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# SYSTEMATIC SKEWNESS AND THE RETURN BEHAVIOR OF COMMON STOCKS

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## Introduction

The seemingly anomalous behavior of high and low risk common stocks has intrigued both security analysts and scholars for many years. Evidence of the acute interest in this subject is found in a whole array of empirical studies. One branch of the literature in this area explains the aberrant behavior of equity returns by hypothesizing skewness preference on the part of rational investors. Tests of skewness preference have evolved along two methodological lines. The studies of McEnally (1974), Pratt (1971), and Soldofsky and Miller (1969) group securities into return categories and then analyze the skewness of each risk class. Others, like Arditti (1967, 1972), Francis (1975), Kraus and Litzenberger (1976), Levy and Sarnat (1972), and Friend and Westerfield (1980), approach the issue by including a skewness measure among the regressors in a more complete model of return behavior. Presented in Table 1 is an overview of several important empirical studies of skewness preference and the pattern of equity returns. Even a cursory review of this research reveals conflicts in the findings and also points out the difficulties associated with a comparison of the results from the two methodologies.

The purpose of this paper is twofold. The first is to present new findings on the relationship between skewness preference and the return behavior of common stocks. These results are based on estimating procedure which incorporates the implications of recent theoretical advances in the three-moment capital asset pricing model (CAPM). The emphasis here is on systematic skewness and the interrelationship between systematic skewness and beta in determining stock returns. The second objective is to compare the findings from the classification and regression methodologies to determine whether they yield consistent interpretations of return behavior.

A discussion of the methodology and data used in this study is provided in Section II. Section III presents our empirical results. The final section summarizes our findings.

## Methodology and Data

Our empirical analysis was conducted in two phases, commensurate with the two analytical branches of the literature pertaining to skewness preference. The first phase was predicated on the work of McEnally (1974), Pratt (1971), and Soldofsky and Miller (1969). As mentioned in the Introduction, each of these studies examined the return behavior of common stocks by grouping the securities into risk classes. In the various works, the variance of returns, agency quality ratings, and systematic risk provided the basis for constructing the risk categories.

The studies by Pratt and Soldofsky and Miller classified stocks into specific groups according to their level of total risk as measured by either the variance of monthly returns or the security's quality rating. Both studies found that group mean returns rose with total risk except for stocks in the highest risk category; here they declined. McEnally criticized these early works by suggesting that their classification procedures were misleading when applied to data from markets where

## TABLE I

**Summary of Selected Empirical Studies of Skewness Preference and The Return Behavior of Common Stocks**

| STUDY CITED BY AUTHOR AND DATE | TIME PERIOD OF STUDY | PURPOSE OF THE STUDY | SKEWNESS MEASURE EMPLOYED | SAMPLE FOR TIME STUDY | RESULTS OF THE STUDY |
|---|---|---|---|---|---|
| **Classification Studies** | | | | | |
| McEnally (1974) | 1945-65 | To explain the lower ex post returns on high risk stocks in comparison to low risk stocks. | Group mean of skewness of holding period returns for the individual securities. | Five hundred and forty-five NYSE listed common stocks classified into five categories. | The results for the rankings by both total risk and systematic risk showed mean monthly yields rising at a decreasing rate for the first four categories and then abruptly declining in the fifth (highest risk) group. The author attributes this pattern to rising average skewness across the categories. |
| Pratt (1971) | 1926-59 | To examine the pattern of group mean monthly returns for common stocks classified into five risk classes. | n.a. | All NYSE stocks for which continuous data was available grouped into five risk classes. | On the average, the mean group return rose with increases in total risk except for the group composed of the highest variance common stocks. |
| Soldofsky and Miller (1969) | 1950-66 | To analyze the relationship between average annual rates of return and the standard deviation of those returns. | n.a. | Seventy-five common stocks selected on the basis of the agreement and consistency of their quality ratings by the three major rating agencies. The stocks were grouped into six risk classes. | Ex post yields on low risk stocks were found to be substantially above those of the high risk or speculative category. |
| **Regression Studies** | | | | | |
| Arditti (1967) | 1946-63 | To examine the relationship between several risk variables and the required rate of return. The risk measures included variance, skewness, and market correlation. | Third moment of return distribution of individual securities. | Stocks of more than 400 firms drawn from the S & P Composite Index. | The second and third moments of the return distribution were important determinants of the required rate of return. Skewness was negatively related to the investors' required rate of return. The author interpreted this result as a preference by investors for positive skewness in the return distribution. |

