

Evaluating Mutual Fund Performance

S.P. Kothari

Sloan School of Management
Massachusetts Institute of Technology
50 Memorial Drive, Cambridge, MA 02142
E-mail Kothari@MIT.edu
617 253-0994

and

Jerold B. Warner

William E. Simon Graduate School of Business Administration
University of Rochester, Rochester, NY 14627
E-mail Warner@ssb.rochester.edu
716 275-2678

First draft: August 1997

We thank Peter Wysocki for excellent research assistance. We are grateful to the Research Foundation of the Institute of Chartered Financial Analysts and the Association for Investment Management and Research, the Bradley Policy Research Center at the Simon School and the John M. Olin Foundation for financial support.

Abstract

We study standard mutual fund performance measures, using simulation procedures combined with random and random-stratified samples of NYSE and AMEX securities. We track simulated fund portfolios over time. These portfolios' performance is ordinary, and well-specified performance measures should not indicate abnormal performance. Our main result, however, is that the performance measures are badly misspecified. Regardless of the performance measure, there are indications of abnormal fund performance, including market-timing ability, when none exists.

Evaluating Mutual Fund Performance

1. Introduction

This paper studies empirical properties of performance measures for mutual funds (i.e., managed equity portfolios). The portfolio performance evaluation literature is extensive, but highly controversial. Performance measures based on the Sharpe/Lintner Capital Asset Pricing Model (CAPM) have a long history and are still used (e.g., Malkiel, 1995, and Ferson and Schadt, 1996). At the theoretical level, however, there have been strong objections to CAPM-based measures (e.g., Roll 1977, 1978, Admati and Ross, 1985, and Dybvig and Ross, 1985a, b). For example, the use of a security market line to measure performance can be “ambiguous” (Roll, 1978, p. 1052). Inference about superior performance using this approach is sometimes regarded as “hopeless” (Admati and Ross, 1985, p. 16) and “in general anything is possible” because performance of a manager with superior information can plot “below or above the security market line and inside or outside of the mean-variance efficient frontier, and any combination of these is possible” (Dybvig and Ross, 1985a, p. 383).

At the empirical level, asset pricing tests have identified non-beta factors, namely size (e.g., Banz, 1981) and book-to-market ratio (e.g., Rosenberg, Reid, and Lanstein, 1985, and Fama and French, 1992), which are relevant in explaining cross-sectional variation in average returns. In light of such results, some recent studies take into account multiple factors in evaluating fund performance (e.g., Carhart, 1996). Fama and French (1993, p. 54) argue that the performance of a managed equity portfolio should be evaluated using a three-factor model including these additional factors, and they advocate a “simple” and “straightforward” procedure for doing so.

We provide direct evidence on commonly employed performance measures. We use simulation procedures, coupled with random and random-stratified samples of NYSE and AMEX securities. We form simulated fund portfolios and track their performance over time, using a variety of measures. These portfolios’ performance is ordinary and could be obtained by uninformed investors. Thus, well-specified performance measures should not indicate abnormal

performance. Our approach differs from mutual fund performance studies. With few exceptions (e.g., Ferson and Schadt, 1996, p. 448), these studies typically assume the validity of a performance measure, and apply it to observed fund returns. In contrast, we offer independent evidence on the specification of performance measures.

Our main result is that standard performance measures are misspecified. Regardless of the performance measure, we find a tendency to detect abnormal fund performance, including market-timing ability, when none is present. For example, simulated mutual-fund portfolios of randomly-selected stocks exhibit an average abnormal performance (Jensen alpha) of over 3% per year, which is both statistically and economically significant. Our simulations indicate that the Fama-French three-factor model's performance is better than the CAPM, but the corresponding figure is -1.2% per year, which is also significant. Regardless of the performance measure, the degree of misspecification is particularly troubling with the CRSP value-weighted index as the benchmark. Ironically, this index is the most commonly used in both the academic and practitioner literature. We document several sources of misspecification and suggest how to reduce it. Some misspecification is due to inadequacies of the assumed asset pricing model, even for the Fama-French three-factor model. Such results have implications beyond the context of fund performance evaluation.

We also provide evidence on the ability to detect superior performance. We do not introduce superior performance into the samples, but our evidence indicates that each performance measure's sampling variation is large when performance is ordinary. Thus, properly specified performance measures will have low power to distinguish superior from normal performance. Although this point has been suggested elsewhere (e.g., Dybvig and Ross, 1985a and b, and Siegel, 1994, p. 289), we provide evidence on how both power and specification depend on several variables. Our results are obtained without any underlying market timing ability, or derivatives use (Jagannathan and Korajczyk, 1986). These considerations can reduce further the informativeness of fund performance measures.

We examine whether the performance measure misspecifications are related to time-varying expected market returns and return distributions' departures from normality, in particular

skewness. The literature identifies several pre-determined information variables that are correlated with expected market returns. These include dividend yield, book-to-market ratio, long-term Government bond yield, term premium, and default premium. We find some evidence that Fama-French three-factor-model-based performance measures are significantly related to the information variables, but correlated the CAPM-based performance measures are not. We find no evidence to suggest that the portfolio returns' co-skewness with the market accounts for the observed performance-measure misspecifications.

Section 2 outlines the issues in measuring fund performance. Section 3 describes our baseline simulation procedure, including sample construction, portfolio performance measures, and distributional properties of the performance measures under the null hypothesis. Section 4 discusses results of baseline simulations using mutual funds of randomly-selected stocks and presents results of simulations using stratified-random stock portfolios (i.e., style-based portfolios). Section 5 examines whether the observed performance-measure misspecifications are explained by time-varying expected market returns and portfolio returns' co-skewness with the market. Section 6 gives our conclusions.

2. Issues in measuring portfolio performance

We briefly outline key issues in performance evaluation. Since the paper's main focus is on test specification, we emphasize issues affecting the properties of the performance benchmarks in the absence of any abnormal performance.

2.1 Security market lines

We study the use of a security market line, which can represent the assumed asset pricing benchmark in any model with linear factor pricing. For example, in the Sharpe-Lintner CAPM, expected returns on assets or portfolios are a linear function of their beta with the market portfolio. A portfolio's deviation from this security market line measures abnormal performance.

The deviation is typically estimated by the “Jensen alpha” (Jensen, 1968, 1969), which is the intercept in a regression of portfolio excess returns against returns on the value-weighted Index.

The security market line generalizes to multifactor models such as the arbitrage pricing theory. Asset or portfolio returns are a linear function of factor sensitivities with respect to each nondiversifiable factor in the economy. To implement this benchmark, excess returns can be regressed against factor returns, and the regression intercept should measure the abnormal return on the portfolio. In the Fama-French three factor model, the factors are the value-weighted index, and mimicking portfolios for size and book-to-market factors. These authors argue that the intercept in this regression should be zero in the absence of any abnormal portfolio performance.

We investigate properties of the regression intercepts involving both the CAPM (the Jensen alpha) and the Fama-French model. In both cases, we find that the estimated intercepts can be systematically nonzero, and are highly sensitive to index choice. These results hold even for randomly selected portfolios, which do not have unusual size or book to market characteristics. In addition, the sampling distribution of the intercepts is non-normal, making inference about performance more complicated than typically assumed.

2.2 Market timing

There is a large literature on market timing. If fund managers have market timing ability, they will shift portfolios to high beta assets when market returns are expected to be high, and vice-versa. The resulting nonstationarity in beta will systematically bias downward the Jensen alpha (Jensen, 1968). Explicit tests for market timing ability have been derived under both single-factor and multifactor asset pricing benchmarks. Typically, additional terms augment the security market line to test for market timing ability.

We examine market timing tests. Since by construction our simulations involve no market timing ability, we should not find any market timing ability. Surprisingly, there are strong indications of timing ability. We investigate several explanations, and in particular the relation of market timing tests to time-varying expected returns (see Ferson and Schadt, 1996).

2.3 Reward-risk ratios

We document properties of reward-risk ratios. In particular, portfolio performance is sometimes measured by its Sharpe ratio, defined as the ratio of market excess returns (over the riskless rate) to market standard deviation. In the Sharpe-Lintner CAPM, the value-weighted market portfolio has the highest Sharpe ratio.

The Sharpe ratio underlies performance measures for dynamic asset allocation strategies (e.g., Graham and Harvey, 1997). To evaluate such strategies, benchmark returns are a weighted average of the riskless and value-weighted market returns having the same standard deviation as the portfolio under study. The Sharpe ratio is also of interest to practitioners. It is reported by Morningstar, and is the basis for current risk measurement practice such as the Morgan-Stanley “M-squared” measure (see the *Wall Street Journal*, 2/10/97). We illustrate how CAPM departures can easily yield higher Sharpe ratios than the value-weighted index. Although some previous literature recognizes this general point (e.g., Grinblatt and Titman, 1987, and MacKinlay, 1995), our results illustrate the implications of excessive reliance on the value-weighted index in formulating a mutual fund benchmark¹.

3. Baseline simulation procedure

This section describes the paper’s baseline simulation procedure. We discuss sample construction, mutual fund performance measures using alternative expected return models, and test statistics under the null hypothesis of no abnormal performance. We use some of the more commonly used measures as found in the literature, e.g., Bodie, Kane, and Marcus (1996, ch. 24). The baseline simulations use portfolios of randomly selected stocks. Later, we examine the sensitivity of the baseline results to stratified-random stock portfolios (e.g., style-based portfolios), but the conclusion of misspecification is unchanged.

3.1 Sample construction

¹ The precise implications of our results for M-squared measures and evaluating dynamic asset allocation strategies are the subject of a separate study we are undertaking.

We construct a 50-stock mutual fund portfolio each month from January 1964 through December 1991. We then track these 336 simulated mutual fund portfolios' performance over three-year periods (months 1 through 36) using a number of performance measures. As discussed later, these three-year periods are overlapping.

Stock selection. The 50 stocks in each portfolio are selected randomly and without replacement from the population of all NYSE/AMEX securities having return data on the Center for Research in Security Prices (CRSP) monthly returns tape. Since the number of NASDAQ stocks is generally far greater than the number of NYSE/AMEX stocks, inclusion of NASDAQ stocks in our sampling would have resulted in simulated mutual fund portfolios dominated by NASDAQ stocks.

