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AN INVESTIGATION OF THE QUALITY OF EARNINGS CONCEPT AS APPLIED TO DEFENSE CONTRACTORS

by

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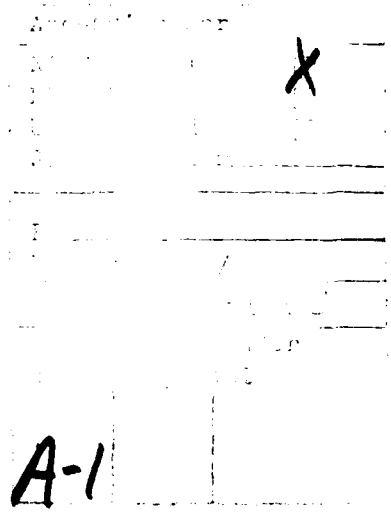

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ABSTRACT

This thesis analyzes whether the quality of earnings concept can be usefully employed in the security analysis of defense contractors. Background is provided by an extensive review of the literature relevant to quality of earnings. Since the quality of earnings concept is very subjective, specific quantitative measures of quality of earnings are developed and used in a statistical analysis to validate the variables as explanatory predictors of a firm's price earnings (P/E) ratio. The statistical techniques employed include Pearson's Product Moment Correlation, Spearman's Rank Order Correlation, stepwise regression and other multiple linear regression models. Results of the study suggest that there are significant relationships between several hypothesized quality of earnings variables and a firm's P/E ratio. The statistically significant variables in the final regression models explain between 67.8% and 76.6% of the variation in the P/E ratio. The evidence indicates that variables related to cash flow, degree of government business, order backlogs and earnings stability reflect aspects of a firm's quality of earnings.

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I. INTRODUCTION

A. BACKGROUND

Security analysts use several different techniques in assessing the financial position or true earning power of a company. Comparisons of reported earnings are of limited value since the earnings figures represent the interaction of accounting methods and management decisions which may vary from firm to firm. Thus, analysts often resort to an analysis of the company's "quality of earnings." The concept of quality of earnings relates to whether the reported earnings figures reflect the true earning power of a company. It can be affected by the accounting methods used by the firm, management policies regarding discretionary expenses, persistence of earnings, cash content of earnings and other factors which tend to make the reported earnings an unreliable indicator of true future earning power. Several of these factors are qualitative, which makes the analysis of quality of earnings a very subjective process varying from analyst to analyst. This study investigates the quality of earnings concept in the defense contracting environment in an attempt to develop methods of quantifying quality of earnings. Measures of quality of earnings are identified and the relationship of these measures to security valuation measures such as a

company's price earnings (P/E) ratio are examined. Knowledge of this relationship provides insight into the role of the quality of earnings concept in security analysis.

B. OBJECTIVES AND RESEARCH QUESTIONS

The purpose of this thesis is to determine if the quality of earnings concept can be usefully employed in the security analysis of defense contractors. An analysis of the literature relevant to quality of earnings provides the background necessary to develop methods of quantifying the qualitative factors. The concepts are used to develop 14 specific variables for quality of earnings in the defense industry. Expected relationships between the quality of earnings variables and a defense contractor's P/E ratio are tested statistically to validate the variables as explanatory predictors of a firm's P/E ratio. Specifically, this study attempts to answer the following questions:

(1) What is the state of the art of research on quality of earnings?

(2) How can quality of earnings be measured?

(3) Is there a significant relationship between quality of earnings and security valuation measures such as the price earnings ratio?

C. SCOPE, LIMITATIONS AND ASSUMPTIONS

This study focuses on the quality of earnings concept in the defense contracting environment from 1986-1988. This environment is characterized by unique risks and

uncertainties which may not be present in other areas of private industry. Therefore, although the underlying concepts regarding quality of earnings are the same, the results of the analysis may not be generalizable to all segments of industry. Since no previous empirical studies have focused on the defense industry, the purpose of the statistical analysis is to validate specific hypothesized quality of earnings variables as explanatory predictors of a firm's P/E ratio. Once these variables are identified, a similar type of analysis could be used to test the hypothesized market reaction to valid quality of earnings indicators.

The sample of contractors used in the study were the 25 defense contractors having the largest dollar value of government contracts in 1987. The sample size was selected to provide a representative sample, yet still permit manual data extraction from annual shareholder reports. Since each company may follow different practices and procedures with regard to account classifications and presentation of financial data (and still follow Generally Accepted Accounting Principles), direct comparison of several company's statements is difficult. Therefore, by manually extracting the data from the annual reports for use in the quality of earnings variables and adjusting that data for accounting differences, it is possible to ensure comparability between companies.

The analysis assumes that the reader has a fundamental knowledge of accounting methods and financial statement analysis techniques. Specific applications of accounting methods and financial statement analysis as related to quality of earnings are elaborated upon in the following chapters.

D. LITERATURE REVIEW AND METHODOLOGY

The methodology for the empirical portion of this analysis is based upon a study of quality of earnings by Joel G. Siegel and Jae K. Shim [Ref. 1:pp. 68-75]. Their study covered 252 companies from all segments of industry for the period 1965-1974, and consisted of a multiple regression of cross sectional data for their quality of earnings factors against the P/E ratio. A detailed explanation of this study and other literature relevant to the quality of earnings concept is presented in Chapter II.

E. ORGANIZATION OF THESIS

Since there is no widely accepted definition of quality of earnings, Chapter II sets the framework for the analysis by developing a working definition for the remainder of the study. Additionally, it provides an analysis and synthesis of the literature relevant to quality of earnings including the results of previous empirical studies. With this background, the underlying concepts are applied to the defense contracting environment in Chapter III. Chapter III

first examines the defense contracting environment in terms of the unique risks and uncertainties which affect quality of earnings. The characteristics of this environment are used to develop 14 specific quality of earnings measures for defense contractors. Finally, Chapter III closes with a description of the sample of contractors included in the analysis.

Once the specific quality of earnings variables are established, Chapter IV develops hypotheses regarding their expected relationship with a firm's P/E ratio. The hypotheses are tested statistically (through univariate and multivariate tests) to validate their acceptability as predictors of the P/E ratio and to gain insight into the role of quality of earnings in security analysis. Chapter V completes the study with conclusions of the analysis and recommendations for further investigation.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

This chapter provides an analysis and synthesis of the literature relevant to quality of earnings. The primary emphasis is on definition of the quality of earnings concept, previous attempts to identify and measure the components of earnings quality, and results of empirical studies showing relationships between quality of earnings factors and other security valuation measures.

A. THE QUALITY OF EARNINGS CONCEPT

Security analysts often use the phrase "quality of earnings" when they refer to a company's reported earnings. Bernstein and Siegel provide an explanation of why earnings quality assessment is an important part of security analysis:

> Of course, any professional knows that earnings numbers are in large part the product of conscious and often subjective choices between various accounting treatments and business options, as well as of various external economic factors. Two firms in a given industry may report identical earnings but experience completely different operating performance. If he wants to assess the true earning power of each company, the financial statement user must make some determination of the "quality" of its earnings. [Ref. 2:p. 72]

Olstein and O'Glove reinforce this idea with their observation that as figures in financial statements become more and more removed from economic reality, they may be misleading as indicators of a company's real resources and

obligations [Ref. 3:p. 74]. Most security analysts agree that quality of earnings relates to the true earning power of a company, however, "There is no generally accepted or common definition of the degrees of earnings quality or what constitutes high or low earnings quality." [Ref. 4:p. 206] According to Hawkins, this depends on each analyst's objectives and the characteristics he believes are relevant to his objectives [Ref. 4:p. 207]. Even though there is no widely accepted definition of quality of earnings, a working definition can be developed from common themes present in literature on the subject: Quality of earnings is a function of: (1) The persistence of earnings, and (2) The cash content of earnings. Several underlying variables which may influence quality of earnings through these fundamental characteristics are discussed in the next section.

B. ASSESSMENT OF QUALITY OF EARNINGS

Since the assessment of quality of earnings involves numerous qualitative and quantitative considerations, disclosure of corporate information is a very important factor. In Accounting Series Release No. 159, the Securities and Exchange Commission (SEC) addressed the issue of disclosure with respect to quality of earnings, as well as providing insight into some possible characteristics which influence earnings quality.

> Securities Act Guide 22 and Exchange Act Guide 1 require an explanation of the Summary of Earnings and Summary of Operations to enable investors to appraise the quality of earnings. Investors should understand the extent to which accounting changes, as well as changes in business activity, have affected the comparability of year-to-year data and should be in a position to assess the source and probability of recurrence of net income (or loss). [Ref. 5:p. 3297]

This emphasis on disclosure, coupled with recent advances in information processing systems, helped provide security analysts with the data necessary for assessing a company's quality of earnings. The remainder of this section focuses on various characteristics thought to affect earnings quality and how they have been measured.

1. Accounting Methods and Management Policy

a. Accounting Methods

Management's choice and application of accounting methods has a significant impact on quality of earnings. The accounting methods are evaluated in terms of the degree of conservatism inherent in each method.

> The more conservative a company's reporting methods are within generally accepted accounting principles (GAAP)--that is, the more likely the company is to minimize reported profits regardless of underlying earning power--the higher will be the quality of reported earnings. [Ref. 6:p. 40]

While conservative accounting practices are associated with high quality earnings, excessive conservatism is also not desirable because it results in a lack of reporting integrity [Ref. 2:p. 73]. Examples of conservative accounting policies which minimize reported profits are summarized below:

(1) LIFO inventory valuation during periods of inflation.

(2) Accelerated depreciation methods as compared to methods that depreciate assets less rapidly.

(3) Amortization of intangible assets over the shortest possible life.

(4) Deferral of income and "flow through" of expenses. [Ref. 6:p. 43]

In some cases, a company's quality of earnings is affected by industry practices and external regulatory agencies. A prime example is the utilities industry, where earnings quality has deteriorated as a result of reporting an allowance for funds used during construction (AFUDC) and using the "flow through" method of tax accounting. The allowance for funds used during construction is essentially non-cash earnings created through the capitalization of interest expense with the offsetting credit entry made to the income account. Reported earnings are overstated since, "In recent years, capitalized interest charged to construction has ranged on average between 50 and 60 percent of reported earnings of electric utility companies." [Ref. 7:p. 33]

In an effort to boost reported earnings, regulatory agencies in the utility industry may also require companies to use "flow through" tax accounting, which has the same adverse impact on earnings quality. When a company uses accelerated depreciation for tax purposes and straight-line depreciation for reporting, the "flow through" method establishes no deferred tax liability account, but instead

flows through the difference to reported earnings by reporting a tax expense equal to the tax liability. Rather than following the conservative practice of deferring income and flow through of expenses, the utilities have boosted current reported earnings by using flow through tax accounting. This practice, which is contrary to the deferral method of tax accounting specified in Financial Accounting Standards Board (FASB) Opinion No. 11, is allowed only in regulated industries under specific conditions.

