New Evidence on the Capital Asset Pricing Model

by

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The original Sharpe-Lintner capital asset pricing model advanced to explain the variations in risk differentials on different risky assets has now been widely questioned on the basis of the empirical evidence, and a large number of modified theories have been proposed to explain the discrepancies between theory and observation. The evidence points to a reasonably linear relationship on the average between return and non-diversifiable risk of outstanding common stock, or at least those listed on the New York and American Stock Exchanges. However, this same return-risk linear relationship does not seem to imply a riskless market rate of return consistent with any reasonable measure of the actual risk-free rates of return.[1]

Moreover, while over the long-run the observed linear relationship between return and risk on individual stocks yields the expected positive sign of the risk coefficient more often than not, the shorter-term relationship has been erratic and has not been explained satisfactorily by the observed difference between the market rate of return of stocks as a whole and the risk-free rate. As a result of these findings, questions have been raised about the nature of the relationship between expected and actual rates of return, i.e., about the return generating model, as well as about the theory relating expected return to risk.

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[1]Friend, I. and Blume, M, "Measurement of Portfolio Performance Under Uncertainty, American Economic Review, September, 1970; Black, F., Jensen, M., and Scholes, M., "The Capital Asset Pricing Model: Some Empirical Tests," in Jensen, M. (ed.), Studies in the Theory of Capital Markets, Praeger, 1972; Blume, M. and Friend, I., "A New Look at the Capital Asset Pricing Model," The Journal of Finance, March, 1973; Fama, E. and J.D. MacBeth, "Risk, Return and Equilibrium: Empirical Tests, Journal of Political Economy, May, 1973, and Pettit R. and R. Westerfield, "Using the Market Model and Capital Asset Pricing Model to Predict Security Returns," Journal of Financial and Quantitative Analysis, December 1974.

A number of theoretical and empirical attempts have been made either to explain the apparent deficiencies in the original model on measurement and other statistical grounds or to modify that model to bring theory in closer conformance with reality. In our view, none of these attempts has been successful in bridging the gap between theory and measurement.[1] However, four recent studies bearing on the plausability of the original or modified capital asset pricing models and on the relevance of past tests of these models merit brief mention prior to the introduction of the new tests presented in this paper.

The first of these studies, based on an analysis of the stock portfolios as well as the major classes of assets and liabilities held by different individuals,[2] found that a surprisingly large proportion of portfolios and assets were highly undiversified. It was concluded from an examination of the other alternatives that the two most plausible explanations of this finding are either, first, that investors hold heterogeneous expectations as to expected return and risk and the short sales mechanism is imperfect or, second, that they do not properly aggregate risks of individual assets to measure the risk of an entire portfolio. Both of these explanations conflict with important assumptions typically made in capital asset theory, but the second is obviously basic since it raises questions about the justification for sole reliance on beta or covariance with the market return rather than on variance (or standard deviation) of the asset's own returns as a measure of the market's appraisal of asset risk.

[1] These attempts are summarized in Friend, I., "Recent Developments in Finance," Journal of Banking and Finance, October, 1977.

[2] Blume, M. and I. Friend, "The Asset Structure of Individual Portfolios and Some Implications for Utility Functions," The Journal of Finance, May 1975.

The second study, based on a survey of over 1000 individual stockholders in the fall of 1975, found that when the 82% of stockholding families which customarily evaluated the degree of risk involved in purchasing stock were asked what measures of risk they used, 45% stated they used earnings volatility, 30% price volatility and 17% betas.[1] The answers to other questions also suggested that the preponderance of investors including those who were rich had very little conception of the relationship of an asset's covariance with the market to its contribution to the riskiness of a portfolio. Thus this second study like the first raises questions about at least one of the basic assumptions made in current capital asset pricing theory.

Of course, even if the basic assumptions of the theory appear to be grossly inconsistent with the facts, the theory might still be useful if it can explain the observed phenomena in which we are interested, i.e., risky asset returns. (Conceivably, it might also be of interest for normative reasons). In the absence of direct evidence that beta is the only or at least the predominant measure of market risk for purposes of explaining asset returns, we might be satisfied with strong indirect empirical evidence if we could adequately explain the discrepancies between the original or modified capital asset pricing theories and the observed facts. Thus, it is of some interest to note that a third recent study finds that a measure of co-skewness can be used as a supplement to the customary beta or covariance measure of risk to explain the otherwise observed discrepencies between theory and fact

[1] Blume, M. and I. Friend, The Changing Role of the Individual Investor, The Twentieth Century Fund, 1978. Weighting the replies by the value of a family's stock portfolio does not change these results substantially.

in relating the returns on individual NYSE stocks to the return on NYSE stocks as a whole.[1] In other words, this study finds that capital asset pricing theory now modified to make the plausible assumption that investors prefer positive skewness in their portfolios (and therefore positive co-skewness in individual assets) is apparently able to explain observed returns in the stock market without the substitution of a zero-beta construct for the risk-free rate.

The fourth recent study to which we want to refer is one which neither attempts to confirm or disprove the two-parameter capital asset pricing model but instead argues that it is defective as a scientific hypothesis, no valid test of this model has ever been carried out, and it is doubtful that a valid test can be made.[2] The main thrust of this argument is that all testable implications of the theory follow from the _ex ante_ efficiency of the market portfolio and thus the theory is not testable unless the true market portfolio is known and used in the test since even a small departure from the true market portfolio may vitiate the tests. To support this position, it is shown that it is possible to construct a market proxy that supports the Sharpe-Lintner model perfectly even though it has a .895 correlation with the market proxy used in one well-known test which resulted in a rejection of that model.

It would appear that this recent study has rediscovered the fact that the testing of a theory is a joint test of the validity of theory and the reasonableness of the empirical constructs used in testing it. If the study had been able to construct a market portfolio which had _a priori_

[1]Alan Kraus and Robert H. Litzenberger, "Skewness Preference and the Valuation of Risk Assets," _The Journal of Finance_, Setember 1976.

[2]Richard Roll, "A Critique of the Asset Pricing Theory's Tests," _Journal of Financial Economics_, March 1977.

reasonableness and supported the Sharpe-Lintner model, this would constitute scientific evidence in favor of that model. However, to our knowledge, no one has yet been able to do this even though various plausible combinations of marketable assets (mainly stocks and bonds) have been tried. To demonstrate that a "curve-fitting" process can provide a portfolio which is called the "market" because it supports the Sharpe-Lintner model has no obvious relevance to scientific testing.[1] It is mentioned here mainly because it has received widespread attention and because it has some relevance to the new tests in this paper.

These new tests are of two types. The first set substitutes ex ante (expected) for ex post (realized) measures of return in testing capital asset pricing theory. These ex ante data were obtained for a sample of common stocks from a sample of financial institutions for each of four periods in 1972, 1974, 1976 and 1977. Such data not previously available permit a more direct test of theory explaining the relationship between expected or required rates of returns and risk than is possible when only actual rates of return are available since it is no longer necessary to predicate the nature of the relationship between expected and actual rate of returns. They also permit the estimation of a direct measure of the heterogeneity of expectations for individual stocks and of the relationship between both expected and actual rates of return and the measure of heterogeneity.