Portfolio turnover. While each portfolio's performance is evaluated over three years, the portfolio composition is changed at the beginning of the second and third years (i.e., beginning of months 13 and 25) to mimic turnover in a typical mutual fund. Specifically, we assume 100% turnover of the stocks in the mutual fund portfolio at the end of each year.

Data availability criteria. Any NYSE/AMEX security with return data available in month 1 is eligible for inclusion in the portfolio formed at the beginning of month 1, and similarly any security with return data available in month 13 can be included in the portfolio formed at the beginning of month 13. Thus, we impose minimal data-availability requirements in the baseline simulations. For example, only the securities for which return data become available starting in months 2 through 11 (e.g., initial public offerings) are excluded from the mutual fund portfolio formed at the beginning of month 1.

Portfolio returns. For each of the 336 mutual fund portfolios, we construct a time series of 36 monthly returns starting in month 1. We begin with an equal-weighted portfolio, but the portfolio is not rebalanced at the end of each month. This is consistent with the monthly returns earned on a mutual fund that does not trade any of its stocks in one year. We assume dividends are re-invested, which may or may not be descriptive of an actual mutual fund. However, performance evaluation assuming dividend reinvestment is typical. Since we reconstruct the mutual fund at the beginning of months 13 and 25, we begin the second and third years with equal-weighted portfolios.

3.2 Portfolio performance measures

We apply the following performance measures: Sharpe measure, Jensen alpha, Treynor measure, appraisal ratio, and Fama-French three-factor model alpha. The finance profession has used the first four performance measures for many years. The Jensen alpha, the Treynor measure, and the appraisal ratio are all rooted in the Sharpe-Lintner CAPM, whereas the Fama-French three-factor alpha is the equivalent of the CAPM-based Jensen alpha in a multi-factor setting that includes size and book-to-market factors along with the market factor. To evaluate market timing, we employ two measures: CAPM-based market-timing alpha and gamma and Fama-French three-factor model-based timing alpha and gamma. Table 1 summarizes the performance measures and provides a list of selected references for each. Below we briefly discuss each measure.

[Table 1]

Sharpe measure. The Sharpe measure (see Sharpe, 1966) provides the reward to volatility trade-off. It is the ratio of the portfolio's average excess return divided by the standard deviation of returns:

$$\text{Sharpe measure} = (AR_p - AR_f) / \sigma_p \quad (1)$$

where AR_p = average return on a mutual fund portfolio over the sample period, AR_f = average risk free return over the sample period, and σ_p = the standard deviation of excess returns over the sample period.

Jensen alpha. The Jensen alpha measure (see Jensen, 1968, 1969) is the intercept from the Sharpe-Lintner CAPM regression of portfolio excess returns on the market portfolio excess returns over the sample period:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{Mt} - R_{ft}) + \epsilon_{pt} \quad (2)$$

where R_{pt} is the mutual fund portfolio return in month t , R_{ft} is the risk free return in month t , R_{Mt} is the return on the market portfolio in month t , ϵ_{pt} is the white noise error term, and α_p β_p are the regression's intercept and slope (beta risk) coefficients.

Treynor measure. The Treynor measure (see Treynor, 1965) is similar to the Sharpe measure except that it defines reward (average excess return) as a ratio of the CAPM beta risk:

$$\text{Treynor measure} = (AR_p - AR_f)/\beta_p . \quad (3)$$

Appraisal ratio. The appraisal ratio is a transformation of the Jensen's alpha (see Treynor and Black, 1973). It is the ratio of Jensen's alpha to the standard deviation of the portfolio's non-market risk (i.e., unsystematic risk) as estimated from eq. (2):

$$\text{Appraisal ratio} = \alpha_p/\sigma(\epsilon_p). \quad (4)$$

Fama-French three-factor model alpha. The Fama-French three-factor model alpha (see Fama and French, 1993) is estimated from the following expanded form of the CAPM regression:

$$R_{Pt} - R_{ft} = \alpha_p + \beta_{p1}(R_{Mt} - R_{ft}) + \beta_{p2}HML_t + \beta_{p3}SMB_t + \epsilon_{Pt} \quad (5)$$

where HML_t and SMB_t are the Fama-French book-to-market and size factor returns. HML_t is the high-minus-low book-to-market portfolio return in month t and SMB_t is the small-minus-big size portfolio return in month t . We construct the book-to-market and size factors similarly to that in Fama and French (1993) and details are available on request.

CAPM market-timing alpha and gamma. We use the Henriksson and Merton (1981) model to measure the market-timing ability of a mutual fund manager. The quadratic regression of Treynor and Mazuy (1966) is an alternative measure of evaluating the market-timing ability. Both measures are CAPM based. The Henriksson-Merton market-timing measure allows for the beta risk to be different in *ex post* up and down markets. Specifically, the market-timing alpha and gamma are given by

$$R_{Pt} - R_{ft} = \alpha_p + \beta_p(R_{Mt} - R_{ft}) + \gamma_p(R_{Mt} - R_{ft}) * D + \epsilon_{Pt} \quad (6)$$

where D is a dummy variable that equals 1 for $(R_{Mt} - R_{ft}) > 0$ and zero otherwise, and α_p and γ_p are the market-timing alpha and gamma. Under the null hypothesis of no market timing, both α_p and γ_p are expected to be zero, whereas a successful market timer's mutual fund should exhibit positive values of α_p and γ_p .

Fama-French three-factor model market-timing alpha and gamma. Henriksson and Merton (1981) argue that market-timing ability can be inferred from a multi-factor analog of the CAPM timing alpha and gamma (p. 517). Accordingly, we define the market-timing alpha and gamma using the Fama-French three-factor model similar to eq. (6). The only difference is that book-to-market and size-factors are also included as independent variables, as in eq. (5) for the Fama-French three-factor model.

3.3 Distributional properties of performance measures

Our research design and data analysis yield a time series of 336 overlapping performance measure estimates using each of the techniques described in section 3.2. Our objective is to examine the distributional properties of the estimated performance measures. Under the null hypothesis of no abnormal performance in the mutual fund portfolios consisting of randomly-selected stocks, Jensen alpha and Fama-French three-factor model alpha are expected to be zero. We test the null hypothesis that the time series mean of the Jensen alphas and Fama-French three-factor model alphas is zero. The test statistic is:

$$t = (1/T) \sum_t \alpha_t / \text{S.E.}(\alpha) \quad (7)$$

where $\text{S.E.}(\alpha)$ is the standard error of the mean of the estimated alphas. If the estimated alphas are assumed independently distributed, then the standard error is given by:

$$\text{S.E.}(\alpha) = [\sum_t (\alpha_t - (1/T) \sum_t \alpha_t)^2]^{1/2} / (T - 1). \quad (8)$$

Since the alphas are estimated using 36-month overlapping windows, we use a correction for serial dependence in estimating the standard error of the mean (see Newey and West, 1987, 1994 and Andrews, 1991) in the calculation of the t-statistic in eq. (7). We also discuss the serial dependence in the alphas estimated using various models.

Under the null hypothesis the alpha and the up-market beta in the Henriksson-Merton market-timing regression model are zero. This holds also in the Fama-French three-factor model analog of the Henriksson-Merton regression. The test statistic for abnormal performance (i.e., $\alpha = 0$) and market-timing ability (i.e., γ_p from eq. (6) = 0) are similar to that in eq. (7), with the standard error adjusted using the Newey-West correction for serial dependence.

4. Simulation results

This section reports the paper's main results. We present distributional properties of regression-based mutual fund performance measures (e.g., Jensen alpha, the associated t-statistic, and rejection frequencies) and reward-risk ratios (e.g., the Sharpe measure) for randomly- and non-randomly selected stock portfolios. The performance measures are often misspecified. The

generally significant misspecifications of the CAPM-based performance measures are reduced, but not eliminated, using the Fama-French three-factor model. For the randomly-selected stock portfolios, misspecification is generally severe using the CRSP value-weighted portfolio as the market factor proxy in the CAPM or Fama-French three-factor model regressions to evaluate performance. Since we select stocks randomly, well-specified performance measures by construction should not exhibit evidence of market timing. However, the market-timing performance measures are often economically and statistically significant. In non-random samples (style portfolios) there is evidence of misspecification using both value- and equal-weighted indexes as market factor proxies.

4.1 Regression-based performance measures: CRSP value-weighted index as the market-factor proxy

Table 2 reports distributional properties of the time series of 336 regression-based performance measures for randomly-selected 50-stock portfolios. The results in this subsection are based on using the CRSP value-weighted index. Our focus on results using the value-weighted index is motivated by its ubiquitous use in both academic and practitioner research, due perhaps to the “true” value-weighted market portfolio’s central role in the CAPM theory.

Regressions with no market timing variables. From table 2 panel A, the average of 336 Jensen alpha estimates using the CRSP value-weighted index is 27 basis points (t-statistic = 3.08) per month, or 3.24% per year. The average alpha using the Fama-French three-factor model has the opposite sign, -10 basis points, and reliably is negative (t-statistic = -4.68). Abnormal performance of economically significant magnitudes for a naïve strategy of investing in 50 randomly-selected stocks every year is quite surprising, as are the conflicting results for the two models.

The standard error of the average Jensen alpha, with the Newey-West correction to account for serial correlation, is 8.8 basis points per year.² The serial correlation in the estimated

² The Newey-West corrected standard errors reported in this study are based on five lags selected on the basis of sample size. There are alternative lag selection procedures discussed in Andrews (1991) and Newey and West (1987, 1994). These alternative procedures yield 50-100% larger standard errors only in the case of CAPM-based regression alphas estimated using the CRSP value-weighted index as the market proxy. In all other cases, i.e., alphas from the Fama-French three-factor model using equal- or value-weighted index and Jensen alphas using the

Jensen alphas is a direct consequence of our use of overlapping three-year return windows. However, the degree of serial correlation is sensitive to the choice of the model, due perhaps to omitted determinants of expected returns from various models. For example, untabulated results show that, the value-weighted index CAPM Jensen alphas exhibit autocorrelations that decline only gradually from about 0.8 at the first lag to 0.1 at lag 33. In contrast, however, the equal-weight CAPM Jensen alphas or the three-factor model alphas exhibit only a modest degree of positive autocorrelation. Most of these autocorrelations are not reliably different from zero, with point estimates generally below 0.1 and several estimates are negative. The autocorrelation-corrected standard errors are thus substantially larger than the uncorrected standard errors only in case of the value-weighted CAPM Jensen alphas.