> In Statement No. 71, "Accounting for the Effects of Certain Types of Regulation," the FASB concluded that when a regulator does not include the income tax effect of certain transactions in allowable costs in the period in which the transactions are reported, but includes income taxes related to those transactions in allowable costs in the period in which these taxes become payable, flow-through tax accounting is permissible. [Ref. 4:p. 485]

Even though the practices followed by the utilities industry for AFUDC and "flow through" tax accounting are allowed under current FASB regulations, the Statement of Financial Accounting Standards No. 96 (scheduled for implementation in 1990) eliminates these practices. Statement No. 96 specifies methods of accounting for income taxes using the liability approach in which deferred tax liabilities are calculated with the tax rates expected to be in effect when timing differences reverse themselves. Statement No. 96 supercedes FASB Opinion No. 11 and addresses regulated industries:

> Regulated enterprises that meet the criteria for application of FASB Statement No. 71, Accounting for the Effects of Certain Types of Regulation, are not exempt

from the requirements of the statement. Specifically, this statement:

a. Prohibits net-of-tax accounting and reporting
b. Requires recognition of a deferred tax liability (1) for tax benefits that are flowed through to customers when temporary differences originate and (2) for the equity component of the allowance for funds used during construction.
c. Requires adjustment of a deferred tax liability or asset for an enacted change in tax laws or rates.

If it is probable that the future increase or decrease in taxes payable for items (b) and (c) above will be recovered from or returned to customers through future rates, an asset or liability shall be recognized for that probable future revenue or reduction in future revenue pursuant to paragraphs 9-11 of Statement 71. [Ref. 8:p. 11]

When companies adopt Statement No. 96, their reported earnings will change without changing their underlying earning power. Thus, an investigation of the accounting practices used by a company can help give a better indication of true earning power than the reported earnings figures alone.

b. Discretionary Expenses/Business Choices

Management can also affect the level of reported earnings by altering discretionary spending such as research and development, advertising, maintenance and training expenses. Bernstein and Siegel claim that the quality of earnings relates to whether the company has made an adequate provision for "maintenance of assets and for the maintenance and enhancement of present and future earning power." [Ref. 2:p. 74] They suggest analysts examine trends in discretionary expenses in relation to assets for which they are incurred to determine if those expenses have been

altered in a way that affects the quality of earnings. This type of analysis requires the person use his judgment as to the required level of expenses, in view of the nature of the industry and long term growth prospects.

c. Credit Policy

Management also establishes the firm's credit policy. The credit policy includes variables such as credit period, credit standards, collection policy and discounts given for early payment. Assuming that sales revenue is recognized when goods are shipped to the customer, a conservative credit policy also leads to higher quality earnings. Management must balance the desire for higher quality earnings gained through a conservative credit policy against the possibility that an overly conservative credit policy can lead to lost credit sales that would be fully collectible. One method of assessing the quality of accounts receivable (and thus reported earnings), is to compare the average collection period to the firm's own credit policy and that of other companies in the same industry [Ref. 4:p. 177]. Additionally, any lengthening of the collection period under the same credit policy may be indicative of future collection problems.

2. Earnings Persistence

Persistence of earnings is one of the fundamental characteristics of quality of earnings. Analysts define persistence of earnings in terms of its probability of

recurrence in the future. "This recurrence is a favorable characteristic and contributes to the quality of earnings." [Ref. 9:p. 30] Since it is difficult to directly measure the probability of recurrence of earnings, some of the more readily quantifiable underlying variables which affect persistence can be examined instead. These variables include earnings stability, the source of earnings and growth rate of earnings.

a. Earnings Stability

Stability of earnings is one of the characteristics most frequently associated with quality of earnings because of its impact on earnings persistence. Measures of historical earnings volatility include the standard deviation of earnings, coefficient of variation, instability index and beta. Hawkins suggests that ratio and trend analysis may also help identify possible future earnings volatility. An increase in fixed costs as a percentage of total costs (operating leverage) can lead to earnings instability, depending on the level of sales [Ref. 4:p. 209]. High operating leverage is associated with greater business risk; the uncertainty in projections of future income or earnings before interest and taxes (EBIT). "In general, holding other factors constant, the higher the degree of operating leverage, the greater the business risk as measured by the standard deviation of expected EBIT." [Ref. 10:p. 413]

Operating characteristics of the firm such as sources of raw materials and its product line may also affect earnings stability. If raw material sources and costs are unreliable, this may interrupt the production process or require the use of expensive substitutes. This will reduce earnings for the period and have a negative effect on stability as well as quality of earnings. Siegel explains that the type of product demand and nature of product correlation must be considered in evaluating earnings stability. Within this context, an inelastic product demand and diversified mix of negatively correlated items promotes earnings stability [Ref. 9:p. 32]. Additional operating characteristics such as availability of financing, capital structure of the firm and tax effects also influence earnings stability and quality of earnings. These factors will be explored in detail throughout later sections.

b. Source of Earnings

There is a widespread belief that only earnings derived from the day to day operations of the firm are of high quality. Comiskey states, "The assessment of earnings quality basically entails extracting the continuing operating cash flow from earnings reported on an accrual basis." [Ref. 11:p. 34] On the other hand, Siegel favors a more in-depth analysis of nonrecurring vs. recurring earnings and nonoperating vs. operating earnings [Ref. 9:pp.

30-31]. Siegel and Comiskey are in agreement at the extremes, however, Siegel points out that nonrecurring items which relate to the normal business of the company, and are part of its long-term earnings cycle, do not necessarily lower the quality if reported in net income. Additionally, nonoperating earnings which are very stable may actually increase earnings quality. Therefore, to perform an analysis similar to Siegel's, the analyst must thoroughly understand the connotations of accounting terminology such as "extraordinary items" and "nonrecurring items."

c. Earnings Growth

Growth rates of reported earnings have received significant attention in accounting research over the years. At one extreme, and a widely used model in practice, is the view that projections of future earnings can be based on a historical average or trend. "For the constant mean or constant growth process, any deviation of reported earnings from the historical trend is presumed to be determined totally by chance factors." [Ref. 12:p. 59] An alternative is the viewpoint that earnings follow a "random walk" process in which future earnings changes are independent of past changes. In this case, the best estimate of next period's earnings is the earnings of the current period. Between the two extremes are several complex models which incorporate smoothing processes and autoregressive techniques for forecasting future earnings. Griffin

summarized the results of several studies related to reported earnings.

> As an initial representation of earnings behavior, the aforementioned studies generally favor the random-walk model for reported annual earnings (e.g., available for common [shareholders]) and models that closely resemble a random walk (moving-average or mean-reverting processes) for annual earnings if deflated by size. [Ref. 12:p. 63]

The controversy surrounding earnings growth rates raises the question of whether this variable should even be considered in an analysis of quality of earnings. If the random walk model for earnings growth prevails, it may not be useful for predicting an absolute level of future earnings. However, Siegel and Shim use the growth rate in earnings as a proxy variable which represents the effectiveness of management. "It shows that the firm has been successful in obtaining above normal returns on assets employed. It infers that management is knowledgeable and has the ability to take advantage of business opportunities." [Ref. 1:p. 70] Using a proxy variable such as earnings growth rate for the effectiveness of management provides a method to quantify some of the qualitative considerations discussed earlier.

3. Cash Content of Earnings

The other fundamental characteristic of quality of earnings cited earlier is the cash content of earnings. Its effect on quality of earnings is examined below by first considering revenues and then expenses, as well as some additional tax implications.

a. Non-Cash vs. Cash Revenues

The cash content of reported revenues affects the amount of funds available to finance future growth. Under the accrual basis of accounting, Generally Accepted Accounting Principles require revenue recognition when the revenues are: (1) realized or realizable, and (2) earned. It is not necessary for a cash transaction to take place for the revenues to be recognized. Revenues without immediate cash flow provide no assistance to the company in meeting its current debt repayment obligations, so the quality of reported earnings will increase as the cash portion of total revenues increases. With a normal credit sale under the accrual accounting system in which cash is collected shortly after revenue recognition, quality of earnings is not affected. "However, where the inflow of cash is delayed for a substantial period (a long-term installment sale), earnings quality is diminished." [Ref. 11:p. 38] This is also the case when a company fails to make an adequate provision for doubtful accounts. Since the revenue has already been recognized on the sale, but will never be collected, future provisions for doubtful accounts must be larger to compensate for the current bad debt expense.

Other specific accounting practices also create non-cash revenues. Comiskey illustrates how the equity method of accounting for intercorporate investments and the capitalization of interest introduce profits not backed by

cash flow, and thus reduce the quality of earnings [Ref. 11:pp. 38-40]. As discussed above, the capitalization of interest expense and the allowance for funds used in construction adversely affected the earnings quality of the utilities industry.

b. Expenses/Taxes

Timing differences between expenses in the accrual system of accounting and the corresponding cash outflows also affect the cash content of expenses. "In the case of the associated expenses, earnings are of higher quality where cash outflow, with a high degree of certainty, will not exceed (or perhaps fall short of) the recorded expense." [Ref. 13:p. 54] Perhaps the best example of deferring cash outlays is the accrual of deferred taxes. Deferred taxes arise as a result of different computations for accounting (book) income and tax return income, for items such as depreciation and warranties. Therefore, companies which are able to defer a consistently large portion of their current tax expense will have higher quality earnings because the associated cash outlay is deferred to the future, if not indefinitely. In order to maintain the tax deferral, the company must continue growth and make capital expenditures, or at some future point in time the cash outlay will exceed the tax expense and reduce earnings quality. Hawkins disagrees with this approach, stating that an increase in deferred taxes may signal more

liberal accounting policies for reporting purposes, or a lower pre-tax profit for tax purposes. The underlying reason for the increase in deferred taxes should be investigated prior to assessing its impact on quality of earnings. [Ref. 4:p. 213]

The tax effects from timing differences mentioned above relate to the cash outflow for taxes relative to the total recorded tax expense. Another possibility is that an item of income or expense is included or deducted in accounting (book) income or taxable income, but not both. Examples cited by Comiskey include tax-exempt interest, the investment tax credit, capital gains tax rates and percentage depletion allowances. This causes the company's effective tax rate to vary from the statutory rate. For example, assume that a company has substantial interest income that is not taxable. Since the interest income is included in the pre-tax accounting (book) income but not the taxable income, based on the reported income figure the company will have a lower effective tax rate than the statutory rate. Comiskey supports the belief that a lower effective tax rate signals lower quality earnings, since the source of the tax rate reductions may be vulnerable to future changes in laws, leading to instability of reported earnings and less persistence. [Ref. 13:p. 56]

4. Other Factors--Financial Characteristics

Some analysts attempt to define a "financial position quality" by considering book to liquidation values of assets and liabilities and the dollar value of off-balance-sheet assets and liabilities [Ref. 11:p. 36]. However, other analysts incorporate the financial characteristics of the balance sheet in their analysis of quality of earnings, since the balance sheet accounts represent future benefits and obligations for the company. The characteristics which affect earnings quality are discussed below.

a. Asset Realization Risk

Asset realization risk refers to the probability that a recorded asset will actually produce a given level of future benefits or cash flow. "The greater the dollar frequency of a firm's assets in the high risk category, the lower its earnings quality." [Ref. 1:p. 69] Siegel and Shim suggest a possible measure of asset realization risk is the trend in the ratio of intangible assets to total assets, because the intangible assets have a higher probability of being written off in the future [Ref. 1:p. 69]. Ratios such as the book value to liquidation value of assets also measure asset realization risk, but are difficult to use in practice due to lack of accurate information regarding asset liquidation values.

b. Liquidity

Credit analysts examine a firm's liquidity position prior to the approval of new financing, since it is important to judge whether a company will be able to meet its financial obligations. Although liquidity does not affect current earnings, it can affect the quality of earnings through the ability of the firm to meet its financial obligations and secure stable sources of new financing. Thus, a highly liquid firm enhances the quality of its earnings by reducing the uncertainty and risk associated with future earnings [Ref. 4:p. 210]. Common measures of liquidity include the current ratio, quick ratio, accounts receivable turnover and inventory turnover.

c. Capital Structure

Just as operating leverage contributes to business risk and future volatility of EBIT, financial leverage (debt financing) increases the total risk borne by the stockholders of the firm. The additional risk placed on the stockholders stemming from financial leverage is known as financial risk. Financial leverage increases risk to investors as profits and losses are amplified in the presence of fixed charges related to the debt financing [Ref. 7:p. 36]. As the fixed charges increase, the earnings available to stockholders are more unstable and therefore have lower quality. Brigham and Gapenski use the standard deviation of return on assets (σ_{ROA}) as a measure of

business risk, and the standard deviation of return on equity (σ_{ROE}) as a measure of the total risk borne by stockholders.