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[1]The computed tangent portfolio used by Roll, representing some unknown combination of assets, is presumably a much less satisfactory proxy for the market portfolio than the value-weighted total of stocks used in the studies he is criticizing. It may be worth adding that all proxies for the market portfolio selected ex ante (rather than ex post) have led to the same qualitative result Roll questions.

The second set of new tests uses data on bond indexes and a large sample of individual bonds both to obtain improved measures of the rate of return on the portfolio of marketable risky assets[1] and to incorporate, for the first time to our knowledge, returns on individual bonds as well as on individual stocks in the return-risk relationships used to test capital asset pricing theory. The improved estimates of return on the market portfolio permit a more satisfactory test of the thesis that the discrepencies between Sharpe-Lintner theory and the observed facts are attributable to deficiencies in measurement of return on the market portfolio. The data on bond returns should provide an especially promising source of information to test the importance of co-skewness in explaining returns on risky assets since bonds would be expected to be quite different from stocks in their co-skewness properties. Moreover, it is difficult to understand why heretofore no systematic attempt has been made to determine whether the only major class of risky marketable assets other than stocks for which returns can readily be estimated appears to conform to the return-risk relationship observed for stocks.

[1]That the introduction of the main non-marketable risky asset, i.e., human capital, does not significantly alter the results of the tests of the capital asset pricing model which make no allowance for non-marketable assets is suggested by Fama, E. and G. Schwert, "Human Capital and Capital Market Equilibrium," Journal of Financial Economics, Jan. 1977.

Tests of the CAPM Based on Expected Returns

As a by-product of another study, expected annual rates of return were collected on 41 common stocks from 7 financial institutions in June 1972; the corresponding numbers were 66 and 21 in August 1974, 49 and 33 in March 1976, and 56 and 29 in February 1977. The institutions covered, including commercial banks, insurance companies and investment counseling firms were those with the largest equity portfolios and the response rates averaged over 80%.[1] The stocks covered, all listed on the NYSE and over $100 million in size, were as a whole of lower than average risk, with unadjusted beta coefficients and residual standard deviations (based on 60 monthly rates of return) varying in the 1974 survey from .57 to 1.16 and .035 to .080, respectively, and with a comparable range for other years.[2] The annual rate of return in a particular stock expected by a specific institution was obtained for each of these years by adding a spot dividend yield (adjusted for the expected growth rate)[3] to the annual growth rate in per share earnings expected over a five year (or, if the data were available, longer) time period and used by these institutions to estimate expected returns for purposes of their investment decisions.

In the analysis of these data, the 1972 results were omitted because of the much smaller size of the institutional sample than in the subsequent years. In each of the other years, mean expected returns were computed for

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[1]A number of the responses could not be used because the institutions did not have available the information required (in particular, 5 year or longer expected growth rates).

[2]These data were computed using the Standard & Poor 500 Composite Index and return relatives taken from a Rodney L. White Center data tape containing monthly returns on all NYSE firms.

[3]The adjustment used was to multiply the spot yield by one plus one-half the expected growth rate.

every stock for which at least five institutions regularly estimated the long-run, i.e., five years or longer, expected growth rate.[1] In computing the mean expected return for each stock, equal weight was given to the estimate of each institution.

The mean expected return relatives for each stock, $\overline{E(R_i)}$, was regressed first on its beta coefficient (β_i) and then on β_i and the residual standard deviation (σ_{ri}),[2] both with and without the standard deviation of the returns for that stock expected by the different institutions (h_i). The latter variable, h_i, is basically a measure of the heterogeneity of expectations, though it also might be considered to be an <u>ex ante</u> measure of the market's risk assessment. These cross-section regressions (where individual stocks are the units of observation) were computed for each year covered by the available data. For comparative purposes, similar regressions were also computed substituting the mean realized or <u>ex post</u> rates of return for the mean expected or <u>ex ante</u> rates. The β_i and σ_{ri} measures used in the regressions presented are based on monthly rates of return for the preceding five years, but other rates (quarterly, semi-annual and annual) were also tested. In computing β_i and σ_{ri}, the market rate of return in this analysis was assumed to be the return on the Standard and Poors Index of 500 New York Stock Exchange stocks.

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[1] There were 46 such stocks in 1974, 34 in 1976 and 48 in 1977. The long-run expected growth rates reported for these stocks almost invariably referred to five year periods.

[2] Regressions substituting residual variance and, separately, variance of returns for residual standard deviation were also estimated but the results were quite similar. A recent paper by Haim Levy, "Equilibrium in an Imperfect Market: A Constraint on the Number of Securities in the Portfolio," Hebrew University, 1977, suggests that total variance is the appropriate variable to use together with β_i.

Table 1 presents the regressions of $\overline{E(r_i)}$ relatives on β_i, on β_i and σ_{ri}, and on β_i, σ_{ri} and h_i for 1974, 1976, and 1977, where the units of observation are data for individual stocks. The constant terms in the (β_i) regressions are uniformly much higher than the risk-free rate, and higher also than the risk-free rates implied by the constant terms in the cross-section regressions of the mean realized rate of return on these stocks $(\bar{R}_i)$ on β_i. Contrary to theoretical expectations, the coefficient of β_i in these $\overline{E(R_i)}$ regressions is uniformly negative though approaching statistical significance (at the customary .05 level) only in one year.

The coefficient of σ_{ri} in the (β_i,σ_{ri}) regressions is statistically significant and positive only for 1974, while again the coefficient of β_i is significant only in one year when it has the wrong sign. The σ_{ri} coefficient has the theoretically expected positive sign in two of the three years and the β_i coefficient in only one year. These results are not changed when h_i is added to these regressions, but the coefficient of h_i is significant in 1977, approaches significance in 1974 and is positive in all three years.[1] In contrast to the apparent slight superiority of σ_{ri} (and σ_{ri}^2 or σ_i^2 which were tested separately) over β_i in explaining the average ex ante return relatives, $\overline{E(R_i)}$, over the three years, the results for β_i and σ_{ri} are indistinguish-

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[1] If the returns are generated by an asymmetric distribution, a significant relationship might reflect the fact that sample means and variances can be spuriously associated if skewness exists.

able in the regressions relating the mean realized or *ex post* return relatives[1] to σ_{ri} and β_i for the same years. It should be noted that in those regressions relating realized returns to h_i as well as to β_i and σ_{ri}, h_i again seems a more useful explanatory variable than either of the other two. The explanatory power of the *ex post* regressions, it should be noted, is even lower than that for the *ex ante* regressions.

These findings while not at all strong support the view that the residual standard deviation of return and related variance measures play fully as significant a role in the pricing of risky assets as the beta coefficient. Virtually identical results are obtained when the logs of return relatives are substituted for the returns themselves to take cognizance of the difference in investment horizons reflected is the *ex ante* return and *ex post* beta measures used. However, the sample of observations is limited and the explanatory power of the regression is hardly impressive. Moreover, while the use of *ex ante* in lieu of *ex post* returns avoids some of the problems associated with such analyses, one basic problem remains --the substantial measurement errors in estimating β_i and σ_{ri} from observations on individual stocks.

