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THE RELATIONSHIP BETWEEN SYSTEMATIC OPERATING CASH FLOW RISK AND MARKET RETURNS TO SECURITIES: AN EMPIRICAL STUDY

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THE RELATIONSHIP BETWEEN SYSTEMATIC OPERATING CASH FLOW RISK AND MARKET RETURNS TO SECURITIES: AN EMPIRICAL STUDY

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ABSTRACT

THE RELATIONSHIP BETWEEN SYSTEMATIC OPERATING CASH FLOW RISK AND MARKET RETURNS TO SECURITIES: AN EMPIRICAL STUDY

By

Merle Wayne Hopkins

This research is an empirical investigation of the relationship between corporate cash-flow risk measures and stock market returns. Prior research has generally used accounting income numbers to construct accounting-based risk measures. The association between such measures and systematic risk estimated via a market model has been cited as evidence of the usefulness to investors of accounting data. In this study, the explanatory power of cash-flow risk measures is directly tested.

The testing procedure employed is that developed by Fama and MacBeth. The objective of their research and the present research is to assess directly the relationship between systematic risk and returns to securities. In their study the measure of systematic risk was formed from historical market returns rather than from historical corporate cash flow data as in the present study.

In this study, portfolios of firms with homogeneous cash flow risk levels were formed. The cash flow risk of the portfolio is used as one independent variable among others in an attempt to establish the extent to which market returns (dependent variable) reflect this measure of systematic risk.

The principal hypothesis is that systematic cash-flow risk and market returns are related. The test results are not consistent with this hypothesis. The statistical power of the test procedure was reduced by a large degree of instability in the observed levels of estimated corporate cash flow risk. This instability hindered the formation of portfolios with homogeneous levels of cash flow risk at the firm level and led in part to inconclusive results. Several suggestions to improve the test design are included to be pursued in future research.

DEDICATION

This dissertation is dedicated to my family and friends. Their understanding and confidence have made a major contribution to the completion of this study.

ACKNOWLEDGMENTS

I wish to express my sincere thanks to my dissertation committee of Professor Richard R. Simonds (Chairman), Professor Melvin C. O'Connor, and Professor Kelly Price. Their counsel and encouragement have been appreciated at the various stages in the development and completion of this research.

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Merle Wayne Hopkins

TABLE OF CONTENTS

LIST OF TABLES

ABBREVIATIONS

AICPA	American Institute of Certified Public Accountants
BKS	Beaver, Kettler, and Scholes
CAPM	Capital Asset Pricing Model
CRSP	Center for Research in Security Prices
FASB	Financial Accounting Standards Board
HP	Haugen and Pappas
MM	Modigliani and Miller
NOI	Net Operating Income
NYSE	New York Stock Exchange
OLS	Ordinary Least Squares
PIF	Production, Investment, and Financing

INTRODUCTION

This dissertation investigates the empirical relationship between corporate net operating cash flows and market returns to equity holders. The relationship is explored through the use of an analytical model which relates systematic cash flow risk to firm financial leverage.

Chapter One discusses the significance to investors of cash flow information. Chapter Two reviews the extant literature in this area of research. Chapter Three develops the analytical model used in this study. Chapter Four defines the various cash flow measures employed in empirically testing the model. Statistical test procedures are explained in Chapter Five and the results are presented in Chapter Six. Conclusions and limitations of the present study are detailed in Chapter Seven.

CHAPTER ONE

SIGNIFICANCE OF CASH FLOW MEASURES

This chapter summarizes the importance of actual and expected cash flows to the areas of accounting and finance. From the perspective of finance, these cash flows are discussed in relation to firm valuation and systematic risk.

Providing information leading to accurate prediction of future cash flows to each firm has been mentioned frequently as a desirable objective of financial reporting. Many prominent references to this objective are discussed below. This desirability originates in the understanding that present and future net cash flows to the firm are the ultimate source of cash flows to the debt and equity investors.

The American Institute of Certified Public Accountants (AICPA) appointed a Study Group on Objectives of Financial Statements in April of 1971. This act resulted in a statement of Objectives of Financial Statements (commonly known as the Trueblood Report) issued by the AICPA in October 1973. Among the objectives presented and defended by the Study Group is the following statement:

> Information about the cash consequences of decisions made by the enterprise is useful for predicting, comparing and evaluating cash flows to the users.[1]

The Study Group felt that knowledge about current and expected cash flows to the firm was an essential part of an investor's useful micro-information set. The micro-information set is the aggregation of all information available on a single firm. The investor's objective may be to form reliable expectations of future cash flows to himself via dividends or interest from either equity or debt securities, respectively, or from the proceeds of the sale of these debt or equity securities. This objective assumes a link between cash flows to the firm and cash flows to the investor. All valuation models employing cash flows to the firm as a principal element rely on this presumed relationship.

The Study Group reported the following among the criticisms of current accounting practice relative to an investor's legitimate need for reliable information on or expectations of cash flows to the firm:

> Assertions have been made that the present financial statements do not provide sufficient information about the liquidity and cash flows to an enterprise.[2]

The Financial Accounting Standards Board (FASB) issued its Tentative Conclusions on Objectives of Financial Statements of Business Enterprises in December 1976. The importance attributed by the Study Group to the firm's cash flow information was adopted and made more explicit by the FASB in these tentative conclusions.

In November 1978, the FASB issued Statement of Financial Accounting Concepts No. 1, "Objectives of Financial Reporting by Business Enterprises." In this Statement the FASB expressed the following view:

> Financial reporting should provide information to help present and potential investors and creditors and others in assessing the amounts, timing, and uncertainty of prospective cash receipts from dividends or interest and the proceeds from the sale, redemption, or maturity of securities or loans. The prospects for those cash receipts are affected by an enterprise's ability to generate enough cash to meet its obligations when due and its other cash operating needs, to reinvest in operations, and to pay cash dividends and may also be affected by perceptions of investors and creditors generally about that ability, which affect market prices

> of the enterprise's securities. Thus, financial reporting should provide information to help investors, creditors, and others assess the amounts, timing, and uncertainty of prospective net cash inflows to the related enterprise.[3]

An important aspect of financial reporting is providing information aiding in assessments of cash flow prospects to the enterprise as the FASB clearly asserted above.

In July 1979, the FASB issued a discussion memorandum on reporting earnings which announced that the resolution of the reporting issues surrounding the relationship between the earnings process and cash flows would wait until the forthcoming project on fund flows and liquidity. The FASB did, however, make the following interesting statement with respect to its current thoughts on the significance of cash flows and the earning process:

> . . . . it is desirable that financial reports should give information on the differences in timing between current earnings and current cash flows and information to help users to project such differences into the future.[4]

The investor-user group has been emphasized in the foregoing discussion on the merits of cash flow data relative to accrual earnings. Equity security and debt security owners or potential owners are included in this investor-user group. Among other user groups which may be interested in cash flow data are sellers of resources where payment is to be deferred.

The decision model approach to accounting theory manifests itself in the specification of cash flows as a variable of interest. This approach to accounting theory holds that the decision model specifies the variable(s) of interest. In this context cash flows achieve importance because they are the driving force of firms' values and the expected values of firms enable an investor to expand or preserve his utility.

The capital asset pricing model (CAPM) based on the two-parameter portfolio theory developed and extended by Markowitz,[5] Tobin,[6] Sharpe,[7] Mossin,[8] and others specifies that the only firm-specific parameter necessary to establish the expected return to firm i is β_i, the systematic risk parameter of firm i in the market portfolio m.

The CAPM is presented and described below:

Eq. 1 $$E(\tilde{R}_{it}) = R_{ft} + \beta_{im} [E(\tilde{R}_{mt}) - R_{ft}]$$

where $E(\tilde{R}_{it})$ equals the expected return on security i in time t, conditional upon β_{im} and $\tilde{R}_{mt}$.

β_{im} = cov $(\tilde{R}_{it}, \tilde{R}_{mt})/\text{var}(\tilde{R}_{mt})$ which reflects the systematic risk of security i in the market portfolio m.

$E(\tilde{R}_{mt})$ = the return on the market portfolio in time t.

R_{ft} = the riskless rate of return.

Note: β_{im} need not be a constant or known ex ante despite its appearance in the CAPM.

Summarizing to this point: (1) there is an extensive body of literature in finance arguing analytically and intuitively that firms' values are functions of actual and expected cash flows. (2) Accounting information is part of the macro-information set available for use by the market participants. This macro-information set is the aggregate of all information available with or without cost to economic decision-makers. Cash flow information for the firm can be derived from the published accounting data. (3) An analytical theory (CAPM) argues persuasively the significance of β_i as the relevant firm-specific risk parameter under a standard set of assumptions. It is an empirical question whether the analytical and intuitive significance of cash flow information to firm valuation can be used to more accurately estimate the systematic risk measure, β_i, than can the use of market return data alone.

Expectations within the two-parameter model describe the process through which equilibrium prices are formed in the marketplace. An equation can be expressed describing the relation between the expected return on any security in an efficient portfolio and the risk contribution that security makes to the portfolio. The market model has been commonly used to generate estimates of β_i via ordinary least squares (OLS) for use in testing the CAPM. The market model is presented below:

Eq. 2
$$\tilde{R}_{it} = R_{ft} + b_i(\tilde{R}_{mt} - R_{ft}) + \tilde{u}_{it},$$

where $\tilde{R}_{it}$ = the return to security i in time t.

R_{ft} = the riskless rate of return in time t.

$\tilde{R}_{mt}$ = the return on the market portfolio in time t.

b_i = the OLS estimate of β_i (referred to here as ex post beta).

$\tilde{u}_{it}$ = the random error term.

$E(\tilde{u}_{it}|\tilde{R}_{mt}) = 0.$

$\text{cov}\,(\tilde{u}_{it},\tilde{R}_{mt}) = 0.$

$\text{cov}\,(\tilde{u}_{it},\tilde{u}_{i,t+1}) = 0.$

Note the subtle and crucial stationarity assumption made when using the market model to implement the CAPM. β_i is assumed to be stationary in its estimation period and over the future time horizon of market participants. This assumption may be the source of the naive belief that this parameter is stable over intermediate time spans. The CAPM does not require the assumption of a stationary β_i. The expectation of β_i will be referred to here as ex ante beta. When β_i will remain stable and is expected to do so, the ex post and ex ante betas will be equal.

The introduction here of the ex ante beta acknowledges that market participants may modify the ex post betas in view of whatever pertinent information is available at time t or is expected to become available between time t and t+n.

In the context of the CAPM and ex ante β, accountants should explore the role of accounting data as a possible source of useful information to investors seeking to revise ex post b_i in such a way that the expectation of future systematic risk is closer to the β_i which will in fact be observed over the relevant time horizon in the future than is ex post beta.[9] The investors may form portfolios to more accurately reflect their tastes for expected risk and expected return if they have better ex ante β estimates.

It should not be concluded, however, that the role of accounting data is or should be limited to this objective of seeking better ex ante estimates of true β_i over some future time horizon.[10]

Two significant implications could result if returns to securities were found to be some function of corporate cash flow data. One, that cash flow data serves as a meaningful determinant of systematic risk. This could be used in a more fully specified market model to perhaps obtain better estimates of ex ante beta than are currently generated using only past return series. Two, that the CAPM might be made into a more complete, richer model through the addition of another variable reflecting the form of the function of cash flow data found to be significant.

What are the theoretical determinants of the systematic risk measure? Fama and Miller develop the concept that β_i is a representation for the standardized covariance of expected outcomes of production, investment and financing decisions (PIF decisions) made by the firm relative to PIF decisions made by other firms in the market.[11] This covariance of expected outcomes of PIF decisions made by the firm and the market would of course be standardized by the variance of the market return. The standardized covariance relation is based entirely upon expectations.

Haley and Schall compare the firm to a money pump.[12] The value of the firm is determined in this context by the firm's output of money to its debt and equity owners and the expected future output of money relative to the market's actual and expected output of money. But where do these expectations of future cash flows to the firm and to the market originate? For a moment, consider the basis upon which PIF decisions are made by the managers of firms. The managerial finance literature is founded upon the premise that managerial decisions (PIF decisions) ought to be made via a careful evaluation of future uncertain cash flows over time.

Thus, when the PIF decisions of a firm change relative to those decisions made by other firms in the market, we should expect a β_i change. The covariance of the current cash flows to the firm and to the market would be expected to differ from the former covariance relation to the extent relative changes in PIF decisions involve current period cash flows. The variance of current cash flows to the market could be altered as a result of the relative change in firms' PIF decisions.

The foregoing directly implies the efficacy of a current cash flow beta. Given the links between cash flows, expected cash flows, firm valuation, and market returns, can a systematic current cash flow risk measure be developed analogous to the market model b_i and be found to be part of the market return generating process?

FOOTNOTES - CHAPTER ONE

[1]American Institute of Certified Public Accountants, Objectives of Financial Statements (New York: 1973), p. 14.

[2]Ibid., p. 16.

[3]Financial Accounting Standards Board, Statement of Financial Accounting Concepts No. 1, "Objectives of Financial Reporting by Business Enterprises" (Stamford, Connecticut: 1978), p. 17.

[4]Idem, Discussion Memorandum: "An Analysis of Issues Related to the Reporting of Earnings" (Stamford, Connecticut: 1979), p. 95.

[5]H. Markowitz, Portfolio Selection: Efficient Diversification of Investments (New York: Wiley, 1959).

[6]J. Tobin, "Liquidity Preference as a Behavior towards Risk," Review of Economic Studies 25 (February 1958): 65-86.

[7]W. F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," Journal of Finance 19 (September 1964): 425-442.

[8]Jan Mossin, "Equilibrium in a Capital Asset Market," Econometrica 34 (October 1966): 768-783.

[9]b_i is the market model's estimate of β_i. b_i is generated from observed returns and has not been revised in any direct way for changes in the return prospects of the firm nor of the market.

[10]James C. Boatsman and Lawrence Revsine, "Firm Specific Accounting Data and the Capital Asset Pricing Model: A Reconciliation and Extension," (unpublished paper, 1979), p. 19.

[11]Eugene F. Fama and Merton H. Miller, The Theory of Finance (New York: Holt Rinehart and Winston, 1972), Chapter 7.

[12]Charles W. Haley and Lawrence D. Schall, The Theory of Financial Decisions, 2d ed. (New York: McGraw-Hill Book Company, 1979), p. 25.

CHAPTER TWO

LITERATURE REVIEW

Chapter One outlined in some detail the role the present research plays in identifying the determinants of systematic risk. Numerous previous works, many of which are discussed below, have addressed the problem of identifying these determinants. The purpose of the present chapter is to identify and summarize significant previous research and form an integrated background for the present research. The last part of this chapter is devoted to the integration of previous research papers into a framework which permits the role of the present research to be more fully understood.

The ten papers reviewed in this chapter are grouped conveniently into four areas. The first area includes the papers by Modigliani and Miller,[1] Haugen and Pappas,[2] Hamada,[3] and Myers.[4] These papers develop the idea that both cyclicality and financial leverage should be determinants of systematic risk. These papers generally present empirical or analytical arguments in support of these determinants. The second area contains papers by Lev[5] and Wolfson.[6] These papers suggest that operating leverage in conjunction with financial leverage is a determinant of systematic risk. The third area is composed of the papers by Beaver, Kettler, and Scholes;[7] Thompson;[8] and Bildersee.[9] These papers explore the association between several variables and the observed level of systematic risk displayed by the firm. The predictive power of these variables with respect to future observations of the level of systematic risk displayed by the firm is also explored. The variables analyzed in this area include both accounting variables (risk measures) and corporate decision variables. The fourth area contains only the Fama and MacBeth[10] paper. This paper provides the basic procedures for testing the research hypotheses in the present paper.

Empirical and Analytical Determinants of Systematic Risk

Myers[11] presented a review of empirical research in the area of systematic risk determinants. In addition, he developed a model incorporating variables which he analytically showed to be determinants of systematic risk.

In his review of significant empirical research, it became apparent that the principal emphasis to date has been on accounting variables. Occasionally, these accounting variables have been used in conjunction with financial market variables. Myers was troubled by the use of financial market risk measures in attempting to understand the determinants of systematic risk. He felt that those financial market measures would reflect not only the real sources of systematic risk but also the variables perceived as proxies of those real sources. For this reason, he believed that studies should exclude financial market measures from the independent variables used as prospective determinants of systematic risk.

Myers pointed out that the determinants of systematic risk need not be the same each period, and that the relative roles played by the various determinants of systematic risk need not be the same across all time periods. Thus, he argued that the initial problem would be the identification of the various determinants of systematic risk. With these determinants identified, the relative roles they played could be examined over time.

Myers' empirical research summary listed four measures thought to be determinants of systematic risk and which the empirical tests had confirmed as being generally significantly associated with systematic risk: cyclicality, earnings variability, financial leverage, and growth. Cyclicality described the relation between the earnings process for a single firm and the earnings process of the market. If these two earnings processes tend to move closely together, then the cyclicality measure would be high for the firm. Conversely, a low cyclicality measure would reflect an earnings process largely immune from fluctuations in the earnings process of the market. Myers concluded that the significance of earnings variability may have stemmed from its being a surrogate for cyclicality. He felt that financial leverage was well supported in the empirical research literature as a determinant of systematic risk. He noted that the measurement problems surrounding the testing of growth were especially troublesome. Growth exhibited uneven significance as an explainer of systematic risk over the studies he examined in which it had been one of the variables examined. It may be that the special measurement difficulties for this hypothesized determinant make the erratic significance understandable.

In the portion of his paper that developed an analytical model explaining the role played by the hypothesized and empirically supported determinants of systematic risk, Myers concluded that cyclicality, earnings variability, and financial leverage should be determinants of systematic risk. He began by assuming that cyclicality was a determinant. His analytical work did not confirm the empirically irregular significance of growth as a determinant of systematic risk. The principal significant feature of the model he developed is the covariance between the market's earnings and the "surprise" portion of the firm's earnings. Another feature of the model is a term reflecting the elasticity of earnings expectations. This term reflects the covariance of elasticities of earnings expectations for the individual firm and for the market. Specifically,

Eq. 3 $$\beta = B \left(\frac{r + \eta}{1 - \lambda \rho \sigma_{\delta}} \right),$$

where $B = \dfrac{\text{cov}\,(\tilde{R}_m, \delta)}{\sigma_m^2}$.

$r =$ one period rate of riskless interest.

$\eta =$ elasticity of expectations or the ratio of the signal of a changed mean earnings to the sum of this signal plus noise contained in the signal.

$\lambda =$ the price of risk as traditionally expressed, or

$$\frac{\tilde{R}_m - R_f}{\sigma(\tilde{R}_m)} .$$

$\rho =$ the correlation between a security's rate of return and the market's rate of return.

$\delta =$ (expected cash flow at time $t)_{t-1}$ - (actual cash flow at time $t)_t$.

This suggests intuitively the relevance of an ex ante beta as the variable of interest based upon those elasticities of earnings expectations. Myers concluded that it is questionable whether cyclicality can be measured by a single statistic. He acknowledged that an important problem existed in the comprehensive measurement of cyclicality for use in empirical studies.