> (σ_{ROE}) = (σ_{ROA}) if the firm does not use any debt, or financial leverage....The difference between (σ_{ROA}), the risk that stockholders would bear if no financial leverage were used, and (σ_{ROE}) the risk stockholders actually face, is a measure of the risk increasing effects of financial leverage: Risk from financial leverage = (σ_{ROE}) - (σ_{ROA}). [Ref. 10:p. 417]

Other analysts cite an increasing spread between return on equity and return on total capital in recent years as a signal of financial risk, and lower quality of earnings for American companies [Ref. 14:p. 40]. A firm's financial leverage can also be evaluated through ratios such as debt to equity, net income to fixed charges and financial leverage index (ROE/ROA).

d. Common Stock Value

Quality of earnings can also be affected by the company's ability to sell common stock at a price above its book value if the rate of return is set by an outside regulatory agency (i.e., the utilities industry). For a constant return on owner's equity, selling stock at a price above book value translates into higher earnings per share, enhancing the earnings quality.

> For example, a company earning 14 per cent return on owner's equity has a book value of $10 per share. That translates into reported earnings of $1.40 per share of common stock. Now suppose that the company sells a new issue of common stock large enough to double the shares outstanding at $20 per share. The book value for all shares becomes $15 per share. If the company is able to generate the same 14 per cent return on owner's equity,

reported earnings would be $2.10 per share. [Ref. 7:p. 37]

A higher market value to book value ratio indicates that the market expects future benefits and earnings from assets which may be under-valued on the firm's balance sheet (low asset realization risk).

C. QUANTIFYING QUALITY OF EARNINGS FACTORS

One difficulty encountered in assessing the quality of earnings is the lack of quantitative measures for several factors discussed above. However, an analyst can gain an understanding of the relative accounting quality and bias of management toward conservatism through a management appraisal approach described by Hawkins. In this system, the analyst assigns "penalty points" for policies he considers liberal. The total penalty point scores are then used to rank each company within its industry. [Ref. 4:p. 213] An alternative is to use proxy variables to represent the qualitative considerations, just as Siegel and Shim used the earnings growth rate to represent the effectiveness of management. Once the analyst develops quantitative measures for the relevant quality of earnings factors, they can be used in empirical studies to investigate their relationship to other security valuation measures. The results of two of these studies are discussed below.

D. PREVIOUS EMPIRICAL STUDIES

1. Fitzpatrick and Stitzel Study [Ref. 15:pp. 18-22]

The purpose of Fitzpatrick and Stitzel's study was to evaluate the impact of the "allowance for funds used during construction" (AFUDC) on the quality of earnings in the utility industry. They ran a series of multiple regression analyses for 1969-1975 on 95 domestic investor-owned electric utilities to test the hypothesis that AFUDC accounting will detract from the quality of earnings as reflected in the market-to-book value ratio of the stock. Independent variables in the regression equation included: AFUDC as a per cent of net income, return on common equity, the square of return on common equity, common dividends as a per cent of cash flow, Moody's bond ratings, long-term debt as a per cent of total long-term capital, and five-year earnings per share annual growth rate. [Ref. 15:p. 20] Fitzpatrick and Stitzel concluded from their regression results that AFUDC contributes to lower quality earnings in the utilities industry. "In six of the last seven years, the negative signs of the regression coefficients for the AFUDC as a per cent of net income variable support the hypothesis that AFUDC has depressant impact on utility market-to-book valuations...." [Ref. 15:p. 21]

2. Siegel and Shim Study [Ref. 1:pp. 68-75]

Siegel and Shim based their study on the belief that the price earnings ratio (P/E) is higher for companies with

better quality earnings and lower for companies with poor quality earnings. Factors expected to influence quality of earnings included: stability of earnings, cash flow, asset realization risk, maintenance of plant assets, financial characteristics, liquidity, market risk of the stock, growth of earnings, growth of dividends, dividends per share, and operating income. These factors were expressed in quantitative measures (shown in Table 1) for subsequent regression analysis.

Data for the study came from 252 companies over the period 1965-1974. Siegel and Shim performed a multiple regression of cross section data from 1974 for the quality of earnings factors (independent variables) against the P/E ratio (dependent variable) to test the following hypothesis: "Those factors which improve the quality of earnings have positive correlations to the P/E multiples while factors which detract from earnings quality have negative correlations." [Ref. 1:p. 70] Results from the regression supported their basic hypothesis, since almost all quality of earnings factors showed signs consistent with their theoretical expectations. The results are shown in Table 1. Statistically significant factors included the ratio of extraordinary items to net income, cash flow as a percent of net income and growth rate of earnings from 1965-1969. Siegel and Shim concluded that the P/E ratio is affected by quality of earnings factors, and these factors should be

TABLE 1

REGRESSION RESULTS

Quality Factor	Variables	Expected Sign	Results
1. Stability of Earnings	Instability index	Negative	Negative
	Coefficient of variation	Negative	Negative
	$\frac{\text{Extraordinary items}}{\text{Net income}}$	Negative	Negative
2. Cash Flow	$\frac{\text{Net inc.+Dep.+Amor.}}{\text{Net income}}$	Positive	Positive
3. Asset Realiz. Risk	$\frac{\text{Intang. Assets}}{\text{Total Assets}}$	Negative	Negative
4. Maintenance of Plant	$\frac{\text{Dep.+Amor.}}{\text{Net Plant}}$	Positive	No effect
5. Financial Character.	$\frac{\text{Debt}}{\text{Equity}}$	Negative	Negative
	$\frac{\text{Net Income}}{\text{Fixed Charges}}$	Positive	Negative[1]
6. Liquidity	$\frac{\text{Curr. Assets}}{\text{Curr. Liab.}}$	Positive	No effect

[1]Siegel and Shim mention this ratio had a negative coefficient, however, further explain an increase in the ratio promotes earnings stability and better quality.

TABLE 1 (CONTINUED)

Quality Factor	Variables	Expected Sign	Results
	Sales / Receivables	Positive	No effect
	CGS / Inventory	Positive	No effect
7. Market Risk	Beta	Negative	Negative
8. Operating Income	Sales / Net Income	Positive	Negative[2]
9. Earnings Grwoth	Growth Rate: '65-69	Positive	Positive
	'70-74	Positive	Positive
	'65-74	Positive	Not included
10. Dividends	Div. per share	Positive	Positive
	Div. Growth Rate	Positive	Positive

considered by security analysts and financial planners.

[Ref. 1:p. 73]

[2]The regression results indicate that earnings from sales are not necessarily high quality in comparison to earnings from other sources.

D. SYNTHESIS OF LITERATURE

An assessment of quality of earnings involves consideration of numerous qualitative and quantitative factors which affect the true earning power of a company. The analyst's task is to translate these factors into specific measures which are relevant to his objectives. The factors presented above represent several analysts' viewpoints about which factors affect quality of earnings, and various methods used to quantify those issues to this date. Quality of earnings assessment is becoming an increasingly important part of security analysis as accounting policies become more complex and the opportunity for direct comparison of financial statements is reduced.

In the next chapter, the concepts discussed above will be applied to the defense contracting environment in order to develop specific quality of earnings measures for defense contractors. These measures will be used in a statistical analysis similar to Siegel and Shim's study [Ref. 1:pp. 68-75] in an attempt to validate the specific variables as explanatory predictors of a firm's P/E ratio.

III. METHODOLOGY AND DATA

This chapter presents the methodology and data used in the development of quality of earnings factors for defense contractors. These factors will be used in the subsequent statistical analysis of how quality of earnings relates to a security valuation measure such as the firm's P/E ratio, to evaluate the role of the quality of earnings concept in security analysis. First, the government contracting environment is explored with emphasis on those unique characteristics which may impact quality of earnings. The purpose of the first section is to discuss features of the particular industry under study which will be relevant in later sections when specific quality of earnings measures are explained. This is followed by the development of specific measures of quality of earnings for government contractors and a description of the sample of companies included in the analysis.

A. OVERVIEW OF GOVERNMENT CONTRACTING ENVIRONMENT

A primary goal of management in most firms is to maximize the value of the company's common stock, thus maximizing shareholder wealth. Within a framework of external constraints and regulations, management develops an optimal strategic policy for investments, production methods, capital structure of the firm, dividend policy,

etc. which is consistent with this goal. Stock value and price can also be affected by factors over which management has no control such as the amount of business risk inherent in its operations and the level of economic activity. Government contractors are also faced with several additional socio-economic factors and risks which are peculiar to companies which do business with the U.S. Government. These factors are described below.

1. Competition

The government contracting environment is essentially a monopsonistic market where there is a single buyer of goods and services (U.S. Government) provided by several contractors.[1] This situation is advantageous for the U.S. Government since it provides the opportunity to select the best products at least cost in a bidding system and it allows significant leeway in setting the terms and conditions of the contracts. However, from the contractor's perspective, this creates intense competition for government contracts among firms in the same industry. In their 1988 annual report to the Securities and Exchange Commission, the management of Lockheed Corporation expressed concern over competition:

> Consequently, the degree to which the company may participate in future government business will depend to a

[1]Foreign governments also purchase goods from the contractors under the Foreign Military Sales Program, however, the U.S. Government is the single dominating consumer in the market.

> large extent on the effectiveness and innovativeness of its research and development programs, its ability to offer better program performance than its competitors at a lower cost to the government, and its readiness in facilities, equipment, and manpower to undertake the programs for which it may be competing. [Ref. 16:p. 4]

This increased competition and the government's emphasis on technical and managerial capabilities of the corporations should stimulate actions which are consistent with the policy of maximizing shareholder wealth.

2. Budget Constraints

Government contractors encounter problems associated with long lead times and the advanced design of products since they must submit bids based on forecasts of future costs and schedules. The uncertainty in forecasts may cause variability in future contractor income under a fixed-price type contract, or even fewer contracts in the future if the company develops a reputation for cost overruns under cost-reimbursable type contracts. The availability of congressional appropriations also influences the company's future income. Since a major program may be only partially funded at its outset, the success of a given program may be dependent on future appropriations for defense spending which may never materialize.

