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Financial Policies and the Agency Costs of Free Cash Flow:Evidence from the Oil Industry

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Abstract: This study focuses on the long-term investment performance of employee stock options (ESOs) issued by listed companies in Taiwan for their respective employee compensation packages. The results indicate that the detrimental effect on investment performance of the companies manifest three months after the issuance of the ESOs. In addition, companies that own low free cash flow (FCF) have better long-term performance after issuing ESOs. This result supports the FCF theory of Jensen (1986).

1. Introduction

This paper examines the effect of firm financial and ownership characteristics on the agency costs of free cash flow. The free cash flow theory, presented by Jensen (1986a), argues that firms that generate cash flow beyond that required to finance all positive net present value projects are particularly prone to agency problems. The excess or free cash flow is available to managers to use at their discretion. Firm value is affected because investors impound anticipated agency costs, both the consumption of firm resources by the manager and expenditures made to limit such consumption, into the price they are willing to pay for a firm's securities.

Since the source of the free cash flow is often quasi-rents due to imperfect competition, product market forces are inadequate to correct the managerial inefficiencies. Free cash flow theory stresses the importance of firm capital structure and dividend policy in controlling these inefficiencies. The theory predicts that an unlevered firm with free cash flow will have higher agency costs

than a similar levered firm, *ceteris paribus*. The manager of an all-equity firm is not formally penalized if he chooses to consume rather than distribute the excess cash flow to shareholders. If the manager of a levered firm does not make the firm's promised debt service payment, the holders of the debt can take the firm to court and demand payment. By not making the firm's debt service payment, the manager also risks losing his position and the wealth associated with it. The presence of debt in a firm's capital structure bonds the manager's promise to pay out future cash flows to securityholders.

According to the free cash flow theory, dividends reduce the manager's consumption of firm resources, and thereby agency costs, in the current period by reducing the cash flow available to the manager. If managers try to avoid reducing dividends, unless this is absolutely necessary, then current dividends are indicative of future dividend payouts. Even if dividend distributions are "sticky" they remain discretionary payments, that is, there is no formal or contractual commitment to make future distributions. Therefore, free cash flow theory argues that dividends are less efficacious than debt in reducing agency costs.

Although not strictly part of free cash flow theory, managerial ownership is also hypothesized to affect agency costs. Jensen and Meckling (1976) argue that the manager's decisions become increasingly oriented toward maximizing firm value as the value of his ownership stake in the firm increases. Stulz (1988), however, suggests that large insider holdings may aggravate, rather than mitigate, the agency conflict between shareholders and managers. A manager who is also the owner of a large block of stock can hinder the control function of the takeover process and thereby entrench himself.

The free cash flow theory is consistent with much of the existing evidence on financial transactions. Jensen (1986b) surveys a number of event studies and finds that of 32, 30 of the announcement date stock return responses examined are consistent with the predictions of the free cash flow theory. A problem, however, with using the extant evidence as support for the free cash flow theory is that there is no assurance that firms included in the samples of these studies satisfy the free cash flow theory assumptions of excess cash flow. Evidence supporting the free cash flow theory must be based on a sample of firms for which the theory's assumptions are likely to hold. The present study attempts to address this problem.

The data used in the current study are from the U.S. oil and gas production industry for the period 1979 through 1985. There are two characteristics that make the oil and gas industry during this period particularly appropriate for testing the free cash flow theory. First, the firms in the sample appear to generate free cash flow. High cash flow is likely because of the Ricardian rents that accrue to owners of exhaustible resources, and the cartel pricing of oil by OPEC, which creates monopoly rents for fringe producers such as the firms included in the sample. Furthermore, evidence presented by Picchi (1985) and McConnell and Muscarella (1986) suggests that investment opportunities in oil and gas exploration are limited.[11] With high cash flow and limited investment opportunities, oil and gas firms appear likely to have free cash flow, and so satisfy Jensen's criteria for being particularly prone to agency conflicts due to free cash flow.

Second, for domestic oil and gas production companies, a method of estimating the agency costs of free cash flow exists. The assets of oil and gas producers are primarily petroleum reserves. There are several published measures for the value of each firm's petroleum assets. For instance, the SEC and Department of Energy have required that "The Present Value of Future Cash Flows from Oil and Gas Reserves" be reported in firm financial reports since 1979. John S. Herold, a petroleum industry analyst group, publishes a second measure of the present value of petroleum reserves. These measures are compared to the value of the firm's petroleum reserves implied by the market values of the financial claims against the firm. This implied market value is the value of the firm's liabilities and equity less the value of its non-reserve assets. The difference between the published present value measure and the implied market value of the reserves is an estimate of how much investors overvalue or undervalue the assets of each firm. In the context of the free cash flow theory the difference is an estimate of the agency costs of free cash flow. This difference becomes the dependent variable in regression models, which include financial and ownership characteristics as explanatory variables.

Our empirical results are consistent with the free cash flow theory prediction regarding long-term debt. Furthermore, the beneficial effects of leverage do not appear to be explained entirely by the interest tax subsidy associated with corporate

[11] Picchi finds that for the 30 largest U.S. petroleum companies, for the period 1980-1984, the present value of increases in reserves has been, on average, less than the expenditures made on exploration and development. McConnell and Muscarella find significant negative stock returns for firms announcing increases in exploration and development expenditures. These are the only negative average responses to capital budget increases in their study.

borrowing. No support is found for the hypothesis that dividends enhance firm value. There is evidence that large outside ownership stakes reduce agency costs.

The remainder of the paper details the topics introduced above. Section 2 reviews the theoretical work which gives rise to the hypotheses being tested. A survey of some of the relevant empirical evidence is also included in this section. The sample is described in section 3. In section 4 the test methodology and procedures for calculating the implied market value of firm petroleum reserves are discussed. The study's results are presented in section 5, and section 6 provides a summary and conclusion.

2. Firm characteristics and agency costs

2.1 The effect of firm characteristics on agency costs

Several theories argue that increased leverage reduces a manager's incentive or ability to consume firm assets or operate the assets inefficiently. Grossman and Hart (1984) present a model in which the manager has incentives to increase firm value (for example, his compensation scheme is tied to firm value) and does so by issuing debt. Additional debt increases the likelihood of bankruptcy and its accompanying displacement of the manager. If displaced, the manager loses his access to perquisites and salary. The manager offsets the increased probability of bankruptcy, and its threat to his welfare, by operating the firm's assets more efficiently. Additional debt at once signals and bonds the manager's intention to improve his efficiency and so increases firm value. The manager continues to issue debt, constraining himself as he does, as long as increases in his utility from added wealth offset the disutility of the constraints.