[Table 2]

Specifications of the tests using Jensen alpha or the three-factor model alpha can be examined by focusing on the distributions' departures from normality or rejection rates of the null hypothesis of zero abnormal performance. We report skewness and kurtosis properties in table 2 and rejection frequencies in table 3, which is discussed later. The distribution of Jensen alphas is significantly positively skewed. A skewness coefficient greater than 0.23 indicates right skewness at the 5% level of significance (see Pearson and Hartley, 1958).³ The Jensen alpha distribution does not exhibit significant departure from normality in the tails (i.e., neither fat nor thin tails), but its large positive mean is likely to generate excessive rejections of the null of zero abnormal performance.

The estimated Jensen alphas range from -1.28 to 2.69% per month. The large standard deviation and the wide range even in the absence of abnormal performance are indications that Jensen alpha, even if properly specified, will have low power to distinguish superior from normal

equal-weighted index, all procedures to implement the Newey-West correction yield virtually identical standard error estimates. The source of the difference between the standard errors from alternative procedures in case of the CAPM-based alphas using the value-weighted index appears to be in the persistently high positive autocorrelation in the estimated alphas using overlapping three-year return data. The alphas using the equal-weighted index or the alphas from the three-factor model regardless of the choice of the index are far less serially correlated and the standard error estimates are insensitive to the choice of the Newey-West correction procedure.

³ Since the 336 Jensen alpha estimates are not independent, caution should be exercised in drawing inferences about the statistical significance of the observed departures from normality.

performance. Abnormal performance of economically large magnitudes in a 50-stock portfolio might not be statistically detectable.

The magnitudes of average annual abnormal performance of 3.2% and -1.2% indicated by the CAPM and the Fama-French model are comparable in absolute magnitude to a typical mutual fund's abnormal performance reported in the literature. For example, Malkiel (1995, table III) estimates an average Jensen alpha using returns before expenses of 239 general equity funds from 1982-1991 to be -2% per year. Employing a number of arbitrage portfolio theory factor models, Lehmann and Modest (1987) estimate abnormal performance of approximately -3 to -4% per year using returns after expenses for 130 mutual funds from 1968 to 1982. They conclude that either the average mutual fund significantly under-performs or that inferences about performance are sensitive to "the choice of what constitutes normal performance" (p. 263). Since we find that the CAPM and three-factor models indicate abnormal performance magnitudes using random portfolios that are similar to those reported in the literature using actual mutual fund portfolio returns, popularly used performance measures appear incapable of distinguishing a mutual fund manager's superior from ordinary performance and/or skill.

Regressions with market timing variables. Panel A shows that the CAPM-based Henriksson and Merton (1981) test of market timing is severely misspecified. Using the value-weighted portfolio, the average market timing alpha for the portfolio of randomly-selected 50 stocks is a whopping 63 basis points per month or 7.6% per year (t-statistic = 4.95). Even though there is no market timing in the simulations, the estimated average market-timing gamma is -0.22 (t-statistic = -4.19). The Fama-French three-factor-model-based tests of market timing exhibit a moderate degree of misspecification. The average timing alpha is -7 basis points (t-statistic = -1.70) and the average timing gamma of -0.03 is indistinguishable from zero. Greater misspecification of the market-timing tests compared to the Jensen-alpha tests suggests that omitted determinants of expected returns, departures from normality (e.g., skewness) and/or changing expected rates of returns might be the contributing factors. We explore these explanations in section 5.

4.2 Regression-based performance measures: CRSP equal-weighted index as the market-factor proxy

Although not generally used to evaluate mutual fund performance, we also report results using the CRSP equal-weighted index as the market factor proxy. It is well known that there are statistically significant firm-size-related deviations from the CAPM (e.g., Banz, 1981). For example, given size effects, equal-weighted portfolios of randomly-selected stocks should show positive Jensen alpha using the equal-weighted index. Therefore, the use of the equal-weighted index might mitigate any size-related Jensen-alpha misspecifications. The observed misspecifications are unlikely to be entirely related to firm size, however, because performance measures based on the Fama-French three-factor model, that explicitly includes a size factor, were also misspecified.

No market timing. From panel B, consistent with the expectation of lesser misspecification, the average Jensen alpha and the Fama-French three-factor model alpha are one basis point or less in absolute magnitude and statistically indistinguishable from zero. The distribution is significantly right skewed and fat tailed, but the results in table 3 suggest departures from normality are not large enough to produce test misspecification using the Jensen alpha performance measure. Since we construct portfolios from randomly-selected stocks, not surprisingly, Jensen alphas using the equal-weighted index are close to zero. However, the use of an equal-weighted market factor proxy does not always yield well-specified tests, as seen below.

Market timing. The market-timing tests using both CAPM and the three-factor model are quite misspecified. The CAPM-based average market-timing alpha is 19 basis points per month or 2.3% per year. The Fama-French three-factor model also yields an average market timing alpha of similar magnitude. In both cases the average alphas are statistically highly significant. To counterbalance the estimated average positive timing alphas in the regressions, the timing gammas are on average negative. They are -0.10 (t-statistic = -6.47) using the CAPM and -0.08 (t-statistic = -5.66) using the three-factor model. Thus, commonly-used methods tend to conclude that a buy-and-hold strategy exhibits negative market-timing ability.

Raw performance measures. Panel C of table 2 reports average monthly returns on the value- and equal-weighted indexes and the portfolio of randomly-selected stocks. The averages are calculated from the time series of 336 overlapping three-year average monthly returns. The grand mean of the 336 three-year average returns for the value-weighted index is 0.93% return per month with a standard deviation of 0.57%. The corresponding figures for the randomly-selected 50-stock portfolios are 1.26% and 0.94%. The difference is not surprising because the value-weighted index is dominated by larger, less risky stocks. The average return on the CRSP equal-weighted index is 1.26% with a standard deviation of 0.94% per month. As expected, this is comparable to the average return and standard deviation of the portfolio of randomly-selected 50 stocks. This in part explains the lack of misspecification of the performance measures using the equal-weighted index. That is, tests with no market-timing variables are well-specified when the sample portfolio by construction mimics the index in virtually every dimension.

4.3 Test statistics and rejection frequencies of regression-based tests of performance

Table 3 reports distributional properties of the test statistics from the 336 CAPM and three-factor model regressions using the equal- and value-weighted indexes with and without market timing. To focus on the tail regions of the distributions, table 3 also reports rejection rates of the null hypothesis of zero abnormal performance or of no market timing ability. The results in table 3 reinforce those in table 2 and the misspecification of the performance measure can be dramatic.

From panel A, the average t-statistics are generally large in absolute magnitude when the regressions employed the CRSP value-weighted index. For example, the average t-statistic for the Jensen alphas is 0.43 (standard deviation = 1.42) and for the timing alphas it is 0.82 (standard deviation = 1.34). The standard deviations of the distributions of t-statistics are considerably greater than 1 for the Jensen alpha and the market-timing alpha using the value-weighted index.⁴ If the tests were well-specified, the mean (standard deviation) of the distribution of t-statistics should be zero (one). Panel B shows that the positive means and fat-tailed distributions of t-statistics for the Jensen alphas and CAPM timing alphas generate excessive rates of rejections of

⁴ Since the regressions use overlapping return data, the reported standard deviation likely understates the true standard deviation that would be applicable for a sample of 336 independent estimates of t-statistics.

the null hypothesis in favor of positive abnormal performance. The CAPM timing alpha is significantly positive at the 5% level of significance 27.7% of the time.

[Table 3]

Panel B shows that, using the equal-weighted index, both the CAPM and the three-factor model timing alphas indicate positive abnormal performance moderately too often (11.6% and 9.8% compared to an expected rate of 5%). The CAPM timing gamma using both equal- and value-weighted index and the three-factor model timing gamma using the equal-weighted index also exhibit too many rejections in favor of negative market timing.

4.4 Reward-risk ratios

The central prediction of the Sharpe-Lintner CAPM is that ex ante the value-weighted market portfolio has the highest Sharpe ratio. Table 4 reports descriptive statistics on reward-to-risk ratios for the value- and equal-weighted indexes and the 336 simulated portfolios of randomly-selected stocks.

Contrary to the CAPM prediction, mutual fund the Sharpe ratios of the CRSP equal-weighted index and the portfolio of randomly-selected stocks substantially exceed the Sharpe ratio of the CRSP value-weighted index. The average Sharpe ratio of the value-weighted index is only 0.10, compared to 0.14 for the equal-weighted index and 0.13 for the simulated portfolio of randomly-selected stocks. This finding is not driven by extreme observations. Median Sharpe ratios yield the same inference. Given well-documented inadequacies of the CAPM, these results should not be surprising. These inadequacies make it less probable that the value-weighted index was ex ante efficient, but that the equal-weighted index performed better than the value-weighted index in the 28-year sample period.⁵

[Table 4]

The Treynor measure uses beta in the denominator of the ratio, unlike the Sharpe measure, which uses total volatility. Since betas (which are given an equal-weight in our mutual-fund portfolios) estimated against the value-weighted index are generally greater than those estimated against the equal-weighted index, one expects the Treynor measure using the value-

⁵ The Sharpe ratio of the CRSP equal-weighted index is greater than that of the CRSP value-weighted index over a much longer period beginning in 1926. This makes it less likely that the higher Sharpe ratio of the equal-weighted index over the 28-year sample period examined in this study is a period-specific phenomenon.

weighted index to exceed that using the equal-weighted index.⁶ Table 4, however, shows that the Treynor measure for the portfolios of randomly-selected stocks using the value-weighted index betas is 0.63 compared to 0.72 using the equal-weighted index betas. These results are consistent with a lower Sharpe ratio of the value-weighted index than that of the equal-weighted index.

The appraisal ratios using the equal- and value-weighted indexes provide conflicting inferences. The appraisal ratio of the random-stocks portfolio using the value-weighted index is 0.07 (t-statistic 2.47) compared to -0.02 (t-statistic -1.60) using the equal-weighted index.

4.5 Subperiods

Table 5 reports subperiod results for 1964-71, 1972-81, and 1982-91. It provides both regression-based measures using the value- and equal-weighted market indexes and reward-risk ratios. The subperiod results reinforce the impression of serious misspecification.

