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Disclosure Level and the Cost of Equity Capital

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ABSTRACT: The effect of disclosure level on the cost of equity capital is a matter of considerable interest and importance to the financial reporting community. However, the association between disclosure level and cost of equity capital is not well established and has been difficult to quantify. In this paper I examine the association between disclosure level and the cost of equity capital by regressing firm-specific estimates of cost of equity capital on market beta, firm size and a self-constructed measure of disclosure level. My measure of disclosure level is based on the amount of voluntary disclosure provided in the 1990 annual reports of a sample of 122 manufacturing firms. For firms that attract a low analyst following, the results indicate that greater disclosure is associated with a lower cost of equity capital. The magnitude of the effect is such that a one-unit difference in the disclosure measure is associated with a difference of approximately twenty-eight basis points in the cost of equity capital, after controlling for market beta and firm size. For firms with a high analyst following, however, I find no evidence of an association between my measure of disclosure level and cost of equity capital perhaps because the disclosure measure is limited to the annual report and accordingly may not provide a powerful proxy for overall disclosure level when analysts play a significant role in the communication process.

Key Words: *Voluntary disclosure, Cost of equity capital, Corporate disclosure strategy.*

Data Availability: *Contact the author.*

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I. INTRODUCTION

The extent to which firms benefit from increased disclosure remains a controversial issue. Several models of asset pricing suggest increased disclosure reduces cost of equity capital but little empirical evidence exists to support these claims. This absence of evidence fuels an ongoing debate among practitioners regarding the benefits of enhanced disclosure. For example, the Special Committee on Financial Reporting of the American Institute of Certified Public Accountants (1994) (i.e., Jenkins Committee) states that an important benefit of greater disclosure is a lower cost of equity capital. In rebuttal, the Financial Executives Institute (Berton 1994) argues that the enhanced disclosures called for in the Committee's report are targeted to stock traders which would add to share price volatility thereby increasing risk and leading to a higher cost of equity capital.

Theoretical research supporting a negative association between disclosure level and cost of equity capital has followed two related thrusts. The first is that greater disclosure enhances stock market liquidity thereby reducing cost of equity capital either through reduced transactions costs or increased demand for a firm's securities. This stream of research includes Demsetz (1968), Copeland and Galai (1983), Glosten and Milgrom (1985), Amihud and Mendelson (1986) and Diamond and Verrecchia (1991). The second stream of research which includes Klein and Bawa (1976), Barry and Brown (1985), Coles and Loewenstein (1988), Handa and Linn (1993), Coles et al. (1995) and Clarkson et al. (1996) suggests that greater disclosure reduces estimation risk arising from investors' estimates of the parameters of an asset's return or payoff distribution. That is, greater uncertainty exists regarding the "true" parameters when information is low. If estimation risk is nondiversifiable, investors require compensation for this additional element of risk. However, no consensus has been reached on the diversifiability of estimation risk (Clarkson et al. 1996).

Although existing empirical research tends to support a negative association between disclosure level¹ and cost of equity capital, the authors of the Jenkins Committee (1994, 38) report admit that the evidence to date does not present "an empirical case that informative disclosure lowers the cost of capital." This is because prior research has examined the impact of disclosure on variables that are expected to be positively related to cost of equity capital² and not on cost of equity capital itself. Prior research has adopted an indirect approach because appropriate cost of equity capital estimates for an investigation of the impact of disclosure on cost of equity capital are difficult to obtain. That is, traditional methods of estimating cost of equity capital either provide no role for information (this is the case with the traditional Capital Asset Pricing Model) or yield measures of this cost that demonstrate little or no relation to market beta (the most well accepted measure of firm risk) and are difficult to defend as a result.

In this study I estimate the cost of equity capital using an accounting based valuation formula developed by Edwards and Bell (1961), Ohlson (1995) and Feltham and Ohlson (1995). I show that these estimates are both increasing in market beta and decreasing in firm size. I then test for the association between disclosure level and the cost of capital itself after controlling for market beta and firm size and document a negative association between cost of equity capital and voluntary disclosure level for firms that attract a low analyst following. The magnitude of the effect is such that a one-unit difference in the disclosure measure is associated with a difference

¹ Disclosure quality is also important but very difficult to assess. As a result, researchers tend to assume quantity and quality are positively related. This assumption seems justified given the importance of managers' reporting reputations and the constraints placed on managers by legal liability.

² See for example, Healy et al. (1995), Byrd et al. (1995), Frankel et al. (1995), Healy and Palepu (1995) and Welker (1995).

in the cost of equity capital of 28 basis points, on average, for these firms. However, I find no evidence of an association between my measure of disclosure level and cost of equity capital for firms with a high analyst following. This may be because my disclosure measure is limited to the information provided in the annual report and accordingly may not yield a powerful proxy for overall disclosure level when a substantial amount of information is disseminated through financial analysts.

The remainder of the paper is organized as follows. I develop the hypotheses in section II. My sample selection procedures and descriptive statistics for the sample are provided in section III. Procedures used to estimate firms' cost of equity capital and level of disclosure are described in section IV followed by the empirical results in section V. Conclusions, limitations and suggestions for future research appear in section VI.

II. HYPOTHESIS DEVELOPMENT

Theoretical support for a negative association between disclosure level and cost of equity capital is provided by two streams of research. The first is represented by Amihud and Mendelson (AM) (1986) and Diamond and Verrecchia (DV) (1991). AM (1986, 228) claim that the cost of equity capital is greater for securities with wider bid-ask spreads because investors demand compensation for added transactions costs. By disclosing private information firms can reduce the adverse selection component of the bid-ask spread and reduce their cost of equity capital. DV suggest that greater disclosure reduces the amount of information revealed by a large trade thereby reducing the adverse price impact associated with such trades. As a result, investors are willing to take larger positions in a particular firm's stock than they otherwise would. This increases demand for the firm's securities and raises the current price of the firm's stock, thus reducing the cost of equity capital.³

The second stream of theoretical research suggests that greater disclosure can reduce cost of equity capital by reducing nondiversifiable estimation risk. Klein and Bawa (1976) were perhaps the first to consider estimation risk but, more recent work includes Barry and Brown (1985), Coles and Loewenstein (1988), Handa and Linn (1993), Coles et al. (1995) and Clarkson et al. (1996).

These researchers recognize that the parameters of a security's return or payoff distribution must be estimated by investors based on a firm's return history and/or other information about the firm. Barry and Brown (1985), Handa and Linn (1993) and Coles et al. (1995) use a Bayesian approach which recognizes that investors form predictive distributions that reflect their uncertainty about the true parameters. They conclude that estimation risk is nondiversifiable, is not reflected in the traditional CAPM formula for market beta (which is derived under the assumption that the parameters of the distribution are known) and that estimates of market beta are systematically too low for low information securities because market beta fails to incorporate estimation risk.

Clarkson et al. (CGT) (1996), state that estimation risk has a significant nondiversifiable component if resolution of uncertainty about low information securities affects the return earned on the market portfolio. CGT also argue, however, that the breadth of modern securities markets allows the correlation of returns induced by the resolution of uncertainty to be diluted to the point that any nondiversifiable component of estimation risk is immaterial. Nevertheless, CGT (1996, 79) conclude that "...the extent of the impact of estimation risk remains, fundamentally, an empirical question."

³ DV also show that when reduced information asymmetry results in rapid exit from market making the opposite result obtains. However, the conditions that give rise to this finding are described as "less typical."

The research discussed above, motivates the following hypothesis (stated in alternative form):

H1: There is a negative association between cost of equity capital and disclosure level.

Existing evidence indicates that firms coordinate their disclosure policies across different media. For example, using the set of corporate disclosure rankings produced by the Association for Investment Management and Research (AIMR), Lang and Lundholm (LL) (1993) document a significant rank-order correlation between annual report and other publication disclosure rankings (coefficient of 0.62) and between annual report and investor relations disclosure rankings (coefficient of 0.41).⁴ This suggests that a measure of disclosure level produced by examining any one aspect of corporate reporting could proxy for the general level of disclosure provided by a firm. I rely on this assumption when using the amount of voluntary information found in a firm's annual report alone to serve as a proxy for the amount of disclosure provided by a firm across all avenues.

If firms perfectly coordinated their disclosure policies across various avenues, this assumption would not introduce additional measurement error into the analyses. However, as LL indicate, the correlation, while significantly positive, does not approach one, particularly with respect to the correlation between annual report disclosure rankings and investor relations rankings. As a result, my measure of disclosure level which is limited to disclosure provided in the annual report may not provide a powerful proxy for overall disclosure level when firms are followed by a large number of analysts and presumably use these analysts to communicate with the market. For firms with fewer analysts, however, measurement error arising from the limited scope of the disclosure measure should be less severe because the annual report plays a much larger role in the communication process. For example, Previts et al. (1994, 67) observe, "The parties who have an interest in (small publicly traded companies) appear to be left to their own resources and to *general purpose statements* [emphasis added] to ascertain information, since analysts do not provide a ready source of guidance." This suggests that the association between cost of equity capital and my measure of disclosure level may not be as significant for firms with a large analyst following. This is restated as hypothesis two.