Operating Risk and the Cost of Capital

Modigliani and Miller[12] claimed in their Proposition II that the expected return to equity investors (r_j) was a linear function of the capitalization rate (ρ_k) appropriate for the firm's operating characteristics, the risk premium originating in the risky operating characteristics ($\rho_k - r$), the risk-free rate of return (r), and the debt/equity ratio (D_j/S_j):

Eq. 4
$$r_j = \rho_k + (\rho_k - r)\frac{D_j}{S_j} .$$

A firm has an inherent operating risk level associated with the operating characteristics of the firm. This risk level cannot be changed by financial leverage within MM's risk classes. MM argued that financial leverage can only change the systematic risk levels borne by the various classes of debt investors relative to the systematic risk experienced by the equity investors. It follows directly that financial leverage should be a determinant of the systematic risk level experienced by the equity investors. Conversely, financial leverage should not be a determinant of the systematic operating risk levels displayed by the firms within the risk-class construct utilized by MM.

Before MM's Proposition II, the traditional view had been that the required rate of return to equity investors in the absence of taxes was invariant with respect to the debt ratio employed by the firm until some critical debt level had been surpassed. MM argued that investors were sensitive to even low levels of financial leverage because of the effect such leverage had on the distribution of returns to equity investors. The significance of the work by MM is that financial leverage should be positively correlated with the required rate of return across all levels of financial leverage. This viewpoint is consistent with the CAPM regarding the role of borrowing or lending upon the return required by the equity investors.

Operating Risk, Cost of Capital, and Risky Debt

Haugen and Pappas[13] analytically linked the theory of investor behavior toward risk with the theory of corporate finance. Essentially, they showed that Modigliani and Miller (MM) were correct in the Net Operating Income construct for the cost of capital. Haugen and Pappas showed that the cost of capital for the firm was invariant with respect to the extent of financial leverage undertaken by the firm. Moreover, Haugen and Pappas demonstrated this result without the restrictive use of MM's homogeneous business risk classes.

Haugen and Pappas's analytical results suggest that one can use the systematic risk level of the firm in conjunction with the systematic risk level of the firm's risky debt securities and the firm's level of financial leverage to obtain an alternative specification of the systematic risk level of the firm's equity securities. The analytical framework developed by them provides the basis for present study. See Chapter Three of the present research for the details of their analytical framework as it has been implemented here.

Financial Leverage and Systematic Risk

Hamada[14] examined the relationship between levels of financial leverage and systematic risk. One motivation for this research was to confirm the MM theory, which argued that the financial leverage would increase the rate of return required on equity securities.

Hamada assumed MM to be correct and proceeded to construct both levered and unlevered return measures. The latter is the levered return measure which has been adjusted both in the numerator and denominator to represent what the unlevered return would have been. These unlevered returns are not directly observable since virtually all firms utilize some degree of financial leverage. First, the levered systematic risk measure and then, the unlevered systematic risk measure as Hamada developed them:

Eq. 5 $$\beta_{levered} = \frac{\text{cov}\,(\tilde{R}_{Bt}, \tilde{R}_{mt})}{\sigma^2(\tilde{R}_{mt})} .$$

Eq. 6 $$\beta_{unlevered} = \frac{\text{cov}\,(\tilde{R}_{At}, \tilde{R}_{mt})}{\sigma^2(\tilde{R}_{mt})} .$$

where $$\tilde{R}_{Bt} = \frac{(X - I)(1 - \tau)_t - P_t + \Delta G_t}{S_{Bt-1}} .$$

I = interest payments.

P = preferred stock dividends.

S_{Bt-1} = the market value of the firm's common shares at the beginning of the period.

$$\tilde{R}_{At} = \frac{X\,(1 - \tau)_t + \Delta G_t}{S_{At-1}} .$$

S_{At-1} = the market value of the firm's common shares if the firm had no debt or preferred shares.

$\tilde{X}_t$ = the firm's earnings before taxes, interest, and preferred dividends.

τ = the corporate tax rate.

ΔG_t = the change in the firm's future growth opportunities occurring since t-1.

$\sigma^2(\tilde{R}_{mt})$ = the variance of the return to the market.

$\tilde{R}_{mt}$ = the market rate of return at time t.

These levered and unlevered return measures were constructed from annual CRSP and Compustat data. The return measures were separately regressed onto a market return index. The market return index was the NYSE arithmetic rate of return where the dividends had been reinvested. The study included 304 firms which had complete data on both CRSP and Compustat tapes over the 20-year span, 1948-1967. The regressions were run using 20 annual observations for each measure.

Hamada reported results consistent with the hypothesis that financial leverage is associated with a higher level of systematic risk. He claimed to have explained 20-24 percent of the mean systematic risk levels through the use of his levered and unlevered return measures. Thus he argued that financial leverage must be a determinant of systematic risk because it alone had explained a significant proportion of the value of the mean beta.

Hamada acknowledged problems in the measurement of the unlevered return measure. However, he claimed support for the role of financial leverage as a determinant of systematic risk in spite of the measurement problems. Unless the direction of the measurement errors can be assessed, the results obtained may be because of, rather than in spite of, those measurement errors. However, measurement errors need not necessarily work against a significant finding.

Hamada did conduct further regressions to check the apparent adequacy of the unlevered systematic risk estimates. He modified the unlevered systematic risk measure and proceeded to regress the modified risk measure on the traditional market-return determined systematic risk measure. The slope coefficients observed in these regressions were remarkably near 1.00 when using a 20-year average for the ratio of the equity's market value in the levered case (numerator) and in the unlevered case (denominator). This ratio was the device used to modify the unlevered systematic risk. A slope coefficient of 1.00 would have indicated a perfect positive relation between the two risk measures.

Of significance to the present research is Hamada's conclusion that financial leverage is a determinant of systematic risk. This conclusion has been regarded as valid. For example, Myers later stated that Hamada's empirical results "justify substantial confidence in the link between financial leverage and the stock beta."[15] Myers even excluded financial leverage from his analytic model because he felt no further analytical justification was required in defense of financial leverage as a determinant of systematic risk.[16]

Hamada's investigation of the relationship between financial leverage and systematic risk could have been conducted at the portfolio level. This might have reduced the role of measurement errors inherent in the measurement of the return to the unlevered securities. If those measurement errors were random, they could be expected to be reduced if portfolios were formed either randomly or using some ranking on the observable level of systematic risk.

Operating Leverage and Systematic Risk

Lev[17] hypothesized and then analytically demonstrated that the firm's degree of operating leverage has a positive relation to the systematic risk level displayed by the firm's equity securities.[18] This analytic conclusion was consistent with the theory put forth by Fama and Miller[19] that the production, investment, and financing decisions made by a firm were collectively reflected in the systematic risk measure. The production and investment decisions made by the firm relative to similar decisions by other firms would influence the firm's relative operating results in response to relative changes in the demand for the goods and services produced by the firm or by the market. Thus, intuitively, operating leverage and its determinants should have an influence on the systematic risk level of the equity securities.

Lev regressed the total cost of production onto the level of ouput achieved by the firm measured in relatively homogeneous units. He used the resulting slope coefficient as his surrogate for the variable cost per unit of output. In the next step of his study, he regressed the firm's systematic risk measure onto the variable cost per unit in order to assess the strength of that relation. The results of regression confirmed his hypothesis and analytic conclusion that there is a positive and significant relation between operating leverage and systematic risk.

In selecting firms for inclusion in his study, Lev restricted himself to industries whose units of output were relatively homogeneous so he could cross-sectionally consider many firms within the same industry. Industries selected were electric utilities, steel production, and oil production. There were two test periods, 1949-1968 and 1957-1968. These periods of overlapping years, but of differing lengths, reduced the sensitivity of the conclusions to changes in the production technology within these industries. Lev's results confirmed the relation between the firm's operating leverage and systematic risk of the firm's equity securities.

Operating Leverage and Financial Leverage

As many authors have shown, financial leverage is considered to be a determinant of systematic risk. In his dissertation, Wolfson[20] has shown empirically that financial leverage and operating leverage are inversely related to each other. Moreover, he has shown that both are directly related to the systematic risk level of the firm's equity securities. Thus, these sources of risk are complementary in their effect on the overall systematic risk level of the firm's equity securities.

In establishing this link on an intuitive plane, Wolfson used agency cost arguments. Agency cost is the difference in the firm's market value caused by the necessity to use professional management personnel rather than owners and lenders in management. He argued that when a firm exhibits any degree of financial leverage, maximizing the value of equity may not be consistent with maximizing the value of the firm. Managers acting for equity owners may select investment opportunities which are sub-optimal with respect to maximizing the firm's value. Their justification for making these decisions may be a desire to abide by the indenture agreements put in place by the debt security owners. These creditors have perhaps sought to restrict the kinds of operating decisions the managers could make so the risk level of the firm could not be substantially increased. A drastic increase in the operating risk level of the firm could cause a wealth transfer from the debt owners to the equity owners. The sudden increase in the operating risk could result from entrance into a very risky but profitable venture where the debt securities prices would fall.

In his empirical testing, Wolfson used monthly time series of several variables which were taken from the monthly CRSP tapes, or which were constructed from both CRSP and Compustat data. His primary effort was to estimate the systematic operating risk, overall systematic risk, variability of the operating return measure, and the degree of financial leverage, each for adjacent 30-month periods within a 60-month span. The systematic operating risk measure was obtained by regressing a market-value-weighted return to holders of various classes of debt and equity of a single firm onto the return to the equally weighted market index. Through the use of a Chi-square test, he found that the interrelationships he hypothesized were present in the variables he constructed.

The significance of Wolfson's work is that consideration of operating risk in the absence of consideration of financial leverage may produce erratic results. Moreover, both kinds of risk are positively related to the firm's overall cyclicality risk level. In light of Wolfson's findings, it is not prudent to explore the role played by cash flow risk without controlling for the degree of financial leverage employed by the firm.

If systematic cash flow risk were the same as either Lev's operating leverage or Wolfson's operating risk, then Wolfson's findings would strongly argue for the simultaneous inclusion of financial leverage into the consideration of either as a determinant of systematic risk. Systematic cash flow risk, however, is not the same as either operating risk or operating leverage. Whether one of these can be a surrogate for the other is an interesting issue, but not relevant to the present research.

Accounting Measures of Risk and Systematic Risk

Beaver, Kettler, and Scholes[21] (BKS) conducted one of the earliest studies in the testing of the contemporaneous relation between accounting measures of risk and the market-determined measure of risk (ex post beta), and the usefulness of accounting measures of risk to predict the relevant systematic risk parameter (ex ante beta). This study can be interpreted as (1) an attempt to explore certain traditional accounting-based risk measures, looking for evidence that one or more of these accounting risk measures contemporaneously reflects a determinant of systematic risk, or as (2) an attempt to establish a causal relation between the accounting risk measures and the market risk measures. The authors felt that an accounting system could be constructed or defended in terms of the decision-making criterion if either interpretation of their first objective was supported.

The accounting risk measures were developed from a review of the traditional security analysis and valuation literature. No analytic theory was used in defense of these specific accounting measures of risk. One accounting risk measure, however, is substantially exempt from these comments. Specifically, the accounting beta has an intuitively and conceptually persuasive body of reasoning behind its selection for use in the BKS study.

The BKS study analyzed the financial statement data of 307 firms whose annual Compustat data and monthly CRSP data were complete for the 1947-1965 period. The 19-year period was broken into two time periods so tests could be run assessing the stationarity of the accounting and market-based risk estimates between the two periods. The contemporaneous association tests were conducted via correlation analysis at both the individual security level and the portfolio level. The correlations in both time periods were statistically significant for four accounting risk measures: payout ratio, financial leverage, earnings variability, and accounting beta. This significance held at the individual security level and at the portfolio level.

The tests of prediction of future systematic risk involved the use of certain accounting risk measures from the first period (1947-1956) to form an estimate of the systematic market risk to be observed in the second period (1957-1965). These estimates were contrasted against the naive systematic risk forecast, where the systematic risk level in the first period is used without modification as the forecast of the systematic risk in the second period.

Multiple stepwise regression was used to select the accounting variables used in making the forecast of the systematic risk to be observed in the second period. Multicollinearity was a concern, and ultimately only three accounting variables were selected for use in making the forecast of systematic risk: payout ratio, growth, and earnings variability. Note that neither financial leverage nor the accounting beta were used in generating the forecasts of the systematic risk level to be observed in the second period. The BKS forecast of beta through accounting risk measures slightly outperformed the naive forecast of beta in explaining variation between the levels of systematic risk observed.

BKS suggested two explanations of their results: (1) investors do use the accounting risk measures in making their decision, and (2) the accounting risk measures reflect some of the same underlying processes which influence the behaviors of investors. One cannot conclude that the accounting risk measures are a causal force in this relationship. The scant improvement obtained through the use of the accounting risk measures over the use of a naive forecast of ex ante systematic risk does not serve as impressive evidence that these accounting measures are causal factors. Moreover, the authors made no analytic argument for there being such a relationship. Only for the accounting beta and financial leverage can one develop a plausible argument that these accounting risk measures could be a vital force in the relationship.

If there is any other accounting variable which is correlated with the accounting income measure, then this other variable is a possible source of confounding. At most, this other accounting variable could be the force driving the systematic risk generation process. Cash flows to firms should be correlated with the accounting income measure.

Accountants would suspect that their income measure is the driving force in this relationship. We must remember that the accounting income measure is the result of applying a myriad of accounting rules. Accounting income is an empty economic concept except that it may, under certain unusual circumstances, represent an approximation to economic income. Income measured in cash flows may provide a better understanding of the risk-return relation than does the measurement of income via the accounting income concept.

BKS could have included a cash flow risk measure in their correlational studies. Inclusion of that accounting variable might have contributed to our understanding of the role of net operating cash flows to the firm in the determination of the systematic risk exhibited by the equity securities of the firm.

Covariant Forms of Accounting Variables and Systematic Risk

Thompson conducted another test of contemporaneous association between the various forms of accounting variables and the ex post level of systematic risk.[22] The principal contribution of this study was his emphasis on the form of the accounting variables themselves. Specifically, he investigated the relation between the mean, trend, covariance, and variance forms of the accounting variables selected relative to the observed systematic risk level.

Thompson developed a model which suggests that covariance forms of some accounting variables may exhibit a higher association with the systematic risk level observed ex post. The model is presented below with time subscripts deleted:

Eq. 7
$$\beta_i = \frac{\text{cov}\ [(\tilde{d}_i + \tilde{e}_i + \tilde{k}_i),\ (\tilde{d}_m + \tilde{e}_m + \tilde{k}_m)]}{\sigma^2(\tilde{d}_m + \tilde{e}_m + \tilde{k}_m)},$$

where d, e, and k represent dividends, accounting earnings, and earnings multiple measures, respectively. Thompson also used the separate covariance/variance components in combination to form dividend betas, earning betas, and earnings multiple betas. These betas were also used in the correlation results he reported. Thompson conducted the tests on individual firm data, and on data from portfolios which had been formed to minimize the impact of measurement errors in the accounting variables selected.[23]

Thompson identified 290 firms which had complete data available for at least one of the two testing periods, 1951-1959 and 1960-1968. To be included, the firm had to have complete data available for construction of the accounting variable being correlated with the systematic risk level. The composition of the samples investigated differed for each accounting variable examined and for each of the two testing periods for these reasons. The actual sample sizes ranged from 193 to 282 firms, depending upon which variable and which testing period was examined.

The correlation coefficients at the individual security level were generally statistically different from zero. However, the sizes of the correlation coefficients were not economically impressive. Thompson concluded that the covariant forms of the explanatory variables were more closely correlated to the levels of systematic risk than were the mean and variance forms during the 1951-1959 period. He did not conclude that the covariant forms were more closely correlated with systematic risk during the second testing period 1960-1968.

The correlation coefficients at the portfolio level were nearly all statistically different from zero. More important, the size of most of the coefficients was impressively large, with many of them being higher than .70. An accounting risk measure was investigated at the portfolio level only if at the individual security level it had a high correlation with the systematic risk level, had the correct sign, had consistent implications for both testing periods, and had been found to be correlated in previous analytic or empirical work. Perhaps the high degree of correlation observed at the portfolio level can be more easily understood because of these rigorous selection criteria. Tests at the portfolio level were run only on data from 1960-1968 because of the need to use data from the earlier period to rank the firms for portfolio formation.

Thompson then ran multiple regressions using the firm's systematic risk as the independent variable. The independent variables generally were the accounting risk measures which had been identified as being highly associated with the systematic risk level when observed at the portfolio level.

Thompson's objective was to see which combinations of accounting risk variables seemed to be better explainers of the observed level of systematic risk. When he used the covariant forms for dividends, earnings, and earnings multiples, he obtained an r^2 of .846 (standard error of .063). In the regressions using the mean dividend payout, earnings variance, and the earnings multiple variance, he obtained an r^2 of .658 (standard error of .093). Based on these results, he concluded that the use of the covariant forms did add noticeably to the ability of these variables to explain differences in levels of systematic risk.

Thompson appears to have empirically justified the use of the covariant forms of the variables which are being explored as possible determinants of systematic risk. His results were impressive. Moreover, they are encouraging for the use of covariant forms of other accounting variables. This is especially true if an analytic framework exists or can be developed defending the use of a particular accounting variable in some form. In order for significant empirical results to be compelling, there must be an analytic theory explaining why the results should be as they are. In the absence of such an analytic theory, the significant findings seem to be the result of chance.

Corporate Decision Variables and Systematic Risk

Bildersee[24] demonstrated that a higher adjusted r^2 in a multiple regression could be obtained if corporate decision variables were added to the set of independent variables commonly used to explain the systematic risk exhibited by common equity shares. Bildersee interpreted his improved explanatory power to imply that the information added to the multiple regressions by the decision variables must be non-overlapping with the information contained in the accounting variables. His conclusion appears plausible.

The sample was limited to those firms having both traded common and traded non-convertible preferred shares. Ninety-eight such firms were included in this study.

Bildersee looked at the dividend decisions on the firm's common and preferred shares. From these dividend decisions he structured dummy variables. These dummy variables were used in conjunction with accounting variables traditionally used in systematic risk association studies. One decision variable did not deal with dividend policy. He called it the diversification variable and it reflected changes in the firm's SIC code in comparison with the firm's Compustat industry number.

Bildersee reported an adjusted r^2 of .598 for multiple regressions of systematic risk onto independent variables comprised of accounting risk measures and decision variables. These results were obtained at the individual security level. No results were reported from regressions of the same variables measured at the portfolio level.

Fama and Miller[25] had previously argued that the observed systematic risk level should be a summary measure of the impact of the production, investment, and financing decisions made at the firm level relative to those made by firms comprising the market index. Building directly upon that idea, Bildersee demonstrated that decision variables (largely related to dividend policy) can be added as independent variables to multiple regression analysis in order to improve the explanatory power of the association.

The significance of Bildersee's work for the present research is its emphasis that the scope of the variables which can be legitimately considered for inclusion in a systematic risk association study is much broader than merely looking at accounting variables.