To minimize this problem of measurement error, it is desirable to re-estimate the return-risk relationships from grouped data. Unfortunately the limited number of observations on mean expected returns for individual stocks does not permit a satisfactory grouping of individual stocks simultaneously by past values of β_i and σ_{ri}--a procedure followed in the next section of this paper for which much more data are available. It should be noted, however, that tests of capital asset pricing theory that rely only on grouped data, to

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[1]The *ex post* return used for each stock in each of the three periods covered was the monthly average for the 60 month period preceding the month of the year for which the *ex ante* return was estimated.

the exclusion of tests based on individual assets, are not completely satisfactory, since it is the returns on individual assets which the theory is trying to explain and individual asset deviations from linearity may cancel out in the formation of portfolios.[1]

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[1]See Levy, op cit, and Roll, op cit.

Tests of the CAPM Based on Bond Returns

The first set of tests of the CAPM based on bond returns makes use of a data tape compiled by the Rodney L. White Center for Financial Research containing quarterly rates of return from the fourth quarter of 1968 through the third quarter of 1973 for every corporate bond listed on the New York Stock Exchange (NYSE) for which satisfactory price and interest data were available. After the removal of a small number of bonds for which data were not available for as many as 10 quarters, a total of 891 individual bonds were used for testing the return-risk relationship implied by the CAPM. The same data tape was used to obtain for this period an equally-weighted quarterly index of market return on bonds (the RLW index) based on all issues covered by this tape. To compare the risk-return relationships for bonds with those for stocks, the quarterly rates of return for the same period were obtained for 867 NYSE common stocks from a second Center tape.[1]

To construct an overall market return index more satisfactory for testing the CAPM than the usual stock index, it was necessary to obtain appropriate market indexes for the major classes of marketable assets and then to apply the relevant market weights.[2] We used the NYSE Composite index to cover all common stocks, the RLW index to cover all bonds other than U.S. Governments, and a U.S. Government bond index developed by John Bildersee to cover

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[1]The common stocks were required to have 19 quarters of return data in each period from the 1st quarter 1964 to the 2nd quarter 1968 and from the 3rd quarter of 1968 to the 2nd quarter of 1973. This requirement can introduce a potentially significant <u>ex post</u> selection bias. However, when the 1968-1973 regressions for the 867 individual assets having 38 quarters of continuous data are compared to those where 1087 individual assets with 19 quarters of continuous data are included the qualitative results are the same.

[2]Correct weights on various classes of securities are difficult to determine because of problems associated with the treatment of government debt, financial intermediation and non-marketable assets. As a result several different sets of weights were tested.

long-term marketable U.S. Government issues.[2] The weights applied in estimating the overall market return (R_m) for 1973 from the three constituent returns were 60% for corporate equities (with a return of R_s), 30% for bonds other than U.S. Governments (R_b), and 10% for long-term marketable U.S. Government issues (R_g). These weights which varied from year to year were obtained from the annual Federal Reserve Board <u>Flow of Funds</u> data on the market value of stocks and bonds held by U.S. individuals and financial institutions. A potential limitation of the R_m index as an estimate of return on all stocks and bonds is that in the absence of a satisfactory index for returns on municipal bonds, which account for about 10% of the value of all stocks and bonds held by individuals and institutions, they have been assumed to move in the same manner as the returns on corporate bonds.

Table 2 presents separately for stocks, for bonds, and for stocks and bonds combined, four risk-return cross-section relationships in which average quarterly returns for individual issues over the period from the fourth quarter of 1968 through the third quarter of 1973 ($\bar{R}_i$) are regressed on combinations of three variables, β_i (the beta coefficient), β_i^2 and σ_{ri}.[2] Unlike the β_i and σ_{ri} variables which can be given a strong <u>a priori</u> justification, β_i^2 is introduced to permit a simple test of the basic linearity assumption of the capital asset pricing model (either with a risk-free or zero-beta asset). The R_m estimates used for deriving the β_i and σ_{ri} measures in these cross-section relationships are the quarterly time series of weighted stock and bond returns described above rather than the customary stock market

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[1] Bildersee, John S. "Some New Bond Indexes," <u>Journal of Business</u>, October 1975.

[2] The residual standard deviation for individual assets, σ_{ri}, is taken from estimates of the "market model", $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$; where R_{it} and R_{mt} are, respectively, returns on individual asset i and the composite market portfolio.

index. The β_i measures have been adjusted for order bias using procedures suggested by Vasicek.[1]

The intercepts in the three regressions which assume the validity of the Sharp-Lintner version of the CAPM (Regs. 1,5 and 9) point to a mean annualized risk-free rate of 10.0%, 6.4% and 8.8% respectively, on the basis of the stock, bond and combined regressions. All of these values are significantly higher than the annualized mean 3 month Treasury bill rate of 5.3%.[2] This result is qualitatively identical with those obtained in many earlier studies which regressed mean returns of individual stocks against a beta coefficient derived from a stock market index rather than from the combined stock and bond indexes used here. Nor was this result changed when different corporate bond indexes were used (such as S&P's Composite AAA Bond Price Index or Salomon Bros. Total Performance Bond Index), when bonds were reduced in weight to 20% (vs. 80% for equities) or increased to 50% (vs. 50% for equities), or when the

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[1] O.A. Vasicek, "A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas," Journal of Finance, December 1973. Also, see M.E. Blume, "Betas and Their Regression Tendencies," Journal of Finance, June 1975. The exact procedure is found on pages 790-791 of Blume, except that sample means replace the population means and the error in measuring beta for each asset is not assumed to be the same.

[2] Qualitatively similar results are obtained when β_i is not adjusted for order bias. We rely on the t-statistic in developing conclusions concerning statistical significance of regression coefficients. However, we report only standard errors.

logarithms of return relatives were substituted for the returns themselves.[1] Thus, these findings are inconsistant with Sharpe-Lintner theory if it is appropriate to use for empirical testing the customary return-generating function relating actual to expected return.[1] Moreover, it should be noted that if tax-adjusted rates of return instead of market rates of return are the appropriate variables for testing Sharpe-Lintner theory, the regression intercepts obtained through the use of market rates of return would be expected to be smaller than the risk-free rate,[2] so that our findings (and most earlier empirical results) would be even more inconsistent with Sharpe-Lintner theory.

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[1]These results do not appear to be strongly dependent on the exact composition of our proxy for the true market portfolio. When the NYSE composite index R_s, is used in place of the composite market index R_m, the following results are obtained for equations 1 and 4 in Table 2.

	γ_0	γ_1	γ_3	$\bar{R}^2$
(1')	1.025 (.0032)	-.023 (.0025)		.087
(4')	1.029 (.0035)	-.019 (.0028)	-.077 (.0250)	.096

Similar results are obtained for the other equations in the 1968-1973 period. However, comparisons have not been made for the 1964-1968 period.