H2: The association between cost of equity capital and disclosure level is less significant for firms that attract a greater number of analysts.

III. SAMPLE SELECTION AND DESCRIPTION

Sample Selection

Two factors are critical to the power of my empirical analysis: (1) sufficient cross-sectional variation in disclosure levels and (2) a sufficiently large sample. A sufficiently large sample could be provided in the disclosure rankings produced by the AIMR which provides a readily available source of a relatively long time series of disclosure rankings across a broad spectrum of industries. However, the AIMR sample tends to be limited to the largest most heavily followed firms in an industry.⁵ Since disclosure levels are positively correlated with firm size (Lang and Lundholm

⁴ Each year the AIMR selects a small number of firms from a variety of different industries and provides a within industry ranking of firms' corporate reporting along three dimensions: annual reports, quarterly and other published reports and investor relations. These rankings are published annually in The Association for Investment Management and Research, Report of the Corporate Information Committee.

⁵ Based on a sample of 751 firms with at least one year of AIMR data during the period 1985 to 1989, Lang and Lundholm (1996) report that the average firm in this sample is followed by approximately eighteen analysts and has a market value of equity of approximately \$2.4 billion.

1993), AIMR firms are unlikely to display sufficient cross-sectional variation in disclosure levels.⁶

An alternative to using the AIMR sample is to select a sample of firms characterized by greater variation in firm size and analyst following but for which disclosure rankings are not readily available. The advantage of obtaining potentially greater cross-sectional variation in disclosure level comes at the cost of a limited sample size and a more narrowly defined measure of disclosure level due to the difficulty of constructing a data base of disclosure rankings. I chose to adopt this latter approach and limit the sample to one year and one industry to maximize statistical power, as discussed below. I also test hypothesis two to address the possibility that an association between cost of equity capital and my disclosure measure might be attenuated when financial analysts play a significant role in the communication process.

I limit the analysis to one year because firms' disclosure policies appear to remain relatively constant over time. For example, Healy et al. (1995) are able to identify only 90 large and sustained increases in AIMR disclosure rankings in a sample of 595 firms in 23 industries over the period 1980 to 1990. Since this suggests that year-to-year disclosure observations for a given firm are not independent, I chose to increase sample size by adding cross-section observations as opposed to observations over time. Fiscal year 1990 was chosen because it was recent enough to ensure reasonable access to firms' corporate reports yet still ensure other post-sample year data would be available.

One industry was selected because different industries display different patterns of disclosure. For example, firms in the pharmaceuticals industry tend to provide much more disclosure about their research and development activities than do firms in other industries. Using different disclosure measures for firms in different industries necessitates a *within* industry analysis resulting in smaller intra-industry samples so I chose instead to select firms for which the same disclosure measure is expected to be appropriate. Specifically, I examine firms in the machinery industry broadly defined to include firms with primary operations in the following SIC codes: 3312–3399 (primary metals), 3411–3499 (fabricated metal products, except machinery and transportation equipment) and 3511–3569 and 3581–3599 (industrial and commercial machinery).⁷

Firms in this particular industry appear to display a sufficient amount of variation in disclosure practices. This is evidenced by the within industry variation in disclosure scores assigned by the AIMR during 1985–1989. For all AIMR industries with a full five years of data, I computed the cross-sectional standard deviation of AIMR scores assigned to firms within a particular industry for a given year.⁸ Standard deviations for each industry were then averaged across time, and rank ordered. The machinery industry was selected for analysis because its mean standard deviation fell in the top quintile of the distribution and it is a large industry.⁹

The 1994 edition of Ward's Business Directory lists 372 publicly traded companies in the SIC codes of interest. Seventy-one of these firms were dropped from the sample because at least 24 of the 60 monthly return observations in the five-year period ended May 31, 1991 (the data needed to estimate beta) were not available in the Center for Research in Security Prices (CRSP) 1993

⁶ Evidence to suggest that this may indeed be the case is provided later in this section.

⁷ Electronic components manufacturers (SIC codes 3571–3579) are excluded because their disclosure practices may be influenced by the high technology nature of these firms which is quite different from the other firms included in the analysis.

⁸ The banking and insurance industries are excluded because their disclosure practices are heavily influenced by regulatory requirements.

⁹ The lowest mean standard deviation of total disclosure scores is 5.5 and is associated with the retail industry. The highest is 11.8 and is associated with Publishing and Broadcasting. The mean standard deviation of total disclosure scores for the machinery industry is 10.2.

stock return files. All of the remaining firms were contacted to request a copy of their 1990 annual report to shareholders. Of these, 87 failed to send the requested report. However, annual reports for 40 of these 87 were collected from other sources, such as *LaserD* (distributed by Disclosure Information Services), yielding a total sample of 254 annual reports. During fiscal 1990, four of these firms were reorganizing under Chapter 11, two were not primarily engaged in manufacturing activities, and one underwent a major merger. Since the disclosures made by firms engaged in such activities are likely to differ from the norm, they were excluded from the analysis. One hundred and twenty-five firms not followed by Value Line were also excluded because I need the forecast data provided by Value Line to estimate cost of equity capital.¹⁰ As shown in table 1, the sample selection procedures yielded a final sample of 122 firms.

Sample Description

Descriptive statistics for the sample are provided in table 2. ANALYST is the maximum number of analysts reported either in the 1991 edition of *Nelson's Directory of Investment Research* or in any of the 12 monthly IBES reports issued during 1990. BETA is estimated via a market model regression of at least 24 of the 60 monthly return observations in the five-year period ended May 31, 1991 on a market index defined in terms of equally weighted NYSE/AMEX returns. MVAL is the market value of equity at the end of 1990 in millions of dollars. ASSET is the book value of total assets, PPE is the net book value of property, plant and equipment and SALES is total sales, all for the fiscal year ended 1990, and all in millions of dollars. NUMEMP is the number of employees reported in the fiscal year end 1990 annual report or 10-K. DSCORE is the firm's disclosure score. A discussion of this measure is provided in section IV.

¹⁰Other forecasting services such as IBES, Nelson Publications and Zacks do not provide long-term forecasts of book value, earnings and future price; key inputs into the cost of equity capital formula described in section IV.

TABLE 1
Summary of Sample Selection Procedures

	<i>Number</i>	<i>Percent</i>
Public firms in SIC codes 3312–3599 (excluding 3571–3579)	372	124%
Firms with insufficient CRSP data	(71)	(24)
Firms contacted for 1990 annual report	301	100%
Firms failing to respond	(87)	(29)
Annual reports received	214	71%
Annual reports collected from alternative sources	40	13
Total annual reports	254	84%
Firms in Chapter 11	(4)	(1)
Firms not primarily engaged in manufacturing	(2)	(1)
Firms undergoing a major merger during 1990	(1)	(0)
Firms not followed by Value Line	(125)	(42)
	<u>122</u>	<u>40%</u>

The data indicate a wide range of firm size with market value of equity of \$18.5 million at the first percentile compared to \$5.9 billion at the ninety-ninth percentile of the distribution. The range associated with several other measures of firm size—ASSET, PPE, SALES and NUMEMP—also suggest substantial cross-sectional variation in firm size. Mean (median) market value of equity is \$713.4 million (\$209 million). In contrast, the average firm ranked by the Machinery Industry Subcommittee of the AIMR (Subcommittee) in 1990 was twice as large with mean (median) market value of equity of \$1.2 billion (\$543.9 million).

The average sample firm is followed by approximately eleven analysts. One-quarter of the firms attract the attention of five or fewer analysts compared with the firms in the upper quartile which are followed by 15 or more analysts. In comparison, the mean number of analysts following the sample of firms examined by the Subcommittee in 1990 was 18.

Compared to the sample employed in this study, virtually all of the Subcommittee's firms fall in the upper half of the distributions of firm size and analyst following. The most lightly followed firm included in the Subcommittee's sample in 1990 attracted the attention of eight analysts while the market value of equity of the smallest firm was \$189 million. Thus, expanding the sample of firms beyond those ranked by the AIMR yielded a final sample characterized by a broader distribution of firms with respect to firm size and analyst following. Since disclosure is positively correlated with firm size, this should lead to greater variation in disclosure level which appears to be the case. Of the 24 firms included in the AIMR sample and in the sample employed here, 67 percent fall in the top two quintiles of my disclosure rankings.

Hypothesis two is tested by dividing the sample into firms followed by less than the median number of analysts and those followed by more than the median number and estimating the association between cost of equity capital and disclosure level for the two resulting subsamples. Splitting the sample into only two subsamples still ensures a reasonable number of observations in each subset. The low analyst following subsample includes 62 firms with nine or fewer analysts. Sixty firms with ten or more analysts are included in the high analyst following subsample. Panels B and C of table 2 present descriptive statistics for the two subsamples.

