ENERGY CO	NYS	1.89	2.0
TULTEX CORP	NYS	15.93	12.0

Appendix A continued

Co. Name	Exchange	Disclosure	Value Line
UNITED JERSEY BANKS	NYS	3.00	5.0
UNITED VIRGINIA BANKSHARES INC	OTH	2.76	1.5
WACHOVIA CORP	NYS	0.66	1.0
WAL MART STORES INC	NYS	41.67	50.0
WARNACO INC	NYS	5.67	3.1
WELLS FARGO & CO	NYS	2.92	3.0
WENDY S INTERNATIONAL INC	NYS	17.29	14.0
ZAYRE CORP	NYS	11.00	13.0
ZIONS UTAH BANCORPORATION	OTH	3.55	17.0
	Mean	18.1973	16.9061
	Standard Deviation	20.9424	19.6488

Appendix B

NORMALITY TESTS AND RESIDUAL PLOTS FOR PAYOUT DATA

TABLE 1 B

Measure of Skewness, Kurtosis, and Normality for

Payout Ratio

Sample	N	Skewness (P value)	Kurtosis (P value)	Kolmogorov-Smirnov D Statistic
Aggregate Data				
Without Transformation	1771	0.7103 (.001)	-0.3401 (.002)	0.1823
Natural Log Transformation		0.4297 (.001)	-0.8934 (.001)	0.1978
Square Root Transformation		-0.1518 (.005)	-1.4229 (.001)	0.2312
Group 1 - Widely Held	719	0.2863 (.001)	-0.7954 (.001)	0.1243
Group 2	706	0.8409 (.001)	0.0918 (.308)	0.1964
Group 3 - Closely Held	346	1.5746 (.001)	2.3995 (.001)	0.2869
Residuals				
Without Transformation	1725	0.2098 (.001)	0.7691 (.057)	0.0827
Natural Log Transformation		0.5589 (.001)	0.1873 (.057)	0.0563
Square Root Transformation		-0.0049 (.468)	-0.3591 (.001)	0.0330

A value of 0 for skewness and kurtosis represents normality

For the Kolmogorov-Smirnov D statistic all P values are significant at the less than .01 level.