3. Political Developments

The level of defense spending is determined in Congress through the Planning, Programming, and Budgeting System (PPBS) by considering the anticipated threat, and the military strategy and force levels necessary to achieve U.S.

national security objectives. Therefore, world events and political developments such as new arms control treaties may have a significant impact on U.S. Government procurement policy. For example, the signing of a treaty limiting strategic nuclear weapons may force cancellation of several contracts for the "convenience of the government." In this case, the contractor receives compensation only for the work actually accomplished and commitments made at the time of termination including an appropriate allowance for profit on the completed work. This element of uncertainty is a growing concern for government contractors with today's dynamic political environment and shrinking defense budgets.

4. Government Regulation

The U.S. Government protects its own interests through regulation of the individual contractors. Once a contract is awarded to a company, the firm must follow strict regulations for cost allocation to the contract as well as consenting to numerous audits. The Defense Contract Audit Agency (DCAA), under the direction of the Office of the Assistant Secretary of Defense (Comptroller), is the primary agency in the Department of Defense for contract auditing. The audits cover all aspects of the contracts including negotiation, performance, accounting policies and general practices. This ensures that the company is following all terms and conditions of the contract as set forth by the government and agreed to by the contractor.

The factors described above interact to create unique risks and uncertainties in the government contracting environment which are not present in private industry. These features are relevant to the development of quality of earnings measures since defense contractors are the subject of this study. The next section will consider several specific measures which reflect aspects of quality of earnings in the defense industry.

B. QUALITY OF EARNINGS MEASURES FOR DEFENSE CONTRACTORS

Since the quantitative measures will be used in a cross sectional statistical analysis, similar to Siegel and Shim's study of quality of earnings [Ref. 1:pp. 68-75], it is important that the variables be expressed in a form which allows comparison between companies of different sizes. Therefore, each characteristic or proxy variable is expressed as an index number or ratio whenever possible to allow a common size analysis. The variables are defined below in the context of the general characteristics of quality of earnings: Management policies, persistence of earnings, cash content of earnings and other financial characteristics of the firm. Several quality of earnings concepts were discussed in Chapter II, however, methods of quantifying all the concepts were not feasible. For example, it is difficult to quantify management's choice and application of accounting policies for use in statistical analyses. The following paragraphs describe those aspects

of quality of earnings which could be quantified for further analysis.

1. Management Policies

The prime consideration in analyzing management policies is whether management has made an adequate provision for maintenance of company assets and enhancement of future earning power. Two measures which reflect this aspect of management policy relate to depreciation expense and research and development expenses.

a. Depreciation

Service potential of a company's fixed assets declines over time as the assets become obsolete or require more maintenance to keep them in working order. The firm recognizes this decline in service potential by depreciating the historical cost of the assets, so the net value of an asset on the balance sheet will decrease over time. The company can offset the decline in service potential and operating efficiency through continuous reinvestment in new assets having greater earning power than the old assets. Because management has discretion in the method of depreciation for the fixed assets, the depreciation policy can provide insight into whether they have properly recognized the diminished service potential and made an adequate provision for maintenance of assets. "When there is a significant reduction in depreciation expense relative to fixed assets, it may be inferred that depreciation

provisions are inadequate in measuring the decline in service potential of plant assets." [Ref. 1:p. 69]

A smaller depreciation expense to fixed assets ratio will result in overstated assets relative to their realizable service potential as well as overstated current earnings. Theoretically, the assets included in the denominator of the ratio should not include land, since it is not depreciated under generally accepted accounting principles. Due to inconsistency in the classification of balance sheet accounts (i.e., land and improvements in one single account for some firms), this value could not be determined for all companies in the study. Therefore, the measure for maintenance of assets used in this study (DNP) is the ratio of depreciation plus amortization expenses (for fixed assets) to average net plant, property and equipment for the year.

b. Research and Development

Management can enhance the future earning power of the company by varying the level of discretionary spending on items such as advertising and research and development. One useful measure of discretionary spending is the ratio of research and development costs to current sales. However, in the defense contracting industry, a portion of the reported research and development costs may be government sponsored and consequently are recoverable by the company through allocation to various contracts.

Therefore, total research and development expenses will not give a true indication of discretionary spending by the company. Taking this fact into consideration, a more appropriate measure of discretionary expenses for defense contractors is the ratio of company sponsored research and development costs to current sales (RD).

2. Persistence of Earnings

a. Earnings Stability

The first measure of stability considered in this study pertains to historical earnings volatility. As previously discussed, earnings with a high degree of variability will have a lower quality because they are considered less persistent. A common measure of historical earnings volatility is standard deviation, however, this may be misleading because the firms in the study vary in size. The coefficient of variation in earnings per share (CVEPS) takes this into consideration and provides a more meaningful basis for comparison because it shows the variability of earnings per dollar of earnings. It is calculated by dividing the standard deviation of earnings per share by the average value of earnings per share for the time period of concern as shown below:

$$CVEPS = \frac{\text{Standard Deviation of EPS}}{\text{Average EPS}} = \frac{\left[\frac{\sum (EPS - \overline{EPS})^2}{n-1}\right]^{1/2}}{\overline{EPS}}$$

Where:

n = Number of years considered,

EPS = Earnings per share, and

$\overline{EPS}$ = Average Earnings per share.

Siegel and Shim included this variable in their analysis and found that it had an adverse impact on the P/E ratio (negative regression coefficient), although it was not statistically significant [Ref. 1:p. 72].

Another consideration in the stability of earnings is the level of risk faced by investors. The total risk faced by investors can be classified as either business risk or financial risk. Business risk causes variability of earnings due to corporate and industry uncertainties inherent in the firm's operations. When the firm uses debt financing, the financial risk increases the variability of earnings beyond the level caused by business risk. The measure of risk used in the quality of earnings analysis should incorporate both aspects of risk, including any characteristics peculiar to the defense contracting environment.

The variable selected for the analysis as a measure of total risk is the standard deviation of the return on average common shareholder's equity (SDROE). This variable is calculated as follows:

$$\text{ROE } (r) = \frac{\text{Net Income After Taxes and Preferred Dividends}}{\text{Average Common Shareholder's Equity}}$$

$$\text{SDROE} = \left[\frac{\sum_{i=1}^{n} (r_i - \bar{r})^2}{n-1} \right] 1/2$$

Rationale supporting selection of the standard deviation of return on equity as a proxy variable for total risk is presented in Martin's study of defense contractor risk from 1976-1984. Martin showed through regression analysis that for defense oriented firms, the average return on equity was equal to an average risk-adjusted rate of return for all firms (r_o) plus a risk premium compensating the shareholders for greater earnings variability (b_i). He therefore concluded that the standard deviation of return on equity is an appropriate measure of total risk. [Ref. 17:pp. 75-89]

Theoretically, this measure of total risk includes all aspects of business risk and financial risk. However, there are still two important aspects of risk which should be considered in the analysis. First, financial risk depends not only on the variability of income arising from debt financing, but also the level of income relative to the fixed payment commitments for the debt. For example,

> An income stream that fluctuates widely, with even the lowest values far in excess of all fixed payment commitments, will present less risk to the shareholders and the firm than a stream that has a lesser magnitude of variation in which the lowest values are close to the level of fixed charges. [Ref. 18:p. 618]

This specific dimension of financial risk is incorporated in the analysis through the times interest earned ratio (TIE). This ratio shows the level of operating profit before interest expense relative to the fixed interest charges arising from the debt; calculated by dividing earnings before interest and taxes by the annual interest charges. This variable is similar to Siegel and Shim's fixed charge coverage ratio which had a negative relationship to the P/E ratio but was not statistically significant [Ref. 1:p. 73].

An additional important potential cause of income instability is over-reliance on government contract work. Since government contracts are vulnerable to political developments and budget constraints, the business risk inherent in the contractor's operations increases. Diversification of product lines and customer base reduces the business risk and thus enhances the quality of earnings. This component of business risk for defense contractors can be measured by the ratio of government sales to total sales for the year (GOVT).

The final variable in the study which may reflect income stability is backlog. Backlog consists of orders for products which are scheduled for delivery over extended future periods but are not yet completed. Backlog may provide an indication of future demand for the company's products and serve as a proxy variable for market share. The firm's total backlog is classified as either funded or

non-funded. Funded backlog represents contracts for which the U.S. Government (or another company) is obligated to reimburse the firm for work performed, while non-funded backlog represents orders for which no obligation exists. For this reason, the variable used in the analysis to represent market share is the ratio of funded backlog to total sales for the year (BKLG). A large funded backlog can be expected to have a stabilizing influence on income.[2]

b. Source of Earnings

The source of earnings may affect the predictability or persistence of future income. As discussed in Chapter II, analysts agree that nonrecurring and nonoperating gains or losses are not predictable and therefore adversely affect quality of earnings, while income derived from the day to day selling function of the firm is of higher quality. Siegel and Shim tested this hypothesis in their study by including the ratio of sales to net income in the regression equation, expecting the ratio to have a positive effect on the P/E multiple. The regression results showed an unexpected negative sign which was not statistically significant, indicating that income from sales is not necessarily of high quality. [Ref. 1:pp. 68-75] To

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[2]It is important to note that even contracts classified as funded backlog may be terminated for the convenience of the government if political developments such as new treaties occur. However, in this case the contractor will receive compensation for the work accomplished up to that point in time.

further test this hypothesis, while refining Siegel and Shim's measure, the variable chosen for this study is the ratio of earnings from continuing operations to net income (ECONI). This ratio is used since it excludes the nonrecurring and nonoperating gains and losses while incorporating other income derived from the continuing operations of the firm.

The other source of income which may reflect the persistence of future income is income derived from the benefits of a lower effective tax rate than the statutory rate. This income is a result of "permanent" differences in the amount of accounting (book) income and taxable income, which are vulnerable to future changes in tax laws. Since several analysts believe that a lower effective tax rate than the statutory rate signals lower quality earnings, a variable is used in this study to assess the impact of this source of income on earnings quality. This variable (TAX) is the ratio of the income arising from a lower effective tax rate than the statutory rate, to net income. It is calculated as follows:

$$TAX = \frac{(\text{Statutory Rate} - \text{Effective Rate})}{(1 - \text{Effective Rate})}$$ [3]

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[3] $\frac{EBT(1 - \text{Eff. Rate}) - EBT(1 - \text{Stat. Rate})}{EBT(1 - \text{Eff. Rate})} = \frac{(\text{Stat. Rate} - \text{Eff. Rate})}{(1 - \text{Eff. Rate})}$

where EBT = Earnings after interest but before taxes.

In order to eliminate the distorting effects of different foreign tax rates on the company's effective tax rate, the tax rates in the formula represent U.S. federal corporate taxes only.

3. Cash Content of Earnings

Cash flow from operations is frequently approximated by adjusting net income for revenues not producing cash and expenses not using cash. Following this line of reasoning, a common measure of "cash flow" is net income plus depreciation, depletion and amortization. This common measure is only an approximation of actual cash flow from operations. Using this definition of cash flow, Siegel and Shim found that cash flow as a percent of reported earnings was a statistically significant quality of earnings variable [Ref. 1:p. 71]. Even though this measure of cash flow is widely used by financial analysts, it is somewhat limited in that it does not take into consideration the cash flow generated by other asset and liability accounts such as inventory, accounts receivable and accounts payable, as required by current generally accepted accounting principles (GAAP). Since these accounts may have a significant impact on actual cash flow from operations, it is desirable to include their effect on cash flow in the analysis of quality of earnings.