In his free cash flow theory, Jensen (1986) argues that debt enhances firm value not only by increasing the manager's incentives to operate the firm's assets more efficiently, but also by committing the manager to distribute cash to securityholders. With its contractual payments, debt bonds the manager's promise to distribute the firm's excess cash rather than consume it or invest it in negative net present value projects. Debt limits agency costs by reducing the funds, both current and future, at the manager's discretion.

These authors argue that by reducing agency costs, debt increases firm value beyond the benefits from the tax deductibility of interest. The agency cost theories of debt predict that at moderate levels of debt marginal changes in leverage will increase firm value at a rate greater than that due to the interest tax subsidy.

As leverage is increased, the benefits from debt financing are reduced and eventually offset by the anticipated costs of financial distress. Therefore, the relationship between firm value and leverage is concave; as leverage increases firm value increases at a slower rate.

The payment of common stock dividends also reduces the discretionary funds available to the manager. If managers are reluctant to cut dividends, then current dividends create a non-contractual commitment to make future distributions and, according to free cash flow theory, reduce anticipated agency costs. Easterbrook (1984) and Rozeff (1982) also consider how dividend policy may decrease agency costs by increasing the monitoring of managers. Higher dividend payout implies lower retained earnings and more frequent trips to the capital markets for funds where, they argue, the monitoring of management is particularly effective. Higher dividend payout increases firm value as long as the marginal net benefits of additional monitoring exceed the marginal flotation costs of raising additional external capital.

Ownership of common stock by managers and large blocks of stock held by outsiders are also hypothesized to affect agency costs. Jensen and Meckling (1976) argue that as inside ownership increases the cost of perquisites to the manager also increases. The manager responds to this higher cost by decreasing his consumption of perquisites, and agency costs decrease. According to this theory agency costs decrease monotonically as management ownership rises. Stulz (1988), on the other hand, presents a model in which large insider holdings aggravate, rather than mitigate, the agency conflict between shareholders and managers. A manager who is also the owner of a large block of stock can hinder the control function of the takeover process and thereby entrench himself. Stulz's model predicts a concave relationship between agency costs and inside ownership.

Shleifer and Vishny (1986) examine the role that non-managerial owners of large blocks of stock play in monitoring managers. With widely dispersed ownership a public goods problem exists: costly monitoring is unlikely to be sufficiently profitable to be undertaken by any individual shareholder, so a sub-optimal amount of monitoring occurs. However, a shareholder with a large block of shares may find monitoring profitable, since he captures a large portion of the benefits from monitoring. Therefore, the probability of monitoring (and its attendant firm-valuation effects) rises as the size of the largest block held by an outsider increases.

2.2 Empirical research on firm characteristics and agency costs

A large body of empirical work examines the effect on shareholder wealth of corporate actions that change firm leverage or dividend payout levels. Jensen (1986b) surveys 32 event studies of financial transactions and finds that 30 of the studies document announcement date stock return responses that are consistent with the predictions of his free cash flow theory. The evidence pertaining to leverage increasing events shows that leverage changes, which do not increase the funds at the disposal of managers, for example exchange offers [Masulis (1980)], are associated with significantly positive abnormal announcement date stock price responses. When leverage changes also increase the funds available to managers, as in issues of debt for purposes other than refunding, the announcement date abnormal returns are non-positive [Dann and Mikkelson (1984) and Eckbo (1986)]. These results are consistent with the free cash flow theory. Leverage increasing exchange offers increase the manager's commitment to payout cash to securityholders without increasing available cash flow. Increasing leverage by issuing new debt securities increases the manager's commitment to make future cash payouts, but this commitment is offset by the increased funds available to the manager.

Announcements of increased cash distributions to securityholders are associated with positive average abnormal stock returns. Dann (1981) documents a large positive abnormal stock return at the announcement of tender offer share repurchases. Asquith and Mullins (1983) examine dividend initiations and changes. They find positive abnormal stock returns at announcements of increased cash distributions to shareholders.

Morck, Shleifer, and Vishny (1988) investigate the relationship between firm value and inside ownership. Using Tobin's Q-ratio as a proxy for the market's valuation of firm assets, a positive relationship between inside ownership and Tobin's Q-ratio is found (as predicted by Jensen and Meckling) for very low (0% to 5%) and very high (over 25%) inside ownership stakes. However, the relationship is negative between 5% and 25% ownership stakes. Wruck (1989), in a study of private equity sales, finds results that are very similar in magnitude and significance to those of Morck et al. These two studies suggest that the inside ownership levels at which managerial entrenchment begins to affect firm value may be as low as 5%.

It is well documented that shareholders benefit from increases in dividend distributions and increased leverage (when no simultaneous change in assets occurs). However, these results may not be relevant to the free cash flow theory since there is no assurance that firms included in the samples of these studies satisfy the free cash flow theory assumptions of excess cash flow. The present study attempts to provide evidence more directly relevant to the free cash flow theory by using a sample of firms for which the theory's assumptions are likely to hold. The study also provides additional evidence regarding the effect of managerial ownership on firm value.

3. The sample

The sample consists of corporations in the U.S. petroleum production industry from 1979 through 1985, and includes 316 firm-year observations involving 59 different firms. In order to be included in the sample each firm-date observation satisfied the following four criteria.

1. The firm was listed under the category "US Producing Companies" in *Oil Industry Comparative Appraisals*, published by John S. Herold, Inc., at some time during the period January 1979, through December 1985.

2. The firm was organized as a corporation rather than a master limited partnership or royalty trust.

3. The majority of the firm's petroleum reserves were located in North America.

4. The firm's 10-K or annual report, prices for traded securities, and proxy statements were available for the fiscal year-end corresponding to the Herold's appraisal for each year a firm appears in the sample.

These criteria limit the sample to corporations with petroleum reserves as their primary assets and for which sufficient data are available to carry out the empirical tests. The first criterion identifies petroleum production firms for which appraisals of asset value are available. The study focuses on oil and gas production firms because these firms have relatively simple asset structures: the assets are primarily petroleum reserves. Discounted cash flow value measures for petroleum reserves are possible because oil and gas firms must disclose in their annual reports total petroleum reserves, average sales prices, and production costs and rates, as well as expenditures for the acquisition of reserves, exploration, and

development. Unlike petroleum reserves, very little information is disclosed about non-reserve assets. This lack of information makes computing discounted cash flow value measures for non-reserve assets difficult. Limiting the sample to petroleum production firms reduces measurement problems associated with valuing non-reserve assets. Further limiting the sample to firms included in Herold's *Oil Industry Comparative Appraisals* allows the Herold's measures of the value of non-reserve assets to be used. The Herold's analysts appear to have some expertise in valuing petroleum industry assets

The time period of the study coincides with the initiation of the SEC's disclosure rules regarding oil and gas reserves. This provides a second assessment of reserve value, which is independent of market value.