Group 1: below 10 percent insider ownership

Group 2: between 10 and 45 percent insider ownership

Group 3: above 45 percent insider ownership

FIGURE 1 B
RESIDUAL PLOT FOR %INSID

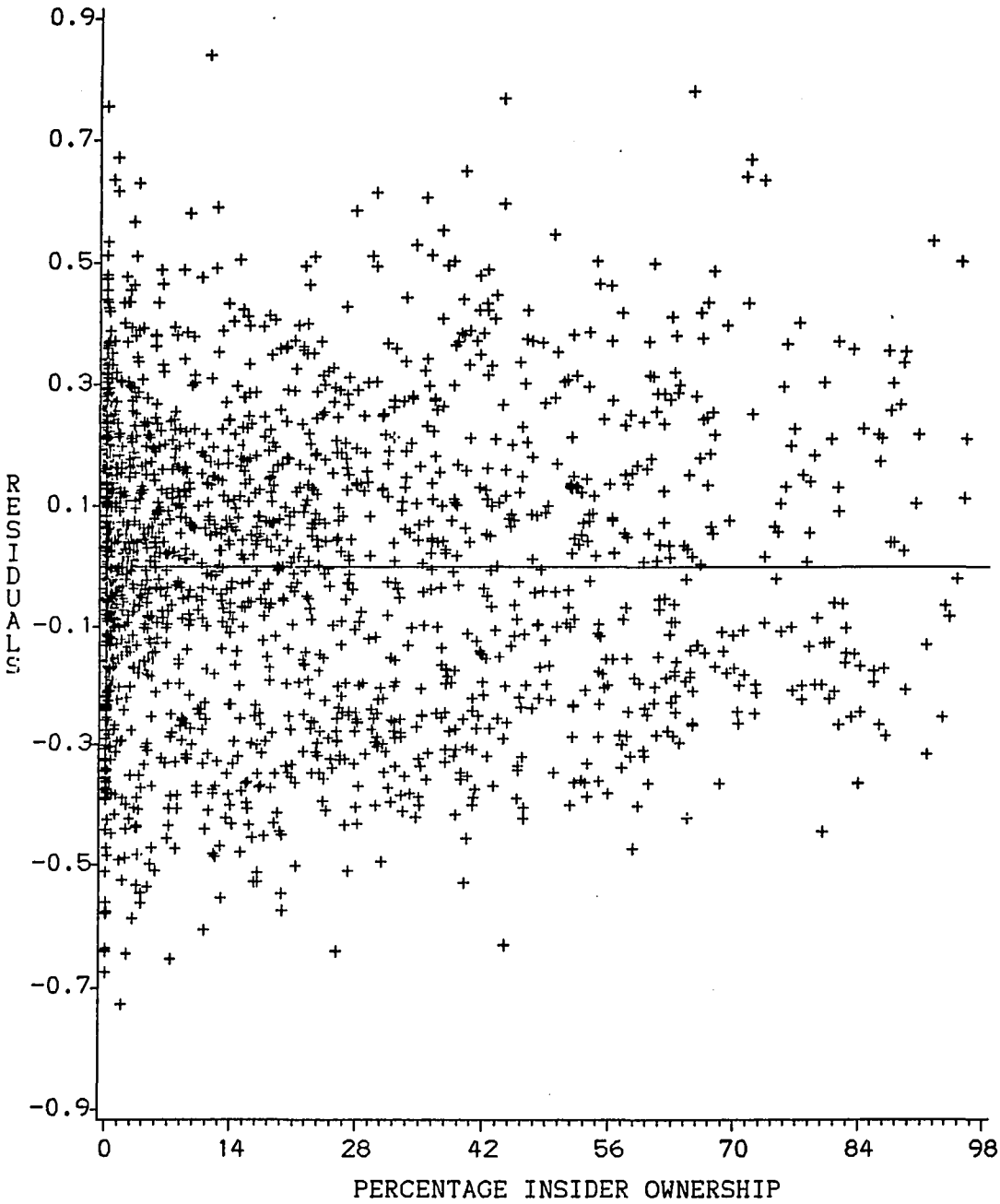


FIGURE 2 B
RESIDUAL PLOT FOR NOINSID

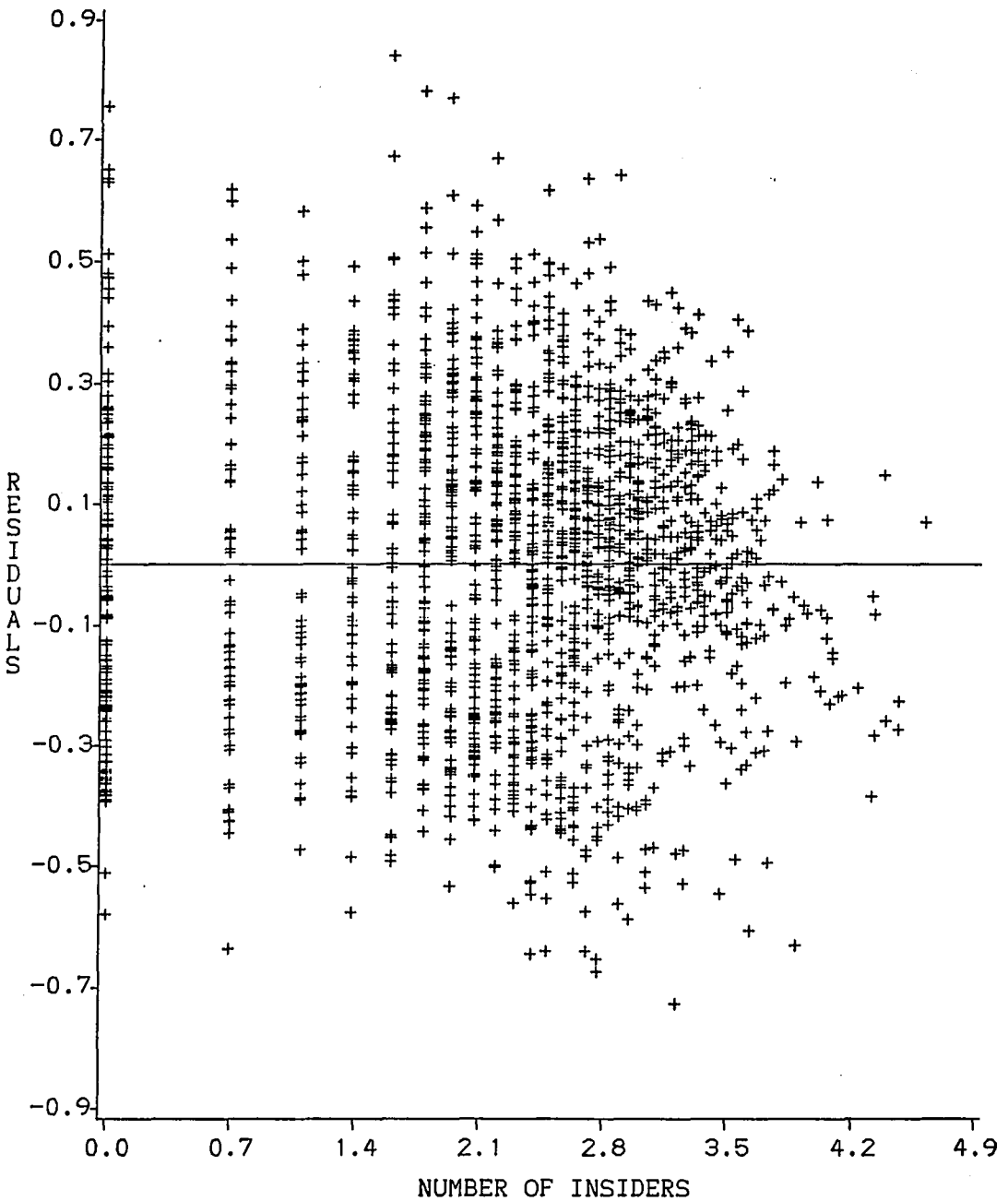


FIGURE 3 B
RESIDUAL PLOT FOR DOL

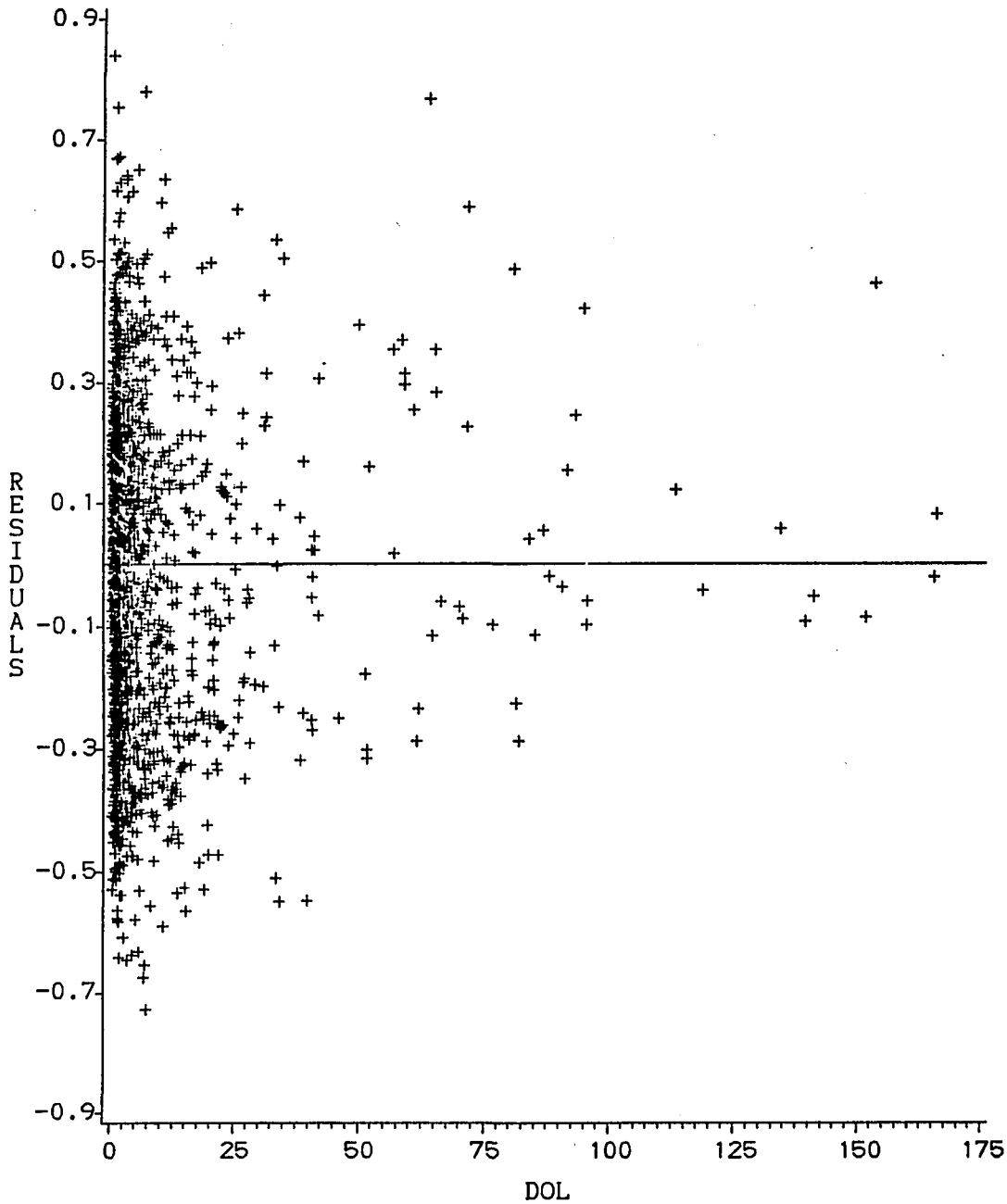


FIGURE 4 B
RESIDUAL PLOT FOR DFL

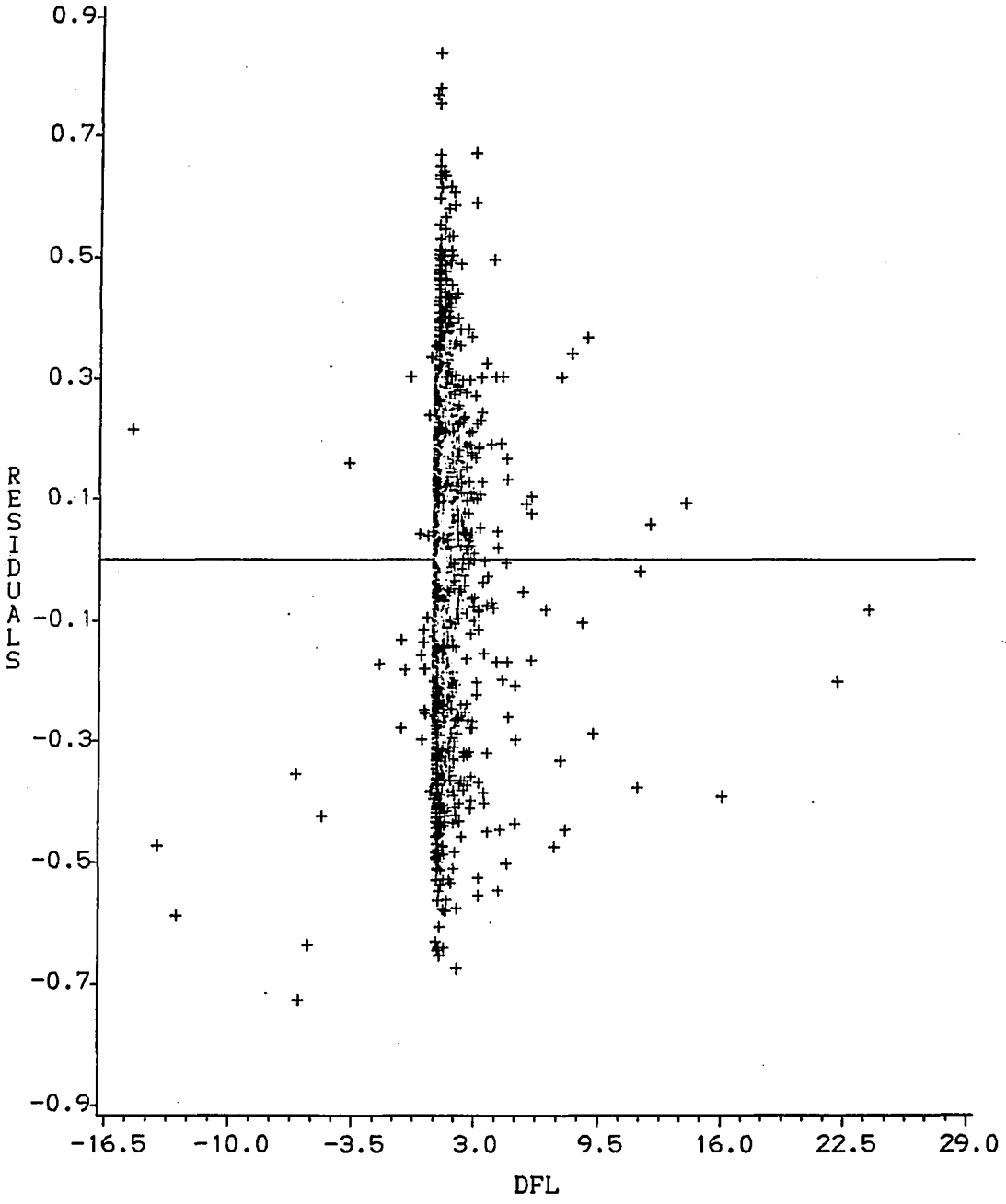


FIGURE 5 B
RESIDUAL PLOT FOR SGROTH

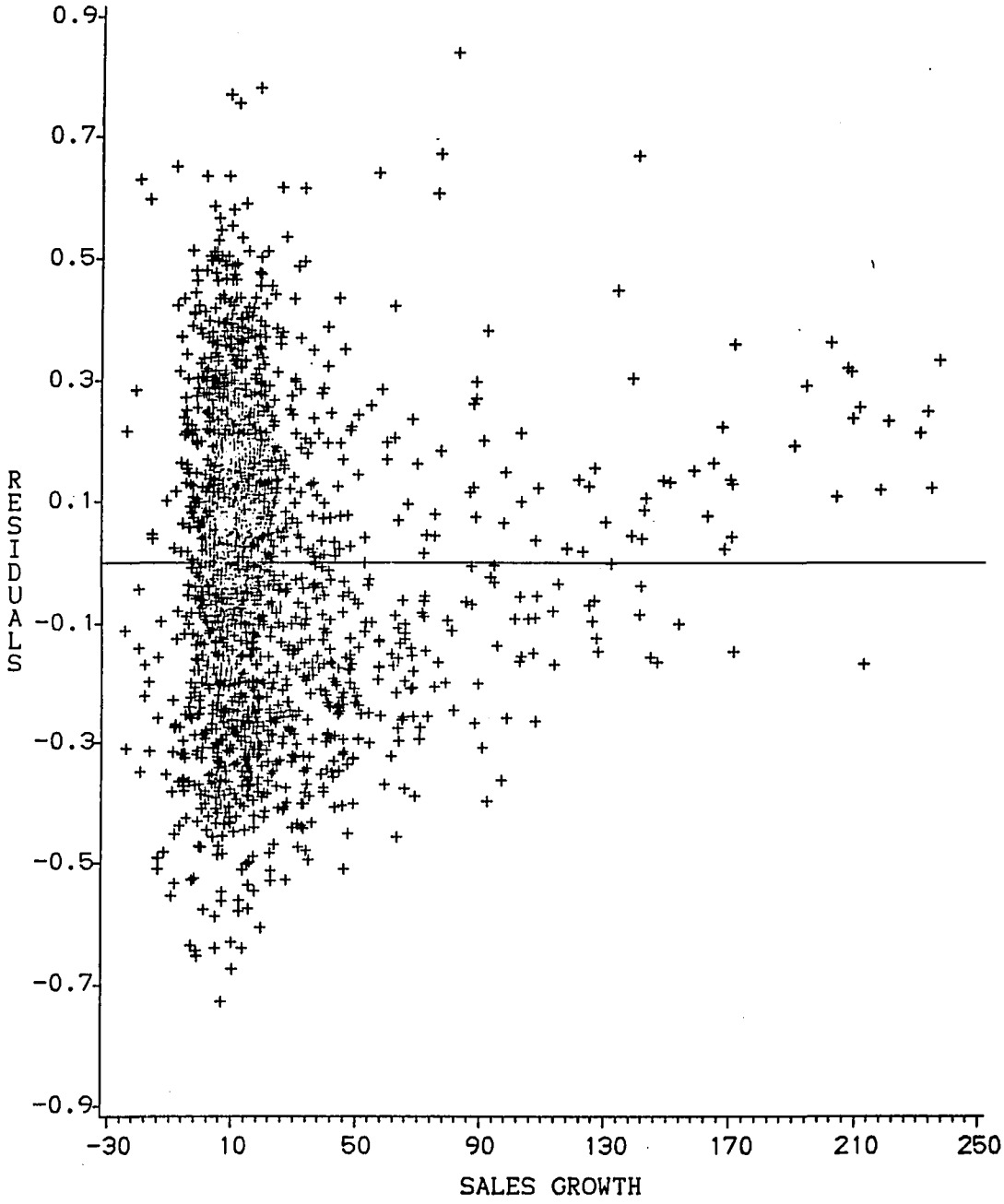


FIGURE 6 B