Two variables related to cash flow will be considered in this analysis in an attempt to determine which

variable has the most significant relationship to quality of earnings. The first variable (CFNI) is the ratio of cash flow to net income using the common approximation of cash flow mentioned above. The second variable (CFONI) is the ratio of actual net cash provided by operating activities to net income. This measure is more realistic and is consistent with the format of the statement of cash flows required by current GAAP.

4. Other Financial Characteristics

The other financial characteristics evaluated in the study include asset realization risk, liquidity and the status of pension plan funding.

a. Asset Realization Risk

The principal source of asset realization risk for a company is its investment in intangible assets. Intangible assets such as patents, trademarks, product technology and goodwill provide future benefits without having physical form, so they are capitalized as assets and then amortized over time. The level of future benefits derived from an intangible asset, however, is highly uncertain if it can be measured at all. The risk associated with future benefits influences future income of the company and may adversely affect the quality of earnings. The variable used to measure this asset realization risk is the ratio of intangible assets to total assets of the company

(IATA).[4] Siegel and Shim found that this variable was negatively related to the P/E ratio but was not statistically significant [Ref. 1:p. 73].

b. Liquidity

Siegel and Shim used the liquidity measures of receivable turnover, inventory turnover and current ratio in their study. They found that these measures had no effect on the P/E ratio of the firm. [Ref. 1:p. 73] This suggests that liquidity may not affect quality of earnings as expected. However, since analysts frequently associate liquidity with quality of earnings, a measure of liquidity is included in this study to further test this hypothesis. The companies included in this study are from a specific industry, so the results of the statistical analysis may vary from those found by Siegel and Shim. The variable used as a measure of liquidity is the current ratio (CR) which is the ratio of current assets to current liabilities.

c. Pension Plan Funding

Pension plans provide payments to eligible employees upon retirement based on their years of service and level of earnings. The employer contributes money to the pension fund which then pays benefits to the retired employees. The pension plan assets held by the fund are

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[4]The value used in the ratio is from the account "Deferred Charges and Other Assets" if intangible assets were not listed separately on the balance sheet or in the accompanying footnotes.

usually secure investments which can be relied upon to provide an adequate rate of return, but whose value may fluctuate with the securities market. Thus, the only asset the employer may carry on his balance sheet related to the pension plan is a pre-paid pension cost if his contributions to the fund exceed the cumulative value of net periodic pension costs. On the other hand, the employer may carry a liability on his balance sheet called "unfunded pension liability." Under Financial Accounting Standards No. 87 covering defined benefit pension plans, this liability is the larger of:

(1) The cumulative value of net periodic pension costs (based on actuarial assumptions) over the employer's contributions to the fund, and

(2) The excess of the accumulated benefit obligation (based on the actual present and past service of employees) over the fair market value of pension plan assets.

Usually the liability based on the actuarial assumptions is a more conservative estimate of the liability for future payments, whereas the accumulated benefit obligation represents the actual future obligations of the employer if the plan was terminated today. Thus, the status of pension plan funding at a specific point in time can be found by analyzing the accumulated benefit obligations of the employer.

The accumulated benefit obligation is broken down into vested and nonvested benefits. The vested portions represents the obligations the employer must pay if

the plan was terminated today, while the nonvested portion represents future obligations for the employer once an employee accrues enough service time to have his benefits become vested. In the analysis of quality of earnings, the pension fund should be analyzed in terms of actual current obligations of the employer in relation to the assets available to fund the obligations. Therefore, the variable included in the analysis is the ratio of net pension assets to vested plan benefits (PENSION). As discussed above, these values are not listed on the employer's balance sheet, but instead are disclosed in the notes accompanying the financial statements. Frequently the financial statement user must turn to the footnotes even to find the value of the prepaid pension cost asset or unfunded pension liability since they are incorporated in the balance sheet accounts under titles such as "other assets" or "accrued compensation and benefits."

C. SUMMARY OF QUANTITATIVE MEASURES

The quantitative measures discussed above were developed by considering the characteristics of quality of earnings pertinent to the defense contracting environment. The variables and method of calculation are summarized in Table 2. These variables will be used in the statistical analysis of the next chapter which analyzes their relationship to other security valuation measures.

TABLE 2

QUALITY OF EARNINGS VARIABLES

(1) $$DNP = \frac{\text{Depreciation + Amortization}}{\text{Average Net Plant, Property and Equipment}}$$

(2) $$RD = \frac{\text{Company Sponsored R\&D Expense}}{\text{Sales}}$$

(3) $$CVEPS = \frac{\text{Std. Deviation of EPS}}{\text{Average EPS}} = \frac{\left[\frac{\sum (EPS - \overline{EPS})^2}{n-1}\right]^{1/2}}{\overline{EPS}}$$

(4) $$SDROE = \left[\frac{\sum_{i=1}^{n} (r_i - \bar{r})^2}{n-1}\right]^{1/2}$$

where: $$r = \frac{\text{N.I. After Taxes and Preferred Dividends}}{\text{Avg. Common Equity}}$$

(5) $$TIE = \frac{EBIT}{\text{Interest Expense}}$$

where: EBIT = Earnings Before Interest and Taxes

(6) $$GOVT = \frac{\text{Gov't Sales}}{\text{Total Sales}}$$

(7) $$BKLG = \frac{\text{Funded Backlog}}{\text{Sales}}$$

(8) $$ECONI = \frac{\text{Earnings From Continuing Operations}}{\text{Net Income}}$$

(9) $$TAX = \frac{\text{(Statutory Rate - Effective Rate)}}{\text{(1 - Effective RAte)}}$$

TABLE 2 (CONTINUED)

$$(10) \quad CFNI = \frac{\text{Net Income + Depreciation + Amortization}}{\text{Net Income}}$$

$$(11) \quad CFONI = \frac{\text{Net Cash Provided by Operating Activities}}{\text{Net Income}}$$

$$(12) \quad IATA = \frac{\text{Intangible Assets}}{\text{Total Assets}}$$

$$(13) \quad CR = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

$$(14) \quad Pension = \frac{\text{Net Pension Assets}}{\text{Vested Plan Benefits}}$$

D. SAMPLE SELECTION/DATA COLLECTION

1. Sample of Defense Contractors

The objective of this study is to determine if the quality of earnings concept can be usefully employed in the analysis of defense contractors. An arbitrary sample size of 25 defense contractors was selected in order to provide a representative sample, while still permitting manual data extraction from annual shareholder reports. Since the time period of interest is 1986-1988, the companies included in the sample are the 25 defense contractors having the largest dollar value of government contracts in 1987, as reported in the July/August 1988 issue of Military Forum [Ref. 19:p. 15].

2. Data Collection

Upon sample selection, financial performance data (annual reports to shareholders and SEC 10K reports) were collected from the companies of interest for 1986-1988 through correspondence with the firms using their address listed in the Standard and Poor's Register [Ref. 20]. Follow-up letters were sent to those companies which did not provide all the information requested in the initial correspondence. A complete set of annual reports (1986-1988) was collected for 21 companies, with an additional three companies providing reports for 1988 only or both 1987 and 1988. The SEC 10K reports received included 20 reports for 1988 and approximately ten from each year 1986 and 1987. The lower response rate for 1986 and 1987 should not adversely affect the study since most of the companies' 1988 reports contain summaries of data from previous years for comparison purposes. The 24 defense contractors which provided at least the 1988 annual report, and thus are included in the study, are shown in Table 3.

E. SUMMARY

The concepts developed in Chapter II and features peculiar to the defense contracting environment were used to develop the specific quantitative measures of quality of earnings discussed above for the companies of interest. In the next chapter, hypotheses will be developed regarding the expected relationship of these quality of earnings variables

TABLE 3

SAMPLE OF 24 DEFENSE CONTRACTORS

Company	NYSE Symbol
McDonnell Douglas Corporation	MD
General Dynamics Corporation	GD
General Electric Company	GE
Lockheed Corporation	LK
Raytheon Company	RTN
Martin Marietta Corporation	ML
Boeing Company	BA
United Technologies Corporation	UTX
Grumman Corporation	GQ
Unisys Corporation	UIS
Rockwell International Corporation	ROK
Litton Industries, Inc.	LIT
Tenneco, Inc.	TGT
Honeywell, Inc.	HON
International Business Machines Corporation	IBM
Textron, Inc.	TXT
Westinghouse Electric Corporation	WX
GTE Corporation	GTE
LTV Corporation	LTV
TRW, Inc.	TRW
Texas Instruments	TXN
Northrop Corporation	NOC
ITT Corporation	ITT
Allied-Signal, Inc.	ALD

to a firm's P/E ratio. Using financial data from defense contractors, the hypotheses will be tested statistically to determine if the quality of earnings concept can be usefully employed in security analysis.

IV. DATA ANALYSIS AND INTERPRETATION

This chapter presents the statistical analysis of quality of earnings variables for defense contractors and the implications of the results. The chapter first describes the conceptual framework and specific hypotheses of the analysis. This is followed by a detailed description of the statistical tests used in the study and a discussion of the results.

A. CONCEPTUAL FRAMEWORK FOR STATISTICAL TESTS

The statistical analysis presented in this chapter analyzes the relationship of several hypothesized quality of earnings variables for defense contractors to their price earnings (P/E) ratio. Since the P/E ratio is a common security valuation measure, knowledge of this relationship provides insight into the role of the quality of earnings concept in security analysis. The statistical analysis described below could be used for two related, yet very distinct purposes: (1) to validate specific hypothesized quality of earnings variables as explanatory predictors of a firm's P/E ratio, and (2) to test the hypothesized market reaction to valid quality of earnings indicators. The structure and assumptions inherent in each of these types of analyses are discussed below.

1. Validation of Quality of Earnings Variables

The primary assumptions in this perspective are that the P/E ratio is set in the market by investors and it reflects quality of earnings. Price earnings ratios will be higher for companies with high quality earnings than those with low quality earnings. Hawkins points out that this assumption is justified based on mathematical logic as well as investors goals [Ref. 4:p. 210]. For example, consider two similar companies with one company using "conservative" accounting policies and the other using "liberal" policies. The firm with conservative accounting policies will show lower earnings for the same time period.

> However, efficient market theory suggests that the stock market will see through the accounting differences and place a similar stock price value on the two companies ....simple arithmetic dictates that the company with the more conservative lower earnings will have a higher total market value to earnings multiplier [P/E ratio] than the company with the more liberal higher earnings. [Ref. 4:pp. 210-211]

Investors are also likely to pay a higher price for the stock of a firm which possesses those characteristics they associate with high quality earnings such as low risk, low uncertainty in future earnings and high cash content of earnings to mention a few. Thus, this perspective considers the P/E ratio as given (set in the market), and the objective of the analysis is to validate the specific hypothesized quality of earnings variables as explanatory predictors of the P/E ratio.

2. Testing Market Reaction to Quality of Earnings

The statistical analysis can also be used to test the hypothesized market reaction to valid quality of earnings indicators. The primary assumptions in this perspective of the analysis are that the specific quality of earnings indicators are valid and that the P/E ratio is a surrogate measure for the market's impoundment of quality of earnings information.