The second criterion excludes master limited partnerships (MLPs) and royalty trusts from the sample. Royalty trusts and MLPs are sufficiently different than corporations that their inclusion in the sample could confound the empirical results.[12] Royalty trusts typically have no debt and are structured so cash flows are immediately transferred to unit holders, so operating managers of royalty trusts rarely have discretion over any funds. MLPs are more flexible, but have explicit rules governing the distribution of cash to unitholders. This quasi-contractual aspect of MLP distributions makes them difficult to compare with corporate dividends. While these organizations appear to provide an interesting solution to free cash flow problems, such an examination is beyond the scope of the present study.

The third criterion is included to reduce problems associated with currency translation, differential tax treatment, and political factors. The final criterion assures that sufficient data is available to construct the variables used in the empirical tests.

Table 1 presents a time profile of the sample and details the reasons for firms entering and exiting the sample. Some firms appear in the sample for only a single year, while others are included for the entire seven-year period. Thirteen of the firms left the sample because another firm acquired them. Two firms reentered the sample after being excluded for at least one year. Sample firms are almost evenly divided between NYSE, ASE and OTC traded firms.

[12] See Kensinger and Martin (1986) for a discussion of royalty trusts and MLPs.

Table 1

Time profile of the sample of oil and gas production firms and reasons for yearly sample size changes over the period 1979 through 1985 (the sample includes 316 observations for 59 different firms).

	1980	1981	1982	1983	1984	1985	total
Firms entering the sample during the year[a]	5	1	3	1	1	2	13
Firms departing the sample during the year							
Reasons firm left the sample							
Acquired	3	1	1	3	5	0	13
Became Trust or MLP[b]	0	0	0	1	0	1	2
Dropped by Herolds	0	0	2	0	3	3	8
Bankruptcy	0	0	0	3	0	1	4
Data deficiency	0	0	0	0	2	0	2
Net change in observations	2	0	0	(6)	(9)	(3)	(16)
Observations from previous year	49	51	51	51	45	36	
Ending sample size	51	47	44	45	36	33	

[a]Firms entering the sample include two firms that reentered the sample after having been excluded for a year or more.

[b] The category "Became Trust or MLP" refers to firms that changed from the corporate form to a royalty trust or master limited partnership (MLP).

Descriptive statistics for the sample are presented in table 2 and indicate the considerable diversity of financial and ownership characteristics of the sample firms. Panel A presents data on total assets for sample firms, as reported on firm balance sheets. Firm size, as measured by total assets, ranges from $8.8 million to nearly $4 billion. Data on the book value of long-term debt is presented in panel B. Much variation exists among sample firms' capital structures with several all-equity firms in the sample as well as some highly levered firms. Data on common stock dividends are shown in panel C. Over one-third of the corporations in the sample paid no common stock dividends.

Panel D of table 2 presents summary statistics for the ownership of common stock by managers and members of the board of directors as reported on firm proxy statements. Mean inside ownership, measured in terms of percentage ownership of outstanding shares, is about 20% in each of the seven sample years. The range of the data indicates that there is a great deal of cross-sectional variation in ownership structures among sample firms.

Panel E of table 2 presents summary statistics for the largest block of stock held by an outside investor as reported on firm proxy statements. Over 50% of sample firms reported no outside investor holding more than 5% of the outstanding

shares. The largest ownership stakes held by outsiders exceeded 80% for one firm, but were under 10% for the majority of firms reporting such data.

Table 2

Descriptive statistics of sample firm financial and ownership characteristics for 59 oil and gas production companies over the period 1979 through 1985.

Panel A. Total assets (in $ millions)

Year	1979	1980	1981	1982	1983	1984	1985	Total
Mean	273.8	348.9	467.9	520.2	526.0	643.6	548.8	464.4
Std Dev	336.8	415.2	560.7	613.6	631.8	884.4	755.3	607.4
Minimum	8.8	13.3	25.1	29.0	29.1	22.2	16.9	8.8
Median	146.1	173.5	253.0	331.7	285.2	309.9	261.2	225.9
Maximum	1390.5	1798.1	2611.5	2832.9	2924.8	3956.0	3818.1	3956.0
Count	49	51	51	51	45	36	33	316

Panel B. Book value of long-term debt($ millions)

Year	1979	1980	1981	1982	1983	1984	1985	Total
Mean	79.5	101.8	162.1	194.4	201.0	236.2	179.4	160.5
Std Dev	109.2	132.8	204.0	233.2	252.8	385.1	221.4	230.1
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	45.8	64.1	91.0	105.6	113.8	90.9	85.7	78.7
Maximum	456.7	615.0	947.8	1129.4	1248.9	2152.7	920.1	2152.7
Count	49	51	51	51	45	36	33	316
Zero debt	2	4	3	3	4	2	3	21

Panel C. Common stock dividends ($ millions)

Year	1979	1980	1981	1982	1983	1984	1985	Total
Mean	3.7	5.2	6.5	7.0	5.6	7.3	8.0	6.1
Std Dev	8.4	12.1	14.9	16.0	10.5	12.1	12.9	12.7
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.7	1.1	1.0	1.0	0.3	2.3	2.1	1.0
Maximum	52.4	68.4	72.4	82.7	51.6	51.7	51.6	82.7
Count	49	51	51	51	45	36.00	33.00	316
Zero Dividends	17	19	19	22	21	13	11	122

Panel D. Total inside ownership (% of outstanding shares)[a]

Year	1979	1980	1981	1982	1983	1984	1985	Total
Mean	21.15	22.53	21.37	20.94	18.78	18.89	18.27	20.40
Std Dev	19.05	16.98	17.05	18.00	16.69	17.19	18.70	17.46
Minimum	0.00	0.07	0.07	0.00	0.07	0.08	0.08	0.00
Median	14.20	18.84	16.45	14.89	14.76	12.50	12.21	15.13
Maximum	63.86	63.00	63.00	64.90	65.20	64.70	80.00	80.00
Count	49	51	51	51	45	36	33	316

Panel E. Largest single block of stock held by an outsider (% of outstanding shares)

Year	1979	1980	1981	1982	1983	1984	1985	Total
Mean	7.15	6.74	6.40	7.43	7.61	7.05	9.61	7.32
Std Dev	15.39	14.09	13.96	14.60	15.14	12.47	12.80	14.10
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Median	0.00	0.00	0.00	0.00	0.00	0.00	5.90	0.00
Maximum	81.50	80.30	81.60	82.00	81.97	58.80	59.40	82.00
Less than 5%	31	28	29	27	24	21	12	172
Count	49	51	51	51	45	36	33	316

[a] Inside ownership includes all shares beneficially held by managers and members of the firm's board of directors.