[2]I.e., $R_i = E(R_i) + \beta_i \pi + \varepsilon_i$ where π is the market factor and ε_i is an independently distributed error term.

[3]If the average marginal rates of taxes paid by individuals and taxable institutions are .35 on risk-free assets and .20 on risky assets (including stocks, taxable and non-taxable bonds) and if tax-free institutions hold one-third of both types of assets, the intercept would be expected to be .89 R_f.

Several other interesting findings emerge from these regressions. Residual standard deviation as well as the beta coefficient seems to affect asset return significantly, with both negatively related to asset return in this period (when $\bar{R}_m$ is less than the risk-free rate). While β^2 as well as β seems to affect the returns of both stocks and to a lesser extent bonds, this is no longer true when stocks and bonds are combined.

The differences between the stock and bond return-risk relationships are of particular interest. The Sharpe-Lintner models (Equations 1,5 and 9) as well as the other regressions point to significantly different relationships for stocks and bonds, with the return-risk relationships for bonds implying a lower zero-beta or risk-free rate of return than the corresponding relationships for stocks.[1]

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[1] On the basis of less comprehensive data in different time periods, a similar point made by Blume and Friend (Journal of Finance, March 1973) had been questioned by Roll (op. cit.).

The mean return and mean beta for stocks and bonds, respectively (in return relatives) are $\underset{(.031)}{.997}$, $\underset{(.519)}{1.569}$ and $\underset{(.009)}{1.016}$, $\underset{(.139)}{.362}$. The standard deviations are in parentheses. Not surprisingly, we can reject the hypothesis that the mean returns for bonds and stocks are from the same population. Furthermore, if the mean beta of bonds is substituted into Equation 1 in Table 2, the conditional expected return for bonds (from the stock return-beta equation) is equal to 1.0187 with standard deviation .0298. This value is significantly different from the actual mean return of bonds (the t value is 2.282), indicating that the return-beta relationship for stocks cannot explain the return-beta relationship for bonds. It should be noted that there is very little overlap in the distribution of means and betas between the population of bonds and stocks making direct comparisons impossible.

However in view of the potentially substantial measurement errors in estimating the beta coefficient and the residual sigma from observations on individual stocks (even when adjusted for order bias), and the potential sensitivity of the regression coefficients in the return-risk relationships to such errors, it is desirable to reestimate these relationships from grouped data so as to minimize this problem. Table 3 presents the same types of regressions as in Table 2 except that the observations are now 50 groups of stocks, 50 groups of bonds, and 100 groups of stocks and bonds combined.[1] For stocks the procedure followed was to rank them first by beta decile on the basis of monthly data for the preceding 60 month period and then within each decile by residual standard deviation into 5 sub-groups, resulting in a total of 50 groups.[2] Each equation was then estimated using subsequent betas and standard deviation estimates for each group. For bonds, where the required data for the preceding 60 month period were not readily available for most issues, the ranking by beta decile and then by residual standard deviation decile within each beta decile was based on the expected values of β_i and σ_{ri}

[1]The values of β, β^2 and σ_{ri} in the grouped regressions represent group means. They are equally weighted averages of the values for the individual assets in the group.

[2]This procedure is similar to (but not identical with) that employed by F. Black and M. Scholes, "The Effect of Dividend Yield and Dividend Policy on Common Stock Prices and Returns," Journal of Financial Economics, May 1974.

estimated from regressions of these measures of risk on the bond's Standard and Poors quality rating, its maturity and its coupon.[1]

The results of the analysis of grouped data in Table 3 are with minor exceptions consistent with those for the ungrouped data. The stock and combined regressions, but not the bond regressions, once more seem to imply risk-free rates or more precisely zero-beta rates of return significantly higher than the 3 month Treasury bill rates. Residual sigma is not only still significant for stocks, for bonds and for stocks and bonds combined but in all three instances is more significant than the beta coefficient. Again the return-risk relationships for stock are quite different from those for bonds. Moreover, in the Sharpe-Lintner regressions the grouped like the ungrouped results point to a zero-beta return for bonds significantly lower than that for stocks.

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[1]These regressions were

$$\beta_i = .28Q_1 + .23Q_2 + .23Q_3 + .19Q_4 + .30Q_5 + .23Q_6$$
$$(11.1) \quad (10.5) \quad (10.6) \quad (6.4) \quad (7.1) \quad (4.8)$$
$$+ .47Q_7 \quad -.06C \quad + .01\,M; \qquad \bar{R}^2 = .13$$
$$(11.8) \quad (-.38) \quad (7.6)$$

where the parentheses represent the t-statistics of the regression coefficients and $\bar{R}^2$ is the coefficient of determination adjusted for degrees of freedom; and

$$\sigma_{ri} = .03Q_1 + 03Q_2 + .03Q_3 + 0.05Q_4 + .06Q_5 + .09Q_6$$
$$(11.1) \quad (13.5) \quad (14.3) \quad (15.3) \quad (12.6) \quad (17.2)$$
$$+ .08Q_7 - .12\,C - .0004M; \qquad \bar{R}^2 = .33$$
$$(19.4) \quad (-7.2) \quad (5.4)$$

where Q_1 is the highest and Q_7 the lowest S&P quality rating, C is the coupon rate and M the years to maturity.

The grouped results which point to a significant role for σ_{ri} in the determination of $\bar{R}_i$ for all groups of assets tested might be expected to be biased against σ_{ri} since the method of grouping permitted greater variation in β_i than in σ_{ri}. To check that possibility, a grouping method which ranks issues independently by β_i and σ_{ri} into two sets of deciles was also used.[1] This method, which yields 100 portfolios for stocks and another 100 for bonds, in which each stock or bond would enter into two different portfolios, is not biased in favor of β_i as is the procedure used in Table 3 but suffers from the deficiency that the grouped observations are not independent so that measures of significance are overstated. In any event, the results utilizing this grouping technique are quite close to those in Table 3 except that if this technique were taken at face value, the intercept value in the bond regression (corresponding to Reg. 5 in Table 3) would also appear to be significantly higher than the Treasury bill rate.

On the basis of this analysis of returns on individual stocks and bonds, and a broader measure of the overall market rate of return, it would not appear that the Sharpe-Lintner model is able to explain the observed data in the period covered, residual standard deviation seems to be at least as important as the beta coefficient in explaining these data, and the return-risk relationship appears to differ as between stocks and bonds. Appendix I contains some additional statistical analyses of the significance of residual standard deviation.