RESIDUAL PLOT FOR SALES

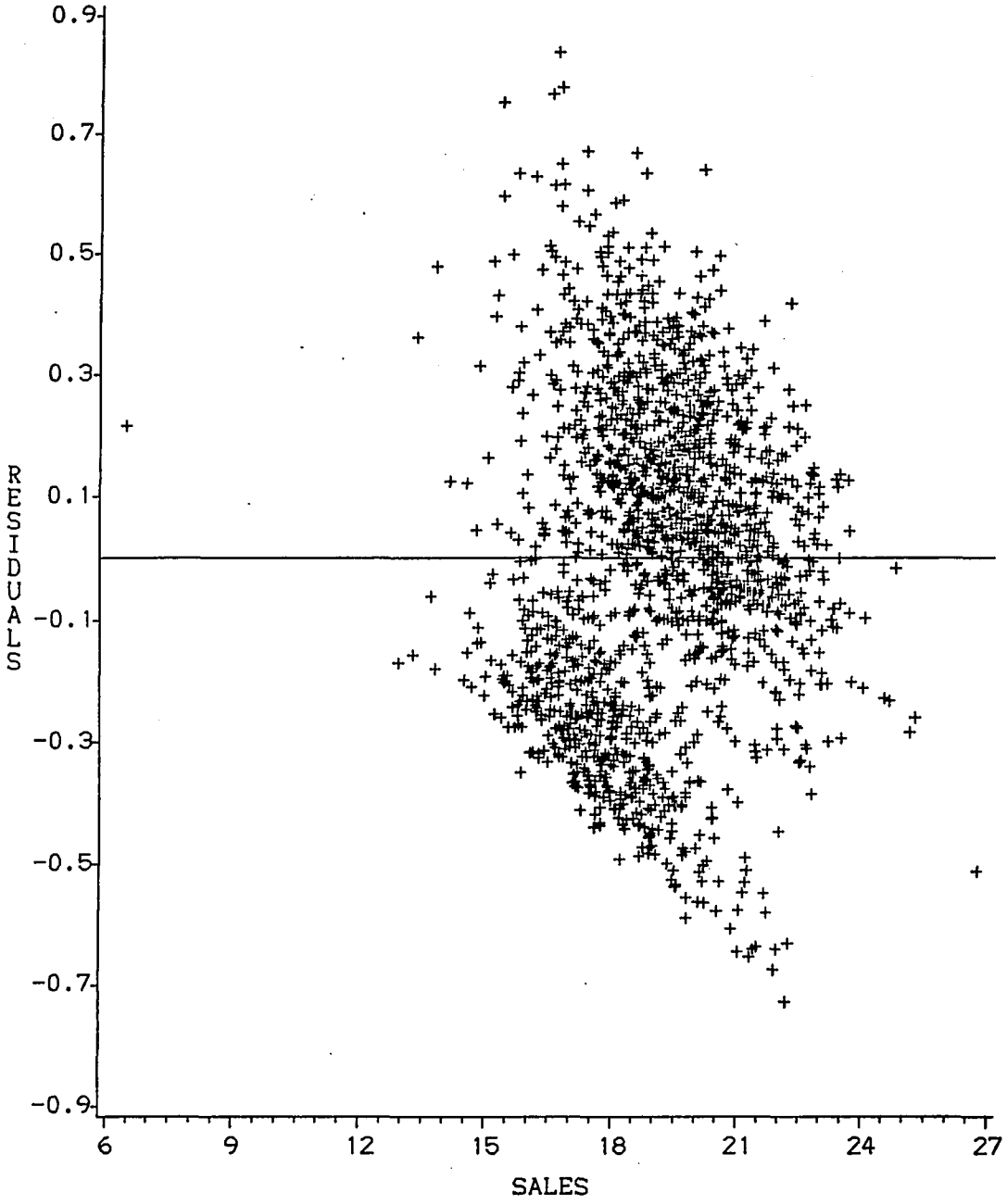
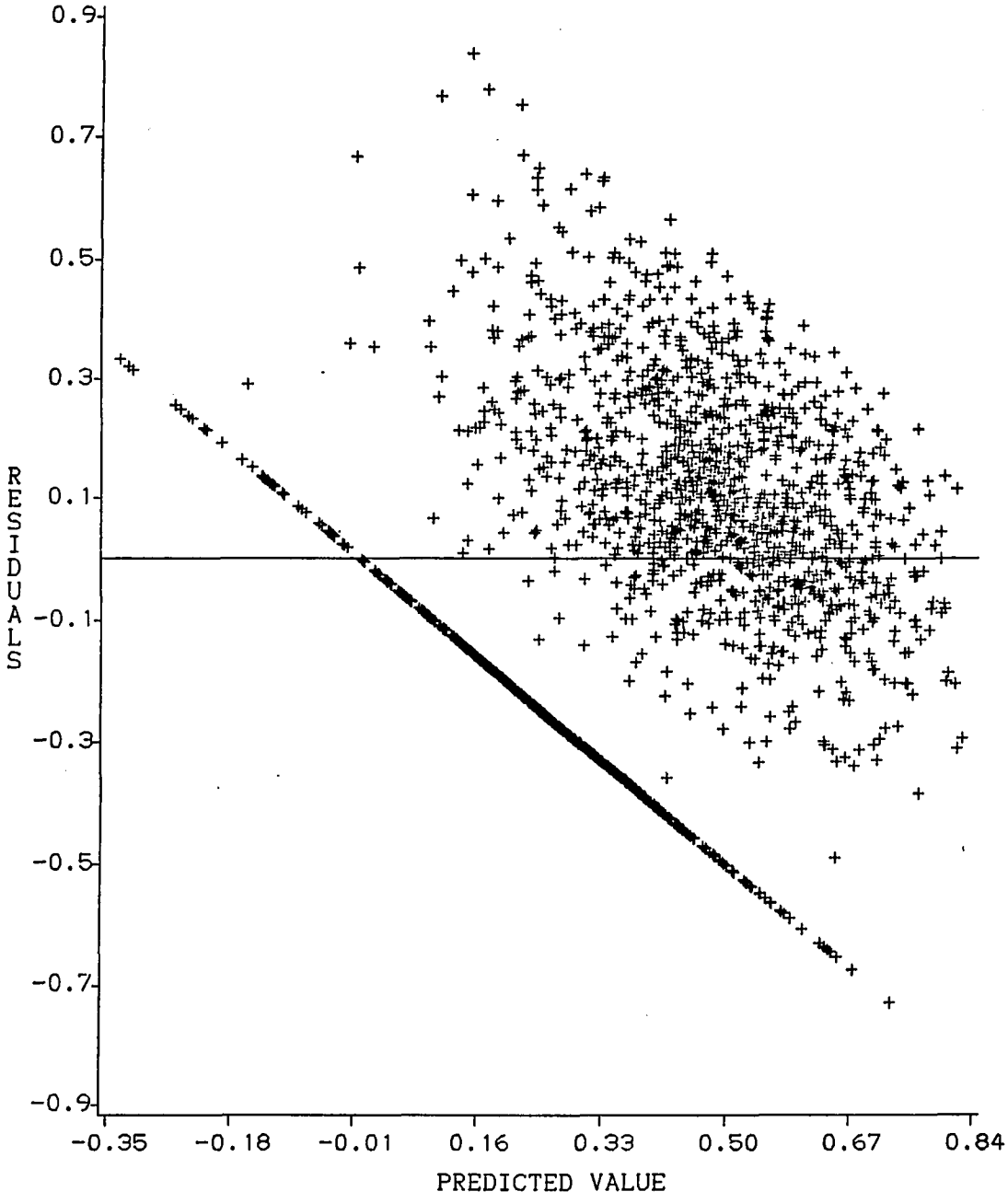


FIGURE 7 B
RESIDUAL PLOT FOR PREDICTED VALUE



Appendix C

NORMALITY TESTS AND RESIDUAL PLOTS FOR LEVERAGE DATA

TABLE 1 C

Measure of Skewness, Kurtosis, and Normality for

Leverage Ratio

Sample	N	Skewness (P Value)	Kurtosis (P Value)	Kolmogorov-Smirnov D Statistic
Aggregate Data				
Without Transformation	1771	1.1833 (.001)	1.1347 (.001)	0.1610
Natural Log Transformation		0.8518 (.001)	-0.0049 (.484)	0.1409
Square Root Transformation		0.0689 (.119)	-0.9355 (.001)	0.0671
Group 1 - Widely Held	719	1.0776 (.001)	0.8359 (.001)	0.1436
Group 2	706	1.4933 (.001)	2.5058 (.001)	0.1786
Group 3 - Closely Held	346	0.8344 (.001)	-0.2862 (.060)	0.1576
Residuals				
Without Transformation	1765	1.1499 (.001)	1.4557 (.001)	0.1023
Natural Log Transformation		0.8131 (.001)	0.2649 (.012)	0.0921
Square Root Transformation		0.0884 (.066)	-0.7067 (.001)	0.0432

A value of 0 for skewness and kurtosis represents normality

For the Kolmogorov-Smirnov D statistic all P values are significant at the .01 level.