B. HYPOTHESES

The perspectives described above point out two alternative purposes for the statistical analysis. Since no previous empirical studies have focused on the defense contracting environment, the objective of this study is to validate specific hypothesized quality of earnings variables as explanatory predictors of a defense contractor's P/E ratio. The variables included in the study were previously developed in Chapter III. Hypotheses concerning the expected correlation of each variable to the firm's P/E ratio along with a brief explanation of the underlying reasons are summarized in Table 4.

C. DATA PRESENTATION

Of the 24 defense contractors from which data was collected, 22 are included in the statistical analysis. Honeywell Inc. is excluded from the analysis because of a net loss incurred in 1988, resulting in a P/E ratio and

TABLE 4

HYPOTHESES

VARIABLE	EXPECTED CORRELATION TO P/E RATIO	UNDERLYING JUSTIFICATION
DNP	POSITIVE	Higher depreciation shows proper recognition of the decline in service potential of plant assets; results in conservative statement of earnings.
RD	POSITIVE	Higher discretionary R&D expenses shows management concern for future earnings.
CVEPS	NEGATIVE	CVEPS measures earnings instability; Instability of earnings adversely affects quality.
SDROE	NEGATIVE	SDROE measures total risk; the higher the risk the lower the quality of earnings.
TIE	POSITIVE	A higher times interest earned ratio indicates lower financial risk which enhances quality of earnings.
GOVT	NEGATIVE	GOVT measures the business risk of the contractor in terms of the degree of reliance on government contract work. Over-reliance on a single customer detracts from quality of earnings.
BKLG	POSITIVE	BKLG indicates future demand for a firm's products and thus a high BKLG promotes future earnings stability; enhances the quality of earnings.
ECONI	POSITIVE	ECONI reflects income derived from continuing operations of the firm; this source of earnings is expected to enhance quality of earnings.

TABLE 4 (CONTINUED)

VARIABLE	EXPECTED CORRELATION TO P/E RATIO	UNDERLYING JUSTIFICATION
TAX	NEGATIVE	TAX measures the portion of net income derived from the benefits of a lower effective tax rate than statutory rate; benefits are vulnerable to future changes in laws so this detracts from quality.
CFNI	POSITIVE	CFNI measures the portion of net income backed by cash (using the traditional definition of "cash flow"). A higher cash content of earnings enhances quality.
CFONI	POSITIVE	CFONI measures the portion of net income backed by cash flow from operating activities (using the definition of "cash flow" from GAAP). Similar to CFNI, a higher cash content of earnings enhances quality.
IATA	NEGATIVE	IATA measures asset realization risk. A high asset realization risk detracts from quality of earnings.
CR	POSITIVE	CR measures the firm's liquidity. A better liquidity position is expected to enhance quality of earnings.
PENSION	POSITIVE	PENSION measures the available plan assets in relation to the vested benefits. A higher ratio is expected to enhance quality of earnings since it indicates that management has conservative pension plan policies.

several other variables that would be meaningless. LTV Corporation was removed from the sample for the same reason, along with the fact that LTV is currently involved in Chapter 11 bankruptcy proceedings. For the remaining 22 companies, two alternative P/E ratios were calculated using 1988 earnings per share, and stock prices for both December 30, 1988, and March 31, 1989, as listed in the Wall Street Journal [Ref. 21]. Both P/E ratios were calculated because of the possibility that there could be a time delay factor involved in the market's reaction to quality of earnings information. This could occur because the companies typically publish their annual reports to shareholders and the SEC 10K reports during the quarter following the close of the year being analyzed. The 14 quality of earnings variables were calculated for each company using the formulas shown in Table 2 of Chapter III. A summary of the variables for all companies is shown in Appendix A.

D. PRELIMINARY DATA ANALYSIS

The principal statistical analysis used in this study is a multiple linear regression employing the least squares method. In order to provide for valid statistical inferences from the regression model, the data must not violate the underlying assumptions inherent in the regression procedure. The following paragraphs describe the analysis of the data with regard to these assumptions.

1. Tests of Normality

One of the primary assumptions of the regression model is that the values of the dependent variable (P/E ratio) are normally distributed. If this assumption is violated, the dependent variable may need to be transformed (i.e., with a logarithmic or square root function) to make the distribution approximately symmetrical. The distributions of the two dependent variables, PEDEC88 and PEMAR89, were plotted on histograms to test this assumption. (See Appendix B) The histograms show that the distributions for both PEDEC88 and PEMAR89 are approximately symmetrical in the shape of a normal distribution. Thus, transformation of the two dependent variables is not necessary for the analysis.

2. Observation of Outliers

Another factor which influences the validity of the regression model is when the distributions of the explanatory variables contain "outliers." These outliers influence the magnitude of the coefficients associated with the explanatory variables, and may even change their sign. Analysis of the data in Appendix A with the aid of histograms revealed three outliers in the explanatory variables. These outliers are: TIE for Boeing of 137.67, ECONI for Tenneco of -0.0012 and TAX for Tenneco of -1.22. One possible method of reducing the influence of the outliers is to transform the data using a logarithmic or

square root function. However, since these data points include negative values, this is not a viable method. Instead, the distributions of these explanatory variables were truncated, and the outlier replaced with a value at the truncation point so that the rank order of the distribution was not changed.[1] In this way the influence of the outlier is reduced while maintaining the integrity of the original distribution.

3. Correlation of Explanatory Variables

The final issue which may present a problem in the regression analysis is correlation between the explanatory variables, or multicollinearity. When two independent variables which are significantly correlated to each other are included in a regression model, it is impossible to distinguish the effects of each variable on the dependent variable. The existence of multicollinearity between the independent variables is determined by analysis of a correlation matrix showing the correlation between each pair of variables. The correlation matrix for the 14 independent variables in this study is shown in Appendix C. The matrix shows that there is a moderate correlation between the

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[1]The outliers were replaced with the following values: TIE for Boeing = 18.0, since the histogram reveals a frequency distribution decreasing at a slow rate with a maximum value of approximately 16.5 for the other companies. ECONI for Tenneco = 0.70, since the histogram shows a close distribution with a minimum value of approximately 0.71 for the other companies. TAX for Tenneco = -0.06, since the histogram shows a close distribution of mostly positive values with a minimum of -0.058 for the remaining firms.

variables CVEPS and SDROE (0.629), and between BKLG and IATA (-0.506). Thus when the regression model is constructed, only one of the two variables exhibiting correlation with each other should be included.

Statistical correlation aside, it is possible that two variables may be "conceptually correlated," meaning they are designed to measure the same concept and contain similar information. An example of this type of relationship is that which is present between the variables CFONI and CFNI. Each variable is designed to represent the portion of net income which is backed by cash, however, they are calculated by different methods. The purpose of including both variables in the study is to determine which variable has the most significant association with the P/E ratio. In spite of a low statistical correlation between CFONI and CFNI (i.e., 0.214), only one of these variables should be included in the regression model.

The results of the preliminary data analysis must be kept in mind during the remainder of the statistical analyses. The following sections discuss the analysis of the relationship between P/E ratios and the quality of earnings variables.

E. UNIVARIATE TESTS

Univariate statistical tests measure the relationship between a dependent variable and a single explanatory variable, excluding the effects of the other explanatory

variables. The two univariate tests used in this study are Pearson's Product Moment Correlation and Spearman's Rank Order Correlation.

1. Pearson Product Moment Correlation

Pearson's Product Moment Correlation (R-value) is based on parametric methods of measuring the degree of correlation between two variables. A value of R close to 0 indicates only slight correlation, while a value near +1 indicates a strong positive relationship and a value near -1 indicates a strong negative relationship. Two separate Pearson correlation tests were performed on the data sample. The first tested the correlation of the P/E ratio from December 30, 1988 (PEDEC88), with the 14 explanatory variables, and the second tested the correlation of the P/E ratio from March 31, 1989 (PEMAR89), with the explanatory variables. The results are summarized in Table 5. The significance level of the correlation was found by performing individual regressions of the dependent variable with each explanatory variable (to exclude the effects of the other variables).

2. Spearman Rank Order Correlation

Spearman's Rank Order Correlation is similar to Pearson's Product Moment Correlation, except that it is based on nonparametric methods which establish the correlation between two variables based on their relative rank order in the sample. It thus serves as a check on

TABLE 5

CORRELATION DATA

VARIABLE	CORR. PEDEC88	SIG. LEVEL	CORR. PEMAR89	SIG. LEVEL	RANK CORRELATION PEDEC88	RANK CORRELATION PEMAR89
DNP	-0.185	0.409	-0.223	0.317	-0.256	-0.287
RD	0.094	0.686	-0.073	0.754	-0.047	-0.142
CVEPS	-0.252	0.259	-0.298	0.178	-0.281	-0.379
SDROE	-0.385	0.077	-0.428	0.047	-0.280	-0.439
TIE	0.028	0.900	0.005	0.981	-0.113	-0.237
GOVT	-0.495	0.019	-0.419	0.052	-0.411	-0.320
BKLG	0.119	0.627	0.271	0.262	-0.163	-0.065
ECONI	0.335	0.127	0.363	0.097	0.128	0.238
TAX	-0.263	0.237	-0.270	0.225	-0.086	-0.128
CFNI	0.405	0.061	0.406	0.061	0.361	0.468
CFONI	0.356	0.104	0.430	0.046	0.300	0.468
IATA	-0.196	0.382	-0.270	0.224	-0.047	-0.019
CR	-0.053	0.814	-0.086	0.702	-0.145	-0.150
PENSION	-0.032	0.888	-0.024	0.917	0.006	0.049

CORRELATION WITH PEDEC88
(11 VARIABLES AS EXPECTED)

VARIABLE	SIGNIF. LEVEL
GOVT	0.019
CFNI	0.061
SDROE	0.077
CFONI	0.104
ECONI	0.127
TAX	0.237
CVEPS	0.259
IATA	0.382
*BKLG	0.627
*RD	0.686
*TIE	0.900

CORRELATION WITH PEMAR89
(10 VARIABLES AS EXPECTED)

VARIABLE	SIGNIF. LEVEL
CFONI	0.046
SDROE	0.047
GOVT	0.052
CFNI	0.061
ECONI	0.097
CVEPS	0.178
IATA	0.224
TAX	0.225
*BKLG	0.262
*TIE	0.981

NOTE 1: For correlation with PEDEC88, the variables DNP, CR, and PENSION had opposite signs than expected.

For correlation with PEMAR89, the variables DNP, RD, CR, and PENSION had opposite signs than expected.

NOTE 2: * indicates that this variable changed sign in the Spearman Rank Correlation.

Pearson's correlation by allowing for violations of the more rigorous distributional assumptions inherent in the parametric tests. Rank order correlations were also performed for the P/E ratios from December 30, 1988, and March 31, 1989; the results are also summarized in Table 5.

3. Interpretation of Univariate Tests

Table 5 shows that for the P/E ratio from December 30, 1988, 11 quality of earnings variables had the expected correlation, while for the P/E ratio from March 31, 1989, ten variables had the expected correlation. Spearman's Rank Order Correlation showed changes in signs for those variables with the lowest significance from the Pearson tests. An interesting point to note is that after excluding those variables which changed signs in the rank order test, or had the opposite sign than expected to start with, the remaining eight variables are exactly the same for the two time periods, although their significance varies. Generally, the significance level of the correlation is higher for March 31, 1989, than December 30, 1988, which may indicate that there is a time delay in the market's impoundment of quality of earnings information.