The average Jensen alpha per month using the value-weighted index for the portfolio of randomly-selected securities ranges from 66 basis points (t-statistic = 8.77) during 1972-81 to -16 basis points (t-statistic = -2.11) during 1982-91 (see panel A of table 5). The large positive average Jensen alpha in the seventies and negative average alpha in the eighties is consistent with the well-documented time-varying size-related inadequacies of the CAPM. Misspecification is severe even for a portfolio of randomly-selected -- not extreme size -- stocks.

[Table 5]

The three-factor model alpha is indistinguishable from zero in the 1964-71 subperiod, but it is a highly significant -15 basis points per month in the subperiods 1972-81 and 1982-91. The timing alphas in the subperiods using the CAPM with the value-weighted index are 1.07% (t-statistic = 5.60) and 0.46% (t-statistic = 3.93) per month. The three-factor model timing alphas are economically and statistically significant in all three subperiods, with a positive sign in the first subperiod.

Panel B shows that the use of the equal-weighted index eliminates the misspecification of the Jensen alpha and the three-factor model alpha. The average Jensen alphas ranges from -7 to 3

⁶ This is expected because beta is a relative risk measure and the equal-weighted index is more volatile than the value-weighted index.

basis points per month and the three-factor model alphas average -3 to 4 basis points per month in the three subperiods. These are fairly small economically and in all but one case statistically insignificant. The CAPM and the three-factor model timing alphas, however, continue to be significantly non-zero, but their magnitudes are muted compared to those observed using the value-weighted index. Both the models yield timing alphas that are consistently positive in all three subperiods. To offset the effect of positive timing alphas in the regression, the market timing gammas are consistently negative.

4.6 Style (non-random) portfolios

Results so far show that even when portfolios have no systematically unusual characteristics, i.e., style, performance measures are misspecified. Therefore, our priors are that style portfolios' (i.e., portfolios comprising non-randomly selected stocks) performance measures will also be misspecified. We report results using non-randomly selected stocks in the hope that such analysis would provide clues to the determinants of the misspecifications.

Size portfolios. Table 6 reports results for large- (panel A) and small-capitalization stock portfolios (panel B) using the CRSP value-weighted index as the market-factor proxy. Large (small) stocks are defined as those belonging to CRSP market-capitalization deciles 8-10 (deciles 1-3), where the decile rankings are based only on NYSE stocks' market capitalizations.

The Jensen alpha and Fama-French three-factor model alpha of the large-stock portfolios are quite small, 5 and -2 basis points per month, respectively. The corresponding alphas of the small-stock portfolios are statistically and economically significantly non-zero, however. Consistent with the size effect, the Jensen alpha of the small-stock mutual fund portfolios is 50 basis points (t-statistic = 3.23) per month. Interestingly, the Fama-French three-factor alpha is -17 basis points per month (t-statistic = 3.21) or 2% per year. The three-factor timing alphas are significantly negative for both large- and small-capitalization stocks, and for small-firm stocks it is a whopping 1.10% per month using the CAPM.

[Table 6]

Book-to-market portfolios. From table 7, the performance measures also exhibit misspecification when applied to the low (panel A) and high (panel B) book-to-market stock

portfolios. The lowest 30% of the stocks ranked according to their book-to-market ratios are defined as low book-to-market or growth stocks. The corresponding highest 30% stocks are high book-to-market or value stocks. Book-to-market ratio is calculated using financial data from Compustat. Since financial data on Compustat is not available for every NYSE/AMEX stock, the universe of firms from which the low and high book-to-market stocks are samples is less comprehensive than that used elsewhere in the study. From table 7, the CAPM-based measures are misspecified for the high book-to-market (value) portfolios, whereas the three-factor-model-based measures are misspecified in case of the low book-to-market (growth) portfolios. For example, the three-factor alpha and the timing alpha are significantly negative for the low book-to-market stocks, but they are indistinguishable from zero using the high book-to-market portfolios. Since the low book-to-market stocks are generally large market capitalization stocks, the three-factor model's misspecification is not limited to small stocks.

[Table 7]

5. Exploring causes of test misspecification: Time-varying expected returns and co-skewness

In this section we perform an exploratory analysis of whether the test misspecification documented in the previous section are explained by time-varying expected returns and/or departures from normality, in particular, coskewness. Neither appears to substantially account for the performance measure misspecification. There is only weak evidence that the simulated mutual fund portfolios' estimated performance measures covary with proxies for time-variation in market expected returns, particularly the book-to-market ratio. We do not find co-skewness to be systematically associated with the estimated performance measures.

5.1 Association of performance measures with variables proxying for the market expected return

In our simulated mutual fund portfolios, the null hypothesis of no market timing is true and performance measures are not expected to show market timing. However, the existing performance measures assume stationary expected market (or factor) returns and constant factor

sensitivities of the mutual fund portfolios. Both could change through time, thus potentially inducing test misspecification. Although we do not know the exact relation, one means of examining whether changing expected market returns induce misspecification is to test for a relation between the performance measures and predetermined variables that are correlated with expected market returns.

Our approach complements the emerging literature that seeks to uncover the effect of mutual fund managers' market-timing ability that might be related to time-varying expected market return as inferred from observable indicators like the dividend yield or term premium (see, for example, Ferson and Schadt, 1996, Glosten and Jagannathan, 1994, and Chen and Knez, 1996). Ferson and Schadt (1996) infer mutual fund managers' market-timing ability from the relation between the mutual funds' risks and variables correlated with expected market returns. Ferson and Schadt make the usual assumption that in the absence of market timing and time-varying expected returns the mutual fund performance measures are well specified. Our objective is to ascertain whether reported market-timing results for actual funds could be in part a manifestation of the observed performance measure misspecification.

We regress the time series of 336 estimated performance measures (i.e., estimated alphas from the CAPM and the Fama-French three-factor models without market timing, and estimated alphas and betas from these two models with market timing) on a set of pre-determined information variables that previous literature has shown to be correlated with time variation in expected market returns (e.g., Fama and French, 1989, Ferson and Harvey, 1991, Breen, Glosten, and Jagannathan, 1989, and Evans, 1994). The information variables we use are dividend yield on the NYSE-AMEX value-weighted portfolio, book-to-market ratio of the value-weighted NYSE-AMEX stocks (for which book value of equity data are available on COMPUSTAT), ten-year Government bond yield, term premium measured as the difference between the ten-year bond yield and the one-month T-bill interest rate, and default premium measured as the difference between the junk-bond yield and the 10-year Government bond yield. We also entertained additional information variables like the price-earnings ratio, one-month T-bill interest rate, and default premium defined as the difference between BAA and AAA corporate bond yields.

Neither individually nor collectively did they add significantly to the reported results, so we omit those from the tabulated results.

Table 8 reports the results using the value-weighted index as the market-factor proxy employed in estimating various performance measures. We obtain results that are qualitatively similar to those reported below using the equal-weighted index. Since the performance measures are estimated using returns for overlapping three-year periods, the residuals from the regressions of performance measures on the information variables are likely to be autocorrelated. This is confirmed by the observed low values of the Durbin-Watson statistic. We re-estimate the models that had significant Durbin-Watson statistic by fitting a first- and second-order autoregressive process on the errors. The Durbin-Watson statistic of the regression models using the transformed variables is close to 2 and statistically insignificant.

Panel A contains results using performance measures for the simulated portfolios consisting randomly-selected 50 stocks. The CAPM-based alphas with and without market timing do not exhibit a statistically reliable evidence of covariation between the performance measures and market expected return proxies. The CAPM market-timing gamma is positively related to book-to-market and negatively related to default premium at the 5% significance level and dividend yield is significant at the 10% level. The opposite signs on the coefficients on dividend yield and book-to-market are surprising because expected market returns increase in both these variables (e.g., Fama and French, 1989, and Kothari and Shanken, 1997). The significant relation between the timing gammas and the information variables in the absence of true market timing in the simulations raises questions about the interpretation of similar associations using mutual fund return data (e.g., Ferson and Schadt, 1996). It appears that a portion of the observed association between information variables and market-timing gammas using mutual fund return data might be due to model misspecification. Panel A also shows that the Fama-French three-factor model alphas with and without timing are significantly negatively associated with book-to-market, term premium, and default premium. The timing gammas, however, do not exhibit significant covariation with the information variables.

[Table 8]

Panels B and C report results for stratified random samples of large and small firms and panels D and E report results for the high and low book-to-market stock portfolios. These results indicate that the small firms and high book-to-market portfolios' three-factor model alphas are reliably negatively correlated with the book-to-market ratio and default premium. The results suggest that in high expected market return periods the three-factor model is likely to erroneously indicate under-performance of small and high book-to-market stocks, and conversely, above-normal performance in low expected market return periods.

Except for the large stock portfolios, the three-factor model timing gammas are reliably correlated with dividend yield and default premium. However, the associations between performance measures and the information variables do not appear to entirely explain the misspecifications noted in tables 6 and 7. There we find that the three-factor model is misspecified in the case of low, not high, book-to-market stock portfolios. Panels B through E show that there is limited evidence of the CAPM-based performance measures, with and without timing, being associated with the information variables.

5.2 Association of performance measures with coskewness

The observed performance measure misspecification could be related to the return distributions' departures from normality. First, departures from joint normality of the mutual fund portfolio returns and market returns could distort the performance measures' sampling distribution under the null hypothesis (Stapleton and Subrahmanyam, 1983). Second, if there is coskewness in portfolio returns that is priced (Kraus and Litzenberger, 1976 and Rubinstein, 1973), then the mean-variance-analysis-based performance measures examined in this study would likely be misspecified in part because coskewness and beta are significantly positively correlated (Kraus and Litzenberger, 1976).

To examine coskewness-related performance-measure misspecification, we regress the time series of performance measures on portfolios' coskewness estimated contemporaneously with the three-year period used to estimate the performance measures. Following Kraus and Litzenberger, coskewness is defined as

$$\text{Coskewness} = \text{Cov} [(R_m - \text{Avg } R_m)^2, (R_p - \text{Avg } R_p)] / E (R_m - \text{Avg } R_m)^3$$

which is the ratio of a portfolio's covariance with squared market return divided by the skewness of the market return. Untabulated results show that all the mutual fund portfolios we examine exhibit highly significant coskewness. However, the estimated coskewness has generally little ability to explain the variation in estimated performance measures. Thus, although we provide little direct evidence on the price of coskewness in the market, portfolio returns' coskewness with the market does not appear to explain the misspecifications of the performance measures examined in this study.