Empirical Relation between Ex Post Risk and Market Returns

Fama and MacBeth[26] developed procedures for testing the strength of the association between ex post beta (b_i) and the market returns to the related equity security. Their work supported the CAPM as an adequate explainer of the risk-return relation. The details of the testing procedure used in Chapter Five of the present research are essentially those developed by Fama and MacBeth.

The hypotheses tested by Fama and MacBeth were:

1. Is the CAPM properly specified when it contains no term reflecting a non-linear relationship between $\tilde{R}_i$ and $\tilde{R}_m - R_f$? Specifically, they tested whether the relationship was non-linear in b_i by using a b_i^2 term as an independent variable in addition to a b_i term.

2. Are there systematic effects from non-β risk? Specifically, does the average residual term from the b_i estimating regressions prove to be useful in explaining observed market returns to security i?

Fama and MacBeth concluded they could not reject the testable hypotheses with respect to the two-parameter model when using ex post betas as the estimate of β_i. The results of their study have established the legitimacy of these testing procedures in the attempt to more fully understand the risk-return relation. Given the results of their study, it is an empirical question whether other specifications of the systematic risk parameter can be used within their testing procedures to achieve the same relationship between systematic risk and market returns to securities.

Role of the Present Study

All three papers in the first area empirically or analytically support the theory that financial leverage is a determinant of systematic risk. Myers concluded that cyclicality is also a determinant of systematic risk and is subject to major measurement difficulties. The research reported in this dissertation measures cyclicality through the estimation of an operating net cash flow beta. The analytic model developed later explicitly integrates various levels of financial leverage into the systematic risk measure which is constructed for each firm and each portfolio. This is an innovative empirical contribution of the present research.

The papers in the second area deal with operating leverage as a determinant of systematic risk. Wolfson incorporated both financial leverage and operating leverage. Operating leverage may seem closely related to the systematic operating cash flow risk measure which will be developed later. For that reason, understanding the differences between these measures becomes important. These measures may be related, however. Operating leverage expresses a relation between the fixed operating expenses and variable operating expenses. These expenses may be cash or non-cash. Depreciation, for example, would be a non-cash operating expense which typically is fixed in nature. Systematic cash flow risk as used in the present research expresses a relation between the net operating cash inflows to the firm relative to the net operating cash inflows to the group of firms which comprise the market index. The operating leverage is a relation between two kinds of intra-firm expenses. The operating cash flow risk is the systematic net operating cash inflow relation between the firm and equivalently measured market index. The relationships express greatly different firm-specific characteristics.

If there is a correlation between the net operating cash flow to the market and the number of units produced by a single firm, then it would be reasonable to expect the two risk measures described above to be related. Alternatively, if there is a correlation between the total costs of a single firm and the net operating cash inflows to the market, it could be expected there would be a relationship between the two risk measures.

No relationships between operating leverage and operating cash flow risk need exist for purposes of the current research. This research focuses on the hypothesized relationship between an alternative specification of the systematic risk measure and the returns to securities. This relationship entirely avoids the necessity of a link between systematic net operating cash flow risk and operating leverage.

Papers in the third area represent efforts to express the correlation between or the predictive relation of two or more risk measures. These papers examined the extent to which certain accounting or corporate decision variables could be found to be determinants of systematic risk.

Significant correlational results were generally interpreted to indicate a contemporaneous relation between the accounting and decision risk measures being examined and the surrogate for the true level of systematic risk. In the predictive ability studies, a significant relation between the accounting (or decision) variables and the systematic risk level observed in the subsequent period would have been thought to confirm the role of these variables as determinants of systematic risk. There was relatively little success reported in these predictive ability tests.

One significant potential contribution of the present study will be to directly observe the relation between the new systematic risk measure and the observed market returns. Earlier studies relied on correlations between risk measures in generating test results.

This direct test is not as sensitive to non-stationarity in the market-based systematic risk measures as were the three studies included in the third area. If the true systematic risk level changes, the observed returns ought to reflect the new level of systematic risk, the market being assumed efficient in its assessment of the ex ante systematic risk levels. Non-stationarity in the accounting-based systematic risk level remains an issue, however. All previous association or prediction studies had two sources of non-stationarity to contend with: (1) non-stationarity in the accounting (or decision) variables' systematic risk measure, and (2) non-stationarity in the market-based systematic risk measure.

Testing the strength of the risk-return association directly, rather than measuring the associations between the two risk measures, appears to make sense. If an alternative risk measure can be developed which alone or in conjunction with the more traditional risk measure can be more closely related to observed returns, then this alternative risk measure would add to our understanding of the risk-return relationship. Indirectly, at least, the new measure would be a determinant of systematic risk.

FOOTNOTES - CHAPTER TWO

[1]Franco Modigliani and Merton H. Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment," American Economic Review (June 1958): 261-270.

[2]R. A. Haugen and J. L. Pappas, "Equilibrium in the Pricing of Capital Assets, Risk-Bearing Debt Instruments, and the Question of Optimal Capital Structure," Journal of Financial and Quantitative Analysis VI (June 1971): 943-953.

[3]R. Hamada, "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stocks," Journal of Finance 27 (May 1972): 435-452.

[4]S. C. Myers, "The Relation between Real and Financial Measures of Risk and Return," in Risk and Return in Finance, ed. Irwin Friend and James L. Bicksler (Cambridge, Massachusetts: Ballinger Publishing, 1977), pp. 49-100.

[5]B. Lev, "On the Association between Operating Leverage and Risk," Journal of Financial and Quantitative Analysis IX (September 1974): 627.

[6]Mark A. Wolfson, "Toward the Understanding of the Complementary Nature of Security Price and Non-Security Price Information in Relative Risk Parameter Estimation," (unpublished Ph.D. dissertation, University of Texas at Austin: 1977).

[7]William Beaver, Paul Kettler, and Myron Scholes, "The Association between Market Determined and Accounting Determined Risk Measures," Accounting Review (October 1970): 654.

[8]Donald J. Thompson II, "Sources of Systematic Risk in Common Stocks," Journal of Business (April 1976): 173.

[9]John S. Bildersee, "The Association between a Market-Determined Measure of Risk and Alternative Measures of Risk," Accounting Review (January 1975): 81-98.

[10]Eugene F. Fama and James D. MacBeth, "Risk, Return, and Equilibrium: Empirical Tests," Journal of Political Economy 18 (May-June 1973): 607-636.

[11]Myers, "The Relation between Real and Financial Measures of Risk and Return," pp. 49-100.

[12]Modligiani and Miller, "The Cost of Capital," p. 270.

[13]Haugen and Pappas, "Equilibrium in the Pricing of Assets," pp. 943-953.

[14]Hamada, "The Effect of the Firm's Capital Structure," p. 435.

[15]Myers, "The Relation between Real and Financial Measures of Risk and Return," p. 64.

[16]*Ibid.*, p. 76.

[17]Lev, "On the Association between Operating Leverage and Risk," p. 627.

[18]Operating leverage is the ratio of the relative change in income for a relative change in the units of production. It essentially expresses the relation between the firm's fixed and variable expenses.

[19]Fama and Miller, *The Theory of Finance*, Chapter 7.

[20]Wolfson, "Toward the Understanding of the Complementary Nature of Security Price and Non-Security Price Information."

[21]Beaver, Kettler, and Scholes, "The Association between Market Determined and Accounting Determined Risk Measures," pp. 654-682.

[22]Thompson, "Sources of Systematic Risk in Common Stocks," pp. 173-188.

[23]See Chapter Five of the present research for the details of this common approach.

[24]Bildersee, "The Association between a Market-Determined Measure of Risk and Alternative Measures of Risk," pp. 81-98.

[25]Fama and Miller, *The Theory of Finance*, Chapter 7.

[26]Fama and MacBeth, "Risk, Return, and Equilibrium," pp. 607-636.

CHAPTER THREE

MODEL DEVELOPMENT

Accountants have, or should have, a particular interest in the role played by accounting data within the macro-information set. This macro-information set is the aggregate of all information available with or without cost to economic decision-makers, including investors. A relevant parameter of interest to this group has been shown to be the ex ante systematic risk measure of securities in the marketplace. Some argue that the ex ante systematic risk measure is the only relevant parameter of interest in a CAPM world. Beaver and Manegold[1] (1975) believe this systematic risk parameter to be relevant if it is merely one of the measures of security risk.

Various accounting risk measures have been shown frequently to be contemporaneously related to the ex post beta measure. As has been mentioned above, the link between accounting data and ex ante beta becomes tenuous because of the important explicit role played by investor expectations in the ex ante beta measure. To the extent there are accounting variables correlated with accounting income, accountants cannot feel comfortable that accounting income *per se* is the accounting variable of interest in this contemporaneous relationship. Accrual income has often been described as a good predictor or measure of recurring cash flows. An intuitive justification of the relevance of the firm's cash flows to investor decision-making typically followed. No study has been reported where cash flow cyclicality measures have been explored as a contemporaneous explainer of ex post systematic risk.

Empirically testing the hypothesized relationship between cash flows to the firm and ex post market returns on the security would be a natural first step. This must be limited to current cash flow measures since cash flow expectations are not available for empirical analysis. The objective of this research is to establish empirically the relationship, if any, between current cash flow risk measures and returns on the related securities. The broader goal of this type of research is to establish the relationship, if any, between current accounting data and ex ante beta. If measuring the ex ante beta were not an intractible task at the present time, the broader goal would already have been explored at length.

Lenders comprise one subset of the investor group. The concept of systematic cash flow risk is especially relevant to these users because of their emphasis on repayment prospects. The concept of systematic cash flow risk is also relevant to equity investors to the extent a link can be established between cash flow risk and equity returns. Haley and Schall[2] support the essence of the preceding statements when they state that the firm's value (the value of debt plus the value of the equity) is a function of the firm's output of money and the firm's investment policies. Their comments reflect the expectation of future outflows of money from the firm to both classes of investors, either directly or indirectly.

In 1958, Modigliani and Miller[3] set forth two now famous propositions. MM evaluated the interrelationships of security valuation, financial leverage and the cost of capital. They made three noteworthy assumptions:

1. The stream of profits to a firm has a known and finite mean and observations on this stream are randomly distributed subject to a probability distribution.

2. Within homogeneous risk classes, the stream of profits is assumed to be capitalized at a constant rate (ρ_k). This represents the required rate of return to the firm. ρ_k reflects only the operating risk characteristics of the firm and none of the financial risks of the firm.

3. Debt securities are issued to yield r -- the capitalization rate for sure and constant streams. Thus, this debt is riskless in nature.

The propositions set forth by MM are paraphrased below. After each proposition, explanations are made to facilitate an intuitive grasp of their significance in relation to later work by Haugen and Pappas[4] in 1971.

Proposition I:

Eq. 8
$$V_{firm} = \frac{\bar{X}}{\rho_k} = V_{equity} + V_{debt},$$

where V = value.

$\bar{X}$ = the mean of the stream of profits.

ρ_k = the capitalization rate within risk class k.

As the debt/equity ratio changes, the value of the firm does not. This relationship states that the <u>firm's</u> cost of capital (ρ_k) is invariant with respect to changes in the degree of financial leverage employed by the firm. Note, however, the cost of capital to the firm is not the same as the required rate of return to levered equity as Proposition II clearly sets forth below.

Proposition II:

Eq. 9
$$i_j = \rho_k + (\rho_k - r)\frac{\text{Debt}}{\text{Equity}},$$

where i_j = the return required to a firm's levered equity.

ρ_k = the cost of capital to firm j in risk class k.

Note that i_j is the sum of (1) an operating risk measure reflecting the character of the firm's assets and (2) a financial risk measure.

Haugen and Pappas (HP) began by stating MM's Proposition II this way:

Eq. 10 $$K_e = K_o + (K_o - r)\,\frac{\text{Debt}}{\text{Equity}}\,.$$

In either MM's or HP's formulation, the model is based on net operating income (NOI). Debt is still considered riskless at this point, however, since r remains the riskless rate of return on debt. This NOI formulation of the required rate of return to levered equity says that the rate is a linear function of the debt/equity ratio. The CAPM formulation of the required rate of return to equity is a function of the systematic risk of the equity. HP demonstrated that the systematic risk measure of the CAPM is affected by financial leverage. In determining this result, however, debt became risky and MM's homogeneous risk class assumption became unnecessary.

HP proceeded to their reformulated β_i through a lengthy series of substitutions which are presented and explained below. First, the CAPM as presented earlier:

Eq. 11 $$E(\tilde{R}_{it}) = R_f + \beta_i\,[E(\tilde{R}_{mt}) - R_f]\,.$$

In equation 11, the terms are as defined earlier.

The assumptions commonly made with respect to the CAPM are as follows:

1. Investors want their portfolios to be on the efficient frontier. That is, more expected return is preferred to less expected return *ceteris paribus*. Additionally, less expected variability of return is preferred to more expected variability of return. The desire to be on the efficient frontier directly implies a necessary trade-off between expected risk (variability of return)

and expected return. The investor's relative tastes for expected risk and expected return will determine the portfolio mix the investor will select.

2. The investors may borrow or lend an unlimited amount of money at the risk-free rate.

3. All investors share homogeneous expectations with respect to the probability distributions of returns and variability of returns.

4. All investors have a one-period time horizon for their investment decisions.

5. All investment opportunities are infinitely divisible.

6. There are no transaction costs nor taxes involved in securities transactions. That is, there are no incentives to fail to revise portfolios given new information.

7. The capital markets are in equilibrium.

From the CAPM we obtain the following for an all-equity firm:

Eq. 12 $$E(R_{et}) = R_f + \beta_e\,[E(R_{mt}) - R_f],$$

or alternatively:

Eq. 13 $$E(\tilde{R}_{et}) = R_f + [E(\tilde{R}_{mt}) - R_f]\,[\rho_{em}\,\sigma_e\,\sigma_m]/\sigma_m^2,$$

where $E(\tilde{R}_e)$ is the expected return to a firm which has no debt outstanding. $E(\tilde{R}_e)$ is equal to $E(\tilde{R}_i)$ in such cases.

ρ_{em} is the correlation coefficient between the return to unlevered equity and the return to the market.

σ_e is the standard deviation of the expected return to unlevered equity.

σ_m is the standard deviation of the expected return to the market.

Similarly, for debt:

Eq. 14 $$E(\tilde{R}_{dt}) = R_f + \frac{E(\tilde{R}_{mt}) - R_f}{\sigma_m^2}\,(\rho_{dm}\sigma_d\sigma_m).$$

Here $E(\tilde{R}_{dt})$ represents the expected return to risky debtholders of the firm.

Haugen and Pappas derived, as have many others in the finance literature, the analytic relationship which follows:

Eq. 15 $$\frac{\bar{X}}{K_o} = V_e^* + V_d = V_{firm},$$

where $\bar{X}$ is the expected return to the firm (i.e., return to the debt holders and to equity holders).

K_o is the capitalization rate which causes the expected mean return to the firm to equal the market value of debt and equity.

V_e^* and V_d are the market values of levered equity and debt respectively.

Haugen and Pappas were interested specifically in whether changes in the debt/equity ratio via financing decisions were capable of being specified in the Net Operating Income (NOI) construct below. Starting with MM's Proposition II:

Eq. 16 $$K_e = K_o + (K_o - r)\,\frac{\text{Debt}}{\text{Equity}},$$

where K_e is the return to levered equity.

Then modifying MM's Proposition II to accommodate risky debt they had:

Eq. 17 $$K_e = K_o + [K_o - E(R_d)]\,\frac{V_d}{V_e^*},$$

where $E(\tilde{R}_d)$ is the expected return to risky debt.

V_d and V_e^* are the market values of debt and levered equity respectively.

Note the following definitional equalities:

$$K_e = \tilde{R}_e^* = \text{return on levered equity.}$$

$$K_o = \tilde{R}_e = \text{return on unlevered equity.}$$

$$\tilde{R}_d = \text{return on debt securities.}$$

Then, by substitution, they obtained the NOI construct in the following form:

Eq. 18 $$E(\tilde{R}_e^*) = E(\tilde{R}_e) + [E(\tilde{R}_e) - E(\tilde{R}_d)] \frac{V_d}{V_e^*}.$$

Equation 18 is equivalent to Equation 12 and Equation 13 via the CAPM. Therefore, Equation 12 and Equation 13 can be rewritten as follows:

Eq. 19 $$E(\tilde{R}_e^*) = R_f + \frac{[E(\tilde{R}_{mt}) - R_f]}{\sigma_m^2} (\rho_{em}^* \sigma^*_e \sigma_m).$$

The e^* denotes levered equity. The σ^*_e can be expressed as follows:

Eq. 20 $$\sigma^*_e = [(\frac{V_e + V_d}{V_e})^2 \sigma_e^2 + \frac{2(V_e + V_d)}{V_e} (1 - \frac{V_e + V_d}{V_e}) (\sigma_e \sigma_d \rho_{ed}) + (1 - \frac{V_e + V_d}{V_e})^2 \sigma^2{}_d]^{1/2}.$$

The assumption required in expressing the weights to the various components as in Equation 20 is that the proceeds from any debt sold are used to purchase equity securities previously issued.

The ρ^*_{em} reduces to Equation 23 via the following intermediate steps:

Eq. 21 $$\sigma(\tilde{R}^*_e, R_m) = \frac{(V_e + V_d)}{V_e} \sigma(\tilde{R}_e, \tilde{R}_m) + (1 - \frac{V_e + V_d}{V_e}) \sigma(\tilde{R}_d, \tilde{R}_m).$$

Then substituting $\rho^*_{em} \sigma^*_e \sigma_m$ for $\sigma(\tilde{R}^*_e, \tilde{R}_m)$ and similarly for $\sigma(\tilde{R}_e, \tilde{R}_m)$ and $\sigma(\tilde{R}_d, \tilde{R}_m)$ yields Equation 22.

Eq. 22 $$\rho^*_{em} \sigma^*_e \sigma_m = \frac{V_e + V_d}{V_e} \rho_{em} \sigma_e \sigma_m + (1 - \frac{V_e + V_d}{V_e}) \rho_{dm} \sigma_d \sigma_m$$

$$\rho^*_{em} = \frac{\frac{V_e + V_d}{V_e} \rho_{em} \sigma_e \sigma_m}{\sigma^*_e \sigma_m} + \frac{(1 - \frac{V_e + V_d}{V_e}) \rho_{dm} \sigma_d \sigma_m}{\sigma^*_e \sigma_m}.$$

Now substituting Equation 20 and Equation 23 into Equation 19 above yields the following relationships which should be readily recognizable:

Eq. 24

$$E(\tilde{R}_e*) = R_f + [\frac{E(\tilde{R}_m) - R_f}{\sigma_m^2}] \left[\frac{\frac{(V_e + V_d)}{V_e} \rho_{em}\sigma_e\sigma_m}{\sigma^*_e \sigma_m} + \frac{(1 - \frac{V_e + V_d}{V_e}) \rho_{dm}\sigma_d\sigma_m}{\sigma^*_e \sigma_m} \right] \text{cont.}$$

$$\left[\frac{(V_e + V_d)^2}{V_e} \sigma^2_e + \frac{2(V_e + V_d)}{V_e} (1 - \frac{V_e + V_d}{V_e}) \sigma_e\sigma_d\sigma_{ed} + (1 - \frac{V_e + V_d}{V_e})^2 \sigma^2_d \right]^{\frac{1}{2}} (\sigma_m).$$

Simplifying, we obtain:

Eq. 25 $$E(\tilde{R}_e^*) = R_f + \{E(\tilde{R}_m) - R_f\} (1 + \frac{V_d}{V_e})(\beta_e) - \frac{V_d}{V_e} \{E(\tilde{R}_m) - R_f\} (\beta_d).$$

Or we obtain:

Eq. 26 $$E(\tilde{R}_e^*) = R_f + \{E(\tilde{R}_m) - R_f\} \{\beta_e + \frac{V_d}{V_e} (\beta_e - \beta_d)\},$$

where $\beta_e = \frac{\text{cov}(\tilde{R}_e, \tilde{R}_m)}{\text{var}(\tilde{R}_m)}$,

and $\beta_d = \frac{\text{cov}(\tilde{R}_d, \tilde{R}_m)}{\text{var}(\tilde{R}_m)}$.