4. Methodology and data description

4.1 The regression model

The data in table 2 document that sample firms differ dramatically in terms of debt, dividends, and ownership structure. If, as suggested above, sample firms are prone to agency problems and if financial and ownership characteristics mitigate agency problems, then firm market values will vary systematically with these characteristics, *ceteris paribus*. However, the *ceteris paribus* condition is unlikely to hold. For example, the quality, tax treatment, time of extraction, and extraction costs of petroleum reserves may vary across firms.

In this study the problem of varying asset quality is addressed by using the difference between the market value of firm petroleum reserves, estimated by valuing the liabilities and equity side of firm balance sheets minus non-reserve assets, and an independent assessment of asset value (the Herold's present value measures). This difference measures how investors value the company relative to the value of its assets in place.

Since the market value of a firm is a combination of the values of assets in place, growth opportunities, and agency costs, the difference proxies for the value of growth opportunities as well as agency costs. Picchi (1985) and McConnell and Muscarella (1986) present evidence suggesting that growth opportunities in the petroleum industry during the 1980s were limited. Jensen (1986a) argues that the industry should be contracting over this period, which again suggests limited growth opportunities. Following these arguments, it is assumed growth opportunities are slight and the difference between market value and appraised value is an acceptable proxy for agency costs. The empirical tests will be biased if debt, dividend or ownership levels vary systematically with the presence of growth opportunities. The likely direction of the bias is discussed with the presentation of the empirical results.

According to free cash flow theory higher levels of debt or dividend distribution are associated with lower agency costs. Similarly, increased managerial ownership is associated (at least initially) with lower agency costs. Assuming a linear relationship among these variables, the regression model is

$$AC = \beta_0 + \beta_1 LTDebt + \beta_2 Dividends + \beta_3 Inside + \beta_4 Outside \qquad (1)$$

where:

AC = Agency costs, the difference between the Herold's appraised value and the market value firm petroleum reserves [agency costs are signed positive];

LTDebt = Long-term debt, the value of each firm's long-term obligations [predicted sign of coefficient is negative];

Dividends = Common stock dividends, the total annual cash dividends paid to common shareholders [predicted sign of coefficient is negative];

Inside = Inside ownership, the fraction of outstanding shares owned by all managers and members of the board of directors expressed as a percent[predicted sign of coefficient is negative].

Outside = Ownership by an outside investor, the fraction of outstanding shares owned by the single largest outside investor expressed as a percent[predicted sign of coefficient is negative].

Modigliani and Miller (1963) show that the value of the levered firm is the value of the firm if unlevered plus the present value of the interest tax shields. If debt is maintained at current levels indefinitely, and the tax rate is "τ", then the tax benefits of leverage are "τ" times the debt level, or "τ*LTDebt." If long-term debt provides agency cost reduction benefits as well as tax reduction benefits, the model can be modified to.

$$AC = \beta_0 + (\beta_1 + \tau)LTDebt + \beta_2 Dividends + \beta_3 Inside + \beta_4 Outside \qquad (2)$$

where b_1 measures the agency cost reduction effect of marginal increases in debt. The benefits of debt may be offset by anticipated costs of bankruptcy or financial distress. These costs are considered in the regression model by adding a debt-squared term to the model. The final model is

$$AC = \beta_0 + (\beta_1 + \tau)LTDebt + \beta_2 Dividends + \beta_3 Inside + \beta_4 Outside + \beta_5 LTDebt^2 \quad (3)$$

Table 3

Panel A: Summary statistics of estimates of agency costs in millions of dollars with costs signed positive for 59 oil and gas production companies for the period 1979 through 1985 (316 total observations).[a]

	1979	1980	1981	1982	1983	1984	1985	1979-85
Mean	59.1	-88.1	-15.6	55.9	-62.6	-86.2	-104.3	-28.2
Standard Deviation	290.6	338.8	299.2	187.4	384.0	383.1	187.6	309.0
Minimum	-499.6	-1,341.8	-1,513.5	-384.2	-2,392.4	-2,056.5	-881.4	-2,392.4
Median	11.4	-80.1	-5.2	25.1	-14.7	-0.7	-54.0	-7.4
Maximum	1,830.6	1,469.8	656.3	621.1	591.4	236.4	158.4	1,830.6
Count	49	51	51	51	45	36	33	316
t-statistic :Ho μ=0	1.42	-1.86	-0.37	2.13	-1.09	-1.35	-3.19	-1.62
Number poisitve	29	15	25	33	19	18	7	146

Panel B: Summary statistics of estimates of agency costs per barrel equivalent of oil with costs signed positive for 59 oil and gas production companies for the period 1979 through 1985 (316 total observations).[b]

	1979	1980	1981	1982	1983	1984	1985	1979-85
Mean	0.20	-3.54	-1.54	0.75	-1.03	-0.82	-1.87	-1.11
Standard Deviation	3.35	5.99	9.92	3.75	3.02	2.65	2.70	5.47
Minimum	-8.58	-22.38	-66.57	-16.61	-9.46	-8.35	-11.09	-66.57
Median	0.67	-2.12	-0.21	1.15	-0.51	-0.01	-1.66	-0.26
Maximum	7.22	7.33	6.83	7.95	5.23	5.98	3.19	7.95
Count	49	51	51	51	45	36.00	33.00	316
t-statistic :Ho μ=0	0.41	-4.22	-1.11	1.42	-2.29	-1.86	-3.97	-3.59

[a] Agency costs are estimated as the Herold's value of a company's oil and gas reserves less the implied market value of those reserves. The implied market value of reserves is computed by valuing the firm's liabilities and equity and subtracting the value of non-reserve assets. If the Herold's value exceeds the implied market value this difference is attributed to agency costs.

[b] The industry standard of 6,000 cubic feet of natural gas per barrel of oil is used which is roughly the BTU equivalence between the two energy sources.

If bankruptcy costs attenuate the benefits of debt, a positive sign is expected on the coefficient of the $LTDebt^2$-term.

Stulz (1988) predicts a non-linear relationship between firm market value and the control of votes by insiders; initially inside ownership aligns the interests of managers and shareholders, but at high levels allows managers to entrench themselves. Evidence presented by Morck, Shleifer, and Vishny (1988), McConnell and Servaes (1990) and Wruck (1989) suggest that this is a valuable hypothesis to examine. We include the inside ownership variable squared test for such non-linearities.