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[1] A similar procedure was followed by A. Kraus and R.H. Litzenberger, *op. cit.*

However, we have yet to test the recent Kraus-Litzenberger thesis that through the modification of Sharpe-Lintner theory by adding co-skewness with the market portfolio to the usual beta coefficient, it is possible to explain the discrepency between the risk-free rate and the observed intercepts in the return-risk cross-section regressions. They assume that just as investors are averse to variance in their portfolios, and therefore beta in individual assets, they prefer positive skewness in their portfolios. Thus, since they also assume that all investors hold the market portfolio, if that portfolio is characterized by positive skewness which seems likely (if there is any significant market skewness at all), investors other things equal would be willing to pay a premium for assets which possess positive co-skewness with the market. (If the market had negative skewness, investors would be averse to positive co-skewness with the market).[1]

Table 4 indicates that with the introduction of co-skewness (δ_i) as an additional explanatory variable in the regressions of stock returns on beta, the intercept in the individual asset regression is not significantly different from zero, which means that the expected return on the zero-beta portfolio is not significantly different from the risk-free rate, even though a different period and more importantly a broader market index are used in

[1]The Kraus-Litzenberger theory also holds if the market portfolio is symmetric in the returns distribution and individual assets exhibit co-skewness with the market.

this analysis than in the Kraus-Litzenberger paper.[1] However, for bonds this difference between the implied zero-beta return and the risk-free rate is marginally significant, and for stocks and bonds combined it is highly significant. Co-skewness is significantly and positively related to returns on stocks and on stocks and bonds combined, but insignificantly related to returns on bonds. The beta coefficient has a significant positive relationship with bond return unlike the negative relationship for stocks and stocks and bonds combined.[2] When σ_{ri} is added as an explanatory variable in Table 4, it has a consistently significant negative relationship with return for all three groups of assets. Both stock and bond returns appear to be affected in a similar manner by σ_{ri} but this does not seem to be true for β_i and δ_i.

When groups of assets are substituted for individual assets in these regressions (Table 5), using the grouping techniques previously discussed, the differences between the implied zero-beta return and the risk-free rate are more marked and are significant even for stocks alone. Co-skewness is now significantly and positively related to returns on bonds and on stocks and bonds combined but not quite significant for stocks alone. The beta coefficient for bonds is now a negative factor but is not significant. (The extension of Table 5 to include σ_{ri}, which requires a 3-way grouping of assets by β_i, δ_i and σ_{ri}, has not yet been completed).

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[1]The form of the return variable $(\bar{R}_i/R_f - 1)100$ and therefore the interpretation of the intercept, which differ from those used in the earlier regressions, follow the Kraus-Litzenberger analysis.

[2]The return distribution of the composite market portfolio, R_m, had negative skewness in this period and also there was a negative realized risk premium (i.e., $R_m < R_f$).

Thus, while the introduction of co-skewness does appear to be useful in explaining asset returns in this period, it does not explain the differences between the implicit zero-beta return and the risk-free rate. It might also be noted that the sums of the beta and co-skewness coefficients in each of the stock and bond regressions, which might both be expected to be equal to $[E(R_m) - R_f)]/R_f$, are different from each other.

The evidence against the descriptive ability of the alternative versions of the CAPM tested would appear to be rather strong once bond returns and a broader market index are introduced into the empirical analysis. Nor are we aware of any versions of this theory in conjunction with plausible return-generating functions likely to pass the tests in view of the relative importance of residual sigma (or variance) in explaining returns. However, we have been able to test the CAPM against comprehensive new bond data and the broader market index only for the period from the fourth quarter of 1968 through the third quarter of 1973. To obtain some additional insights for at least one other period, quarterly rates of return from the first quarter of 1964 through the third quarter of 1968 were computed for a random sample of 86 corporate bonds included in our group of 891 bonds covered in the subsequent period, except that not more than one bond was included from a single corporation. The S&P Composite AAA Bond Price Index was used to obtain for this period a quarterly index of market return on bonds. Again, to compare the risk-return relationships for bonds with those for stocks, the quarterly rates of return over this period were obtained for 802 NYSE stocks having continuous return data from 2nd quarter 1959 to 3rd quarter 1968 from a Rodney L. White Center data tape. The appropriate overall market return index was then constructed following the same procedures as for the 1968-73 period.

Table 6 and 7 present the individual and grouped asset risk-return relationships for the 1964-68 period corresponding to those for the 1968-73 period shown in Tables 2 and 3. The results for stock and bonds separately are probably more meaningful than for both combined in view of the relatively low representation of bonds in the total number of assets used in the combined regression.[1]

The results for individual assets over the 1964-68 period indicate a significantly lower intercept for the stock and bond return regressions on beta (but not for stocks and bonds combined where it is higher) than the annualized mean 3 month bill rate of 4.2%.[2] Again residual sigma is significantly related to bond and stock returns, indicating a strong positive relationship in this period for both types of securities, with sigma apparently much more important than beta. The usual return-beta risk relationships (Equations 1,5 and 9) for stocks and bonds separately, unlike the results for the subsequent period, do not appear to be significantly different.

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[1]The understatement of the risk-free rate in this period by the Sharpe-Lintner model is also found in more traditional tests based on a market portfolio consisting only of stock (e.g., see Blume and Friend, op. cit.). On the other hand, it should be noted that this is one of the few periods for which this is true.

[2]The grouping procedure is identical to that described for the 1968-1973 period, except that only 5 individual assets are included in each group. The grouping for stocks was based upon beta estimates in the 19 quarters preceeding the 1st quarter of 1964. The grouping for bonds was based upon the instrumental variable equations described previously, estimated for the 86 bonds covered in this period.

Moreover, for 1964-68 unlike 1968-73, the relationships between returns and both the beta and sigma measures of risk are quite close for stocks and bonds suggesting that at least in this period an identical return-risk relationship (though not the Sharpe-Lintner model) is able to explain returns in both markets. It should be noted that the explanatory power ($\bar{R}^2$) of these return-risk relationships is quite high in this period, and very much higher than for 1968-73, perhaps reflecting a closer coincidence between _ex ante_ and _ex post_ returns (and the inadequacies of the return generating functions implied by the regressions fitted). Obviously, an examination of other periods will be required before a more definitive conclusion can be drawn on this point.

When the assets are grouped following the procedures described earlier, the intercepts of the return regressions on beta for stocks and bonds separately remain significantly lower than the 3 month bill rate (using a t-statistic at the usual 2 σ level). Again when sigma is introduced into those regressions, it dominates the results and an identical return-risk relationship is able to explain returns in both markets.

The results of the introduction of co-skewness into the return-risk relationships for the 1964-68 period (Tables 8 and 9) are not much more consistent with the Kraus-Litzenberger version of Sharpe-Lintner theory than for 1968-73. The intercepts in two of the six stock, bond and combined regressions for individual and grouped assets (not including those with the residual standard deviation) imply strongly significantly different risk-free rates from the annualized 3 month bill rate, two imply marginally significant differences between the implied and actual risk-free rates, and two are consistent with the Kraus-Litzenberger version of Sharpe-Lintner theory. The intercepts in the stock and bond regresssions are now significantly different from each other, unlike the results obtained without co-skewness. It should be noted that the addition of the residual sigma to beta to explain returns on individual assets yields much better fits than the addition of co-skewness to beta ($\bar{R}^2$ of .49 vs. .21 for stocks, .68 vs. .36 for bonds, and .55 vs. .29 for stocks and bonds combined).[1] When residual sigma, beta and co-skewness are all used to explain returns on individual assets, sigma not only is uniformly of correct sign and statistically significant but dominates beta and co-skewness in importance in all six of the relationships tested for this period.[2]

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[1]In the 1968-73 period, the differences in fit provided by the addition of residual sigma vs. co-skewness were quite small.