In words, Equation 25 and Equation 26 state that the expected return to levered equity ($\tilde{R}^*_e$) is a linear function of R_f, $\tilde{R}_m - R_f$, the debt/equity ratio measured by market values, and the variance-covariance structures of returns to equityholders and debtholders. These variance-covariance structures are standardized by the variance of the return to the market and thus emerge as familiar betas.

Gonedes[5] stated that a principal role of a model in empirical research is to assist in the organization of ideas and data in a comprehensive manner. Moreover, he added, if people make decisions as if they use the model, it is unimportant whether they have explicit knowledge of the model.

The foregoing analytically develops an alternative specification of the systematic risk parameter. The empirical testing of the validity of this new specification in the CAPM requires considerable surrogation in order for this model to be operational. Note the following surrogations which are necessary before outlining the testing procedures to be employed:

1. The operating cash flow beta must be estimated. This will require the development of at least one measure of operating cash flows.

2. Financial leverage and the debt beta must be estimated. Cash payments to debtholders must be estimated.

The development of these surrogates will be done in Chapter Four which follows.

FOOTNOTES - CHAPTER THREE

[1]William Beaver and James Manegold, "The Association between Market-Determined and Accounting-Determined Measures of Systematic Risk: Some Further Evidence," Journal of Financial and Quantitative Analysis 10 (June 1975): 231-284.

[2]Haley and Schall, The Theory of Financial Decisions.

[3]Modigliani and Miller, "The Cost of Capital," pp. 261-270.

[4]Haugen and Pappas, "Equilibrium in the Pricing of Assets," pp. 943-953.

[5]Nicholas J. Gonedes, "Remarks on 'Empirical Research in Accounting 1960-1970: An Appraisal'," in Accounting Research 1960-1970: A Critical Evaluation, ed. Nicholas Dopuch and Lawrence Revsine (Champaign, Illinois: University of Illinois Center for International Education and Research in Accounting, 1973), pp. 179-191.

CHAPTER FOUR

CONSTRUCTING THE FIVE CASH FLOW RETURN MEASURES AND THE SYSTEMATIC CASH RISK MEASURES FOR THE FIRMS

Five cash flow return measures were constructed for the firms included in the study. Four of these cash flow measures were surrogations of net operating cash flow to the firm (a through d below). The fifth cash flow measure was an estimate of net outflows to holders of the firm's debt and liabilities as well as to preferred shareholders net of corporate taxes (e below).

These five cash flow measures are defined as follows:

a. Operating income plus depreciation and amortization expenses ($Op\$F^1_{it}$).

b. Operating income without adding back the depreciation or amortization expenses. This reflects a measure of capital maintenance ($Op\$F^2_{it}$).

c. Operating income adjusted as in (a) above and then reduced for the pro rata share of operating income's tax payments ($Op\$F^3_{it}$).

d. Operating income adjusted only for its pro rata share of the firm's tax payments ($Op\$F^4_{it}$).

e. Interest expense reduced by the tax savings experienced by the firm because of interest expense, then increased by preferred share dividends [(Interest $expense_{it}$) $(1 - \tau)$ +

preferred share $dividends_{it}$].

The operating cash flow measures 1 through 4 for each firm were scaled by the sum of the market value of the firm's equity plus the book value of the firm's debt at the beginning of the period for which the $Op\$F_{it}$ was estimated.[1] Cash flow measure (e) for each firm was scaled by the sum of the book values of debt and other liabilities plus the book values of the firm's preferred shares at the outset of the period for which cash flow measure (e) was estimated. These scalings produced the one-period cash flow return metrics required to estimate the net operating cash flow betas as required by the analytical model being employed here. Cash flow measure (e) thus became $R^{\$F}_{dit}$ or the cash flow return to debt and liabilities. Operating cash flow measures 1 through 4 became the operating cash flow return measures for the firm $(R^{\$F}_{it})$ under each of the four specifications.

These $R^{\$F}_{it}$ display considerable seasonality within annual periods because their origins are partially in quarterly accounting data.[2] It is unknown how users of accounting information accommodate this suspected seasonality, if at all. For this reason these original return series $(R^{\$F}_{it})$ were transformed into seasonally adjusted return series $(SAR^{\$F}_{it})$ via a process described in detail in Johnston.[3] Each definition of the cash flow return measure was estimated in two series, one unadjusted for seasonality and the other seasonally adjusted. Thus, for each firm there were eight cash flow return series measures. Similarly there were eight cash flow return measures for the market:

$$R^{\$F1}_{it} \qquad R^{\$F1}_{mt}$$

$$R^{\$F2}_{it} \qquad R^{\$F2}_{mt}$$

$R_{it}^{\$F3}$ $R_{mt}^{\$F3}$

$R_{it}^{\$F4}$ $R_{mt}^{\$F4}$

$SAR_{it}^{\$F1}$ $SAR_{mt}^{\$F1}$

$SAR_{it}^{\$F2}$ $SAR_{mt}^{\$F2}$

$SAR_{it}^{\$F3}$ $SAR_{mt}^{\$F3}$

$SAR_{it}^{\$F4}$ $SAR_{mt}^{\$F4}$

It would be correct to label these $R_{it}^{\$F}$ and $R_{mt}^{\$F}$ as $R_{eit}^{\$F}$ and $R_{emt}^{\$F}$ respectively, but the subscript e has been dropped without loss of understanding.

Now for each definition of the cash flow return measure series the following regressions will be run separately in order to estimate the $\beta_{ei}^{\$F}$ for the respective definition of cash flow returns.

	Dependent variable	Independent variable	$\beta_{ei}^{\$F}$ estimate
(a)	$R_{it}^{\$F1}$	$R_{mt}^{\$F1}$	$b_{ei}^{\$F1a}$
(b)	$SAR_{it}^{\$F1}$	$R_{mt}^{\$F1}$	$b_{ei}^{\$F1b}$
(c)	$SAR_{it}^{\$F1}$	$SAR_{mt}^{\$F1}$	$b_{ei}^{\$F1c}$
(d)	$R_{it}^{\$F1}$	$SAR_{mt}^{\$F1}$	$b_{ei}^{\$F1d}$

Users of cash flow information at the firm level or the market level may make adjustments in either, both, or neither return series. Consequently, each return series will be seasonally adjusted and the separate regressions run as described above. Firms which have highly seasonal operating cash flow patterns might be likely candidates for seasonal adjustment efforts by the users of such cash flow information. To the extent the operating cash flow market index is seasonal in character, it is reasonable to assume that users would seasonally adjust that market return series before comparing individual firm return series to the market index.

The technique described in Johnston is well-suited for seasonal adjustment purposes.[4] If the original series does not exhibit a strong seasonal pattern, the seasonal adjustment of the series results in a trivial adjustment of the original series. Alternatively, if the original series is highly seasonal, the seasonal adjustment of that series results in a significant adjustment of the original series.

Tests of the research hypotheses stated in Chapter Five require observations on the quarterly time series of the following cash flow (\$F) variables and monthly time series of the market return (mr) variables constructed from cash flow measures and market return data respectively. These variables will be calculated as follows:

Eq. 27 $R_{it}^{\$F} = \dfrac{OP\$F_{it}}{V_{ei,t-1} + V_{di,t-1}}$ calculated for each quarter in the estimation period. There are four such measures, $OP\$F^1$ through $OP\$F^4$.

Eq. 28 $SAR_{it}^{\$F} = R_{it}^{\$F} - Db$. Regressing $R_{it}^{\$F}$ on $Pa + Db$ where P is an appropriate set of powers of time chosen to control for elements of trend in the unadjusted data and where D is the set of quarterly dummy variables to permit the estimation of the seasonal components in the presence of a possible trend in the data.[5] There are four such measures, $OP\$F^1$ through $OP\$F^4$.

Eq. 29 $R_{mt}^{\$F} = \sum_{i=1}^{n} R_{it}^{\$F}/n$ where n is the number of firms in the study. There are four such measures, $OP\$F^1$ through $OP\$F^4$.

Eq. 30 $SAR^{\$F}_{mt} = \sum_{i=1}^{n} SAR^{\$F}_{it}/n$ where n is the number of firms in the study. There are four such measures, $Op\$F^1$ through $Op\$F^4$.

Eq. 31 V_{eit} = (the number of common shares outstanding at time t) (market price per common share at time t).

Eq. 32 V_{dit} = the book value of the firm's liabilities, debt issues, and preferred shares at time t.

Eq. 33 $\beta^{\$F}_{eit} = \text{cov}\ (R^{\$F}_{it}, R^{\$F}_{mt})\ /\ \text{Var}\ R^{\$F}_{mt}$. There are 16 such $\beta^{\$F}_{eit}$ measures, $Op\$F^{1a}$, $Op\$F^{1b}$, $Op\$F^{1c}$, $Op\$F^{1d}$, $Op\$F^{2a}$, ... through $Op\$F^{4d}$.

Eq. 34 $$R^{\$F}_{dit} = \frac{\text{Interest expense}_{it}\ (1 - \tau) + \text{Preferred share dividends}_{it}}{\text{Book values of debt, liabilities, and preferred shares}}$$

all at time t-1. These quarterly values will be obtained by straight-lining the changes in the annual values available from the Compustat tapes. This return measure has only one definition.

Eq. 35 $\beta^{\$F}_{dit} = \text{cov}\ (R^{\$F}_{dit}, R^{\$F}_{mt})\ /\ \text{var}\ R^{\$F}_{mt}$. There are four such measures, $Op\$F^1$ through $Op\$F^4$. To simplify the calculations, $R^{\$F}_{dit}$ will not be regressed upon the seasonally adjusted versions of $R^{\$F}_{mt}$ under any of the definitions of the cash flow measures.

Eq. 36 $\beta^{\$F}_{it} = \beta^{\$F}_{eit} + \frac{V_d}{V_e}(\beta^{\$F}_{eit} - \beta^{\$F}_{dit})$. There are 16 such $\beta^{\$F}_{it}$ measures, one each for $Op\$F^{1a}$, $Op\$F^{1b}$, $Op\$F^{1c}$, $Op\$F^{1d}$, $Op\$F^{2a}$ . . . . . . $Op\$F^{4d}$.

Eq. 37 $\beta^{\$F}_{pt} = \sum_{i=1}^{n} \beta^{\$F}_{it}/q$ where q is the number of firms in the portfolio. There are 16 such $\beta^{\$F}_{pt}$ measures, $Op\$F^{1a}$, $Op\$F^{1b}$, $Op\$f^{1c}$, $Op\$F^{1d}$ . . . . . . $.Op\$F^{4d}$.

Eq. 38 $\tilde{R}^{mr}_{it} = \dfrac{Price_{it} + Dividends_{it}}{Price_{i,t-1}}$ where adjustments have been made for stock splits and stock dividends.

Eq. 39 $\tilde{R}^{mr}_{mt} = \sum_{i=1}^{n} \tilde{R}^{mr}_{it} / n$ where n is the number of firms in the study.

Eq. 40 $\tilde{R}^{mr}_{pt} = \sum_{i=1}^{q} \tilde{R}_{it} / q$ where q is the number of firms in the portfolio.

Eq. 41 $\beta^{mr}_{it} = \text{cov}\ (\tilde{R}^{mr}_{it}, \tilde{R}^{mr}_{mt})\ /\ \text{var}\ (\tilde{R}^{mr}_{mt})$.

Eq. 42 $\beta^{mr}_{pt} = \sum_{i=1}^{q} \beta^{mr}_{it} / q$ where q is the number of firms in the portfolio.

Eq. 43 R_{ft} = the 90-day Treasury Bill rate_t.

FOOTNOTES - CHAPTER FOUR

[1]Bowman (1980) explored the differential impacts of using market and book values of debt each in conjunction with market and book values of equity in order to test the relationship between ex post beta and the degree of financial leverage employed by the firm. In these empirical tests, he developed surrogations for the market values of untraded issues. In these comparisons to test whether the use of market or book values of debt were better explainers of ex post systematic risk, Bowman found the two very nearly equal. The market value of equity proved to supply a debt/equity ratio more closely linked with the ex post beta than did the book value of equity.

[2]Some of the elements of the calculation of the $R_{it}^{\$F}$ are annual accounting data which have been straight-lined to approximate what their quarterly values might have been.

[3]J. Johnston, Econometric Methods, 2nd ed. (New York: McGraw-Hill Book Company, 1972), Chapter 6.

[4]Idem.

[5]Idem.

CHAPTER FIVE

TESTING

Systematic risk traditionally has been estimated from market returns on securities. The current research has specified an alternative means of estimating the systematic risk parameter in accordance with the analytic model developed in Chapter Three. Do the average returns conform to the CAPM risk-return relationship when this newly specified systematic risk estimate is used instead of the estimate made ex post from observed market returns? This issue has been tested by directly observing the relation between these risk and return measures using the methodology developed by Fama and MacBeth.[1] This manner of testing is materially different from observing the correlation between risk measures as is commonly done in this area of research (Beaver, Kettler, and Scholes[2]).

What has been developed analytically is the concept of two cash flow systematic risk measures ($\beta^{\$F}_{eit}$ and $\beta^{\$F}_{dit}$) and the set of weights (V_{dit} and V_{eit}) to be applied in obtaining a systematic operating cash flow risk measure for the firm. The developed model, like the CAPM, is based upon expectations. For purposes of the empirical testing it has been necessary, however, to observe the relationship between ex post risk measures at time t-1 and returns at time t. The ideal test would have been to observe the relation between cash flow risk measures formed entirely from expectations at time t-1 and the returns at time t. Because these expectations are unobservable, it has been necessary to surrogate these ex ante risk measures from ex post data. The results of these tests using β_i^{mr} and $\beta_i^{\$F}$ are compared and evaluated in Chapter Six to see if $\beta_i^{\$F}$ has value as a direct explainer of observed market returns.

This estimate of $\beta_i^{\$F}$ has been used in the CAPM to test the linear relationship of the observed market returns at time t to the systematic risk measure at time t-1. Thus, the CAPM became as follows for the tests here:

Eq. 44 $$E(\tilde{R}_{it}^{mr}) = R_{ft} + \beta_{i,t-1}^{\$F} [E(\tilde{R}_{mt}^{mr}) - R_{ft}].$$

In the attempt to show that the linear relation between $\beta_{i,t-1}^{\$F}$ and $\tilde{R}_{it}^{mr}$ is as represented in the CAPM, it has been necessary to attempt to show that (1) these values are linearly related, and (2) no other measure of risk is needed.

Test Design and Research Hypotheses

The thrust of this research has been to assess the relationship between actual market returns on securities and measures of systematic operating cash flow risk. The CAPM has been supported elsewhere as a depictor of the linear relation between ex post systematic risk and security returns.

The testing assumes the CAPM to be a valid representation of the risk-return relationship, and the crucial issue is whether an alternative specification of the systematic risk parameter based on accounting data can be confirmed as an explainer of returns on securities as the analytic model suggests.

Consider these models[3] for the testing of the hypotheses to be stated later:

Eq. 45 $\tilde{R}^{mr}_{pt} = \gamma_{1t} + \gamma_{2t}b_{p,t-1} + \gamma_{3t}(b_{p,t-1})^2 + \gamma_{4t}s(\bar{e}_i) + \tilde{\eta}_{pt}$.

Eq. 46 $\tilde{R}^{mr}_{pt} = \gamma_{1t} + \gamma_{2t}b_{p,t-1} + \gamma_{3t}(b_{p,t-1})^2 + \qquad + \tilde{\eta}_{pt}$.

Eq. 47 $\tilde{R}^{mr}_{pt} = \gamma_{1t} + \gamma_{2t}b_{p,t-1} + \qquad + \gamma_{4t}s(\bar{e}_i) + \tilde{\eta}_{pt}$.

Eq. 48 $\tilde{R}^{mr}_{pt} = \gamma_{1t} + \gamma_{2t}b_{p,t-1} + \qquad + \tilde{\eta}_{pt}$.

Research hypotheses:

1. H_0: $\bar{\gamma}_3 \neq 0$ in Eq. 45 and Eq. 46 above.

   H_1: $\bar{\gamma}_3 = 0$ in Eq. 45 and Eq. 46 above.

2. H_0: $\bar{\gamma}_4 \neq 0$ in Eq. 45 and Eq. 47 above.

   H_1: $\bar{\gamma}_4 = 0$ in Eq. 45 and Eq. 47 above.

3. H_0: $\bar{\gamma}_2 \leq 0$ in Eq. 45 through Eq. 48 above

   H_1: $\bar{\gamma}_2 \geq 0$ in Eq. 45 through Eq. 48 above.

The $\bar{\gamma}_j$ are the means of the regression coefficients averaged across the 20 portfolios for each of the models (Eq. 45 through Eq. 48). These regression coefficients are originally calculated for each portfolio separately. The $s(\bar{e}_i)$ terms are the averages of the portfolio's component firms' residuals from the $b^{\$F}_{ei}$ estimating regressions. The $(b^{\$F}_{p,t-1})^2$ terms are the averages of the portfolio's component firms' $b^{\$F}_{ei}$ which have been squared separately. Thus, the $(b^{\$F}_{p,t-1})^2$ term is mislabeled in a strict sense.

Tests of the three research hypotheses answer the following questions:

1. Is there a linear relation between systematic cash flow risk and security returns? Or can some non-linear relation between these variables be discovered?

2. To what extent, if any, does the residual risk from the $b^{\$F}_{ei}$ estimating regressions explain the returns on securities?

Alternatively stated, does the variability of the error terms $[s^2(\bar{e}_{it})]$ exhibit some relation to $\tilde{R}^{mr}_{it}$?

3. Is the average multiple regression coefficient on $b^{\$F}_{p,t-1}$ $(\bar{\gamma}_2)$ statistically greater than zero?

If the general CAPM relation between market returns on securities and systematic operating cash flow risk is found to be significant, there would be support for the hypothesis that systematic net operating cash flows are a surrogate for the firm's cyclicality measure.