The agency cost proxy variable is calculated by first valuing all the financial claims against the firm, i.e., by valuing the right-hand-side of the firm's balance sheet, then subtracting the value of all non-reserve assets as given in the Herold's report. This is an estimate of the implied market value of a company's petroleum reserves. This value is subtracted from the value assigned to the company's petroleum reserves in the Herold's report. If the Herold's reserve value exceeds the implied market value of reserves, we attribute this difference to investors impounding anticipated agency costs into their market valuation of the firm.

We rely on the Herold's estimates of value for reserve and non-reserve assets rather than book values or the SEC petroleum reserve estimates for several reasons. First, the Herold's estimates are done by an independent organization while the reporting company computes the SEC estimates. The SEC requires reporting companies to use current oil and gas prices and a 10% discount rate when computing reserve values. Herold's analysts may modify oil and gas prices, company production forecasts and the discount rate depending on public and proprietary information. The book value of assets may not be an accurate reflection of their current market value. Herold's analysts try to estimate the current market value a company's non-reserve assets. While their estimates may not be accurate, we believe that their efforts to estimate a market value makes them a more appropriate metric of the value of these assets than book value.

Several procedures were used to value financial claims. Traded claims are valued at their observed market values corresponding to the date of the firm's balance sheet. Common and preferred stock prices, as well as the price of traded warrants, were found in either the STANDARD & POORS Security Owners Guide (for fiscal year-ends other than December 31) or *The Wall Street Journal* (for fiscal years ending on December 31). The number of shares and amount of each bond issue outstanding were taken from the firm's annual financial reports. Prices for traded debt, straight and convertible, were taken from the Moody's Bond Guide.

Table 4

Descriptive statistics of sample firm funds from operations and funds from all sources in millions of dollars and per barrel equivalent of oil for 59 oil and gas production companies over the period 1979 through 1985.

Funds from Operations in millions of dollars

	1979	1980	1981	1982	1983	1984	1985	Total
Mean	52.4	75.4	87.5	89.0	73.9	90.2	78.6	77.8
Std Dev	81.5	110.1	126.2	134.9	116.3	142.9	143.0	121.4
Minimum	1.3	1.1	-3.2	-2.1	-34.9	0.6	2.1	-34.9
Median	20.2	34.1	36.2	44.2	27.2	48.1	23.4	27.5
Maximum	357.4	426.7	526.7	610.3	622.2	754.9	731.9	754.9
Count	48	51	51	51	45	36	33	311

Funds from all sources in millions of dollars

	1979	1980	1981	1982	1983	1984	1985	Total
Mean	103.2	129.4	192.6	184.4	166.5	205.0	155.2	161.0
Std Dev	162.5	154.9	227.3	225.1	240.5	306.9	225.1	221.2
Minimum	2.0	5.9	3.3	2.4	6.3	6.4	4.0	2.0
Median	61.1	72.2	107.0	106.4	72.7	80.3	77.5	77.9
Maximum	980.4	737.2	1004.6	847.2	1201.0	1506.3	1177.1	1506.3
Count	48	51	51	51	45	36	33	311

Funds from operations as a percent of total assets

	1979	1980	1981	1982	1983	1984	1985	Total
Mean	0.16	0.18	0.16	0.14	0.12	0.15	0.12	0.15
Std Dev	0.07	0.08	0.09	0.09	0.07	0.09	0.06	0.08
Minimum	0.04	0.03	-0.02	-0.02	-0.10	0.02	0.02	-0.10
Median	0.16	0.16	0.16	0.13	0.13	0.12	0.13	0.14
Maximum	0.35	0.36	0.34	0.38	0.32	0.42	0.29	0.42
Count	48	51	51	51	45	36	33	315

Funds from all sources as a percent of total assets

	1979	1980	1981	1982	1983	1984	1985	Total
Mean	0.38	0.40	0.43	0.36	0.30	0.33	0.31	0.36
Std Dev	0.18	0.15	0.19	0.20	0.16	0.18	0.16	0.18
Minimum	0.02	0.15	0.10	0.08	0.08	0.13	0.11	0.02
Median	0.34	0.36	0.39	0.30	0.27	0.27	0.28	0.33
Maximum	0.89	0.82	1.03	1.10	0.79	0.87	0.88	1.10
Count	48	51	51	51	45	36	33	315

The following procedures were used to value non-traded liabilities. Current liabilities were valued at their book value. A market value for non-traded long-term debt was inferred by discounting the debt's promised payment pattern by the average yield on the firm's traded debt of similar maturity. If no traded debt of similar maturity was available, the firm's current short-term rate was used as the discount rate. The short-term rate was typically from zero to three percent above

the current prime or LIBOR rate. Debt for which no maturity or interest rate was reported in the annual report or 10-K form was recorded at book value, as was debt reported as non-interest bearing. No option value was attributed to non-traded convertible debt. Non-traded convertible debt was valued as either a straight bond or as equity, depending on which was greater.[13] The total value of the firm's long-term debt is used as an explanatory variable in the empirical tests.[14]

Non-traded preferred stock was valued at its liquidating value or face value. For non-traded convertible preferred, the greater of its liquidating or conversion value was used, without attributing any value to the conversion option.[15]

Long-term, noncancelable operating leases were valued by discounting the lease obligations at the interest rate used on debt of a similar maturity. Capitalized leases were recorded at their discounted value. Common stock options and non-traded warrants were valued at their expiration value, the greater of zero or current stock price less exercise price. Only options exercisable at the time of the annual report (or within six months of the fiscal year-end) were included in the calculation of the total value of options.[16] If this figure was not available, the total number of options outstanding was used.[17] Pension obligations were not valued.

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[13] Convertible debt was present in 86 of the 316 corporate observations. Of these 86 observations only 18 observations (for seven different firms) involved convertible debt which was not traded. The average amount of non-traded convertible debt outstanding was $12.06 million, or about 19% of the firm's total debt outstanding. For these 18 observations, the average deviation of the share price from the conversion price (above or below the conversion price) was 55%, with only 5 of the 18 observations having share prices at year-end within 30% (plus or minus) of the conversion price. Since option values are greatest at their conversion (or exercise) prices, the large difference between the conversion and share prices suggests that the option value, which is omitted from these calculations is likely to be small, and its omission is unlikely to affect the empirical results.

[14] The procedures for valuing debt resulted in a value for the market value of long-term debt that is quite similar to the book value presented in Panel B of Table 2. The correlation between the debt measures is 0.9854.

[15] Of the 50 firm-year observations with preferred stock, 22 were convertible and only 3 of these were not traded. For these non-traded convertible preferred stock issues, the average deviation of the market price of the firm's stock above or below the liquidating value of the preferred stock was 75%. The option value of the conversion feature is therefore likely to be small, so the omission of the option value is unlikely to affect the empirical results.