[2]Again, the regressions for asset groups relating returns to σ_{ri} as well as to β_i and δ_i have not been completed.

Risk-Return Relations for Bonds vs. Stocks

The preceding analysis has indicated that there may be significant differences in the risk-return relations for bonds as compared with those for stocks, suggesting at least some degree of segmentation in the factors affecting the two markets. Such segmentation to the extent it exists might reflect a clientele effect dependent upon such institutional factors as the tax status of different classes of investors (e.g., individuals vs. tax-exempt institutions). Or it might reflect very substantial differences in holding periods for the two types of assets or the hedging potential inherent in bond investment.

While we plan to pursue the nature and degree of any market segmentation in another paper, we present in Table 10 for the 1968-73 and 1964-68 periods a test of a specific two factor model which permits a further test of the segmentation hypothesis as well as of Sharpe-Lintner theory. That model relates mean return of the i^{th} bond to the usual beta factor (β_{1i}) which measures covariance of the bond's returns with the general market for stocks and bonds combined, and to a second factor (β_{2i}) which measures covariance of the bond's return with that part of return in the bond market which is independent of return in the general market.[1] In an integrated market, the B_{2i}

[1] Three regressions are estimated sequentionally in the development of this model.

(1) $R_{bt} = \alpha_0 + \alpha_1 R_{mt} + \phi_t$ for bonds as a whole from time-series data, where R_{bt} is the return on a bond market portfolio;

(2) $R_{it} = \beta_0 + \beta_{1i} R_{mt} + \beta_{2i} \phi_t$ for individual bonds from time-series data; and

(3) $\bar{R}_i = \gamma_0 + \gamma_1 \beta_{1i} + \gamma_2 \beta_{2i}$ for individual bonds from cross-section data. If there is no segmentation, the expected value of $\gamma_2 = 0$ but the expected value of $\gamma_1 = \bar{R}_m - R_f$ and $\gamma_0 = R_f$.

coefficient should be insignificantly different from zero, since it measures the effect of a special type of diversifiable risk. Its influence on the risk of an individual bond should be zero if the market for stocks and bonds is integrated.

Both the ungrouped and grouped regressions in Table 10, which are based on the same bond data, market index, and grouping procedures as those used earlier, point to significant segmentation as indicated by the apparent influence of an independent bond factor in the 1968-73 period, but only the grouped regression implies significant segmentation in the 1964-68 period.[1] When residual standard deviation is added to the ungrouped regressions, its effect on return is again significant in both periods, and the bond market seems to evidence an independent influence on returns even in the ungrouped regression for 1964-68.[2]

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[1]The grouping procedure used in the 1964-1968 period is based upon beta and residual standard deviation estimates from the instrumental variable estimation equation described earlier. The grouping procedure in the 1968-1973 period is based upon beta and gamma estimates. Thus they are not completely comparable.

[2]The corresponding grouped regressions have not been completed.

Appendix I

Miller and Scholes "Rates of Return in Relation to Risk: A Re-Examination of Recent Findings," In Studies in the Theory of Capital Markets, edited by Michael Jensen, New York: Praeger, 1972) also found that residual standard deviation (they used residual variance) was significant in determining returns using yearly data for individual common stocks. They examined several explanations for this result and concluded that skewness in the return generating process probably caused the association observed. In contrast Fama and McBeth (op. cit.) using monthly data for groups of common stocks found residual standard deviation was not cross-sectionally significant. Roll (op. cit.) has argued the most important explanation for the difference between the Miller and Scholes and the Fama-McBeth results stems from the grouping technique used by Fama-McBeth --grouping has the effect of reducing the skewness in the return distributions. Our regressions detect a significant influence of residual standard deviation for both the individual asset and group tests and thus imply that return skewness is not an adequate explanation.

However there are several differences in our estimations and those of Fama-McBeth that could explain differences in our results. First, the standard errors of the residual standard deviation in the Fama-McBeth model will be greater than the ones estimated in our regressions. Fama-McBeth used an estimation procedure that allows for random variations in the true values of the coefficients as well as the measurement error. Second, our market proxy is different. Third and more importantly Fama-McBeth formed groups based upon beta estimates in previous periods. They did not group upon previous estimates of residual standard deviation. Thus the Fama-McBeth grouping prcedures would tend to understate the influence of residual standard deviation when compared to the influence of beta.

To more closely examine the different results that can arise from grouping, we have re-estimated equation 2 in Table 2B using grouping procedures designed to properly account for the real non-stationarities in the true values of the parameter coefficients (γ_0, γ_1 and γ_2) and to compare the Fama-McBeth procedures with the ones used in this paper. The general method is to form portfolios on the basis of beta deciles for individual securities in 1964-1968 and then re-estimate group mean betas and group mean residual standard deviations in the subsequent period, 1968-1973. Next for each quarter the cross section or individual common stock returns are regressed on the estimated betas and residual standard deviations. This procedure results in a time series of observations in the estimates (γ_0, γ_1 and γ_2) and averaging these 19 cross-sectional estimates provides an estimate of the risk return trade-off. Standard errors of these averages are taken from the time series of $\hat{\gamma}_0, \hat{\gamma}_1$ and $\hat{\gamma}_2$, thus incorporating the variability of the risk-return trade-off. Equation A below reports statistics for 50 groups of common stocks formed from beta estimates (similar to the procedure adopted by Fama-McBeth). Equation B reports statistics for 50 groups formed from beta deciles and residual standard deviation subgroups (as explained previously). Equation C uses the latter procedure (except that there are 144 groups) but reports values for the 1964-1968 time period. The values in parentheses are standard errors.

Note that σ_{ri} (γ_2) is statistically significant when the groups are formed from both previously estimated betas and residual standard deviations (Equations B and C) but not when the groups are formed solely from previously estimated betas. It should be recalled that all these equations allow for non-stationarities in the same manner.

Regression Estimates

Equation	γ_0	γ_1	γ_2
A	1.034 (.0184)	-.009 (.017)	-.185 (.1745)
B	1.037 (.0182)	-.004 (.0168)	-.284 (.1582)
C	.989 (.0143)	.004 (.0134)	.456 (.1348)

In sum, we feel our results are likely to be correct because of our more powerful grouping technique, because of our use of a more appropriate market proxy and because the sign on the coefficient of residual standard deviation in both periods tested is as predicted by the hypothesis that individual asset standard deviation is an appropriate additional measure of risk.