Testing Procedures

Tests of the research hypotheses involve the means of γ_2, γ_3, and γ_4. Many of the testing procedures used here were developed in Fama and MacBeth[4] to test the relation between risk and return in the CAPM where β_i was estimated from the return series $\tilde{R}^{mr}_{it}$ and $\tilde{R}^{mr}_{mt}$. With the various $\beta^{\$F}_i$ estimates formed as described earlier, the relationship between market returns to portfolios and these various risk measures has been assessed. In order to determine the extent to which non-systematic risk or the non-linear systematic risk measure is related to observed market returns, $\bar{\gamma}_3$ and $\bar{\gamma}_4$ [in equations 45, 46, and 47 as indicated] have been evaluated to determine if those coefficients are statistically different from zero.

The approach here has been to form portfolios using the firms included in the study in order to yield relatively homogeneous $b^{\$F}_i$ and b^{mr}_i within each portfolio. Portfolios were formed to allow for the offsetting of measurement errors in the estimating of β_i from the return series data. These measurement errors were assumed to be random. Estimates of β_i have been found to be quite volatile over short measurement periods.[5]

If measurement errors occur in $b_i^{\$F}$ as they do in b_i^{mr}, the formation of portfolios should have permitted a reduction in the standard error of the estimate of the systematic risk measure to be used in the CAPM. This volatility in β_i estimates has been assumed here and elsewhere to result from measurement errors while the underlying true beta was relatively more stationary over longer periods. Thus, in the formation of equally weighted portfolios random measurement errors were assumed to offset each other. These measurement errors were assumed to be uncorrelated with β_i or with R_{mt}^{mr}.

By assigning securities to portfolios based upon a ranking of b_i^{mr}, the intent was to form portfolios of relatively homogeneous $b_i^{\$F}$ and b_i^{mr} within those portfolios. This would occur if there were a high correlation between $b_i^{\$F}$ and b_i^{mr}. The primary objective in this assignment to portfolios was to test the risk-return relation across a wide span of systematic risk levels. By maximizing the diversity between the various $b_p^{\$F}$ and b_p^{mr} across the portfolios, a clearer understanding of the relation of the proposed systematic risk estimator to observed market returns on securities can be obtained.

If portfolio betas ($b_p^{\$F}$ and b_p^{mr}) are estimated from the same data used to rank the securities and subsequently form portfolios, the $b_p^{\$F}$ and b_p^{mr} are likely to be biased toward 1.0 in the testing periods which follow. This phenomenon is called regression-toward-the-mean and has long been recognized as a potential problem in portfolio formation situations (Blume;[6] Fama and MacBeth;[7] and Foster[8]). The regression phenomenon originates when the β_i are measured with error and the firms are ranked according to the observed b_i^{mr}. As indicated above, $b_p^{\$F}$ (b_p^{mr}) were formed to permit random measurement errors to have minimal impact on the results. However, because of ranking on b_i^{mr} to form portfolios, there is reason to suspect the measurement errors in high and low b_i^{mr} firms are not random. High b_i^{mr} firms probably contain non-random measurement errors biasing that measurement away from 1.0 relative to the true β_i, and vice versa for low b_i^{mr} firms. Consequently, estimates of β_p would be formed reflecting these non-random measurment errors. Therefore, the b_p^{mr} ($b_p^{\$F}$) would be expected to be less extreme in the subsequent testing period when these non-random measurement errors have an expected value of zero. In summary, a mechanism must be used to cause these non-random measurement errors to have minimal impact on the $b_p^{\$F}$ (b_p^{mr}) before using the $b_p^{\$F}$ (b_p^{mr}) estimates in the CAPM during the testing periods.

The common mechanism employed for this purpose is to use data from one period to form estimates of β_i to permit a ranking of these firms. This ranking provides a basis for portfolio formation, but not for the purpose of $b_p^{\$F}$ (b_p^{mr}) estimation. Fresh data from a subsequent period are used to form $b_i^{\$F}$ (b_i^{mr}) and these values are used to estimate β_p, where the $b_i^{\$F}$ (b_i^{mr}) have been equally weighted within their respective portfolios.

The cash flow data used to form $b_i^{\$F}$ estimates are available on a quarterly basis. Portfolios were formed initially from firms ranked on b_i^{mr} which have been computed from monthly market return series in the July 1965-June 1970 period. Quarterly Compustat data from July 1970-June 1975 were used to initially compute $b_p^{\$F}$. Details of these procedures for obtaining $b_p^{\$F}$ were explained in Chapter Four.

The b_i^{mr} estimates were generated from the monthly returns on the CRSP tapes. The firm had to be continuously listed from July 1965 through December 1978 on the CRSP tapes in order to be included in the sample of firms. Firms were also required to have complete Compustat data in the time period July 1970 through December 1978 to be included in the sample.

The ranking, estimation, and testing periods are shown and described below.

Initial Ranking Periods	Initial Estimation Periods	Initial Testing Periods
July 1965-June 1970	July 1970-June 1975	July 1975-December 1978
β_i^{mr} estimation	$\beta_p^{\$F}$ estimation	Test Period
β_i^{mr} estimation	β_p^{mr} estimation	Test Period

The estimates of $b_{i,t+1}^{mr}$ ($b_{i,t+1}^{\$F}$) were updated quarterly by dropping the earliest data entering into the estimation of b_{it}^{mr} ($b_{it}^{\$F}$) and adding the next quarter's data in chronological sequence. Thus, the ranking periods for $b_{i,t+j}^{mr}$ ($b_{i,t+j}^{\$F}$) were all 20 quarters in length. This updating process was also used to obtain new $b_{i,t+j}^{\$F}$ and $b_{i,t+j}^{mr}$ estimates which enter into the $b_{p,t+j}^{\$F}$ and $b_{p,t+j}^{mr}$ estimates as described earlier on page 50. These market return ranking procedures yield $b_{p,t+j}^{\$F}$ and $b_{p,t+j}^{mr}$ estimated from their component firms' $b_{i,t+j}^{\$F}$ and $b_{i,t+j}^{mr}$ which have been previously ranked using only market return data from the five-year period ending at time t+j-20.

In addition to the ranking, estimation and testing procedures described above, portfolios were formed from a ranking on $b_i^{\$F}$ in order to assure that the conclusions formed about the relation between $b_i^{\$F}$ and R_i^{mr} are not adversely affected by a low correlation between $b_i^{\$F}$ and b_i^{mr} in the initial estimation period. Recall that, in assigning firms to portfolios, the rankings had been on b_i^{mr} for both the cash flow portfolios and the market return portfolios. This procedure permits relatively longer testing periods but at the risk of not attaining the desirable degree of homogeneity of $b_i^{\$F}$ within portfolios. By additionally forming portfolios from rankings on $b_i^{\$F}$, a check was permitted on the earlier decision to rank on b_i^{mr}. This additional information was obtained at the expense of shortening the ranking and estimation periods to two and one-half years each (ten quarters) to reflect the shorter time period over which Compustat data was available. This reserved three and one-half years of data for testing. This testing period was the same length as that which had been used during the initial ranking for portfolio information on the basis of market return data.

These tests on $b_i^{\$F}$ rankings have ranking, estimation, and testing periods as follows:

Initial Ranking Periods	Initial Estimation Periods	Initial Testing Periods
July 1970-December 1972	January 1973-June 1975	July 1975-December 1978

The ranking on Compustat data yielded $b_{p,t+j}^{\$F}$ estimated from $b_{i,t+j}^{\$F}$ where these $b_{i,t+j}^{\$F}$ have been previously ranked using only cash flow data from the ten-quarter period ending at time t+j-10.

These $b_{p,t+j}^{\$F}$ and $b_{p,t+j}^{mr}$ obtained from both initial ranking procedures were used in equations 45 through 48 as indicated. Monthly market returns for the portfolio were used to provide three test observations for each $b_{p,t+j}^{\$F}$. The test period was 14 quarters in length with each quarter yielding three monthly test observations.

The regressions described in equations 45 through 48 were run for each portfolio for all 17 of the $b^{\$F}_{p,t+j}$ and $b^{mr}_{p,t+j}$ estimates.

Then, via t-statistics, the significance of $\bar{\gamma}_3$, $\bar{\gamma}_4$, and $\bar{\gamma}_2$ were assessed. These t-statistics were computed as follows (illustrated only for research hypothesis 1):

Eq. 49 $$t(\bar{\gamma}_3) = \frac{\bar{\gamma}_3 - E(\bar{\gamma}_3)}{s(\bar{\gamma}_3) \ / \ \sqrt{T-1}},$$

where T is the number of test observations (42) in each series. The statistical significance of the research hypotheses was assessed where the alpha (α) level was 5 percent for all three research hypotheses. Rejection regions for Research Hypotheses 1 and 2 are two-tailed. The critical value indicating statistical significance for these two hypotheses is $\pm$ 2.000. Research Hypothesis 3 has a one-tailed rejection region and consequently has a critical value of + 1.671.

FOOTNOTES - CHAPTER FIVE

[1]Fama and MacBeth, "Risk, Return, and Equilibrium," pp. 607-636.

[2]Beaver, Kettler, and Scholes, "The Association between Market Determined and Accounting Determined Risk Measures," pp. 654-682.

[3]Fama and MacBeth, "Risk, Return, and Equilibrium," p. 622.

[4]*Ibid.*, pp. 607-636.

[5]Nancy Jacob, "The Measurement of Systematic Risk for Securities and Portfolios: Some Empirical Results," *Journal of Financial and Quantitative Analysis* (March 1971): 815-834.

[6]M. E. Blume, "Portfolio Theory: A Step toward Its Practical Applications," *Journal of Business* 43 (April 1970): 152-173.

[7]Fama and MacBeth, "Risk, Return, and Equilibrium," p. 615.

[8]George Foster, "Asset Pricing Models: Further Tests," *Journal of Financial and Quantitative Analysis* (March 1978): 39-53.

CHAPTER SIX

TEST RESULTS

Rejection of H_{o3} would indicate that a statistical relationship does exist between $\beta_i^{\$F}$ and $\tilde{R}_i^{mr}$ analogous to what has been demonstrated elsewhere for the relation between β_i^{mr} and $\tilde{R}_i^{mr}$. The evidence presented here generally suggested that the hypothesized relation between the systematic operating cash flow risk of firms and market returns to securities of those firms had not been captured by the model or the testing procedures used here.

Rejection of H_{o1} would have permitted the conclusion that the non-linear relation between systematic operating cash flow risk and market returns was not statistically significant. Similarly, rejection of H_{o2} would have permitted the conclusion that specific risk, as measured by the size of residuals in the $\beta_{ei}^{\$F}$ estimating regressions, was not significantly related to the market returns of the securities of those firms. The evidence presented here made it possible to conclude that non-linear systematic operating cash flow risk was not statistically related to the market returns of those securities. The evidence did suggest that the average size of the residuals in the $\beta_{ei}^{\$F}$ estimating regressions was positively related to the market returns of those firms' securities.

The tables of statistical results presented below include summary statistics as follows:

1. $\bar{\gamma}_j$: the regression coefficients for each term in the regression equations 45 through 48 averaged across the 20 portfolios for market and cash flow data.

2. $s(\bar{\gamma}_j)$: the standard deviation of each of those average regression coefficients about the $\bar{\gamma}_j$.

3. The t-score of each of the average regression coefficients where there are 41 degrees of freedom. The formula is:

$$t(\bar{\gamma}_j) = \frac{\bar{\gamma}_j}{s(\bar{\gamma}_j) / \sqrt{T-1}}$$

4. The r^2 of each regression equation has been averaged across the 20 portfolios and is presented along with the standard deviation of this r^2.

Tables 1 through 4 contain statistical results for the tests included here. The table number represents the number of the cash flow definition whose results are being presented (see page 46). Panels A through D in each table contain the results for those portfolios ranked initially on b_i^{mr}, while Panels E through H in each table contain the results for the portfolios initially ranked on $b_i^{\$F}$. Panels A and E contain the results for those portfolios whose $b_i^{\$F}$ were estimated from unseasonally adjusted $R_{it}^{\$F}$ and $R_{mt}^{\$F}$ [see (a) on page 48]. Panels B and F contain the results for portfolios whose $b_i^{\$F}$ was estimated from seasonally adjusted $R_{it}^{\$F}$ but using unseasonally adjusted $R_{mt}^{\$F}$ [see (b) on page 48]. Panels C and G contain the results for portfolios whose $b_i^{\$F}$ were estimated from the seasonally adjusted series of both $R_{it}^{\$F}$ and $R_{mt}^{\$F}$ [see (c) on page 48]. Panels D and H contain the results for portfolios whose $b_i^{\$F}$ were estimated from the unseasonally adjusted series of $R_{it}^{\$F}$ but the seasonally adjusted series of $R_{mt}^{\$F}$ [see (d) on page 48]. Table 5 presents the results of a

TABLE 1

STATISTICAL RESULTS USING CASH FLOW DEFINITION 1 IN ESTIMATING SYSTEMATIC RISK

Panel A

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
-.2668-2	-.1366-2	.1711-4	.6373	.3134-1	.1366-1	.7503-3	3.0219	-.545	-.641	.146	1.350	.3559	.2177
.4374-2	-.4973-3	.2486-4		.3427-1	.1631-1	.7574-3		.817	-.195	.209		.2030	.1488
-.3599-2	-.2866-3		.6960	.3103-1	.9214-2		2.9629	-.743	-.200		1.504	.2723	.2249
.4102-2	.1038-2			.3440-1	.1266-1			.764	.525			.1157	.1217

Panel B

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.2219-2	-.5345-2	.4881-3	.3847	.2862-1	.1347-1	.1880-2	3.1368	.496	-.254	1.663	.785	.3616	.2105
.5599-2	-.4995-2	.4988-3		.3628-1	.1349-1	.2538-2		.988	-2.372	1.259		.1856	.1220
.3426-3	-.1892-2		.5411	.2813-1	.9615-2		3.1732	.078	-1.260		1.092	.2770	.2239
.5715-2	-.1341-2			.3832-1	.1015-1			.955	-.846			.0604	.0710

Panel C

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
-.1167-2	.7419-2	.7634-2	.4333	.2754-1	.7601-4	.3376-1	3.0426	-.271	.625	1.448	.912	.3358	.2165
.2499-2	.4868-2	.3900-2		.3587-1	.7760-1	.5438-1		.446	.402	.459		.1813	.1434
.3489-3	-.2319-2		.4487	.2745-1	.2816-1		2.9778	.081	-.527		.965	.2627	.2194
.5446-2	-.6402-2			.4043-1	.3182-1			.863	-1.288			.0541	.0728

Panel D

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
-.3265-2	.8895-2	.1034-1	.4798	.2879-1	.6760-1	3657-1	2.6586	-.726	.843	1.811	1.155	.3241	.2174
.2462-2	.2092-2	.5753-2		.3570-1	.7581-1	5942-1		.442	.177	.620		.1831	.1433
-.2169-2	-.9977-3		.5246	.2932-1	.2814-1		2.7150	-.474	-.227		1.237	.2535	.2202
.5362-2	-.5571-2			.3990-1	.2866-1			.861	-1.245			.0502	.0700

TABLE 1 (Continued)

Panel E

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.4336-2	-.1524-2	.1002-3	.1708	.3706-1	.9903-2	.6692-3	1.7897	.749	-.986	.959	.615	.2765	.1742
.6535-2	-.6155-3	.7123-4		.3931-1	.1177-1	.6164-3		1.064	-.335	.740		.2136	.1562
.3709-2	.1611-3		.2245	.3744-1	.6680-2		1.7561	.634	-.154		.818	.2070	.1758
.5939-2	.5460-3			.3932-1	.9197-2			.967	.380			.1365	.1471

Panel F

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.6007-2	-.1017-2	-.3012-3	.0792	.3541-1	.1083-1	.1989-2	2.9786	1.086	-.652	-.969	.170	.2665	.1752
.6909-2	-.1318-3	-.1601-3		.3911-1	.1113-1	.1269-2		1.131	-.076	-.808		.1369	.1343
.7101-2	-.9580-3		-.0936	.3489-1	.5825-2		1.7903	1.303	-1.053		-.335	.1945	.1636
.6599-2	-.1370-2			.4073-1	.6783-2			1.037	-1.296			.0722	.0978

Panel G

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.4534-2	.3802-2	-.4632-2	.3569	.3282-1	.4288-1	.1504-1	2.6767	.884	.568	-1.972	.854	.2627	.1804
.7143-2	-.386602	-.1105-2		.3805-1	.4668-1	.1141-1		1.202	-.530	.620		.1700	.1430
.6568-2	.2225-5		-.0286	.3389-1	.2944-1		1.961	1.241	.000		-.094	.1985	.1701
.6527-2	-.3035-2			.3958-1	.3954-1			1.056	-.492			.1008	.1273

Panel H

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.5014-2	.1809-2	-.1207-2	.2154	.3166-1	.4708-1	.1336-1	1.7575	1.014	.246	-.578	.785	.2412	.1315
.7273-2	-.2944-2	-.7177-3		.3791-1	.4835-1	.1303-1		1.229	-.390	-.353		.1471	.1002
.4817-2	.4673-3		.1465	.3301-1	.2333-1		1.7125	.934	.128		.548	.1665	.1201
.6700-2	-.4274-3			.4056-1	.2418-1			1.058	-.113			.0677	.0805

TABLE 2

STATISTICAL RESULTS USING CASH FLOW DEFINITION 2 IN ESTIMATING SYSTEMATIC RISK

Panel A

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
-.2765-2	-.1337-2	.1936-4	.6855	.3087-1	.1009-1	.4138-3	3.0748	-.573	-.849	.300	1.428	.3627	.2182
.4662-2	-.9215-3	.3675-4		.3511-1	.1143-1	.4244-3		.869	.516	.555		.2098	.1527
-.3622-2	-.3663-3		.7383	.3081-1	.7065-2		3.0188	-.753	-.332		1.566	.2758	.2274
.4434-2	.5612-3			.3504-1	.9371-2			.8103	.3835			.1152	.1201

Panel B

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.1802-2	-.3951-2	.2421-3	.4180	.2824-1	.1050-1	.1123-2	3.2141	.409	-2.409	1.381	.833	.3712	.2111
.5203-2	-.3590-2	.2780-3		.3580-1	.1032-1	.1464-2		.931	-2.227	1.216		.1962	.1299
.2750-3	-.1501-2		.5623	.2798-1	.7487-2		3.2377	.063	-1.283		1.112	.2821	.2243
.5590-2	-.1170-2			.3845-1	.7922-2			.931	-.945			.0640	.0761

Panel C

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.2716-3	.6905-3	.4111-2	.3562	.2801-1	.5605-1	.1673-1	3.1492	.062	.079	1.574	.724	.3414	.2173
.3051-2	.1247-2	.1965-2		.3553-1	.5507-1	.2518-1		.550	.145	.500		.1849	.1499
.8679-3	-.3046-2		.4314	.2761-1	.2308-1		3.0442	.201	-.845		.907	.2696	.2153
.5200-2	-.5301-2			.3974-1	.2278-1			.838	-1.490			.0641	.0802