6. Summary and conclusions

Although there is a large literature on mutual fund performance measures, their empirical properties in the absence of abnormal performance have received little attention. We study these properties. From our simulations, the main message is that standard mutual fund performance are unreliable and can result in false inferences. In particular, it is easy to detect abnormal performance and market-timing ability when none exists.

Our results also show that the range of measured performance is quite large even when true performance is ordinary. This provides a benchmark to gauge mutual fund performance. Comparisons of our numerical results with those reported in actual mutual fund studies raises the possibility that reported results are due to misspecification, rather than abnormal performance.

Finally, the results indicate that procedures based on the Fama-French 3-factor model are somewhat better than CAPM based measures. This is not surprising, and indicates that "style" analysis is useful in benchmarking fund returns. The misspecification even for Fama-French suggests at least two possibilities. One is that size and book-to-market do not completely describe the characteristics relevant for expected returns. The second is related to the estimation process, and that sampling distributions of the performance measures differ from those assumed under the null hypothesis, for example because expected returns change over time. Further investigation of the latter possibility could be particularly fruitful in explaining why our tests using simulated portfolios often show market timing when none is present.

References

- Admati, Anat and Stephen A. Ross, 1985, Measuring investment performance in a rational expectations equilibrium model, *Journal of Business* 58, 1-26.
- Andrews, Donald W. K., 1991, Heteroskedasticity and autocorrelation consistent covariance matrix estimation, *Econometrica* 59, 817-858.
- Banz, Rolf W., 1981, The relationship between return and market value of common stocks, *Journal of Financial Economics* 9, 3-18.
- Bodie, Zvi, Alex Kane, and Alan J. Marcus, 1996, *Investments* (Richard D. Irwin, Chicago IL).
- Breen, William J., Lawrence R. Glosten, and Ravi Jagannathan, 1989, Economic significance of predictable variations in stock index returns, *Journal of Finance* 44, 1177-1189.
- Brown, Stephen J. and William N. Goetzmann, 1995, Performance persistence, *Journal of Finance* 50, 679-698.
- Carhart, Mark M., 1997, On persistence in mutual fund performance, *Journal of Finance* 52, 57-82.
- Chen, Zhiwu and Peter J. Knez, 1996, Portfolio performance measurement: Theory and applications, *Review of Financial Studies* 9, 511-555.
- Dybvig, Philip H. and Stephen A. Ross, 1985a, Differential information and performance measurement using a security market line, *Journal of Finance* 40, 383-399.
- Dybvig, Philip H. and Stephen A. Ross, 1985b, The analytics of performance measurement using a security market line, *Journal of Finance* 40, 401-416.
- Elton, Edwin J., Martin J. Gruber, Sanjiv Das, and Matthew Hlavka, 1993, Efficiency with costly information: A reinterpretation of evidence from managed portfolios, *Review of Financial Studies* 6, 1-22.
- Elton, Edwin J., Martin J. Gruber, and Christopher R. Blake, 1996a, The persistence of risk-adjusted mutual fund performance, *Journal of Business* 69, 133-157.
- Elton, Edwin J., Martin J. Gruber, and Christopher R. Blake, 1996b, Survivorship bias and mutual fund performance, *Review of Financial Studies* 9, 1097-1120.
- Elton, Edwin J., Martin J. Gruber, and M. Padberg, 1976, Simple criteria for optimal portfolio selection, *Journal of Finance* 31, 1341-57.

- Evans, Martin D. D., 1994, Expected returns, time-varying risk, and risk premia, *Journal of Finance* 49, 655-679.
- Fama, Eugene F., 1972, Components of investment performance, *Journal of Finance* 27, 551-567.
- Fama, Eugene F. and Kenneth R. French, 1989, Business conditions and expected returns on stocks and bonds, *Journal of Financial Economics* 25, 23-49.
- Fama, Eugene F. and Kenneth R. French, 1992, The cross-section of expected returns, *Journal of Finance* 47, 427-465.
- Fama, Eugene F. and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3-56.
- Ferson, Wayne E. and Campbell R. Harvey, 1991, The variation of economic risk premiums, *Journal of Political Economy* 99, 385-415.
- Ferson, Wayne E. and Rudi W. Schadt, 1996, Measuring fund strategy and performance in changing economic conditions, *Journal of Finance* 51, 425-461.
- Graham, John R. and Campbell R. Harvey, 1996, Market timing ability and volatility implied in investment newsletters' asset allocation recommendations, *Journal of Financial Economics* 42, 397-421.
- Graham, John R. and Campbell R. Harvey, 1997, Grading the performance of market timing newsletters, unpublished manuscript, Duke University.
- Glosten, Lawrence and Ravi Jagannathan 1994, A contingent claims approach to performance evaluation, *Journal of Empirical Finance* 1, 133-166.
- Grinblatt, Mark and Sheridan Titman, 1990, Portfolio performance evaluation: Old issues and new insights, *Review of Financial Studies* 2, 393-421.
- Grinblatt, Mark and Sheridan Titman, 1989, Mutual fund performance: An analysis of quarterly portfolio holdings, *Journal of Business* 62, 393-416.
- Henriksson, Roy D., 1984, Market timing and mutual fund performance: An empirical investigation, *Journal of Business* 57, 73-96.
- Henriksson, Roy D. and Robert C. Merton, 1981, On market timing and investment performance II: Statistical procedures for evaluating forecasting skills, *Journal of Business* 54, 513-534.

- Jagannathan, Ravi and Robert A. Korajczyk, 1986, Assessing the market timing performance of managed portfolios, *Journal of Business* 59, 217-235.
- Jensen, Michael C., 1968, The performance of mutual funds in the period 1945-1964, *Journal of Finance* 23, 389-416.
- Jensen, Michael C., 1969, Risk, the pricing of capital assets, and the evaluation of investment portfolios, *Journal of Business* 42, 167-247.
- Kothari, S.P. and Jay Shanken, 1997, Book-to-market, dividend yield, and expected market returns: A time-series analysis, *Journal of Financial Economics* 44, 169-203.
- Kraus, Alan and Robert H. Litzenberger, 1976, Skewness preference and the valuation of risk assets, *Journal of Finance* 31, 1085-1100.
- Lehmann, Bruce N. and David M. Modest, 1987, Mutual fund performance evaluation: A comparison of benchmarks and benchmark comparisons, *Journal of Finance* 42, 233-265.
- MacKinlay, A. Craig, 1995, Multifactor models do not explain deviations from the CAPM, *Journal of Financial Economics* 38, 3-28.
- Malkiel, Burton G., 1995, Returns from investing in equity mutual funds 1971 to 1991, *Journal of Finance* 50, 549-572.
- Newey, Whitney D. and Kenneth D. and West, 1987, A simple, positive semi-definite heteroskedasticity and autocorrelation consistent covariance matrix, *Econometrica* 55, 703-708.
- Newey, Whitney D. and Kenneth D. and West, 1994, Automatic lag selection in covariance matrix estimation, *Review of Economic Studies* 61, 631-.
- Pearson, E. S. and H. O. Hartley, 1958, *Biometrika Tables for Statisticians, Volume I, Third Edition* (The Syndics of the Cambridge University Press, London, United Kingdom).
- Roll, Richard, 1977, A critique of the asset pricing theory's tests; Part I: On past and potential testability of the theory, *Journal of Financial Economics* 4, 129-176.
- Roll, Richard, 1978, Ambiguity when performance is measured by the security market line, *Journal of Finance* 33, 1051-1069.
- Rubinstein, Mark, 1973, The fundamental theory of parameter-preference security valuation, *Journal of Financial and Quantitative Analysis* 8, 61-69.

Rosenberg, Barr, Kenneth Reid, and Ronald Lanstein, 1985, Persuasive evidence of market inefficiency, *Journal of Portfolio Management* 11, 9-17.

Sharpe, William F., 1966, Mutual fund performance, *Journal of Finance* 39, 119-138.

Siegel, Jeremy J., 1994, *Stocks for the long run* (Irwin Professional Publishing, New York, NY).

Stapleton, Richard C. and M.G. Subrahmanyam, 1983, The market model and the capital asset pricing theory: A note, *Journal of Finance* 38, 1637-1642.

Treynor, Jack L., 1965, How to rate management of investment funds, *Harvard Business Review* 43, 63-70.

Treynor, Jack L. and Fischer Black, 1973, How to use security analysis to improve portfolio selection, *Journal of Business* 46, 66-86.

Treynor, Jack L. and Kay Mazuy, 1966, Can mutual funds outguess the market? *Harvard Business Review* 44, 131-136.

Table 1
Mutual fund performance measures

Performance measure	Expression	Selected references
Sharpe measure ¹	$(AR_p - AR_f)/\sigma_p$	Sharpe (1966), MacKinlay (1995)
Jensen alpha ²	$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{Mt} - R_{ft}) + \varepsilon_{pt}$	Brown and Goetzmann (1995), Carhart (1997), Elton, Gruber, and Blake (1996b), Elton, Gruber, Das, and Hlavka (1993), Ferson and Schadt (1996), Fama (1972), Henriksson (1984), Grinblatt and Titman (1990), Jensen (1968, 1969), Malkiel (1995)
Treynor measure	$(AR_p - AR_f)/\beta_p$	Treynor (1965)
Appraisal ratio	$\alpha_p/\sigma(\varepsilon_p)$	Elton, Gruber, and Blake (1996), Elton, Gruber, and Padberg (1976), Treynor and Black (1973)
Fama-French three-factor model alpha ³	$R_{pt} - R_{ft} = \alpha_p + \beta_{p1}(R_{Mt} - R_{ft}) + \beta_{p2}HML_t + \beta_{p3}SMB_t + \varepsilon_{pt}$	Carhart (1997), Elton, Gruber, and Blake (1996a)
Henriksson-Merton market timing model ⁴	$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{Mt} - R_{ft}) + \gamma_p(R_{Mt} - R_{ft}) * D + \varepsilon_{pt}$	Henriksson and Merton (1981), Henriksson (1984), Graham and Harvey (1996)
Market timing using the Fama-French three-factor model	$R_{pt} - R_{ft} = \alpha_p + \beta_{p1}(R_{Mt} - R_{ft}) + \beta_{p2}HML_t + \beta_{p3}SMB_t + \gamma_p(R_{Mt} - R_{ft}) * D + \varepsilon_{pt}$	Henriksson and Merton (1981)

¹ AR_p = average return over the sample period, AR_f = average risk free return over the sample period, and σ_p = the standard deviation of excess returns over the sample period.