[16] The average value of options exercisable within six months, calculated at their expiration value, is $1.37 million. Since the market value of the firm's common stock averages several hundred million dollars, omitting unexercisable stock options, and not calculating an option value for the options is unlikely, on average, to have a material effect on the agency cost measure.

[17] In a few cases the number of exercisable options was not published in company reports, but information was available regarding the lag between the issuance of an option and when it became exercisable. When available this information was used to infer the number of exercisable options.

A number of firms in the sample had liabilities categorized as neither current nor long term. Examples of such obligations are deferred revenues, advances from take-or-pay contracts, obligations of subsidiaries, and minority interest. All of these obligations were included in the market value calculation at their book value.[18] A final item on nearly all firm balance sheets was deferred income taxes. This account is the accumulation of differences between taxes payable and tax expense from firm income statements. The Financial Accounting Standards Board's APB Opinion No. 11 states that "[d]eferred income taxes credits are neither liabilities nor reductions of assets in Opinion 11."[19] Bierman (1987) considers the treatment of the deferred tax account by financial analysts. He writes that the deferred tax account, "is *not* a liability. Nothing is owed now, to be payable now or in the future."[20] Deferred taxes will become an obligation only if sometime in the future the firm slows its investment in depreciable or depletable assets and it has taxable income. The recognition of deferred taxes as a liability, Bierman (1987) argues, should be postponed until such future incomes are earned. Accepting this argument, deferred taxes were not included as a liability in the calculation of the market value of the firm.[21]

We use the valuation procedures just described to estimate agency costs for our sample firms. Table 3 reports summary statistics for these agency cost estimates. In Table 3 agency costs are signed positive. Our agency cost estimates are highest in 1979, fall in 1980 then slowly rise through 1982. After 1982 the estimates fall through 1984. The agency cost estimates were statistically positive only in 1982. Oil prices peaked in 1981-2 as did 'funds from all sources as a percent of total assets' (Panel A of Table 4). As Panel B of Table 4 shows during the sample period 'funds from operations as a percent of total assets' were highest during the period 1979-81.

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[18] For the entire sample period these obligations averaged 1.17% of firm market value and 2.2% of total assets.

[19] Accounting Standards Statements of Financial Accounting Concepts 1-5, McGraw Hill, New York, 1985, page 137.

[20] Bierman (1987) p.72, emphasis in the original. See also Foster (1986) pages 65-66.

[21] Over the entire sample of corporations deferred taxes averaged just under 7% of firm market values (computed without considering deferred taxes). Given that the nature of deferred taxes is that they *may* be paid sometime in the future, this value overstates the importance of deferred taxes relative to the market value of the firm. To assure that the exclusion of deferred taxes from the market value computation did not bias the results, the empirical tests were carried out with deferred taxes included in the market value measure. The results of the empirical tests are not affected when the market value of firm petroleum reserves is computed with deferred taxes.

5. Empirical results

The empirical tests are carried out using scaled variables. All variables measured in dollars are deflated by total equivalent barrels of oil (BBL). Natural gas is converted to oil using the industry standard conversion ration of 5,700 cubic feet of gas per barrel of oil. Redefining the variables on a per barrel basis allows the estimated equation to focus on the relationship between agency costs and the explanatory variables, rather than be swamped by size or scale effects. The scaling also reduces problems of heteroscedasticity. Similar deflation procedures have been used in several recent empirical studies of the petroleum industry.[22] We estimate the regression model:

$$\frac{AC}{BBL} = \beta_0 + \beta_1 \frac{LTDebt}{BBL} + \beta_2 \frac{Dividends}{BBL} + \beta_3 Inside + \beta_4 Outside + \beta_5 \left[\frac{LTDebt}{BBL}\right]^2 \quad (4)$$

Three sets of regression results are estimated and reported. First, model (4) is estimated with various combinations of explanatory variables included. The estimation procedure produces robust standard errors based on White (1980). The procedure also corrects for a possible lack of independence between observations for the same firm in different years.[23] The clustering procedure is similar to a generalized-least-squares random-effects model. Table 5 reports the coefficient estimates, t-statistics, p-values, F-statistics, and R^2 values for these regressions. The F-statistics for all but one model are significant at the 0.05 level. In all models the coefficient on the Long-term Debt variable is significant and signed as predicted. The coefficient estimate for the Long-term Debt variable rises in magnitude, but decreases in significance with the addition of the debt-squared term. The Debt-Squared term enters the model with the predicted sign, but is not generally statistically significant at standard alpha-levels. In models that include the Debt-Squared term the coefficient estimate for the Long-term Debt variable exceeds the statutory marginal tax rate in effect during the sample period of 46%. Coefficient point estimates in the range of 0.59 to 0.62 are not, however, statistically different from 0.46.

[22] Miller and Upton (1985a, 1985b), Magliolo (1986) and Harris and Ohlson (1986) all use equivalent barrels to deflate the variables in their regression models.

[23] The specific procedure is Stata's 'regress' procedure utilizing the 'robust' and 'cluster' options.

Table 5

Coefficient estimates from regressions of agency costs per barrel equivalent on firm leverage, dividend and ownership variables for 59 oil and gas production companies (316 total observations) clustered by firm to correct for the lack of independence between observations for the same firm for different years. [a]

	Constant	Market value long-term debt per barrel	Market value long-term debt per barrel squared	Common stock dividends per barrel	Total insider ownership (%)[b]	Size of largest block held by an outsider (%)	F-statistic p-value	R^2
Coefficient	0.89	-0.62	0.03	-0.86	-0.01	-0.03	3.14	2.9%
t-statistic	1.09	-1.96	1.45	-0.40	-0.59	-2.05	0.014	
p-value	0.28	0.06	0.15	0.69	0.56	0.05		
Coefficient	-0.34	-0.21					5.83	1.5%
t-statistic	-0.68	-2.42					0.019	
p-value	0.50	0.02						
Coefficient	0.32	-0.62	0.04				3.56	2.3%
t-statistic	0.62	-2.22	1.73				0.035	
p-value	0.54	0.03	0.09					
Coefficient	0.41	-0.64	0.04	-1.02			2.57	2.3%
t-statistic	0.70	-2.25	1.78	-0.47			0.063	
p-value	0.49	0.03	0.08	0.64				
Coefficient	0.19	-0.23			-0.01	-0.03	4.61	2.2%
t-statistic	0.32	-2.54			-0.49	-2.76	0.006	
p-value	0.75	0.01			0.62	0.01		
Coefficient	0.45	-0.59	0.03			-0.03	5.14	2.7%
t-statistic	0.83	-2.02	1.48			-1.62	0.003	
p-value	0.41	0.05	0.14			0.11		
Coefficient	0.79	-0.60	0.03		-0.01	-0.03	4.2	2.8%
t-statistic	1.03	-1.98	1.48		-0.53	-2.33	0.005	
p-value	0.31	0.05	0.15		0.60	0.02		

[a] Natural gas is translated into barrel equivalents of oil based on the industry standard conversion rate of 5,700 cubic feet of gas per barrel of oil.