Panel D

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
-.2014-2	.3536-2	.5088-2	.4406	.2933-1	.5171-1	.1758-1	2.7369	-.440	.438	1.854	1.031	.3292	.2182
.2764-2	.6800-3	.2841-2		.3525-1	.5533-1	.2692-1		.502	.079	.018		.1889	.1512
-.1472-2	-.2434-2		.5089	.2924-1	.2368-1		2.7692	-.322	-.658		1.177	.2587	.2148
.5245-2	-.5130-2			.3963-1	.2160-1			.848	-1.521			.0603	.0772

TABLE 2 (Continued)

Panel E

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.7964-2	.1175-4	.4414-4	-.1430	.3475-1	.8969-2	.4356-3	1.9945	1.468	.008	.649	-.459	.2869	.1708
.6781-2	-.4941-3	.3514-4		.3932-1	.9588-2	.4240-3		1.104	-.330	.531		.2084	.1658
.7520-2	.6038-3		-.1206	.3421-1	.5825-2		1.9213	1.408	.664		-.402	.2039	.1611
.6142-2	.2675-3			.3971-1	.6970-2			.990	.246			.1198	.1446

Panel F

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.6257-2	-.1613-2	-.7472-5	.0156	.3659-1	.9087-2	.8266-3	2.7120	1.095	-1.136	-.057	.037	.2589	.1962
.6478-2	-.4854-3	.2607-5		.3973-1	.9168-2	.6636-3		1.044	.339	.025		.1219	.1220
.6264-2	-.9861-3		-.0069	.3461-1	.5296-2		1.8275	1.159	-1.192		-.024	.1941	.1757
.6439-2	-.1058-2			.4075-1	.5838-2			1.012	-1.161			.0681	.0873

Panel G

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.5029-2	.4632-2	-.2771-2	.3425	.3379-1	.2214-1	.8853-2	2.7100	.953	1.340	-2.004	.809	.2809	.1758
.6704-2	-.2256-3	.8000-3		.3887-1	.2792-1	.5676		1.104	-.052	.009		.1664	.1279
.6612-2	.2776-2		-.3788	.3482	.1239-1		1.9415	1.216	1.434		-1.249	.2125	.1803
.6329-2	.5643-3			.4021-1	.2472-1			1.008	.146			.0902	.1197

Panel H

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.4249-2	.5233-2	-.8231-3	.2773	.3358-1	.2948-1	.7688-2	1.6335	.810	1.136	-.686	1.097	.2400	.1462
.6856-2	.1245-2	-.3250-3		.3799-1	.3551-1	.8799-2		1.156	.224	-.237		.1588	.1167
.4697-2	.9648-3		.1562	.3444-1	.1781-1		1.614	.873	.347		.620	.1698	.1375
.6484-2	-.4347-3			.4045-1	.2307-1			1.026	-1.207			.0811	.0969

TABLE 3

STATISTICAL RESULTS USING CASH FLOW DEFINITION 3
IN ESTIMATING SYSTEMATIC RISK

Panel A

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(\bar{r}^2)$
.9231-3	-.1145-2	-.1780-4	.5033	.2949-1	.1501-1	.5233-3	2.1652	.200	-.488	.218	1.488	.3157	.1731
.4041-2	.3922-3	.1082-4		.3495-1	.1576-1	.4863-3		.740	.159	.142		.1951	.1481
.4074-3	-.7878-3		.5588	.2993-1	.9768-2		2.1117	.087	-.169		1.694	.2449	.1799
.3674-2	.1832-2			.3545-1	.1127-1			.662	1.041			.1300	.1439

Panel B

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.1161-2	-.4194-2	.1493-3	.6613	.3007-1	.1905-1	.1877-2	3.5902	.247	-1.410	.511	1.179	.3427	.2047
.5355-2	-.4471-2	.2608-3		.3756-1	.1545-1	.1066-2		.913	1.853	1.566		.1797	.1298
.7778-3	-.1276-2		.5968	.3038-1	.1223-1		2.5746	.164	-.668		1.484	.2448	.1919
.4059-2	.1435-2			.3746-1	.1248-1			.694	.736			.0915	.1069

Panel C

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.1122-3	-.8320-2	.5958-3	.5597	.3031-1	.5961-2	.6241-2	3.3748	.024	-.894	.611	1.062	.3070	.2035
.4481-2	-.1717-1	.1526-3		.3827-1	.5749-1	.4518-2		.750	-1.913	.216		.1328	.1113
-.1534-3	-.1449-2		.6795	.2938-1	.1615-1		3.0225	-.033	-.575		1.440	.2299	.1987
.4957-2	-.1755-2			.3860-1	.1444-1			.822	-.778			.0569	.0662

Panel D

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\gamma_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
-.7329-3	-.9276-2	.5139-3	.5102	.2993-1	.5818-1	.5518-2	2.9513	-.050	-1.021	.596	1.107	.3062	.2006
.4345-2	-.1663-1	.8929-4		.3775-1	.6111-1	.4516-2		.737	-1.743	.126		.1375	.1158
-.8257-3	-.1533-2		.6295	.2856-1	.1556-1		2.8206	-.185	.631		1.429	.2304	.2002
.4904-2	-.1699-2			.3852-1	.1455-1			.815	.075			.0581	.0671

TABLE 3 (Continued)

Panel E

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.6192-2	-.9331-3	.1103-3	.0630	.3834-1	.8696-2	.5001-3	1.8411	1.034	-.687	1.412	2.192	.2487	.1527
.5917-2	.2973-3	.2485-4		.4072-1	.8157-2	.4249-3		.931	.233	.375		.1437	.1121
.5707-2	.6328-3		.0452	.3594-1	.4476-2		1.7094	1.017	.905		.169	.1547	.1445
.6143-2	.1023-2			.4051-1	.6537-2			.971	1.005			.0678	.0765

Panel F

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.4969-2	-.8861-3	.3792-4	.1874	.3528-1	.1220-1	.1790-2	1.8020	.902	-.465	.136	.666	.2344	.1693
.6005-2	-.7045-3	.5310-4		.4003-1	.1155-1	.1355		.961	-.391	.003		.1574	.1459
.4964-2	-.1437-2		.1922	.3555-1	.7364-2		1.6967	.894	1.249		.725	.1854	.1625
.6495-2	-.1183-2			.4095-1	.7555-2			1.016	1.003			.0630	.0697

Panel G

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.6736-2	-.1710-2	-.2692-3	-.0101	.3486-1	.3260-1	.4928-2	2.2407	1.237	-.336	-.349	-.003	.2772	.1496
.6599-2	-.2629-2	-.4750-5		.3962-1	.4126-1	.2526-2		1.067	-.408	-.001		.1736	.1295
.5759-2	.8261-3		.0672	.3511-1	.1690-1		1.9805	1.050	.313		.217	.1928	.1627
.6266-2	.1793-2			.4013-1	.1502-1			1.000	.764			.0512	.0746

Panel H

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.2473-2	-.1046-2	-.8265-3	.4959	.3740-1	.2138-1	.4087-2	1.9944	.423	.313	-1.295	1.592	.2220	.1517
.6079-2	-.2699-2	.4620-3		.4109-1	.2248-1	.2887-2		.947	-.769	1.025		.1156	.1001
.2798-2	.1174-3		.4173	.3647-1	.1306-1		1.8812	.491	.058		1.420	.1701	.1460
.6236-2	.5626-3			.4080-1	.1059-1			.979	.340			.0530	.0737

TABLE 4

STATISTICAL RESULTS USING CASH FLOW DEFINITION 4 IN ESTIMATING SYSTEMATIC RISK

Panel A

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.0969-3	-.1158-2	.8860-5	.5168	.3012-1	.9020-2	.2024-3	2.1332	.212	-.822	.280	1.551	.3167	.1740
-.4293-2	.7596-4	.1614-4		.3598-1	.9808-2	.1957-3		.764	.050	.528		.1966	.1453
.4838-3	-.7294-3		.5688	.3024-1	.6319-2		2.0823	.238	-.739		1.749	.2474	.1843
.4064-2	.9958-3			.3601-1	.7365-2			.725	.866			.1321	.1433

Panel B

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.1988-3	-.2024-2	-.5191-4	.8578	.2885-1	.1073-1	.7272-3	3.6234	.044	-1.208	-.457	1.516	.3339	.1985
.4817-2	-.2345-2	-.8187-4		.3772-1	.8854-2	.4746-3		.818	-1.695	-1.105		.1845	.1416
.9011-3	-.9697-3		.5891	.3045-1	.8196-2		2.4694	.189	-.758		1.527	.2478	.1909
.4236-2	.9743-3			.3786-1	.8434-2			.716	.739			.0934	.1150

Panel C

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.6650-3	-.6668-2	.2843-3	.4924	.3027-1	.3289-1	.2934-2	3.6293	.141	-1.300	.620	.869	.3124	.2034
.3792-2	-.1046-1	.3996-4		.3845-1	.3082-1	.1525-2		.063	-2.173	.168		.1400	.1261
.1143-3	-.8416-3		.6837	.2960-1	.8751-2		3.0446	.025	-.616		1.438	.2269	.1928
.4826-2	-.1133-2			.3881-1	.7904-2			.796	-.917			.0527	.0615

Panel D

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.3657-3	-.7213-2	.2712-3	.4345	.2993-1	.3370-1	.2877-2	3.1691	.078	-1.371	.603	.878	.3130	.2037
.3810-2	-.1056-1	.3062-4		.3845-1	.3178-1	.1531-2		.635	-2.128	.128		.1418	.1297
-.5699-3	-.9037-3		.6340	.2879-1	.8463-2		2.8171	-.127	-.684		1.440	.2271	.1956
.4790-2	-.1102-2			.3875-1	.7965-2			.792	-.886			.0538	.0618

TABLE 4 (Continued)

Panel E

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.7814-2	-.1325-2	.8415-4	-.3314	.3952-1	.5618-2	.1254-3	1.7335	1.266	-1.510	4.294	-1.224	.2419	.1410
.5470-2	-.1190-2	.5838-4		.4094-1	.4954-2	.1349-3		.855	-1.538	2.771		.1545	.1095
.6768-2	.6412-3		-.0371	.3862-1	.3928-2		1.7051	1.122	1.045		-.139	.1742	.1278
.6446-2	.4677-3			.4074-1	.4371-2			1.013	.685			.0870	.0732

Panel F

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.5584-2	-.6226-3	-.4455-4	.2670	.3571-4	.7108-2	.7160-3	2.8621	1.001	-.561	.398	.597	.2883	.1656
.6677-2	-.5102-4	.1855-4		.3892-1	.6675-2	.5512-3		1.099	-.049	.215		.1652	.1593
.6655-2	-.1421-2		.0069	.3532-1	.4336-2		1.8461	1.134	-2.099		.024	.2130	.1716
.6426-2	-.1302-2			.4046-1	.4893-2			1.017	-1.704			.0690	.0964

Panel G

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.4912-2	.4637-2	.4736-5	.2743	.3623-1	.1370-2	.1293-2	2.3637	.868	2.167	.023	.743	.2545	.1854
.6372-2	.2023-2	.7066-4		.4029-1	.1389-1	.7394-3		1.013	.932	.612		.1323	.1234
.5537-2	.1452-2		.1300	.3626-1	.7844-2		1.8401	.978	1.186		.452	.1884	.1735
.6461-2	.1336-2			.4035-1	.8351-2			1.025	1.025			.0491	.0805

Panel H

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.2444-2	.6086-3	-.1476-3	.5044	.3612-1	.1267-1	.1075-2	1.7842	.433	.308	-.880	1.810	.2108	.1545
.5997-2	-.8265-3	.8173-4		.4007-1	.1311-1	.8940-3		.958	-.404	.585		.1281	.1024
.3068-2	-.1072-2		.4008	.3600-1	.6090-2		1.7401	.546	-1.127		1.475	.1532	.1432
.6228-2	-.1094-2			.4046-1	.5264-2			.986	-1.331			.0547	.0565

TABLE 5

STATISTICAL RESULTS USING MARKET RETURN DATA IN ESTIMATING SYSTEMATIC RISK

Panel A

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_1)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
-.4647-2	.5022-1	-.2567-1	-.0411	.5408-1	.1646	.1338	.4699	.550	1.953	-1.2288	.5608	.3887	.2401
-.5599-2	.2026-1	-.3218-1		.3416-1	.1495	.1291		-1.050	.868	-1.596		.3195	.2328
-.2996-2	.1902-1		-.0351	.5199-1	.5187-1		.4481	-.3690	2.3474		.5019	.3401	.2575
-.4774-2	.1536-1			.3339-1	.7185-1			-.9154	1.3689			.2676	.2496

Panel B

$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$s(\bar{\gamma}_4)$	$s(\bar{\gamma}_2)$	$s(\bar{\gamma}_3)$	$s(\bar{\gamma}_4)$	$t(\bar{\gamma}_1)$	$t(\bar{\gamma}_2)$	$t(\bar{\gamma}_3)$	$t(\bar{\gamma}_4)$	r^2	$s(r^2)$
.3362-1	-.6818-1	.5713-1	-.1890	.1227	.2310	.1399	1.1317	1.755	-1.890	2.616	-1.070	.4248	.2251
.2127-1	-.5968-1	.4487-1		.8717-1	.2317	.1208		1.562	-1.649	2.378		.3166	.2245
-.5088-2	.2444-1		-.8941	.5987-1	.6661-1		1.0494	-.639	2.349		-.546	.3552	.2485
-.7958-2	.1825-1			.4459-1	.8540-1			-1.143	1.369			.2599	.2456

replication of the Fama and MacBeth study using only those firms meeting the selection criteria described in Chapter Five. Panel A of Table 5 presents the results based on monthly market return data and Panel B presents the results based on quarterly data.

In the tables which follow, it was convenient to generally present four digits to the left of the decimal point and to indicate the number of places the decimal point needs to be moved to the left to interpret the size of the number being presented. For example, .5678-3 is equivalent to .0005678 throughout the tables which follow.

The test results permitted several comparisons and conclusions about the research hypotheses which were posed in this research.

The Relation between $b_p^{\$F}$ and R_p^{mr}

The t-scores on the $b_p^{\$F}$ terms were not statistically significant under either ranking procedure <u>or</u> under any definition of operating cash flow used in this study. While the principal research hypothesis has been rejected, there are observations which should be made. The following comments may overlap other comments made within this section and should not be interpreted in isolation from these other observations.

For operating cash flow definitions 3 and 4 both in unseasonally adjusted format for $R_i^{\$F}$ and $R_m^{\$F}$ <u>and</u> for both initial ranking procedures, the t-scores were around +1.0 in the fourth regression where the independent variables were the risk-free rate and the $b_p^{\$F}$ [see Table 3 Panels A and E, and also Table 4 Panels A and E]. These t-scores indicate a positive relation between the two variables of principal interest in this study.

When using the cash flow ranking procedure in conjunction with cash flow definition 4, where both $R_i^{\$F}$ and $R_m^{\$F}$ were in seasonally adjusted format (Table 4 Panel G), the t-scores on the $b_p^{\$F}$ term were all positive and near +1.0 except in the first regression where the t-score was +2.167. When using the other three formats for seasonally adjusting the return series (or not adjusting the return series), the t-scores were inconsistently positive. These results were encouraging for cash flow definition 4, where $R_i^{\$F}$ and $R_m^{\$F}$ had been seasonally adjusted and where the firms had been ranked on cash flow data as described earlier.

When using the cash flow ranking procedure and cash flow definition 3, the t-scores on the $b_p^{\$F}$ were all positive in regressions 3 and 4. In these regressions, the independent variables were the risk-free rate, $b_p^{\$F}$, and $s(\bar{e}_i)$; and the risk-free rate and $b_p^{\$F}$ respectively. These comments hold regardless of which pattern of seasonal adjustment was employed (Table 3 Panels E through H). The t-scores on $b_p^{\$F}$ were larger in Panels E and F than in Panels G and H. It should be noted here, however, that in the Fama and MacBeth replication the t-scores were significant at the α=.05 level for the b_p^{mr} term in regression 3 but not for regression 4 (see Table 5 Panels A and B).

The Relation between $b_p^{\$F}$ and $\tilde{R}_p^{mr}$ Using Cash Flow Definitions 1 and 2

From the results obtained in the regressions with only two independent variables (R_f and $b_p^{\$F}$), there seemed to be little support for the hypothesized relation between systematic operating cash flow risk as surrogated in this study and the market returns to portfolios. At a minimum, support for the hypothesized relationship would require that the sign of the t-scores on the $b_p^{\$F}$ term would be consistently or generally positive. Using these two definitions of cash flow and market return rankings for portfolio formation purposes, six of eight t-scores on the $b_p^{\$F}$ term were negative. Similarly, using only cash flow data for the initial ranking of firms prior to portfolio formation, five of eight t-scores were negative. Of the positive t-scores in the regressions with only two independent variables from either ranking procedure and from either cash flow definition, the largest positive coefficient was +.525 and is found in Table 1 Panel A.

Since the other cash flow definitions provided more support for the hypothesized relationship between $b_p^{\$F}$ and $\tilde{R}_p^{mr}$, it was not necessary to conclude that the hypothesized relation motivating this study was non-existent. Specifically, cash flow definition 3 provided t-scores which were appealing with respect to sign <u>and</u> size. The conclusion which did seem warranted by the t-scores in the regressions containing only two independent variables was that cash flow definitions 1 and 2 did not provide surrogates of systematic operating cash flow risk which were related to market returns of their respective portfolios regardless of which of the two ranking procedures were used. A priori, it was not known which, if any, of the definitions of cash flow might provide significant or encouraging results. Moreover, it was not clear which ranking procedure would be best suited to provide portfolios with a wide spectrum of $b_p^{\$F}$ values.

Rankings on Cash Flow Data versus Market Return Data

The tests of the hypotheses were conducted on portfolios formed from firms which had been initially ranked on both market return data and cash flow return data. When using the cash flow ranked portfolios (Panels E through H) observe that the t-score obtained for the risk-free rate's contribution to the multiple regression relation was always positive and often was almost significantly positive at the .05 level. This result was comparable to what Fama and MacBeth observed over a much longer period of time when using market return betas.[1] The t-scores obtained on the R_f rate when using portfolios initially ranked on market return data (see Panels A through D) were rarely as large as +1.0 when positive, and were sometimes negative. It was not expected that the risk-free rate should be negatively related to the observed end-of-period market returns to the portfolios. Therefore, the cash flow ranked portfolios appeared to provide t-scores on the risk-free rate which suggested this ranking method was preferable to ranking on market return betas to form portfolios.

The t-scores on the independent variables other than the risk-free rate in these various regressions did not permit reference to an expected outcome as did the t-scores on the risk-free rate. The reason for this was that the other independent variables had not been used in previous empirical research and thus, there were no prior empirical results against which a comparison could be made. Since the t-scores on the risk-free rate in regressions involving portfolios initially ranked on systematic operating cash flow risk measures were positive and often approached significance at the .05 level, the conclusion was drawn that the ranking procedure which was based on cash flow betas in the initial ranking periods was superior to the ranking procedure based on market return betas.