² R_{pt} is portfolio return in month t, R_{ft} is the risk free return in month t, R_{Mt} is the return on the market portfolio in month t, ε_{pt} is the white noise error term, and α_p β_p are the regression's intercept and slope (beta risk) coefficients.

³ HML_t and SMB_t are the Fama-French book-to-market and size factor returns; HML_t is the high-minus-low book-to-market portfolio return in month t and SMB_t is the small-minus-big size portfolio return in month t .

⁴ D is a dummy variable that equals 1 for $(R_{Mt} - R_{ft}) > 0$ and zero otherwise, and α_p and γ_p are the market-timing alpha and gamma.

Table 2
Distributional properties of 336 regression-based mutual fund performance measures of portfolios of randomly-selected securities

Sample: Each month from January 1964 through December 1991 (336 months) a 50-stock mutual fund portfolio is constructed. Its performance is tracked for a three-year period (months 1 through 36). The portfolio composition is changed 100% in months 13 and 25. The 50 stocks are selected randomly and without replacement from all NYSE/AMEX stocks with non-missing return data in month 1, and this procedure is repeated in months 13 and 25 using stocks available in those months. For each of the 336 portfolios, a time-series of monthly returns from month 1 through 36 is constructed. Portfolios returns are equal-weighted at the beginning of months 1, 13, and 25, but they are not rebalanced in the intervening periods. Returns are inclusive of dividends.

All the performance measures are as defined in table 1. Performance measures in panel A (B) are estimated using the CRSP value-weighted (equal-weighted) index return as the market-factor proxy.

Standard errors, S.E., are calculated by applying the Newey-West (1987) correction for serial dependence up to five lags.

T-statistics are ratios of the performance measures' mean values to the standard errors, S.E.

Descriptive statistics in panel C are for a sample of 336 three-year average returns on the simulated mutual fund portfolios and CRSP equal- and value-weighted indexes.

Performance measure	Mean	S.E.	t-stat	Std. Dev.	Min	Median	Max	Skewness	Kurtosis
Panel A: Portfolios of 50 randomly-selected securities, CRSP value-weighted index as market factor									
Jensen α in %	0.27	0.088	3.08	0.72	-1.28	0.24	2.69	0.32	2.72
FF 3-factor α in %	-0.10	0.022	-4.68	0.35	-1.57	-0.12	1.01	0.14	4.24
CAPM timing α in %	0.63	0.127	4.95	1.07	-2.09	0.60	3.76	0.07	2.51
CAPM timing γ	-0.22	0.053	-4.19	0.47	-1.47	-0.30	1.39	0.26	3.18
FF 3-factor timing α in %	-0.07	0.043	-1.70	0.59	-2.10	-0.09	2.13	0.22	3.82
FF 3-factor timing γ	-0.03	0.019	-1.48	0.29	-0.95	-0.03	1.14	-0.01	3.68
Panel B: Portfolios of 50 randomly-selected securities, CRSP equal-weighted index as market factor									
Jensen α in %	-0.01	0.019	-0.74	0.31	-0.97	-0.05	1.12	0.47	3.83
FF 3-factor α in %	0.00	0.020	0.00	0.34	-1.10	-0.03	1.03	0.40	3.64
CAPM timing α in %	0.19	0.030	6.17	0.50	-1.25	0.15	1.75	0.27	2.91
CAPM timing γ	-0.10	0.015	-6.47	0.21	-0.84	-0.10	0.49	-0.26	3.63
FF 3-factor timing α in %	0.16	0.031	5.00	0.53	-1.64	0.15	1.92	0.04	3.16
FF 3-factor timing γ	-0.08	0.014	-5.66	0.21	-0.71	-0.08	0.48	-0.19	3.39
Panel C: Descriptive statistics on returns									
Random stocks portfolio return %	1.24	0.122	10.14	0.98	-1.49	1.28	3.87	-0.34	2.79
CRSP v-wt return %	0.93	0.073	12.74	0.57	-0.98	0.95	2.40	-0.53	3.58

CRSP eq-wt return %	1.26	0.122	10.29	0.94	-1.66	1.27	3.21	-0.54	30 2.79
---------------------	------	-------	-------	------	-------	------	------	-------	------------

Table 2 (Cont'd)

The 95th and 99th percentiles of skewness coefficients for a sample of 300 are 0.230 and 0.329, and for samples of 350 they are 0.213 and 0.305.

Selected percentiles for the kurtosis coefficient are:

Sample	1%	5%	95%	99%
300	2.46	2.59	3.47	3.79
350	2.50	2.62	3.44	3.72

Table 3
Test statistics and rejection frequencies for the regression-based mutual fund performance measures:
Randomly-selected stock portfolios

Sample: Each month from January 1964 through December 1991 (336 months) a 50-stock mutual fund portfolio is constructed. Its performance is tracked for a three-year period (months 1 through 36). The portfolio composition is changed 100% in months 13 and 25. The 50 stocks are selected randomly and without replacement from all NYSE/AMEX stocks with non-missing return data in month 1, and this procedure is repeated in months 13 and 25 using stocks available in those months. For each of the 336 portfolios, a time-series of monthly returns from month 1 through 36 is constructed. Portfolios returns are equal-weighted at the beginning of months 1, 13, and 25, but they are not rebalanced in the intervening periods. Returns are inclusive of dividends.

All the performance measures regressions are as described in table 1. Performance measures in panel A (B) are estimated using the CRSP value-weighted (equal-weighted) index return as the market-factor proxy.

Distributional properties of the test statistics are for samples of 336 t-statistics from the performance measure regressions described in table 1.

Rejection frequencies are based on one-sided tests of the null hypothesis of zero value of the performance measure. The table values report the percentage of times out of 336 the null hypothesis is rejected at the specified level of significance.

Performance measure	Distributional properties of test-statistics							Rejection frequencies					
	Mean	Std. Dev.	Min	Median	Max	Skewness	Kurtosis	<0.5%	<2.5%	<5%	>95%	>97.5%	>99.5%
Panel A: Portfolios of 50 randomly-selected securities, CRSP value-weighted index as market factor													
Jensen α	0.43	1.42	-2.97	0.43	4.30	0.01	2.36	0.6	3.9	6.9	21.7	15.5	4.8
FF 3-factor α	-0.36	1.02	-3.19	-0.39	3.10	0.13	3.18	1.2	4.5	8.9	2.1	1.8	0.3
CAPM timing α	0.82	1.34	-2.20	0.79	4.02	0.05	2.27	0.0	0.3	2.1	27.7	21.4	7.1
CAPM timing γ	-0.71	1.26	-4.01	-0.75	2.91	-0.07	2.57	4.5	15.5	22.9	2.1	0.6	0.3
FF 3-factor timing α	-0.16	1.06	-3.22	-0.19	2.96	0.20	2.97	0.6	2.7	5.7	5.1	3.0	0.3
FF 3-factor timing γ	-0.09	1.13	-3.12	-0.13	3.23	0.05	2.85	0.6	5.1	8.3	5.4	3.0	1.2

Table 3 (Cont'd)

Panel B: Portfolios of 50 randomly-selected securities, CRSP equal-weighted index as market factor													
Jensen α	-0.10	1.01	-2.59	-0.18	3.07	0.20	2.90	0.0	2.1	5.7	4.5	2.1	0.3
FF 3-factor α	-0.04	1.05	-2.90	-0.09	3.33	0.22	2.99	0.3	2.1	4.5	5.7	2.4	0.9
CAPM timing α	0.38	1.07	-2.12	0.35	3.64	0.23	2.83	0.0	0.6	1.5	11.6	5.4	2.1
CAPM timing γ	-0.58	1.16	-4.75	-0.58	2.44	-0.13	3.24	3.0	9.5	17.3	2.1	1.5	0.0
FF 3-factor timing α	0.32	1.09	-2.74	0.28	3.79	0.15	2.99	0.3	0.9	2.1	9.8	4.8	2.1
FF 3-factor timing γ	-0.47	1.16	-4.37	-0.49	2.56	-0.26	3.22	3.0	9.5	13.7	2.4	1.2	0.0

Table 4**Distributional properties of reward-risk ratios of portfolios of randomly-selected securities**

Sample: Each month from January 1964 through December 1991 (336 months) a 50-stock mutual fund portfolio is constructed. Its performance is tracked for a three-year period (months 1 through 36). The portfolio composition is changed 100% in months 13 and 25. The 50 stocks are selected randomly and without replacement from all NYSE/AMEX stocks with non-missing return data in month 1, and this procedure is repeated in months 13 and 25 using stocks available in those months. For each of the 336 portfolios, a time-series of monthly returns from month 1 through 36 is constructed. Portfolios returns are equal-weighted at the beginning of months 1, 13, and 25, but they are not rebalanced in the intervening periods. Returns are inclusive of dividends.

All the reward-risk ratios are as described in table 1.

Standard errors, S.E., are calculated by applying the Newey-West (1987) correction for serial dependence up to five lags.

T-statistics are ratios of the performance measures' mean values to the standard errors, S.E.

Descriptive statistics in panels A and C are for samples of 336 three-year average returns on the CRSP equal- and value-weighted indexes.

Performance measure	Mean	S.E.	t-stat	Std.d	Min	Median	Max	Skewnes	Kurtosis
				ev.				s	
Panel A: CRSP value-weighted index									
Sharpe ratio	0.10	0.020	5.05	0.12	-0.33	0.12	0.43	-0.43	3.66
Panel B: Portfolios of 50 randomly-selected securities, CRSP value-weighted index as market factor									
Sharpe ratio	0.13	0.020	6.50	0.16	-0.30	0.13	0.55	-0.11	2.70
Treynor measure	0.63	0.099	6.32	0.81	-1.65	0.70	3.13	-0.26	3.01
Appraisal ratio	0.07	0.030	2.47	0.24	-0.51	0.07	0.73	0.01	2.36
Panel C: CRSP equal-weighted index									
Sharpe ratio	0.14	0.021	6.71	0.16	-0.32	0.14	0.50	-0.23	2.45
Panel D: Portfolios of 50 randomly-selected securities, CRSP equal-weighted index as market factor									
Treynor measure	0.72	0.122	5.87	0.99	-2.12	0.76	3.16	-0.33	3.09
Appraisal ratio	-0.02	0.010	-1.60	0.18	-0.45	-0.03	0.52	0.20	2.88

Table 5
Distributional properties of mutual fund performance measures: Sub-period analysis using
portfolios of randomly-selected securities

Sample: Each month from January 1964 through December 1991 (336 months) a 50-stock mutual fund portfolio is constructed. Its performance is tracked for a three-year period (months 1 through 36). The portfolio composition is changed 100% in months 13 and 25. The 50 stocks are selected randomly and without replacement from all NYSE/AMEX stocks with non-missing return data in month 1, and this procedure is repeated in months 13 and 25 using stocks available in those months. For each of the 336 portfolios, a time-series of monthly returns from month 1 through 36 is constructed. Portfolios returns are equal-weighted at the beginning of months 1, 13, and 25, but they are not rebalanced in the intervening periods. Returns are inclusive of dividends.