| | | | | | |
|---|---|---|---|---|---|
| Arditti (1972) | 1954-63 | To determine the impact of skewness on mean returns for 34 mutual funds and whether skewness could be used as a parameter in evaluating fund performance. | Normalized third moment of mutual fund's return distribution. | Thirty-four mutual funds analyzed in a previous study by Sharpe. | Regression of the mean return on the standard deviation and third moment implied that investors were willing to accept a somewhat lower return for greater positive skewness. |
| Francis (1975) | 1960-68 | This paper had two general purposes. The first was to evaluate the sample selection, definition of variables, and test design of Arditti (1975) and Levy and Sarnat (1972). And second, to present new evidence on the relationship between skewness and mutual fund returns. | Third moment of return distribution of individual securities. | Quarterly observations for 113 mutual funds. | Skewness was not an important factor in determining the rate of return on mutual funds or share purchase patterns. |
| Friend and Westerfield (1980) | 1952-76 and serveral subperiods | To provide a more complete analysis of the Kraus and Litzenberger three moment CAPM. | Systematic skewness; i.e., the skewness of the ith security and portfolio return distribution relative to that of the market. | Returns on varying samples from NYSE common stocks and bonds. | Some evidences that investors were willing to pay a premium for positive skewness was found but the test results were not strong. |
| Kraus and Litzenberger (1976) | 1936-mid-1970 | To incorporate the effect of skewness into the CAPM and to test the importance of skewness preference as a determinant of expected returns. | Systematic skewness; i.e., the skewness of the ith security or portfolio return distribution relative to that of the market. | Monthly deflated excess rates of return on 20 portfolios constructed from stocks that were continuously listed on NYSE during the test period. | Systematic skewness was found to be a significant factor explaining the level of excess portfolio returns. |
| Levy and Sarnat (1972) | 1943-67 and serveral subperiods | To estimate the effect of the third and higher moments of the return distribution on expected returns. | Third moment of the return distribution of the individual mutual fund shares. | Annual rates of return for 51 to 86 different mutual funds from Arthur Wiesenberger and Co., **Investment Companies.** | The regression coefficient of the third moment was negative and highly significant in three of the four test periods. |

investors can diversify their portfolios. His approach was to classify stocks on the basis of systematic risk. Once again, however, mean monthly yields rose at a decreasing rate across the first four categories and then abruptly declined in the fifth (highest risk) group. Since average group skewness increased across all the classes, McEnally (1974, p. 200) explains his findings as the market's willingness to trade-off "some expected returns from high risk common stocks in exchange for the enhanced opportunity they afford for extraordinarily large returns." However, even these results are difficult to interpret for, as discussed below, return behavior is predicated on systematic skewness in rational security markets, not on the individual security return distribution per se. Rational investors pay a premium for securities possessing positive co-skewness with the market when the market is positively skewed and discount securities having positive co-skewness with the market when the market return distribution is negatively skewed. Thus, in the context of McEnally's study, expected group mean returns are a function of mean systematic skewness and not the average skewness of security returns in the specific risk class.[1]

Our classification analysis began with the calculation of the mean, standard deviation, systematic skewness ($\gamma$), and CAPM beta ($\beta$) of monthly holding period returns for a sample of NYSE issues over the period 1961-1980. Tests were conducted for four non-overlapping time periods: 1961-1965, 1966-1970, 1971-1975, and 1976-1980. Each period had observations for 685 randomly-selected stocks for which continuous monthly data were available over the entire period. The total sample was segmented into five risk categories according to the $\beta$ coefficient. Each category in each subperiod was composed of 137 stocks. The market portfolio was proxied by an equally-weighted average of all NYSE listed stocks.