Only in the t-scores for one other independent variable, $s(\bar{e}_i)$, the average residual from the $b_{ei}^{\$F}$ estimating regressions, was there a distinct and recurring difference between the two methods of ranking the firms for the purpose of portfolio formation. The t-scores on this measure of residual risk were always positive and approached significance at the .05 level when using portfolios formed from initial rankings on market return betas (Panels A through D). When observing the t-scores on the same independent variable, but in the regressions where the portfolios had been formed from cash flow betas (Panels E through H) in the initial estimation period, there were nine negative t-scores while six of these values were larger than +1.0. Intuitively, these t-scores should have been positive because the residual risk term reflects (1) a measure of the extent to which the estimation of $b_{ei}^{\$F}$ did not reflect the cyclicality of the firm's earnings process and (2) random error. A more complete discussion of the first point follows later in this chapter.

The t-scores on the $b_p^{\$F}$ and $(b_p^{\$F})^2$ terms did not provide any basis for assessing the aptness of either the cash flow ranking procedure or the market return ranking procedure. The sign and significance levels of the t-scores on the $b_p^{\$F}$ and $(b_p^{\$F})^2$ terms in the various regressions in Tables 1 through 4 were not sufficiently different from the two firm ranking procedures to provide a basis for a conclusion as to which ranking procedure was better.

One factor must be remembered in the interpretation of the results from these two rankings, the initial $b_i^{\$F}$ estimation periods and the $b_p^{\$F}$ estimation periods were of different lengths between the two ranking methods. In the testing procedure where the initial ranking had been on the market return betas, the estimation periods for $b_i^{\$F}$ and $b_p^{\$F}$ were each 20 quarters in length. Recall that the estimation of $b_i^{\$F}$ for this ranking purpose had been via market return data and not by systematic operating cash flow data. The $b_i^{\$F}$ here had been formed from fresh cash flow data over the 20 quarters in the portfolio estimation period.

Alternatively, when the initial ranking of firms had been via cash flow risk measures, the $b_i^{\$F}$ and $b_p^{\$F}$ estimation periods had been only ten quarters in length due to availability of cash flow data only back through July 1970 for enough firms to enable a satisfactory sample size to be obtained for the study.

For the reasons given above and subject to the limitations noted above, it seemed the cash flow beta ranking procedure (Panels E through H) provided a better basis for ordering the firms for entrance into their respective portfolios than did the market ranking procedure. The consistently positive and relatively large t-scores obtained on the risk-free rate when using the cash flow ranking procedure provided credibility for that ranking procedure despite the smaller number of observations available for the estimation of $b_i^{\$F}$ in both the ranking and portfolio estimation periods.

Relation between the Risk-Free Rate and the $\tilde{R}_p^{mr}$

As noted in the previous section, only when the portfolios were formed on the basis of $b_i^{\$F}$ estimated over ten quarters of cash flow data and ranked on this measure, were the t-scores on the risk-free rate of the expected sign (+). If the risk-return relation should be positive ex post, then the owner of a portfolio of risky assets should have earned a rate of return higher than if that owner held the risk-free asset over the same period. While these expected results would not be borne out consistently in ex post results, it could be expected that over a relatively long time period the expected relation would emerge in the ex post results. This expected relation did occur consistently when firms had been ranked for portfolio formation purposes using systematic operating cash flow risk measures rather than using systematic risk measures obtained from market return data assuming these two measures were strongly correlated.

The conclusion that the t-scores on the risk-free rates have the expected sign was contingent upon which ranking procedure was used. In an earlier section of this chapter, the conclusion was drawn that the cash flow ranking procedure was marginally better than the market return ranking procedure. These conclusions were not, therefore, independent of each other.

Seasonally adjusting the return series ($R_{it}^{\$F}$ and $R_{mt}^{\$F}$ or both) generally provided results which were farther from being statistically significant than did the unseasonally adjusted return series ($R_{it}^{\$F}$ and $R_{mt}^{\$F}$). This applied to both methods of ranking the firms prior to portfolio formation. In regression 4 (with only two independent variables) the signs on the coefficient for the $b_p^{\$F}$ term were always positive in Panels A and E in each table. Some of the signs on the coefficient for the $b_p^{\$F}$ term were positive in other panels where some seasonal adjusting had taken place. Except for Table 3 there was no general pattern of positive signs in the other panels. In all cases the r^2 of the regressions involving only two independent variables were higher when neither return series had been seasonally adjusted. The explanatory power of the models used in the testing here has not been enhanced by the efforts to seasonally adjust either return series or both.

The Relation between b_p^{mr} and $\tilde{R}_p^{mr}$ when Using Quarterly Returns

In Table 5, Panels A and B, the results were presented respectively for the replication of the Fama and MacBeth study where the estimation and testing had been done (1) on monthly returns over a time period corresponding to the periods used in this study, and (2) on quarterly returns instead of monthly returns over these corresponding time periods. In the first two regressions listed in Table 5, Panel B, the t-scores on the b_p^{mr} terms were negative. The t-scores on the same independent variable, but in the third and fourth regressions in the same table were positive. The point is that negative t-scores on the b_p^{mr} term in the first regressions were insufficient to judge the extent to which the general CAPM relation between risk and return was fulfilled when using quarterly returns. The observed result on market data and for quarterly returns may make it easier to understand or interpret similar negative t-scores on the $b_p^{\$F}$ terms in the corresponding regressions while using a cash flow definition in conjunction with one of the ranking procedures.

The Relation between the $s(\bar{e}_i)$ Term and the Observed r^2 in the Regressions

Throughout the results obtained, the presence among the independent variables of the $s(\bar{e}_i)$ term was related to a greatly improved degree of explanatory power in the regression (r^2). The $s(\bar{e}_i)$ term reflected a measure of the extent to which the $b_{ei}^{\$F}$ term did not capture the cyclicality of the firm. Thus, the $s(\bar{e}_i)$ term could be thought of as a measure of other unspecified cyclicality measures as well as a measure of random error. These other unspecified cyclicality measures would be reflected in the observed R_p^{mr} if we assume the market can properly interpret all the information coming to it from whatever sources. This explains why the $s(\bar{e}_i)$ terms were positively and almost significantly related to the market return to the portfolios at the .05 level. Moreover, it helps to explain why the observed r^2 in these regressions was enhanced by the inclusion of the $s(\bar{e}_i)$ term in the regressions.

FOOTNOTES - CHAPTER SIX

[1] Fama and MacBeth, "Risk, Return, and Equilibrium," pp. 607-636.

CHAPTER SEVEN

CONCLUSIONS AND LIMITATIONS

This study has failed to establish the hypothesized link between systematic operating cash flow risk as surrogated here and the market returns to portfolios. The value of the present research of an embyonic nature should be judged on its contributions to research which may follow, rather than on the results of this one study alone.

The limitations of the investigation conducted include several factors. First, the cash flow return definitions may not reflect the most appropriate return measures. Perhaps another untried surrogate return measure for operating cash flow would provide a systematic operating cash flow risk estimate that is more closely related to market returns. Improvements in surrogation might be obtained in either the numerator or denominator of the cash flow return measure. The FASB has not concluded its project on funds flow and liquidity. Conclusions of that study may provide alternative useful ways of specifying cash flows.

A second limitation of this study may be the time span over which the cash flow data were available for the various estimation and testing periods. The systematic operating cash flow risk measures actually used during the testing periods were intended to represent a wide range of those systematic risk levels. Because of considerable instability in those measures, however, the $b_p^{\$F}$ used in the testing do not represent the $b_p^{\$F}$ which could have been expected if these systematic risk measures were stable at either the firm or the portfolio level (see Appendix A). This limitation may be the result of estimation periods and portfolio periods which are not long enough to permit a stable measure to be obtained.

A third limitation involves the selected analytical model provided by Haugen and Pappas.[1] There are other related analytical models which, if implemented, might yield results more consistent with the motivation of this study. Rubinstein[2] and Myers and Turnbull,[3] among others, have developed such models which could provide a basis for further testing.

This study has sought to establish the existence of a direct contemporaneous one-period relationship between observed cash flow returns and observed market returns to securities. Financial theory suggests there is a multi-period relationship between <u>expected</u> future cash flows and current security market returns. Such a lead relationship has been ignored in this study. If a model could be developed incorporating actual cash flows and expected future cash flows, the likelihood of observing a relationship between cash flows and market returns would appear to be improved.

FOOTNOTES - CHAPTER SEVEN

[1]Haugen and Pappas, "Equilbrium in the Pricing of Capital Assets," pp. 943-953.

[2]M. E. Rubinstein, "A Mean-Variance Synthesis of Corporate Financial Theory," Journal of Finance 49 (March 1973): 167-181.

[3]S. C. Myers and Stuart M. Turnbull, "Capital Budgeting and the Capital Asset Pricing Model: Good News and Bad News," Journal of Finance (May 1977): 321-333.

APPENDIX A

As noted in the limitations portion of Chapter Seven, there was a large degree of instability in the $b_p^{\$F}$ which were used in the 42 test periods throughout the 14 calendar quarters used in the testing period. In this appendix the $b_p^{\$F}$ which were used in the test periods will be presented for one of the cash flow definitions as an illustration of this instability. For this purpose, the first cash flow definition was selected and neither the firms' nor the market's return series were adjusted for the seasonality factor. Recall the procedures used in arriving at these values. There were two alternative ways of obtaining a ranking of firms for the purpose of assigning those firms to their portfolios. One of these methods was a ranking on market return betas (b_i^{mr}) and the other method was a ranking on cash flow betas ($b_i^{\$F}$). Regardless of the method used to rank these firms, the $b_p^{\$F}$ used in the test periods exhibited a large degree of instability. This instability may have prevented this study from presenting a definitive statement about the risk-return relation where risk is considered to be systematic operating cash flow risk. Additionally, recall, the cash flow return measures used here excluded expected cash flows from their computations.

Table 6, Panel A contains the $b_p^{\$F}$ as they were used in the 14 quarters representing the test periods. These firms were ranked initially on b_i^{mr} for the purpose of forming portfolios. The $b_i^{\$F}$ were then measured in the subsequent 20 quarters and equally weighted to obtain $b_p^{\$F}$. This process was updated each quarter to provide the $b_{p,t-1}^{\$F}$ which was the surrogate for the systematic operating cash flow risk measure at the outset of each quarter. Table 6, Panel B contains the $b_p^{\$F}$ as they were used in the same 14 quarters in the testing period. The firms here were ranked initially using ten quarters of cash flow return data. The $b_i^{\$F}$ were estimated again in the subsequent ten quarters and equally weighted in order to obtain the $b_{i,t-1}^{\$F}$ which were used in the testing periods to surrogate the ex ante concept of systematic operating cash flow risk as it has been described above.

As might be expected, the longer the period of observation of b_i for the purpose of ranking firms on the systematic risk estimate, the less extreme are the subsequent measures of $b_p^{\$F}$ used in the testing periods. This longer period of observation, however, requires the use of market return data for that ranking process. Alternatively, as Table 6, Panel B indicates, when ten quarters of cash flow return data are used for the initial ranking of firms, the result is that the $b_p^{\$F}$ which appear in the testing periods are more extreme. It seems that this is a result of the regression model's inability to efficiently measure the systematic risk of a firm when ten observations are used in that estimation.

Each table contains 20 portfolios. These portfolios are presented here starting with the lowest $b_p^{\$F}$ portfolio and progressing to the highest $b_p^{\$F}$ portfolio. Because of the instability discussed earlier and again above, that progress from low to high may not be apparent.

TABLE 6 PANEL A

Initial Ranking on b_1^{mr}

Quarterly Test Period	$b^{\$F}_{p,1}$	$b^{\$F}_{p,2}$	$b^{\$F}_{p,3}$	$b^{\$F}_{p,4}$	$b^{\$F}_{p,5}$	$b^{\$F}_{p,6}$	$b^{\$F}_{p,7}$	$b^{\$F}_{p,8}$	$b^{\$F}_{p,9}$	$b^{\$F}_{p,10}$
1	0.517	0.309	0.467	0.268	0.445	0.417	0.564	0.833	0.492	0.465
2	0.487	0.458	0.473	0.401	0.570	0.482	0.287	0.509	0.677	0.633
3	0.548	0.318	0.470	0.426	0.433	0.385	0.195	0.259	0.392	0.532
4	0.473	0.566	0.350	0.499	0.465	0.318	0.269	0.479	0.447	0.387
5	0.693	0.460	0.538	0.424	0.498	0.564	0.109	0.411	0.352	0.428
6	0.604	0.556	0.405	0.318	0.448	0.392	0.318	0.412	0.279	0.301
7	0.560	0.501	0.631	0.541	0.490	0.413	0.471	0.541	0.465	0.631
8	0.876	0.450	0.578	0.467	0.599	0.521	0.354	0.597	0.471	0.714
9	1.131	0.825	0.665	0.467	0.602	0.626	0.464	0.389	0.705	0.607
10	1.024	0.787	0.587	0.499	0.606	0.540	0.608	0.482	0.696	0.745
11	1.015	0.708	0.624	0.551	0.533	0.502	0.577	0.596	0.725	0.745
12	1.083	0.815	0.603	0.556	0.543	0.720	0.658	0.655	0.472	0.563
13	1.058	0.628	0.828	0.583	0.705	0.466	0.654	0.731	0.698	0.619
14	1.157	0.653	0.549	0.531	0.753	0.564	0.667	0.611	0.651	0.615
	$b^{\$F}_{p,11}$	$b^{\$F}_{p,12}$	$b^{\$F}_{p,13}$	$b^{\$F}_{p,14}$	$b^{\$F}_{p,15}$	$b^{\$F}_{p,16}$	$b^{\$F}_{p,17}$	$b^{\$F}_{p,18}$	$b^{\$F}_{p,19}$	$b^{\$F}_{p,20}$
1	0.410	0.622	0.522	0.800	0.825	0.747	0.742	0.664	0.977	1.508
2	0.761	0.505	0.478	0.812	0.778	0.657	0.556	0.680	0.699	1.416
3	0.550	0.273	0.803	0.521	0.777	0.898	0.757	0.583	0.463	1.477
4	0.464	0.592	0.645	0.805	0.964	0.999	0.835	0.943	0.490	1.162
5	0.493	0.829	0.807	0.909	0.420	0.532	0.678	0.837	0.814	0.976
6	0.722	0.588	1.019	0.585	0.561	1.023	0.634	0.662	1.066	0.945
7	0.782	0.716	0.762	0.746	0.659	0.836	0.813	0.895	0.736	0.826
8	0.847	0.804	0.963	0.892	0.886	0.911	0.530	0.767	0.781	0.697
9	0.523	0.837	0.699	0.773	0.884	0.738	0.580	0.777	0.949	0.684
10	0.524	0.661	0.632	0.719	0.657	0.677	0.469	0.754	0.900	0.684
11	0.619	0.634	0.641	8.706	0.777	0.684	0.564	0.744	0.857	0.754
12	0.726	0.616	0.791	0.544	0.620	0.810	0.572	0.865	0.848	0.721
13	0.655	0.615	0.721	0.607	0.461	0.716	0.908	0.753	0.906	0.725
14	0.620	0.576	0.690	0.626	0.628	0.807	0.881	0.961	0.866	1.027

TABLE 6 PANEL B

Initial Ranking on $b_1^{\$F}$

Quarterly Test Period	$b_{p,1}^{\$F}$	$b_{p,2}^{\$F}$	$b_{p,3}^{\$F}$	$b_{p,4}^{\$F}$	$b_{p,5}^{\$F}$	$b_{p,6}^{\$F}$	$b_{p,7}^{\$F}$	$b_{p,8}^{\$F}$	$b_{p,9}^{\$F}$	$b_{p,10}^{\$F}$
1	-0.333	1.492	-0.054	-0.066	1.420	0.331	0.367	0.481	0.286	0.288
2	-0.062	1.339	0.913	0.068	0.143	0.289	0.396	0.063	0.614	0.216
3	0.193	1.006	0.042	0.501	0.019	0.186	-0.097	0.088	0.224	-0.722
4	0.252	0.958	0.056	-0.171	0.044	-0.111	-0.248	-0.351	-0.461	-0.074
5	-0.282	-0.235	-0.074	-0.088	-0.538	-0.325	0.652	0.031	-0.058	0.172
6	-0.540	-0.576	-0.250	-0.029	-0.136	0.023	-0.271	-0.018	-0.193	-0.135
7	-0.406	-0.148	-0.500	-0.280	-0.824	0.026	-0.257	-0.079	1.770	-0.119
8	-0.906	-0.170	-0.463	0.622	1.096	-0.282	-0.010	-0.169	0.010	-0.014
9	0.338	-0.899	-0.867	-0.832	-0.304	3.265	-0.362	-0.369	1.117	-0.513
10	0.229	-0.756	-1.092	-0.398	-0.597	5.034	-0.701	0.124	-0.007	1.270
11	0.327	-1.023	-0.769	-0.239	-0.740	4.843	0.293	-0.597	-0.862	0.876
12	0.265	-0.505	-0.576	-0.507	-0.827	5.076	-0.449	-0.611	-0.375	-0.625
13	0.437	0.154	0.139	-2.249	-1.394	-2.276	-1.578	4.173	-3.173	-0.848
14	-1.467	0.775	-2.510	-2.632	-1.701	-2.305	0.898	-0.757	-1.500	-0.131

Quarterly Test Period	$b_{p,11}^{\$F}$	$b_{p,12}^{\$F}$	$b_{p,13}^{\$F}$	$b_{p,14}^{\$F}$	$b_{p,15}^{\$F}$	$b_{p,16}^{\$F}$	$b_{p,17}^{\$F}$	$b_{p,18}^{\$F}$	$b_{p,19}^{\$F}$	$b_{p,20}^{\$F}$
1	-0.239	0.481	0.529	0.589	0.228	1.602	-0.786	0.829	0.048	2.530
2	-0.403	0.435	0.414	0.570	0.266	-0.267	0.803	0.261	0.247	2.881
3	0.151	0.734	-0.017	0.347	1.518	-0.207	0.482	0.413	0.535	2.500
4	-0.141	-0.042	1.970	0.251	0.334	0.016	0.316	0.049	0.261	2.595
5	0.127	0.257	0.238	1.677	0.060	-0.016	0.053	0.178	0.058	3.326
6	0.324	0.287	-0.039	0.136	1.259	0.528	0.830	0.498	0.892	3.799
7	0.117	0.291	0.438	0.178	0.462	0.422	0.098	1.032	1.122	4.555
8	0.163	0.151	0.084	0.513	0.141	0.919	0.549	0.651	1.292	4.309
9	-0.010	0.238	0.089	-0.304	0.401	0.188	0.112	0.395	1.229	4.447
10	-0.560	0.023	0.213	0.148	0.398	0.285	0.257	0.752	0.602	4.394
11	-0.815	-0.035	-0.014	0.656	0.182	0.283	0.348	0.735	0.869	5.004
12	-1.176	0.259	0.500	-0.119	-0.498	1.053	0.113	0.723	1.353	5.278
13	0.114	0.011	1.653	2.512	0.514	0.795	2.714	0.832	4.254	8.081
14	-1.014	-1.960	-1.039	0.187	4.220	0.883	1.919	2.998	3.823	4.661