Results for subperiod 1964-71 are based on samples of 96 three-year performance measures. Results for subperiods 1972-81 and 1982-91 are each based on samples of 120 performance measures.

All the regression-based performance measures and reward-risk ratio performance measures are as defined in table 1. Performance measures in panel A (B) are estimated using the CRSP value-weighted (equal-weighted) index return as the market-factor proxy.

Standard errors, S.E., are calculated by applying the Newey-West (1987) correction for serial dependence up to five lags.

T-statistics are ratios of the performance measures' mean values to the standard errors, S.E.

Descriptive statistics in panel C are for samples of 96 (subperiod 1964-71), 120 (subperiod 1972-81), and 120 (subperiod 1982-91) three-year average returns on the simulated mutual fund portfolios and CRSP equal- and value-weighted indexes.

Performance measure	1964-71			1972-81			1982-91		
	Mean	S.E.	t-stat	Mean	S.E.	t-stat	Mean	S.E.	t-stat
Panel A: Portfolios of 50 randomly-selected securities, CRSP value-weighted index as market factor									
Jensen α in %	0.33	0.182	1.81	0.66	0.075	8.77	-0.16	0.076	-2.11
FF 3-factor α in %	0.01	0.042	0.19	-0.15	0.035	-4.14	-0.15	0.024	-6.29
CAPM timing α in %	0.29	0.235	1.23	1.07	0.191	5.60	0.46	0.117	3.93
CAPM timing γ	0.01	0.057	0.18	-0.22	0.100	-2.22	-0.41	0.057	-7.14
FF 3-factor timing α in %	0.28	0.054	5.18	-0.33	0.053	6.14	-0.10	0.035	2.93
FF 3-factor timing γ	-0.17	0.025	7.04	0.09	0.023	3.67	-0.03	0.024	1.12
Treynor measure	0.37	0.183	2.00	0.82	0.144	5.69	0.64	0.111	5.77
Appraisal ratio	0.10	0.056	1.77	0.21	0.025	8.52	-0.09	0.029	-2.93

Table 5 (cont'd)

Panel B: Portfolios of 50 randomly-selected securities, CRSP equal-weighted index as market factor									
Jensen α in %	0.03	0.043	0.77	-0.07	0.027	-2.59	0.00	0.022	0.18
FF 3-factor α in %	0.04	0.041	1.00	-0.03	0.029	-0.86	-0.01	0.027	-0.30
CAPM timing α in %	0.21	0.047	4.10	0.10	0.047	2.06	0.25	0.050	5.00
CAPM timing γ	-0.08	0.014	-5.50	-0.06	0.015	-4.20	-0.15	0.031	-4.74
FF 3-factor timing α in %	0.19	0.053	3.64	0.07	0.056	1.19	0.21	0.041	5.23
FF 3-factor timing γ	-0.07	0.016	4.23	-0.04	0.017	2.24	-0.13	0.023	5.67
Treynor measure	0.51	0.251	2.02	0.82	0.144	5.69	0.64	0.105	6.09
Appraisal ratio	-0.00	0.023	-0.09	-0.04	0.016	-2.75	0.00	0.013	0.00
Panel C: Descriptive statistics on returns and Sharpe ratios of indexes and random stock portfolio									
VW index return in %	0.53	0.088	6.00	0.90	0.110	8.16	1.28	0.100	12.82
EW index return in %	0.88	0.229	3.84	1.68	0.175	9.58	1.13	0.103	10.99
Random stocks portfolio return in %	0.93	0.243	3.81	1.61	0.174	9.25	1.11	0.100	11.12
VW index Sharpe ratio	0.04	0.024	1.79	0.06	0.019	3.16	0.19	0.016	11.81
EW index Sharpe ratio	0.10	0.041	2.37	0.17	0.027	6.44	0.14	0.025	5.68
Random stocks portfolio Sharpe ratio	0.10	0.041	2.31	0.16	0.025	6.32	0.13	0.023	5.70

Table 6
Distributional properties of mutual fund performance measures of non-randomly sampled portfolios: large and small market capitalization securities

Sample: Each month from January 1964 through December 1991 (336 months) a 50-stock mutual fund portfolio is constructed. Its performance is tracked for a three-year period (months 1 through 36). The portfolio composition is changed 100% in months 13 and 25. In panel A (B) the 50 large (small) stocks are selected randomly and without replacement from all NYSE/AMEX stocks whose market capitalization falls among the largest (smallest) three deciles of stocks ranked each year on January 1 according to the equity market capitalization of all the NYSE stocks. From this universe of large and small stocks each year, any firm with non-missing return data in month 1 is eligible for inclusion. This procedure is repeated in months 13 and 25 using large and small stocks available in those months. For each of the 336 portfolios, a time-series of monthly returns from month 1 through 36 is constructed. Portfolios returns are equal-weighted at the beginning of months 1, 13, and 25, but they are not rebalanced in the intervening periods. Returns are inclusive of dividends.

All the distributional properties are based on samples of 336 performance measures.

All the regression-based performance measures and reward-risk ratio performance measures are as defined in table 1. All performance measures are estimated using the CRSP value-weighted index return as the market-factor proxy.

Standard errors, S.E., are calculated by applying the Newey-West (1987) correction for serial dependence up to five lags.

T-statistics are ratios of the performance measures' mean values to the standard errors, S.E.

Performance measure	Mean	S.E.	t-stat	Std. Dev.	Min	Median	Max	Skewness	Kurtosis
Panel A: Large capitalization securities, CRSP value-weighted index as market factor									
Jensen α in %	0.05	0.016	2.88	0.20	-0.56	0.04	0.69	0.13	3.14
FF 3-factor α in %	-0.02	0.013	-1.38	0.19	-0.62	-0.02	0.51	-0.16	3.00
CAPM timing α in %	0.01	0.032	0.19	0.36	-1.02	0.01	1.10	0.17	3.27
CAPM timing γ	0.01	0.017	0.65	0.19	-0.65	0.02	0.64	-0.56	4.33
FF 3-factor timing α in %	-0.08	0.028	-2.68	0.36	-1.48	-0.08	0.98	0.12	3.78
FF 3-factor timing γ	0.02	0.016	1.25	0.19	-0.76	0.04	0.54	-0.74	4.71
Return in %	0.99	0.078	12.67	0.63	-1.35	1.03	2.36	-0.62	3.90
Sharpe ratio	0.11	0.016	6.75	0.13	-0.37	0.12	0.48	-0.27	3.87
Treynor measure	0.45	0.071	6.39	0.58	-1.73	0.50	1.84	-0.60	3.94
Appraisal ratio	0.04	0.013	2.69	0.17	-0.53	0.04	0.54	-0.03	3.24

Table 6 (Cont'd)

Panel B: Small capitalization securities, CRSP value-weighted index as market factor									
Jensen α in %	0.50	0.154	3.23	1.21	-1.79	0.53	3.79	0.20	2.19
FF 3-factor α in %	-0.17	0.053	-3.21	0.54	-1.76	-0.15	1.17	-0.28	2.82
CAPM timing α in %	1.10	0.207	5.31	1.69	-2.81	1.06	4.91	-0.03	2.12
CAPM timing γ	-0.37	0.095	-3.92	0.80	-2.49	-0.46	3.10	0.48	4.29
FF 3-factor timing α in %	-0.16	0.102	-1.52	0.99	-3.15	-0.15	2.06	-0.40	2.92
FF 3-factor timing γ	-0.02	0.044	-0.39	0.46	-1.20	-0.04	1.71	0.44	3.53
Return in %	1.47	0.184	7.97	1.45	-2.11	1.51	5.32	-0.06	2.37
Sharpe ratio	0.13	0.023	5.48	0.19	-0.30	0.13	0.57	-0.08	2.28
Treynor measure	0.90	0.201	4.46	2.09	-2.60	0.88	30.9	-8.93	128.7
Appraisal ratio	0.08	0.031	2.52	0.24	-0.50	0.10	0.65	2.30	7.46

Table 7
Distributional properties of mutual fund performance measures of non-randomly sampled portfolios: low and high book-to-market securities

Sample: Each month from January 1964 through December 1991 (336 months) a 50-stock mutual fund portfolio is constructed. Its performance is tracked for a three-year period (months 1 through 36). The portfolio composition is changed 100% in months 13 and 25. In panel A (B) the 50 low (high) book-to-market stocks are selected randomly and without replacement from all NYSE/AMEX stocks whose market capitalization falls among the lowest (highest) three deciles of stocks ranked each year on January 1 according to the book-to-market ratios of all the NYSE/AMEX stocks. Book-to-market ratios are defined as the book value of common equity at the beginning of each year, as reported on the COMPUSTAT, divided by the market capitalization of equity at the beginning of the year. From this universe of low and high book-to-market stocks each year, any firm with non-missing return data in month 1 is eligible for inclusion. This procedure is repeated in months 13 and 25 using large and small stocks available in those months. For each of the 336 portfolios, a time-series of monthly returns from month 1 through 36 is constructed. Portfolios returns are equal-weighted at the beginning of months 1, 13, and 25, but they are not rebalanced in the intervening periods. Returns are inclusive of dividends.

All the distributional properties are based on samples of 336 performance measures.

All the regression-based performance measures and reward-risk ratio performance measures are as defined in table 1. All performance measures are estimated using the CRSP value-weighted index return as the market-factor proxy.

Standard errors, S.E., are calculated by applying the Newey-West (1987) correction for serial dependence up to five lags.

T-statistics are ratios of the performance measures' mean values to the standard errors, S.E.