[b] Total insider ownership is the proportion of outstanding shares held by all managers and directors of the company.

Neither the Common Stock Dividend nor the Inside Ownership variable coefficients are statistically significant. In almost all configurations the coefficient estimate for the Large Outside Blockholder variable is signed as

predicted and significant. Overall, these results are consistent with the predictions of the Jensen (1986a) and Grossman and Hart (1982) theories that debt can reduce agency costs.

Table 6

Robust regression coefficient estimates from regressions of agency costs per barrel equivalent on firm leverage, dividend and ownership variables for 59 oil and gas production companies (316 total observations) clustered by firm to correct for the lack of independence between observations for the same firm for different years. The robust estimation is based on an iterative technique to reduce the weight of observations with large residuals based on Cook's distance. [a]

	Constant	Market value long-term debt per barrel	Market value long-term debt per barrel squared	Common stock dividends per barrel	Total insider ownership (%)[b]	Size of largest block held by an outsider (%)	F-statistic p-value	R^2 Adj-R^2
Coefficient	1.24	-0.41	0.02	-1.45	-0.003	-0.04	6.24	9.1%
t-statistic	2.61	-2.53	1.20	-1.09	-0.32	-3.00	0.001	7.6%
p-value	0.01	0.01	0.23	0.28	0.75	0.003		
Coefficient	0.53	-0.24					17.63	5.3%
t-statistic	1.98	-4.20					0.001	5.0%
p-value	0.05	0.001						
Coefficient	0.92	-0.23		-1.01	-0.002	-0.04	7.55	8.9%
t-statistic	2.35	-4.07		-0.78	-0.23	-3.19	0.002	7.7%
p-value	0.02	0.001		0.43	0.82	0.002		
Coefficient	0.82	-0.43	0.017				9.25	5.6%
t-statistic	2.28	-2.65	1.29				0.0001	5.0%
p-value	0.02	0.008	0.20					
Coefficient	0.99	-0.47	0.02	-2.14			6.83	6.2%
t-statistic	2.63	-2.87	1.69	-1.64			0.002	5.3%
p-value	0.01	0.004	0.09	0.10				
Coefficient	0.92	-0.23		-1.01	-0.002	-0.04	7.55	8.9%
t-statistic	2.35	-4.07		-0.78	-0.23	-3.19	0.002	7.7%
p-value	0.02	0.001		0.43	0.82	0.002		

[a] Natural gas is translated into barrel equivalents of oil based on the industry standard conversion rate of 5,700 cubic feet of gas per barrel of oil.

[b] Total insider ownership is the proportion of outstanding shares held by all managers and directors of the company.

Table 6 presents results for regressions using an iterative procedure to assign a lower weight to observations with large residuals.[24] Residuals plots suggest that extreme outliers could influence the regression results. These results confirm those presented in Table 5: the Long-term Debt coefficient estimates are statistically significant and signed as predicted; including the Debt-squared term produces point estimates for the Long-term Debt coefficient that are close to the maximum statutory marginal tax rate in effect during the sample period; and that agency costs are reduced the larger the stake owned by outside stockholders. As in Table 5 the regression models explain only a small portion of the total variation in the agency cost variable.

Table 7 presents the third set of regression results. These results examine the effect of debt, dividends and ownership variables during sub-periods of the sample period. We estimate separate regressions for three time periods: 1979-80, 1981-83, and 1984-85. Table 3 showed that our agency costs estimates peaked in 1982. If debt, dividends and/or ownership affect agency costs, then these relationships should be particularly apparent during the sub-period (1981-83) in which agency issues are most severe. As Table 7 shows, the negative relationship between agency costs and debt only exists during the 1981-83 sub-period.

The coefficient estimate for the Long-term Debt variable includes any effect on market value due to the interest tax subsidy. The free cash flow theory predicts that benefits beyond these tax advantages accrue to levered firms. If so, the coefficient estimates on the Long-term Debt variable should be greater than the marginal tax rate of sample firms. While the maximum statutory marginal tax rate in effect during the sample period was 46%, this rate may not represent the value of the interest tax subsidy for all firms. Forty-seven sample companies, comprising nearly two-thirds of all observations, report unused tax loss or investment tax credit carryforwards. These firms are forced to postpone the use of some tax benefits that reduces the value of the interest tax subsidy.[25] Furthermore, the alternative minimum tax (AMT) is likely to reduce the effective marginal tax benefits of interest for tax paying firms to about 39%.[26] While it is difficult to identify an

[24] The specific estimation procedure is the 'rreg' procedure in Stata.

[25] The fact that in 1981 the maximum period over which tax losses could be carried forward was increased from 7 to 15 years is also suggestive of long delays in realizing tax benefits for some firms.

[26] During the sample period the AMT was a 15% surtax on the difference between the greater of $10,000 or the firm's regular income tax (close to zero for most firms with carryforwards) and any tax preference items included in the calculation of the regular tax. The primary tax preference items for oil companies are percent depletion and accelerated depreciation. For firms paying taxes of more than $10,000 an additional dollar of interest expense reduces the regular tax burden by 46¢, but also increases the base on which the surtax is

exact marginal tax rate for the sample firms, it is clear that the rate is below 46%, is probably below 39%, and may be in the range of 30% (which corresponds to a 39.1% rate for firms without carryforwards, a 4 to 5-year delay in realizing tax benefits for firms with carryforwards, and a discount rate of 12%). The coefficient estimate for the Long-term Debt variable of -0.84 is statistically different (at the 5% level of significance) from marginal tax rates of about 30% or lower. This result supports the theories of Jensen (1986a) and Grossman and Hart (1982) that debt financing can create value beyond the interest tax subsidy by reducing agency costs.

In all of the regression models in Tables 5 through 7 the coefficient estimate for the Debt-squared term is positive although not always statistically significant. The positive sign implies that the benefits of debt financing diminish as leverage rises, consistent with anticipated bankruptcy costs offsetting the benefits of debt financing. In almost every regression models the Common Stock Dividend variable coefficient is always signed negative, as predicted, but is not statistically significant.