Appendix B

Firms Included in the Sample for at Least One Quarter

1. Adams Drug Inc
2. Akzona
3. Alagasco Inc
4. Alcan Aluminium Ltd
5. Alco Standard Corp
6. Allegheny Ludlum Inds
7. Allegheny Power System
8. Allied Chemical Corp
9. Allright Auto Parks Inc
10. Alpha Portland Inds
11. Aluminum Co of America
12. Amerada Hess Corp
13. American Airlines Inc
14. Amcord Inc
15. American Cyanamid Co
16. American Electric Power
17. American Seating Co
18. American Stores Co - New
19. Ampco-Pittsburgh Corp
20. Anderson, Clayton & Co
21. Arizona Public Service Co
22. Arkansas Best Corp
23. Arkansas Louisiana Gas
24. Armco Inc
25. Asarco Inc
26. Ashland Oil Inc
27. Atlantic City Electric
28. Atlantic Richfield Co
29. BT Mortgage Investors
30. Baltimore Gas & Electric
31. Bandag Inc
32. Bausch & Lomb Inc
33. Bayuk Cigars Inc
34. Beckman Instruments Inc
35. Beech Aircraft Corp
36. Belco Petroleum Corp
37. Bendix Corp
38. Beneficial Corp
39. Bethlehem Steel Corp
40. Big Three Industries
41. Blair (John) & Co
42. Borg-Warner Corp
43. Boston Edison Co
44. British Petroleum Co Ltd
45. Browning-Ferris Inds
46. Bucyrus-Erie Co
47. Burlington Industries Inc
48. Butler International Inc
49. Buttes Gas & Oil Co
50. CP National Corp

51. Cabot Corp
52. Campbell Red Lake Mines
53. Carlisle Corp
54. Carolina Power & Light
55. Cascade Natural Gas Corp
56. Caterpillar Tractor Co
57. Central & South West Corp
58. Central Hudson Gas & Electric
59. Central Illinois Light
60. Central Illinois Public Service
61. Central Louisiana Energy Corp
62. Central Maine Power Co
63. Certain-Teed Corp
64. Chesapeake Corp of Va
65. Chrysler Corp
66. Cincinnati Bell Inc
67. Cincinnati Gas & Electric
68. Cincinnati Milacron Inc
69. Cities Service Inc
70. City Investing Co
71. Clark Oil & Refining Corp
72. Cleveland Electric Illum
73. Cluett, Peabody & Co
74. Coleco Inds
75. Columbia Gas System
76. Columbus & Southern Ohio
77. Commonwealth Edison
78. Community Public Service
79. Conoco Inc
80. Consolidated Edison of NY
81. Consolidated Natural Gas Co
82. Cooper Inds Inc
83. Copperweld Corp
84. Corning Glass Works
85. Cox Broadcasting Corp
86. Crane Co
87. Cummins Engine
88. Cyclops Corp
89. Dayton Power & Light
90. Delmarva Power & Light
91. Delta Airlines Inc
92. Deltec International Ltd
93. De Soto Inc
94. Detroit Edison Co
95. Dillon Cos
96. Dome Mines Ltd
97. Dover Corp
98. Dow Chemical
99. Dow Jones & Co Inc
100. Du Pont (E.I.) de Nemours

101. Duke Power Co
102. Duquesne Light Co
103. Easco Corp
104. Eastern Air Lines
105. Eastern Gas & Fuel Assoc
106. Eastern Utilities Assoc
107. Eaton Corp
108. Empire District Electric Co
109. Enserch Corp
110. Equitable Gas Co
111. Evans Products Co
112. Exxon Corp
113. Fairchild Industries Inc
114. Federal National Mortgage Assn
115. Florida Power & Light
116. Florida Power Corp
117. Ford Motor Corp
118. Fruehauf Corp
119. Gannett Co
120. Gen Amer Oil Co of Texas
121. General Growth Prop
122. General Motors Corp
123. General Public Utilities
124. Getty Oil Co
125. Gino's Inc
126. Global Marine Inc
127. Goodyear Tire & Rubber Co
128. Great Northern Nekoosa Corp
129. Greyhound Corp
130. Gulf Oil Corp
131. Gulf Resources & Chemical
132. Gulf States Utilities Co
133. Hammermill Paper Co
134. Hanna Mining Co
135. Harte-Hanks Communications
136. Hawaiian Electric Co
137. Helmerich & Payne
138. Hercules Inc
139. Hilton Hotels Corp
140. Hospital Corp of America
141. Host International Inc
142. Hudson Bay Mining & Smelting
143. Huyck Corp
144. IU International Corp
145. Idaho Power Co
146. Illinois Power Co
147. Inco Ltd
148. Indiana Gas Co
149. Indianapolis Power & Light
150. Inexco Oil

151. Inland Steel Co
152. International Paper Co
153. Interstate Power Co
154. Iowa-Illinois Gas & Electric
155. Kaiser Aluminum & Chemical Corp
156. Kaiser Cement Corp
157. Kaiser Steel Corp
158. Kane-Miller Corp
159. Kansas City Power & Light
160. Kansas Gas & Electric
161. Kansas-Nebraska Natl Gas Co
162. Kansas Power & Light
163. Keene Corp
164. Kennecott Copper Co
165. Kentucky Utilities Co
166. Kerr-MeGee Corp
167. Knight-Ridder Newspapers Inc
168. Kroger Co
169. LaClede Gas Co
170. Lamson & Sessions Co
171. Libbey-Owens-Ford Co
172. Lomas & Nettleton Mtg Inv
173. Long Island Lighting
174. Louisiana Land & Exploration
175. Louisiana Pacific
176. Louisville Gas & Electric
177. Ludlow Corp
178. Macke Co
179. Mapco Inc
180. Marathon Mfg Co
181. Marathon Oil Co
182. Maytag Co
183. McDermott (J. Ray) & Co
184. McGraw-Hill Inc
185. McIntyre Mines Ltd
186. McLouth Steel Corp
187. Mead Corp
188. Melville Corp
189. Meredith Corp
190. Mesa Petroleum
191. Mesta Machine Co
192. Metromedia Inc
193. Mid-Continent Telephone
194. Middle South Utilities
195. Midland-Ross Corp
196. Milton Roy Co
197. Minnesota Power & Light
198. Missouri Pacific Corp
199. Missouri Public Service Co
200. Mobil Corp

201. Mohawk Rubber Co
202. Monsanto Co
203. Montana-Dakota Utilities
204. Montana Power Co
205. Murphy Oil Co
206. Murray Ohio Mfg Co
207. National Airlines Inc
208. National Can Corp
209. National Distillers & Chemical
210. National Gypsum Co
211. National Steel Corp
212. Nevada Power Co
213. New England Electric System
214. New England Gas & Electric
215. New York State Elec & Gas
216. Newmont Mining Co
217. Niagara Mohawk Power
218. Northeast Utilities
219. Northern Indiana Public Service
220. Northern States Power
221. Northgate Exploration Ltd
222. Northwest Airlines Inc
223. Ohio Edison Co
224. Oklahoma Gas & Electric
225. Olin Corp
226. Orange & Rockland Utilities
227. Overnite Transportation
228. Overseas Shipholding Group
229. Owens-Illinois Inc
230. PPG Industries Inc
231. PSA Inc
232. Pacific Gas & Electric
233. Pacific Lighting Corp
234. Pacific Lumber Co
235. Pacific Tin Cons Corp
236. Pan American World Airways
237. Panhandle Eastern Pipe Line
238. Pargas Inc
239. Pennsylvania Power & Light
240. Pennzoil Co
241. Peoples Gas Co
242. Petrolane Inc
243. Phelps Dodge Corp
244. Philadelphia Electric Co
245. Phillips Petroleum Co
246. Pioneer Corp
247. Portland General Electric
248. Potlatch Corp
249. Potomac Electric Power
250. Public Service Co of Colorado

251. Public Service Co of Indiana
252. Public Service Co of New Hapshire
253. Public Service Co of New Mexico
254. Public Service Elec & Gas
255. Puget Sound Power & Light
256. Quaker State Oil Refining
257. Raytheon Co
258. Reeves Brothers Inc
259. Republic Airlines Inc
260. Republic Steel Corp
261. Reserve Oil & Gas
262. Revere Copper & Brass Inc
263. Rexham Corp
264. Reynolds Metals Co
265. Robertshaw Controls
266. Rochester Gas & Electric
267. Rowan Cos Inc
268. Royal Dutch Petroleum Co
269. SCM Corp
270. SPS Technologies Inc
271. St. Joseph Light & Power
272. Sambo's Restaurants
273. San Diego Gas & Electric
274. Santa Fe International
275. Saul (B. F.) Real Estate Inv
276. Sav-On-Drugs Inc
277. Savannah Electric & Power
278. Schlumberger Ltd
279. Scott Paper Co
280. Seaboard World Airlines
281. Seagrave Corp
282. Shell Oil Co
283. Sierra Pacific Power
284. South Carolina Electric & Gas
285. Southern Calif Edison Co
286. Southern Co
287. Southern Natural Resources
288. Southern New England Telephone
289. Southern Railway
290. Southern Union Co
291. Southwest Airlines
292. Sperry Corp
293. Square D Co
294. Standard Oil Co (Calif)
295. Standard Oil Co (Indiana)
296. Standard Oil Co (Ohio)
297. Stauffer Chemical Co
298. Stone & Webster Inc
299. Stone Container Corp
300. Suburban Propane Gas Corp

301. Sun Co
302. Sunshine Mining Co
303. Superior Oil Co
304. TRW Inc
305. Tampa Electric Co
306. Tappan Co
307. Teleprompter Corp
308. Tenneco Inc
309. Texaco Inc
310. Texas Eastern Corp
311. Texas Gas Transmission
312. Texas Utilities Co
313. Textron Inc
314. Thiokol Corp
315. Tidewater Inc
316. Tiger International
317. Times Mirror Co
318. Toledo Edison Company
319. Tucson Electric Power Co
320. UAL Inc
321. UGI Corp
322. UNC Resources Inc
323. Union Camp Corp
324. Union Carbide Corp
325. Union Electric Co
326. Union Oil Co of California
327. Uniroyal Inc
328. United Illuminating Co
329. United Inns Inc
330. United Refining Co
331. U. S. Industries
332. U. S. Steel Corp
333. Utah Power & Light
334. Viacom International
335. Virginia Electric & Power
336. Vulcan Materials Co
337. WUI Inc
338. Warner & Swasey
339. Washington Water Power
340. Wells Fargo Mtg & Equity Tr
341. Western Airlines Inc
342. Western Union Corp
343. Wheeling-Pittsburgh Steel
344. Wisconsin Electric Power
345. Wisconsin Power & Light
346. Wisconsin Public Service
347. Witco Chemical Corp
348. Wometco Enterprises Inc
349. World Airways Inc
350. Xerox Corp
351. Zapata Corp
352. Zenith Radio Corp

BIBLIOGRAPHY

American Accounting Association. Statement on Accounting Theory and Theory Acceptance. Sarasota, Florida: American Accounting Association, 1977.

American Institute of Certified Public Accountants. Objectives of Financial Statements. New York: American Institute of Certified Public Accountants, 1973.

Ball, Ray, and Brown, Phillip. "An Empirical Evaluation of Accounting Income Numbers." Journal of Accounting Research Vol. 6, Number 2 (Autumn 1968): 159-177.

Ball, Ray, and Brown, Phillip. "Portfolio Theory and Accounting." Journal of Accounting Research Vol. 7, Number 2 (Autumn 1969): 300-322.

Beaver, William H. "The Behavior of Security Prices and Its Implications for Accounting Research (Methods)." Accounting Review supplement to Vol. XLVII (1972): 407-437.

Beaver, William H. "The Implications of Security Price Research for Disclosure Policy and the Analyst Community." Stanford University (1976).

Beaver, William; Kettler, Paul; and Scholes, Myron. "The Association Between Market Determined and Accounting Determined Risk Measures." Accounting Review Vol. XLV, Number 4 (October 1970): 654-682.

Beaver, William H.; Kinnelly, John W.; and Voss, William H. "Predictive Ability as a Criterion for the Evaluation of Accounting Data." Accounting Review Vol. XLIII, Number 4 (October 1968): 675-683.

Beaver, William, and Manegold, James. "The Association Between Market-Determined and Accounting-Determined Measures of Systematic Risk: Some Further Evidence." Journal of Financial and Quantitative Analysis Vol. 10 (June 1975): 231-284.

Bildersee, John S. "The Association Between a Market-Determined Measure of Risk and Alternative Measures of Risk." Accounting Review Vol. L, Number 1 (January 1975): 81-98.

Blume, M. E. "Portfolio Theory: A Step Towards Its Practical Applications." Journal of Business Vol. 43 (April 1970): 152-173.

Boatman, James R. and Revsine, Lawrence. "Firm Specific Accounting Data and the Capital Asset Pricing Model: A Reconciliation and Extension." Northwestern University (1979).

Bowman, Robert G. "The Theoretical Relationship Between Systematic Risk and Financial (Accounting) Variables." Journal of Finance Vol. 34 (June 1979): 617-630.

Bowman, Robert G. "The Importance of a Market Value Measurement of Debt in Assessing Leverage." Journal of Accounting Research Vol. 18, Number 1 (Spring 1980): 242-254.

Breen, W. J., and Lerner, E. M. "Corporate Financial Strategies and Market Measures of Risk and Return." Journal of Finance Vol. XXVIII (May 1973): 339-352.

Brennan, M. J. "An Approach to the Valuation of Uncertain Income Streams," Journal of Finance Vol. 28 (June 1973): 661-674.

Dutta, M. Econometric Methods. Cincinnati: Southwestern Publishing Co., 1975.

Fama, Eugene F. Foundations of Finance. New York: Basic Books, 1976.

Fama, Eugene F., and MacBeth, James D. "Risk, Return, and Equilibrium: Empirical Tests." Journal of Political Economy Vol. 18 (May-June 1973): 607-636.

Fama, Eugene F., and Miller, Merton H. The Theory of Finance. New York: Holt Rinehart and Winston, 1972.

Financial Accounting Standards Board. Tentative Conclusions on Objectives of Financial Statements of Business Enterprises. Stamford, Connecticut: Financial Accounting Standards Board, 1976.

Financial Accounting Standards Board. FASB Discussion Memorandum: An Analysis of Issues Related to Reporting Earnings. Stamford, Connecticut: Financial Accounting Standards Board, 1979.

Financial Accounting Standards Board. Statement of Financial Accounting Concepts No. 1. Stamford, Connecticut: Financial Accounting Standards Board, 1978.

Foster, George. "Asset Pricing Models: Further Tests." Journal of Financial and Quantitative Analysis (March 1978): 39-53.

Gonedes, Nicholas J. "Remarks on 'Empirical Research in Accounting 1960-1970: An Appraisal'," In Accounting Research 1960-1970: A Critical Evaluation, edited by Nicholas Dopuch and Lawrence Revsine. Champaign, Illinois: University of Illinois Center for International Education and Research in Accounting, 1973.

Gonedes, N. J. "Evidence on the Information Content of Accounting Numbers: Accounting-Based and Market-Based Estimates of Systematic Risk." Journal of Financial and Quantitative Analysis Vol. VIII (June 1973): 407-444.

Gonedes, Nicholas J. "A Note on Accounting-Based and Market-Based Estimates of Systematic Risk." Journal of Financial and Quantitative Analysis Vol. 10 (June 1975): 355-365.

Gonedes, Nicholas J. "The Capital Market, the Market for Information, and External Accounting." Journal of Finance Vol. 31 (May 1976): 611-630.

Haley, Charles W., and Schall, Lawrence J. The Theory of Financial Decisions 2d ed. New York: McGraw-Hill, 1979.

Hamada, R. "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stocks." Journal of Finance Vol. XXVII (May 1972): 435-452.

Haugen, R. A., and Pappas, J. L. "Equilibrium in the Pricing of Capital Assets, Risk-Bearing Debt Instruments, and the Question of Optimal Capital Structure." Journal of Financial and Quantitative Analysis Vol. VI (June 1971): 943-953.

Jacob, Nancy. "The Measurement of Systematic Risk for Securities and Portfolios: Some Empirical Results." Journal of Financial and Quantitative Analysis Vol. VI (March 1971): 815-834.

Johnston, J. Econometric Methods 2d ed. New York: McGraw-Hill, 1972.

Lev, B. "On the Association Between Operating Leverage and Risk." Journal of Financial and Quantitative Analysis Vol. IX (September 1974): 627-642.

Lev, B., and Kunitsky, S. "On the Association Between Smoothing Measures and Risk of Common Stocks." Accounting Review Vol. XLIX, Number 2 (April 1974): 259-270.

Markowitz, H. Portfolio Selection: Efficient Diversification on Investments. New York: Wiley, 1959.

May, Robert G., and Sundem, Gary L. "Cost of Information and Security Prices: Market Association Tests for Accounting Policy Decisions." Accounting Review Vol. XLVIII, Number 1 (January 1973): 80-94.

Modigliani, Franco, and Miller, Merton H. "The Cost of Capital, Corporation Finance, and the Theory of Investment." American Economic Review Vol. 48 (June 1958): 261-297.

Mossin, Jan. "Equilibrium in a Capital Asset Market." Econometrica Vol. 34 (October 1966): 768-783.

Myers, S. C. "The Relation Between Real and Financial Measures of Risk and Return." In Risk and Return in Finance edited by Irwin Friend and James L. Bicksler. Cambridge, Massachusetts: Ballinger Publishing, 1977.

Myers, Stewart C., and Turnbull, Stuart M. "Capital Budgeting and the Capital Asset Pricing Model: Good News and Bad News." Journal of Finance Vol. 32 (May 1977): 321-333.

Rubinstein, Mark E. "A Mean-Variance Synthesis of Corporate Financial Theory." Journal of Finance Vol. 28 (March 1973): 167-181.

Sharpe, W. F. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." Journal of Finance Vol. 19 (September 1964): 425-442.

Thompson, Donald J. II. "Sources of Systematic Risk in Common Stocks." Journal of Business Vol. 49 (April 1976): 173-188.

Tobin, J. "Liquidity Preference as a Behavior Towards Risk." Review of Economic Studies Vol. 25 (February 1958): 65-86.

Turnbull, Stuart M. "Market Value and Systematic Risk." Journal of Finance Vol. 32 (September 1977): 1125-1142.

Turnbull, Stuart M. "Debt Capacity." Journal of Finance Vol. 34 (September 1979): 931-940.

Wolfson, Mark A. "Toward an Understanding of the Complimentary Nature of Security Price and Non-Security Price Information in Relative Risk Parameter Estimation." Ph.D. dissertation, University of Texas at Austin, 1977.

Wolfson, Mark A. "Leverage, Cost of Capital, and Dependence Between Production-Investment and Financing Decision Variables." Stanford University (1978).