On average a firm in the low analyst following subsample attracts the attention of five analysts.¹¹ The corresponding figure for firms in the high analyst following subsample is 18. On average the firms in the low analyst following subsample are smaller with mean market value of equity of \$129.5 million compared to \$1.3 billion for the firms in the other subsample. This difference is statistically significant at the 1 percent level using a t-test or Wilcoxon rank-sum test. Finally, the mean market beta for the high analyst following subsample is significantly greater than the corresponding average market beta for the low analyst following subsample.

IV. EMPIRICAL PROXIES

The Disclosure Index

In this section I describe my disclosure index and provide evidence supporting its reliability and validity. As noted earlier, I base my index on the information firms provide in their annual reports to shareholders. Although the annual report is only one means of corporate reporting, it should serve as a good proxy for the level of voluntary disclosure provided by a firm across all disclosure avenues. This is because annual report disclosure levels are positively correlated with the amount of disclosure provided via other media (Lang and Lundholm 1993). The annual report

¹¹ Although a firm must be followed by Value Line to be included in the sample, three firms reportedly have no analyst following. This discrepancy arises because analyst following is determined by the number of analysts reported in either Nelson's Directory of Investment Research or IBES. Since neither source is comprehensive some understatement of analyst following is to be expected.

TABLE 2
Descriptive Statistics

Panel A: Full Sample of Firms

Variable ^a	n	Mean	Percentile					Standard Deviation
			1%	25%	50%	75%	99%	
ANALYST	122	11.5	1.0	5.0	9.0	15.0	41.0	9.3
BETA	122	1.14	0.66	0.94	1.11	1.30	2.05	0.28
MVAL	121	713.4	18.5	89.3	209.0	593.9	5865.4	1244.3
ASSET	122	1408.6	68.9	206.4	413.8	1104.7	15918.3	2898.2
PPE	122	489.4	11.2	57.6	124.5	383.9	6596.0	1085.4
SALES	122	1493.9	69.0	241.4	559.6	1438.2	14511.0	2847.5
NUMEMP	122	10362.4	351.0	2056.0	3945.0	10700.0	63700.0	20279.7
DSCORE	122	30.0	12.0	25.0	29.6	35.0	46.0	7.7

Panel B: Low Analyst Following Subsample of Firms

Variable ^a	n	Mean	Percentile					Standard Deviation
			1%	25%	50%	75%	99%	
ANALYST	62	4.8	0.0	3.0	5.0	7.0	9.0	2.6
BETA	62	1.09	0.56	0.89	1.07	1.27	1.75	0.26
MVAL	61	129.5	9.0	45.1	90.7	170.6	624.9	120.1
ASSET	62	350.4	57.3	148.1	217.9	361.6	2516.7	423.9
PPE	62	115.2	11.2	43.7	65.5	110.5	1025.6	161.7
SALES	62	422.9	69.0	197.8	280.8	461.7	1858.0	383.5
NUMEMP	62	3448.1	351.0	1684.0	2277.5	3930.0	18860.0	3599.7
DSCORE	62	26.5	11.4	22.0	27.0	30.4	42.0	6.5

Panel C: High Analyst Following Subsample of Firms

Variable ^a	n	Mean	Percentile					Standard Deviation
			1%	25%	50%	75%	99%	
ANALYST	60	18.4**	10.0	12.0	15.0	22.5	42.0	8.6
BETA	60	1.20*	0.67	1.01	1.19	1.38	2.09	0.28
MVAL	60	1307.2**	40.1	320.6	592.3	1555.6	6095.6	1556.6
ASSET	60	2501.9**	68.9	438.1	1025.9	2690.2	19034.0	3827.4
PPE	60	876.1**	5.9	150.9	311.1	796.6	6747.0	1445.6
SALES	60	2600.7**	67.1	617.4	1397.4	3140.5	21442.0	3745.1
NUMEMP	60	17507.2**	230.0	4130.0	9800.0	20330.5	192600.0	26979.6
DSCORE	60	33.6**	17.0	29.4	33.9	37.8	50.5	7.2

* Difference between the low and high analyst following samples is significant at the 5 percent level using either a t-test or Wilcoxon rank sum test (two-tail test).

** Difference between the low and high analyst following samples is significant at the 1 percent level using either a t-test or Wilcoxon rank sum test (two-tail test).

^a ANALYST is the maximum number of analysts following the firm reported in either the 1991 edition of *Nelson's Directory of Investment Research* or any of the 12 monthly IBES reports issued during 1990, BETA is estimated via a market model regression using at least 24 of the 60 monthly return observations in the five-year period ended May 31, 1991, and MVAL is the market value of equity at the end of 1990 in millions of dollars. ASSET is the book value of total assets, PPE is the net book value of property, plant and equipment and SALES is total sales, for the fiscal year ended 1990, all in millions of dollars. NUMEMP is the number of employees reported in the fiscal year end 1990 annual report or 10-K. DSCORE is the firm's disclosure score. See table 3 for a summary of the major items included in DSCORE and section IV for a discussion of this measure.

is the focus of my disclosure index because the annual report is generally considered to be one of the most important sources of corporate information. For example, Knutson (1992, 7) states, "At the top of every analyst's list (of financial reports used by analysts) is the annual report to shareholders. It is the major reporting document and every other financial report is in some respect subsidiary or supplementary to it."

The purpose of my disclosure measure (which I refer to as DSCORE) is to produce a cross-sectional ranking of disclosure levels based on the amount of voluntary disclosure provided by firms in their annual reports. The selection of items included in the index was guided by recommendations provided in the American Institute of Certified Public Accountants (1994) study of business reporting (i.e., the Jenkins Committee report), the SRI International (1987) survey of investor information needs, and the Canadian Institute of Chartered Accountants (1991) study of the annual report.¹² The items included in DSCORE reflect five categories of voluntary information identified by investors and financial analysts as useful in investment decision making: background information, summary of historical results, key non-financial statistics, projected information and management discussion and analysis. Table 3 summarizes just the major elements of DSCORE; the entire instrument is available from the author upon request.

Background Information

Background information such as management's objectives and business strategy, the competitive environment, the principal products produced and the principal markets served is useful to investors because it provides a context within which to interpret other detailed information about the firm. Firms were awarded one point for each background item disclosed. One additional point per item was given if the information provided included quantitative data not recoverable from the basic financial statements, such as the total size of the market in units or a corporate goal stated in terms of a numerical target (e.g., minimum return-on-equity of 16 percent).

Summary of Historical Results

Ready access to historical summaries of quarterly and annual financial results provide information useful in trend analysis. Historical summaries present information on a consistent basis, reflecting restatements due to acquisitions, discontinued operations, stock splits and stock dividends. According to the SRI International Survey (1987), 46.2% of the individual investors and 69.6% of the professional investors surveyed rate the historical summary of operating results as important or extremely important.

Typically, firms present five or ten years of annual data. However, ten years of data is preferable due to the long cyclical trends characteristic of the machinery industry.¹³ Accordingly my scoring procedure awarded twice as many points for a summary of ten or more years (or the maximum number of years possible for firms in existence less than ten years), than for a summary of shorter duration. The points awarded were based on the availability of information to compute basic profitability ratios such as return-on-assets, net profit margin, asset turnover and return-on-equity.

¹²Additional sources that guided the selection of items included in the index were Merton (1987), King et al. (1990), Healy and Palepu (1993), the Corporate Information Committee Reports of the AIMR, the AIMR Machinery Industry Subcommittee's rating sheet, conversations with the members of this committee and prior research employing disclosure indices including Cerf (1961), Singhvi and Desai (1971), Buzby (1975) and Chow and Wong-Boren (1987).

¹³The Machinery Industry Subcommittee of the AIMR's scoring sheet indicates that firms are awarded ten points if ten years of data are presented. If fewer than ten years are disclosed, they are given a score of zero for this item. Since 25 percent of the total points available are allocated to this one item, firms are severely penalized by the Subcommittee for not providing a full ten years of data.

TABLE 3
Summary of the Major Elements of DSCORE

I. Background Information:

- i. Statement of corporate goals or objectives
- ii. Barriers to entry are discussed
- iii. Competitive environment
- iv. General description of the business
- v. Principle products
- vi. Principle markets

II. Ten- or Five-Year Summary of Historical Results:

- i. Return-on-assets or sufficient information to compute return-on-assets (i.e., net income, tax rate, interest expense and total assets)
- ii. Net profit margin or sufficient information to compute net profit margin (i.e., net income, tax rate, interest expense and sales)
- iii. Asset turnover or sufficient information to compute asset turnover (i.e., sales and total assets)
- iv. Return-on-equity or sufficient information to compute return-on-equity (i.e., net income and stockholders' equity)
- v. Summary of sales and net income for most recent eight quarters

III. Key Non-Financial Statistics:

- i. Number of employees
- ii. Average compensation per employee
- iii. Order backlog
- iv. Percentage of sales in products designed in the last five years
- v. Market share
- vi. Units sold
- vii. Unit selling price
- viii. Growth in units sold

IV. Projected Information:

- i. Forecasted market share
- ii. Cash flow forecast
- iii. Capital expenditures and/or R&D expenditure forecast
- iv. Profit forecast
- v. Sales forecast

V. Management Discussion and Analysis:

- i. Change in sales
- ii. Change in operating income
- iii. Change in cost of goods sold
- iv. Change in gross profit
- v. Change in selling and administrative expenses
- vi. Change in interest expense or interest income
- vii. Change in net income
- viii. Change in inventory
- ix. Change in accounts receivable
- x. Change in capital expenditures or R&D
- xi. Change in market share

The above is a partial list of the items included in DSCORE. The entire instrument is available from the author on request.

