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Source: *The Journal of Finance*, Vol. 43, No. 4 (Sep., 1988), pp. 1035-1039
Published by: Blackwell Publishing for the American Finance Association
Stable URL: http://www.jstor.org/stable/2328152
Accessed: 26/11/2009 07:40

THE JOURNAL OF FINANCE • VOL. XLIII, NO. 4 • SEPTEMBER 1988

A Fundamental Study of the Seasonal Risk-Return Relationship: A Note

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TWO FEATURES OF MANY capital asset pricing theories are a) that the relationship between risk and expected returns is linear and b) that risk is defined as the covariability of an asset's returns with the returns on a properly defined hedging portfolio. Among such theories, the Sharpe [9]–Lintner [7] Capital Asset Pricing Model (CAPM), the Black [1] CAPM, and the Ross [8] Arbitrage Pricing Theory (APT) have received the greatest attention.

Despite earlier evidence in support of the CAPM,[1] recent findings by Tinic and West [11] challenge both the completeness of beta as a measure of relevant risk and the linearity of the relationship between risk and expected returns. In a separate study, Tinic and West [10] also demonstrate that beta risk may not be priced by the market, except in January and (to a lesser extent) July. Gultekin and Gultekin [5] report that APT factors are also not priced in non-January months.

The above tests involve cross-sectional regressions of realized security returns against various measures of risk that are estimated in time-series regressions in preceding periods. Portfolio grouping procedures are used to create dispersion in the risk estimates and (hopefully) also in the average realized returns. Portfolio formation also helps to eliminate estimation errors. However, since the actual hedging portfolios and the securities' risk exposures are unobservable, it is difficult to determine whether the above findings reflect a) the absence of a risk-return relationship or b) inadequacies in (testing) these specific asset-pricing models.

This study seeks to disentangle the above two interpretations by comparing the month-to-month holding-period return spreads between stock and T-bill returns. No need exists to calculate beta (or other risk estimators) because stocks are universally accepted as being more risky than government T-bills. If these relative risk rankings are correct and if a consistent risk-return relationship exists, then the average monthly holding-period return spread should be systematically positive.

However, we find that, between 1927 and 1983, average spreads between (even small firms') stocks and T-bills are significantly greater than zero only in January and (to a lesser extent) July. Subperiod results are similar. Thus, we fail to find a pervasive risk-return relationship, and its absence cannot be attributed to misspecification of asset-pricing models or to nonstationary or inefficient estimates of beta.

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[1] See, for example, Black, Jensen, and Scholes [2] and Fama and Macbeth [4].

The remainder of the paper proceeds as follows. Section I presents our data. Section II discusses our empirical results, and Section III summarizes.

I. Data

Returns on government T-bills from January 1927 through December 1983 are taken from Ibbotson and Sinquefeld's 1985 yearbook of *Stocks, Bonds, Bills and Inflation* (Chicago: Ibbotson Associates). Stock return data for the same period are taken from the Center for Research in Security Prices (CRSP) monthly returns tape. Because of the extensive evidence that stock prices of small-equity-value firms behave differently from the stock prices of large firms, we form ten portfolios ranked by the aggregate market value of equity. Rankings for portfolio returns observed in any year t occur in year $t - 1$. Thus, we rank firms initially at the end of 1926 and update the composition of the portfolios annually through December 1982. The average market value of the equity for the ten portfolios ranges from approximately \$7.53 million to \$1.26 billion.

The hypothesis we test is that mean (median) return spreads between stock and T-bills equal zero. We use a matched-pairs t-statistic and a Wilcoxon signed-rank test to determine the statistical significance of the differences between stock and T-bill returns. However, because the results of the Wilcoxon signed-rank test are essentially the same as the results of the t-tests, Wilcoxon signed-rank test results are reported (in footnotes) only when they differ from the t-test results. For the t-statistic, we report two-tailed p-values in parentheses under the mean return spread estimates. We assume that 0.100 is an acceptable level of significance for rejecting the null hypothesis. Therefore, to aid in identifying significant p-values, we mark each set of parentheses with values of 0.100 or lower with an asterisk in Table I.