F. MULTIVARIATE TESTS

Multivariate statistical tests are used to examine the relationship between a dependent variable and several explanatory variables. The multivariate tests used in this study attempt to determine the subset of quality of earnings

variables that best explains the P/E ratio. These tests include stepwise regression, where explanatory variables were selected statistically, and other "heuristic" regression models, where explanatory variables were selected judgmentally.

1. Stepwise Regression

Stepwise regression identifies the best subset of explanatory variables using the maximum F-statistic criterion.[2] The analyst can supply the criteria for a variable to enter the model or be removed from the model.

> At each step, the procedure calculates an F-statistic for each variable in the model....If the F-statistic for any variable is less than the [cutoff F-value supplied by the researcher], the variable with the smallest F is removed from the model. The regression equation is calculated for this smaller model, the results are printed and the procedure goes to a new step....If no variable can be removed, the procedure tries to add a variable....The variable with the largest F-statistic is added, provided its F-statistic is larger than the [cutoff F-value supplied by the researcher]....If no variable can enter, STEPWISE ends. [Paraphrased from Ref. 22:pp. 7.15-7.16]

Stepwise regressions were run for PEDEC88 and PEMAR89, allowing the procedure to select from the variables which had the expected correlation with the P/E ratios in the univariate tests. The F-statistic necessary for a variable to enter or be removed from the equation was 4.0, a default value built into the stepwise program. For both P/E ratios, the only variable which entered the regression model was ECONI. Since this variable ranks fifth out of all the

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[2]The F-statistic is the square of the T-statistic commonly used in regression models.

variables in terms of its correlation with the P/E ratios, the cutoff F-values for allowing variables to enter and leave the model were changed to 1.5 and 1.0 respectively. The stepwise regression was run again with significantly different results, as shown in Appendix D. For the regression of PEDEC88, the variables CFNI, GOVT and BKLG entered the model and for the regression of PEMAR89, the variables SDROE, GOVT, CFNI and BKLG entered the model.

The stepwise regression provides a starting point for model refinement, however, it must be scrutinized because of the following limitations:

(1) The stepwise regression procedure eliminates all rows of data which have missing values. Since values are missing for the variables RD and BKLG, the number of companies used in the regression for PEDEC88 is 18 and for PEMAR89 is 19. (Since RD was not included as a variable in the PEMAR89 regression.)

(2) The procedure does not consider mathematical correlations (multicollinearity) between the explanatory variables.

(3) The procedure does not consider any conceptual relationships such as that between CFONI and CFNI.

Recognizing these limitations of the stepwise regression procedure, several additional regression models were run on the data to verify results.

2. Heuristic Regression Models

Several additional regression models were run to test the validity of the stepwise regression and the relationships of CVEPS with SDROE, BKLG with IATA and CFONI with CFNI. Variables included in the models were selected

judgmentally considering the findings from previous tests and the statistical or conceptual correlations between variables. For the regression of PEDEC88 these tests confirmed that the best regression model with statistically significant explanatory variables was in fact the model using CFNI, GOVT, and BKLG. This model has an R-squared value of 73.2% and an adjusted R-squared value of 67.8%. For the regression of PEMAR89, a better model was found (as compared with stepwise) by substitution of CVEPS for SDROE. This model includes the variables CVEPS, CFNI, GOVT and BKLG. The R-squared value is 81.8% and the adjusted R-squared value is 76.6%. The output for both regression models is shown in Table 6.

3. Interpretation of Multivariate Tests

The stepwise and heuristic regression models show that as a group the variables CFNI, GOVT and BKLG are the most significant predictors of quality of earnings (P/E ratio) for defense contractors. The adjusted R-squared value is higher (76.6% vs. 67.8%) for PEMAR89 than PEDEC88 supporting the earlier hypothesis that the time delay may be a factor in the market's impoundment of quality of earnings information. Other regression models are possible, however, they result in lower significance for the explanatory variables and a lower adjusted R-squared value.

In the regression model of PEDEC88 containing the variables CFNI, GOVT and BKLG the t-ratios were 4.84, -5.73

TABLE 6

REGRESSION MODELS

REGRESSION MODEL FOR PEDEC88:

The regression equation is

PEDEC88 = 3.52 - 8.36 GOVT + 4.29 CFNI + 1.37 BKLG

19 cases used 3 cases contain missing values

Predictor	Coef	Stdev	t-ratio	p
Constant	3.515	1.569	2.24	0.041
GOVT	-8.361	1.459	-5.73	0.000
CFNI	4.2907	0.8858	4.84	0.000
BKLG	1.3699	0.4961	2.76	0.015

R-SQ = 73.2% R-SQ(ADJ) = 67.8%

REGRESSION MODEL FOR PEMAR89:

The regression equation is

PEMAR89 = 4.96 - 1.76 CVEPS - 8.80 GOVT + 4.20 CFNI
+ 1.88 BKLG

19 cases used 3 cases contain missing values

Predictor	Coef	Stdev	t-ratio	p
Constant	4.962	1.506	3.29	0.005
CVEPS	-1.7600	0.8918	-1.97	0.069
GOVT	-8.797	1.293	-6.80	0.000
CFNI	4.1981	0.7848	5.35	0.000
BKLG	1.8785	0.4428	4.24	0.001

R-SQ = 81.8% R-SQ(ADJ) = 76.6%

and 2.76 respectively. This shows that each variable possesses quality of earnings information and provides a significant contribution to the explanation of the P/E ratio in the regression model. Additionally, all three variables

have the expected signs for their coefficients: CFNI is positive, GOVT is negative and BKLG is positive. This supports the hypotheses presented earlier in Table 4. Earnings quality is enhanced when a larger portion of reported net income is backed by cash. Over-reliance on government contracts detracts from quality of earnings because it increases the business risk of the contractor. A large backlog of orders enhances the quality of earnings since it indicates future demand for the firm's products and promotes earnings stability.

The regression model of PEMAR89 also shows that the variables CFNI, GOVT and BKLG are significant explanatory predictors of the firm's P/E ratio with t-ratios of 5.35, -6.80 and 4.24. Once again they have the expected signs as hypothesized in Table 4. This model also includes the variable CVEPS with a t-ratio of -1.97 and a negative regression coefficient. As expected, this implies that instability of earnings (as measured by the coefficient of variation of earnings per share) adversely affects the quality of earnings.

G. SUMMARY AND SYNTHESIS OF RESULTS

The objective of this chapter was to validate the specific hypothesized quality of earnings variables for defense contractors by analyzing their relationship with a firm's P/E ratio. For the December 30, 1988 P/E ratio, 11 of the 14 variables had the expected correlation and for the

March 31, 1989 P/E ratio, ten of the 14 variables had the expected correlation. As a group in a regression model, the variables CFNI, GOVT and BKLG (and CVEPS for March 31, 1989 P/E ratio) were the most significant predictors of quality of earnings.

Siegel and Shim [Ref. 1:pp. 68-75] also found that CFNI was a significant quality of earnings variable, however, they did not include GOVT or BKLG as a variable since their analysis covered several industries. This study supports Siegel and Shim's finding that liquidity measures (such as the variable CR) do not have a significant relationship to quality of earnings. Another interesting comparison between this study and Siegel and Shim's study is that they had an adjusted R-squared value of between 51% and 66%, while the regression models discussed above had values of 67.8% and 76.6%. Possible explanations for this difference include:

(1) Siegel and Shim used a much larger sample (252 companies) which spanned industry boundaries.

(2) The firms in this study are largely "blue-chip" corporations which are analyzed very thoroughly, leading to a very efficient market for these companies and a more valid P/E ratio as set in the market.

The results above suggest that each segment of industry may have its own unique quality of earnings indicators which must be defined for the segment of interest to the analyst.

V. SUMMARY AND CONCLUSIONS

A. SUMMARY OF THESIS METHODOLOGY

The overall purpose of this study was to determine if the quality of earnings concept can be usefully employed in the security analysis of defense contractors. The literature relevant to quality of earnings was explored to develop a working definition for quality of earnings and provide background for the remainder of the analysis. Using the underlying concepts presented in the literature and the unique aspects of the defense contracting environment, 14 specific quality of earnings variables were developed for defense contractors. These hypothesized variables were used in a statistical analysis similar to that presented by Siegel and Shim [Ref. 1:pp. 68-75] to validate the variables as explanatory predictors of a firm's P/E ratio. Univariate statistical tests used in the analysis to examine the correlation of each explanatory variable with the P/E ratio included Pearson's Product Moment Correlation and Spearman's Rank Order Correlation.

The results of these tests were used in the subsequent multivariate statistical tests which analyzed the relationship of the firm's P/E ratio with a subset of the 14 explanatory variables. The multivariate tests included stepwise regression, where the explanatory variables were

selected statistically, and other "heuristic" multiple linear regression models where explanatory variables were selected judgmentally. The implications of the statistical tests are discussed in the following section.

B. CONCLUSIONS AND RECOMMENDATIONS

1. Results of Statistical Analyses

The univariate tests showed that 11 of the 14 hypothesized quality of earnings variables had the expected correlation with the P/E ratio from December 30, 1988. Significance levels ranged from 0.019 to 0.900. For the P/E ratio from March 31, 1989, ten of the 14 variables had the expected correlation, with significance levels ranging from 0.046 to 0.981. Overall, significance levels of correlations with the March 31, 1989 P/E ratio was higher than for the December 30, 1988 P/E ratio, indicating that there may be a time delay factor in the market's impoundment of quality of earnings information.

The multivariate statistical tests showed that the variables CFNI, GOVT and BKLG were the most significant quality of earnings predictors for defense contractors. All three variables had the expected sign for their coefficients in the final regression model. CFNI measures the portion of net income backed by cash, so the positive coefficient implies that a higher cash content of earnings enhances quality. GOVT measures the business risk of the contractor in terms of the degree of reliance on government contract

work. Its negative coefficient implies that over-reliance on the government as a customer detracts from quality of earnings. BKLG measures the future demand for a firm's product or services as indicated by the amount of funded unfilled orders. The positive coefficient suggests that a higher future demand for products enhances the quality of earnings because it promotes earnings stability. In addition to the explanatory variables mentioned above, the variable CVEPS is included in the regression model for the P/E ratio from March 31, 1989, with a negative regression coefficient. Since CVEPS is a measure of earnings instability, this supports the hypothesis that earnings instability adversely affect quality of earnings.

The regression model for PEDEC88 had an adjusted R-squared value of 67.8% with t-ratios for CFNI, GOVT and BKLG of 4.84, -5.73 and 2.76 respectively. The regression model for PEMAR89 had an adjusted R-squared value of 76.6% with t-ratios for CFNI, GOVT, BKLG and CVEPS of 5.35, -6.80, 4.24 and -1.97. The higher adjusted R-squared value for PEMAR89 than for PEDEC88 supports the earlier hypothesis that time delay is an important factor in the market's impoundment of quality of earnings information. The variables discussed above appear to contain significant quality of earnings information for defense contractors, and thus are valid explanatory predictors of a firm's P/E ratio.

2. Recommendations

The sample of defense contractors used in the study was limited to 25 to permit manual data extraction from annual reports and adjustment for accounting policy differences. In this way, the explanatory variables are directly comparable between several companies. However, it is also desirable to extend the statistical analysis presented above to a larger sample of defense contractors using a database of financial information for the firms in order to confirm the results.