Group 1: below 10 percent insider ownership

Group 2: between 10 and 45 percent insider ownership

Group 3: above 45 percent insider ownership

FIGURE 1 C
RESIDUAL PLOT FOR %INSID

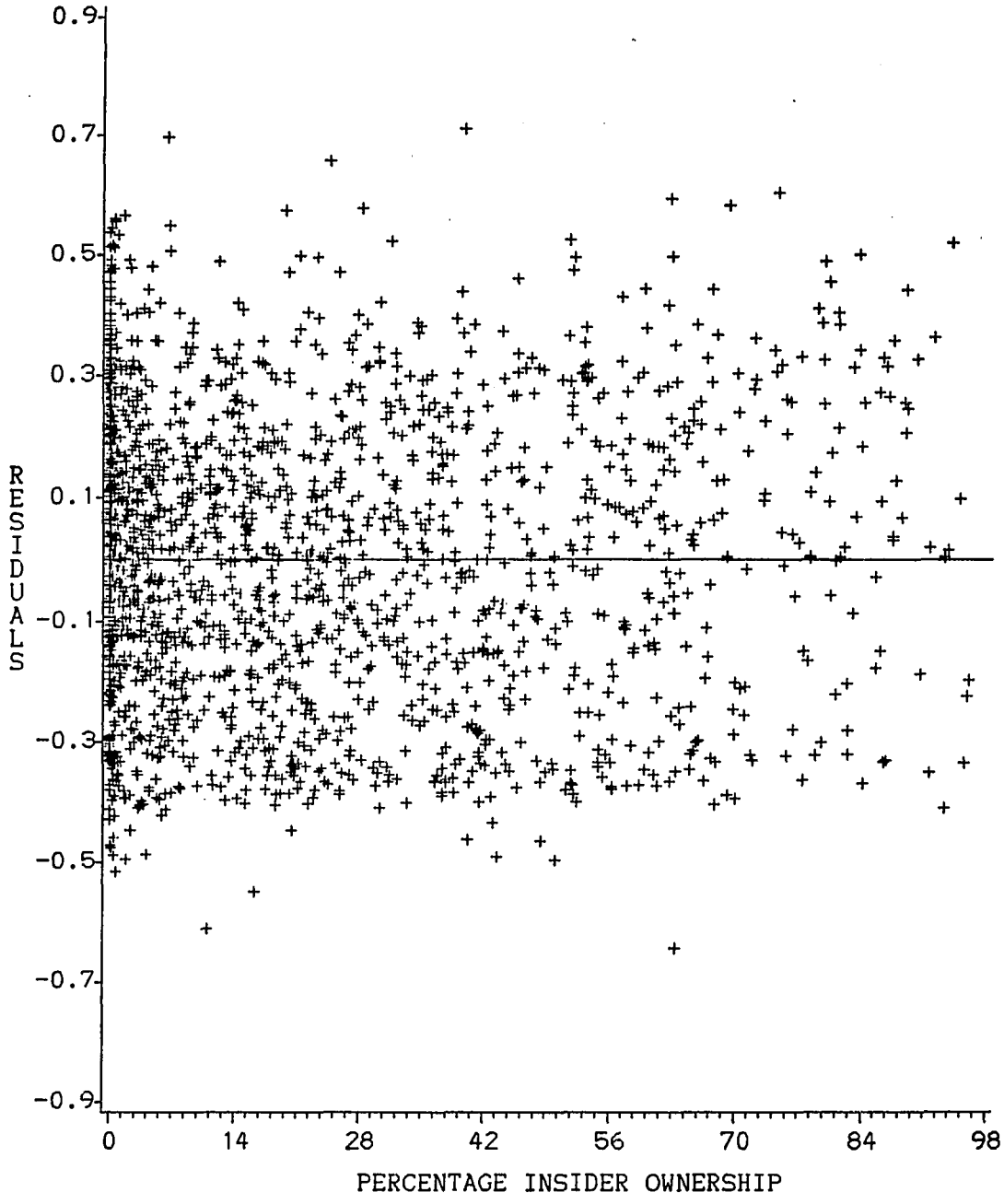


FIGURE 2 C
RESIDUAL PLOT FOR NOINSID

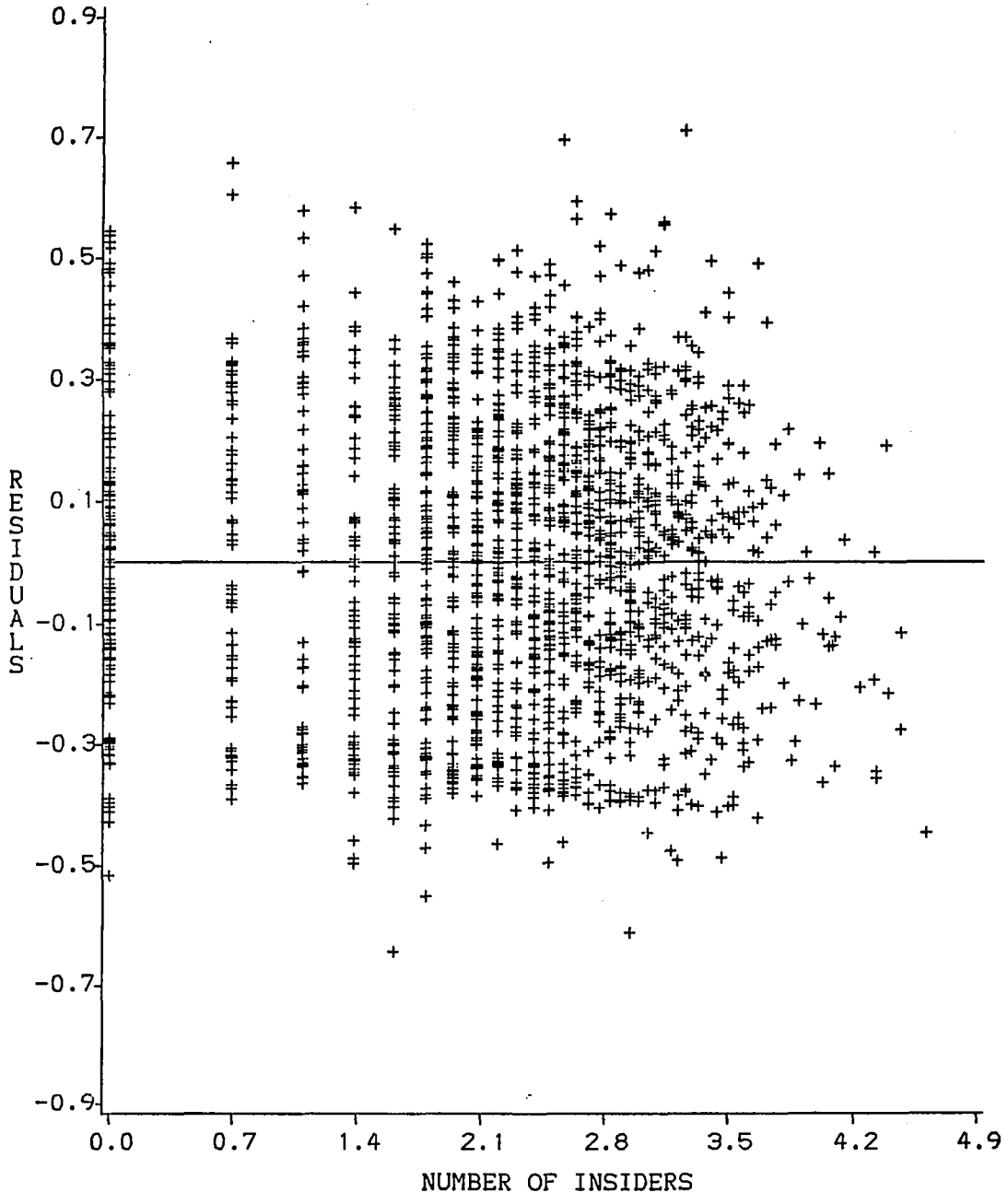


FIGURE 3 C
RESIDUAL PLOT FOR STDDEV

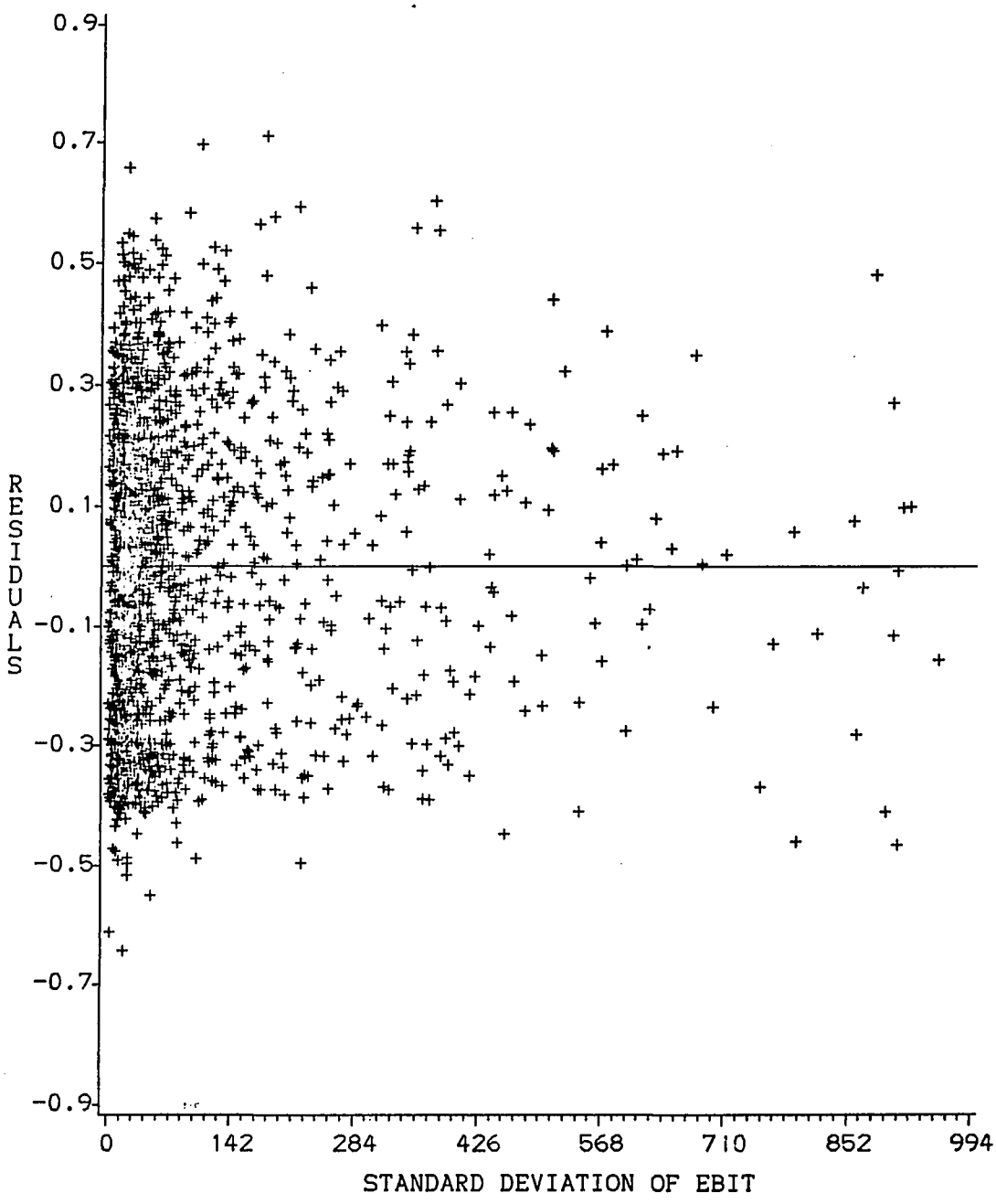