Key Non-Financial Statistics

The Jenkins Committee Report (AICPA 1994) suggests that non-financial statistics about a company's business activities that are not recoverable from the financial statements and related disclosures provide users with important information. Moreover, the SRI International Survey (1987) indicates that 73.7% of professional investors surveyed believe that the annual report should include company performance statistics and ratios. The non-financial statistics category of the index includes items such as market share, units sold, order backlog and average compensation/employee. Firms were awarded two points for each non-financial statistic disclosed.

Projected Information

The Jenkins Committee Report (AICPA 1994) also indicates that information about opportunities and risks and management's future plans is important to professional investors and analysts. However, these individuals do not consider forecasted operating and financial data to be necessary or even desirable, preferring instead to develop their own forecasts. This sentiment is echoed by Lees' (1981) finding that 65 percent of analysts surveyed oppose mandatory disclosure of management earnings forecasts. In both studies, participants question the objectivity of management forecasts and believe that users' needs for forecast information are adequately served by the analyst community. Of course this sentiment may merely reflect a bias against management forecasts motivated by analysts' self-interest. Accordingly, I decided to incorporate forecasts of sales, profits and capital expenditures, and disclosure of future opportunities, risks and plans into my index. The scoring procedure assigned two points for each directional prediction and three points for a point estimate.

Management Discussion and Analysis

The management discussion and analysis (MD&A) section of the annual report is intended to convey information about year-to-year changes that is not recoverable from the basic financial statements. This information is valued by financial analysts. For example, Knutson's (1992, 7) position paper for the AIMR states, "Other than the financial statements themselves, perhaps the most useful single part of the annual report is the management discussion and analysis...." Similarly, the Jenkins Committee report includes the MD&A in its list of important information. However, the participants in the Jenkins study caution that the MD&A provided by managers is often superficial and one-sided. As a result, the scoring procedure assigned one point for each item discussed, provided a detailed explanation that was not recoverable from the basic financial statements or footnotes was given for the change. One additional point per item was awarded if the explanation included quantitative data also not recoverable from the basic financial statements or footnotes.

Weighting of Items Included in the Index

A major concern is that large firms could achieve higher scores because they have more disclosure opportunities due to the complexity of their organizational structures. For example, if a company operates in several different industries, it may selectively disclose forecasts or other types of voluntary information for some industry segments while withholding this information for others. However, if a firm operates in only one industry segment, it does not have the same opportunity to strategically disclose or withhold forecast or other information for particular segments. Several steps were taken in the design of my disclosure index and scoring procedures to circumvent this problem. First, projected sales and earnings information provided by multi-segment firms was weighted by the proportionate contribution of the segment being forecasted

to consolidated earnings or sales for fiscal year end 1990. Hence, multi-segment firms earned all of the points allocated to projected information only if they provided a forecast for all segments or an overall forecast for the consolidated entity. Second, I limited the disclosure index to items that all sample firms could choose to disclose and I did not award multiple points for multiple references to the same disclosure item.¹⁴ Quantitative information was weighted more heavily in the disclosure index than qualitative information because precise information is more useful and may enhance management's reporting reputation and credibility.

The total points earned by a given firm is computed by the following formula:

$$DSCORE_j = \sum_{i=1}^5 SCORE_{ij}. \quad (1)$$

Summing the total number of points awarded to firm j for category i across all categories $i=1,5$ produces an ordinal measure of disclosure level (DSCORE) for each firm. All of my primary statistical analyses are based on the ranks of the disclosure measure, and non-parametric tests are conducted when feasible.

A disclosure score that places equal weight on each of the five disclosure categories was also examined. This disclosure score was computed by:

$$ESCORE_j = \sum_{i=1}^5 \frac{SCORE_{ij}}{\max(SCORE_i)} \times 20\%. \quad (2)$$

Where $\max(SCORE_i)$ is the maximum score awarded to any sample firm for a given category. The results reported in the tables employ DSCORE since none of the conclusions change when ESCORE is used.

Descriptive Statistics Pertaining to DSCORE

Table 2 presents descriptive statistics pertaining to DSCORE for the full sample and the two subsamples. Cascade Corporation's disclosure score of 12.0 marks the first percentile of the distribution. In its 1990 annual report, Cascade Corporation provides no discussion of its principle products or markets and presents a very limited, five year summary of historical results. The only key non-financial statistic disclosed is the number of individuals employed by the company, and no forecast information is included in the report. Its management discussion and analysis discusses the change in sales, net income, capital expenditures and market share in qualitative terms only. At the opposite end of the distribution, Cummins Engine Co., received one of the highest scores, 46.0, for its 1990 annual report disclosures. Cummins' report provides a detailed discussion of its principle products and markets with specific quantitative information, a comprehensive ten year summary of historical results and several key non-financial statistics such as number of employees, average compensation per employee, market share statistics and units sold. In addition, Cummins' management discussion and analysis deals with more items than Cascade's and incorporates quantitative information not recoverable from the financial statements and footnotes. Finally, Cummins' report includes profit and sales projections, a discussion of the future impact of existing industry trends, and a capital expenditure budget for the coming

¹⁴The disclosure index does not include a category for segment data because it is very difficult to assess whether non-disclosing firms are simply withholding this information or are truly single segment entities. Approximately one-half of the sample firms identify themselves as single-segment companies.

year. Hence, the range of scores reported in table 2 reflects a substantial amount of variation in the underlying documents.

The range of disclosure scores awarded to the firms in each of the two subsamples is quite similar. Specifically, disclosure scores range from 11.4 to 42.0 (first and ninety-ninth percentiles) for the sample of firms with low analyst following, as compared to a range of 17.0 to 50.5 for firms with high analyst following. The null hypothesis that the sample variances are equal cannot be rejected at conventional levels of significance.

Consistent with Lang and Lundholm's (1996) finding that larger numbers of analysts are attracted to more forthcoming firms, the average disclosure score for firms with a high analyst following is 33.6, compared to 26.5 for firms with a low analyst following. This difference is statistically significant at the 1 percent level (two-tail test). Notwithstanding a positive correlation between analyst following and DSCORE, however, partitioning the sample by analyst following does not also partition the sample by disclosure level. For example, a firm with 30 points on the disclosure index would fall in the upper quartile of the distribution of the low analyst following subsample and in the second quartile of the distribution of the subsample of high analyst following.

Assessment of Validity of DSCORE

Prior studies that use disclosure indices to investigate the determinants of corporate disclosure levels have documented consistently strong and corroborative results.¹⁵ This prior work demonstrates that disclosure indices are a useful research tool. However, financial disclosure level is not easily measured because the development and application of a disclosure index requires subjective assessments by the researcher applying the technique. As a result, it is important to assess the validity of the resulting measure.

An examination of the internal consistency of DSCORE provides some insight into the reliability of my measure and its possible limitations. Since disclosure strategies are coordinated across various avenues, I expect the components of the disclosure index to be positively correlated with one another, the number of *Wall Street Journal* articles written about the firm during 1990 and the number of financial analysts following the firm during that year—two other potential proxies for availability of corporate information. Each of these correlation coefficients is positive and statistically significant at the 2 percent level or better.

Cronbach's coefficient alpha (Cronbach 1951), is a measure of internal consistency that uses repeated measurements (in this case the various categories of the disclosure index) to assess the degree to which correlation among the measurements is attenuated due to random error. Coefficient alpha takes on a maximum value of one when the correlation between each pair of variables is one. Computed with standardized data, Cronbach's coefficient alpha, for the five categories of the disclosure index is 0.64. There is no standard test of significance for this statistic. As a general rule, an alpha of 0.8 indicates that the correlation is attenuated very little by random measurement error (Carmines and Zellner 1979). Thus, a coefficient alpha of 0.64 suggests that random measurement error could reduce the power of the empirical tests that follow.¹⁶

¹⁵For example, Cerf (1961), Singhvi and Desai (1971), Buzby (1975), Chow and Wong-Boren (1987) and Lang and Lundholm (1993) examine the association between disclosure level and firm specific characteristics and document similar results. Also, see Ball and Foster (1982), Marston and Shrivs (1991) and Ahmed (1995) for reviews of accounting research employing disclosure indices.