3. Research Questions

Chapter I presented three specific research questions for consideration in this study. These questions are restated below along with a brief answer for each one:

(1) What is the state of the art of research on quality of earnings?

The literature relevant to quality of earnings is mainly subjective, with few supporting empirical studies. The previous empirical studies cover time periods up to 1975, so their results may not be valid today. Additionally, new accounting policies such as the Statement of Financial Accounting Standards No. 96 (Accounting for Income Taxes) scheduled for implementation in 1990 have important implications for quality of earnings which should be evaluated in future studies.

(2) How can quality of earnings be measured?

Quality of earnings can be measured with variables such as CFNI, GOVT, BKLG and CVEPS which capture the underlying concepts of quality including cash content of earnings, business risk of the firm, reliance on a single customer and instability of earnings.

(3) Is there a significant relationship between quality of earnings and security valuation measures such as the price earnings ratio?

There is a significant relationship between quality of earnings and a firm's P/E ratio as shown by the results of the statistical analyses in this study. Specifically, for the P/E ratio from December 30, 1988, 67.8% of the variation in the P/E ratio is explained by the significant quality of earnings variables CFNI, GOVT and BKLG. For the P/E ratio from March 31, 1989, 76.6% of the variation in the P/E ratio is explained by the significant quality of earnings variables CFNI, GOVT, BKLG and CVEPS.

C. SUGGESTIONS FOR FUTURE RESEARCH

This study sought to validate specific hypothesized quality of earnings variables as explanatory predictors of a firm's P/E ratio. Once these variables have been validated as predictors, a statistical analysis similar to that presented above can be used to test the hypothesized market reaction to these valid indicators. This will give insight into the usefulness of the quality of earnings variables as predictors of a firm's stock value in the future. More

generally, the fact that quality of earnings variables are strongly associated with stock value suggests that they are relevant measures for assessing the future health and prospects for a firm. Future research to determine if such quality of earnings measures are predictors of other future events, such as timely and satisfactory performance on government contracts, would be of value.

APPENDIX A

SUMMARY OF VARIABLES

COMPANY	PEDEC88	PEMAR89
McDonnell Douglas	8.2421	10.0630
General Dynamics	5.6202	6.0078
General Electric	11.9333	11.8667
Lockheed	3.9778	4.5082
Raytheon	9.1156	9.3367
Martin Marietta	6.0000	6.7407
Boeing	15.0808	16.9776
United Technologies	8.1436	9.0099
Grumman	7.9000	8.8000
Unisys	7.8561	7.2277
Rockwell	7.1546	7.3191
Litton	11.3547	11.9866
Tenneco	8.9188	9.2381
IBM	12.4362	11.1352
Textron	8.8951	10.1124
Westinghouse Elect.	9.2977	9.5848
GTE	12.4302	12.7793
TRW	9.7028	10.3730
Texas Instruments	10.1235	9.7840
Northrop	12.5000	12.3874
ITT	8.8377	9.2763
Allied Signal	10.4839	10.5242

COMPANY	DNP	RD	CVEPS	SDROE	TIE	GOVT	BKLG
McDonnell Douglas	0.167385	0.040480	0.28246	0.020075	2.496	0.645431	1.74869
General Dynamics	0.204198	0.043189	0.66585	0.155459	10.787	0.849953	1.88334
General Electric	0.170478	0.029773	0.18551	0.007826	1.980	0.200000	0.34439
Lockheed	0.203473	0.050614	0.36277	0.076227	7.237	0.859679	0.69613
Raytheon	0.201364	0.033081	0.33451	0.038661	12.234	0.511713	0.82507
Martin Marietta	0.159976	0.034027	1.22069	0.237687	13.268	0.854477	1.95548
Boeing	0.205821	0.044275	0.26905	0.017248	137.667	0.282514	3.16006
United Technologies	0.158703	0.051800	0.48971	0.066136	4.732	0.260000	0.93749
Grumman	0.192997	0.004978	0.57245	0.070083	2.537	0.918119	2.01988
Unisys	0.307310	0.105302	0.81930	0.074042	4.148	0.371880	*
Rockwell	0.186044	0.036045	0.43394	0.014771	11.385	0.473201	0.62781
Litton	0.157410	0.016399	0.29697	0.041891	2.691	0.480000	1.31684
Tenneco	0.057411	*	1.00489	0.099883	1.076	0.136013	0.59695
IBM	0.175412	0.148277	0.13365	0.055858	13.740	0.150000	*
Textron	0.178504	0.031445	0.35168	0.034261	1.720	0.393060	0.84255
Westinghouse Elect.	0.143645	0.016230	0.52813	0.095051	5.841	0.234654	0.46079
GTE	0.113761	0.018044	0.50183	0.064389	2.794	0.157776	*
TRW	0.180351	0.032226	0.68653	0.006107	4.231	0.443426	0.60155
Texas Instruments	0.240187	0.078477	1.25389	0.160317	16.461	0.240000	0.71313
Northrop	0.160887	0.035535	0.54697	0.098838	0.453	0.921875	0.83800
ITT	0.146929	0.009403	0.50317	0.034855	4.103	0.071661	0.17566
Allied Signal	0.114914	0.054329	1.25640	0.036983	2.991	0.192208	0.22798

COMPANY	ECONI	TAX	CFNI	CFONI	IATA	CR	PENSION
McDonnell Douglas	1.00000	0.04348	2.16571	2.12286	0.016239	1.69138	1.98714
General Dynamics	1.00000	0.20768	1.86121	1.10897	0.022621	1.77729	1.34108
General Electric	1.00000	0.04762	1.66923	2.09746	0.077139	1.30523	1.54746
Lockheed	0.70833	0.13158	1.60096	1.50801	0.133976	0.91343	1.67260
Raytheon	1.00000	0.04899	1.52903	0.65782	0.003161	1.10365	1.41660
Martin Marietta	0.89105	0.01932	1.55342	0.31846	0.001687	1.42124	2.05885
Boeing	1.00000	0.06516	1.88111	2.30456	0.024191	1.27681	1.43024
United Technologies	1.00000	-0.02804	1.81384	1.11774	0.020465	1.61448	1.65234
Grumman	1.00000	0.00407	2.31676	0.10264	0.001674	2.45197	1.58068
Unisys	1.00000	-0.05769	1.87158	0.25698	0.165970	1.69460	1.39736
Rockwell	1.00000	0.17085	1.60833	0.85712	0.114416	1.29740	1.48011
Litton	1.00000	-0.02612	2.13219	1.38238	0.091157	1.69360	1.74518
Tenneco	-0.00122	-1.22222	1.61800	-0.06448	0.022387	1.15709	1.67659
IBM	0.94575	0.02077	1.66672	1.04719	0.048277	2.03273	1.82225
Textron	1.16084	-0.05095	1.70392	2.57039	0.088927	1.26196	1.52559
Westinghouse Elect.	1.00024	0.05308	1.42234	0.17817	0.034976	1.07530	0.95409
GTE	1.00000	0.00752	3.08952	2.90493	0.009192	0.95602	2.66882
TRW	1.00000	-0.00152	2.24138	1.31418	0.067762	1.50788	1.54742
Texas Instruments	1.00000	0.07068	2.06497	1.83920	0.034512	2.12490	2.81165
Northrop	1.00000	0.04486	3.31094	0.93666	0.009079	1.08043	0.26490
ITT	1.05018	0.17189	1.61199	2.95716	0.076703	1.18947	1.05514
Allied Signal	1.00000	0.10569	1.81209	1.50790	0.137731	1.28576	1.34667

APPENDIX B

HISTOGRAMS OF DEPENDENT VARIABLES

Histogram of PEDEC88 N = 22

Midpoint	Count	
4	1	*
5	0	
6	2	**
7	1	*
8	4	****
9	5	*****
10	3	***
11	1	*
12	3	***
13	1	*
14	0	
15	1	*

Histogram of PEMAR89 N = 22

Midpoint	Count	
5	1	*
6	1	*
7	3	***
8	0	
9	5	*****
10	5	*****
11	2	**
12	3	***
13	1	*
14	0	
15	0	
16	0	
17	1	*

APPENDIX C

CORRELATION MATRIX FOR THE 14 INDEPENDENT VARIABLES

	EMP	RD	CVEPS	SDROE	TIE	GOVT	BKLG	ECONI	TAX	CFNI	CFONI	IATA	CR
RD	0.457												
CVEPS	-0.078	0.073											
SDROE	0.049	0.105	0.629										
TIE	0.409	0.400	0.076	0.315									
GOVT	0.280	-0.230	0.004	0.370	0.004								
BKLG	0.350	-0.017	-0.143	0.201	0.447	0.442							
ECONI	0.270	-0.198	-0.216	-0.311	-0.050	-0.149	0.043						
TAX	0.080	-0.135	-0.020	0.041	0.364	0.170	-0.065	0.008					
CFNI	-0.075	-0.172	-0.015	-0.015	-0.350	0.253	0.169	0.196	-0.179				
CFONI	-0.065	-0.172	-0.315	-0.400	-0.041	-0.343	-0.041	0.410	0.234	0.214			
IATA	0.305	0.267	0.033	-0.354	-0.182	-0.193	-0.506	-0.007	0.115	-0.298	0.097		
CR	0.402	0.348	0.120	0.175	0.196	0.165	0.388	0.209	-0.145	0.040	-0.230	-0.142	
PENSION	0.031	0.189	0.216	0.217	0.295	-0.211	0.169	-0.138	-0.196	0.016	0.251	-0.140	0.313

APPENDIX D

STEPWISE REGRESSION RESULTS

STEPWISE REGRESSION OF PEDEC88 ON 11 PREDICTORS, WITH N = 18
N(CASES WITH MISSING OBS.) = 4 N(ALL CASES) = 22

STEP	1	2	3	4	5
CONSTANT	-5.242	-7.715	2.720	4.594	3.784
ECONI	14.5	13.3	2.0		
T-RATIO	2.12	2.00	0.32		
CFNI		1.96	4.04	4.18	4.26
T-RATIO		1.52	3.39	3.93	4.78
GOVT			-6.6	-7.0	-8.6
T-RATIO			-3.26	-4.26	-5.75
BKLG					1.36
T-RATIO					2.72
S	2.41	2.31	1.81	1.75	1.47
R-SQ	21.92	32.33	61.49	61.20	74.63

STEPWISE REGRESSION OF PEMAR89 ON 10 PREDICTORS, WITH N = 19
N(CASES WITH MISSING OBS.) = 3 N(ALL CASES) = 22

STEP	1	2	3	4	5	6
CONSTANT	11.008	12.826	14.015	8.114	4.764	4.628
SDROE	-19.3	-27.2	-22.7	-15.5	-10.5	-10.2
T-RATIO	-2.03	-2.76	-2.28	-1.74	-1.60	-1.82
IATA		-24.6	-26.9	-18.5	-0.9	
T-RATIO		-1.85	-2.08	-1.62	-0.10	
GOVT			-2.9	-5.3	-7.7	-7.8
T-RATIO			-1.48	-2.78	-5.07	-5.45
CFNI				3.22	3.83	3.86
T-RATIO				2.63	4.26	4.72
BKLG					1.99	2.01
T-RATIO					3.72	4.50
S	2.47	2.31	2.23	1.88	1.36	1.31
R-SQ	19.52	33.69	42.12	61.28	81.24	81.22

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