FIGURE 4 C
RESIDUAL PLOT FOR RAD

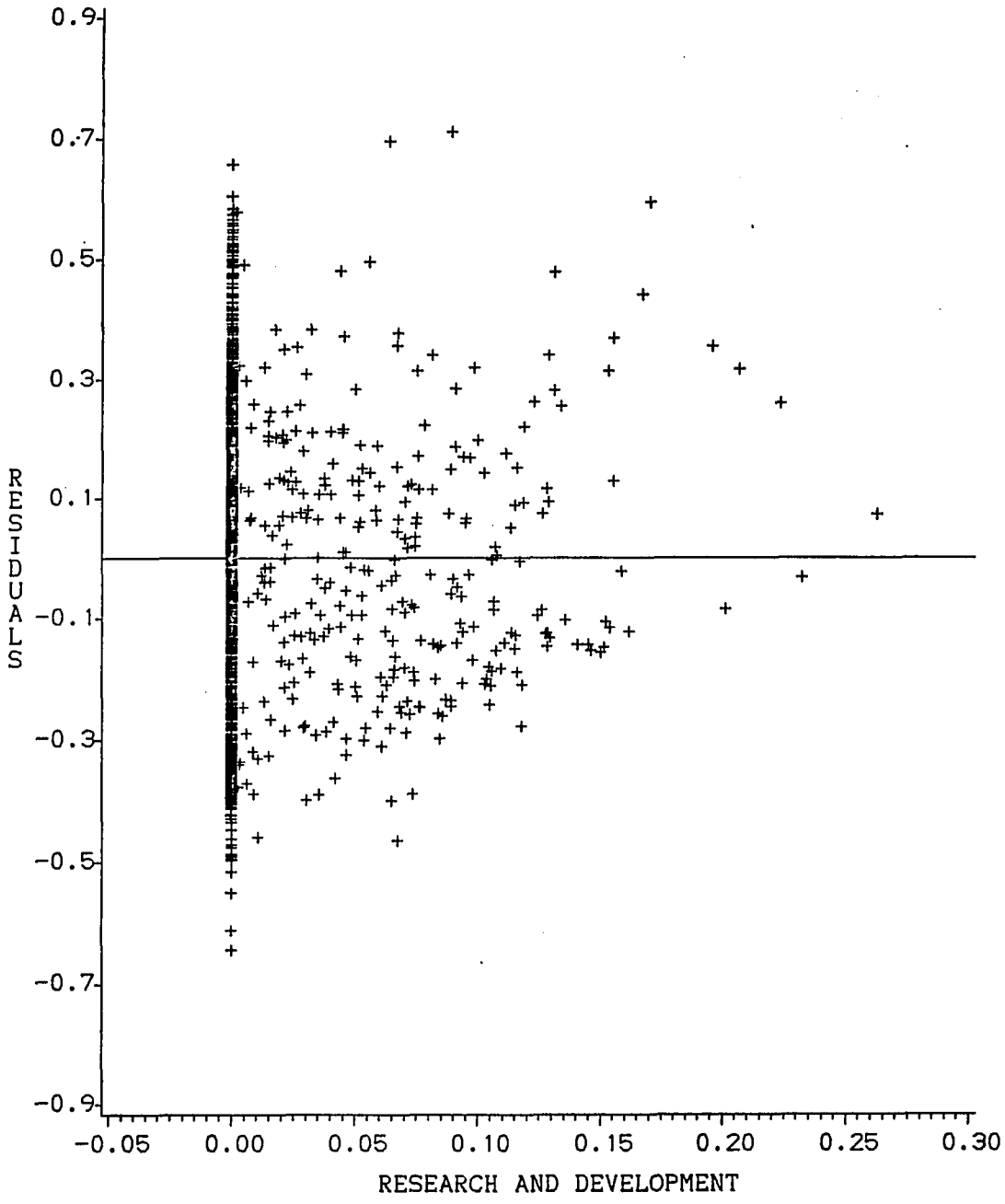


FIGURE 5 C
RESIDUAL PLOT FOR DEPR

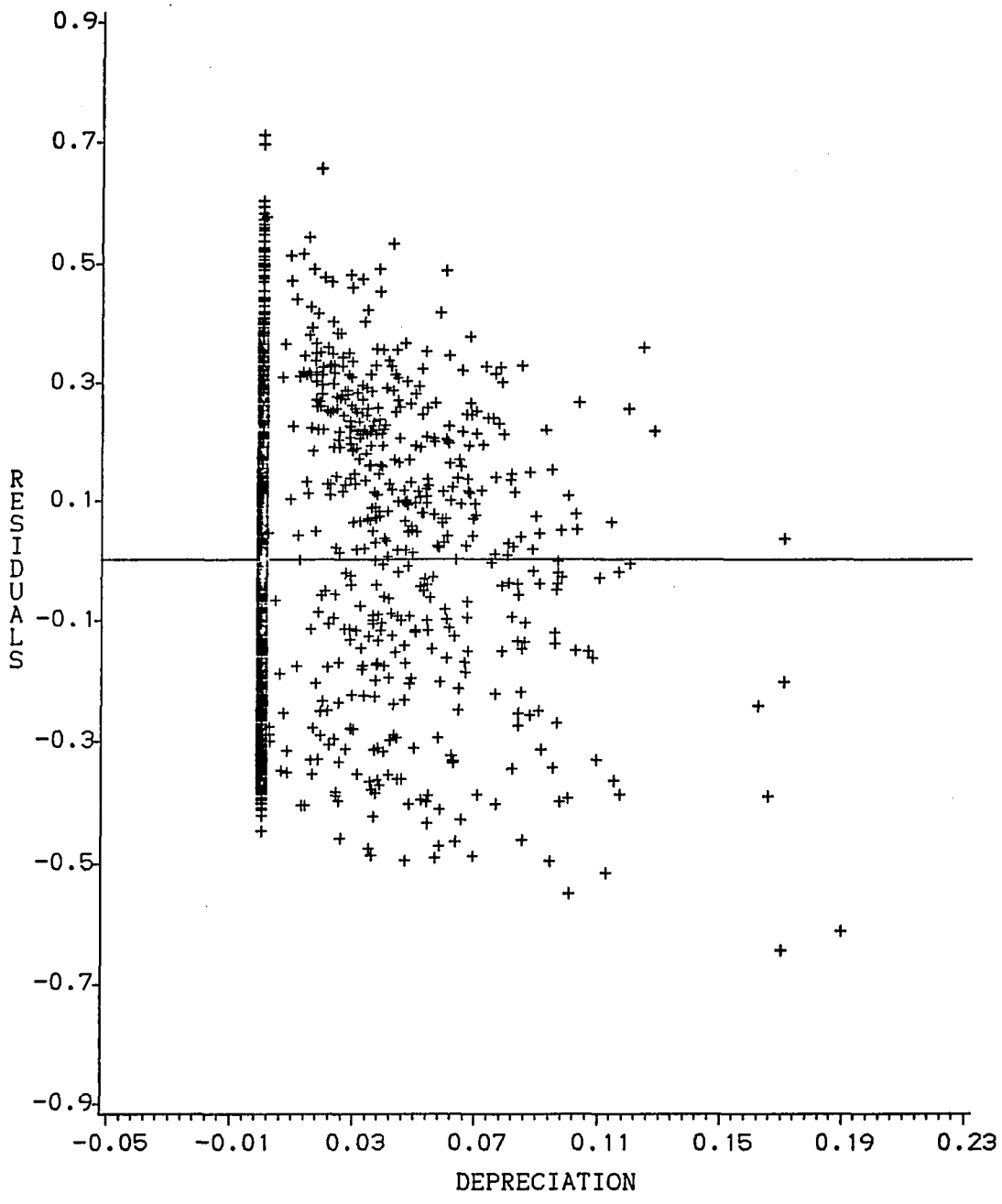
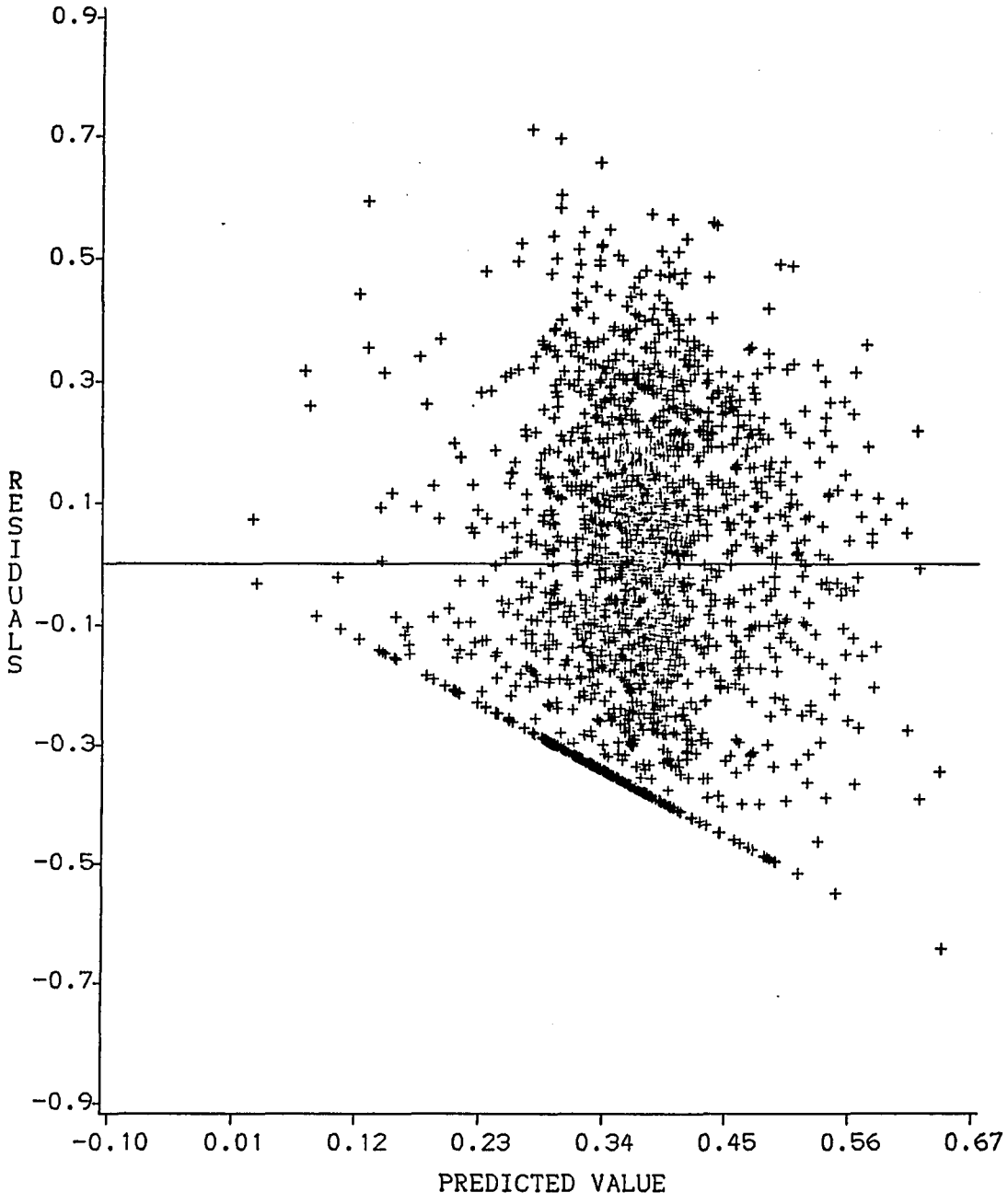