¹⁶A factor analysis including DSCORE, the number of *WSJ* articles and the number of analysts indicates that all variables load on the same factor. However, consistent with the relatively low coefficient alpha, the amount of variation explained is only about 48 percent. These results support the conclusion that DSCORE is a reliable measure of disclosure level although random measurement error in the disclosure index may reduce the power of subsequent empirical tests.

Ahmed (1995) provides a meta-analysis of the results of 23 separate studies of the association between annual report disclosure level and firm characteristics. He finds that the following four variables have a statistically significant positive association with disclosure level: firm size, exchange listing status, audit firm size and leverage. If my disclosure index measures disclosure level, it should be correlated with these characteristics.

Panel A of table 4 presents Spearman correlation coefficients between DSCORE and firm size, leverage and exchange listing status. Audit firm size is not examined because all but two of the sample firms are audited by a Big 6 firm. The results are very similar to those reported by Ahmed in terms of direction and magnitude. Each firm characteristic variable is positively correlated with DSCORE and the magnitude of the coefficients fall within the 95 percent confidence intervals presented by Ahmed (1995) for leverage and exchange listing status and just outside of this interval for firm size.

Although the studies considered by Ahmed (1995) tend not to use multivariate analyses, panel B presents the results of a rank regression of DSCORE on firm size, leverage and exchange listing status. Firm size and leverage continue to be positively associated with disclosure level while listing status is no longer statistically significant. Approximately twenty-five percent of the variation in DSCORE rank is explained by the variables included in the model.

I also computed the rank-order correlation between DSCORE and the annual report disclosure scores assigned by the AIMR (ASCORE) during 1990/1991 for the 24 firms appearing in both samples.¹⁷ Initially, I find that DSCORE and ASCORE are not significantly correlated. However, this result is sensitive to the inclusion of two extreme observations. When these observations are excluded the positive correlation between DSCORE and ASCORE is statistically significant. The correlation coefficient is 0.37 with a p-value of 0.04 (one-tail). Even with these two observations, the rank-order correlation between ASCORE and (1) the summary of historical results category score (HIST) and (2) the projected information category score (FORE) is significantly positive at less than a 5 percent level of significance (one-tail). The correlation coefficients between ASCORE and HIST and ASCORE and FORE are 0.43 and 0.37, respectively.

The correlation between ASCORE and these specific categories may reflect the relatively heavy weight the Machinery Industry Subcommittee of the AIMR (Subcommittee) places on these types of disclosures in its scoring procedures. The percentage of total points allocated by the Subcommittee to the ten-year historical summary and to future outlook statements are 25 percent and ten percent of the total, respectively.

In summary, the validity of DSCORE is supported by four different sets of analyses: (1) the correlation among the components of DSCORE, number of analysts and number of *WSJ* articles, (2) Cronbach's coefficient alpha, (3) the correlation between DSCORE and firm characteristics identified in prior research to be associated with disclosure level, and (4) the correlation between DSCORE and annual report disclosure scores assigned by the AIMR to the 24 firms in both samples. The results suggest that extending the main hypothesis to include individual category scores, the number of *Wall Street Journal* articles and/or the number of analysts might provide insights in addition to those revealed by an examination of DSCORE alone.

Cost of Equity Capital

Several alternative approaches to estimating the cost of equity capital were considered. One approach estimates this cost using average realized returns. However, average realized returns

¹⁷These results should be interpreted cautiously for several reasons. First, statistical power is limited by the small number of firms common to both groups. Second, there is no basis for judging what the magnitude of the correlation between DSCORE and ASCORE should be before DSCORE is deemed a valid measure of disclosure level relative to ASCORE. Finally, the analysis assumes ASCORE is an appropriate benchmark which may not be the case.

TABLE 4
Correlation Analysis of Disclosure Scores and Firm Characteristics

Panel A: Univariate Analysis

	<i>MVAL^b</i>	<i>DERATIO</i>	<i>STATUS</i>
correlation	0.4443	0.2647	0.2172
p-value	0.0001	0.0034	0.0163
# of observations	121	121	122

Panel B: Multivariate Analysis^a

	<i>Intercept</i>	<i>MVAL</i>	<i>DERATIO</i>	<i>STATUS</i>
coefficient ^c	0.1368	0.4261	0.2625	0.0329
t-statistic	2.059	5.167	3.267	0.560
p-value	0.0418	0.0001*	0.0007*	0.2884*
adj. R ²	24.7%			
Prob. > F	0.0001			

* One-tail test.

^a The fractional rank (rank divided by the number of observations) of each variable (including DSCORE) is included in the analysis. White's (1980) test does not indicate the presence of heteroscedasticity. The results have been checked for the presence of influential data points using Cook's D statistic. No influential data points were detected.

^b MVAL is the market value of equity at the end of 1990 in millions of dollars, DERATIO is the debt-to-equity ratio at the end of 1990 and STATUS is a dummy variable set equal to one if the firm is listed on the NYSE or AMEX exchange and zero if the firm is listed on NASDAQ.

^c Estimated with 120 observations.

provide an extremely noisy measure of cost of equity capital. Indeed, prior research employing average realized returns has had difficulty establishing a significant association between returns and market beta, the most widely accepted measure of risk (Fama and French 1992). Recently Lakonishok (1993) concluded that at least 70 years of data would be required to show that even market beta is a statistically significant risk factor if average realized returns are used to proxy for the cost of equity capital. Hence, it is unlikely that this approach would provide a powerful test of the disclosure hypothesis, especially given the limited sample employed in this study.

Practice and prior research suggest other alternatives that may incorporate less noise than realized returns. One is to estimate cost of equity capital with the Capital Asset Pricing Model (CAPM) which defines expected return as the sum of the expected risk free rate ($E(R_f)$) and the product of a firm's estimated market beta ($\hat{\beta}$) and the expected risk premium ($E(R_m - R_f)$). The premise of my study, however, is that cross-sectional variation in disclosure level explains variation in cost of equity capital. In contrast, the CAPM assumes that cross-sectional variation in market beta alone drives variation in the cost of capital. As a result, the CAPM approach provides no role for disclosure level, unless one assumes cross-sectional variation in disclosure level induces variation in beta, a notion that has no theoretical support.

The earnings-to-price ratio adjusted for growth and dividend payout is a measure that has been used in the past by academics and practitioners to estimate cost of equity capital that does not impose such restrictions.¹⁸ This approach defines cost of equity capital as follows:

¹⁸For an excellent discussion of various approaches used in practice to estimate cost of equity capital see Ehrhardt (1994) and Gitman and Mercurio (1982).

$$r_j = K_j \left(1 + g_j\right) \left(\frac{E_t}{P_t}\right)_j + g_j; \text{ for firm } j. \quad (3)$$

In this model cost of equity capital, “ r_j ”, is a function of a constant rate of dividend payout, “ K_j ”, a constant rate of growth, “ g_j ”, and the earnings-to-price ratio $\left(\frac{E_t}{P_t}\right)_j$. If one assumes zero growth and a 100 percent dividend payout rate, cost of equity capital is equal to $\frac{E_t}{P_t}$. Since these restrictions are not valid for many firms, a more sophisticated approach involves estimations of g and K for each firm.

Penman (1993) argues that the E/P ratio may be used to estimate the cost of equity capital only in the rare situation where expected future earnings is current earnings adjusted for growth at a rate equal to the cost of capital. He points out that prior research fails to find a connection between the E/P ratio and measures of risk because E/P ratios reflect cross-sectional variation in the ability of firms’ current earnings to predict their future earnings more than they reflect cross-sectional variation in cost of equity capital. Consistent with this, I find no statistically significant association between the cost of equity capital estimates generated by equation (3) and market beta for my sample of firms.¹⁹

None of the above approaches provide viable estimates of cost of equity capital in the context of this study so I adopt an alternative approach using the accounting based valuation formula developed by Edwards and Bell (1961), Ohlson (1995) and Feltham and Ohlson (1995) (i.e., the EBO valuation formula). The derivation of the EBO valuation formula is briefly outlined below, beginning with the well known dividend discount formula:

$$P_t = \sum_{\tau=1}^{\infty} (1+r)^{-\tau} E_t[d_{t+\tau}]. \quad (4)$$

This model states that the market price of a firm’s stock (P_t) is equal to the sum of expected dividends $\{E_t(d_{t+\tau})\}$ discounted at the cost of equity capital (r).²⁰ Ohlson (1995) shows that as long as all gains and losses that affect forecasted book value flow through forecasted earnings (i.e., clean surplus accounting holds) equation (4) can be rewritten as a function of current book value plus the discounted sum of expected abnormal earnings. This leads to equation (5):

$$P_t = b_t + \sum_{\tau=1}^{\infty} (1+r)^{-\tau} E_t[x_{t+\tau} - rb_{t+\tau-1}]. \quad (5)$$

¹⁹I estimated cost of equity capital for my sample firms using four different specifications of the formula given by equation (3). The first two specifications adjusted for growth but assumed a constant dividend payout: (1) earnings-price ratio adjusted for growth in earnings and (2) earnings-price ratio adjusted for growth in dividends. The next two specifications adjust for growth and dividend payout: (3) earnings-price ratio adjusted for growth in earnings and dividend payout and (4) earnings-price ratio adjusted for growth in dividends and dividend payout. I also estimated cost of equity capital using two other approaches found in practice: average return-on-equity and the Gordon Growth model (also known as the Constant or Perpetual Growth Valuation Model). Consistent with prior research, I found no correlation between the cost of equity capital estimates produced by any of these methods and market beta. As a result, these estimates are not considered further in the analysis.