Following Arditti (1967, 1972), Francis (1975), Kraus and Litzenberger (1976), and Friend and Westerfield (1980), our next step was to directly test the impact of skewness on the returns in each of the five risk classes through regression analysis. Arditti (1967) made one of the first direct tests of investor preference for positive skewness by including the third moment of the security return distribution among the regressors in a model focusing on the determinants of the required rate of return. His estimations revealed an inverse relationship between skewness and the investors' required rate of return. Similar results were obtained by Arditti (1972) in a study of thirty-four mutual funds over the years 1954-1963. From these regression tests, Arditti concluded that investors had a preference for positive skewness in the return distribution.

Arditti's work elicited a lengthy comment by Francis (1975).[2] After criticizing Arditti's sample selection, definition of variables, and test design, Francis presented his own regression results. Estimations based on a sample of 113 mutual funds showed that while the skewness measure was usually statistically significant, it generally carried an unexpected positive sign. In his reply to Francis' criticisms, Arditti (1975) raised an important methodological issue. He suggested that the ambiguous interpretation of the skewness variable in prior regression studies resulted from the lack of a market equilibrium model incorporating the first three moments of return distribution.

Subsequently, Kraus and Litzenberger (1976) presented a derivation and empirical test of a three-moment CAPM. By invoking the assumption of homogenous expectations, Kraus and Litzenberger showed that the equilibrium return on a security depends on the risk-free rate, beta, and systematic skewness. In this model, rational investors pay a premium for securities possessing positive co-skewness with the market when the market is positively skewed. In contrast, investors discount securities having positive co-skewness with the market when the market return distribution is negatively skewed. Thus, in a three-moment framework, it is systematic skewness that is important and not the third moment of the individual security's return distribution. Kraus and Litzenberger's empirical tests of the model yielded negative and significant coefficients for systematic skewness. Since the market index exhibited positive skewness during the test period, it was anticipated that investors would pay a premium for portfolios with positive co-skewness.

Our regression analysis of the impact of systematic skewness on average returns is premised on the theoretical insights of Kraus and Litzenberger. Equation (1) shows the modified three - moment model estimated in this paper.

$$\bar{r}_{it} = a_0 + a_1\beta_{it} + a_2\gamma_{it} + a_3\beta_{it}\gamma_{it} + \varepsilon_{it}. \quad (1)$$

where $\bar{r}_{it}$ = the average return for the ith security in the tth subperiod,

$\beta_{it}$ = the systematic risk measure for the ith security in the tth subperiod,

$\gamma_{it}$ = the systematic skewness of the ith security in the tth subperiod,

$\varepsilon_{it}$ = the disturbance terms,

$i$ = 1, 2, . . . , 685, and

$t$ = 1, . . . 4.

The final term, $\beta_{it}\gamma_{it}$, in equation (1) needs further explanation. Kraus and Litzenberger (1976, p. 1098) found that higher beta portfolios tended to have proportionately higher gammas. As will be discussed below, our classification results imply similar offsetting behavioral effects between beta and systematic skewness. For example, under conditions of positive market skewness, we found that investors' aversion to higher systematic risk was offset, to some extent, by their preference for higher systematic skewness. According to equation (1), the influence of systematic skewness on average returns is $\partial \bar{r}_{it}/\partial \gamma_{it} = a_2 + a_3\beta_{it}$. A difficulty associated with this specification arises in testing the significance of the individual regression coefficients. Given the high degree of collinearity between $\beta_{it}$ and $\gamma_{it}$, testing the null hypothesis that these variables do not affect average returns requires that the coefficients of all the regressors involving either measure be jointly zero (Kmenta, 1970, P.456).

## Empirical Findings

This section presents the results of the classification and regression analyses. Table 2 reports the findings for the classification procedure outlined in the previous section.[3] Except for the second subperiod, average systematic skewness increases