FIGURE 6 C
RESIDUAL PLOT FOR PREDICTED VALUE



Appendix D

COMPARATIVE STATIC RESULTS OF THE MODEL

D.1 FIRST AND SECOND DERIVATIVES OF THE TOTAL COST

The total cost function from the model is:

$$TC = \int_{B}^{D+B} \beta(D+B-X)f(X)dX + \int_{\lambda}^{B} \gamma(B-X)f(X)dX + \delta(\alpha,A) \quad (1D)$$

The first derivatives are:

$$\frac{dTC}{dB} = \int_{B}^{D+B} \beta'(D+B-X)f(X)dX + \beta(0)f(B+D) - \beta(D)f(B) + \int_{\lambda}^{B} \gamma'(B-X)f(X)dX + \gamma(0)f(B) \quad (2D)$$

$$\frac{dTC}{dD} = \int_{B}^{D+B} \beta'(D+B-X)f(X)dX + \beta(0)f(B+D) > 0 \quad (3D)$$

$$\frac{dTC}{d\alpha} = \frac{d\delta}{d\alpha} > 0 \quad (4D)$$

Assuming $\beta(0) = \gamma(0) = 0$ (5D)

and $\beta'(.), \gamma'(.) > 0$ (6D)

The equation 2D may be simplified to:

$$\frac{dTC}{dB} = \int_{B}^{D+B} \beta'(D+B-X)f(X)dX - \beta(D)f(B)$$

$$+ \int_{\lambda}^{B} \gamma'(B-X)f(X)dX \qquad (7D)$$

Using change of variables in equation 7D:

let $Y = D + B - X$

then $dY = - dX$

Substituting in the first term of the equation:

$$- \int_{D}^{0} \beta'(Y)f(D+B-Y)dY = \int_{0}^{D} \beta'(Y)f(D+B-Y)dY$$

Note $\beta(D) = \int_{0}^{D} \beta'(Y)dY$ so equation 7D may be written as:

$$\frac{dTC}{dB} = \int_{0}^{D} \beta'(Y)[f(D+B-Y)-f(B)]\, dY$$

$$+ \int_{\lambda}^{B} \gamma'(B-X)f(X)dX \qquad (8D)$$

If f(.) is increasing in the relevant range:

$$f(D+B-Y) \geq f(B) \quad \text{for all } Y \leq D$$

Thus the term in the square brackets is always greater than zero. This, with the assumption in 6D implies that the derivative is positive.

Hence the first derivatives are positive and:

$$\frac{dTC}{dD}, \quad \frac{dTC}{dB}, \quad \text{and} \quad \frac{d\delta}{d\alpha} > 0 \qquad (9D)$$

The second deriatives are:

$$\frac{d^2TC}{dB^2} = \int_0^D \beta'(Y)[f'(D+B-Y)-f'(B)]\,dY + \int_\lambda^B \gamma''(B-X)f(X)dX + \gamma'(0)f(B) \qquad (10D)$$

$$\frac{d^2TC}{dD^2} = \int_B^{D+B} \beta''(D+B-X)f(X)dX + \beta'(0)f(D+B) > 0 \qquad (11D)$$

Equation 11D is greater than 0, from earlier assumptions.

$$\frac{d^2TC}{d\alpha^2} = \frac{d^2\delta}{d\alpha^2} > 0 \qquad (12D)$$

The relevant cross derivative is:

$$\frac{d^2TC}{d\alpha dA} > 0 \qquad (13D)$$

Again if $f'(.)$ is increasing in the relevant range:

$$f'(D+B-Y) \geq f'(B) \text{ for all } Y \leq D$$

The term in the square brackets in equation 10D is positive and:

$$\frac{d^2TC}{dB^2}, \frac{d^2TC}{dD^2}, \text{ and } \frac{d^2TC}{d\alpha^2} > 0 \qquad (14D)$$

D.2 COMPARITIVE STATICS

For the optimal solution of the maximization problem the following conditions must be satisfied:

$$\frac{dE}{dB} = \frac{dV}{dB} - \frac{dTC}{dB} = 0 \qquad (15D)$$

$$\frac{dE}{dD} = \frac{dV}{dD} - \frac{dTC}{dD} = 0 \qquad (16D)$$

$$\frac{dE}{d\alpha} = \frac{dV}{d\alpha} - \frac{d\delta}{d\alpha} = 0 \qquad (17D)$$

Now dividing 17D by 15D, for equilibrium:

$$\frac{d\delta}{d\alpha} / \frac{dTC}{dB} = \frac{dV}{d\alpha} / \frac{dV}{dB} \qquad (18D)$$

Assuming $\frac{dV}{d\alpha} / \frac{dV}{dB} = K$

where K is a constant. Equation 18D may then be written as:

$$\frac{d\delta}{d\alpha} = K \frac{dTC}{dB} \tag{19D}$$

Taking a differential of both sides:

$$\frac{d^2\delta}{d\alpha^2} d\alpha + \frac{d^2\alpha}{d\alpha dA} dA = K \frac{d^2TC}{dB^2} dB \tag{20D}$$

A marginal change in each, holding the other constant will yield:

$$\frac{d\alpha}{dA} = - \frac{d^2\delta}{d\alpha^2} / \frac{d^2\delta}{d\alpha dA} < 0 \tag{21D}$$

and

$$\frac{dB}{dA} = \frac{d^2\delta}{d\alpha dA} / \frac{d^2TC}{dB^2} > 0 \tag{22D}$$

Thus α and B will move in opposite directions in response to a change in the marginal cost. A similar derivation may be used to show that α and D also move in opposite directions in response to a change in marginal cost.

VITA

Upinder Singh Dhillon was born on December 16, 1950 in Solan, India, son of Mr. and Mrs. Joginder S. Dhillon. He graduated from Panjab University, India in June 1972 with a Bachelor of Science degree in Mechanical Engineering.

After working as an engineer with Shriram Chemicals for eight years, the author entered graduate school at Louisiana State University in August, 1980. He earned a Master of Science in Mechanical Engineering in 1981 and a Master of Business Administration in 1983. At present he is a candidate for the Doctor of Philosophy in Business Administration.

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Title of Dissertation: Corporate Ownership, Dividend Policy, and Capital Structure Under Asymmetric Information

Approved:

Jacques W. Wakeley
Major Professor and Chairman

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EXAMINING COMMITTEE:

Stephen Looney

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Date of Examination:

July 17, 1986