Table 1

Expected Return - Risk Regressions for Individual Stocks[1]
for Three Periods: August 1974, March 1976, and February 1977

Period	Reg. No.	Estimates of Regression Coefficients γ_0	γ_1	γ_2	γ_3	$\bar{R}^2$
August 74	1	1.171	-.028			.02
		(.018)	(.021)			
	2	1.121	-.027	.918		.21
		(.022)	(.018)	(.273)		
	3	1.105	-.019	.926	.506	.24
		(.023)	(.019)	(.267)	(.297)	
March 76	4	1.132	-.002			0
		(.010)	(.014)			
	5	1.144	.004	-.282		.02
		(.012)	(.014)	(.170)		
	6	1.142	.005	-.283	-.051	0
		(.014)	(.014)	(.173)	(.285)	
February 77	7	1.210	-.071			.06
		(.031)	(.037)			
	8	1.179	-.097	.875		.08
		(.038)	(.041)	(.604)		
	9	1.179	-.079	.222	.669	.24
		(.034)	(.037)	(.586)	(.208)	

[1] These are cross-section regressions of the general form $\overline{E(R_i)} = \gamma_o + \gamma_1 \beta_i + \gamma_2 \sigma_{ri} + \gamma_3 h_i$. $\bar{R}^2$ is the coefficient of determination adjusted for degrees of freedom. The standard error of a regression coefficient is indicated by ( ). The number of observations is 46 for 1974, 34 for 1976 and 48 for 1977.

Table 2

Return – Risk Regressions for Individual Assets[1] Adjusted for Order Bias,
4th Quarter 1968 – 3rd Quarter 1973

Type of Asset	Reg.No.	Estimates of Regression Coefficients				$\bar{R}^2$
		γ_o	γ_1	γ_2	γ_3	
Stocks	1.	1.025 (.0032)	– .018 (.0020)			0.087
	2.	1.042 (.0083)	– .041 (.0107)	.007 (.0032)		0.091
	3.	1.044 (.0083)	– .035 (.0108)	.006 (.0032)	– .074 (.0245)	0.099
	4.	1.030 (.0035)	– .015 (.0022)		– .078 (.0245)	0.097
Corp. Bonds	5.	1.016 (.0009)	.001 (.0022)			–0.001
	6.	1.018 (.0014)	– .010 (.0070)	.014 (.0085)		0.001
	7.	1.019 (.0015)	– .010 (.0070)	.014 (.0085)	– .037 (.0101)	0.014
	8.	1.017 (.0009)	.001 (.0022)		– .037 (.0102)	0.013
Stocks and Corp. Bonds	9.	1.022 (.0009)	– .016 (.0008)			0.209
	10.	1.021 (.0014)	– .014 (.0030)	– .001 (.0012)		0.208
	11.	1.022 (.0014)	– .008 .0032)	– .002 (.0012)	– .064 (.0143)	0.217
	12.	1.023 (.0009)	– .012 .0011)		–.060 (.0141)	0.216

[1] The regressions are of the general form $\bar{R}_i = \gamma_0 + \gamma_1\beta_1 + \gamma_2\beta_i^2 + \gamma_3\sigma_{ri}$. The number of observations is 867 for stocks, 891 for corporate bonds, and 1758 for stocks and corporate bonds combined.

Table 3

Return - Risk Regressions for Assets Grouped to Minimize Measurement Errors,[1] 4th Quarter 1968 to 3rd Quarter 1973

Type of Asset	Reg. No.	Estimates of Regression Coefficients γ_0	γ_1	γ_2	γ_3	$\bar{R}^2$
Stocks	1.	1.032 (.0046)	- .022 (0.0027)			.556
	2.	1.009 (.0170)	.009 (.0216)	-.010 (0.0066)		.565
	3.	1.005 (.0148)	.041 (.0202)	-.013 (.0058)	-.311 (.0761)	.674
	4.	1.037 (.0044)	-.004 (.0054)		-.284 (.0784)	.645
Corp. Bonds	5.	1.016 (.0018)	.001 (0.0048)			-.020
	6.	1.029 (.0033)	-.070 (0.0161)	.087 (0.0191)		.276
	7.	1.032 (.0036)	-.079 (0.0164)	.106 (.0209)	-.060 (.0302)	.318
	8.	1.016 (.0018)	-.001 (.0058)		.011 (.0331)	-.039
Stocks and Corp. Bonds	9.	1.022 (.0013)	-.016 (.0011)			.693
	10.	1.018 (.0022)	-.004 (.0049)	-.005 (.0020)		.709
	11.	1.019 (.0021)	.0086 (.0061)	-.007 (.0020)	-.136 (.0422)	.734
	12.	1.024 (.001)	-.010 (.0029)		-.099 (.0428)	.706

[1]The regression forms are identical to those described in Table 2. Observations in this table are based upon the means as for groups of individual assets (50 groups for each of stocks and corporate bonds and 100 groups for stocks and corporate bonds combined).

Table 4

Return - Risk Regressions for Individual Assets Incorporating Co-Skewness Measures[1]
4th Quarter 1968 - 3rd Quarter 1973

Type of Asset	Reg. No.	Estimates of Regression Coefficients γ_0	γ_1	γ_2	γ_3	$\bar{R}^2$
Stocks	1.	.033 (.2465)	-1.119 (.1351)	.143 (.0368)		.093
Corp. Bonds	2.	.089 (.0554)	.601 (.1261)	-.042 (.0282)		.023
Stocks & Corp. Bonds	3.	.596 (.0820)	-1.327 (.0641)	.101 (.0249)		.196
Stocks	4.	.672 (.3025)	-.876 (.15025)	.147 (.03657)	-8.651 (2.40753)	.105
Corp. Bonds	5.	.272 (.0706)	.571 (.12519)	.008 (.0304)	-4.564 (1.1034)	.041
Stocks & Corp. Bonds	6.	.919 (.0912)	-.866 (.0874)	.134 (.0248)	-10.051 (1.3228)	.221

[1] The regressions are of the general form $\bar{r}_i = \gamma_0 + \gamma_1 \beta_i + \gamma_2 \delta_i + \gamma_3 \sigma_{ri}$ where δ_i, the measure of co-skewness, is equal to $\Sigma_t (R_{mt} - \bar{R}_m)^2 (R_{it} - \bar{R}_i / \Sigma_t (R_{mt} - \bar{R}_m)^3$ and $\bar{r}_i$ is equal to $(\bar{R}_i - R_F)/R_F$. The number of observations is 867 for stocks, 891 for bonds, and 1758 for the combined regression.

Table 5

Return - Risk Regressions for Asset Groups Incorporating Co-Skewness Measures[1]
4th Quarter 1968 - 3rd Quarter 1973

Type of Asset	Reg. No.	Estimates of Regression Coefficients			$\bar{R}^2$
		γ_0	γ_1	γ_2	
Stocks	1.	.976 (.5518)	-1.770 (.3349)	.232 (.1634)	.349
Corp. Bonds	2.	.478 (.2120)	-.683 (.5877)	.373 (.1418)	.022
Stocks and Corp.Bonds	3.	.903 (.1116)	-1.689 (.1190)	.174 (.0918)	.732

[1] The regression forms are indentical with Table 4. The only difference is that observations in this table are groups of assets (50 for each of stocks and bonds and 100 for stocks and bonds combined) instead of individual assets.