Inside ownership, as measured by the stock ownership of the all managers and directors, is not statistically significant in any regressions. We explore the relationship between ownership and agency costs further, but do not tabulate the following analyses. The lack of statistical significance for the coefficient estimate of the Inside Ownership variable continues to hold when an ownership-squared term is added to the regression model. This result could occur because our definition of inside ownership includes the stock holdings of managers, directors with ties to the management or the firm, and independent outside directors. For a subset of the sample we have ownership data that distinguishes between these groups. Entering these ownership categories into the regression model separately does not produce any significant ownership coefficients. Similarly, using variables for the ownership of the CEO or the combined ownership of managers and affiliated directors (outside directors with ties to the company) produces no significant coefficients. Nor does adding squared terms of these variables result in statistically significant coefficient estimates on any ownership variables. This subset of data also allows us to examine the role of independent directors in reducing agency costs. Coefficient estimates for a board independence variable (either as the percent of seats held by independent directors or a dummy variable

computed. The net effect is a marginal benefit of 85% of 46¢ or 39.1¢ per additional dollar of interest expense. For firms paying less than $10,000 in regular taxes, an additional dollar of interest expense has no effect on the AMT base, so the full 46% interest tax shield is realized.

for boards with over 50% of seats held by independent outside directors) are not statistically significant. These results are not tabulated.

Table 7

Coefficient estimates for three time periods (1979-80, 1981-83 and 1984-85) from regressions of agency costs per barrel equivalent on firm leverage, dividend and ownership variables clustered by firm to correct for the lack of independence between observations for the same firm for different years.

	Constant	Market value long-term debt per barrel	Market value long-term debt per barrel squared	Common stock dividends per barrel	Total insider ownership (%)[b]	Size of largest block held by an outsider (%)	F-statistic p-value	R^2
1979-80	obs=100							
Coefficient	1.92	-1.19	0.07	-8.47	-0.03	-0.07	6.14	13.0%
t-statistic	1.38	-1.49	0.62	-1.07	-1.10	-2.49	0.0001	
p-value	0.17	0.14	0.54	0.29	0.28	0.02		
1981-83	obs=147							
Coefficient	2.24	-0.84	0.05	0.43	-0.03	-0.02	3.14	3.1%
t-statistic	2.66	-2.53	1.74	0.18	-0.76	-1.51	0.015	
p-value	0.01	0.01	0.09	0.86	0.45	0.14		
1984-85	obs=69							
Coefficient	-1.68	-0.08	0.00	-1.29	0.03	0.04	3.02	11.6%
t-statistic	-0.97	-0.18	-0.12	-0.96	1.46	1.41	0.022	
p-value	0.34	0.86	0.90	0.34	0.15	0.17		

A final set of results that are not tabulated examine the role of cash holdings, funds from operations and funds from all sources on agency costs. For the entire sample period the funds from operations and all sources variables have coefficient estimates that are signed negative and are significant in the regressions using the clustering method. Further investigation shows that this result is due to observations in the 1979-80 sub-period. In this sub-period a greater flow of funds is associated with a reduction in our agency cost measure. This result would occur if investors see a higher flow of funds as enhancing the market value of sample companies. In later sub-periods this relationship does not hold suggesting that investors no longer perceive a higher flow of funds as value enhancing. Such

a perception by investors is consistent with the free cash flow theory of agency costs.

To investigate whether the agency cost reduction role of debt is stronger among sample firms with a higher generation of cash (as measured by funds from operations). The sample is divided into two groups using the median value of the funds from operations variable (adjusted by barrel equivalents of oil). For the 1981-83 sub-period (the sub-period in which agency cost estimates are highest) the Long-term Debt coefficient is negative and statistically significant (p-value 0.02) only for the regressions using observations with high funds from operations. Thus, among our sample firms the agency cost reduction effect of debt is found primarily for companies with high funds generations (from either operations or all sources) during the sub-period of higher agency costs. This result lends further support to the free cash flow theory: debt reduces agency costs for firms with high cash flow (here proxied by funds from operations) and limited investment opportunities such as these oil and gas production companies have during the period 1981-83.

6. Summary and Conclusion

This paper attempts to test Jensen's (1986a) free cash flow theory of agency costs by identifying a group of firms and a time period during which such agency costs should exist, if the theory is correct. We then develop a measure to estimate agency costs and use that measure to test whether higher debt and higher cash dividends are associated with lower agency costs as predicted by Jensen. We also examine whether stock ownership structure affects agency costs.

Relying on various observers and analysts, we choose the oil and gas production industry during the early 1980s as an industry that fits the assumptions of Jensen's model. Several attributes of the industry also allow us to develop an estimate of agency costs (e.g., the uniformity of assets across firms, the existence of outside valuations of petroleum reserves and new SEC reporting standards). The agency cost measure compares valuation estimate of a company's oil and gas reserves, as computed by analysts at John S. Herold's, to the value implied by the market value of the company's liabilities and equity. We attribute market values of petroleum reserves that are below the Herold's value as value loss due to agency costs. This measure becomes the dependent variable in our regression analysis.

The evidence from our regression analysis is supportive of Jensen's theory that debt financing, with its mandatory payout of cash, is associated with lower

agency costs. The magnitude of the coefficient estimate for the Long-term Debt variable is greater than (as a point estimate) the marginal tax rate in effect during this period. In the sub-period in which agency costs are most likely to exist (1981-83) this coefficient estimates is statistically greater than 30% that is likely very close to the effective marginal rate for most firms in our sample. This suggests that the interest tax shield does not explain all of the benefits of debt financing. This result is robust across a variety of model specifications and estimation techniques. Moreover, the result applies primarily to those sample firms that generate relatively high funds from operations. This is consistent with the free cash flow theory that debt will be particularly important in resolving agency conflicts in firms that generate high cash flow. We also find some evidence that large blocks of stock held by outside investors can reduce agency costs. We find no evidence, however, supportive of managerial stock ownership or board independence mitigating agency conflicts. Overall, our results are consistent with the theories of Jensen (1986a) and Grossman and Hart (1982) that posit that debt financing can reduce agency costs.

The methodology used in this paper depended on sample companies having free cash flow. The high oil prices of the early 1980s almost assured this was the case. A similar period of high cash flows occurred in the 2000s. West Texas crude averaged about $22 per barrel through the 1990s and early 2000s. In 2004 the average price rose to $41.43 with a peak of over $50. THis trend continued with average crude prices of $56 in 2005 and in the $66 to $70 range in 2006 and 2007. In 2008 oil prices peaked at over $130 per barrel. This period provides another opportunity to apply the estimation methodology. Since 1990 much has been much written about corporate cash holdings (Mikkelson and Partch (2003) and Harford (1999)) and particularly about cash holdings and governance (see, for example, Harford, Mansi and Maxwell (2008) and Pinkowitz, Stulz and Williamson (2006)). Applying the current methodology and our better understanding and measurement of governance variables might provide insights that cannot be obtained using just financial variables with no direct estimate of agency costs.

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