II. Empirical Evidence

Table I contains the mean return spread estimates and associated p-values for comparisons of stock and T-bill returns. In addition to term structure differences, comparisons of stock and T-bill returns incorporate differences in default and other sources of risk. To the extent that these risk differences are priced, the mean spreads should be systematically positive.

However, as in Tinic and West [10] and Gultekin and Gultekin [5], the risk-return relationship is upheld only in January and (to a lesser extent) July. Of the ten size-ranked portfolios, only the largest has an insignificant mean return spread estimate in January. The January mean spread estimates range from 0.71 percent for the largest portfolio to 11.28 percent for the smallest portfolio. In July, all the mean spread estimates are significantly positive, but the range between the spreads on the largest (1.47 percent) and the smallest (2.53 percent) portfolios is only 1.06 percent. Of the one hundred non-January/non-July

Table I

Month-to-Month Holding-Period Return Spreads between Ten Stock Portfolios Ranked by Firm Size and T-Bills, 1927–1983 (Two-Tail *p*-Values in Parentheses)[a]

Portfolio	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Smallest Stocks	0.1128	0.0138	−0.0024	0.0105	0.0029	0.0056	0.0253	0.0148	−0.0052	−0.0111	0.0112	−0.0063
	(0.000)*	(0.182)	(0.838)	(0.464)	(0.866)	(0.674)	(0.028)*	(0.366)	(0.760)	(0.344)	(0.401)	(0.580)
2	0.0781	0.0116	0.0001	0.0080	−0.0026	0.0025	0.0211	0.0144	−0.0174	−0.0076	0.0113	−0.0036
	(0.000)*	(0.127)	(0.995)	(0.582)	(0.879)	(0.838)	(0.078)*	(0.298)	(0.240)	(0.494)	(0.305)	(0.710)
3	0.0593	0.0095	−0.0031	0.0045	−0.0054	0.0024	0.0221	0.0121	−0.0173	−0.0081	0.0129	−0.0013
	(0.000)*	(0.184)	(0.774)	(0.703)	(0.737)	(0.829)	(0.064)*	(0.312)	(0.182)	(0.462)	(0.200)	(0.890)
4	0.0461)	0.0067	−0.0011	0.0065	−0.0034	0.0027	0.0189	0.0145	−0.0130	−0.0065	0.0142	0.0040
	(0.000)*	(0.331)	(0.913)	(0.588)	(0.822)	(0.797)	(0.095)*	(0.217)	(0.311)	(0.512)	(0.135)	(0.633)
5	0.0408	0.0050	−0.0035	0.0043	−0.0048	0.0036	0.0189	0.0165	−0.0125	−0.0087	0.0153	0.0067
	(0.000)*	(0.411)	(0.738)	(0.713)	(0.706)	(0.733)	(0.084)*	(0.139)	(0.312)	(0.393)	(0.086)*	(0.363)
6	0.0347	0.0052	−0.0013	0.0051	−0.0075	0.0059	0.0185	0.0159	−0.0116	−0.0066	0.0128	0.0083
	(0.000)*	(0.424)	(0.895)	(0.663)	(0.555)	(0.540)	(0.095)*	(0.127)	(0.323)	(0.496)	(0.138)	(0.272)
7	0.0250	0.0046	−0.0005	0.0082	−0.0063	0.0062	0.0174	0.0153	−0.0109	−0.0051	0.0140	0.0096
	(0.003)*	(0.437)	(0.961)	(0.488)	(0.605)	(0.502)	(0.087)*	(0.108)	(0.337)	(0.589)	(0.099)*	(0.152)
8	0.0208	0.0026	0.0006	0.0053	−0.0089	0.0070	0.0161	0.0119	−0.0125	−0.0043	0.0124	0.0090
	(0.007)*	(0.655)	(0.943)	(0.635)	(0.409)	(0.459)	(0.096)*	(0.189)	(0.242)	(0.642)	(0.152)	(0.156)
9	0.0179	0.0031	−0.0005	0.0055	−0.0055	0.0087	0.0167	0.0149	−0.0144	−0.0023	0.0130	0.0113
	(0.011)*	(0.585)	(0.958)	(0.596)	(0.584)	(0.330)	(0.084)*	(0.125)	(0.159)	(0.790)	(0.088)*	(0.065)*
Largest Stocks	0.0071	0.0003	−0.0001	0.0070	−0.0056	0.0075	0.0147	0.0119	−0.0156	−0.0019	0.0105	0.0100
	(0.252)	(0.959)	(0.985)	(0.448)	(0.541)	(0.322)	(0.094)*	(0.150)	(0.083)*	(0.817)	(0.151)	(0.072)*
F-Statistic[b]	9.937	0.487	0.019	0.470	0.129	0.033	0.110	0.046	0.148	0.059	0.027	0.503
	(0.000)*	(0.884)	(1.000)	(0.895)	(0.999)	(1.000)	(0.999)	(1.000)	(0.998)	(1.000)	(1.000)	(0.873)