## TABLE 2

**Dispersion Measures For The Distribution of Monthly Holding Period Returns For 685 Common Stocks Listed on The NYSE, 1961-1980**

| | Ranking of Risk Class by CAPM Beta | | | | |
|---|---|---|---|---|---|
| **Subperiod** | **1** | **2** | **3** | **4** | **5** |
| 1961-1965 | | | | | |
| Mean Return[a] | **0.005** | **0.005** | **0.008** | **0.008** | **0.012** |
| Average Standard Deviation | 0.006 | 0.007 | 0.008 | 0.009 | 0.015 |
| Average CAPM Beta | 0.506 | 0.765 | 0.955 | 1.174 | 1.600 |
| Average Systematic Skewness[b] | 0.686 | 0.848 | 1.000 | 1.040 | 1.410 |
| 1966-1970 | | | | | |
| Mean Return | **0.007** | **0.011** | **0.012** | **0.010** | **0.013** |
| Average Standard Deviation | 0.006 | 0.009 | 0.009 | 0.009 | 0.013 |
| Average CAPM Beta | 0.494 | 0.742 | 0.943 | 1.192 | 1.630 |
| Average Systematic Skewness | 1.062 | 1.022 | 1.138 | 0.819 | 0.957 |
| 1971-1975 | | | | | |
| Mean Return | **0.011** | **0.008** | **0.009** | **0.010** | **0.007** |
| Average Standard Deviation | 0.008 | 0.006 | 0.007 | 0.009 | 0.011 |
| Average CAPM Beta | 0.503 | 0.772 | 0.962 | 1.180 | 1.583 |
| Average Systematic Skewness | 0.319 | 0.741 | 0.955 | 1.134 | 1.852 |
| 1976-1980 | | | | | |
| Mean Return | **0.009** | **0.009** | **0.012** | **0.016** | **0.021** |
| Average Standard Deviation | 0.006 | 0.008 | 0.010 | 0.010 | 0.013 |
| Average CAPM Beta | 0.459 | 0.770 | 0.964 | 1.185 | 1.622 |
| Average Systematic Skewness | 0.441 | 0.682 | 1.022 | 1.259 | 1.519 |

NOTE: [a]The statistics reported in this table are the arithmetic averages of the returns and dispersion measures for the stocks included in each group.

[b]Overall market skewness, defined as $m_3 = \sqrt[3]{M_3}$ where

$$M_3 = \sum_{t=1}^{T=60} (R_{m,t} - \overline{R}_m)^3$$ is: 1961-65, −0.452; 1966-70, −0.074

1971-75, 0.980; 1976-80, −0.949.

monotonically across the risk classes. As discussed in Section II, a presupposition of the three-moment CAPM is that investors prefer greater systematic skewness when the market is positively skewed, but are averse to co-skewness when the market is negatively skewed. The classification results in Table 2 seem in accord with the hypothesis and, along with the evidence on beta, provide a plausible explanation for the pattern of returns across the risk classes.

For example, in the first subperiod, mean returns increase from lowest to the highest risk category. Both risk dimensions are consistent with this increase. Beta rises from group 1 to group 5. Risk-averse investors require higher returns to compensate for the increasing risk across the groups. Important for our analysis, however, is the fact that systematic skewness reenforces this tendency. Investors are averse to greater co-skewness in this subperiod because the aggregate market is negatively skewed (see fn.b, Table 1). In the second subperiod, there are some offsetting effects, particularly with respect to the fourth risk class. For this time period, mean returns rise until the fourth risk class, decline in group 4, and then rise once again in group 5. Since beta rises continuously across the classes, the decline in the mean return for group 4 seems related to $\gamma$ . Systematic skewness falls rather dramatically between groups 3 and 4. Investors bid down the return in the fourth class because of their preference for lower systematic skewness in a negatively-skewed market. For the fifth group, the mean return is only slightly higher than that for group 3, even though its beta is 1.7 times as great. Here again aversion to a high beta is offset by a lower degree of systematic skewness (i.e., between groups 3 and 5).

Subperiod three follows the predictions of the three-moment framework under conditions of positive market skewness. Nevertheless, it must be remembered that for this period, we were unable to reject the null hypothesis of equivalency among the risk classes. Mean returns, beta, and gamma all increased from the lowest to the highest risk class in subperiod four. Per our previous comments, these results appear due to the combined aversion of investors to beta and systematic skewness. The aversion to higher systematic skewness occurs because in subperiod four, the market is negatively skewed.