²⁰It should be noted that both the EBO valuation formula and the dividend discount formula were developed assuming that the expression arguments to be discounted are risk-adjusted and discounting takes place at the risk-free rate. However, in application the dividend discount formula is typically stated in terms of unadjusted dividends discounted at the cost of equity capital. A similar substitution in the EBO valuation formula does not require any assumptions in addition to those already implicit in the risky discount rate form of the dividend discount formula (Bernard 1995, 743).

Equation (5) specifies price per share entirely in terms of accounting numbers—current and future book values (b_t and $b_{t+\tau}$) and future earnings ($x_{t+\tau}$). It can be written in terms of a shorter horizon by recognizing that equation (5) is equivalent to:

$$P_t = b_t + \sum_{\tau=1}^T (1+r)^{-\tau} E_t[x_{t+\tau} - rb_{t+\tau-1}] + \sum_{\tau=T+1}^{\infty} (1+r)^{-\tau} E_t[x_{t+\tau} - rb_{t+\tau-1}]. \quad (6)$$

The infinite horizon term in equation (6) can then be rewritten as:

$$\sum_{\tau=T+1}^{\infty} (1+r)^{-\tau} E_t[x_{t+\tau} - rb_{t+\tau-1}] = (1+r)^{-T} \sum_{\tau=T+1}^{\infty} (1+r)^{-\tau+T} E_t[x_{t+\tau} - rb_{t+\tau-1}]. \quad (7)$$

The summation term on the right-hand side of equation (7) is equal to the excess of forecasted price over forecasted book value at time T (i.e., $E_t(P_T - b_T)$, see equation (5)). Substituting this into equation (7) and the result into equation (6) yields the short horizon form of the valuation equation:

$$P_t = b_t + \sum_{\tau=1}^T (1+r)^{-\tau} E_t[x_{t+\tau} - rb_{t+\tau-1}] + (1+r)^{-T} E_t(P_T - b_T). \quad (8)^{21}$$

I set T in equation (8) equal to four and solve the resulting fourth-degree polynomial equation for cost of equity capital, $r_{E/BV}$. Using *Mathematica* software, I identified four unique closed form solutions for $r_{E/BV}$. (In general, an nth-degree polynomial equation has exactly n solutions (Chiang 1984).) The formulas are not reproduced here due to their extraordinary length, however, each defines $r_{E/BV}$ as a function of the same set of variables.

$$r_{E/BV,i} = g_i \left(\begin{matrix} p_t, E_t(p_{t+4}), b_t, E_t(b_{t+1}), E_t(b_{t+2}), E_t(b_{t+3}), \\ E_t(b_{t+4}), E_t(x_{t+1}), E_t(x_{t+2}), E_t(x_{t+3}), E_t(x_{t+4}) \end{matrix} \right) \quad (9)$$

where: $r_{E/BV,i}$ = cost of equity capital estimate i (i=1,4)

$g_i(\circ)$ = the function operator i (i=1,4)

p_t = price at date t

$E_t(\circ)$ = the expectations operator

b_t = book value at time t

x_t = earnings for year t.

Forecasts of earnings and book value for fiscal years 1991 and 1992 and long-range forecasts of earnings, book value, P/E ratio, maximum price and minimum price for 1994 were collected from forecasts published by Value Line during the second quarter of 1991.²² Since Value Line does not provide a forecast for 1993, I interpolate between 1992 and 1994 to obtain estimated forecasts of earnings and book value for 1993. Current stock price is the stock price reported by

²¹The derivation sketched out via equations (6) to (8) is drawn from Abarbanell and Bernard (1994).

²²Value Line forecasts earnings, book value and stock price. Other sources such as IBES, Nelson Publications and Zacks do not provide forecasts of all of these variables. As a result, restrictive assumptions regarding future growth in earnings beyond year T and growth in book value would be necessary if non-Value Line sources are used. The potential measurement error induced by these restrictions would further reduce the statistical power of the tests.

CRSP on June 30, 1991 and current book value is the book value reported by the company at the end of fiscal year 1990. I use the price implicit in the long-run P/E ratio forecast as the forecast of price in year four.²³

Using the data described above I solved the four closed form solutions for each firm. In each case, two of the four solutions were undefined and one was unrealistic (a negative number typically in the neighborhood of -2). The remaining estimate (denoted r_{EBV}) became my estimate of the firm's cost of equity capital.

Table 5 provides descriptive statistics pertaining to the cost of equity capital for the entire sample and for the two subsamples. For the full sample, the mean r_{EBV} is 20.1% while the corresponding figures for the low and high analyst following subsamples are 22 percent and 18 percent, respectively. Although 20.1% may appear inflated, it is reasonable. Ehrhardt (1994) indicates that estimates of the risk free rate range between 6.0% and 9.25% with associated market risk premiums ranging between 8.2% and 7.8%. Using Ehrhardt's median values and the sample average beta of 1.146 the CAPM estimate of cost of equity capital is 17.4%. This crude approximation suggests that, on average, information risk might add about 2.7% to the cost of equity capital.

The inter-quartile range of 11.4% indicates that the distribution of the cost of equity capital estimates is relatively tight. However, six of the 122 estimates fall more than two standard deviations from the mean (i.e., six estimates are either less than three percent or greater than 40 percent).²⁴ The primary analyses have been estimated with and without these observations. The

²³ An alternative would be to use the average of the minimum and maximum long-run price forecast. Both approaches yield virtually identical estimates of future price. The difference between the price implicit in the long-run P/E ratio forecast and the mid-point of the long-run price forecast is less than 15 percent of the price implicit in the long-run P/E ratio forecast in all cases. It is ten percent or less for all but two firms and five percent or less for 113 of the 122 sample firms.

²⁴ All six firms are members of the low analyst following subsample. The four cost of equity capital estimates that are "too high" appear to be caused by overly optimistic forecasts of future stock price on the part of Value Line that have not been impounded into current stock price. For example, one company is currently trading at about \$1.125 with a market-to-book ratio of 0.72. Value Line is forecasting a stock price four years into the future of \$9.00 with a market-to-book ratio of 2.9. It takes a very high cost of equity capital to equate these high forecasted values back to the low current price. In one of the two cases with a low cost of equity capital estimate, Value Lines notes that its forecasts of earnings may be understated because the company is actively involved in an acquisition program. If Value Line's forecasts are understated relative to the market's assessment of future earnings, the discount rate that falls out of the formula is understated. The remaining low cost of capital estimate is associated with a company whose current stock price peaked during the months of May to August 1991. The unusually high stock price used in the computation lowered the estimated cost of equity capital figure.

TABLE 5
Descriptive Statistics for Cost of Equity Capital Estimates

	<i>n</i>	<i>Mean</i>	<i>Percentile</i>					<i>Standard Deviation</i>
			<i>1%</i>	<i>25%</i>	<i>50%</i>	<i>75%</i>	<i>99%</i>	
Full Sample	122	20.1%	2.3%	13.3%	19.0%	24.7%	51.0%	10.0%
Low Analyst Following	62	22.1	-2.7	15.0	20.4	27.1	65.2	11.7
High Analyst Following	60	18.2*	4.6	11.6	17.8^	24.0	35.6	7.3

^ Difference between low and high analyst following samples is significant at the ten percent level (Wilcoxon Rank Sum Test, two-tail test)

* Difference between the low and high analyst following samples is significant at the five percent level (T-test, two-tail test). Cost of equity capital is estimated using the earnings/book value approach with Value Line forecasts for expected earnings, book value and future stock price.

results documented in the tables exclude them because model fit is improved and, for the most part, the conclusions drawn are not affected. Where this is not the case, I discuss in the footnotes the impact of including these observations.

Assessing the Validity of $r_{E/BV}$

A valid measure of cost of equity capital should be increasing in risk as measured by market beta. Moreover, we might also expect it to display the well known “size effect.” The results of a regression of $r_{E/BV}$ on market value and market beta are presented in table 6. BETA is estimated by the market model using a minimum of 24 monthly return observations over the five-year period ended May 31, 1991, and an equally weighted NYSE/AMEX market index return. MVAL is the market value of outstanding common equity at December 31, 1990.