Table 6

Return-Risk Regressions for Individual Assets[1]
Adjusted for Order Bias 1st Quarter 1964 - 3rd Quarter 1968

Type of Asset	Reg No.	Estimates of Regression Coefficients				R^2
		γ_0	γ_1	γ_2	γ_3	
Stocks	1.	1.004 (.0035)	.029 (.0022)			.185
	2	.994 (.0077)	.043 (.0102)	-.004 (.0032)		.186
	3	.992 (.0062)	.002 (.0083)	.003 (.0026)	.392 (.0184)	.481
	4	.986 (.0039)	.011 (.0019)		.389 (.0182)	.481
Corp.Bonds	5	1.001 (.0025)	.024 (.0069)			.114
	6	1.003 (.0037)	.009 (.0204)	.018 (.0229)		.109
	7	.990 (.0025)	.015 (.0129)	-.017 (.0148)	.397 (.0351)	.648
	8	.992 (.0017)	.001 (.0048)		.385 (.0344)	.647
Stocks & Corp. Bonds	9	1.0144 (.0025)	.031 (.0016)			.281
	10	.997 (.0039)	.040 (.0059)	-.003 (.0021)		.282
	11	.992 (.0031)	.002 (.0050)	.003 (.0017)	.392 (.0173)	.546
	12	.988 (.0021)	.010 (.0016)		.387 (.0170)	.545

[1]The regression forms are identical with Table 2. The number of observations is 802 for stocks, 86 for bonds, and 888 for stocks and bonds combined.

Table 7

Return – Risk Regressions for Assets Grouped to Minimize Measurement Error[1], 1st Quarter 1964 to 3rd Quarter 1968

Type of Asset	Reg No.	Estimates of Regression Coefficients				$\bar{R}^2$
		γ_0	γ_1	γ_2	γ_3	
Stocks	1.	1.006 (.0050)	.027 (.0030)			.360
	2	1.002 (.0133)	.033 (.0158)	-.002 (.0045)		.361
	3	.999 (.0080)	-.010 (.0099)	.004 (.0028)	.461 (.0292)	.768
	4	.989 (.0032)	.004 (.0023)		.456 (.0291)	.767
Corp. Bonds	5	.999 (.0021)	.026 (.0055)			.583
	6	1.007 (.0036)	-.024 (.0193)	.056 (.0212)		.708
	7	1.004 (.0065)	-.018 (.0220)	.045 (.0292)	.075 (.1272)	.693
	8	.995 (.0027)	.014 (.0077)		.204 (.0996)	.661
Stocks and Bonds	9	1.016 (.0034)	.029 (.0021)			.549
	10	.997 (.0053)	.038 (.0073)	-.003 (.0025)		.550
	11	.991 (.0032)	.000 (.005)	.001 (.0015)	.457 (.0279)	.834
	12	.989 (.0022)	.004 (.0020)		.453 (.0275)	.834

[1] The regression forms are identical to those described in Table 6. Observations in this table are based upon the means of groups of individual assets (144 groups for stocks, 16 groups for corporate bonds and 160 groups for both stocks and corporate bonds combined).

Table 8

Return - Risk Regression for Individual Assets Incorporating Co-Skewness Measures[1]
1st Quarter 1964 - 3rd Quarter 1968

Type of Asset	Reg. No.	Estimates of Regression Coefficients				$\bar{R}^2$
		γ_0	γ_1	γ_2	γ_3	
Stocks	1	0.696 (.2367)	1.935 (.1339)	-0.027 (.0056)		.206
Corp. Bonds	2	-0.920 (.1478)	1.843 (.2767)	-0.017 (.0159)		.364
Stocks and Corp. Bonds	3	0.177 (.1943)	2.180 (.1150)	-0.028 (.0054)		.287
Stocks	4	-1.938 (.2280)	.818 (.1200)	-.013 (.0045)	37.729 (1.8002)	.487
Corp. Bonds	5	-1.793 (.1433)	.681 (.2359)	.007 (.0117)	33.398 (3.711)	.676
Stocks and Corp. Bonds	6	-1.954 (.1802)	.820 (.1089)	-.013 (.0043)	37.745 (1.6521)	.551

[1]The regression forms are identical with Table 4. The number of observations is 802 for stocks, 86 for bonds, and 888 for stocks and bonds combined.

Table 9

Return - Risk Regressions for Asset Groups[1]
Incorporating Co-Skewness Measures,
1st Quarter 1964 - 3rd Quarter 1968

Type of Asset	Reg.No.	Estimates of Regression Coefficients			$\bar{R}^2$
Stocks	1.	.445 (.4820)	2.105 (.2951)	-0.042 (.0143)	.261
Corp. Bonds	2.	-.713 (.3994)	.904 (1.0886)	-.075 (.0635)	.023
Stocks and Corp. Bonds	3.	-.564 (.3203)	2.691 (.2067)	-0.046 (.0139)	.513

[1]The regression forms are identical with Tables 4 and 8. The number of observations is 144 for stocks, 16 for bonds and 160 for stocks and bonds combined.

Table 10

Market Segmentation Test for Bonds
and Stocks Based Upon Individual Assets
and Groups of Assets

I. 4th Quarter 1968 - 3rd Quarter 1973

Reg. No.	Estimates of Regression Coefficients[1]				$\bar{R}^2$
	Individual Bonds				
	γ_0	γ_1	γ_2	γ_3	
1.	1.019 (.0009)	.006 (.0021)	-.006 (.0008)		.055
2.	1.020 (.0007)	.006 (.0012)	-.006 (.0008)	-.026 (.0100)	.061
	Groups of Bonds				
3.	1.021 (.0020)	.0097 (.0047)	-.010 (.0020)		.422

II. 1st Quarter 1964 - 3rd Quarter 1968

Reg. No.	γ_0	γ_1	γ_2	γ_3	$\bar{R}^2$
	Individual Bonds				
1.	1.001 (.0043)	.022 (.0067)	.000 (.0041)		.093
2.	.997 (.0026)	.000 (.0045)	-.006 (.0025)	.405 (.0342)	.66
	Groups of Bonds				
3.	1.001 (.0022)	.032 (.0024)	-.005 (.0022)		.924

[1]From the regression $\bar{R}_i = \gamma_o + \gamma_1\beta_{1i} + \gamma_2\beta_{2i} + \gamma_3\sigma_{ri}$ where $\beta_{1i} = cov(R_i R_{mt})/var(R_{mt})$ and $\beta_{2i} = cov(R_{it}, \delta_t)/var(\delta_t)$ (see footnote 1 page 25). R_{bt} and R_{it} represent, respectively, the rates of return for bonds as a whole (a market portfolio of bonds) and individual bonds. R_{mt} is the corporate market index described previously. $\bar{R}_i$ represents the average annual rate of return for individual bonds, with the relevent regression estimates of γ_0, γ_1 and γ_2 from cross section data relating $\bar{R}_i$ to β_{1i} and β_{2i}.