The regression estimates for the modified three-moment model are reported in Table 3.[4] The coefficients of all three regressors are positive in subperiod 1961-1965. Since the aggregate return distribution for the market was negatively skewed, one would anticipate a positive sign for gamma. Investor aversion to negative skewness implies that a higher rate of return is required on stocks with greater systematic skewness. Furthermore, the interaction term shows that investors were increasingly averse to risk (as indicated by the higher $r_{it}$) across the stock groups, not only because of increasing systematic risk but also because high beta stocks had greater co-skewness with the market.

Gamma was not an influential factor in the determination of average returns in subperiod 2. However, the degree of overall market skewness was relatively low in this period. As previously noted, when the market is positively skewed, one expects $\gamma_{it}$ to carry a negative sign because investors are willing to pay somewhat of a premium for stocks providing a chance for large gains. $\gamma_{it}$ carries the anticipated negative sign in subperiod 3 and is significant at the .01 level. The positive sign of the interaction term implies that greater systematic risk offset, to some extent, the premium paid for greater systematic skewness during this period. The results for subperiod 4, a time of negative market skewness, parallel the findings for subperiod 1.

**TABLE 3**

**Regression Results For Modified Three-Moment Model**

| Subperiod | $\gamma_{it}$ | $\beta_{it}$ | $\gamma_{it}\beta_{it}$ | Intercept | $R^2$/F |
|---|---|---|---|---|---|
| 1961-1965 | 0.0014 | 0.0018 | 0.0022* | 0.0021 | 0.1940/54.64* |
| | (1.3300) | (1.4010) | (2.5870) | (1.5680) | |
| 1966-1970 | 0.0002 | 0.0045* | 0.0002 | 0.0057* | 0.0570/13.71* |
| | (0.6510) | (4.7980) | (0.7100) | (5.5600) | |
| 1971-1975 | −0.0035* | 0.0013 | 0.0001 | 0.0110* | 0.0659/16.02* |
| | (3.3510) | (0.9100) | (0.1440) | (9.3900) | |
| 1976-1980 | 0.0036† | 0.0066* | 0.0004 | 0.0027 | 0.1953/55.08* |
| | (1.9040) | (3.0650) | (0.2590) | (1.5400) | |

NOTE: t-statistics are in parenthesis. *indicates significance at the 0.01 level or better using a two-tail test. † indicates significance at the 0.05 level or better using a two-tail test.

## Conclusions

Past research on the connection between skewness preference and the return behavior of common stocks has been conducted in terms of two statistical methodologies. Classification studies group common stocks into risk classes and then relate group mean returns to the average intraclass skewness of the individual security return distributions. In the second analytical framework, either the third moment of the individual security returns distributions or systematic skewness is included among the regressors in a model of return behavior. Both methodologies have produced fruitful results. However, previous works are difficult to compare for two reasons. First, skewness preference is not proxied in a uniform manner. And second, with the possible exception of Kraus and Litzenberger, the studies do not consider the interaction of gamma and beta in the determination of security returns.

By consistently defining skewness as gamma (systematic skewness), this paper attempts to make the two analytical approaches more comparable. In addition, the interaction of gamma and beta is considered in the context of a three-moment model of security returns. Systematic skewness was found to be an important determinant of common stock yields. Both statistical methodologies revealed that investors desire greater systematic skewness when the market is positively skewed and eschew co-skewness in negatively-skewed markets.

## Notes

[1] Systematic skewness is defined as:

$$\gamma_i = \left[ \sum_{t=1}^{n} (R_{mt} - \bar{R}_m)^2 (R_{it} - \bar{R}_i) \right] \Big/ \left[ \sum_{t=;}^{n} (R_{mt} - \bar{R}_m)^3 \right]$$

where i = ith security.

[2]Criticisms were also directed at a study by Levy and Sarnat (1972, pp. 244-248) using a methodology similar to Arditti.

[3]Joint tests of the differences between the class means of the variables listed in Table 1 were conducted using the Hotelling $T^2$. The null hypothesis of no difference between the means was rejected in three of the four periods. We could not reject the null hypothesis for subperiod 1971-1975.

[4]In most cases, the joint tests using an F-distribution led to a rejection of the null hypothesis that $\beta_{it}$ and $\gamma_{it}$ had no effect on $\bar{r}_{it}$. This was true even though the t-statistics for some of the individual variables indicated significance at less than the 90 percent level.

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