As expected $r_{E/BV}$ is increasing in market beta and decreasing in firm size. In addition, the magnitude of the coefficient on beta suggests a market risk premium of approximately seven

TABLE 6
Regression of $r_{E/BV}$ on Market Value and Beta

$$r_{E/BV,i} = \gamma_0 + \gamma_1 \text{beta}_i + \gamma_2 \ln(\text{mval}_i) + \varepsilon_i$$

Panel A: Simple Regression Including Beta^b

	<i>Intercept</i>	<i>Beta^a</i>
coefficient	0.1094	0.0738
p-value	0.0003	0.0020*
adj. R ²	6.3%	
Prob. > F	0.0039	

Panel B: Simple Regression Including MVAL^c

	<i>Intercept</i>	<i>MVAL</i>
coefficient	0.2879	−0.017
p-value	0.0001	0.0003*
adj. R ²	8.8%	
Prob. > F	0.0007	

Panel C: Multiple Regression Including Beta and MVAL^c

	<i>Intercept</i>	<i>Beta</i>	<i>MVAL</i>
coefficient	0.2050	0.0661	−0.0155
p-value	0.0001	0.0037*	0.0007*
adj. R ²	13.7%		
Prob. > F	0.0001		

* One-tail test

The log of market value is included in the analysis. White's (1980) test does not indicate the presence of heteroscedasticity. All regression results have been checked for the presence of influential data points using Cook's D statistic. No influential data points were detected.

^a $r_{E/BV}$ is the estimated cost of equity capital produced using the earnings/book value approach. Beta is estimated via the market model based on a minimum of 24 monthly return observations over the five-year period ended May 31, 1991 with the market index defined in terms of the equally weighted NYSE/AMEX return. MVAL is the market value of equity at 12/31/90.

^b Estimated with 116 observations.

^c Estimated with 115 observations.

percent, very close to the historical average market risk premium of approximately eight percent referred to earlier. These results support the validity of $r_{E/BV}$ as a measure of the cost of equity capital.

It is apparent from the R^2 s reported in table 6 (six percent to 14 percent depending on the specification) that substantial variation in cost of equity capital is left unexplained by market beta and firm size. This could reflect noise in the cost of equity capital estimates, noise in the risk measures, and/or missing risk factors (such as estimation risk). The next section examines the effect of expanding this model to include disclosure level.

V. EMPIRICAL RESULTS

Empirical Analysis of Hypothesis One

Table 7 provides Pearson correlation coefficients between cost of equity capital, market beta, market value, disclosure level and analyst following.²⁵ DRANK is computed by dividing the rank of a firm's DSCORE by the number of firms included in the sample and is increasing in disclosure level. All other variables are computed as discussed earlier.

The correlation between $r_{E/BV}$ and DRANK is -0.143 , significant at the 6.3% level using a one-tail test. Before controlling for any other variables, this result is consistent with the claim that cost of equity capital is decreasing in disclosure level. As documented earlier, cost of equity capital correlates positively with BETA and negatively with market value, and DRANK is positively correlated with firm size and analyst following. All of the correlation coefficients are less than 0.80 except for the correlation between analyst following and firm size. This suggests that multi-collinearity should not be a problem unless both of these variables are included in the same model.

²⁵One hundred and fifteen observations are used in all analyses involving market value because market value of common equity as of December 30, 1990 is missing for one sample firm. (i.e. One hundred and twenty-two observations less six extreme observations and less one with missing firm size data.)

TABLE 7
Pearson Correlation Coefficients

Variable ^a	$r_{E/BV}$	DRANK	BETA	MVAL	ANALYST
$r_{E/BV}$	1.000 0.0				
DRANK	-0.143 0.1254	1.000 0.0			
BETA	0.266 0.0039	0.149 0.1098	1.000 0.0		
MVAL	-0.310 0.0007	0.404 0.0001	-0.096 0.3070	1.000 0.0	
ANALYST	-0.059 0.5258	0.457 0.0001	0.118 0.2042	0.819 0.0001	1.000 0.0

The p-values quoted above are for a two-tail test of statistical significance.

The log of market value is included in the analysis.

^a $r_{E/BV}$ is the estimated cost of equity capital produced using the earnings/book value approach, DRANK is the fractional rank of the firm's disclosure score, BETA is estimated via a market model regression using at least 24 of the 60 monthly return observations in the five-year period ended May 31, 1991, with the market index defined in terms of the equally weighted NYSE/AMEX return, MVAL is the market value of equity at the end of 1990 in millions of dollars and ANALYST is the maximum number of analysts following the firm reported in either the 1991 edition of *Nelson's Directory of Investment Research* or any of the 12 monthly IBES reports issued during 1990.

Hypothesis one is tested by regressing cost of equity capital on market beta, fractional disclosure rank and the log of market value measured at the end of 1990.²⁶ That is,

$$r_{E/BV,i} = \gamma_0 + \gamma_1 BETA_i + \gamma_2 DRANK_i + \gamma_3 MVAL_i + \varepsilon_i. \quad (10)$$

Market value is included in the analysis because evidence presented earlier indicates a significant association between market value and cost of equity capital, as well as between market value and disclosure level suggesting that market value would be a correlated omitted variable if excluded from the analysis.

The results are presented in table 8. The market risk premium implied by the statistically significant coefficient on beta of 7.0% is comparable to the historical average risk premium discussed earlier and the coefficient on MVAL is significantly negative as expected. The coefficient on DRANK, however, while negative is not statistically significant. These results indicate that, for the full sample of firms, cost of equity capital is not decreasing in DRANK after controlling for cross-sectional variation in market beta and firm size.

Specification Tests

I assessed the sensitivity of these results to model specification by estimating two other specifications of equation (10). The first regresses fractional rank of cost of equity capital on each of the fractional ranks of market beta, disclosure level and market value. The second specification allows the disclosure measure to enter the model via two categorical variables (DHI, set equal to one if the firm is a high disclosing firm, zero otherwise; and DMED, set equal to one if the firm is a moderate disclosing firm, zero otherwise). This specification allows the level of cost of equity capital to vary with high, medium and low disclosure level after controlling for firm size and beta. If cost of equity capital is decreasing in disclosure level the coefficients on DMED and DHI should

²⁶The conclusions drawn from this analysis are not altered if common equity at the beginning of 1990 is used in place of ending market value.

TABLE 8
Regression Results Based on Full Sample

	<i>Intercept</i>	<i>BETA</i> ^a (+)	<i>DRANK</i> (-)	<i>MVAL</i> (-)
coefficient ^b	0.201	0.070	-0.021	-0.014
t-statistic	4.879	2.831	-0.812	-2.624
p-value	0.0001	0.0028*	0.2093*	0.0050*
adj. R ²	13.5%			
Prob. > F	0.0003			

* One-tail test.

The log of market value is included in the analysis. White's (1980) test does not indicate the presence of heteroscedasticity. All regression results have been checked for the presence of influential data points using Cook's D statistic. No influential data points were detected.

^a $r_{E/BV}$ is the estimated cost of equity capital produced using the earnings/book value approach. DRANK is the fractional rank of the firm's disclosure score. BETA is estimated via a market model regression using at least 24 of the 60 monthly return observations in the five-year period ended May 31, 1991, with the market index defined in terms of the equally weighted NYSE/AMEX return, and MVAL is the market value of equity at the end of 1990 in millions of dollars.

^b Estimated with 115 observations.

be negative with the coefficient on DMED greater than the coefficient on DHI. The results (not reported in tables) do not differ significantly from those reported in table 8.

Empirical Analysis of Hypothesis Two

Hypothesis two states that the association between DRANK and the cost of equity capital may be diluted for firms with a large analyst following. To address this possibility, I constructed a categorical variable (DU) set equal to one if the number of analysts is less than or equal to the median of nine and zero otherwise, and allowed DU to enter the model on its own and in interaction with DRANK. This model allows the slope coefficient associated with DRANK and the intercept to vary for low versus high analyst following. A significantly negative coefficient on the interaction variable (in equation (11) below) indicates that the association between cost of capital and DRANK is stronger for firms with fewer analysts. The full model is given below:

$$r_{E/BV,i} = \gamma_0 + \gamma_1 DU_i + \gamma_2 BETA_i + \gamma_3 DRANK_i + \gamma_4 DRANK_i * DU_i + \gamma_5 MVAL_i + \varepsilon_i \quad (11)$$

The results obtained from estimating regression equation (11) are presented in table 9. The coefficient on BETA is significantly positive, the coefficient on MVAL is significantly negative and the coefficient on DRANK is insignificant suggesting that, for firms with high analyst following, cost of equity capital is increasing in market beta, decreasing in firm size and is unrelated to disclosure level as measured by DRANK. The coefficient on DRANK*DU is significantly negative, however, suggesting that the association between cost of equity capital and disclosure level is significantly more negative for the subsample of firms with low analyst following even after controlling for firm value and market beta. An F-test of the sum of the slope coefficients associated with DRANK and DRANK*DU suggests that, for firms with low analyst following, the association between disclosure level and cost of equity capital is significantly negative at the one percent level or better (one-tail test).