[a] The *p*-value is for a matched-paired *t*-test.

[b] The *F*-statistics have 9,560 degrees of freedom. The *F*-statistic tests the null hypothesis that mean spreads are jointly equal in every size-ranked portfolio.

* *p*-Value ≤ 0.100.

spreads, only six (concentrated mostly in November and/or December) are significant at the 0.100 level.[2]

These findings are consistent with the findings of Tinic and West and Gultekin and Gultekin [5]. However, Tinic and West [11, p. 143] argue that the "difficulty in making very much" of their earlier results is that their tests assume that "the proxies for the true market portfolio . . . are mean-variance efficient." Since their latter findings "demonstrate conclusively" that mean-variance efficiency does not hold for the equal- and value-weighted portfolios of NYSE-listed stocks, Tinic and West cannot determine whether their results are attributable to inefficient proxies for the market portfolio or to deficiencies in the CAPM. Our findings, on the other hand, cannot be ascribed to inefficient proxies for the market portfolio because our risk rankings depend on fundamental differences in the characteristics of stocks and T-bills rather than on stock price sensitivities to variations in a market index.

As commonly noted in empirical tests of asset-pricing models, it is important to group assets into portfolios so as to spread their expected returns over a wide range and to enhance the descriptive power of the cross-sectional tests. Chen, Roll, and Ross [3] report that, in general, grouping portfolios on the basis of firm size can spread portfolio returns more effectively than forming portfolios according to a) the stocks' beta on a market index, b) the standard deviation of the residual in a market model regression, and/or c) the level of the stock price. However, the F-statistics at the bottom of Table I indicate that the dispersion across even size-ranked portfolios is limited because the hypothesis that mean spreads are jointly equal in every size-ranked portfolio can only be rejected in January. Therefore, if firm-size groupings are indeed the most effective way to spread portfolio returns, there is little hope in non-January months of documenting significantly positive risk premium estimates in two-stage regressions, regardless of how much the estimates of beta (or other risk measures) are improved.

III. Conclusion

From 1927 through 1983, average holding-period returns on T-bills have not been significantly lower than average holding-period returns on common stocks in months other than January and July. Our findings are not attributable to misspecification or misestimation of asset-pricing model inputs; nor do they result from a few large outliers in the sample.

Our results also show that even grouping stocks into portfolios by size cannot effectively spread realized returns over a wide range between February and

[2] With the Wilcoxon signed-rank test p-values included, sixteen estimates are significant at the 0.100 level. All but one of the additional estimates that are significant occur in November or December.

Analysis of the first and second halves of the sample period indicates only trivial differences in the conclusions drawn from Table I. The differences in the second half of the sample period relative to the first are a) that the range of January spreads is smaller and b) that the secondary support for a risk-return relationship shifts from July to March and November. These minor differences do little to enhance our confidence in the pervasive risk-return tradeoff that much of finance theory posits.

December. This indicates that efforts to improve beta estimation alone are unlikely to enhance the discriminatory power of the cross-sectional regressions in months other than January.

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