Performance measure	Mean	S.E.	t-stat	Std. Dev.	Min	Median	Max	Skewness	Kurtosis
Panel A: Low book-to-market securities, CRSP value-weighted index as market factor									
Jensen α in %	-0.05	0.069	0.67	0.59	-1.72	-0.08	1.26	0.06	2.32
FF 3-factor α in %	-0.10	0.022	4.53	0.32	-1.57	-0.11	0.90	-0.19	4.25
CAPM timing α in %	0.29	0.096	2.97	0.84	-1.72	0.24	2.68	0.08	2.72
CAPM timing γ	-0.19	0.032	6.05	0.32	-0.89	-0.23	0.92	0.38	3.11
FF 3-factor timing α in %	-0.14	0.031	-4.58	0.49	-1.72	-0.14	1.18	-0.18	3.14
FF 3-factor timing γ	0.02	0.017	1.24	0.25	-0.66	0.02	1.09	0.40	4.05
Return in %	0.95	0.116	8.16	0.93	-2.32	1.05	3.01	-0.74	3.75
Sharpe ratio	0.09	0.018	4.86	0.14	-0.37	0.10	0.37	-0.54	3.04
Treynor measure	0.36	0.086	4.26	0.70	-2.11	0.48	1.67	-0.92	3.87
Appraisal ratio	-0.01	0.030	0.24	0.01	-0.65	-0.03	0.71	0.19	2.35

Table 7 (Cont'd)

Panel B: High book-to-market securities, CRSP value-weighted index as market factor									
Jensen α in %	0.61	0.106	5.77	0.84	-1.72	0.68	2.58	-0.19	2.18
FF 3-factor α in %	0.03	0.048	0.60	0.46	-1.75	0.05	1.95	-0.31	4.14
CAPM timing α in %	1.00	0.157	6.32	1.28	-2.50	1.09	3.65	-0.28	2.45
CAPM timing γ	-0.24	0.082	2.99	0.67	-2.26	-0.33	2.78	0.50	3.99
FF 3-factor timing α in %	-0.03	0.085	-0.39	0.80	-2.65	0.11	1.58	-0.54	2.81
FF 3-factor timing γ	0.03	0.019	1.42	0.35	-0.97	-0.01	1.45	0.47	3.71
Return in %	1.56	0.129	12.07	1.03	-1.14	1.74	4.02	-0.35	2.39
Sharpe ratio	0.17	0.021	8.16	0.17	-0.25	0.19	0.56	-0.17	2.25
Treynor measure	0.99	0.128	7.73	1.07	-1.67	1.06	6.23	0.65	5.49
Appraisal ratio	0.16	0.029	5.30	0.24	-0.52	0.17	0.63	-0.15	2.38

Table 8**Relation between portfolio performance measures and pre-determined state variables**

$$\text{Performance Measure}_{t,t+3} = g_0 + g_1 \text{ Dividend Yield}_t + g_2 \text{ Book-to-market}_t + g_3 \text{ Long-term Government bond yield}_t + g_4 \text{ Term premium}_t + g_6 \text{ Default premium}_t + \text{Error}_{t,t+3}$$

t-statistics are reported below the estimated coefficients

Performance measures are as described in table 1. All performance measures are estimated using the CRSP value-weighted index return as the market-factor proxy.

Dividend yield at the end of month t is the ratio of total dividend in the preceding 12 months on the portfolio of all the NYSE/AMEX stocks to the portfolio's market capitalization at the end of month t.

Book-to-market ratio at the end of month t is the value-weighted ratio of the most recent available book-value of common equity of the NYSE/AMEX stocks to the market capitalization of these stocks at the end of month t.

Long-term Government bond yield at the end of month t is the yield-to-maturity on 10-year Government bonds.

Term premium at the end of month t is the difference between the long-term Government bond yield and one-month Treasury bill interest rate.

Default premium at the end of month t is the difference between the yield on junk bonds and the yield on AAA-rated corporate bonds.

Sample: Each month from January 1964 through December 1991 (336 months) a 50-stock mutual fund portfolio is constructed. Its performance is tracked for a three-year period (months 1 through 36). The portfolio composition is changed 100% in months 13 and 25. For each of the 336 portfolios, a time-series of monthly returns from month 1 through 36 is constructed. Portfolios returns are equal-weighted at the beginning of months 1, 13, and 25, but they are not rebalanced in the intervening periods. Returns are inclusive of dividends.

In panel A, the 50 stocks are selected randomly and without replacement from all NYSE/AMEX stocks with non-missing return data in month 1, and this procedure is repeated in months 13 and 25 using stocks available in those months.

In panel B (C) the 50 large (small) stocks are selected randomly and without replacement from all NYSE/AMEX stocks whose market capitalization falls among the largest (smallest) three deciles of stocks ranked each year on January 1 according to the equity market capitalization of all the NYSE stocks. From this universe of large and small stocks each year, any firm with non-missing return data in month 1 is eligible for inclusion. This procedure is repeated in months 13 and 25 using large and small stocks available in those months.

In panel D (E) the 50 low (high) book-to-market stocks are selected randomly and without replacement from all NYSE/AMEX stocks whose market capitalization falls among the lowest (highest) three deciles of stocks ranked each year on January 1 according to the book-to-market ratios of all the NYSE/AMEX stocks. Book-to-market ratios are defined as the book value of common equity at the beginning of each year, as reported on the COMPUSTAT, divided by the market capitalization of equity at the beginning of the year. From this universe of low and high book-to-market stocks each year, any firm with non-missing return data in month 1 is eligible for inclusion.

Table 8 (Cont'd)

State variable	Performance measure					
	Jensen alpha	FF 3-factor model alpha	CAPM market timing		FF 3-factor market timing	
			Alpha	Gamma	Alpha	Beta
Panel A: Portfolio of randomly-selected 50 stocks						
Constant	0.009	0.001	0.009	0.214	0.007	-0.32
	1.98	1.08	1.34	1.13	3.68	-3.30
Dividend yield	-0.175	0.055	-0.125	-16.34	-0.026	1.79
	-1.12	1.35	-0.51	-1.79	-0.25	0.36
Book-to-market	0.004	-0.003	0.001	0.53	-0.006	0.14
	1.04	-3.91	0.09	2.39	-4.32	1.68
LT bond yield	-0.72	-0.048	0.129	-22.05	-0.033	11.18
	-1.28	-0.33	0.16	-0.74	-0.10	0.73
Term premium	0.201	-0.373	-0.159	10.65	-0.397	5.08
	0.57	-2.72	-0.36	0.54	-1.92	0.40
Default premium	0.344	-0.339	0.555	-87.60	-0.486	8.06
	0.59	-3.26	0.655	-2.93	-1.79	1.57

Table 8 (Cont'd)

Panel B: Portfolio of 50 large stocks						
Constant	0.001	-0.000	-0.000	0.03	0.001	-0.09
	0.72	-0.27	-0.06	0.27	0.56	-0.93
Dividend yield	-0.063	-0.005	-0.015	-3.11	-0.062	2.56
	-1.65	-0.15	-0.23	-1.10	-1.10	0.83
Book-to-market	0.002	-0.001	-0.000	0.13	-0.000	-0.000
	2.80	-0.87	-0.12	2.02	-0.20	-0.01
LT bond yield	0.045	0.038	-0.002	5.49	0.031	4.32
	0.38	0.36	-0.01	0.47	0.15	0.33
Term premium	-0.118	0.093	-0.105	2.44	0.081	3.77
	-1.19	1.17	-0.51	0.24	0.44	0.35
Default premium	0.186	0.157	0.542	-31.09	0.316	-10.27
	1.52	2.11	1.95	-1.99	1.29	-0.64
Panel C: Portfolio of 50 small stocks						
Constant	0.001	0.001	-0.001	0.38	0.007	0.49
	0.21	0.28	-0.15	1.14	2.12	1.33
Dividend yield	0.287	0.222	0.645	-33.17	0.336	-0.040
	1.38	1.84	2.04	-1.96	1.99	-2.73
Book-to-market	-0.005	-0.007	-0.018	1.28	-0.016	0.20
	-1.06	-3.18	-2.42	3.27	-4.99	1.45
LT bond yield	-0.808	-0.447	0.528	-75.27	0.54	-53.02
	-1.04	-1.27	0.45	-1.59	-1.09	-2.46
Term premium	0.536	-0.343	0.446	-12.95	-0.505	24.71
	1.60	-0.96	0.63	-0.40	-0.89	0.99
Default premium	0.777	-0.389	0.096	-73.63	-1.434	102.39
	1.27	-1.32	0.08	-1.43	-2.57	2.66

Table 8 (Cont'd)

Panel D: Portfolio of 50 high book-to-market stocks						
Constant	0.014	0.005	0.017	-0.16	0.008	-0.19
	3.21	3.03	2.39	-0.45	2.73	-1.20
Dividend yield	-0.184	-0.018	-0.277	4.12	0.017	-2.86
	-1.37	-0.20	-1.19	0.35	0.13	-0.47
Book-to-market	0.005	-0.005	0.003	0.27	-0.009	0.21
	1.40	-3.19	0.55	0.88	-3.03	1.29
LT bond yield	-0.663	0.380	0.254	-59.36	0.411	1.33
	-1.24	1.26	0.33	-1.62	0.94	0.06
Term premium	0.237	-0.444	0.532	-32.12	-0.395	1.23
	0.62	-1.51	1.01	-1.13	-0.94	0.06
Default premium	-0.438	-0.774	-0.656	-39.20	-1.72	72.51
	-0.77	-3.40	-0.76	-0.85	-4.05	2.99
Panel E: Portfolio of 50 low book-to-market stocks						
Constant	0.004	-0.000	-0.001	0.29	0.004	-0.15
	1.40	-0.02	-0.17	1.94	2.52	-1.95
Dividend yield	0.009	0.063	0.210	-15.37	-0.102	6.77
	0.07	1.08	1.12	-2.51	-1.62	1.92
Book-to-market	0.002	-0.001	0.001	0.24	0.001	-0.09
	1.10	-0.88	0.15	1.45	1.08	-1.53
LT bond yield	-1.051	-0.362	-0.56	-13.29	-0.179	-5.60
	-2.45	-1.92	-0.91	-0.55	-0.83	-0.42
Term premium	0.155	0.006	0.188	-3.74	-0.001	-0.52
	0.71	0.03	0.54	-0.21	-0.01	-0.03
Default premium	-0.387	-0.200	-0.734	-7.67	-0.465	20.38
	-0.83	-1.37	-1.53	-0.41	-2.88	1.97