The magnitude of the coefficients on DRANK and DRANK*DU indicate that among the firms with low analyst following, the *most* forthcoming firm enjoys about a 9.7% reduction in its cost of equity capital relative to the *least* forthcoming firm. Alternatively, estimating the model with DRANK replaced by DSCORE indicates that a one-unit increase in DSCORE results in a reduction in cost of equity capital of 0.28% for these firms.

A perspective on the magnitude of this effect is provided by the following examples. Walbro Corporation's score of 12.0 was the highest score awarded to any sample firm in the low analyst following subset for the forecast information category. In its 1990 annual report, Walbro provided a discussion of the potential impact of anticipated risks and existing opportunities facing the firm, provided directional predictions of future profits and sales, and gave a point estimate forecast of capital expenditures. One interpretation of the results discussed above would imply that by providing this information Walbro Corporation reduced its cost of equity capital by approximately 3.4% (i.e., $12.0 \times 0.28\%$) relative to a firm with low analyst following that provided *no* forecast information, holding all else equal. The results could also be interpreted to imply, other things equal, that a firm with low analyst following could reduce its cost of equity capital by 2.0% (i.e., maximum points for historical summary information of $7.0 \times 0.28\%$) relative to a non-disclosing firm by providing a ten-year summary of historical data and eight quarters of interim sales and profit information.

The preceding discussion is provided to place the magnitude of the effect in context. However, the discussion should be interpreted with caution for two different reasons. First, the standard error associated with the slope coefficients is large, such that a 95 percent confidence interval around the 28 basis-point figure indicates that the "true" reduction in cost of equity capital

TABLE 9
Regression Results for Low vs. High Analyst Following

	<i>Intercept</i> (?)	<i>DU</i> ^a (?)	<i>BETA</i> (+)	<i>DRANK</i> (-)	<i>DRANK*DU</i> (-)	<i>MVAL</i> (-)
coefficient ^b	0.140	0.069	0.082	0.035	-0.132	-0.012
t-statistic	2.063	2.002	3.130	0.994	-2.460	-1.725
p-value	0.0415	0.0477	0.0011*	0.8387*	0.0078*	0.0437*
adj. R ²	16.5%					
Prob. > F	0.0001					

* One-tail test.

The log of market value is included in the analysis. White's (1980) test does not indicate the presence of heteroscedasticity. Regression results have been checked for the presence of influential data points using Cook's D statistic. No influential data points were detected.

^a r_{EBV} is the estimated cost of equity capital produced using the earnings/book value approach. DRANK is the fractional rank of the firm's disclosure score. DU is a categorical variable set equal to one if the number of analysts is less than or equal to the median and zero otherwise. DU*DRANK refers to the interaction of DU with DRANK. BETA is estimated via a market model regression using at least 24 of the 60 monthly return observations in the five-year period ended May 31, 1991, with the market index defined in terms of the equally weighted NYSE/AMEX return, and MVAL is the market value of equity at the end of 1990 in millions of dollars.

^b Estimated with 115 observations.

may fall somewhere in the range of less than one basis point to slightly in excess of 66 basis points. Second, the analysis conducted relates cross-firm differences in cost of capital to cross-firm differences in disclosure level. Such a cross-firm analysis will not necessarily provide accurate predictions about how within-firm changes in disclosure level will change a firm's cost of capital.

Analysis of Individual Disclosure Categories

Specifically what type of disclosure reduces cost of equity capital is an interesting and important question; it is also a difficult one to address. This is because firms coordinate their disclosure policies across various avenues (see Lang and Lundholm (1993)) so any correlation between "alternative" measures of disclosure obscures the relative importance of individual types of disclosure. This is the case here since the five categories that comprise DSCORE are positively correlated with one another, the number of analysts following the firm, the number of *Wall Street Journal* articles published about the firm and with DSCORE itself. Moreover, the sample size is small, particularly when split into high and low analyst following subsamples resulting in a small number of observations (55 to 60) with which to estimate the seven to nine regressors included in the model depending on the specification.²⁷ Hence, the results that follow should be viewed as exploratory.

Depending on the subsample examined, coefficients on three of the five categories that comprise DRANK are negative and statistically significant after controlling for firm size and market beta (results not reported). With respect to the subsample of firms with low analyst following, cost of equity capital is decreasing in the level of forecast information (FRANK) and key non-financial statistics (SRANK) provided by a firm. The magnitude of the coefficient on each variable implies that the most forthcoming firm has a smaller cost of equity capital by approximately six percent relative to the least forthcoming firm. The p-values associated with the

²⁷To aid in interpretation, separate regression equations were estimated for the low versus high analyst following subsamples in this section. The results of these analyses are not reported in tables but are discussed in the paragraphs that follow.

coefficients on FRANK and SRANK are 0.07 and 0.09, respectively (one-tail). For the subsample of firms with high analyst following the coefficient on the historical summary category (HRANK) is negative and statistically significant with a p-value of 0.05 (one-tail). The magnitude of the coefficient on HRANK indicates that the most forthcoming firm's cost of equity capital is smaller by approximately six percent relative to that of the least forthcoming firm.

Evidence presented in the SRI International Survey (1987) may provide a partial explanation for these results. According to the survey, individual investors value financial projections in the annual report to a greater extent than analysts or portfolio managers ("professional investors") while the opposite relation holds with respect to historical summary information. The survey indicates that 61.5% of individuals favor including forecast information in the annual report as compared to 54.5% of professionals. In contrast, only 46.2% of individual investors view the historical summary as important, compared to 69.6% of professional investors. Hence, forecast information may be particularly important when a firm is not followed by a large number of analysts because individual investors rely on management forecasts when analyst forecasts are more scarce. When a large number of analysts follow a firm, however, firms benefit more by providing historical summary information which is valued by financial analysts.

Analyses Incorporating Analyst Following and Number of WSJ Articles

I altered the model estimated in table 9 to include two additional potential proxies for disclosure: ARANK (the fractional rank of analyst following) and WRANK (the fractional rank of the number of *Wall Street Journal* articles). I also estimated a model that includes the five categories of DRANK, along with ARANK and WRANK. None of the conclusions drawn from the previously reported results are changed. In some cases, however, the condition index is high indicating the presence of multi-collinearity, probably due to the high correlation between analyst following and firm size.

Finally, I estimated the following regression equation with the full sample:

$$r_{E/BV,i} = \gamma_0 + \gamma_1 BETA_i + \gamma_2 DRANK_i + \gamma_3 (DRANK_i * ANALYST_i) + \gamma_4 ANALYST_i + \gamma_5 MVAL_i + \varepsilon_i \quad (12)$$

The results from estimating regression equation (12) are consistent with those arising from the analyses reported in table 9. Specifically, the coefficients on BETA and MVAL remain significantly positive and negative, respectively. The coefficient on DRANK is significantly negative while the coefficient on the interaction term is significantly positive. This suggests that cost of equity capital is decreasing in disclosure level as measured by DRANK, but at a decreasing rate as analyst following increases. The coefficient on ANALYST is not statistically significant.

VI. SUMMARY AND CONCLUSION

The effect of disclosure level on the cost of equity capital is a matter of considerable interest and importance to the financial reporting community. However, the ongoing debate between proponents and opponents of greater disclosure has been unproductive because the benefits of greater disclosure are not well established and are difficult to quantify. This paper provides direct evidence of an association between cost of equity capital and disclosure level, and an indication of the magnitude of its effect. For a sample of firms with relatively low analyst following, the evidence suggests that greater disclosure is associated with a lower cost of equity capital, holding cross-sectional variation in market beta and firm size constant. For firms with high analyst following, no significant relation between disclosure level, as measured by DRANK, and cost of equity capital is observed.

My study also provides some preliminary evidence on the types of disclosure that seem to

play an important role in reducing cost of equity capital. Specifically, for firms with low analyst following, disclosure of forecast information and key non-financial statistics is particularly important while for firms with high analyst following, disclosure of historical summary information is beneficial. Questions remain, however, that could be examined in future research. Given the high correlation among various types of disclosure, initial attempts may choose to focus on a limited number of broad categories of disclosure such as those contained in the AIMR rankings.

Finally, my study demonstrates a procedure for estimating cost of equity capital that could be applied in other contexts in which firm-specific cost of equity capital estimates are required and analyst forecast data is available. In addition to being negatively associated with disclosure level, the cost of equity capital estimates produced by my approach are increasing in market beta and decreasing in firm size.

The analyses and results reported here are based on observations for firms in one industry, for one year. Hence, the results may not be generalizable to other industries and/or time periods. This issue could be addressed in future research by applying the same techniques to a different industry or time period. However, the advantage of achieving greater cross-sectional variation in disclosure levels, must be weighed against the need to create a data set of disclosure rankings. An alternative would be to use the disclosure rankings produced by the Association for Investment Management and Research which covers a broad spectrum of industries and time periods and offers a more comprehensive measure of disclosure level. However, the AIMR sample restrains cross-sectional variation in disclosure to the upper end of the distribution potentially limiting the power of the analysis.

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